DEVELOPMENT CENTRE STUDIES

MANUAL OF INDUSTRIAL PROJECT ANALYSIS

IN DEVELOPING COUNTRIES

VOLUME II

SOCIAL COST BENEFIT ANALYSIS

by

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DEVELOPMENT CENTRE
OF THE ORGANISATION
FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The Organisation for Economic Co-operation and Development (OECD) was set up under a Convention signed in Paris on 14th December, 1960, which provides that the OECD shall promote policies designed:

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INTRODUCTION, AND READER'S GUIDE

This is the Second Volume of the OECD Development Centre's Manual of Industrial Project Analysis for developing countries. It deals with projects from the point of view of society as a whole. The word ' manual ' implies a slim volume, carried around and oft consulted. It has turned out to be as misnomer. This Volume is more of a textbook, aimed first to convince its readers that, especially for industrial projects, social cost-benefit analysis is both important and possible ; and, secondly, to teach them how it can best be done. The subject is not one where techniques are fully accepted, and consequently the Volume has more in it that is new, than is usual for a textboqk. The authors hope that its relation to works that could be more properly described as ' manuals ' will be that of a parent. It aims to be relevant for all developing countries : but most developing countries should have their own manuals.

Does it apply only to developing countries ? The authors have throughout had in mind that most developing countries are more characterized by disequilibrium situations, and that the price mechanism is, for very varied reasons, less reliable as a guide to policy than in more developed countries. They have also had in mind that statistics, and information generally, are less reliable and harder to come by. These considerations have led to a very different presentation than would probably have been appropriate if the authors had been writing for developed countries. Of course, many basic principles remain the same anywhere : but the emphases and the structure of the analysis would have been quite different.

The methods of industrial project analysis advocated could not be justified without explaining some basic economic principles, nor without relating project analysis to more general economic policy-making. The reader will therefore find a possibly surprising amount of discussion of principles and policy.

The authors have tried to address themselves primarily to two different kinds of people. First, there is the senior administrator or politician, who should understand the broad lines of what is implied by operating a system of social cost-benefit analysis, and how this may be carried out. Secondly, there are those who will actually make project evaluations, and teach others how to make them. The Volume is divided into two parts. The first is intended mainly for the first kind of person : and the second mainly for the second : but both parts are certainly relevant for the latter.

Thus Part I is concerned largely with economic principles, with the need for cost-benefit analysis, and with its relationship to policy-making and planning. Some of the chapters of Part I may be a little academic for the senior man who has become familiar with economics by practical exposure to it, and who does not want to feel he is going back to school.

Such a one might read only Chapters V, VI, and VII. The very busy man might confine himself to Chapter VII only: by reading this he will get a broad idea of what the authors are up to. The trained economist may also want to confine himself to these chapters, since the first four will be all too familiar. In Part I we have tried to avoid all use of economic jargon, so that it can be read by someone with no economic training.

The authors have tried to make Part II mainly comprehensible to someone, perhaps an engineer, with little economic training. Probably, however, some bits will be fully comprehensible only to a fully trained economist: but these parts are more concerned with the detailed justification of the methods advocated, and full understanding should not be essential for someone who wishes to learn how to operate (this sort of reader may want to skip Chapters IX, X, XI, and possibly XVI also).

A little algebra was unavoidable: but no more difficult mathematical tools are used than compound interest, the summation of simple series, and weighted averages: except for the technical Appendix, which is anyway addressed only to the suspicious theorist who may want to assure himself of the basis for the authors' approach.

The whole Volume is intended also to be useful for training courses in development planning and economics. Some bibliographies are provided.

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Chapter I

PROJECT ANALYSIS FROM THE POINT OF VIEW OF THE FIRM — A RECAPITULATION OF VOLUME I, AND ITS RELATION TO VOLUME II

The First Volume of this Manual was designed to show how the profitability of a new proposed industrial project, or a major extension of an existing one, can best be assessed. While its immediate appeal was therefore to firms themselves, such assessments may also be required or made by lending institutions and those government officials who have to concern themselves with actual profitability (as opposed to the wider assessment from the point of view of the whole society which we shall call social cost-benefit analysis).

A decision to go ahead with a project may depend not only on an assessment of whether it would be more advantageous to the enterprise than doing nothing, but also on a comparison with other feasible projects. If two or more projects are incompatible for technical reasons, then clearly only the best of them should be chosen — even although each one of them would be better than nothing. An important case of such incompatible possibilities is when they are really just variants of the same project. Thus an output may be produced on a smaller or larger scale, and also a given quantity of the output can usually be produced by a wide variety of methods. In other words, the input-mix may offer a wide variety of economic choices, even where the scale of output has been decided.

But a project under consideration must also usually be compared with other feasible projects for financial reasons. This is not the case if an enterprise can borrow enough at fixed rates of interest (for loans of the same duration) to do everything which it is in a position to consider. In that event it does everything which passes some profitability test, and therefore projects do not need to be weighed against each other. However, this state of affairs is not the most usual.

Thus Volume I was primarily concerned with the following problems[1] :

1. the prediction of the values of the variables entering into the measure of profitability used ;
2. the definition of the best measure of profitability ;

1. This is not of course intended to be an exhaustive summary of Volume I which was also, for instance, concerned with the financial and operational planning of projects. It summarizes only those major parts which serve as a lead into the present Volume.

3. the selection of the best set of projects, given that all projects, calculated to be profitable, could not be simultaneously pursued; an important part of this being the examination and rejection of feasible variants of the same project.

Let us elaborate further on these three problems, with a view to showing how much of the discussion of Volume I is also relevant to the social cost-benefit analysis of the present Volume, and what will therefore be taken for granted in the present Volume.

1.1 The Prediction of the Values of the Variables of the Measure of Profitability

The basic figures required annually for the best measure of profitability are as follows:

a) all receipts from the sale of outputs of the project for each year of the life of the project, these including the sale of any buildings and equipment remaining at the end of the life of the project, and

b) all expenditures on goods and services according to the year in which they are made, from the date of the first expenditures until the end of the life of the project. These expenditures include capital expenditures, whether for initial equipment or for replacement, as well as all current costs.

For purposes of prediction and for assessing the reliability of such prediction, all the values of the above receipts and expenditures should wherever possible be split into quantities and prices.

These figures are required for a social cost-benefit analysis just as much as for a profitability analysis. While, as we shall see, a social cost-benefit analysis may revalue the quantities of goods and services used and produced (that is, use different prices from those appropriate to an estimate of profitability), nevertheless such price revisions will often be based on the prices which enter into the profitability analysis.

The above figures are thus the raw material with which the economic evaluator works, whether he works for an enterprise or in a planning bureau. If these basic predictions are to be as accurately established as possible, a great deal of preliminary work is required. This preliminary work is largely described in Volume I. It cannot be too strongly emphasized that such work is as essential for social cost-benefit analysis as it is for profitability analysis. In view of its importance, some recapitulation may be valuable, though it must be remembered that this important part of project design and analysis is not the proper subject of this Volume.

The reliability of the basic figures — the quantities and prices of inputs and outputs — depend upon three kinds of considerations, (a) technical, (b) human and managerial, and (c) economic.

It is a technical matter whether the physical inputs and outputs, which are presupposed by the figures for receipts and expenditures, are consistent with each other. For instance, is it true that the stated quantities of raw materials, components, and fuels, when properly fed into the designed plant will produce the stated quantities of outputs for the number of years for which the project is supposed to endure? This all concerns quantities not prices, and is a matter for engineers. Its importance is obvious. Dams

do break and plants have technical troubles. The quality of inputs may be wrongly assessed, with disappointing results — and so on. Even so, it is probably true that technical miscalculation is a cause of major economic failure in a minority of cases.

Turn now to the question of management and skills. This is a more frequent cause for disappointment. One should distinguish four different ways in which over-optimistic assumptions about the quality of management and the skill of the labour force affect the predicted figures for inputs and outputs. First, the period of construction is underestimated. Despite exceptions, it has been the rule in developing countries that projects take longer to complete than is allowed for in the project report. This has probably been because neither the consultant engineers nor the host government departments had much experience of industrial projects in developing countries, and therefore underestimated the difficulties. Secondly, the period, between when a plant is finished and when the new management team and labour force are sufficiently skilled to be able to operate it at its rated capacity, has usually been underestimated. Again, the reason has probably been that there was little experience to go on. Thirdly, of course, it is always possible that the rated capacity is never attained, despite there being no reason for this, either from a technical point of view, or because of insufficient demand or insufficient supply of materials. Fourthly, although the rated capacity is attained, it may be attained only with the use of more inputs, especially labour, than was allowed for. This excess use of labour is extremely common, and is not always the fault of the management itself. It is often forced upon the management for political reasons, or because labour laws make it virtually impossible to sack anyone.

We turn now to the economic assumptions which lie behind the basic figures used for the economic evaluation of profitability or cost-benefit, and first consider the receipts. First, the figures naturally imply that a certain amount of output can be sold, and at a certain price, for every year of the project's economic life. This presupposes that a sound demand analysis has been made. It has been mentioned in Volume I that demand will always depend to a lesser or greater extent on government policies and/or planning. This subject will be reconsidered in Chapters V and VI of this Volume, since the government's proper influence on demand is very closely linked with social cost-benefit analysis. It may well also be the case that from a cost-benefit point of view outputs will be valued at different prices from those actually obtained. This in no way interferes with the need to establish that the outputs can be sold at the actual prices assumed in the project report.

Secondly, of course, the basic figures also presume that realistic prices have been attached to current inputs of materials, components, and labour, throughout the life of a project: and that these inputs will be obtainable when wanted. The chief reasons for their sometimes not being obtainable are (1) exchange control forced on the government because of a failure to be realistic in foreign exchange planning, and (2) delays in the establishment of other projects which should have supplied these inputs, and/or a failure to supply inputs of the right specifications.

As far as this initial capital investment goes, the reality of the cost estimates depends largely on the advice of the consulting engineers, and also upon the nature of the contracts with the supplying firms. Particular

attention must be paid to construction costs and estimated construction periods, since underestimation and long delays are commonplace. It should also be noted that changes in design may release supplying firms from the original contract prices.

In saying that all the above matters are presupposed in the basic figures which confront the economic evaluator or evaluation team, it should not be assumed that their function does not include that of asking nasty questions about all of these assumptions. Certainly, it must be someone's function to do just this. Indeed, it is of great importance that some central staff should undertake this essential probing. This is because projects will come up from many different sources, from different departments of government employing their own different staffs, or from different consultant engineers. In these circumstances it is almost inevitable that different degrees of care will have been exercised. Moreover, different, even conflicting, assumptions will often have been made. We shall return again to this subject in Chapter V.

From now on it is assumed that the basic engineering and demand and cost analyses have been properly conducted for every project and every variant of every project which is to be evaluated.

1.2 The Definition of the Best Measure of Profitability, and its Relation to Social Cost-Benefit Analysis

The method proposed in Volume I is widely known as 'discounted cash flow', often abbreviated to DCF.

For every year all expected expenditures on goods and services for the project (including capital expenditures) and all expected receipts from the project are recorded. For each year, the subtraction of the former from the latter shows how much cash the firm gains or loses as a result of the project. Borrowing and lending, and interest or dividend payments, are normally excluded from the concept of 'cash flow' when this is used for the purpose of assessing the profitability of a new investment. In years when there is no capital expenditure on the project 'cash flow' for this purpose differs from net operating profit for the year only in that no allowance for depreciation (or obsolescence) is made.

The above paragraph ignores company taxation. From the point of view of the firm, direct taxes should also be subtracted to arrive at 'cash flow'. But, from the social point of view, as we shall see later, this is not so. The definition of cash flow is related in more detail to accounting concepts in Table I hereafter. The cash flow which is relevant to assessing profitability from the point of view of the firm is the 'cash flow from non-financial operations' shown in row 15. The 'cash flow' relevant to assessing a project from the point of view of society is the 'pre-tax cash flow' shown in row 16.

The second essential step is to discount future cash flows back to the present. For this purpose the enterprise must select a rate of discount. This is the rate of return which, given the financial conditions for obtaining cash and the investment opportunities likely to be open to the firm in future years, it deems prudent to aim to earn on its new investments.

The process of discounting is simply compound interest worked backwards. Thus, if we suppose that the rate of discount is 10 per cent,

TABLE I

1.	Current Sales (net of indirect taxes)	R	
2.	Payment for current inputs (including wages and salaries)	C	
3.	*Gross Operating Profit*	$R—C$	
4.	Depreciation	D	
5.	*Net Operating Profit*	$R—C—D$	— 'Normal' Accounting
6.	Interest Charges	I	
7.	*Net Profit before Tax*	$R—C—D—I$	
8.	Direct Taxes	T	
9.	*Net Profit after Tax*	$R—C—D—I—T$	
	Add back Depreciation	D	
10.	*Current 'Cash Flow'*	$R—C—I—T$	
11.	Less net capital expenditures	K	
12.	Total Cash Flow (excluding Borrowing and Lending)	$R—C—I—T—K$	
13.	Add Net New Borrowing	B	
14.	*Total Cash Flow*	$B+R—C—I—T—K$	— 'Cash Flow' Accounting
	Less Cash Flow arising from financial transactions	$B—I$	
15.	*Cash Flow from Non-Financial Operations*	$R—C—T—K$	
	Add back direct tax	T	
	Add indirect taxes on inputs	T^*	
16.	*Social Cash Flow*	$R—C—K+T^*$	

then the present value of a receipt of \$ 110 next year is \$ 100. Similarly, \$ 121 in two years' time is worth \$ 100 today. In general any future receipt or expenditure is multiplied by $\frac{100^t}{(100 + d)^t}$, where d is the percentage rate of discount and t is the number of years ahead, in order to reduce this receipt or expenditure to its present value. Thus, by the process of discounting, expenditures and receipts which occur at different times (and are to this extent incomparable) are all revalued to make them comparable to present expenditures and receipts. They can then all be added up to give a single figure which is therefore named *the present value of the project.* It comes to the same thing, and is more convenient, to subtract expenditures from receipts to give a cash flow for each year, and then discount the cash flows back to the present. This also gives the present value of the project — hence the term 'discounted cash flow'.

Present value is one important measure of profitability. Its only possible deficiency is that it assumes that capital funds, and receipts on current account, need not be distinguished from each other. They are, both of them, just money. This lack of distinction between the two is fully justified if the firm can borrow (or lend) as much as it chooses at a fixed rate of interest equal to or less than the discount rate used to arrive at the present value. If this is the case, there can be no special shortage of investible funds. But if it is not the case then it is necessary

to distinguish investible funds from the current cash flow excluding financial transactions (R-C-T). This brings us to a second measure of profitability.

If the firm does not have unlimited access to borrowing at the market rate of interest, then a slightly more complicated measure of profitability was suggested in Volume I. In this event, capital expenditures should be kept separate from current expenditures, so that the ratio

$$\frac{\text{Discounted Current Cash Flow } (R\text{-}C\text{-}T)}{\text{Discounted Capital Expenditures } (K)}$$

can be calculated. This can be called a 'profitability ratio'. It is important, as shown in the next section, if the firm does not have unlimited access to borrowing, so that its investment fund is limited. One then needs to know the amount of present value resulting from operation of the project, per dollar of capital expenditure, which is what the ratio tells us.

It may also be useful to calculate a third measure of profitability, the *internal rate of return* — that is, the 'yield' — of the project. By definition this is the rate of discount which makes the present value of the project zero[1]. It can be called the 'yield', because it is closely analogous to the yield of a security. Thus if a $ 100 bond pays a dividend of $ 5 per annum for ever, one says that it yields 5 per cent. But the 'internal rate of return' of a purchase of this bond is also 5 per cent, because $ 5 for ever discounted at 5 per cent gives a present value of $ 100 equal to the purchase price of the bond — so that the total present value is zero.

One reason for calculating the yield is given in the next section. But the yield is also important simply because entrepreneurs and other investors are more used to judging investments by their yield rather than by either of the other measures put forward[2].

Now a social cost-benefit analysis takes exactly the same form as a profitability analysis. Indeed, a profitability analysis *is* a *private* cost-benefit analysis[3]. The easiest way to understanding cost-benefit analysis is therefore to examine the differences. These are as follows :

a) For the firm operating the project, receipts are identical to benefits and expenditures are identical to costs. But expenditures and receipts to the firm may differ from costs and benefits to society. This is dealt with where necessary by valuing the inputs and outputs at different prices from those actually paid by, or received by, the firm.

b) There may be some benefits and costs resulting from the project's operation which do not appear as inputs or outputs of the firm,

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1. It is possible to find projects such that there is no single rate of discount which makes the present value zero. In that case, either the project has no internal rate of return, or has more than one. This is one of the reasons why general reliance cannot be placed on the internal rate of return.

2. The above paragraphs are but a brief summary of the discussion in Volume I, and cut some corners. The reader for whose purpose it is insufficient should, of course, refer to Volume I. It should also be mentioned that Volume I discusses other short-cut measures of profitability such as the pay-back period, which, although in principle very inferior, are nevertheless still widely used.

3. But in the remainder of this Volume we shall use 'cost-benefit' to mean 'social cost-benefit' — to avoid unnecessary repetition of the word 'social'.

and do not vary with these inputs or outputs, and so cannot be allowed for by revaluing such inputs or outputs. Any such costs or benefits have to be separately added or subtracted for every year of operation in which they occur.

c) The rate at which costs and benefits need to be discounted may be different in social cost-benefit analysis. It may also be necessary to separate out certain kinds of costs and benefits, because it seems desirable to discount them at different rates.

d) Direct taxation has to be subtracted from the figure for expenditures less receipts of the firm (*R-C-K*) to give the final figure for the benefit derived from a project : but this is not a cost to society, but rather a transfer of benefit to the government, and so must be added back to give the social benefit.

The reasons for these divergences between private and social costs and benefits are fully discussed in Chapter II. But once such adjustments have been made to the benefits and costs which accrue in the various years of the project's life, and to the rate at which they are discounted, then the procedures followed are the same. Thus the present value of the project becomes its present social value, and the internal rate of return or yield, becomes the social yield.

1.3 The Selection of the Best Set of Projects

The simplest case is where the firm has unlimited access to borrowing at a fixed market rate of interest. Then it should accept the project if the present value is positive, and reject it if not. The firm then chooses a rate of discount which is not less than the market rate of interest. If a project has a positive present value at the rate of discount, it has a yield which is greater than the rate at which the firm can borrow. The firm therefore makes a profit, and should accept every such project[1].

If the firm has a limited investment budget, then it should choose successively those projects with the highest profitability ratio, until its investment budget is exhausted, provided that the last one selected has a ratio equal to or greater than unity. It is better not to exhaust the budget if this would imply investing in a project with a profitability ratio of less than unity, for this would imply that the present value was negative.

The above paragraph implies that the yield of the least good project chosen must not be less than the chosen discount rate. But it is also true that the chosen discount rate should not be much below the yield of the accepted project with the lowest profitability ratio. If it is, it is a sign that the rate of discount is too low, and that the profitability ratio should be recalculated[2]. (This was the reason, given in the previous section, for always calculating the yield of possibly marginal projects.) And, finally, there is a limit to how low the discount rate should be. Even if the firm

1. This statement ignores risk. It assumes that a proper allowance for risk will have been made in the expenditure and receipt figures — if, alternatively, risk is allowed for by choosing a relatively high rate of discount, then adopting a project with any positive present value will simply mean that the expected return exceeds the borrowing rate by an amount deemed sufficient to allow for risks.

2. Again, the reader must be warned that the above account is rather summary, and ignores a number of problems which can crop up. Reference can be made to Volume I, and to the bibliography given there.

cannot borrow easily, it can normally lend. And it would be foolish to accept a project whose yield was less than the rate of interest at which the firm might expect to be able to lend over the lifetime of the project.

The rules given above also have a close analogy to the rules which should govern the best selection of public sector projects. For instance, in a country with complete public ownership and no special scarcity of savings, the government should in principle invest in all projects which show a positive present *social* value at the chosen rate of discount.

How the social value of a public project is to be estimated, and the rate of discount chosen, occupies much of the rest of this Volume. But the appraisal of private sector projects from a public point of view is also discussed.

Chapter II

THE NEED FOR COST-BENEFIT ANALYSIS

It is a tenet of laissez-faire capitalism that profits measure the gain which society derives from a project. The acceptance of this view seems to permit capitalists to claim the moral plaudits of society, as they line their pockets. Yet, it cannot be dismissed as intolerable hypocrisy, for the theory that profits measure social (and not merely private) gains has no necessary connection with capitalism at all. Indeed, many would think the theory more valid for a socialist society; and it is generally recognized that profits have an important, even essential, role to play in a socialist society. But just what role?

Profit (or loss) can be thought of as a necessary feature of any decentralization of economic decisions. If institutions and people (these inevitably include local and central government departments and agencies, private people who sell their services and buy consumption goods, and foreigners; and also, in a mixed economy, private firms) are free to buy or sell, then they must have an effect on the profit of any project — for there must always be a profit or loss if *any* output or input is bought or sold, rather than allocated without charge. But their decentralized offers and demands can be made effective only if some positive response is made to them, such as initiating projects which promise to be profitable and rejecting those which do not. It is clear that such a response may be the wrong one if profits in fact fail to reflect social gains. Thus the situation really is that profits are an essential signalling mechanism for guiding economic decisions — but they may or may not be a *good* signalling mechanism. They are good only if expenditures closely measure social costs and receipts closely measure social benefits.

The reader may well ask at this stage if it does not make a difference that public sector profits accrue to the state, and private sector profits to individuals (to the extent that they are not taxed away). It may well seem more plausible that profits can be a good measure of social gain if they are, in the first instance, received by the government rather than going, in part, directly to individuals. We shall not, at this stage, debate that issue. We need only remark that if profits which go to individuals are worth less to society than those which go to the government then a cost-benefit analysis can make allowance for this.

The essence of a cost-benefit analysis is that it does *not* accept that actual receipts adequately measure social benefits, and actual expenditures social costs. But it does accept that actual receipts and expenditures can be suitably adjusted so that the difference between them, which is therefore very closely analogous to ordinary profit, will properly reflect the

social gain. This difference is, therefore, most appropriately called 'social profit'. A rider to this is that a further adjustment may be thought necessary in the light of the previous paragraph depending on who receives the actual profits.

Similarly, cost-benefit analysis may not accept the rate of discount which a firm, whether public or private, would apply to future profits to reduce them to their present value. A special rate of discount may be chosen, which seems to be more valid from the point of view of society, in order to reduce future social profits to 'the present social value'.

We can sum up the above discussion by saying that cost-benefit analysis is the more necessary the greater the extent to which project expenditures differ from the social costs which, according to the theory of laissez-faire, they ought to measure — and similarly for project receipts.

2.1 The Requirements for Private and Social Profit to Coincide

First, then, we ask under what conditions costs to a firm exactly measure costs to society. To put it in another way, we ask 'What assumptions do we need to make about the real world, if the theory that actual costs measure social cost is to be true?'. For simplicity of exposition we shall first deal with a society which has no foreign trade. The complications of foreign trade and payments are considered later. Even without this complication readers with no economic training may find the rest of 2.1 a little esoteric.

2.11 *Full Employment*

The basic requirement is that if a firm A buys a good or service, to the value of $ 1, then that will result in the loss of $ 1 worth of benefit elsewhere in the economy; for the loss to society of a benefit of $ 1 is, of course, a cost to society of $ 1.

Suppose that the service bought is 1 man-day of unskilled labour. The man, if not employed by firm A, might have sat idle. Now if he would have been only just willing to give up a day of leisure for a $ 1, it is true that there is a real social cost of $ 1 in employing him, and the theory holds. But this example points to one important assumption of the theory, which is that *there should not be involuntary unemployment or underemployment* for then the man will not have valued his leisure at $ 1, since he would have preferred to work.

2.12 *No Influence on Prices and Profit Maximization*

If the man would have had other employment (say, in Firm B), then the requirement is that he would have increased the production of Firm B so as to benefit society by $ 1. That this should be so requires:

a) that Firm B would also pay him $ 1, and would employ him for $ 1, only if the resultant extra product sold for $ 1, no more and no less;

b) that the sale of this extra product for $ 1 implies a benefit to society of $ 1.

The second requirement (b) we shall return to under the discussion of benefits. The first (a) needs elaboration as follows. First assume

that Firm B has to pay the man $ 1. Clearly, it would *not* employ him unless the extra receipts from the resulting rise in production were equal to $ 1 or more. Now the extra receipts equal the price obtained for the extra product, *provided that* it is possible to sell this extra product without reducing the price previously obtained. Given this proviso, it appears that the sales value of the extra product must equal or exceed the wage that has to be paid in order to get that extra product.

But if the sales value exceeds the wage paid ($ 1), then it is worth employing yet another man, and so on until the sales value is equal to the wage paid, *provided that* there is no need to raise the wages of those already employed, when taking on an extra man for $ 1. Thus the firm might know that wage rates will rise if employment is increased, in which case it would need to subtract this extra cost from the extra sales proceeds before deciding whether to employ another man.

But, given the above two provisos, it follows that the extra product from an extra man-day costing $ 1 will sell for exactly $ 1. The two provisos can be generalized as follows : if a firm has no influence on the prices of anything it buys or sells, then (assuming that it tries to make as much money as it can), the extra product resulting from the employment of a dollar's worth of extra labour (or anything else) will sell for $ 1. Where these conditions hold true a firm thus makes no profit on the last man it employs, and its profits do not change as a result of losing a man to another firm. So Firm B's profits would not change as the result of Firm A taking a man from it, and the social cost of employing the man in Firm A is therefore the value of his alternative product in Firm B. The condition of ' no influence on prices or wages ', together with the assumption of ' no voluntary unemployment ', also imply that Firm B woud have had to pay the man the same as Firm A, i.e. $ 1.

The conditions given above *(maximizing profits,* and *no influence on prices, including wages)* are, in economic jargon, those of 'perfect competition '.

Mutatis mutandis, what we have said about Firm A buying a man-hour of labour, applies to any input it buys. If it buys an amount of steel costing $ 1, the above assumptions imply either an extra cost to society of $ 1 as a result of producing more steel, or the loss of a benefit of $ 1 as a result of using less steel elsewhere.

The discussion of this section has assumed that if the product of a firm sells for $ 1, then the firm receives $ 1. In reality this is true only if there are no indirect taxes or subsidies. In national income accounting terms output may be valued at ' market prices ' (what the product sells for), or at ' factor costs ' which is market price less indirect taxes plus indirect subsidies, i.e. what the firm receives. We return to this subject in 2.17.

2.13 *Marginality*

It should next be noticed that we have discussed small changes in production and resource use. It cannot be expected that a very large purchase of some input will give rise to a negligible change in profit elsewhere in the economy. If it does, the profit of Firm A cannot be a precise measure of society's benefit, although it may still be a good approximate measure.

2.14 *The Distribution of Wealth, and Government Consumption*

So much for costs. We turn now to the consideration of benefits. Why should it be supposed that a dollar's worth of a good sold represents a benefit to society of $ 1 ?

The good may be sold to the public, to another firm, or to the government. It may be also used for current purposes, or for investment. Consider, first, sales of consumption goods to the public.

Now consumption, including leisure, is normally taken as the ultimate end of economic activity. In other words, if some ordinary individual buys a good for $ 1, that is by definition a benefit of $ 1. The problems associated with defining the end or ends of economic activity will be taken up again in Chapter III. But one problem, that of income distribution, must be mentioned immediately. Surely a dollar's worth of consumption by a rich man, and a poor man, cannot both be reckoned as a benefit of $ 1 to society ? Yet the view that profits are the best measure of benefit presupposes that it is so reckoned. We are now hard up against one of the basic theoretical and practical problems of economics. There will be further discussion of the problem later. Here we shall merely record that the profitability measure treats a dollar's worth of consumption as equally beneficial no matter who gets it. Consequently profitability will be a good measure of the net social benefit (i.e. the social profit) of a project only if the tax system and other measures already promote equality to the extent that is socially desirable.

When a good is sold to another firm, given perfect competition (see 2.12 above), the sale must result in extra production of equal value, and, however long the intermediate chain, the case can therefore be identified with the sale of a final product — to consumers as before, or to the government. So far as government purchases of final goods are concerned, it is difficult to make any general assumption other than that governments act rationally on society's behalf (although we know it is not always true). This implies that a dollar's worth of one good is worth the same to society as a dollar's worth of any other good bought by the government.[1]

2.15 *Interest Rates, and Investment*

We have seen that there is a problem of comparing the consumption of different people. There is also a problem of comparing consumption at different periods. It is clear that a dollar's worth of consumption in 10 years' time may not be as valuable as a dollar's worth of consumption today (at constant prices, for we are not thinking here of changes in the value of money). For instance, a dollar's worth of consumption in 10 years' time might be thought to be only just as valuable as half a dollar of consumption today. Now the profitability analysis described in Chapter I discounts future sales at an interest rate more or less close to the rate at which the firm could borrow (after allowing for risk). On this account, it follows that profitability is a good measure of social benefit only insofar as the rate at which the firm could borrow is the same as the rate at which society ought to discount future consumption — this latter rate

1. This still permits the possibility that public consumption (as well as investment, public or private) may be more valuable, in general, than private consumption. See, e.g., Section 10.2.

will be discussed in Chapter III and elsewhere. Here we need only say that it is questionable whether one can normally expect a close coincidence of the two rates. It may also be added that there need be no coincidence between the risks which any private profitability analysis must take into account, and the risks which society should allow for.

We have thus far written as if all goods and services produced were consumption goods. What is the benefit of a good or service used for investment, which yields no immediate satisfaction? The answer is that it must be valued in terms of the discounted consumption which it makes possible. In theory, under conditions of perfect competition (which implies also that firms do all the investment which pays), and assuming no difference between the rate of discount used by firms and the rate at which the future ought to be discounted, the value of an investment good will always be equal to the discounted value of the future extra consumption which it permits. Thus an investment of $ 1 will produce a future consumption stream with the present value of $ 1, which means of course that it also has the same value as a present consumption good sold for $ 1. Under these conditions society is indifferent as to whether it gets a little more consumption or a little more investment.

2.16 *External Effects*

It may happen that a firm's activities (and it should be recognized that by a 'firm' we really mean any individual or organization which both buys and sells goods and services) result in costs or benefits for society, which have no correspondence to its actual purchases or sales. A very traditional example is pollution of the atmosphere. This is a cost to society, for which the firm does not have to pay — it does not compensate society for the damage it causes. On the benefit side, a good example is that a firm may both help to train its labour, and also has to pay a higher wage as a result, in order to retain it. In other words it 'produces' more fully trained people — but these it cannot sell (slavery having been outlawed). However, this example is watertight only if the firm has to pay the full market price for those whom it trains. In the case of trainees and apprentices, this is often not so. Also, football clubs are an exception (at least in the UK), for they 'sell', by means of a transfer fee, their players to other clubs.

Many, but not all, external economies and diseconomies can be ascribed to the non-fulfilment of the condition of perfect competition. A good example is when an extension of activity by one firm, or an increase in its purchases, would result in a lowering of cost per unit of output in another firm which supplies some of its inputs. This may happen when the latter firm's costs decline with increasing output — due, in the long run, to 'economies of scale'. But economies of scale are not consistent with perfect competition. This is because, in an industry where economies of scale prevail, there will inevitably be so few firms that each must have an influence on the price at which it can sell its output.

But, since not all external benefits and costs can be ascribed to lack of perfect competition, it follows that such externalities must be assumed away if private profitability is to be an exact measure of net social benefit. External costs and benefits may arise in consumption as well as production, as noted in the next section.

2.17 *Consumers' Sovereignty and Public Goods*

It has been said that consumption is supposed to be the end of economic activity, and hence that everything can be valued in terms of its immediate or ultimate contribution to this end. This is part of what is meant by consumers' sovereignty. But the term usually implies rather more — that market prices as determined by technical conditions of production and consumers' tastes, are the best measures of the relative benefit of different items of consumption. But where consumption itself has external benefits or costs, there is a clear case for denying this. If someone buys a handkerchief to sneeze into, he helps to keep his cold to himself.

Aside from such external effects, certain kinds of consumption expenditure are sometimes thought to be more or less worthy than their market valuation suggests. Thus a classical education is felt to be good, and alcohol bad. How far the government should be paternal is always a very open question. But it should be noted that 'bad' consumption is generally taxed so that the producer does not receive as much as the public pays, and consequently production and consumption is less than it otherwise would be. Similarly 'good' consumption may be subsidized. This raises the question of the treatment of indirect taxes and subsidies. If consumers' sovereignty is taken very seriously, goods and services should be valued at market prices — what the consumer pays. But this has queer consequences. Thus project evaluation of cigarette factories would show large benefits, implying that more cigarettes should be made and sold, which could only be done if the tax were lowered. This would be futile, if it were long-standing government policy to tax cigarettes heavily.

The only reasonable assumption for project analysis would thus seem to be to reckon benefits and costs at factor cost, i.e. net of indirect taxes and subsidies[1]. It can be objected that most taxes are there for revenue reasons, and not for paternal reasons. This is true. But it is also true that revenue must be raised: and, if taxes have been well chosen, one can plausibly argue that prices net of factor costs are the best measure of relative benefits. Of course, not all goods are chosen directly by individuals. Governments, both central and local, also buy consumption goods. Sometimes these goods (or their services when they are of a durable nature) are supplied free to individuals, and sometimes a charge is made. Other kinds of public goods (like bombs and tanks which are not normally reckoned as investment) are more essentially collective, since their use cannot be a matter of individual choice. There is, of course, always room for argument as to whether the government's demands for such goods are sensible: whether it should spend so much on defence, whether it should buy more tanks and fewer aircraft, whether it should provide free meals and textbooks in schools. But these arguments do not take place at the level of project selection. If textbooks are supplied free, this is the same thing as saying that they are 100 per cent subsidized. The project evaluator must then take the cost of supply as the measure of benefit (bearing in mind that it may be possible to supply the government's demand either from imports or from domestic production). To put the same point in another way, the benefit has to be taken for granted

1. The above argument has run in terms of domestic prices. But, as we shall see later, there is often a good case for using external or world prices. But these too are then used net of export or import taxes or subsidies.

at the project level, and the problem becomes one of assessing what is the socially cheapest way of meeting the government's demands[1].

2.2 Government Action to bring about a Coincidence of Private and Social Profit

The conditions which must be fulfilled if profits are to be a perfect measure of net social benefit have now been described (very briefly — one could stock a library with works on this subject). Of course, the real world does not correspond to these conditions. Nor could it ever be forced into this non-Procrustean bed, or heavenly strait-jacket.

2.21 *The Regulation Framework*

In the great majority of industrialized economies, by far the greater part of economic activity (even where public) is guided by the price mechanism activated, on the production side, by the profit motive. At the same time, government intervention, partly designed to improve the aggregate social benefit of the system, is quite widespread.

First, and most important, governments usually take responsibility for seeing that large scale unemployment does not result from a deficiency of demand. Secondly, where competition plainly either does not, or cannot, work even approximately in line with the economic assumptions which ensure its social advantages, then certain controls are often introduced — e.g. price or profit controls over monopolistic production, regulations affecting wage-bargaining and employment conditions, etc. Thirdly, progressive taxation is used to help achieve a more equal income distribution than laissez-faire might produce. Fourthly, governments often underwrite certain risks which private persons find it hard to estimate, or overestimate, or cannot easily insure — for example, the insurance of export credits. Lastly, there is always a tremendous amount of legislation designed to see that people's private activities do not impinge unfavourably on others (external diseconomies), — legislation on the siting of industrial activity, on harmful effluents, offensive architecture, infectious diseases, prostitution, drunken driving, etc., etc. Interference with the price mechanism, rather than legislation, also plays a part — for example, very heavy taxation in some countries on smoking and drinking. The positive encouragement of activities with beneficial external effects is less common, but not unknown. For instance, there are subsidized bathrooms in Britain.

Thus the profit motive and price mechanism operate within a regulatory framework — partly taking the form of legislative and other controls, and partly that of changing effective prices. It is thus important not to forget that governments never adopt the position that profits arising from

1. Where the project evaluator is not called up to assess the benefit of the output, cost-benefit analysis becomes what is sometimes called 'cost-effectiveness' analysis. But where the project under consideration produces tradable goods we still value the output as a benefit in the normal way, even although the quantity required may be fixed solely by the government (as might be the case, e.g. with armaments). This is because the government has the alternative of importing the goods. Only if there is no such alternative, does the analysis reduce to one of cost-effectiveness — that is, one assesses the socially cheapest way of supplying from domestic resources a given governmental demand.

uninhibited operation of the price mechanism are always a good measure of social benefit. The process of improving the system by piecemeal reform is an unending one. This is not to say that government intervention, however well-intentioned, is always beneficial. Although, on balance, controls over the operation of the price mechanism are probably beneficial, sometimes they make matters worse.

The question to be asked therefore is whether profits, as affected by such governmental legislation and control, and by taxation, are a good measure of benefit — and whether, if the conclusion is 'not very', cost-benefit analysis can do any better. It is always much easier to think of reasons why a system falls short of an ideal, than it is to devise one which is better.

2.22 *The Use of Cost-Benefit Analysis in Developed Economies*

Since few Western industrialized countries exercise any direct control over investments in the private sector, the question of the use of cost-benefit analysis in the selection of investment arises only for the public sector. Since the public sector tends to include activities, which would be unlikely to serve the public interest very well under a regime of competition, and since this is often part of the reason for their inclusion in the public sector, it might have been thought that attempts to measure social benefits and costs would have gone further than has been the case.

Admittedly, it is not easy to draw a very clear distinction between 'ordinary' project analysis in the public sector, and cost-benefit analysis. But if either accounting prices are used, or if costs and benefits, which do not arise from the purchases and sales of what are normally reckoned as inputs and outputs, are quantified in money terms; and if the social value of the project is given a final quantitative expression, then we would say that cost-benefit analysis was used.

The practical use of cost-benefit analysis began with water resource development in the United States in the 1930's. Despite its intimate theoretical connection with parts of traditional economics, it was originated by engineers. Its use in this connection has become mandatory, and it is now spreading to other fields. Cost-effectiveness analysis has also been extensively used in defence planning, and elsewhere. In the United Kingdom the use of cost-benefit analysis came later, and has been used mainly in the field of transport — e.g. studies of a new underground railway line in London, and of motorways. It is believed that the use of accounting prices has also begun to be acceptable for the analysis of other projects.

France can claim the intellectual father of cost-benefit analysis: Jules Dupuit discussed the subject as early as 1844[1]. His concept of consumers' surplus is used today in the analysis of road investments. In this sphere, and also in water-resource investments, cost-benefit analysis has quite precise expression in France. For instance, the utility of road improvements to the consumers, as well as external benefits and costs, are estimated quantitatively. An accounting rate of discount is used (common to all departments), and the limitation of available funds for particular purposes is recognized by using

1. Jules Dupuit, "De la mesure de l'utilité des travaux publics", *Annales des Ponts et Chaussées*, 2nd Series, Vol. 8, 1844. English translation in *International Economic Papers*, No. 2.

a shadow price for such funds (this comes to the same thing as using a 'profitability ratio' as discussed in Chapter I).

In our sense, until very recently, cost-benefit analysis was not used in the USSR. The planners were mainly interested in industrialization for its own sake, and were therefore concerned primarily with consistency, that is the interlocking of supply and demand by the method of 'commodity balances'. There was no decentralization whereby project decisions were based on the social value of a project as measured by accounting prices. Furthermore, the planners looked on foreign trade more as a means of making good mistakes in planning, as a result of which physical surpluses and deficits of particular goods would arise, than as a systematic means of achieving a more efficient use of resources. In contrast, in the Eastern European communist countries there has been considerable project appraisal based on accounting prices, including the use of world prices. It is believed that the USSR is now also beginning to move in this direction.

Part of the reason why cost-benefit analysis has not been carried further in Western developed countries may be because it has been chiefly thought of in relation to economic activities where either (1) the price mechanism can offer virtually no guide to benefits at all, that is, in fields where the output of the activity either cannot be, or as a matter of policy is not in practice, sold to individuals — such fields including education, health, defence, roads ; or (2) where the investment is so large that its costs and benefits cannot possibly be thought of as marginal, for which reason, as we have seen, it becomes clear that actual expenditure and receipts may offer a poor guide ; or (3) where there is *prima facie* reason to believe that external costs and benefits are very large. In all these fields, it is rather difficult to apply.

In fields where new investments are not extremely large relative to the existing system, and where the outputs are normally sold to individuals on a commercial basis, cost-benefit analysis is much easier to apply because receipts and expenditures offer a better basis for estimation. At the same time, if it is felt that market prices reflect social cost and benefits reasonably well, the same reasons that make cost-benefit analysis relatively easy, also make it relatively unimportant.

2.3 The Conditions which make Cost-Benefit Analysis Desirable in Developing Countries

In this Volume we are seeking to offer guidelines to the use of cost-benefit analysis in developing countries, primarily for industrial projects. While agricultural projects are not excluded, we do not say anything about their special problems. We do exclude areas of the economy such as education, health, and defence — and also we pay little attention to *any* sort of project where sales to individuals or firms do not offer at least a good starting point for the estimation of benefit. This is not meant to imply that useful work is not going on in these fields. Certainly, cost-effectiveness analysis can be applied. But it is still very controversial as to whether full cost-benefit analysis in such sectors, where benefits are particularly hard to measure, is as yet sufficiently soundly-based to be a good guide for policy makers.

Thus we are concerned with the application of cost-benefit analysis precisely in fields in which it is considered unnecessary in developed econo-

mies. The justification for this can only be that it is felt that within such sectors of more advanced economies the price mechanism works in such a way that profits are a reasonable measure of net benefit, but that this is not true of most developing countries.

Why should one thus start with the presupposition that actual prices are very much worse reflectors of social cost and benefit than is the case in advanced economies? The main reasons are briefly adumbrated below. Each of them will receive further attention throughout this Volume. Naturally not all of these reasons apply to all developing countries.

2.31 *Inflation*

Rapid inflation is much more common in developing countries, particularly in Latin America, where it is more the rule than the exception. This is no accident. The very urgency of the desire to develop rapidly results in a constant tendency for demand to outrun supply: furthermore, lagging supply in the sectors which are most resistant to change, particularly agriculture, results in sectoral price rises which tend to transmit themselves across the board, and may virtually force the monetary authorities to increase total money demand if a recession of activity is to be avoided.

If inflation proceeded uniformly so that relative prices were unaffected, it would not be a reason for prices to be a poor measure of real costs and benefits. But this, for institutional and political reasons, is seldom the case. For example, governments in such circumstances will often use price controls in selected fields where they can in practice be operated. This makes activity in these fields relatively or absolutely unprofitable, without regard to the net benefit of such activities.

A particular case of such control concerns the price of foreign exchange, which brings us to the next reason.

2.32 *Currency Overvaluation*

In almost all countries, the government 'manages' the price of foreign exchange. With inflation, if the exchange rate is unaltered, domestic prices get out of line with world prices. This means that the rupee prices of foreign goods become too low relative to those of domestic goods[1]. In other words, the rupee price of an import is less than the real cost to the country. Similarly, the rupee price obtainable for an export is less than the benefit to the country. So long as the currency is not devalued to rectify the situation, the demand for foreign exchange for imports and other purposes will exceed the supply, and the government will be forced to restrict imports, often in ways which cause further gaps between the market prices of goods and the real cost of producing them. But some governments faced with a price inflation do not resort to import controls in order to maintain the domestic currency overvaluation, but devalue more or less frequently. If inflation is rapid and the government devalues periodically but not very frequently, then it is inevitable that the currency will be alternately undervalued and overvalued.

1. Throughout this Volume we often use 'rupees' to stand for the domestic currency unit, and 'dollars' to stand for a unit of foreign exchange. This is solely because it is awkward not to have a short familiar expression for these units: forced to choose, we selected rupees and dollars as being the units of the largest non-communist developing and developed countries respectively.

If the inflation is slow, the government usually tries to avoid devaluation, and long periods of overvaluation are likely.

2.33 *Industrial Wage Rates, and Underemployment*

It has been seen that the theory of competition requires that the marginal product of labour (the extra output resulting from the employment of a small extra amount of labour) be equal to the wage paid.

There are, doubtless, many divergencies from this ideal in industrialized countries — but it is not usually felt that there are large divergences which systematically distort the pattern of production far from what would be socially optimum. On the other hand, it is often argued that this is the case in many developing countries.

Whenever there is ordinary wage employment, the marginal product will seldom be less than the wage — for this would mean that the employer could gain by sacking labour (it is thus only where there are legal or other barriers to reducing the labour force that this will happen). But in many developing countries, peasant agriculture is important or even predominant, and one cannot sack a member of the family. Consequently it is common, perhaps normal, for the worker in peasant agriculture to consume more than his marginal product : this implies that, even without new investment, total output would rise if men were shifted from peasant agriculture to industrial employment : and not merely rise, but rise by more than any extra consumption necessitated by urban rather than rural life[1].

The above is, so to speak, the formal aspect of the widely observed phenomenon of underemployment. It should be noted, however, that the extended family system also permits underemployment in towns, making possible activities which do not suffice to produce as much as is required to live. If relief was give institutionally, via unemployment benefits, such activities would not be possible and people would be openly and wholly unemployed — which, *a fortiori,* is a transgression against the conditions required to make wages reflect the real social cost of employing a man.

Underemployment also arises within the public sector, where absence of the profit motive may and often does mean that men are employed whose marginal product is less than their wage.

2.34 *Very Imperfect Capital Markets*

Where risks are equal, interest rates on loans should be equal, if profits are to measure net social benefits. Interest rates have such an enormous range in many developing countries, that it is implausible to suggest that this is just a measure of differential risks. Other factors operate such as government intervention, ignorance, and monopoly elements in the supply of

1. The marginal product means the extra product resulting from the employment of an extra amount of labour. In more detail the argument of the text goes as follows : a peasant's marginal product is less than his consumption, which is in turn less than the consumption of an industrial worker (and his dependants), which is not more than the latter's marginal product (since his earnings can generally be assumed to be not more than his marginal product on the grounds that no private firm would employ the man if this was false). It follows that the extra consumption is less than the extra product which would result from his transfer from agriculture to industry.

capital, to widen the range from low to astronomical rates well beyond what can be considered rational.

2.35 *Large Projects*

It is more common in developing countries — especially in small countries with, as yet, little development — that a project will be so large as to have important repercussions on profits elsewhere in the economy. In these circumstances, as we have seen, the profitability of the project itself cannot be regarded as a good measure of net social benefit.

2.36 *Inelasticity of Demand for Exports*

In a number of developing countries, a large part of export receipts is accounted for by one, two, or three, export commodities. Where it is also the case that this country accounts for a considerable part of total world production, then it can influence, within limits, the price it obtains by restricting its sales — which is, of course, an abrogation of the conditions of perfect competition. The free market price cannot then correctly measure the benefit, because, like any monopolist, the country would gain if it exported less at a higher price.

This, in turn, implies that the country would gain by devoting rather less resources to producing these primary commodities, and rather more to others, or to industrialization. This situation can be best rectified by suitable export taxes on the commodities, which would improve net foreign exchange earnings, and so permit a lower exchange rate which would be favourable to industrialization[1]. Some countries recognize this situation and do in fact use export taxes. But the situation has also been used as an argument for encouraging industry by protection — which brings us to our next section.

2.37 *Protection — Import Quotas, Tariffs, Export Disincentives*

The protection of domestic industry may be a deliberate interference with the price mechanism designed to make it operate in a manner more conducive to society's benefit than would a laissez-faire commercial policy. There is little doubt that a well-designed interference, in the shape of special encouragement of industrialization, can make industrial profits a better guide to social advantage than they otherwise would be, either for the reasons given in 2.36 above, or for other reasons (protection is further discussed in Chapter VI).

The main way in which industry is specially encouraged is by tariffs and import quotas. Thereby, the domestic price of the output is kept above the import price. But the outputs of one industry are often the inputs of another. Consequently, when an industry contemplates exporting, it finds that the very system which protects it in its home market puts it at a positive disadvantage in export markets: whereas reason suggests that if industrial production is worth special encouragement, then it is worth special encouragement, and not actual discouragement, in producing for export. Thus protection, like current overvaluation, means that the rupee price obtainable for an export underestimates the social value of that export.

1. An improvement in foreign exchange earnings only necessarily results if costs of production equal the direct and indirect foreign exchange cost of exports.

Some developing countries have taken measures to offset this effect, but such measures are often insufficient, and not very scientifically devised in such a way as to make the rupee price a good reflection of the benefit to the country.

Apart from the fact that protection discourages exports, it is also the case that different industries receive enormously different degrees of protection, usually for no apparently rational economic reason[1]. This situation has arisen partly because countries have selected industries or plants (or have agreed to protect private initiatives) without the kind of economic appraisal being advocated here. Protection has followed the establishment of industries, rather than itself being used as a screening device.

Another reason why the relative gap between domestic and world prices is highly divergent as between industries is the extensive use of import quotas. A country runs into balance of payments problems. The situation is brought under control by restricting imports, — and, naturally, the least essential goods are most restricted. The result may be a growth of domestic industry, behind protective quotas, which bears little relation to the long-run comparative advantage of the country. If a wrong industry gets established it handicaps any other industry which uses its output. For example, one cannot properly evaluate a tyre factory using the actual price it must pay for synthetic rubber, if a very high-cost synthetic rubber plant has been established, this latter being protected so that it can sell its output at a price which covers costs. Thus the tyre factory might be socially beneficial, but will show up as unprofitable because of excessive protection of one of its suppliers.

We have now outlined seven important and fairly non-controversial reasons why the price mechanism and the profit motive may not work as closely for the social advantage as in developed countries. Other more general reasons could be adduced, such as ignorance of opportunities and techniques, inertia, short-sightedness, lack of a market economy, and greater fragmentation of markets leading to local monopoly power ; but these have relatively little direct bearing on project selection especially in the public sector. We turn now to a further three reasons, which may be more controversial.

2.38 *Deficiency of Savings*

Two projects may have the same net profit, but a different effect on the relative amount of extra consumption and savings.

As we saw in 2.15, the conventional economic theory of rich countries treats savings and consumption as of equal value. This is really a facet of the principle of consumers' sovereignty. It is assumed that it can make no difference to benefit whether some extra income is consumed or saved. This is reasonable for an individual who freely chooses whether to spend or not. For him, an extra dollar of savings is worth the same as an extra dollar of consumption. But is it true for society ?

To cut a long story short, if the government believes that rather more savings and rather less current consumption would be good for society,

1. Protection is best measured by the degree of protection given to domestic value added in the industry. There is now an extensive literature on this subject. See bibliography.

there may be a conflict. The point is that savings can be transformed into investment, and investment can produce extra future consumption for a sacrifice of present consumption : and the government may put a relatively higher value on the consumption of people in the future than do private persons. We have already referred to this in 2.15 above, where it was argued that the rate at which society ought to discount the future may differ from the rate at which a firm can borrow. Thus, if the government chooses a discount rate for projects which is lower than the market rate of interest[1], this is in effect to say that it considers future consumption to be more valuable than is indicated by the aggregate choices of private individuals. If the public saved more, interest rates would be lower, and the government pleased. In other words, the government considers present savings to be more valuable than present consumption. There is then a conflict.

But what right have we to say that such a conflict exists ? *Prima facie,* nearly every government of a developing country would like to see an increase in savings, and hence an increase in the rate of development. On the other hand, many governments seem to have the power to increase savings by increased taxation, but do not use it. Furthermore, public savings — including those of public enterprises — are often low. So it can be asked whether, in such circumstances, a government can really be said to prefer savings to present consumption.

Thus, the extent to which the conflict referred to is a reality which economists should take into account, is a difficult political, indeed almost philosophical, question. Some economists have in fact argued that, *ceteris paribus*, the greater the contribution of a project to savings, the greater its benefit. We return to this subject in Chapter III.

2.39 *The Distribution of Wealth*

The preceding section was concerned with the distribution of benefits — as between the present and future. But there is also a problem of the distribution of benefits today — the problem of inequality, to which we have already referred. There is a dilemma here, for inequality promotes savings, and helps future generations. Admittedly, the dilemma can be made less acute insofar as public savings can, by increased taxation, take the place of the savings of the rich — but there is a limit to this, and the dilemma remains.

The extent to which project selection should concern itself with different kinds of inequality will come up again. There is the additional important question of how far a practicable criterion for project selection can take proper account of inequalities. Both of these matters are discussed again in Chapter III.

2.310 *External Effects*

Some economists believe that external economies are of special importance in developing countries : that some industries have important beneficial effects on others in ways which cannot be, or anyway are not,

1. 'The market rate of interest' may be quite a wide band in developing countries, even if we restrict the meaning of 'the market' to that for medium and large scale industrial borrowing. See 2.34.

reflected in the price obtainable for the output of the industry, or in the price it pays for its inputs. There has been much speculation and debate on this subject. But there is very little positive evidence. Certainly there has been much naive wishful thinking — for instance, that the provision of electricity, steel, or transport, would somehow create its own demand.

There is so little chance, anyway, of measuring many of these supposed external economies, that we are forced to neglect them in most of our discussion which is aimed to lead a criterion which can be applied, i.e. one which contains only measurable variables. We do not believe that such a criterion is necessarily very unreliable, on the ground that it ignores important immeasurable external effects. External effects are considered in detail in Part II, Chapter XVI.

2.4 The Notion of Accounting Prices

A rather strong case has now been presented for saying that a project's anticipated receipts and expenditures cannot be relied upon to measure social benefits and costs in most developing countries. It is believed that this is true also of more developed economies, but to a much lesser extent. There is therefore a strong *prima facie* case for the use of cost-benefit analysis.

The basic idea of such an analysis is to use hypothetical rather than predicted actual prices when evaluating a project. The rate of discount may also not correspond to any actual interest rate. These ' shadow ' prices, as they are often called, are chosen so as to reflect better the real costs of inputs to society, and the real benefits of the outputs, than do actual prices.

The name ' shadow price ' is perhaps unfortunate. It suggests to many, even to some economists, that an analysis based on them is remote from reality, and therefore academic and highbrow, and so is to be distrusted. Of course, shadow prices are unreal in that they are not the current price of goods in a market. But then no price in a project analysis can ever be an actual price — for every price assumed in such an analysis necessarily lies in the future. The whole point of a shadow price is indeed that it shall correspond more closely to the realities of economic scarcity and the strength of economic needs then will guesses as to what future prices will actually be. From now on we shall use the term ' accounting prices '.

Not all the distortions (i.e. lack of correspondence between prices and real costs or benefits) in the price mechanism to which reference has been made above, can be adequately dealt with by using accounting prices in project selection. Many of the distortions can be satisfactorily dealt with only by removing them — i.e. by adopting policies which lead to a proper correspondence of prices, and costs and benefits. There are yet others which cannot be incorporated in a usable, and politically acceptable, criterion. These have to be left to the final judgment of the politician and his economic advisers.

What we are concerned to do in this Volume is to produce a practical method of analysis which could be systematically applied, and which would, we believe, measure social benefit better than a profitability analysis.

Chapter III

POLICY OBJECTIVES

In this, and the two succeeding chapters, we shall look more closely into the objectives of economic policy, and the manner in which policy can help to ensure that the available resources are best used and adapted to satisfying those objectives. Project selection is, of course, only one of many policy weapons. Criteria for project selection can be properly defined, only when one has placed project selection within a broader framework of economic policy and planning.

3.1 Future and Present Consumption

Provisionally we assume that the ultimate object and intention of the government's economic activities is to provide a high standard of living (we return later on in 3.3 to the question whether other ends exist and are admissible). But we have already seen that consumption occurs through time. Consumption now and next year are competitive with each other. We therefore have not one but two objectives — indeed not two, but an indefinitely large number, since even a finite span of time can be split into as many periods as one chooses.

Now a good way of reconciling many conflicting objectives is to attach a number or 'weight' to each, which is intended to measure the marginal importance to be attached to that particular one. By marginal importance we mean the importance to be attached to satisfying a particular objective a little more fully. By this method one weighs one objective against another in a systematic quantified manner.

Suppose we write $C_0, C_1, \ldots\ldots C_n$ for the anticipated values (at constant prices) of total consumption from year 0 to year n. Dividing by the anticipated population, we arrive at anticipated consumption per head $\frac{C_0}{P_0}, \frac{C_1}{P_1}, \ldots\ldots, \frac{C_n}{P_n}$. By policy changes the government can raise one or more of the Cs, but only at the cost of reducing one or more of the others.

Now there is no presumption that it is just as important to increase say C_{10} as C_0. For instance $\frac{C_{10}}{P_{10}}$ may anyway be higher than $\frac{C_1}{P_1}$. With consumption per head higher in Year 10 than Year 0 the urgency of raising consumption in Year 10 is less than raising it in Year 0. We therefore give a lower weight to consumption in Year 10 than Year 0,

which reflects the lower importance we attach to raising consumption per head in that year. We thus attach a weight to every C, which indicates the importance to be attached to increasing by a little (say \$ 1) the value of that particular C[1].

We thus have $W_0C_0 + W_1C_1 + \ldots\ldots + W_nC_n$. Provided it can be expected that the outcome of economic activity will be rising consumption per head, there is a good case for saying that the W's will fall over time — since the higher is consumption per head, the less important it becomes to increase it further. W_o can be set equal to unity (which means that we take *present* consumption as the measuring rod), so that the W's fall from unity and gradually approach zero. The end of economic activity may now be (provisionally) expressed as maximizing the weighted sum of the values of consumption for every period of time — i.e. the expression given at the beginning of this paragraph.

If it could be expected that income per head would grow faster in some future periods than others, there would be a good case for saying that the W's should fall faster during those periods. But economic prediction is generally too inaccurate for it to be possible to produce any convincing argument against the simplifying assumption that the W's fall at a constant rate — so that one can speak of *the* rate of fall of the W's.

The rate of fall of the W's, $-\frac{1}{W}\cdot\frac{dW}{dt}$, is what some economists have termed the *social discount rate*. We prefer to call it the *consumption rate of interest*, this being the rate at which future consumption ought to be discounted to make it the equivalent in value of present consumption. This rate obviously embodies an ethical judgment about the importance of the welfare of different generations. We have represented it as depending only on consumption per head. Our discussion has implied that if consumption per head is expected to rise, then the W's should fall, and the consumption rate of interest be positive: and that the faster the expected rise, the higher should the rate be. Some may wish to deny even these propositions. A few might argue that a richer man of some future generation has no lesser claim to increased consumption than a poor man of today. Others might say "Why should I do anything for the future? It has done nothing for me".

But even if the above propositions are universally acceptable they amount to very little. Indeed, even if a growth of consumption per head can be confidently expected, they tell us no more than that the consumption rate of interest should be positive. To get any further, one must be able to quantify the relation between the rate of growth of consumption per head and the rate of decline of the importance of further increases. Now this required quantity is once again a matter of ethical judgment. Furthermore, it is one about which people may disagree radically.

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1. Of course, the importance given to increasing consumption in a particular year should depend not merely on aggregate consumption per head, but also on who is going to get the consumption. Indeed, the distribution of consumption between contemporaries plays a role in our treatment of project appraisal. But in this section, we implicitly assume that the distribution of aggregate consumption between households remains more or less the same from year to year.

It is for the above sort of reason that many economists have said that the government must decide what the consumption rate of interest is to be. This seems a rather ethereal sort of thing for a government to decide : and, indeed, no government has ever made such a decision. The reason why economists have made this demand is that they believe the consumption rate of interest should be used as the rate of discount in project analysis, and more generally that it is required to determine economic policy consistently : in an economy in which the government was in effective control of all investment, this rate of interest would then determine the level and kinds of investment, for all projects would be undertaken with a higher or equal yield.

This is not a position which the present authors take. We agree that it is essential that the government set a rate of discount to be used in project analysis[1], but we do not think this need be, or should be, identified with the consumption rate of interest. The reason in brief is that a project gives rise not merely to future consumption but also to future savings and hence investment. As we have seen, the two may not be of equal social value, and therefore a different treatment would need to be accorded to each of these different benefit streams. This however would be complicated, and it is simpler to revalue each year's consumption in terms of savings (or investment) — and then discount the single combined stream at a rate which is appropriate to investment, a rate which we shall call the *accounting rate of interest*[2].

It is thus in no way denied that the government should take some responsibility for the level and kind of investment, these being the main ways of influencing the relative amounts of consumption in this and later generations. But we consider that the significance of the consumption rate of interest has been overestimated especially for developing countries. For instance, a government may be quite convinced that it wishes to raise the rate of investment, without being prepared to make the precise balancing of the relative value of consumption in different periods which the choice of a consumption rate of interest implies. In the above case, if the government's ability or willingness to tax is limited, then it may be important to shunt investment into projects the gains from which are likely to be saved and reinvested.

In the previous Chapter we raised the question whether a government seriously wants to raise the rate of investment at the expense of current consumption, if it does not raise taxation when it can, and if it does not take other steps to see that public savings, including those of public enterprises, are as high as reasonably possible. Of course, governments

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1. It has increasingly been realized that the discount rate plays quite a powerful role in deciding which kinds of investment look best. For instance, it is well known that the decision whether to have nuclear or conventional energy is sensitive to the rate of discount. Another example is electrification versus dieselization of railways. In each case, the former method uses more capital initially, but saves costs later, and so requires a relatively low rate of discount of the future to look better than the latter.

2. This is all explained more closely in Part II. But the economist reader may note that reasons why the investment rate of interest exceeds the consumption rate of interest are (1) that the former is applied to social profits which consist of savings, which are reinvestible, and of a figure for consumption which has been revalued in each period so that it is equivalent to savings in that period ; and (2) that the number of units of consumption equivalent to a unit of savings is assumed to fall over time.

want to stay in power. There is a limit to the extent to which they will try to squeeze more savings from the public, even if it is believed on ethical grounds that a greater provision should be made for investment and growth, and thus for consumption in the future. This raises a very important point. The most important and normal way for a government to hold consumption in check, and so increase savings is taxation; and taxation is notoriously unpopular.

The question therefore arises as to whether the government wishes to use project selection to help it increase savings. This can be done by choosing relatively capital-intensive investments. With such investments, a given gross gain is reflected more in profits and depreciation allowances, which result in more savings, than in wages which result mainly in consumption. Thus capital-intensive projects tend to restrain both consumption and employment, but promote savings and growth.

A government faced with the above question may want to consider whether a low rate of growth of employment opportunities is not likely to be just as unpopular as more taxation. However, one cannot necessarily accuse a government of inconsistency which goes easy on taxation now but opts for investments which result in only a small increase in consumption and employment in the next decade. The time pattern of the restraint is different. Taxation bites *now*. Moreover taxation tends to fall more upon the politically vocal. Anyway, in the last resort, the government itself must decide whether it is being consistent. Essentially, the designer of a system of project analysis needs to know whether the government (after the essence of the choice has been adequately explained) does or does not want to use project choice to promote savings (or, for that matter, employment — which by and large is the reverse case).

We turn away now from the difficult problem of the distribution of consumption through time, to another equally vexed question, but one which has received less attention in the context of project selection — that of the distribution of consumption between contemporaries.

3.2 Equality: the Distribution of Consumption between Contemporaries

We implied in 3.1 above, that the main reason for discounting future consumption was the expectation that consumption per head would be higher in the future. But if one attaches less weight to the consumption of some average man in ten years' time, on the grounds that he will be richer, then it is clearly only logical to attach less weight to the consumption of a rich man today than to that of a poor man today.

So far we have simply taken average consumption, i.e. consumption per head, in a particular year as the measure of the extent to which the objective of economic activity is achieved in that year. But really we should have a weighted average of consumption per head for each year, because the importance of the consumption of each man differs (in precise analogy to the way in which the importance of consumption varies as between different time periods). Of course, such detail is unattainable. But one could approach what is required by attaching different weights to the consumption of different income groups.

The above can be said to be just what a government implicitly does when it tries to make the tax system progressive so that it bears more

heavily on the rich ; and when it subsidizes the consumption of the very poor in various ways.

It can also be argued that all instruments of economic policy should be geared to the same objective. Project selection is one such instrument. It would follow from this that the consumption benefits of a project would have to be traced to different individuals (or at least different groups of individuals with roughly similar incomes), before the total weighted benefit could be assessed — rather similarly to the manner in which one distributes the benefits through time, with an ever smaller weight as the future becomes more distant.

Evidently, this is a great complication, and hard to carry out. Is there any good argument, which would make it unnecessary ?

It would be unnecessary if it were true that other instruments of policy, such as progressive taxation, could achieve as much equality as was desirable (taking account not only of the utility of consumption to different people, but also of the need for incentives), and achieve it more efficiently than if project choice were allowed to be influenced by considerations of equality and inequality. This is closely analogous to the problem presented in the previous section — the problem of whether project selection should be deliberately used to influence the distribution of consumption through time, by influencing the rate of saving.

There is no easy answer to this problem. To bring the matter down to earth, let us ask how project selection will mainly affect the distribution of wealth. First, one project may be situated in a poorer part of the country. Secondly, of two projects which generate the same income, the one which employs more labour relative to capital will, in a country where there is underemployment, result in greater equality. The location and the employment effects are certainly the two most important ways in which equality may be promoted or worsened by project selection. Put like this, the matter seems less academic. These are features of project selection which can hardly be neglected : although it remains an open question how far they can be taken account of in a formal quantifiable criterion.

Dealing with location first, how would one take quantifiable account of the different wealth of different parts of a country ? Suppose there are two distinct states, one rich R and one poor P ; and that a project could be located in either. Suppose the unweighted net benefits for each year would be higher if it were located in R. The question is, whether weighting the benefits according to the state in which they arise would make P the best choice.

The first problem would be to assess the net benefits by state. It would not be true that, because the project was in P, all the benefits would accrue to P, and *vice versa*. Having distributed the net benefits between P and R (for all future years), one would then have to weight them. How could the weights be determined ? The central government would have to lay it down that, say, consumption generated in P was to count for 1.5 and that in R only for 1. For good or ill, it is hard to imagine that agreement on such a fiat could be arrived at. Admittedly, the example given — that of a federal state — is a particularly difficult one. But even in a unified state it is not easy to imagine a government agreeing to such a bare-faced quantification of the problem, despite the fact that it is the

only systematic way of giving preference to one region over another. On the other hand, the government may be quite willing to give subsidies to particularly poor regions, in one form or another. Where these exist, they should be subtracted from costs by the project evaluator since they are a roundabout way of saying that a rupee's worth of income generated in one area is worth more than in another.

Normally, however, no full recognition — and often no recognition — of the inequality of different regions or states will be found in the country's system of taxes or subsidies. If, at the same time, the government is unwilling to put quantitative weights to the benefits of different regions P and R, then their inequality cannot be given *quantitative* recognition in a project criterion. Nevertheless, of course, it may happen that qualitative recognition of the poverty of P would result in its getting projects, which strict application of the criterion would have allotted to R. In such a case, it is important to calculate how much extra weight would have to be given to benefits in P to make the decision to locate it there a rational one. It is only in such ways that one can begin to try to rationalize industrial location policy, and see that P receives projects where the extra weight that needs to be attached to the benefits in P is relatively small, so that P gets benefited in ways which cost the rest of the community least.

We turn now to the second main way in which project selection affects equality, and note that projects which employ a lot of labour (relative to the savings they use up) are more conducive to equality, at least in the short run. But in the previous section it was emphasized that governments may wish to promote savings by choosing capital-intensive projects. This basic dilemma was already referred to in Chapter II. But a good project criterion does not accept dilemmas : it reconciles them. Thus a project which increases the consumption of workers now more than another, also adds little to savings and investment compared to the other, and so adds little to the future consumption of workers[1]. In theory, by suitably weighting consumption both as between rich and poor now, and as between present and future individuals, a correct estimation of benefits can be arrived at. Thus a project which employs a lot of labour will get high marks because it results in a lot of consumption by the poor now, and during the project's life. But the incomes generated by such a project will be almost entirely spent. There will therefore be little savings generated, and so such a project will contribute little to future investment which, in turn, yields future consumption. Thus its main effect on future consumption will be that which it generates directly itself, and it will get few marks for the indirect future consumption which comes from its effect on savings and investment.

A highly capital-intensive project, i.e. one which employs few workers relative to the savings it absorbs, is very different. On the one hand, it adds little to the consumption of the poor now, and during its lifetime. On the other hand, it should generate much gross profit which turns into taxation, ploughed back profit, interest, and dividends. The interest and dividends (and also managerial salaries, etc.) will increase the consumption of the relatively rich, but otherwise the gross profit is saved. Such a

1. When considering the problem of location above, savings were not mentioned. But, of course, locating a project in a less suitable region for reasons of equality will also tend to result in less savings.

project gets low marks for its own effect on consumption, since it raises the consumption of the poor very little, and since the consumption of the relatively rich has a low weight. But it adds a lot to savings during its lifetime (provided, of course, that gross profits really are high). These savings will in turn raise future consumption, and on this account it may get relatively high marks — just how high depends as we have seen on how much the future is to be discounted. It is clear that the benefits of a labour-intensive project come largely in the near future, while those of a capital-intensive one are delayed (and very greatly delayed if the savings generated are, in their turn, invested in capital-intensive projects). All this has to be given its due in a criterion for project selection.

We have said that in principle all of the future consumption (direct and indirect) generated by a project is estimated and weighted. But the preceding paragraph makes it clear that the indirect future consumption is allowed for by estimating the savings directly generated by the project. In Chapter II we saw that in developed economies savings were usually treated as having the same social benefit as consumption, so that no need would arise to distinguish the incomes generated according to their likely effect on savings. But we also saw that it can be argued that in many developing countries governments value savings more highly than consumption. In this event and assuming also that governments wish to use project selection to promote savings, the project evaluator must estimate separately the effect of the project on savings and consumption. But this in no way conflicts with the assumption that consumption is the only end of economic activity. Let us now see whether this assumption can be reasonably challenged.

3.3 Other Possible Objectives

It should first be said that many apparent short-term objectives of economic policy, such as preventing inflation and recession, correcting a balance of payments deficit, and so on, cannot be regarded as ultimate objectives. If rapid inflation is harmful to the consumption objective (which includes the distribution of consumption), as it probably is, then it should be prevented. But the level of prices as such has no claim to consideration apart from its effect on the real standard of life of human beings. Again, a balance of payments surplus is no advantage in itself. No one would mind running a deficit for ever, if that were possible!

Having selected out all those apparent concerns of policy which are really means or constraints and not ends, is there anything but consumption left?

3.31 *Employment*

A possible suggestion is employment. It is not impossible that the consumption objective would be better satisfied with less than full employment (which is hard to define anyway). If employment is an end in itself, a situation of more employment and less consumption could be preferable. But it is possible that this may seem plausible only because one worries about the low consumption of the unemployed. If so, it is not really true that the consumption objective is better satisfied, because this objective includes consideration of the distribution of consumption. Thus

employment is an independent objective only if one believes that a man is better off working than if he manages to consume the same without working. This is a possible viewpoint. But it is academic. In project selection, one should in any case give some special weight to employment for reasons of the distribution of consumption; and this can, as it were, invisibly contain any weight given because employment is considered to be an end in itself.

3.32 *Independence*

Another suggestion, which has to be taken seriously, is that 'economic independence' should be taken as a separate objective.

Economic independence can be given a number of meanings. The first to be considered is independence of foreign aid (excluding net private capital inflows). This is a stated objective of some countries' planning, most notably that of India. It implies that at some point in the future the country wishes to do without some of the aid it could obtain, and so sacrifice some consumption for the sake of independence. There is no difficulty in dealing with this. It implies only that the level of investment has to be lower than otherwise, which will have some influence on project selection.

Aid is only one kind of contact with foreigners, even if it is a particularly sensitive one. Trade also results in many contacts, and some countries have at times preferred to trade as little as possible. We are simply assuming in this Manual that 'pure autarchy' of this kind is not a relevant consideration.

But 'economic independence' is often given a more specific reference. It has been argued by different developing countries that they should aim at independence in food, other 'essential' consumer goods, capital goods, and armaments. The argument 'we should produce our own...' seems to have an intuitive appeal. Steel, oil products, airlines, and motor cars, seem to be particularly attractive. If all such demands for self-sufficiency were met, international trade would be extremely restricted with a forfeit of the very considerable economies which derive from producing things on an adequate scale, and from specialization. But the desire for autarchy in one line or another seems so widespread that it is essential to discuss to what extent it appears to be a rational objective.

One point needs to be disposed of right away. It is often argued that countries must develop production of this or that on long-run balance of payments grounds. We are not here concerned with that at all. Any good criterion for project selection will take proper account of the fact that a country cannot run a balance of payments deficit indefinitely. We are concerned only with valid reasons which would make domestic production desirable, over and above such production as would in any case be dictated by the scarcity of resources, including foreign exchange.

One reason which may lead a country to want to be relatively self-sufficient in some goods, is the risk that imports in general may sometimes have to fall sharply. While, in the end, any economy can accommodate itself efficiently to a change in its ability to import, nevertheless, in the short run, it can cause considerable havoc: because when capital equipment has been laid down and methods of production established, it will be impossible quickly to reorientate production so as to rely less on imports.

Such a sharp drop in the capacity to import could result from warfare dislocating world transport. Again, a few countries suffer from severe price fluctuations in their exports which at times will force a reduction in imports. In the latter case, foreign exchange reserves are, of course, the first and proper insurance against the risk; but it would be too expensive to insure in this way against every eventuality. In the former case financial reserves are useless: physical 'strategic' stocks of some goods may be kept, but this does not apply to perishables, and in any case may be very expensive.

If there is a severe risk of a general import shortage from time to time, the country should perhaps give some attention to seeing that its import bill does not contain a very high proportion of goods whose consumption cannot be postponed without severe damage to life, or to the country's own ability to produce. But it is questionable whether any developing country whose exports are liable to large fluctuations is in such a position.

It is curious that the present argument has been used in favour of producing capital goods. These together with consumer durables are the most postponable of all. It is certainly better to delay investment than have people starving; and it is usually better to delay investment than have existing investments idle, with consequent unemployment for lack of materials (the exception would be if such investments had been misconceived in the first place).

There is also a legitimate fear of relying on one or a very few sources of foreign supply where either, first, the supply is liable to fluctuations so that exports might be discouraged or even forbidden; or where, secondly, exports might be stopped for political reasons. Certain foods might fall into the first category. Armaments and other 'strategic' goods may fall into the second. There is also the possibility of warfare, or near-warfare with the supplying country. In these latter cases it may be preferable to foster a diversity of suppliers rather than give especial priority to costly home production.

To sum up, it is the feeling of the authors that there is rather seldom a very good reason for making (relative or complete) self-sufficiency in particular goods a policy objective. But, of course, the government has to weigh this up.

The consequences for project selection are relatively simple to deal with. If the priority given to self-sufficiency is absolute — then clearly no further criterion is needed, except insofar as not everything can be done at once. But the priority is seldom absolute. In other words, the government will not be willing to create domestic production regardless of cost. In this latter case, the price obtainable for the output, given the competition of imports, is not taken as a sufficient measure of its value to the community. Of course all industry in a developing economy may be protected. But if there is a special argument for home production of a particular good, then it is logical to give it special encouragement — whether by subsidies, or by a tariff or quota.

3.33 *Power and Prestige*

Employment and economic independence apart, it would be naive not to recognise that many countries have aims which cannot reasonably be interpreted as themselves means towards the consumption objective.

Expenditure on defence, police, law, etc. can all be regarded in this latter light. On the other hand, it is clear that expenditures for aggression and national prestige cannot normally be so regarded. Let us take prestige as the less sensitive of the two for purposes of discussion. If a government regards a super hotel, a steel works, an airline, as prestigious — then its value cannot be assessed merely in terms of its consumption potential. As with ' pure autarchy ', we ignore such objectives — not because we take the view that they are necessarily undesirable (the people may take pride and pleasure in the fact that their country has its own airline), but because we have no way of measuring them.

In evaluating projects where prestige enters in, one can sum up only the measurable aspects, and leave it to governments to go ahead despite the low measurable return, or even loss. It needs emphasis, however, that an analysis of the (more or less) measurable aspects should always be carried out, even where non-quantifiable objectives may strongly enter in — for otherwise the government does not know how much it costs, in terms of the people's general standard of life, to pursue prestige or some other aim in that particular way. This is closely analogous to the point which was stressed in connection with regional inequalities in 3.2 above: if a qualitative objective is pursued, it is always worth seeing how much it costs to pursue that objective in the particular way proposed — for the objective may be adequately realized in a less costly manner.

Chapter IV

SCARCE RESOURCES

4.1 Political Economy: or the Economizing of Scarce Resources

The basic meaning of economy is, or should be, not just spending less, but spending wisely: and spending wisely means spending limited resources in such a way as to achieve most.

In Chapter III we dealt with the objectives of economic policy from a country's point of view; and showed how different objectives, such as consumption at different times, and/or consumption by different individuals, have to be weighed and added together, in order to define exactly what 'achieving most' means. Mathematicians call the above process 'defining a function' — in this example the 'function' is the sum of the mathematical products of each year's consumption and the weight attached to that consumption. This function, if it correctly defines what the government wants to maximize, may be called 'the objective function' — i.e. the objective is to maximize this function.

In this Chapter we consider the limited resources. Any maximization problem involves a limitation, or constraint. If there were no limitation to the resources available, there would be no problem. In economics, the limitations are generally known as 'scarce resources'. The economic problem is how to use and combine these 'scarce resources' so as to maximize the objective function. (As in earlier chapters we shall for short speak simply of 'maximizing consumption' rather than 'maximizing the consumption objective', or 'the objective function'.) By 'resource' we mean anything 'scarce' which is not a consumption good[1]. Anything is 'scarce' if more of it would permit an increase in the value of consumption. In this general sense, all goods (other than consumption goods themselves) are scarce resources. So also are people.

Scarce resources, taken as a whole, are used not only to make consumption goods now or in the near future, but also to maintain, reproduce, improve, and multiply themselves, so that as many or more consumption goods can be made later on. This is the process of investment. It is important to note that investment consists not only of improving and adding to buildings, machinery, and stocks of goods; but also of improving the people and the land.

Scarce resources are usually bought and sold at a price. If they were given away free (e.g. by the government) then the amount demanded would inevitably exceed the supply. In such circumstances, it is generally difficult

1. Consumption goods are, of course, scarce relative to the satisfaction of the individual. But we are not here concerned with the economics of individual choice. We also leave on one side ends other than consumption.

to ensure that they go to those who can make best use of them (we refer below to methods of distributing goods other than by free market sales, such as rationing). Thus economists view the price mechanism as a way of 'allocating' scarce resources. If certain conditions hold, then the price mechanism can be shown to be the best way — that is, the goods go to those who will use them to maximum social advantage. It should be no surprise that these conditions are the same as those required to bring about a coincidence of private and society profitability, which were discussed in Chapter II.

There are two essential features of a price mechanism if it is to work properly in society's interest. The first is that the prices of the final outputs of consumption goods should reflect the contribution of each to the social value of consumption. This is, by and large, a matter of consumers' sovereignty (as modified by the system of indirect taxes and subsidies), and of the distribution of consumption between individuals, and through time, as discussed in Sections 2.17, 3.1, and 3.2.

The second feature is that the prices of resources should reflect their scarcity. In the case of resources whose supply cannot be increased, e.g. unimproved land, this means only that the price should be high enough to equate the amount demanded with the fixed supply. But the supply of man-made resources, that is of most resources, can be increased. In this case, what meaning do we attach to the statement that the price should reflect the scarcity? The statement that the price should equate the amounts demanded and supplied remains true: but it is inadequate since the amount to be supplied is a matter of choice. There is an additional requirement, which is that the amount supplied should be such that the social cost of supplying a little more (in economists' jargon this is the 'marginal social cost') is also equal to the price. If this condition is met, we have a situation in which it is both true that supply and demand are equal, and also true that the price equals the marginal social cost. This then is what we mean by saying that the price should reflect the scarcity of the resources.

We still have to ask under what circumstances the price mechanism will operate so that the prices of reproducible resources *will* reflect their scarcity. Once again the conditions are the same as those required to bring about a coincidence of private and social profitability as discussed in Chapter II. This is because private entrepreneurs will, under such conditions, always expand output until the marginal cost (the extra cost of supplying a little more) equals the price. With a coincidence of private and social profitability, this also means that they will adjust the amount they supply until the marginal *social* cost equals the price.

We have stressed that prices should equate supply and demand. This is because, if there is excess demand, supplies have to be 'rationed' by queuing, bribery, official allocation, or even looting. There is then little reason to believe that the amount of the resource used in different uses will be such that it makes the same marginal contribution to the value of consumption. On the other hand, if each producer can obtain a resource only at the same price as everyone else, a price which he cannot influence, there is then a presumption that each producer's use of the resource will result in the same value of output (and hence the same benefit), because each will tend to use the resource in such quantities that the cost of an extra amount to him is just equal to the value of the resulting extra product.

Of course, rationing or allocation of resources has often been justifiably resorted to. But, in general, this is because it is believed that, in some circumstances, the free market price of a good does *not* reflect the contribution of that good to the real value of consumption. For instance, if there is a crop failure, the rationing of cereals at a controlled price may be eminently justifiable. This is basically because the exceptionally high market price, which would otherwise result, would cause a shift in the distribution of real income (to the extent of starving the poor), and therefore reliance on market prices as a measure of social benefit breaks down. In such a case, it is also true that the market price would not reflect the *long-run* cost of supply. Therefore, in exceptional circumstances, a controlled price may well be a better measure of both scarcity and benefit than an ephemeral market price. This can be true of productive resources as well as final consumption goods : but it is usually for temporary reasons.

The above is an example where a free competitive price cannot for short-run reasons be taken as a reflection of real long-run scarcity or benefit. There are many other longer-run reasons why the prices of scarce resources often do not reflect their real costs to society, measured in terms either of their contribution to the objective function, or in terms of the cost of increasing their own availability. These many reasons why costs of production, paid out for the use of scarce resources, do not always reflect cost to society, especially in developing countries, have been outlined in Chapter II.

4.2 Land, Labour, and Capital

Economists have in the past traditionally divided scarce resources into land, labour, and capital. The original idea behind this was that capital consisted of things accumulated as a result of past savings and their investment ; while land, which includes mineral resources, was a gift of God ; and labour, although it may indeed accumulate, was not accumulated as a matter of economic decision. This categorization of resources fails insofar as much investment goes not into accumulating capital goods, but into educating human beings and improving the land. Even so, the distinction can still be useful. But it has to be remembered that land and labour must (if the three categories are to be thought of as exclusive) be considered as unimproved or ' raw ' land, and uneducated or ' raw ' labour : while capital, in the above sense, includes not only those things which are usually thought of as capital goods (factories, railroads, machines, etc.) but also stocks of ' intermediate ' goods (steel, oil, fertilizers, etc.), as well as that part of the value of land and human beings attributable to improvements and education.

Land, labour, and capital (in the senses defined above), are certainly all scarce in developed countries. But, as has been suggested in Chapter II, the emphasis is rather different in many developing countries.

Labour is sometimes believed not to be scarce at all in some developing countries. This means that, from the point of view of society, it is a free resource (like the air) in that the alternative product sacrificed by using raw labour in industry is zero, since withdrawing raw labour from its alternative use — in agriculture — would not reduce output there. This is, probably, an extreme view. But it remains likely that the price that has to be paid in industry is greater than the consequent loss of agricultural production.

If this is true, urban wages suggest that labour is scarcer than it really is : in other words, they do not properly reflect the real cost of using labour in industry.

In a few very underpopulated countries, land may be almost a free resource, from a social point of view. But, in some of these countries, the land tenure system, combined with the value placed by some individuals on mere ownership, may combine to give it an unreal value.

In all developing countries, capital is felt to be particularly scarce. But what exactly does this mean ? Usually, it just means that developing countries have much less capital per head than developed countries. In this sense, it is a reflection of the poverty of these countries, and of their desire for development. More raw land is usually impossible to obtain, and more people would only rarely assist in raising income per head : therefore more capital is the answer. To say that capital is particularly scarce may also be a plea for more domestic savings, or for more aid. Scarcity of capital in the above senses must be carefully distinguished from a scarcity of capital goods, in the sense that their price is too low, so that there is excess demand for them. This is quite a common phenomenon in developing countries, but it is by no means universal : moreover, it could arise in countries with the highest levels of capital per head.

One kind of capital shortage that is often singled out is the lack of skilled and educated human beings. This kind of capital may indeed be scarcer, in the least developed countries, than capital goods — in the sense that more capital goods cannot be effectively used if there are not enough people who know how to use them. But it is, as with capital goods, difficult to generalize about whether skilled human beings tend to be in excess demand — this will be the case only if they are paid less than their worth to employers. In some developing countries, the earnings of the skilled and educated seem to fully reflect their earning power on world markets ; in other countries they receive less than their contribution to the economy, as well as less than their earning power on world markets. This is a problem for some developing countries. If such people are allowed to earn their full world value, they earn an extremely high relative income for a poor country : if they are not so allowed, in the name of equality, then the ' brain drain ' may be very damaging. We shall see later that it is difficult to know how to value skilled labour in a social cost-benefit analysis.

With the possible exception of labour, it is thus difficult to generalize about the manner in which prices reflect the ' scarcity ' of all those people and things subsumed under such concepts as land, labour, and capital. Capital in detail, consists of just about everything there is. It is the prices of individual goods and services that have to be scrutinized. These can, as seen in Chapter II, go wrong for a multitude of reasons. It is true that raw labour enters into everything, and therefore that no price will be right if that of labour is wrong. But this is only one of many reasons why prices may fail to reflect scarcity for individual goods and services. So far as industry at least is concerned, it is not, moreover, one of the most important reasons.

4.3 Foreign Exchange

We have, thus far, dealt with the scarcity of the real resources of the country in question — land, trained people, and things. But it is often

said that two of the basic shortages facing developing countries are foreign exchange and savings. We shall deal with foreign exchange first, then savings, and then the two together.

If we take a snapshot picture of an economy at a given point of time, a reserve or stock of foreign exchange (including unspent loans) is an asset just as are the stocks of capital and intermediate goods which exist. Foreign exchange is, in this sense, a scarce resource like any other, because it can be very quickly transformed in real goods and services.

But this is not what is ordinarily meant by saying that there is a shortage of foreign exchange. What is meant is that the demand for it exceeds the supply. This is equivalent to saying that the demand for foreign goods and services is greater than the supply of foreign currency needed to pay for them ; greater, that is, than the earnings from exports of goods and services plus any net foreign loans or gifts available. The reason for such excess demand is that the rupee price of foreign goods is too low. This necessarily carries the implication that foreign goods and services are worth more to the economy than their rupee price suggests. This is another way of saying that the exchange rate (taking into account transport costs, tariffs, export subsidies, and anything else, other than actual restrictions, which affects the supply and demand for foreign exchange) is overvalued.

Overvaluation implies and is implied by an extensive rationing of foreign exchange itself, or of the foreign goods and services on which it is used. Foreign goods and services are too cheap relative to domestic ones. This implies also that the prices of domestic goods and services, especially of labour, are inflexible — otherwise they would fall until the supply and demand for foreign currency was in balance. Thus, where the currency is overvalued, the rupee price of every foreign resource directly used in a project will understate the cost to the economy relative to the use of domestic resources.

But so far we have not said exactly what we mean by ' domestic resources '. It does *not* mean simply all goods and services purchased from domestic suppliers. Thus the purchase of an electric motor made at home, may result in someone else importing an electric motor instead of buying it from a local source (if, for instance, the supply of domestically made electric motors cannot be quickly increased), or it may result in more imports of copper to make more motors.

The basic domestic resources are domestic labour and land, which cannot normally be traded. If their prices are inflexible then they can be too high relative to traded goods, whether these are actually imported or domestically supplied (the possibility of importing will, at least in the absence of rigid quotas, keep down the price of domestic goods which are in competition with imports). But land and labour are also, of course, inputs for other non-traded goods, like electricity, whose prices will also tend, therefore, to be relatively high.

It follows that, if the exchange rate is wrong, then a true evaluation of the social costs and benefits of a project can be made only by finding a way of separating out the *direct and indirect* use of or savings of foreign resources. Having made the separation, one has two sets of costs and benefits, one expressed in dollars (and this set includes much more than the direct expenditures or receipts of foreign exchange), and one in rupees (this set includes mainly domestic labour). The two sets must then be made

comparable. This can be done by revaluing the final dollar total in terms of rupees (this is using a kind of ' accounting exchange rate '), or *vice versa* (by using a kind of ' accounting wage ').

For industrial projects, it may be best to use either accounting prices for foreign exchange, or an accounting wage rate, even if the general over-valuation, discussed above, does not exist. Thus, in Chapter II, it was said that ' there is little doubt that a well-designed interference (with the price mechanism) in the shape of special encouragement of industrialization, can make industrial profits a better guide to social advantage than they otherwise would be '. Both of the above methods can be used to give the required encouragement. This is further considered in Chapter VI.

4.4 Savings

Saving is not, of course, a real resource like human beings, land, and goods. ' Saving ' means ' not consuming '. Provided the value of output is not thereby reduced, not-consuming implies that goods and services remain available to help increase future production — which is ' investment '. It is thus not a means of production, but rather a means of accumulation and development. More saving now, which involves less consumption now, permits more investment; and hence more consumption later.

We have already discussed the meaning of a *long-run* scarcity of savings — the situation in which the government believes that society would benefit if there were more saving and hence more investment. It was said (in 2.38) that this was equivalent to maintaining that the public over-discounted the future, and that the market rate of interest was higher than the rate at which the future should be discounted. If the public were keener to save, there would be more saving and investment, and a lower rate of interest.

It is important to realize that this does not imply that the government should try to reduce rates of interest. This is appropriate action only if investors are not willing to invest as much as savers are willing to save. In the majority of developing countries, it seems that the government is willing and able to promote, whether by direct ownership or otherwise, sufficient investment to take up all the savings which people are willing to make. The problem of insufficient investment may arise, but we believe that it is much more common for countries to be faced with the reverse problem — in which case a rise in market rates of interest is more likely to be the appropriate action. However, we cannot go into such questions of monetary policy, for any full discussion would take us far afield, and it is not essential for our purposes.

This brings us to the meaning of a *short-run* scarcity of savings. The defining characteristic of the *short run* is that the amount of productive capacity is inflexible. In this situation a deficiency of domestic saving implies that total demand (for investment, exports, and consumption) is tending to exceed total supply. One of two things, or a combination of them, then occurs. The first is an inflationary rise in prices, and the second is a deterioration in the balance of payments. The second is inevitable unless controls are initiated or existing ones tightened. But if more imports are allowed to flow in, then inflation can be avoided. To put the same thing in another way, a deficit in the balance of payments represents a use of foreign

savings. So long as a country can run a balance of payments deficit, as a result of a flow of aid or private capital, it can continue to operate with a level of domestic investment which exceeds the level of domestic savings.

4.5 Foreign Exchange and Savings

We saw above that foreign savings are a good substitute for domestic savings — except insofar, of course, as the deficit is covered by loans which constitute an external liability.

It is an interesting and important question how far the reverse is true. Are domestic savings a good substitute for a balance of payments deficit? An often asked and closely related question is, 'Is aid meant to supplement inadequate domestic savings, or to supplement inadequate earnings of foreign exchange?'. To put it in yet another way, 'Can a developing country sustain, in the long run, any desired level of investment without a balance of payments deficit, provided it saves enough?'. If a country can, by saving more, always cure a balance of payments deficit without causing domestic resources to be underemployed, then foreign exchange has no claim to be a separate and independent limitation or means. This is an important question, not only for aid-donors, but also in project analysis. We must therefore explore it further.

An increase in savings is synonymous with reduced consumption. The extent to which reduced consumption will affect the balance of payments and domestic output respectively will vary greatly from country to country, and also vary with the extent of excess demand. But it is clear that, if the steps taken serve only to reduce consumption, then part of the reduction will depress domestic output, even although imports will be reduced and exports may be increased.

But we are not concerned with the short run in project analysis. In the longer run, we must allow for other policy changes which will help to make the increase in savings cure the balance of payments deficit without affecting domestic production. The most notable is a change in the exchange rate, or substitutes such as higher tariffs, export subsidies, etc., which will make domestic goods cheaper relative to foreign goods, and so turn demand in their favour. Now, given this, there can be no doubt that *industrialized* countries could, within a year or two, substantially raise their investment rates (or sustain the same rate with a reduced inflow of capital) without balance of payments deficits or underemployment of resources, provided savings increased to the same extent. There is rather more doubt in the case of some developing countries. What are the reasons for this?

Investment can be increased, without affecting the level of aggregate domestic production, in the following ways:

a) by switching domestic resources from making consumption goods to making investment goods;
b) by reducing imports of consumption goods, using the savings of foreign exchange to buy more investment goods;
c) by increasing exports of consumption goods, and of intermediate goods or materials which are released by lower consumption at home, using the proceeds to import more investment goods.

Now (a) may be difficult for a developing country, except in the rather long run, because it may lack the engineering and intermediate goods

industries, such as cement and steel, which contribute largely to making investment goods. The second route (b) is relatively easy, where there are large imports of final consumption goods: but some developing countries have virtually completed the process of import substitution in this field, so that they import very little by way of final consumption goods. Finally, some developing countries' exports consist largely of food and materials which are not in very elastic world demand.

If a country is badly placed in all these respects, then investment can be significantly increased (without more foreign aid) only if the investment programme is itself made more labour intensive, and less intensive in the goods which can be obtained only from abroad. It is possible, though not always true, that this would make the investments less productive — and perhaps so much less productive that the desired increase in investment would be worth while only if the situation could be eased by more aid.

What does the above argument amount to? If a country is not in a position to make many capital goods itself, and if it cannot export more without considerably reducing its export prices, then as the level of domestic savings rises it becomes ever less worth while to try to increase savings and investment further. In these circumstances, foreign aid may be a lot more valuable than a nominally equivalent increase in domestic savings. This is what is meant by saying that foreign exchange is 'more of a bottleneck' than domestic savings. But it should also be added that a country which has got into the situation described has not pursued ideal policies in the past (given that the desire to raise investment was foreseen). Such a country should either have diversified its exports to a greater extent, or should have done less import substitution in consumption goods, and more in capital goods.

Our project selection criterion will, of course, make proper allowance for such difficulties in earning foreign exchange, and for a developing country's relative inability to switch production from making consumption goods to making investment goods. In the short run, and given the level of foreign aid, one must not attempt to raise savings and investment to unrealistic levels. In the longer run, by allowing for the difficulty of increasing export earnings from traditional products (which is done by appropriately low accounting prices for such products), the right degree of preference can be given to projects which substitute for imports and diversify exports. The more inelastic the export demand for traditional products, and the greater the difficulty of promoting new exports, and the fewer the consumption goods imported, the more likely is it to be socially advantageous for a country to begin to produce its own capital goods.

Chapter V

PLANS, PROJECT CHOICE, AND PROJECT DESIGN

In Chapters III and IV we described the ends of economic activity, and the means available to those ends. We now turn to a discussion of some of the ways in which a government may help to ensure that the means are efficiently used in pursuit of the ends. Of course, we do not aim to discuss all the policies which governments may use to further economic ends — but only those which are intimately connected with the subject of this Manual. In this Chapter, we discuss the relationship of project choice and design to public ownership and planning.

5.1 Public Ownership and Planning

The degree of public ownership and planning varies very greatly in developing countries. The two are not the same.

A large public sector does not by any means imply much centralized planning. Different departments may make their own investment plans, with little attempt made by a central department, or planning office, to relate these to the future of the economy or to assess priorities. Nor, where some such attempt is made, is it necessarily made within the framework of a plan which seeks to predict, or to influence or control, the movement of the main economic magnitudes (such as consumption, savings and investment, the balance of payments), as well as their breakdown by major sectors. Where there is such a 'macro-economic' plan (which may or may not be published), the extent to which it is supposed to be operational, indicative, or only predictive, in turn varies widely; as also does its possibility of achievement, and in general its relation to reality.

On the other hand, a small public sector, more or less limited to traditional activities, is consistent with the government having a major deliberate influence on project selection: but, where it has a major deliberate influence, it does not follow that it exercises it according to any established principles.

Despite the great range of circumstances, it is necessary to relate project selection to planning. Ideally at least the two are intimately connected, as will appear below. To clarify the issues, we consider in this Chapter the case of a wholly planned economy. Clearly this case is not taken because it is typical or realistic, or likely to become so: it is made only for analytic reasons. By a wholly planned economy we mean (1) that all investment decisions are made within the government machine, (2) that long range production and employment plans are made both for the economy as a whole, and for particular sectors in considerable detail, and (3) that

corresponding income and expenditure plans are made, in order that operating units can just make the purchases implied.

5.2 Plans Require Projects

A sound development plan requires a great deal of knowledge about existing and potential projects. This is obvious enough for a short-term operational plan (3-5 years) which should, among other things, contain firm and realizable plans for government expenditure in different sectors. But it is just as true for a 'perspective' plan, by which we mean a medium-term sketch of economic developments in quantitative form, covering a period of, say, ten to fifteen years.

Such a perspective plan will lay down target rates of growth for gross national product, consumption, and also for investment and its financing by both domestic and foreign savings. For this to be done, it is clear that realistic assumptions must be made as to the amount of investment that can be achieved in each year, about the lags between investment and output, and finally about the amount of output which will flow when capacity operation is achieved (the capital-output ratio). Only then can one establish a well-worked-out relationship between investment and the growth rate — for the relationship between the two is not simple, and varies greatly from time to time, and country to country.

If these assumptions are to be realistic concerning the level of investment which can be effectively carried out, and the connection between this investment and output, a knowledge of the rate at which good projects can be planned, designed, built, and brought to capacity operation, is first required. Secondly, one needs to know the capital-output ratios which can be expected in different sectors of the economy. It is important to note that this kind of knowledge cannot be sufficiently accurately obtained either through the study of investment and output trends in other economies, or from project data, derived from other, especially fully-industrialized, economies. However, lacking anything better, it may be necessary to use such sources. If so, allowance should be made for the fact that costs are usually higher than expected, and outputs lower, in developing countries than they are in industrialized countries. Further to this, the capacity to develop sound projects is often overestimated, while the time-period required for their planning, their construction, and for bringing them to full production, is underestimated. In short, if a plan is to be consistent and feasible, a lot of self-knowledge is required. If this self-knowledge is to be gained, the critical appraisal of projects which have already been constructed should not be neglected.

But one cannot be satisfied with a plan which is merely consistent and feasible. In principle, there are an infinite number of such plans, some of them very bad, and only one of which is the best of all. One can never hope to arrive at this optimum plan. But unless one strives continuously to direct one's investment to those sectors where it would yield the most benefits to the economy, and within sectors to projects which yield most, one will certainly end up with a plan which is very far short of what could be achieved. Thus, if the division of investment between different sectors of the economy is to be rational, it is essential that the costs and benefits of many different projects in each sector should be assessed on a comparable basis.

Here, one must admit that there are limits to what economic analysis can achieve. No matter the sector of activity, costs are relatively easy to estimate on a comparable basis. But this is not always true of benefits. For instance, although there is by now a considerable body of work concerned with estimating the benefits of education and medical expenditure, it would be unwise to put much confidence in the results as yet. But no such strong reservations need be made in the important sectors of economic infrastructure, industry proper, and agriculture. In these areas, although it is of course true that estimates of cost and benefit always go wrong, nevertheless it would be highly obscurantist to suggest that one should not try to peer into the future at all. And, if one is going to peer into the future, it is important to make sure that the manner in which it is done does not lead to biases as between different sectors and different projects. This subject will be explored at greater length later.

While hunch must play a part in the above-mentioned sectors where benefits are hard to measure, it is often carried much too far, and usurps the place of economic analysis, even where the latter can be well applied. Such hunches often carry the euphemistic name of ' strategies '. A list of some of the hunches, dogmas, doctrines, or strategies, which have played a role, is not very enlightening. They include the following :

1. Priority must be given to industry.
2. Self-sufficiency in food is a first consideration.
3. Heavy or basic industry must be established first.
4. Light and consumer goods industries are usually, and should be, established first.
5. Labour-intensive industries must have priority.
6. There is a lot to be said for capital-intensive industries.
7. Preference must be given to industries which process indigenous materials, especially those which are exported.
8. Import substitution is the best road to progress.

Our belief is that such hunches have no general value. The best direction of advance of a particular economy can be determined only by close analysis of that economy. Furthermore, non-quantitative analysis, even if shrewd, is dangerous. It tends to lead to exaggeration. Excessive emphasis on one sector and neglect of another is not uncommon. The best balance between sectors can be achieved only by quantitative analysis. All the arguments which lead some to advocate more for agriculture, and others more for light, or for heavy industry, can be given due weight. The arguments on both sides usually have *some* validity : in practice, though, everything depends on *how much* validity — and this can be determined only by a proper system of cost-benefit analysis.

The point has been made that good realistic plans can hardly be formulated in the absence of a great deal of project planning, and without proper economic appraisal of projects. This should be obvious : in fact it has been almost everywhere neglected.

5.3 Projects Require Plans

But is it also true that the best economic appraisal of projects cannot be made without a plan. To choose the right projects, one must have an estimate of the demand for the product. But how can one estimate the

domestic demand for any product unless one has some idea of how the economy will develop ? And how the economy develops in turn depends on the long-range plans and policies of the government. For instance, one can go very wrong in estimating future demand if one bases the estimate solely on past trends. This is particularly true of intermediate goods and capital goods. In these spheres especially, the government's plans for industrialization and capital development must play a large role in any demand analysis. This sounds obvious indeed, but even so there are many examples of its neglect.

However, it must always be remembered that the total demand (including export demand) may be met either by imports or by domestic production. The extent to which one or the other of these sources of supply will be dominant depends very much on government policies with respect to tariffs, exchange rates, and import controls. These in turn will depend on estimates of how the overall supply and demand for foreign exchange is likely to develop.

Turning to the supply side, any analysis of the real cost of a project requires a knowledge of the strength of the scarcities which are operating and will operate in the economy.

It is most usual to take the actual prices of scarce resources, reigning at the time, as adequate measures of the real scarcities. But scarcities change as development proceeds : and projects last ten or twenty years or more. In theory, at least, future prices thus need to be predicted, and used for the estimation of those costs and benefits which occur in the future. In particular, the relative scarcity of domestic and foreign resources may change, involving a change in the exchange rate. Furthermore, some scarcities, or present bottlenecks, may be broken in a few years' time. If this can be foreseen, it would be wrong to use the existing price as a measure of scarcity throughout the life of the project. A likely future change in a price may be taken as a reason for using an accounting price now — as an approximation to the insertion of a predicted price for each future year[1].

Part, at least, of the point of perspective planning should be to help the planner to guess how scarcities will change. Will disguised or actual unemployment rise or fall ? Will the balance of payments position become easier ? Will the population growth continue to accelerate, with its implications for educational expenditure ? And so on !

Thus the look into the future — and it can be somewhat better founded than mere crystal-gazing — which perspective planning in particular entails, is necessary in order to produce informed guesses as to future scarcities. It is thus necessary whether or not accounting prices are used. For one unavoidable accounting price — the rate of discount — it is particularly necessary. A discount rate cannot be sensibly fixed without taking a view both of the future rate of savings and of the investment opportunities open.

But whereas it is beyond argument that good plans require good

1. For example, Israel is said to have used a shadow rate of exchange in project analysis because the reasonable expectation is that foreign exchange will get scarcer. See M. Bruno, " The Optimal Selection of Export Promoting and Import Substituting Projects ", in *United Nations, Planning the External Sector : Techniques, Problems and Policies* (document No. ST/TAO/SER C/91), p. 30.

projects, the argument outlined above, that a proper analysis of projects itself requires good plans, can be overemphasized. It is certainly true that analysis within the framework of an overall plan for the economy should produce a better estimate of the costs and benefits of the project, than can be the case if no plan exists. But this does not at all mean that cost benefit analysis is useless if it has to be done without the benefit of publication of the central government's guesses as to the future development of the economy. It will certainly be less good insofar as guesses have to be made about the government's own investment intentions. But, in general, one can make some guess as to the real scarcities which face the economy in its development, and put a price on them, even without the benefit of any attempt at overall planning. The difference is that the guess will be a little less enlightened without such planning.

5.4 The Interaction of Project Analysis and Plan Formulation

In presenting the twin propositions that 'plans require projects' and 'projects require plans', it may seem that an insoluble chicken-and-egg dilemma has been posed. If good plans cannot be formulated without a proper economic appraisal of projects, and if the real value of projects cannot be properly ascertained, except within the framework of a plan, where does one start? But the chicken-and-egg analogy is false, as one is never totally devoid of knowledge. Inadequate or inaccurate plans may be first formulated with little knowledge of the contribution to growth made by individual projects. These in turn should permit improvements in project analysis and appraisals, and so on. Macro-economic planning, in terms of figures aggregated for the whole economy, can then be gradually improved in the light of improvements in 'micro-economic' planning, i.e. planning at the sectoral and project levels; and *vice versa*. By such iteration and reiteration, one gradually tries to come nearer to an optimum plan.

We have now dealt with the mutual 'feedback' between project analysis on the one hand and the formulation of economic plans in terms of rather broad macro-economic aggregates on the other hand. In summary, one can say (1) that reasonably consistent economic plans are not likely to be achieved without an assessment of the productivity of investment in various sectors — which requires project knowledge, and (2) that a good assessment of the productivity of investments itself requires a knowledge of scarcities and benefits which can, in principle, be properly made only if a long-run plan has been constructed on the basis of choosing the most productive investments. Everything thus hangs together, and planning must proceed on this understanding.

5.5 The Selection of a Set of Projects

This brings us to the problem of how a set of projects in chosen, after a cost-benefit analysis of each has been conducted. Here, we can make only some general remarks. This is not a manual of planning, which at a practical level is as much an art as a science. In a sense it is true that one cannot write a manual of social cost-benefit analysis without also writing a manual of planning. The two are so intimately connected! But we, nevertheless, have to attempt the impossible — for a textbook of planning goes beyond the scope of what is being attempted in this Volume.

Imagine a ' Central Office of Project Selection ' (COPS). The plan has laid down a sum-total investment target for the current year, and for several succeeding years. A flow of project appraisals is coming in from those responsible for making them. Put in its simplest terms, the problem is to fill up this year's investment budget, by selecting the best from the list of projects coming forward. This means having a project selection criterion, with a single parameter (possibly but not necessarily the discount rate) which can be varied so as to draw the line above which projects are selected which just suffice to exhaust the budget. The specification of such a project selection criterion is examined in Part II. Here we are concerned to state that the problem may in reality be rather more complicated than this paragraph makes it appear. We turn to consider a few of the complications.

1. Not all projects can be subjected to the kind of cost-benefit analysis discussed here, chiefly because a plausible quantitative assessment of benefit cannot be made. This is true of health, education, defence, police, etc. We may call these expenditures ' non-quantifiable ', and those for which economic appraisal is easier, ' quantifiable '[1].

The quantifiable projects, which can by definition be usefully compared, can be considered as forming part of the same budget[2]. But there have to be separate budgets for the non-quantifiable sectors. The total size of these should depend on the change in social profit which would result from a change in the size of the quantifiable investment budget. The smaller the latter the more reasonable it will seem to spend money on education and health which, apart from making some contribution to development, are desirable in themselves. But there is a limit to this, for investment in education and health results in the need for recurrent expenditure in future years, which will limit investment in industry, etc., just when more socially profitable investments in these fields may be coming forward. There can thus come a point when it may be better to raise less taxation for a few years rather than to invest as much as possible — or else to invest abroad. This is all the more true insofar as domestic investment is also a drain on foreign exchange reserves which might have been put to better use later.

For the purposes of this Volume, we effectively limit ourselves to the sectors or sub-sectors which together comprise the quantifiable ' area '; and we assume that the investment budget for this area has been decided. When we speak of the investment budget, we henceforward mean the budget for quantifiable investments.

2. It is not always correct to exhaust the investment budget. In formal terms, the social return must certainly never fall below the consumption rate

1. This is not an adequately descriptive term. ' Benefit-quantifiable ' is more descriptive, but too clumsy. Alternatives such as economic versus social, productive versus non-productive, developmental versus non-developmental, all carry persuasive or pejorative overtones, and are definitely misleading. We are in effect suggesting a new division which might not be very far different from distinctions already often made, but whose logic is different. Of course, there may be *some* non-quantifiable external costs and benefits in the quantifiable area. But the definition of the ' area ' requires that these be small, and that they should normally be neglected when it comes to project selection.

2. In practice, for administrative reasons, there will normally be a number of separate budgets. There is then the additional need to see that no social gain would result from increasing one and reducing another by the same amount. But this introduces no new principle.

of interest as defined in Chapter III : for this would mean that some of the transfer of consumption from the present to the future, which investment implies, was a loss to society. If this situation occurs, then it is best either to spend more on education, etc., or to reduce taxation. Another distinct possibility in such circumstances is that not enough money is being spent on investment surveys and pre-investment surveys, and on research (the benefit from this is also non-quantifiable). The proviso of this paragraph is not at all redundant, for we believe that there has been quite a lot of investment in developing countries, including industrial investment, which has not contributed to future consumption at all — which has had in fact a zero or even negative social yield.

3. Problems may arise because projects are large relative to the budget. For this reason it could, in theory, be correct to include a less good project than one which was rejected — because this permitted a fuller usage of the available funds. But in practice the size of the investment budget is always a matter of nice judgment : no one can say whether it should not be a little larger or smaller, from the point of view of avoiding both inflation and deflation (or a deficit or surplus on the balance of payments). Furthermore, the starting date of projects can be shifted, so that the amount spent in the current budget period is a variable. For these reasons, indivisibilities are not likely to be a problem[1].

4. The costs and benefits of projects are not independent of the date at which they are started. Even although a project would fall within the list to be accepted when judged on its present merits, it may be right to exclude it, and do it later. Projects often improve with time, and there may therefore be a gain from waiting[2]. This may be quite a common case because of economies of scale ; or because some project can be built, for technical reasons, only on a scale such that there is inevitably excess supply for some time.

5. The investment criterion chosen cannot be expected to sum up all relevant considerations — it may, for instance, be decided that no attempt should be made to include, say, regional inequalities in the criterion.

6. A project is not always, or should not always, be simply accepted or rejected. The decision may be that it should be modified or re-designed. This brings up such an important point, that we devote the succeeding Section 5.6 to it.

Despite these, and other possible qualifications, it must finally be emphasized that it is of the essence of good public investment planning that the same criterion for selection should be applied over the whole quantifiable field, and that the 'yea' or 'nay' resulting from using the criterion should not be lightly disregarded on grounds of non-quantifiable,

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1. In other respects, they are certainly a problem. They are further discussed in Part II.

2. The gain must be assessed in terms of present value — i.e. the costs and benefits of the delayed project should be discounted back to the present, not to its starting date ; and then be compared with the cost and benefits of the project if started now, these being also discounted back to the present.

or remote and implausible, economic effects. Some less good projects may be rightly chosen for reasons of equality, but that is rather a different matter.

5.6 Project design

It was emphasized in Volume I of this Manual that a project normally has many variants. First of all, there is the scale of output. But we should be anticipating ourselves too much if we discussed at this point the principles which should govern the choice of scale. They are dealt with in Part II. Here we want to emphasize the range of choice for the method of production, whatever the chosen scale.

Specifically, projects consist of many, more or less separate, processes. The generation of electrical power is relatively unusual, as is the production of steel, in that the main part of production is a single process, which may be of one kind or another, but is an indivisible whole for any particular technique of production. More frequently, each different part of the production process presents its own, independent, alternatives. In the production of textiles, for example, storing, handling, and moving materials around the factory, are quite separate activities from the main business of operating the looms. It may be desirable to use advanced power-driven looms, each with many automatic devices for controlling the output, and yet use relatively 'primitive' labour-intensive methods for moving the material to the looms and away from it, for controlling the finances of the undertaking, for dying the cloth, and so on. The chemical industry is another in which there are usually many separate production processes involved in any particular project, and the same is true of the building of most kinds of machinery, of construction, and of the provision of irrigation.

Even if there are only two or three different ways of performing each stage in the production process, there are a very large number of alternative plans for the project as a whole, if it is made up of many separate processes. This looks rather discouraging for the project planner! It is clearly impossible that the COPS be presented with every possible variant as a separate project. It can ask questions here and there, and examine some of the more important stages of production in more detail, but many of the processes will have to be taken for granted. In other words, a large number of economic choices will have been made already, either at the level of the initiating department, commission, or other decentralized public authority, or by the designing engineers. Many other choices can still be open after a project has been agreed: but these too will generally be taken at a lower level than those responsible for project selection.

Now, industrial engineers — good ones, anyway — are economists. But they are not usually the kind of economists who are trained to look at matters from the point of view of the economy as a whole. They will, or should, have profitability very much in mind. But they will, of course, assess profitability in the light of actual prices.

The value of the COPS choosing from a list of projects according to a criterion using accounting prices, supposed to reflect real scarcities and benefits better than actual prices, is clearly greatly reduced if each such project has in effect been chosen from a long list of variants by a criterion (profitability) which uses actual prices. For instance, if it is desirable to put

stress on employment by using a low accounting price for labour then clearly this stress should take effect at the level of project design, and not merely at the level of final project selection. Indeed, it may be at the former level that a low accounting price for labour would have its main effect.

If, therefore, an accounting-price project-selection criterion is used, it is of great importance that the same accounting prices should be used all down the line reaching to the industrial engineers. This is, perhaps, not quite as difficult as it sounds — and the claim that it cannot be done is certainly not a knock-down objection to the use of accounting prices.

The COPS must keep in close touch with all departments that put up projects for approval. If the departments, or public enterprises, know that the COPS will assess their efforts by using accounting rather than actual prices, it is surely in their own interest to see that projects are designed, and variants assessed, in the light of the same prices. Otherwise their work is liable to be frustrated. Of course, the sheer unfamiliarity will make for difficulty at first: but there is no basic conflict of interest. Where outside, especially foreign, firms of consultant engineers are involved, the difficulties may be greater. First, their psychological objection to accounting prices may be stronger as a result of private-enterprise laissez-faire training, which does not sufficiently admit the possible divergence of social and private interest. Secondly, they generally have something to sell, which has usually been envolved in the light of actual prices. Designs are not all made afresh, from the bottom up, for the project in hand. The COPS must prevent them from being robbers.

With foreign engineers, the problem is recognized to be more acute. Their designs tend to be made in the light of prices prevailing in their own countries, where the price of labour is high. Not only this, but also in making new designs fitted for the future, their thinking runs inevitably in terms of ever greater labour-saving — for labour has always become relatively more expensive as time goes on. Only very few Western firms appear to have made any effort to adapt their designs to the different scarcities prevailing in developing countries — nor, it must be said, have developing countries apparently encouraged them to do so, except in specific cases such as the use of a local rather than an imported raw material.

The preceding paragraph alludes to a well-recognized problem. Sometimes, indeed, the plant which Western engineers design for a developing country is more ' modern ' — i.e. capital-intensive and potentially labour-saving — than anything that exists in their own country. There are two obstacles to overcoming the problem. The first, and possibly most important, is often the lack of an informed and critical client, determined to get a plant which will be very profitable. The second reason — with which we are now familiar — is that profitability and social profitability may not coincide.

Even if the first reason is, in many countries, more important, the second is not negligible. Remember we are still considering a centrally planned economy. The client is therefore a government department, or semi-autonomous commission, or public enterprise. Even if there is, in the sector under consideration, an expert body which can state realistic requirements, and constructively and effectively criticize the project design at all stages in the light of local conditions, this expert body will itself not

be working along the right lines if it is not trying to get the socially most profitable project — and to do this, it must be conscious of the accounting prices by the light of which the COPS will assess the social profitability of all projects.

For the reasons given, it may not be easy to get foreign engineers to adapt. But this is a factor which tends to limit, rather than nullify or reverse, the influence which analysis in the light of accounting prices can bring to bear. However, it must be admitted, when everything in favour of accounting prices has been said, that communication between the COPS and departments, etc. ; between departmental administrators and engineers and scientists ; and between the local client and the foreign firms ; is easier in terms of (predicted) actual prices.

For this reason, it is always better to try to make actual prices realistic, whether it be by refraining from malign governmental interference with the price mechanism, or whether it be by benign governmental 'doctoring' of the price mechanism. Although this may not always be possible, it is certainly best to keep the use of accounting prices as limited as possible. But however good the system of prices — accounting or actual — and however competent and socially conscious the project designers, it will still be desirable for the COPS to do more than accept or reject the project as a whole. One pertinent question arises whenever the project can be broken down into a few major processes or stages of production. It does not follow that each process should be accepted just because the project as a whole is acceptable. For instance, in the chemical industry it can happen that an intermediate product might be best produced abroad and imported, because of economies of scale, while it is still worth while to produce the final product at home. Or again, it is common, when evaluating steel projects, to lump together all the processes from the input of ore and coking coal to the output of finished steel products. Yet it might be wiser for a country with iron ore to carry the process only part way, and export pellets of iron to countries with the expertise and established markets which enable them to make good use of available economies of scale in smelting, rolling, and so on.

Another much neglected question is longevity. Should the equipment be so durable, and the buildings so big and strong? Often, the answer may be no : for engineers are inclined to build monuments if they can persuade their paymasters to finance them. It may well be better to have short-lived projects that yield their benefits quickly : the provision of output later on can be dealt with when the current plant wears out, and by then better methods may be available. This is particularly likely if a high discount rate is appropriate — for then the benefits that the project yields after twenty years may, from the social point of view, be small indeed. If the rate of discount is 15 per cent, a unit of social profit in twenty years' time is worth only 0.06 of a unit now. So it is well worth finding out how much could be saved by building a shorter-lived project.

Finally, even when a project has been accepted, perhaps after modifications, that is often by no means the end of the matter. Snags may arise, and crucial reconsideration be necessary, before the plant goes into operation. Or, again, it may emerge that demand has been under- or overestimated, and enlargement or scaling down may be required. After completion, there may be further plans for extension. Alternatively, the plant may disappoint, and

it become advisable to close it down well before the end of its physical life (unprofitable projects are further considered in Chapter VI). The main points to be made here are (1) that all major changes in the project should be assessed in the light of accounting prices on exactly the same principles as the original project analysis, and (2) that projects should, in any case, be reappraised from time to time.

Chapter VI

THE ENCOURAGEMENT AND PROTECTION OF INDUSTRY : TAXATION, AND THE SUBSIDIZATION OF PROJECTS

In this Chapter we first deal quite generally with the encouragement of industrialization, concerning ourselves with arguments that affect both the private and public sector (6.1). We then turn to consider some special reasons for encouragement which affect only the private sector (6.2). Since the best way of encouraging industry is often to exempt it from some taxes, or to subsidize it, this brings us to a discussion of public finance and its relation to commercial policy (6.3), and of the finances of public sector industry in particular (6.4).

6.1 The Protection and Promotion of Industry

In most developing countries industry is heavily protected. Nominal tariff rates of 100 per cent or more are common. Often again, quotas rather than tariffs are the effective means of protection ; and, under their influence, the domestic price of manufactures is far higher than the import price, sometimes several times as high. Particular industries are very unequally protected, some receiving colossal protection, others very little or even none.

In some countries this high protection has arisen because balance of payments difficulties were met by imposing general quotas rather than by devaluing the currency. In such countries the protection is often far higher than is required to encourage investment in industry, which has had to be restrained by other means, such as licensing.

The question may be asked why *any* protection is necessary to encourage industry. Why should not a suitably low (single) rate of exchange (a high price of foreign currency) make many foreign manufactures so expensive that domestic industry could compete ? The answer is that a single rate of exchange applies also to agriculture and mining. Therefore the rate of exchange that would be established under free trade may make it profitable only to export primary products and import manufactures. Possibly, some lower rate of exchange than this ' equilibrium ' rate would promote industrial development — but then the country would run a balance of payments surplus and accumulate unnecessary reserves.

Thus industry may need special encouragement if it is to become established and grow. But it is important to realize that it is being encouraged relative to agriculture and services. If it is protected it is, in a sense, being protected against other domestic sectors — not against imports,

for the rate of exchange can always reduce their competitiveness. Of course, some industrial investment, e.g. in fertilizers, may be good for agriculture ; some infrastructure investment may assist all sectors. Nevertheless, investment in industry is competitive with direct investment in agriculture, and both sectors compete for skilled people. Therefore, any special encouragement given to industry requires justification. We deal with the arguments which claim to justify special treatment in 6.11 below.

There is an important distinction to be made between giving industry some special advantage (as compared with laissez-faire) in the home market only — this is protection — and giving it a special advantage (again, as compared with laissez-faire) which operates for sales both at home and abroad. There is no generally accepted word for policies of the latter type (which would include subsidization, as well as having a special exchange rate for industrial products). We adopt the word ' promotion '. It is a misfortune that economists since Friedrich List have mostly theorized about protection rather than promotion, the latter (in our sense) being so neglected that there has not even been a generally accepted name for it[1].

Yet if there is some good reason for specially encouraging industrialization in developing countries, there is certainly good reason for making such encouragement at least neutral between domestic and foreign markets. Developing countries are now, rather late in the day (but is is never too late), realizing that protective policies (which actually discourage exports as compared with laissez-faire) have helped to result in a pattern of industrialization which denies them the advantages of the economies of scale and of specialization which international trade can bring. Industrialized countries have contributed to this both by import restrictions, and by tariff systems which discriminate against foreign manufactures.

The following additional point is worth making. Much of the desire for regional trading and payments arrangements springs from the fact that protection implies protection against all-comers including other developing countries. Hence the desire for free trade areas or common markets. Promotion would, on the other hand, enable developing countries to make their industries more competitive, *vis à vis* developed countries, without protecting themselves against each other. In principle, greater economies of scale could thus be realized than with any purely regional arrangement : for, in effect, the whole developing world becomes the ' region '.

6.11 *Reasons for Promoting Manufactures and Appropriate Instruments of Promotion*

The main reasons, applicable to both the public and private sectors, why profitability may, under free trade and laissez-faire conditions, underestimate social advantage fall under three headings :

1. The domestic currency is overvalued : in particular, the exchange rate which would be established under laissez-faire tends to discourage manufactures to a greater extent than is justified by the country's social advantage.

1. The word ' promotion ' tends to suggest only things like training schemes, industrial estates, development banks, etc. — rather than also designing the price mechanism so as to make industry more profitable in all markets — domestic and foreign. But no better alternative suggests itself easily.

2. Industrial earnings are higher than the opportunity cost of labour, so that it would be socially profitable to employ more people in industry than would occur as a result of market forces.
3. There are, in general, external economies from manufacturing.

As we have seen, these are among the main reasons why we want to use accounting prices in project selection[1]. But, in this Chapter, we are concerned also with the private sector, which will only adopt and be able to run the most socially profitable projects if the actual effective prices, which they pay and receive, correspond closely to the accounting prices which divergences of social and private cost make appropriate. We must therefore concern ourselves with the policy instruments which can help to make actual prices approximate to accounting prices. The more closely this latter objective can be achieved, the less important does the use of accounting prices become. Let us consider the three reasons in this light.

Currency Overvaluation

The domestic currency may be overvalued mainly as a result of the commercial policies followed by the government[2]. Thus, foreign currency may be kept cheaper by the operation of import and other controls, or by high tariffs, than is to the advantage of the country. Generally speaking, overvaluation discourages domestic industry : on the other hand, this effect may be compensated, or over-compensated, by the very controls or tariffs which are required to maintain the overvaluation. The combined effect is usually to protect industry so far as domestic sales go, and discourage production for export.

But if the value of the domestic currency would still be too high for maximum national advantage (and in particular too high for a desirable level of industrial development) under free trade and laissez-faire, then some policy which will provide a corrective is required. The problem is then one of finding the right kind of policy.

The value of the currency in terms of foreign exchange would be too high, under free trade, in those developing countries whose exports are in imperfectly elastic world demand. Such countries can gain by reducing the volume of agricultural exports, and raising their price, which can be brought about by taxing these exports (care should be taken not to exaggerate the inelasticity : often the demand is rather inelastic in the short run, but competitive output from other countries is encouraged by high prices, and it consequently becomes much more elastic in the long run). This policy should permit a switch of some resources from agriculture to industry : but the expansion of industry required to absorb the resources freed can occur only if industry becomes more competitive with imports — in other words, either some fall in industrial wages or some reduction in the value of the currency in terms of foreign exchange is implied, and would occur as a

1. They are, under actual conditions, certainly not the only reasons. In fact, much of the need for accounting prices arises from a bad use of commercial policy, and bad choice of projects in the past — see 2.37.

2. By ' overvaluation ', we mean either (1) that the country is tending to lose reserves, or contract too much short-term debt, or that this state of affairs can be clearly foreseen ; or (2) that restrictions on imports, by quota or tariff, are in excess of, and encouragement to exports in less than, the level appropriate to a satisfactory exploitation of the advantages that can be derived from international trade.

result of market forces, provided the government takes expansionary steps whenever both the balance of payments is favourable and there are unused domestic resources.

It is a good rule for economic policy that any attempt to correct a divergence between a laissez-faire outcome, and what is desirable, should go to the heart of the matter — to the basic cause of the divergence : which is, in this case, the inelasticity of demand for the country's exports. Thus inelasticity of export demand for primary products is a reason for the indirect promotion of manufacturing via export taxes on agriculture, rather than for direct protection of manufacturing in the home market, which inhibits exports by raising the domestic cost level.

High Industrial Wages

We turn now to the second reason why manufacturing may need some special encouragement — that industrial wages may be too high relative to other sectors, especially agriculture. The reasons why they may be too high are discussed in Chapter XIII : here we need say only that there are reasons quite apart from government intervention, which are applicable to most developing countries, why they may be too high relative to agricultural wages ; but is should be noted also that many governments actually interfere in order to increase the disparity.

Now, in line with the rule enunciated above, that one should ' go to the heart of the matter ', it follows that there may be a case for reducing wage costs to the manufacturer, and this may involve a subsidy if actual wages cannot be reduced, or reduced sufficiently, as is likely[1]. But, of course, this raises the question of how the subsidy can be financed. Now, in the public sector, if a project has been chosen (because it is *socially* profitable) which loses money given the actual wages paid, then it has to be subsidized anyway. In this event, it is certainly correct that the subsidy be given to wages, for this helps to make the price paid for labour by the project manager equal to the accounting wage. Nevertheless, since the subsidy, whatever form it takes, is a use of limited public funds it is necessary to consider whether there are alternative policies which would permit the project to be operated without subsidization.

For the private sector, the subsidization of wages may be administratively difficult — remembering that it should apply even to the smallest employers. But it also presents a fiscal problem. We defer further consideration of the fiscal problem until 6.3, but we have said enough to show that we must consider the possibility that, for fiscal and other reasons, the government may want to avoid subsidization, and take policy steps to reduce the need for it.

Fiscally speaking, tariffs appear to be the most attractive method. When applied to anything except final consumer goods, they have the disadvantages of discriminating against exports by raising the cost of industrial inputs. Methods which do not have this disadvantage are tariffs

1. An actual reduction in industrial wages may well be good policy in some countries where the possibility of high earnings draws excessive numbers into the towns. Elsewhere, however, the industrial wage level may be justified in terms of promoting labour efficiency through a tolerable standard of living, or for other reasons. By no means the whole of the difference between industrial and rural wages can be taken as a ' distortion '.

together with export subsidies, or a specially low rate of exchange for manufactured products (a uniform rate of tariff and export subsidy on all manufactured products is the exact equivalent of the latter, both as regards incentives, and from the public finance point of view). Both of these methods provide a fairly good substitute for subsidizing industrial wages, because the economic effects of a lowered rate of exchange are not too different from those of a lowered effective wage level[1]. But, they too, have fiscal implications. We therefore discuss their relative merits again in 6.3.

We remarked above that a special exchange rate for manufactures was equivalent to a *uniform* tariff plus equal percentage export subsidies. But, for the private sector, an argument for non-uniformity can be advanced. Some projects and industries will be more nearly competitive at world prices than others. If the uniform tariff-cum-subsidy is high enough (or the exchange rate for manufactures low enough) to promote the amount of industrialization that is socially desirable, then this uniform tariff-cum-subsidy will be unnecessarily high for some industries. If there is sufficient internal competition, or if the industry is in the public sector, this is of no importance. In the former case, competition will prevent excessive profits, and the tariff-cum-subsidy will be partly inoperative. In the latter case monopoly profits are not socially undesirable.

But, in many developing countries, the market (even allowing for exports) is too small to permit more than one, or a very few, firms of economical size. Where such cases arise in the private sector, a tariff-cum-subsidy rate lower than the general rate may be desirable as a means of curtailing excessive monopoly profits. The strength of this argument for non-uniformity depends upon the attitude towards such profits, the strength of the fiscal system in limiting them, and on the willingness of the government to use price control (a lower than normal tariff is a sort of price control).

If non-uniformity is chosen, it still remains possible to use multiple exchange rates to have the same effect. But this would be putting the required cost-analysis and consequent decisions into the hands of the monetary authorities, rather than a tariff commission (which should be working very closely with the planning and fiscal authorities) — which would probably be too unusual in most countries[2].

External Economies

These constitute the third general reason why it may be desirable to give special encouragement to industry[3].

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1. The main difference is that both tariffs on manufactures, and a differential exchange rate for manufactures, specially favour industries or processes in which untaxed materials represent a high proportion of costs. If the tariffs or differential exchange rates were extended to cover materials, then the special favour would be limited to industries in which *domestic* materials, which were not also imported, formed a large part of costs.

2. The choice of a desirable commercial policy also has to take some account of such international authorities as the IMF and the GATT, although these appear to be in practice more tolerant than is often supposed to methods which they theoretically condemn.

3. We are here concerned with external economies which may constitute a reason for promoting industrialization in general: those which may constitute reasons for preferring one project over another are discussed in Chapter XVI.

External economies may arise in connection with the employment of a particular factor. An example is labour-training in specific skills. It is sometimes also suggested that industrialization has more general external economies such as the inculcation of non-traditional attitudes (consciousness of the benefits of change and new methods, a disciplined attitude to work, punctuality, etc.)[1]. Such external economies presumably arise also mainly from employment. One way of dealing with these external economies from employment is, of course, the provision of training in skills, e.g. management, accounting, and technical schools, outside the firm — the cost of which may be partly covered by fees, but partly no doubt from government sources. This tends to remove the distortion at its source, and is therefore in line with our role of ' going to the heart of the matter '. General education may also serve to reduce the force of this argument, which is, again, essentially an argument for subsidies or for providing services to industry.

The other main argument which has been advanced for encouraging industry which can be brought under the heading of external economies, is the ' infant industry ' argument. It is an argument which probably applies more strongly in the private sector, but it is convenient to deal with it here. The essence of this argument is, first, that it takes time to assimilate new techniques and operate them efficiently ; and, secondly, that the benefits of this learning process, as it is now called, spill over to other firms than the ones which first undertake the new processes. As a result, the initiator creates competition which prevents him realizing all the benefits of his own investment, and so may inhibit him from making it.

The infant industry argument is of very wide application. Indeed it can apply to undertaking almost anything new. It may apply in agriculture, depending on the conditions of competition. If it applies to industry at all, it surely applies to some industries far more than others — depending on the difficulty of the learning process, the degree of overspill, and the likelihood of competition. It is thus hardly an argument for promoting industry in general, although it may be an argument for giving special encouragement to particular industries[2] if its validity can be correctly assessed, which is rather doubtful. It is more difficult to decide just what form such special encouragement should take. Sometimes direct help by a public institution in the form of technical assistance, or subsidization of an industrial research and development association, may be the appropriate method : in other cases, more direct help, perhaps in the form of investment subsidies, may be justified.

Just as in the case discussed in the previous section, the use of commercial policy is thus not the most appropriate method of dealing with the possible misallocation of resources which could arise as a result of external economies. It is very much what economists call a ' second best ' policy. But if it is used, then exactly the same considerations apply as in the previous section. In brief, a method should be used which does not discriminate against exports — provided only that the superiority of tariffs from a revenue point of view is not a predominant consideration.

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1. But in some countries, notably India, there is a large number of people who consider that modern industry has important external diseconomies, because it disrupts traditional modes of life, and morality.

2. The infant industry argument is, therefore, referred to again in Chapter XVI.

6.2 Special Considerations affecting the Private Sector

The division of manufacturing activity between the private and public sectors is mostly taken as given in this Chapter. This is not to say that economic arguments play no part in this division, nor that the social costs and benefits may differ for a project depending on which sector it is in. Something is said, briefly, about these matters in Chapter X.

Ex hypothesi, the government cannot directly select projects in the private sector[1]. On the other hand, many governments have powers to reject them, although this, for administrative reasons, may be limited to moderately large projects, and probably also those that involve foreign financing or participation. But projects will come up for approval only if they promise adequate profitability to their promoters.

Nevertheless, a government may have a very powerful influence on what is put forward for approval, or adopted, by the private sector. For instance, a government may decide that it would be desirable to have a motor car industry. It can then promise to put on a high tariff, or even ban imports altogether. It may also offer to provide some of the finance. Sure enough, private proposals will come forward. By sifting these, and promising approval if modifications are made, etc., it comes quite close to selecting the project. This sort of procedure is not uncommon. It is also not uncommon for a private entrepreneur to offer to produce some good, at present unprofitable, if the government puts on, say, a 100 per cent tariff. Such ways of creating plants or industries, proceeding often with no economic appraisal of social profitability, can lead and have led to an industrial development of little or even no advantage to the country.

Clearly, the ideal situation is if general commercial, and fiscal, policy is such that all socially profitable projects come forward for consideration. Given the government's powers of rejection, this might seem sufficient. But one really needs more than this. No government can possibly appraise and approve all investment projects in any profound manner. To attempt to do so would certainly be a crippling barrier to industrialization ! Moreover, it is likely to be often impossible for the government to obtain good projections of inputs and outputs for private sector projects. The entrepreneur will soon guess the features that make for approval, and falsify the projections to suit (after all they are only projections !)[2]. Therefore ideally one also requires that any adequately profitable project should also be socially profitable, as well as the reverse.

The above is an ideal which can never be exactly realized. The method of approaching the ideal is to get actual prices as close to accounting prices as possible, by means of the kind of policies discussed in the previous section. But, for the private sector, where the government cannot actually initiate projects, the kind of 'doctoring' of the price mechanism which has been advocated may be insufficient. It can be argued that there may still be an inadequate response from private investors.

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1. It can start projects in the public sector, and later sell them to the private sector. This has, for instance, been done in Japan and Pakistan. Since the sale price must make the project attractive for the private sector, this procedure is a way of starting projects there.

2. It is also, regrettably, possible that government departments and enterprises will falsify projections to make pet projects look more acceptable.

This inadequate response may be due to a shortage of entrepreneurial and other essential industrial skills, and also to a lack of knowledge of techniques, and to the difficulty of acquiring such knowledge. As we have seen, this can be a good reason for governments to play a role in overcoming such barriers, e.g., by the creation of management schools, research and development institutes, an industrial extension service, and so on. But these are the sort of barriers which are best tackled directly : and they do not seem to constitute good reasons for the protection or promotion of industry by general commercial policy or subsidies. Another reason for inadequate response may be that the capital market is underdeveloped. Again it seems best to tackle such a disadvantage directly — by development banks etc. The same is true so far as concerns the provision of an adequate material infrastructure, transport, and power facilities.

Finally, it is often argued that people in developing countries are more loth to accept risks, and also that they have rather short time-horizons. Of course, a sufficiently high level of expected profitability will overcome almost any inertia, or aversion to risk. But this may be, socially speaking, a heavy price to pay. In short, there may be a close coincidence of expected private and social profit, and yet the private sector may be unwilling to undertake as much industrial investment as the government thinks desirable. This is a good argument for the government to initiate projects itself, and possibly sell them to the private sector later. The same is true if the private sector shows an excessive aversion to undertaking projects whose returns lie rather far in the future. But this has brought us to the subject of the best lines of division between the private and public sectors, which we promised to avoid in this Chapter.

The reader may well be thinking at this point that taxation should be cited as a reason for an inadequate investment response on the part of the private sector. In this Volume, we have thought of taxation as a means of restraining consumption, and hence permitting investment. But it is clear that, after allowing for any increased public investment, taxation must not be of such severity or of such a kind that it stops private companies from making sufficient investment outlays to take up the production slack which would otherwise result from the reduced consumption.

There are good reasons why taxation paid by companies, both direct and indirect taxes, should be relatively high in developing countries. From the government's point of view it is easier and cheaper to collect taxes from companies (which are the main investors) rather than individuals, both because there are fewer of them and because it is less easy for a company to cheat. It is also politically easier. But there is a difference between actually handing over the tax, and suffering from it. In the case of indirect taxes, it is generally and rightly assumed that the tax is passed on in the form of a higher price to the consumer. But this also seems to be at least partly true of direct taxes on companies : that is, the net-of-tax yield on capital assets does not seem to be much lower where or when tax rates are high. Insofar as this is true, it implies that companies, taken as a whole, in effect become tax-collectors for the government rather than tax-payers (but it remains true that the direct taxation of company profits reduces the incentive for individual companies to be as efficient as possible).

The above paragraph is not true of *changes* in indirect taxation. An increase on a particular product may well hit profits for some time : this is

because it takes time to adjust capacity to the reduced demand which the tax will cause. It may also take time for companies to be able to adjust to an increase in direct taxation. Thus caution has to be exercised in increasing taxes paid by companies, and it is surely true that exceptionally high direct company taxation will be a deterrent to investment. For instance, foreign investors have come to regard a 50 per cent corporation tax as quite normal ; but anything over this may be taken as a sign that the government is not very favourable to private investors, and so be a deterrent.

Company taxation can also be designed actually to promote investment : that is, it can be designed to favour companies which invest relatively heavily. Such methods include accelerated depreciation allowances, actual investment subsidies, and tax holidays for new companies. The tax laws can also be designed to encourage company savings, i.e. the non-distribution of profits. But this is not the place to go into any detail about these elements of fiscal policy. However, it is worth noting that governments sometimes go too far in giving such incentives : for instance, tax remissions for investment are excessive when there is more demand for private investment than available savings can satisfy.

To conclude, there are many ways in which governments can and should encourage industrialization in the private sector by the direct provision of the infrastructure and services which no single private enterprise can economically provide for itself — this ranges from transport and power, through finance, education and training, to research and development. Then, there is the backstop of the government's appraisal of private sector projects, which can be brought into operation at least for large projects, and those which significantly affect the country's external liabilities. Such appraisals should be made, broadly speaking, on the same principles as are applied in the public sector. Relatively minor differences of treatment are discussed in Chapter X. Finally, and more important, there are the commercial and indirect taxation policies whose aim it should be to ensure as a close a correspondence as possible between the actual prices which guide the private businessman's endeavours and the accounting prices which aim to measure society's cost and benefits. In the next section we turn to a more detailed consideration of these policies.

6.3 Taxation, Accounting Prices, and Summary Discussion of Industrial Promotion by Means of Commercial Policies

We have seen that every argument in favour of promoting industry is, revenue considerations apart, an argument either for providing services to industry or for subsidizing it. Some but not all of the infrastructural, technical, and educational services should be self-financing : but subsidies (or negative taxes) would appear to be a direct drain on government revenue which could otherwise be used for further investment. Revenue considerations cannot, therefore, be ignored.

Indeed, both commercial policy and taxation can be viewed as instruments, in dealing with the private sector, for making actual and accounting prices approximate to each other as closely as possible. More tax revenue is generally needed to help restrain consumption, and so increase savings and investment (we have been assuming throughout that, in all or almost all developing countries, savings are currently more valuable

than consumption). In this way, tax revenue helps to narrow a gap between social and private benefits. On the other hand, almost all particular taxes create some other distortion of private and social cost, and thus make production less efficient. These contrary arguments have to be weighed up — no easy matter.

We cannot in this Volume pursue the subject of tax policy very far. Nevertheless a brief digression on the principles affecting indirect taxation may be helpful, before returning to consider the problem of promoting industry by tariffs or subsidies, and other means.

First, the primary intention of taxation being, normally, to restrain private consumption, indirect taxes are best imposed on sales of final consumers' goods. Where possible the taxation of intermediate goods should be avoided. The only point of taxing intermediates is really to raise the price of those consumers' goods which use them. It is much better to tax these latter goods directly, for this does not result in producers trying to minimize the use of those inputs which happen to be taxed[1]. There can admittedly be administrative reasons for taxing the input of a material into a consumption good : this arises, for instance, when the producers of the input are relatively few and large, while those of the consumption good are small and many . But before doing so, the end-uses of the intermediate, and the possibilities open to producers to use other inputs instead, should be carefully considered. Thus a tax on steel is unlikely to be a very good tax, since much of it is bought by the government itself or goes into investment which one does not normally want to tax ; while consumer goods, like cars and refrigerators, which use steel can easily be taxed. It should be noted that some goods, like electricity, are both intermediate and final goods. If possible, only the use of electricity by households should be taxed.

Exports should not normally be taxed for this is a disincentive to earn foreign exchange. The only important exceptions to this are if the price the foreigner will pay can thereby be raised (this is the case of inelastic export demand already referred to in 6.1), or if the domestic currency is undervalued — which is rare, and can easily be put right. The only positive benefit to taxing exports lies in a reduction in consumption out of profits earned from exporting. This is probably better taken care of by the direct taxation of profits or dividends. The rule of laying no tax burden on exports is another reason for shunning the taxation of intermediates, which enter into exports ; this is because intermediates raises export prices, unless the exporter can claim a rebate.

We may now turn back to the problem at hand — by what mixture of commercial and fiscal policy industrialization may best be promoted. We start with the presumption, which has already been justified, that some form of subsidization is likely to be superior to protecting only the home market by tariffs or import restrictions — provided there is no sufficient counter-argument from the revenue point of view.

Suppose there is a country which has, as yet, no protection. It is considering the promotion of industrialization by paying a subsidy to the employment of labour, or other inputs, in some industries. This promotion of industry would be beneficial. Consequently, the harmful effects of

1. This does not apply when a value-added tax is used, because any purchaser of the taxed good who pays value-added tax can set off the tax paid against his own liability. The burden of the tax thus falls ultimately on the final product.

increasing taxes to offset the extra commitment to consumption, which would otherwise be entailed by the subsidy, must outweigh the benefits of promoting industrialization if there is to be a compelling argument against such subsidization from the revenue point of view. There is, therefore, a clear argument against subsidization only if all tax increases would, on balance, do harm — only, that is, if taxes are already as high as they should be. But, there can also be a clear case against subsidization only if all reductions in taxation would also do harm, on the grounds that the commitment to consumption is thereby increased : this is because subsidization can itself be legitimately regarded as a reduction of taxation, which, if not offset by other taxes, will raise the level of consumption and hence reduce aggregate savings and investment.

It follows from the above paragraph that we should have in mind an economy in which both increases in taxes, and reductions, would do harm. Any increase in the taxation of consumers' goods will increase savings relative to consumption, and this is reckoned as an advantage : we are therefore supposing that the other disadvantages of increases in the taxation of any and every consumers' good — such as the administrative cost, a possibly adverse effect on income distribution, and harmful effects on incentives — would more than offset the advantage of extra savings. Similarly, any reduction in the taxation of consumers' goods would do harm, since the loss of savings would more than outweigh the reduction in the other disadvantages mentioned. In short, taxes are ' optimal '. In such an economy, it is reasonable to suppose that most manufactured consumption goods will be taxed : although some, which are either particularly difficult to tax, or which are largely consumed by the very poor, may escape.

Now, protection of any good consists in having a lower rate of tax on domestic production than on imports. Provided taxes are optimal in the sense described in the previous paragraph, it should be a matter of indifference whether this protection is introduced by lowering the domestic rate of tax, or by raising the import tax. If the good in question happened to be one on which the optimal tax was zero, then it would be equally harmful (ignoring the benefits expected to be derived from protection itself) to raise a tariff as to pay a subsidy on domestic sales. Either method constitutes protection of the home market only, and is to be contrasted with promotion where the subsidy, normally to be paid for the employment of a factor of production, applies also to export sales.

Consider a specific case of protection. Suppose the best level of tax on a good would be Rs.20, if protection were not in question, and that this is the initial level of taxation. But now the government grants protection by reducing taxation on domestic sales resulting from domestic production to the level of Rs.10, thus losing revenue of Rs.10 per unit on the consequent level of domestic production (the domestic price remaining unchanged). It is, clearly, no casuistry to say, in such a case, that protection loses revenue[1]. Indeed, the lower rate of duty can be considered as a sort of subsidy, relative to the proper level of taxation.

The question can now be posed as to the merits of promoting home production by actually subsidizing, say, labour inputs — while leaving the

1. The word ' casuistry ' is said by the Oxford English Dictionary to be ' often applied to a quibbling or evasive way of dealing with difficult cases of duty '.

product tax at Rs.20 per unit[1]. Now a subsidy of Rs.10 on the labour input per unit of output would cost the government more than the reduction of Rs.10 per unit in the domestic sales taxes, only to the extent that the labour which entered in export sales would also get the subsidy. However, this extra fiscal cost of the labour subsidy might be worth while in that there are advantages in encouraging industry in all its markets, if it is worth special encouragement at all. Also, it might well be true that a subsidy per man employed, amounting to Rs.1 million in total, could make a firm selling 100,000 units at home *plus* 100,000 units abroad, just as profitable as a subsidy of Rs.10 per unit of output would make a firm which sold only 100,000 units at home : this could arise if there were substantial economies of scale.

A very similar argument applies to intermediate goods which are taxed because the final goods incorporating them cannot be so easily taxed.

However, one may wish to refrain from taxing intermediates, because all domestic sales of the final goods which use them, can be, and are, properly taxed — but at the same time one may want to encourage the domestic production of these intermediates. Now a tariff in such circumstances may *lose* as much revenue as a subsidy so far as domestic sales go. This is because a tariff of Rs.10 per unit will raise the price of *all* units supplied by Rs.10. If 100,000 units of these intermediates are sold on the domestic market, the price of final goods will rise by Rs.1 million. If taxation was previously at an optimum level on these goods, then it should be reduced by Rs.1 million. Thus the government would lose Rs.1 million *minus* the yield of the tariff, which is just equal to what a subsidy of Rs.10 per unit on home sales would have cost. Therefore, as with final goods, a subsidy is more costly to the revenue only insofar as it encourages exports. The same argument as before — that a lower unit rate of subsidy which costs the revenue no more than protection, may well be as effective in encouraging industrialization — also applies.

The above arguments, which strongly suggest that subsidies on inputs are a better method of encouraging domestic industry than protection, may fall to the ground if, for administrative reasons, goods made at home are less taxable than imports. If this is the case, the best *effective* rate of tax on domestic production, and even the best nominal rate may be lower than that on imports. But it can also be higher. Even so there may be a case for some protection, purely from the point of view of designing the best tax system. But, in the case of goods which are as easily taxed at the factory gate as at the port, the arguments in favour of encouraging industry are not arguments in favour of protection, unless it is administratively difficult to help the industry in other ways.

We conclude that tariffs can, on economic grounds, be a good method of promoting industry only in cases where the domestic sources of production either cannot be taxed, or can be effectively taxed only at a high administrative cost. From this point on, it is difficult to generalize. But

1. The reader may think it odd that, in such cases, we should in effect be advocating a tax on home sales of the good and at the same time a subsidy on an input used in producing it. There is, however, nothing illogical about this. A tax on domestic sales of the product plus a subsidy on the labour used, makes it more profitable to make the product in a labour intensive manner : also, and just as important, such a system makes it more profitable to produce for export.

we believe that this argument for protection can easily be exaggerated. First, in the case of many factory-made consumer goods the number of producers is fairly small, so that they can be easily taxed. Secondly, import duties can be evaded as well as domestic taxes. Thus, in some countries, smuggling is a very serious problem : and import duties can be generally evaded by under-invoicing, which is also prevalent. Thirdly, countries which have substituted domestic production on a large scale for imports, have found themselves able to raise excise duties to compensate for loss of tariff revenue. The case for tariffs thus seems to be strong only in the case of goods produced largely by very small-scale or handicraft industry, where the difficulties of administering a tax on the product combined with, say, a subsidy on labour employed would probably be insuperable.

Admittedly, it is politically easier to tax imports. Although the consumer suffers either way, foreign producers cannot lobby against tariffs in the way that domestic producers may do against excise taxes. We have to reckon therefore with the fact that protection will be extensively used, even if bounties would often be better.

There is, however, still the possibility of using protective tariffs in conjunction with measures which prevent them from discriminating against exports[1]. The most obvious measure, and one which is quite extensively used, is to grant exporters a rebate of the import duties paid on inputs. This helps, but by no means goes as far as is theoretically desirable. It can seldom compensate fully for the extent to which costs are increased by the whole system of protection in force : nor does it provide any positive encouragement — at best, it merely compensates for a discouragement. There is, therefore, a good case for subsidizing exports to the same extent as the home market is protected — and the more pervasive and higher the protection the stronger is the case. Lastly, as already noted in 6.1, a uniform tariff on imported manufactures plus an equal percentage export subsidy for manufactures, is economically equivalent to a lower rate of exchange applied to manufactures only. This latter is a system of industrial promotion which is, in theory, very attractive. As we have seen above, all systems which promote exports may, but do not necessarily, lose revenue as compared with systems which merely protect the home market. But this relative loss of revenue should not be significant in view of the fact that the purpose of taxation is to reduce domestic consumption. Moreover, a system of taxing imports and subsidizing exports of manufactures will raise a substantial absolute amount of taxation, since imports greatly exceed exports of manufactures in almost all developing countries.

The whole of the above discussion has presumed that protection is not used to maintain an overvalued currency. In fact, the colossal levels of protection to be found in many developing countries is very largely a compensation for an overvalued currency. Such colossal protection of the home market almost prohibits the export of manufactures, with the resultant loss of the benefits of trade. The exchange rate should be kept at an equilibrium level, after the various policies for promoting industry have

1. Customs duties equal to internal excise duties should, of course, always be imposed. There may also be customs duties on goods where there is neither any domestic production nor any likelihood of it. Such duties form a purely revenue tariff with no protective effect. Nevertheless they discriminate against exports, and therefore should be rebated whenever paid in respect of production for export.

been put into effect (this may imply letting it fall as fast as inflation raises the domestic price level).

High protection and overvaluation is often effectively maintained by quotas rather than tariffs. There is little to be said in favour of quotas as a permanent or semi-permanent means of protection — even if applied only to consumer goods. They are inferior to tariffs for several reasons (a) they usually allow private persons to get the difference between the import and the domestic value of actual imports, (b) they may allow the foreign supplier to raise his price, and (c) they are administratively complex, time-consuming, and tend to promote corruption. Sometimes, import control takes the form of a total ban, in which case, objections (a) and (b) do not apply. A total ban is equivalent to a prohibitive tariff, which may, of course, be much too protective — having in mind that some imports are usually desirable from the point of view of competition, and of learning about the merits and faults of foreign products.

Thus, especially if applied to materials and intermediate goods, quotas make it impossible for producers to plan the most efficient means of production: they also tend to prevent change, and often also cause avoidable delays in production and investment. Import controls have their uses in the face of a short-term foreign exchange crisis (because they are quicker to impose and take effect, than tariffs); but they are very inferior as long-run devices for the promotion of an efficient pattern of industrial growth.

Circumstances vary so much from country to country, that we clearly cannot conclude with a blueprint of the optimum policy to be followed. Let us instead try to sum up briefly the above rather involved discussion in the form of a few policy guidelines.

1. Commercial and fiscal policy should be designed so far as possible to keep actual and accounting prices in line. This is the main means by which the government can help to ensure that the private sector chooses projects which are in the public interest.
2. The exchange rate plays an important role. Overvaluation is inimical to achieving the above aim. Quotas should be avoided as a permanent mode of protection.
3. If the currency is not overvalued, the arguments in favour of special measures to promote industry do not suggest that tariffs, if used, need be very high.
4. Sometimes protection will arise as a by-product of an ideal tax system — but only if imports can be easily taxed, while domestic production cannot be.
5. If the domestic product can be easily taxed, it is better to tax it as heavily as competing imports are taxed, so that there is no protection; and, instead, if need be, promote the industry by subsidizing employment or by paying the firms for any external benefits which they produce — provided that this is not administratively very difficult or open to corruption.
6. Where tariffs are used, their effect on the cost of producing for export should be offset. If tariffs are high this best takes the form of uniform export subsidies. A more favourable exchange rate for manufactures is an alternative to tariffs-cum-export-subsidies.

7. Exports, so far as possible, should bear no burden of taxation ; except where export taxes are used (normally only for primary products) in the face of an inelastic foreign demand — in which case the tax is partly shifted to the foreigner.
8. The taxation of materials and intermediates should be avoided except in cases where many of the final goods into which they enter are very difficult to tax.

6.4 The Subsidization of Public Sector Projects

In this concluding section we turn back to the problems of the public sector.

We have seen that, in certain circumstances, subsidies even to private industry may be the best method of encouraging industrialization. By the same token it may be good policy to subsidize public industry. There is, of course, no need for such an instrument for the purpose of project selection, since public sector projects can be, and ought to be, directly selected in the light of accounting prices ; with regard, that is, to their social profitability and not to their actual profitability in the light of ruling prices. It is always possible that public sector projects, thus selected, will make a loss. In this event, automatic subsidies equal to the public company's loss should be avoided, although this may be impossible, for a time, if a mistake has been made. Instead, the subsidies should be given in respect of the inputs or outputs whose actual prices fail to reflect social costs or benefits — and thus are the cause of the unprofitability of a well-chosen project[1]. For instance, labour-intensive projects may be initiated in the public sector as a result of using an accounting price for labour which is less than the actual price. In this event, the labour employed should be subsidized, and the project thereafter be expected to be profitable in terms of the accounting rate of interest. To take another example, a public sector project may have to use an input from another such project, although it costs more than the import price. The use of that particular input should then be subsidized.

We have also seen that, in some cases, it will be advisable to use commercial policy to limit or eliminate the case for subsidies ; and that governments are in fact much more likely to continue to use commercial policy in this sense, than to make extensive use of subsidies. Commercial policy designed to make the private sector sufficiently profitable without subsidies, will also tend to make public industry profitable.

Some readers may worry that the selection of public sector projects by the principles we have discussed would mean that many unprofitable projects would be selected in the public sector, and that this would bring the public sector into further disrepute (since so many people are indoctrinated with the idea that profitability, at least for industrial projects, is the only measure of success).

It is true that losses, and hence subsidies, are very common in public sector industry in developing countries. We believe that these losses arise mainly from two causes. First, the government tends to require the project to sell its output for less than people would be willing to pay (especially where the output is a ' welfare ' good), or to employ too much labour often

1. This does not cover the case when losses arise because of economies of scale. Treatment of this case would take us too far into a much discussed field.

at rather high wages. It is very doubtful whether these social reasons justify the subsidization of public industry : for there are usually better ways of pursuing the social ends. For instance, if more employment is wanted, it is surely better to design and choose relatively labour-intensive projects than employ redundant men in capital-intensive ones.

The second, and perhaps the main, reason why losses occur is that the project was a mistake, and never should have been chosen. Many such projects would certainly have been weeded out by the adoption of our principles. In nearly all the case studies we have been able to make, actual profitability has turned out to be higher than social profitability[1]. We therefore believe that the adoption of our principles would be highly unlikely to make the problem of losses and subsidies to public sector industry worse. Certainly, projects might sometimes need to receive some form of subsidy, but this would be very likely to be more than offset by a reduction in the number of bad projects started, and by a reduction in the employment of redundant labour in the public sector.

1. Two of these case studies are included in this Volume. One of these shows (or, rather, should show if it were carried out) higher actual than social profits ; the other shows the reverse. Further case studies will either be published, or be obtainable from the OECD Development Centre.

Chapter VII

SUMMARY AND OUTLINE OF PROPOSALS

This Chapter is mainly concerned to outline the proposed methods of cost-benefit analysis which are discussed in detail in Part II. The point of this is that a busy administrator should be able to appreciate by reading Part I alone the essential features of the system proposed, and how it fits in with other aspects of economic policy and planning. He should also understand the key assumptions upon which the analysis rests. We start, in 7.1, with a brief outline of the nature of cost-benefit analysis, and its application to industry. In 7.2 we discuss the basic assumptions made about the kind of economy, and the policies followed. In 7.3 we outline the methods proposed in Part II. Section 7.4 deals with some special problems and reservations; while 7.5 and 7.6 discuss how to put the system into operation.

7.1 The Theory

7.11 *The Need for Cost-Benefit Analysis, and its Nature*

We have seen in Chapter II that there are many reasons why profits may not be a very good measure of a project's contribution to social ends. This has been widely recognized. But if profits are dethroned, some other guide to decision-making must be put in their place. There has been some tendency to think that detailed quantitative planning, under which output targets are fixed and resources mobilized to meet those targets, can be a good substitute. But this is wrong, even for an economy with no foreign trade. The amount of a good demanded always depends on the price. Of course, the price can be set at such a level that the target output just gets sold. But then the price may bear no rational relation to what the good costs, which should be a measure of what has been sacrificed to get it produced.

Also, if the potential advantages of foreign trade are to be realized, a country's pattern of production can be sensibly determined only in conjunction with its imports and exports. If you can get more refrigerators by exporting bicycles to pay for them, than by diverting resources from making bicycles to making refrigerators at home, it is clearly right to make and export the bicycles and import the refrigerators. But whether this is in fact the case, requires a knowledge both of the relative costs of production at home, and of world prices and market conditions.

By and large, profits fail to guide production and investment decisions to society's advantage only if the costs and prices used in establishing those profits do not correctly reflect the real costs incurred by society, and the benefits accruing to it. The art of cost-benefit analysis is to assign prices to goods and services which *do* reflect their real costs to society (when they are inputs, i.e. used up) and their real benefits (when they are outputs, i.e. produced). The difference between cost and benefit is then a measure of society's gain, which may therefore be called the social profit. We give the name ' accounting prices ' to these assigned prices. Since the main art of cost-benefit analysis is to make sound estimates of these accounting prices, Part II is largely concerned with discussion of how this can be done.

7.12 *The Limitations of Cost-Benefit Analysis. Its Application to Industry in Developing Countries*

The assigning of prices to inputs and outputs so as to measure social costs and benefits presupposes, of course, that such costs and benefits are quantifiable. Quantifiability is, to some extent, a matter of opinion. Where one is dealing with goods or services that are normally sold, the problem is not usually too great. Even if one does not accept the actual price as a measure of cost or benefit, it provides a basis from which to start. But part of the ' output ' of, for instance, a road improvement may be a saving of life. Any attempt to put a value on human life is sure to be controversial (nevertheless, judges quite often have to do it).

This Volume is, however, limited to industry, especially manufacturing : so that we avoid sectors, such as health and education, where the measurement of benefits is specially difficult. Nor do we concern ourselves directly with agriculture ; or with power, transport, or communications, projects. In a sense, the same principles apply throughout. By this, we mean that choice between projects in any sector should be made on the basis of the present discounted value of the benefits less costs in each year of the project's existence, provided sufficiently plausible estimates can be made of the benefits and costs. But the estimation of the annual benefits and costs for the non-industrial sectors would certainly require special discussion. So also would the question whether quantification in some sectors is really superior to qualitative assessment and hunch. But, so far as industry goes, there is little real doubt about the answer.

The application of cost-benefit analysis to industry has been neglected in industrialized countries. So far as the West goes, this is largely because industry is almost entirely in the private sector, and very few private sector projects need government approval. Also there is wide-spread faith that profits are a tolerably reliable guide. We have seen in Chapter II that it is harder to believe that profits are a good guide in developing countries, and anyway few governments seem to act on the belief that the profit motive acting *via* a freely operating price mechanism will lead to an adequate and beneficent industrial development. When to this is added the fact that many of the actual industrial projects selected in recent years (whether by direct government choice, or *via* special tariffs, subsidies, or import quotas) appear to have been of little social benefit, the case for treating the cost-benefit analysis of industrial projects seriously seems to be overwhelming.

7.2 The Assumed Economic Framework: Planning and Balance of Payment Policies

7.21 *Public and Private Ownership, and the Price Mechanism*

All developing economies are mixed systems, with both public and private ownership of the means of production. There are some, like India, where public ownership is very important even in the manufacturing field: and also many where public ownership of industry is unimportant or even non-existent. But, in almost all developing countries, the government plays a large role in industrialization, either by requiring that government approval be obtained for investments, or by manipulating tariffs, quotas, subsidies, and the credit and fiscal systems, so as to encourage industrialization — or in both ways.

Our system can be applied whenever the government makes industrial investments itself, or when it requires the private sector to submit projects before it decides to approve them, or to take action which will make the private sector willing to go ahead (granting protection, export subsidies, tax reliefs, etc.).

If the government does not itself contemplate industrial investments, and if it merely sets the stage for private enterprise without direct concern for the economics of particular projects, then, of course, there is no place for cost-benefit analysis in the industrial field. But this certainly does not mean that the government plays no role in industrialization: indeed its commercial, fiscal, and credit policies, may still have a large, even dominant, influence. Although not directly the concern of this Volume, we nevertheless have had something to say about such policies in the previous Chapter, and we revert to the theme again in Chapter X. Our recommendations can be summed up by saying that the government should try to adopt policies which result in prices approximating as closely as possible to accounting prices — or, to put it in a more familiar way, to adopt policies which ensure so far as possible that the prices which guide private decisions also reflect real social costs and benefits. In the elaboration of foreign trade, fiscal, and monetary, policies, this consideration should always be in the foreground. Whether or not the government has any great love for the private sector, it is surely its duty to establish as close a coincidence of private profit and social benefit as possible.

Making actual prices reflect social costs and benefits is also important even where the government interferes extensively in private investment decisions. This is both because the government cannot induce the private sector to promote unprofitable schemes, and because the government cannot effectively control all private investment decisions. It is, finally, important even so far as public investments go. This is because it is easier to get engineers and administrators to design and submit projects on the basis of actual prices than on the basis of accounting prices. To the extent that this can be done, the need for cost-benefit analysis is reduced.

7.22 *Planning*

Cost-benefit analysis neither presupposes overall 'macro-economic' planning, nor is inconsistent with it.

The minimum planning which a government should undertake is that of its own expenditures, including investment expenditures. The use of cost-

benefit analysis in the public sector is a means of seeing that less socially beneficial public projects are not chosen at the expense of those that would have been socially more profitable. It is an essential weapon for the achievement of efficient public sector programmes, especially where these extend into the more readily quantifiable fields, and are not confined to such things as public health, education, and roads.

More extensive overall 'indicative' planning, which attempts to predict consistent and desirable values for the main economic aggregates, such as public and private consumption, and investment; imports, exports, and the balance of payments; population, and employment growth; is helpful to the use of cost-benefit analysis, for the predictions themselves, and the studies required to make them, may be valuable for the purposes of estimating demands and valid accounting prices.

The only sort of planning which is inconsistent with the extensive use of cost-benefit analysis is where rigid and detailed quantitative plans are made for sectors, sub-sectors, and the output of specific goods — in advance of detailed knowledge of the costs and benefits of the projects which are going to fill in the sectoral plans, and make possible the planned output targets for specific goods. There is, in theory, no objection to assembling the most detailed Plans when the project knowledge is all available: but this is not realistic. We would therefore argue that Plans should not be at all detailed: for if they are, the government tends to get committed to targets which the accumulating knowledge from project appraisal makes it undesirable to achieve.

It can thus be seen that very little is assumed about planning in this Volume — only that planning does not proceed in defiance of project appraisal and selection through cost-benefit analysis. We would add that we regard the extensive use of such project appraisal as a *sine qua non* of anything that can be called good planning.

7.23 *The Balance of Payments, Full Use of Domestic Capacity, and Foreign Trade Policy*

How does the balance of payments situation of a country relate to our criterion for project selection? It can be shown that it mainly affects the appropriate rate of interest by which future costs and benefits are discounted, i.e. the rate of discount.

Suppose there is a balance of payments deficit. Any cure must have one of the following consequences, or a combination of them: (a) an increase in output, (b) a fall in consumption, and (c) a fall in investment. We consider these in turn.

At any point in time, output can be increased only if there is excess capacity. Clearly, the government must devote itself to maintaining as full a use of domestic capacity as possible. If investment is maintained at the highest level which total savings (domestic, *plus* foreign in the form of aid or a reliable long-run private capital inflow) permit, *but no higher,* then balance of payments trouble can arise only because there is too much use of foreign resources and not enough use of domestic capacity. Thus the basic way of ensuring full use of domestic capacity is to see that the effective competition of foreign goods is not so great that the level of domestic output is less than it might be. The means are the familiar ones of the exchange rate, tariffs and quotas, and export subsidies. Thus, if there is

excess domestic capacity due to insufficient demand, the appropriate means of curing a balance of payments deficit is to change foreign trade policy so as to engineer a rise in domestic output.

But if there is more than adequate demand for domestic products, then consumption or investment is too high, and one or both must be reduced. In this Volume, we normally make the assumption that the government does not permit consumption to rise to undesirably high levels given the need to invest for the future. So, if this condition has not been transgressed, and if the output of the economy is as high as can reasonably be expected (there being no general excess capacity), then a balance of payments deficit is due to excessive investment.

Thus, if the government of our country is pursuing foreign trade policies which do not result in a condition of general excess capacity at home, and is also keeping consumption as low as is desirable, it follows that it must keep the balance of payments in order by controlling the level of investment. We must have rules of project selection which prevent excessive (or deficient) investment. In the system we advocate, the level of public investment is governed by the rate of discount used. Projects are selected only if they have a positive present social value at the chosen rate of discount. Thus raising the rate of discount reduces the level of public investment, and *vice versa.*

But, of course, we are considering mixed systems, not fully socialist economies. This makes a considerable difference. First, if public investment is even as high as, say, half of total investment, it would be absurd to expect changes in public investment alone to keep the balance of payments in equilibrium. What can be expected is that public investment should play its part — often a considerable part. But it will certainly be necessary to exert influence over private investment also.

We thus make two basic assumptions which have a bearing on criteria for project selection. The first is that if the balance of payments is unduly favourable, the government will take steps to expand investment : and if it is unduly weak (after allowing for use of reserves and borrowing), it will, if consumption can be reduced no further, reduce investment. Where investment is subject to the project selection criterion, this implies making the criterion stiffer, which is done by raising the rate of discount. For investment which is not subject to government appraisal and control, other more general measures have to be taken, such as making the tax system less favourable to investment, or restricting credit and raising interest rates.

The second basic assumption is that the government will take measures, in the foreign trade and payments field, to ensure that domestic capacity is fully used ; and that it will (no doubt with temporary lapses) be successful[1]. This assumption is important for the cost-benefit analysis of industrial projects, because it affects the valuation of domestically-purchased inputs for the projects, and also the valuation of any exported output. If there were excess capacity in an industry which supplied an input, the social cost of that input would be less than if there were full capacity operation. Rather similarly, if there were general excess capacity at home, due to a shortage of imported materials and components, additional exports would be worth

1. This does not imply that the measures taken be, in any way, ideal. The methods of project analysis proposed in this Volume do not presuppose an 'optimal' foreign trade and payments policy.

far more than their nominal value, because, by permitting the purchase of more imports from the additional export earnings, they would make it possible for domestic output and demand to be increased.

Now the current inputs and outputs of a project do not usually begin for two or more years after a project evaluation is undertaken : and, after that, they may flow for twenty years or so. The presence of domestic excess capacity, which may occur (but is an aberration), cannot possibly be predicted several years ahead. It, therefore, appears that the only reasonable assumption to make is that the economy will operate without more than occasional lapses from full capacity working : for, obviously, this is the only efficient way of working. We further assume that such lapses will not make a significant difference to the *relative* social profitability of different projects.

Although the above is the general rule, this does not mean that exceptions cannot be allowed for. For instance, the capital inputs of a project occur in the near future, and over such a period it may be known with reasonable certainty that there will be excess capacity in that particular supplying industry. We shall indicate in 8.31 and 8.42 how this can be taken into account.

Finally, the reader may be wondering whether the state of the balance of payments affects the kind of project to be chosen, as well as the level of investment. The answer is that it certainly does. First, the use of a higher rate of discount will favour projects which earn or save foreign exchange in the near future. Secondly, a weak balance of payments position will affect the accounting prices used in project selection, so as to encourage the use of domestic resources. For further discussion of the relation between project selection and the balance of payments see 11.1.

7.3 Outline of the Proposed Methods of Project Selection

If one decides to go ahead with a project, one is committing the economy to using certain things in certain ways. It has to be decided whether, comparing the good with the bad, it is better that things should be used in the way the project implies than that they should be used in other possible ways.

This apparently trite remark is nevertheless a useful guide through the complexities of project evaluation. It suggests at once that the task can usefully be divided into two : first one has to estimate what kind of changes in the economy a particular investment project will lead to ; then one must consider what these changes are worth to the country by, implicitly, comparing them with other changes that might have happened instead. We take up the story at the second stage ; that is, we take it that the physical inputs and outputs of the project have been estimated[1].

In the first year or two of its life, and in some cases for much longer, a project draws resources from the rest of the economy, while giving little or nothing in return. The site is cleared, buildings built, machinery purchased and installed, production lines laid down. Only when this gestation period is over, will the value of the output of the project begin to exceed the value of the current inputs of labour, materials, components, power, and transport.

1. The first stage was discussed in Volume I, and briefly in Chapter I of this Volume.

Both in the gestation period and the operating period, some of the inputs will be purchased directly from abroad. But domestic purchases of inputs will also have an import content. If there is no domestic excess capacity in a supplying industry, then a purchase from it will either cause some previous customer of that industry to import from abroad instead, or else he will be starved of materials with a resultant loss of production. If this does not happen, because output can be expanded, there will still be a foreign exchange cost because the input will itself use some imported inputs. Even the use of unskilled domestic labour has an effect on the balance of payments. If not employed on this project, it would normally have produced something — however little — in some other occupation : and the lack of this production, say of cereals, will mean that more cereals must be imported (even if total consumption were not increased as a result of the extra employment).

In the operating period, the most important item will be the output (unless the project is a failure !). This may be for export. If not, it may be a domestic consumption good, or an intermediate or capital good destined for use in some other branch of industry. Usually, if none of the output is exported, it will replace goods in the domestic market that would otherwise have been imported. If it does not have a direct effect on the foreign exchange balance in one of the above ways, it will be used as an input in the production of other goods, which in turn may be exported or substituted for imports — and so on.

It is a common practice when considering projects in developing countries to separate *direct* foreign exchange costs and receipts (i.e. purchases and sales from abroad) from the rest — because foreign exchange often appears to be especially scarce. The result is often claimed to be the balance of payments effect of the project. But the above account should have made it clear that the balance of payments effect of a project cannot be estimated in this simple direct way. Indeed, it is positively misleading to try to do so. It is much nearer the truth to say that *every* output of the project is a gain of foreign exchange, and that *every* input implies a use of foreign exchange. If more electricity is to be produced, that will enable some other producer to use the electricity to make goods for export, or goods that would otherwise have been imported ; or if not, then that producer's output can be used in one or other of these ways. Following the chain of production around, one must eventually end at commodities that are exported or are substituted for imports. Even if the goods are consumed in the country, some kind of consumer goods would have had to be imported if they had not been available, in order to provide an equivalent benefit. Exactly the same argument applies to costs.

All we are saying is that, in principle, everything can be compared with everything else. Given time to plan production so as to avoid unnecessary bottlenecks, society can have a little more electricity if it is willing to do without a sufficiently large quantity of steel ; it can have a little more food by giving up a quantity of clothes. Because of these possibilities of substitution, we can compare one thing with another ; and in particular, if it is convenient, compare any particular commodity with foreign exchange. It is not sensible (although very often done) to isolate a few of the inputs and outputs of the project, and regard their foreign exchange value as indicating the balance of payments contribution (or

burden) of the project. The only things one can leave out are the inputs that have no use elsewhere, and the outputs that are of no use to anyone.

Thus we do *not* classify inputs and outputs according as to whether they are purchased or sold in the home market or abroad. Instead we make a three-fold classification, (a) traded goods and services, (b) non-traded goods and services, and (c) unskilled labour. These categories we shall now discuss in turn.

7.31 *The Valuation of Traded Goods*

By traded goods we mean (a) goods which are actually imported or exported (or very close substitutes are actually imported or exported), but also (b) goods which would be exported or imported if the country had followed policies which resulted in an optimum industrial development. The second division (b) clearly requires an element of judgment. It is intended to cater for cases such as the following. A country has mistakenly set up a plant which produces an intermediate good A at very high cost — and imports are banned in order to protect it. We are considering a project to produce B, which uses A as an input. If B would be socially desirable using imported intermediates, then the fact that it may be made to buy the domestically produced A at an excessive price should not be allowed, as it were, to incriminate it. An industry which is itself good for a country should not fail to be established because some bad industry has already been started.

How then do we value such traded goods ? If they figure in the import bill, we value them at their c.i.f price. If such goods are exported we value them at their f.o.b. price[1]. It is clear that this valuation expresses their real cost or benefit to the country in terms of foreign exchange : and free foreign exchange is a good yardstick of value because it can be used to satisfy almost any need. For short, we shall speak of valuing such goods at their ' world ' prices, it being understood that this means world prices as they appear to the particular developing country.

World prices are used, not because it is thought that they are, in some sense, necessarily more ' rational ' than domestic prices, but simply because they represent the actual terms on which the country can trade.

It is important to note that the use of world prices applies even if the good is actually bought from a domestic supplier. The justification for this is the assumption of no excess capacity, already discussed in 7.23 above.

Despite the above argument, if there is no excess capacity *and* a fixed quota for, say, electric motors, then the purchase by the project of electric motors will starve some other manufacturer who incorporates electric motors in his final product. In such a case the social cost of using an electric motor for the project would obviously be very much higher than the c.i.f. price. In general, it is very difficult indeed to evaluate projects if such irrational situations are very prevalent. To make general rules, we have to assume that production will not be limited by specific shortages resulting from failures of domestic supply combined with mismanaged import controls.

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1. Sometimes, buying or selling more or less of a good has an effect on the price. This must also be allowed for. In economists' terminology, the statement in the text is thus more correct if we say that we value them at either their marginal import cost, or their marginal export revenue.

This does not mean that we assume that quotas are not used at all. They may be used to prevent excessive stock-piling of materials or components, or for final goods. But it is assumed that foreign exchange management is sufficiently good not to starve domestic industrial capacity of needed materials and other inputs. We are well aware that this situation has arisen in a number of developing countries. To the extent that we have to assume it away, we are expressing a faith in the development of better policies.

7.32 *Non-Traded Goods*

The most important non-traded goods and services (apart from unskilled labour which is considered separately below) are power, internal transport, and construction. Occasionally, power may be imported across a border, but this is rather exceptional. Land is another obviously non-tradable resource, but it is seldom important so far as industrial projects go. To such obvious ' non-tradables ' may be added a good such as cement, where the difference between the import cost and the export price is large, owing to heavy transport costs, so that it may very well make sense neither to import nor export it. Skilled labour may also be sometimes treated as a non-tradable resource. On the other hand, some highly skilled labour may actually be imported. In general, the proper treatment of this ' input ' is difficult to decide — but, fortunately, it is not often a large element of costs.

Having decided to value traded goods at their world prices, it becomes necessary to value non-traded resources also in terms of the contribution they make to earning or saving foreign exchange. Only thus can we ensure that we are valuing everything in terms of a common yardstick. The reader may, by now, be wondering about situations in which foreign exchange is particularly scarce. This common possibility was referred to in Chapter IV where we discussed foreign exchange as a resource. It was there said that one way of allowing for this was to use a special accounting price for foreign exchange. But another way was to revalue domestic resources. This latter is the method here adopted.

There are various methods of assessing the contribution of non-traded goods and services to earning or saving foreign exchange. We shall not trouble the reader with the details of the different methods proposed in Chapter XII. Here it need only be said that they all depend on the same principle. The non-labour costs of a non-traded good can be broken down into traded goods or other non-traded goods, and the latter can themselves be broken down... Alternatively, the contribution of a non-traded good to the output of another good, which is traded, is assessed (to some extent, the costs of these non-traded goods will depend on the amount of them produced : so that, ideally, rules governing how much of them should be produced are required — this is also discussed in Chapter XII). As was said earlier, ' following the chain of production around, one must eventually end at commodities that are exported or substituted for imports '.

7.33 *The Commitment to Consumption, the Shadow Wage, and Profits*

If labour were simply a non-traded service, like any other, we would arrive at the accounting wage for unskilled industrial labour in one of the same ways as for other inputs. Thus, if we assume that unskilled labour is drawn from agriculture, we can assess the differential or marginal contri-

bution of labour to agricultural output, the output being valued at c.i.f. or f.o.b. prices according to whether it is an import substitute or an export. It has been widely suggested that this is often zero : although this is an exaggeration, it remains true that the contribution of unskilled labour to agricultural output is, in nearly all developing countries, significantly less than it is in industry.

Another way of valuing non-traded goods was to value their inputs. Labour like other goods has ' inputs ', which together constitute its consumption. So we could also equate the value of labour with the value of its consumption at world prices. With most non-traded goods or services it does not matter much which method one uses, for the contribution of an intermediate good to production is about the same as the cost of the inputs used up in making it (counting profits as the cost of supply of entrepreneurs and risk-taking). But it is a peculiarity of labour in most developing countries that its consumption is significantly greater than its marginal contribution to production. How then do we value unskilled labour ? To answer this we must first consider the social value of consumption.

This has already been discussed in 3.1 and 3.2. We saw there that a government may be dissatisfied with the level of savings, and hence believe consumption in the present to be too high ; and that it might want to use project selection to help it restrain consumption and raise saving. Now a low accounting price (or shadow wage, as we prefer to call it) for labour encourages employment and consumption by workers, which makes for more equality in the present, but reduces the amount of consumption possible later, by reducing savings and investment.

Now if we set the shadow wage equal to the marginal product of labour (at world prices), this would imply that present consumption was just as valuable to the community as savings. This follows because the extra consumption of labour over and above its marginal product would not then be counted as a disadvantage or cost at all. We can only reasonably do this if the government is satisfied with the level of savings, or considers that project selection should not be used to help raise savings, because it thinks that it can lift savings to a desirable level in the very near future by increases in taxation, or other measures.

But if we set the shadow wage equal to the consumption of labour, this would imply that the *whole* of the extra consumption was a cost. This is plainly absurd, because it would be denying that more consumption (and more equality) in the present has any value at all. Only an all-powerful government with a ruthless determination to maximize the rate of growth could take this line.

Our view is that the shadow wage must be between the consumption of labour and its marginal product (both, as always, reckoned at world prices). In Chapter XIII we give a formula which determines just where between. Since it is rather complex to discuss here, we shall content ourselves with saying that the precise value between the two extremes given, depends on (a) the consumption rate of interest (itself depending on the rate of growth) discussed in 3.1, and (b) the length of time for which the government considers savings are likely to be inadequate, and (c) the amount of extra savings generated by new investments.

The reader may well have been wondering why we have linked the discussion of consumption only with employment. Are not profits also

consumed ? So far as the public sector goes, we assume not (despite the fact that governments may tend to be more lavish with non-developmental expenditure if their receipts rise). If the project is, however, in the private sector, we advocate estimating consumption out of profits, and treating it as a cost (of supply of risk capital or entrepreneurs)[1].

7.34 *The Accounting Rate of Interest, and Social Present Value*

The methods outlined thus far permit one to attach a social value to the inputs and outputs for each year of the project's life. The sum of these values constitutes the *social profit* for that year.

But the social profits (or losses) for each year have to be tied together to form a single measure by which we can judge a project. This is the process of discounting each year's social profit back to the present and adding up, as explained in Chapter I. Just as discounting actual profits, and adding up, yields the present (commercial) value, so discounting social profits yields the *present social value,* which is the final yardstick by which we judge a project.

The question remains ' What rate of interest do we use for discounting social profits ? '. In fact, this question has been already answered in our discussion of the balance of payments in 7.23 above. If all investment were under public control, we would find the rate of interest such that there is a just sufficient number of projects, with positive present social value, to add up to the total amount of investment which available savings (domestic and foreign) permit[2].

When only part of investment is under public control, the effort should be made to see that the interest rate used for discounting is about the same as that rate which would give a zero present social value to the socially least desirable investments made in the private sector. To put it less ponderously, planners should try to see that the marginal social yield is about the same in both sectors. If this is to be done at all accurately it implies doing quite a lot of cost-benefit analyses of projects in the private sector. But if the price mechanism has in the past given the wrong incentives, such analyses will tend to show low returns : it is important, as we frequently emphasize, to get the price mechanism working right.

Some may feel that there is a presumption that the public sector (and others, the private sector) is more likely to produce results which are of high social advantage. In this connection, one can say only that full allowance should be made for benefits felt to be peculiar to either sector (such as the fact that any profits are more fully saved in the public sector, or that excessive employment and lavish expenditure on prestige items is less common in the private sector) : *there is no case, after all such allowances are made, for adopting different rates of interest.*

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1. This may be thought to be a little extreme, since it implies that extra consumption out of profits has no social value. But in most developing countries it surely has a very low social value compared to consumption from wages, and therefore we feel that it is not a bad approximation to treat it merely as a cost of getting things done.

2. As we have seen, not all investment has sufficiently quantifiable benefits for a plausible estimate of present social value to be possible. The total value of such non-quantifiable investments, which it is decided to carry out, must be subtracted from the available savings before trying to strike the balance suggested in the text.

We do not pretend that finding the right rate of interest is easy. Nor is it easy to know how much to vary it, and so vary the level of investment, in the face of short-term fluctuations. This is fairly fully discussed in Chapter XIV. Nevertheless, what sort of magnitude do we guess for the rate of discount? In this connection it must be remembered that our social profits are expressed in equivalent amounts of free foreign exchange. It follows that the interest rate should certainly not be less than what can be earned by portfolio investment abroad — say 5-6 per cent in real terms. If it is found that, on average, projects turn out worse than project appraisals suggest, this figure has to be raised correspondingly. It is, moreover, only a lower limit. There may well be too many projects passing such a test. We would hope and expect that most developing countries could achieve 10 per cent. Even 15 per cent is not beyond reasonable hope in some countries. But much more will be known when a mass of evidence from project studies has been collected: surprisingly enough, given the concern for growth in developing countries, there is a dearth of such evidence.

The relatively high interest rates mentioned above may surprise some readers. What, it may be asked, has happened to the *consumption* rate of interest (called, in many economic writings, the social discount rate)? The answer is that in calculating social profits we have already revalued consumption in terms of savings for each and every period. So that what we are now discounting are investible resources, or their equivalent in social value, which is different from discounting consumption. It is, perhaps, not too misleading to say that we are dealing with surplus social value, which we want to grow as fast as possible. It is because of this that the *accounting* rate of interest should be kept as high as possible consistent with there being as much investment as savings permit (see also 3.1 above).

7.4 Special Problems and Reservations

7.41 *Risk*

We do not advocate making any allowance for risk on most projects. There is a big difference between society and the individual enterprise here. For society, another project is just another project, and it does not significantly increase the total risk of the national income being greater or smaller.

The exception is when the project is very large, even in relation to the whole economy. Even then, it would be very exceptional if it made sense to make more than, say, a 3 per cent allowance for risk in assessing each year's social profit. We do not advocate making an allowance for risk by using a higher discount rate. This assumes that risk increases with time, which is by no means always the case: even less do we advocate the use of 'pay-back' periods.

In general, when there is uncertainty, the proper estimate to make of the value of each input or output item is the *expected value.* This is not the same as the most probable value. For instance, if there are two chances in three of an amount being four, and one chance in three of it being one, then four is the most probable value, but three is the expected value.

7.42 *Externalities*

Projects are often thought to have benefits (and less often thought, at least in developing countries, to have costs) which do not show up as a result of what is normally thought of as their output, and which therefore cannot be assessed by valuing that output. An example often given is that a project trains workers (some of whom leave, and are a sort of 'output'), but receives no payment for this.

Another kind of externality results from industrial interdependence. One project may so increase the demand for some input that it makes it socially desirable to start producing that input domestically. This can happen. But one is bound to say also that bad effects may also arise from this potential interdependence. Thus the new domestic demand for an input may also be used as a reason for producing it domestically, even although this is socially unprofitable. Where the 'linkage' between two or many projects is very strong (as, for instance, in a petro-chemical complex) it may be sensible to look at the whole as a single project (then the so-called externalities become internal, and should automatically be taken care of): but at the same time it is essential also to look at it piece by piece, for in fact it may turn out to be better to import some of the intermediate goods.

External social costs and benefits apart, a project may also have external price effects which are purely redistributional in that they make some people worse off and others better off. Quite apart from the problem of equality or inequality, this could in principle affect our analysis by changing the total savings available to the economy. We allow only for the direct effects of our project on savings. These indirect effects would generally be exceedingly difficult to measure, and perforce we ignore them, hoping, but being unable in general to show, that they will on balance be unimportant (there are often just as good reasons for supposing they go one way as the other).

Our general recommendation is that whenever the possibility of an external economy (or any external effect) is suggested, every effort should be made to measure it, or at least produce some order of magnitude of the possible effect. Where there seems to be no possibility of measurement, one should be suspicious. Vague and theoretical 'external economies' have often been used in support of bad projects.

7.43 *How Much to Produce: Economies of Scale*

The problem may sometimes be more a matter of how much of a good to produce — how many similar projects or how large a project to have — than saying 'yes' or 'no' to a single project of stated size. This arises particularly in the case of non-traded goods, and those with economies of scale. Here the fact, hitherto ignored in this summary, that accounting prices will vary with the planned volume of production becomes important.

Very briefly, in the case of a non-traded good (or one which is planned to become non-traded because it appears (a) that complete import substitution is socially beneficial, but (b) exports are not) the advocated rule, where there are no economies of scale, is that the production be

extended until the accounting costs of supply equal the market price, net of any tax which the government may impose.
Where there are economies of scale, the rules become a little more complicated, and one cannot rely on a single accounting price to estimate the benefit. We shall not go into this here, but refer the interested reader to Chapter IX.

7.44 *Equality and Location*

Regional inequality plays an important part, in some countries, in industrial location policy. We have taken the view that it is probably politically impractical to give a different quantified weight to the social value of consumption in different regions: and that this important consideration should not therefore be formally incorporated in a project selection criterion. But wherever it is suggested that a project should be put in a less good location for reasons of equality, it is strongly suggested that the difference in present social value between the locations should be calculated so that the government can decide rationally whether there are not cheaper ways of dealing with local or regional poverty.

We say rather little in this Volume about location. Equality apart, it is assumed that the social costs of various possible locations will be investigated, and the lowest cost location, after allowing for transport costs, be chosen. There is no special problem here when one is dealing with a single new plant; the economies that arise from proximity to other plants, if any, will be automatically allowed for. We do not concern ourselves in any detail with the economies of creating whole new industrial areas. If this is in question — and, of course, it may be, especially in the least industrialized countries — many problems of deciding just what industries and sub-industries gain by proximity to which others may arise. We believe that much more research needs to be done in this field; in this Volume we content ourselves with only a few trite remarks in Chapter XVI.

7.5 Putting a System of Cost-Benefit Analysis into Operation

For the public sector, the chief problem is one of communication between a central planning staff, or co-ordinating ministry (of which an office of project analysis or selection would, presumably, form a part), and the ministries or agencies which put forward projects. These latter may in turn have a problem of communication between themselves and the engineers, firms, and consultants, who actually design the projects. The point is that if the project is to be appraised on the basis of accounting prices, which differ from market prices and projections of them, then it is very desirable that these same accounting prices should be used at all stages of the formulation and design of the project.

Circumstances differ so much from country to country that we do not feel that we can say very much that is useful, at the general level, concerning how the above problem can best be overcome.

But at least it is clear that, if the principles of this Volume were accepted, the central staff should use it to prepare a much shorter manual instructing ministries and other operative agencies how to prepare cost-benefit studies, and that it should insist that all projects which come before it should include a cost-benefit analysis on the lines laid down, as

well as the normal profitability analysis. Such a manual could be quite short, because it could, unlike the present Volume, leave out much of the argument ! The present Volume should, despite its title, be seen as a text-book on how to prepare a manual, rather than as itself an operational work.

The central staff should also prepare studies and estimates of the accounting prices which will be common to most projects, circulate these to ministries and other operational agencies, and instruct that projects which come before them should use these prices. These central estimates of accounting prices would include the shadow wage, the rate of discount, and the prices to be used for power supply, internal transport, and construction costs. Except for the rate of discount, these estimates might well have to be varied according to the region in which the project was to be located : this is certain to be the case for transport, and in many countries for power and labour supply also.

The points of contact, and their nature, with the private sector are too varied for us to make suggestions as to how important private sector projects can best be appraised from the social point of view. Ministries, public development banks, or credit agencies, or in some cases special government-sponsored industrial research and development institutes, might all play a role.

7.6 A Schema

This section consists of an extremely cursory schema, with forward references to Part II. For each year estimate :

1. Quantities of inputs and outputs (including skilled labour). To find their values use
   a) world prices for traded goods — see 8.3, 8.31, 8.32 ;
   b) accounting prices for non-traded goods — see 8.4, 8.41, 8.42, and Chapter XII.

   N.B. Special studies of transport, power, and construction, which are common to all projects, should be undertaken in order to estimate accounting prices for these services.

2. Estimate the number of unskilled man-days for each year. To find the social cost, value a man-day at the shadow wage rate — see 8.5, and Chapter XIII.

3. Estimate any external effects. See Chapter XVI.

4. If the project is very large, possibly subtract something for risk. See Chapter XV.

5. The net value of outputs less inputs, as estimated and valued under 1 and 2 above, subject to possible adjustments under 3 and 4 above, is *the social profit* for each year.

6. Discount each year's social profit at the accounting rate of interest (see 8.6 and Chapter XIV), and add up to give *the present social value* (PSV).

7. If the PSV is positive undertake the project : if not, reject it.

NOTES

a) If production is to be on a large scale, in an industry where unit costs tend to be less the greater the scale of production, a special set of calculations will have to be performed in order to estimate social profit. See 9.1.

b) If foreign loans are tied to the project, it will be necessary to add the PSV of the loan to the PSV of the project before reaching a decision. See 9.2.

c) In most cases, consideration will have to be given to the financial operation of the project. For example, if it is in the private sector, the government will have to make sure it can run at a profit. See Chapter X.

d) If the project is to produce a non-traded good, the accounting price of that good may have to be estimated from the information about the project. In that case, the social value of the output should be equal to the social cost of the project. More precisely, the good or service should be produced in such a quantity that the extra *social* cost of producing a little more (e.g. by having another project in this sector, say electricity generation) is equal to the price net of indirect taxes that can be obtained for it by the project. This price is then also the proper accounting price. (See 8.4, 8.41., 8.42., and Chapter XII).

7.7 ENVOY

Naturally, much has been left out of this summary Chapter, but it it hoped that it gives a fair idea of the approach and the justification for it.

It is impossible to produce general rules for project appraisal which cover every eventuality, and which are exactly appropriate to the situation and policies of every country. Our hope is that individual countries will consider it worth while to produce their own methods, and will at least find solid and valuable guidance in the present Volume.

It should perhaps be added that our advocated methods are likely to produce the best results where most extensive use is made of the price-mechanism. We strongly believe that use of the price-mechanism is not merely consistent with maximum achievement of any country's objectives, but is almost invariably conducive to it. This in no way precludes — indeed it demands — careful 'doctoring' of the price-mechanism, via exchange rates, tariffs, taxes and subsidies, and so on. Nor does it in any way preclude direct encouragement of industry by government initiative — only that these initiatives be themselves subject to the appraisal we suggest.

Finally, the authors are convinced that the careful 'micro-economic' planning implied by this Volume has a high priority for the achievement of rapid progress.

Part II

Chapter VIII

THE PRINCIPLES OF PROJECT APPRAISAL

In Chapter VII we sketched a criterion for project selection. We now present the reasons for using that criterion. To keep things simple, we shall at this stage ignore the private sector, neglect economies of scale, externalities, uncertainty, and other complications. These matters will be discussed in later chapters. Nor do we here discuss the methods for estimating the various accounting prices. At this stage, we establish the principles : practical methods of estimation are discussed in Chapters XII-XIV.

8.1 What Happens when an Investment Project is Undertaken

Evaluating an investment project means evaluating its consequences. If the project is undertaken, it will use certain inputs and it will produce certain outputs. Typically, during the early years, the inputs used will be much more important than any output ; but, later on, the output or outputs become more important. If we look at one particular year in the life of the project, we can list the quantities of outputs produced and inputs used. This shows the extent to which the project increases the *supply* of certain goods by the economy, and increases the *demand* of the economy for certain other goods[1].

For example, if a new textile mill is built, the supply of various kinds of cloth is increased, but so also is the demand for construction work, looms and other machinery, skilled and unskilled labour, and so on. This list of increases in supply and demand is only the first step. We must also assess how valuable the various inputs and outputs are, so that we can evaluate the social benefit resulting from the increased supplies and the social cost of the increased demands. We have explained in earlier chapters why we should quite often want to use different prices in evaluating social costs and benefits from the market prices that the producer receives for his outputs and pays for his inputs. Instead we use *accounting prices.* Then some cloth that fetches 1,100 rupees when sold to the wholesaler might be worth more or less, say 1,000 *accounting rupees,* when accounting prices are used. The point of this is to ensure that it is just as valuable to the economy to increase the supply of cloth

1. The project, if undertaken, may also have an effect on production and consumption activities elsewhere in the economy. The increases in supply and demand brought about by the project should include these indirect effects, but we neglect them for the moment.

by 1,000 accounting rupees, as it is to increase the supply of electricity or reduce the demand for steel by 1,000 accounting rupees.

Using these accounting prices, we can calculate the value of the increases in supply less the value of the increases in demand, for each year of the project's life. We shall call this number the *social income* of the project in that year. It is the income we impute to the project, as a measure of the net increase in the output of the economy which it brings about. In the early years of its life, the social income of a project will usually be negative — just as the actual financial outlay exceeds receipts when the project is being set up. But we hope that social income will be positive later on, to offset the initial costs.

However, the social income generated by the project is not the measure of its value to society in that year. This is because we have so far neglected the use to which the social income is put. If it were true that a million rupees of social income could always be used in the same way, whatever the kind of project that provided it, there would be no need to ask how the social income of the project would be used. But, in fact, some projects may commit the economy to a large increase in consumption, whereas others may commit only a small part of the social income to consumption, leaving the government to do what it likes with the remainder. Now, as between two projects that generate the same social income, the government will certainly not choose the one that *commits* it to a greater increase in consumption: for it could always devote an equal amount of the social income arising from the other project to consumption, but might well prefer to see it ploughed back into further capital investment instead of being consumed at once.

Why should the government be committed to allowing a certain increase in consumption in the economy if it decides to go ahead with the project? The reason, in general, is that governments are never in a position to control completely the distribution of incomes arising in the economy; nor, in particular, the pattern of incomes created by a project. Politics and administrative considerations may set a limit to possible taxation. As a result, the government cannot ensure that the social income of the project is used in the way that seems best: its choice is restricted, often severely, by the nature of the project, especially by the extent of the new employment it provides.

We visualize the project then as a certain pattern of *social income* over time, having associated with it a certain level of committed consumption in each period. In the end, all the social income will give rise to additional consumption — but not at once. If part of social income is reinvested — that is, ploughed back into the creation of new capital equipment — consumption that might have occurred now will be postponed until later. A government might well want that to happen, if the sacrifice of present consumption implied a large increase in consumption later.

One could think of the project as generating a particular pattern of consumption over time. But that is not very convenient: for if we wanted to know how large an increase in consumption would be provided twenty years from now, we should have to consider a great many other projects (in which part of the social income would have been reinvested), besides the one we are primarily interested in. Instead, we calculate the social income generated in each year, and the commitment to increased

consumption. We shall correct the social income to allow for the disadvantages of being committed to a certain level of consumption, and so arrive at a number which we call the *social profit*. The social profit in a year *does* measure the value to society of the project's activities during that year.

8.2 Simplifications

It is easier to explain how to calculate the social income, and the social profit, if certain considerations are left aside for the moment.

1. We assume that the project will be in the public sector, so that any profit it makes accrues to public funds ; and that the investment cost has to be met out of public funds. The commitment to consumption that arises with private profits will be discussed in Chapter X. So also will the problem of encouraging desirable private investment, and discouraging undesirable private investment.

2. We neglect all *indirect effects* of our project. These might be of several kinds. First, there are pure external effects of the kind mentioned in 7.42 above, and discussed in more detail in Chapter XVI. Secondly, the operation of the project, by altering supplies and demands, may change the market price of various goods. This might encourage some producers — for example private producers who are not guided by cost-benefit analysis — to change their production plans in a way that could be important. Thirdly, in the same sort of way, the project might raise or reduce the consumption of people working in other parts of the economy. These second and third kinds of indirect effect will be explained in more detail in Chapter IX. It is probably not seriously misleading to neglect them at first.

3. We assume that there are no *economies of scale*. These arise when the cost of production — that is, the cost of inputs measured at some particular set of prices — per unit of output, is less when the size of the project is greater. For example, until the scale of production is very large indeed, more cars of a particular model are cheaper to produce than fewer. Similarly, large power stations produce electricity at a lower cost per kilowatt-hour than do smaller ones. As a result, the accounting price for the output may change if a decision to undertake the project in question is taken. In such a case, it is a little more difficult to estimate the contribution of the output to social income. We therefore postpone consideration of large-scale projects until Chapter IX.

4. We assume there is no uncertainty about the results of the project. This simplification will be removed in Chapter XV.

8.3 Accounting Prices for Traded Goods

In this Section, and the succeeding ones, we shall discuss the principles that should govern the estimation of the various accounting prices. Accounting prices, like ordinary market prices, may vary from year to year : and we are always looking ahead, and estimating what they will be in future years.

If some of the demand for a commodity will be satisfied from imports, or some of the supply exported, we call it a *traded good.* Other goods and services are referred to as *non-traded.* Whether or not a particular commodity will be a traded good or a non-traded good, an import or an export, in some future period, depends on how the economy is going to develop between now and then. Sometimes, our guess about whether a commodity will be imported or not may be almost a value judgment: we think that a sensible government would plan to import some, so we assume that it will do so. Of course, if one of our assumptions required government action in order to be fulfilled, this should be drawn to the attention of the appropriate authorities.

In theory, all we need to do to get a good method of project selection is to estimate *relative* accounting prices: so that, for example, we know the ratio of the price of electricity to that for steel. But it is convenient to measure prices in terms of something. We shall try to measure everything in terms of its 'foreign exchange equivalent' — that is, the amount of foreign exchange that is just as valuable to the economy as having an extra unit of the commodity. (We shall sometimes express the unit of foreign exchange in terms of the local currency; this makes no difference provided we always convert, say dollars into rupees, at the same exchange rate. We can speak indifferently of 'an accounting rupee' or 'one rupee's worth of foreign exchange'.)

8.31 *Imported Goods*

Suppose that raw cotton can be purchased from the world market at a definite price, which is virtually independent of the amount bought. If the project is going to use some raw cotton, we shall charge it the amount of foreign exchange that has to be spent to buy the raw cotton. If a bale of cotton costs $x and the official exchange rate is 7 rupees to the dollar, we shall take the accounting price to be 7x rupees. A charge must also be made for the cost of transporting the goods from boat to factory, including insurance and trading costs; the details of this will be discussed later.

What is the justification for the above rule? The answer is that it ensures that the use of, say, 1,000 accounting rupees in buying any one imported commodity costs the economy the same as its use in buying any other imported commodity. For instance, if instead of using raw cotton that costs 1,000 rupees of foreign exchange (say $ 143 worth), raw jute costing 1,000 rupees is used (bought from another country that happens to use rupees as currency), that in itself makes absolutely no difference to the economy. These two inputs cost the economy exactly the same. Thus purchase taxes and import duties are excluded from accounting prices; for the project should not be encouraged to use inputs that happen to have low tariffs or taxes on them, since that might lead the country to spend more foreign exchange to no advantage.

The rule that one should ignore duties and purchase taxes would not be a good one if the government was using these duties deliberately as a means of discouraging one import as compared to another, for reasons that demanded respect in project evaluation. Indeed, governments should, when considering changes in the tariff structure, keep very much in mind the possible effects of tariffs on production decisions. But, in reality, one

cannot pretend that the structure of tariffs, as we find it in any country, is designed to provide just the influence on imports and hence internal production decisions, that the government would now deliberately choose to exert.

The structure of tariffs in most countries is far more the result of a series of historical accidents than of a deliberate attempt to influence production decisions so as to get more of this used and less of that. The import duty might be higher on one commodity compared to others, because it is an important import and therefore a useful source of revenue; or because of past programmes to encourage domestic production of the commodity; or because negotiated tariff reductions had involved the second commodity but not the first. Usually, the reasons for tariffs are irrelevant to the decision whether to use one input or another in production.

There is, however, one exception. The rule that the accounting price should be the foreign exchange cost of a unit of the commodity is correct only if the price the country pays for the commodity is independent of the amount it wants to buy. If this is not true, there is a case, at any rate in terms of narrow national interest, for discouraging use of that commodity. The reason is that an increase in demand will increase the foreign exchange cost of what is already being bought; so that the actual foreign exchange cost is more than the price of the extra amount demanded. In this case, one might well want to have a tariff on imports, and this is a tariff one would want to include in the accounting price. This might happen either because the country's demand for the commodity was a very important part of total world demand, or because any expansion in demand would force the country to resort to more expensive suppliers. The first reason for having an accounting price above the world price is applicable only rarely to the case of a developing economy. The second reason arises more frequently.

The general rule is that the accounting price for an imported commodity is the total foreign exchange cost, including any increase in the cost of existing purchases, of increasing imports by one unit. The technical term for this quantity is the *marginal import cost*. It will seldom be easy to tell just how much higher the marginal cost is than the world price. Probably there are few cases where the difference would matter very much. But a similar point arises in connection with exports; and there it is liable to be much more important.

It may be as well to emphasize that the world price of the imported commodity is the one to use whether the commodity is being used as an input or being produced as an output. The same accounting price should be used for a commodity whatever its role in the economy. After all, it is just as useful to the rest of the economy for a project to make 10,000 rupees worth of steel, as it is for it to save 10,000 rupees worth of steel; we want to encourage both to exactly the same extent, and therefore assign the same price to each. It should also be emphasized that a good is normally considered as an imported good even if it is actually purchased for the project from a domestic supplier, provided that some of the total supply would in any case be imported. The justification is that someone else will have to import instead of buying from this domestic supplier. In some particular year, a commodity that would normally be imported, may in fact be available from a domestic producer with excess capacity. This is hard to

predict far ahead, but might be known to apply to a piece of capital equipment to be bought early in the life of the project. The accounting price can then be less than the price of imports as was explained in Chapter VIII. It becomes, effectively, a non-traded good (see 8.42 below).

8.32 *Exported Goods*

We can now compare a commodity that is exported with a commodity that is imported. If the exported commodity can be sold at a fixed price (in terms of foreign exchange — i.e. neglecting taxes and subsidies, special exchange rates, etc.), that price is the accounting price for the commodity. It is as valuable to obtain 1,000 rupees by exporting cotton piece goods as to save 1,000 rupees by reducing the import demand for tin. Similarly, when comparing two commodities that are both exported, it is obvious that what the projects provide the economy with, is the foreign exchange earned ; in comparing the two commodities, one should look only at the prices they will fetch in world markets.

Thus, if the project produces a commodity that is being exported, it must be credited with the foreign exchange equivalent (less the appropriate transport and distribution costs). This is correct even if the output of the project will not itself be exported, but used in some other domestic industry. For, given the demands of this domestic industry, the output of the project still has the effect of increasing exports, as compared to what they would otherwise have been. Some indirect effects are here neglected, which might occasionally be important. This point will be taken up later.

Unfortunately, the above description of an exported commodity sounds rather unrealistic. Countries seldom feel that they can export as much as they choose of any specified commodity, without significantly affecting the price they can hope to receive. Perhaps the developing countries are apt to exaggerate the difficulties of selling goods abroad ; often the problem is not so much that of finding markets as of maintaining adequate quality on a sufficient volume of production. But sometimes countries face, or feel seriously threatened by, the prospect of impenetrable trade barriers erected by the more industrialized countries.

If, on reflection, project planners decide that the limit on the export of bicycles is the rate at which good quality production can be expanded, then no special problems arise in evaluating particular production proposals (once they are reckoned to be genuinely feasible). If, however, increased production will have to be sold in less and less favourable markets, it may be necessary to reduce prices to all purchasers if exports are to be expanded. This is certainly the position in many of the markets for primary commodities ; if cocoa producers try to increase production too rapidly, the price is forced down. In that case the extra foreign exchange, which will be earned by producing more, is less than the actual foreign exchange receipts from the new sales, since the price reduces the earnings of existing production.

In such a case, it is a good idea to discourage production by crediting the project with rather less than the ruling price for the commodity ; this is the reason for the export taxes discussed in 6.1. This lower price, which is the increase in foreign exchange earnings per unit of extra exports, is called the *marginal export revenue*. It is analogous to the marginal import cost discussed in the previous section. The general rule for determining

the accounting price of a commodity that is being exported is that the accounting price is equal to the marginal export revenue.

In fact, most commodities are produced by a number of countries, and one country acting on its own cannot usually get a significantly better price for its production by restricting its own output. For this reason there are sometimes agreements among the producers of primary commodities to reduce overall production, in order to keep prices from falling too far. In such cases — the International Coffee Agreement is an example — the various producing countries are given quotas which limit the amount of the commodity that they should export. The accounting price for a commodity which is exported under a quota of this kind should not be very different from the world price (for quota exports), provided domestic demand for the commodity is small. But if the country's own demand for the commodity in question is large, and the level of exports is given, the commodity should be regarded for the purposes of project analysis as a non-traded good. The accounting price must, of course, be less than the world price (otherwise it would not be worth exporting at all).

It may be thought that we have still not covered all possibilities. It often seems that the exports of some particular commodity are given in *both* quantity *and* price. What is the project planner supposed to do then ? In fact, the planner may be too quick to suppose that both quantity and price are fixed. He is, after all, planning for the future, and not for today. There is time to try to expand markets by offering lower prices, mounting selling campaigns, and so on. Very occasionally, export contracts — e.g. for bilateral trade — may be fixed well in advance, specifying both quantities and prices, and productive capacity is established precisely for this purpose. In such a case it is obvious what the foreign exchange earnings of the outputs are ! But we suspect that, in general, it is merely a matter of statistical convenience to suppose that future export demand is a given quantity, which cannot be expanded except with the most expensive difficulty ; and not an accurate statement of export possibilities.

On the other hand, in the new export lines that are the particular concern of the industrial planner, export sales require the gradual development of markets, as selling agencies are built up, designs developed, reputations established, the characteristics of different markets learned, and so on. It may then be sensible to act as though exports could be expanded easily up to a certain point, without prices being much affected. This point will be changing through time, and may well not be where the planners think it is going to be. But, while planning production within these limits, the expected prices may be used as the accounting prices in evaluating projects, at any rate when uncertainty about probable markets is not too great. It would be better if one knew how much one could expand sales by spending still more on selling efforts, so that rational decisions could be taken about export promotion. But no one seems to be very well informed about this.

Particular problems and exceptions should not blind us to the essential point of the argument. If the commodity in question is going to be exported or imported in the year under discussion, planners have to decide the accounting price by looking at the foreign markets from which the country buys or to which it sells. Often, it will be enough to forecast the price at the port. Sometimes an ' ideal ' import or export tax may be

allowed for in the accounting price, so as to discourage an export or import that would have a harmful effect on the world price. But one would not look to domestic market prices at all.

8.4 Accounting Prices for Non-Traded Goods

We do not discuss labour for the moment, since it is desirable to treat it in a rather special way. We shall first discuss goods and services that will not be traded at all; and then certain special cases of commodities which, though to some extent imported or exported, have to be treated as non-traded goods.

8.41. *Commodities that do Not Enter into Foreign Trade*

Some non-traded goods like construction work, electricity, and banking services, are almost always produced in the country because it is very awkward and very expensive to produce them elsewhere and then import them. In this case, it is obvious that the goods or services will not be traded. In other cases it is not obvious, and one has to predict rather carefully whether the commodity is likely to be traded or not. Sometimes, the question whether or not the commodity will be traded is to be settled by the decision on the investment project. In none of these cases can one estimate the accounting price simply by forecasting the state of the world market.

Let us first agree that the same accounting price should be used for the commodity in all its uses (apart from the differences that must arise because of transport or transmission costs). If the project uses a hundred thousand kilowatts of electricity, the purpose for which it is used does not alter the sacrifice which society must make in allowing the project to use electricity at that rate. Similarly, the value of an extra unit of electricity to the nation is the same whatever means are used to produce the electricity, or even if the extra electricity is made available by using less electricity in other projects.

The general long-run principle is that the accounting price should equal the social cost of providing a little more of a non-traded good. (In economic jargon this is the *marginal social cost* - MSC.) If this cost varies with output, the level of demand will need to be predicted . If mistakes are made about this, a case may arise for making the accounting price for users temporarily higher or lower than the long-run MSC. For instance, if capacity is insufficient to meet the demand, and cannot be quickly expanded, there is a case for postponing projects which are heavy users of this non-traded good. This can be done by using a higher accounting price than the MSC for a few years — until such time as output can be expanded to satisfy the demand. Similarly, though this is less common, excess capacity may arise — in which case, an accounting price rather below the long-run MSC will be appropriate for a few years.

We have seen that the future level of demand may need to be predicted. This depends not merely on accounting prices, but also on the actual prices charged to different users. In the case of a public utility, these have to be set, for different types of customer, in accordance with government policy. We cannot go at length in this Manual into the problem of optimum

tariff-making. But, unless excess capacity arises, actual prices charged should not be lower than the accounting price : they may be higher either if there is a temporary shortage of capacity, or if the non-traded good enters into private consumption and is a suitable medium for taxation.

To help understand the operation of these principles, let us suppose that the planners have set an accounting price of 1 rupee for peak-period electricity from now until 1975. How do we know if they are right ? On what grounds might we, for instance, say in 1975 that it has proved to be too high ? A higher rather than lower accounting price will have reduced the amount demanded (more accurately, the amount demanded will be less for each actual price charged). This is because (1) public sector projects that use a lot of electricity will have been discouraged, and (2) anticipating too high a social cost, the government may have disallowed extensions of supply such as, say, some schemes for rural eletrification. At the same time, the sanctioning of generating stations will have been encouraged. Thus, the accounting price will have proved too high if, in 1975, there is either more capacity than required to meet the demand, or if, to prevent this, actual charges have to be lower than the long run MSC (or lower than desirable, if some revenue should have been raised but now cannot be). In this situation, the accounting price must be lowered, since too much producing-capacity has been encouraged, and too little using-capacity.

For similar reasons, if the accounting price has been set too low, the demand will exceed the supply unless the actual price (net of any desirable tax element) is raised above the MSC, or unless some form of rationing is applied. In either event, some users will have less electricity than they would have been willing to buy, paying as much as it costs the economy to supply : and the accounting price should then be raised, since more capacity is justified.

We now turn to the problem of estimating the MSC. This is relatively easy if costs do not vary significantly with the amount of capacity constructed — for, in this case, one need not worry about the level of demand. To show this, let us consider the case of electricity a little further.

Except for hydro-electricity, most of the inputs (oil or coal, and equipment) are traded goods, and will, therefore, be valued at c.i.f. or f.o.b. prices. Let us suppose that the shadow wage rate has also been determined, so that the accounting prices for all inputs are known. Further, suppose that supplying any amount of electricity is simply a matter of building more or fewer coal-burning generating stations of the same type (of course, we are simplifying !). Now there will be a minimum accounting price for electricity which will make it socially profitable to build any power station — so that, if the accounting price were less than this, the project selection procedures would not permit the production of any electricity. But if the accounting price were significantly higher than the minimum, there would be good reason to build a limitless number of power stations. So, in this case, there is an unambiguous accounting price, which is equal to the MSC, and which is quite independent of the amount of electricity demanded and supplied. There is thus no need, in estimating the accounting price, to worry about the prices that householders ought to pay, nor about such things as the licensing arrangements which should govern private producers of electricity, nor anything else that affects the demands made upon the public supply. Needless to say, the electricity authorities must still worry ;

for they have to estimate actual future levels of demand (as affected by the accounting price, together with any regulations or rationing the government may impose), in order to decide how many power stations to build.

There are, however, many ways of making electricity. The accounting price for electricity might be too low to allow production by one means, but still higher than is required to allow production by other means. The correct accounting price is the one that is so low that the best of all the available methods of production is just worth using. Then the price reflects the total use of foreign exchange involved in producing the electricity; and, at the same time, it makes sure that no more foreign exchange is used in making electricity than is strictly necessary. For instance, the accounting price might be such as to permit coal-fired stations but disallow oil-fired ones — or *vice versa.*

As already indicated, the problem is theoretically more complicated if, say, the marginal social cost of electricity would be lower if the extension of planned supply was greater rather than smaller. Then one needs to estimate the demand at various accounting prices, and choose that accounting price which will result in a level of demand such that the marginal social cost of supplying that level of demand is also equal to the accounting price. This is obviously much more difficult for it requires knowledge both of how social costs decline with increased output, and of how demand reacts to changes in price. Fortunately, the use of electricity in most industrial projects is a sufficiently small part of costs to make such sophisticated attempts at precision unnecessary.

The discussion has so far been couched in terms of a single non-traded commodity. We have assumed that only one accounting price remained to be determined, all the others being known already. For instance, in discussing inputs into electricity, the non-traded input of construction was left out. Is that not cheating? In fact it is not, for we are providing ourselves with an equation corresponding to each non-traded commodity — the equality of supply and demand. Some of these equations will depend on several of the accounting prices we want to calculate. But there will be as many equations as prices. We can confidently assert that these equations do have a solution. It is theoretically possible that they might have more than one solution: but it will be clear, when we come to discuss the estimation of the accounting prices, that this particular problem is much less troubling in practice than in theory.

We have at this stage done no more than establish the principles governing the accounting prices of non-traded goods. The problem remains of how to estimate them in detail. Discussion of this is reserved for Chapter XII: here we need say only that, in our view, serviceable methods are available.

8.42 *Ambiguous Cases*

The investment rules used by project planners should fit in with the government's tax policies, rationing arrangements, licensing procedures, and so on. If the government deliberately, as a matter of long term policy, makes arrangements that lead to a certain rationed demand for automobiles, accounting prices should be such that just this demand is

supplied. (Sometimes governments like to use queues as a means of restricting demand, so that supply is apparently less than demand — but not less than the demand the government wants to be supplied. We do not think this is a good method of restricting demand ; but if it is done, project selection should not fight against it.)

Sometimes this requirement, that project selection should take account of the ways in which the government influences demand, may force us to regard a commodity that is being imported (or exported) as a non-traded good for the purpose of estimating its accounting price. A straightforward and obvious case is when the country is receiving foreign aid in the form of a fixed amount of some commodity — say wheat —, but the government has no intention of importing any more of the commodity than is provided by way of aid. In such a case, any increased use of the commodity in question must be provided by domestic production ; and, if there is no possibility of export, increased production must be absorbed by domestic users ; in no case will the quantity of imports or exports be affected, and the world price of the commodity is therefore of little help in estimating the accounting price.

A slightly less obvious case of the same situation is when the government imposes a fixed quota on imports of the commodity. The quota might be so ungenerous that many potential users would be willing to use the commodity even if its accounting price was substantially higher than the price of imports. If the quota will really not be influenced by decisions on projects that produce or use the commodity, it may be necessary to use a price above — or possibly below — the foreign exchange cost of importing ; after all, one has to make sure that the demand is not in excess of the supply. In such a case as this, the government is obviously unwise to operate a fixed quota. It is absurd to produce a commodity domestically at a foreign exchange cost greater than the cost of importing the commodity. Project planners can point this out. Indeed, planning for the long run as they are, they may be tempted to take production decisions — or rather decisions not to produce — that will force the government to relax the import quota when the time comes.

Another case where a good which may normally be traded becomes temporarily a non-traded good may arise when there is excess capacity. Extra demand may then have no effect on imports of the good itself, and its accounting price becomes the accounting cost of the current inputs of the labour, fuel, and materials required to make it. Such excess capacity cannot normally be anticipated except sometimes in the case of equipment to be installed at the beginning of the life of a project.

Finally, it will be realized that the distinction between traded goods and non-traded goods is not always as sharp in practice as in theory. One may want to regard textile piece-goods as traded goods, because exports are quite an important part of total production. But the particular kinds of textile goods that are exported will usually be rather different from the kinds that are produced for the domestic market. It is obvious in this case that the whole output can be regarded as traded goods for the purpose of accounting price estimation, at any rate when the different goods are of fairly similar quality. We shall discuss the details later. But there may be awkwards cases, where, say, small workshops produce goods of inferior quality for the domestic market ; one would not necessarily want to assume

in this case that the accounting price and market price were identical, just because market prices and accounting prices are identical in the case of the products of large modern firms.

How far one should go in worrying about the proper classification of a commodity depends, as does the amount of work that should be devoted to estimating the accounting price, on the importance of the commodity for the project in question. In project analysis, troubles tend to come singly. Most of the inputs and outputs will be quite easy to deal with.

8.5 The Treatment of Labour

Few categories of labour can be regarded as imported or exported 'commodities'. In order to estimate the social income generated by the project, one must therefore estimate the accounting price of labour by regarding it as a non-traded good. But at once there is an obvious difficulty : in many of the developing countries, the supply of labour to the industrial sector seems to be considerably greater than the demand for labour by that sector ; and when one comes to think about it, there are reasons why this has to be the situation in the early decades of economic development. So, in this important case, the accounting price is not supposed to make the demand and supply equal. This problem arises because the extent to which industry commits the economy to providing consumption depends upon the size of the labour force it employs.

There are some categories of labour for which one should want supply and demand to be equal. This is certainly true in the case of men with special abilities, skills, training, or education — such as production managers, and skilled labour generally. It is 'unskilled' labour — that is, labour whose work requires only simple training that takes little time, and at which most people can be expected to succeed — that has to be treated specially. Not that it is particularly easy to estimate accounting prices for the various kinds of skilled labour and highly-educated manpower : but for these one needs only very rough estimates, since skilled labour inputs are seldom so large a part of costs that variations in their accounting prices would make much difference to project choices.

In contrast, unskilled labour may be an important input. Precisely because a developing country can seldom afford to commit all its production to consumption, it is unlikely that all those who would like jobs in industrial employment should actually be given them. So, as already remarked, the balance of supply and demand is of no help. But one can still ask by how much production elsewhere would be reduced by the employment of unskilled labour in the project under consideration. The decision to employ people will not usually have a significant effect on employment by other industrialists[1]. The labour will therefore come, directly or indirectly, from the agricultural or service sectors of the economy. The cost to the economy of having these men work on the project can be reasonably estimated by the loss that would result if they all came from the agricultural sector.

1. There may be exceptions to this — it depends upon conditions in the particular country. We shall discuss the matter further when dealing with the estimation of shadow wage rates in Chapter XIII.

To take an extreme case (which is probably not true anywhere), if there was always, every day, unemployment in agriculture, one could assume that there would be no reduction in production. In that case, the social income of the project would not depend at all upon the number of people employed. In the more usual case when, at least for part of the year, labour is a bit scarce in agriculture, one should be more subtle in making an estimate. What one wants to know is the reduction in output, *valued at accounting prices,* that is foregone as a result of reducing the numbers working in agriculture. In principle, the probable reduction in output should be averaged over a representative collection of different crops, using the appropriate accounting price for each. Admittedly this is none too easy, even in developing countries that have quite a lot of statistical data : but one does not need a very accurate estimate when dealing with industrial projects.

This number, the value in terms of accounting prices of the average reduction in agricultural output per man withdrawn from the sector, we call the *accounting marginal productivity of labour* (AMPL).

There are many developing countries where the AMPL is not the largest part of effective labour cost. One can use it to estimate the social *income* of the project ; but what is wanted is the social *profit,* which allows for the cost of the commitment to consumption. For reasons that are not always fully understood, the employment of labour in industry commits the economy to extra consumption. In this sense, labour has a further cost which must be taken into account.

The trouble is that, very often, unskilled industrial labour is paid a wage that allows the worker and his household to consume, despite taxes, goods whose value is considerably greater than the AMPL — the value of the reduction of output in agriculture resulting from his move to industry. If absolute priority were given to generating production that was not committed to being consumed, then the *whole* of the consumption of wage earners would be a cost, to be set against the benefits provided by the project (not just the extra consumption of the wage earner, because his previous consumption is offset by the loss of agricultural production).

An example will make the point clear. We have worked out the value of the output of the project, and subtracted the value of commodity inputs from it: the result is 1 million rupees. The wage bill is 300,000 rupees. It is estimated that the loss in the value of agricultural production as a result of removing this labour force from agriculture is 50,000 rupees. Let us suppose that consumption in the agricultural sector is equal to the net value of production there, and that wage earners consume all their income. (Private saving, and taxes, are neglected : the example is not meant to be particularly realistic, and these details will be dealt with later.) We now have the following situation (valuing all quantities at accounting prices) :

The project provides	: Rs.	1,000,000 (excluding labour costs)
The wage earners would otherwise have produced	: Rs.	50,000
Agricultural consumption is reduced by	: Rs.	50,000
The wage earners consume	: Rs.	300,000.

Thus the net surplus over consumption requirements is Rs. 700,000. But it is impossible to justify subtracting the whole of the wage bill from the net value of production of the project. People are consuming commodities which they could not otherwise have consumed: they are therefore better off, and this is a benefit for which the project can take credit. As against this, more people could be provided with consumption later if it were possible to use the Rs. 300,000 for investment in extra projects. The question is whether it would be better to postpone consumption in this way.

The answer depends upon how fast the economy will be growing anyway, and what could be done if it were possible to undertake more investment projects. We shall go into all this in detail in Chapter XIII. What must be clear already is that we shall not advocate subtracting the whole of the wage bill from the net value of production, only a part of it. To determine what part, we multiply the number of people employed by a number that is less than the actual wage rate. We shall call this number the *shadow wage rate* (SWR)[1]. When a country is setting up a system of project evaluation, one of the more important questions that has to be decided is the magnitude of this shadow wage rate.

In all project evaluation, whether public or private, one has to allow for changes in wage rates over time. In developed economies, the more far-sighted employers allow for a rising cost of labour. Similarly, we must consider whether, in a developing country, the shadow wage rate would be rising; it would hardly be safe to assume that it will be constant. Nevertheless it turns out, rather conveniently, in the circumstances of many developing countries, that there is some reason to think that the ratio of the shadow wage rate to the actual wage rate may remain roughly constant, at any rate for a decade or so. But, naturally, this depends upon the country, and we shall go into the arguments more carefully when we deal with numerical estimation later on. Certainly one must, in some cases, allow for changes in the ratio of the shadow wage to the actual wage. But it is unlikely that the changes will be big enough to make very much difference to investment decisions. This is one of the complications that project evaluators can afford to ignore.

To summarize: the cost involved in committing the economy to providing consumption as a result of increased employment can be adequately measured by valuing labour inputs at a certain shadow wage rate, which is usually a roughly constant proportion of the actual wage rate (revalued at world prices). To determine this shadow wage rate, we have to consider what can be achieved by further investment; we have to forecast the probable future growth of the economy; estimate the marginal productivity of labour in agriculture, and also the extent to which agricultural incomes and wage incomes are spent on consumption. The details, along with suggestions for different kinds of developing economy, will be set out in Chapter XIII.

8.6 The Project as a Whole: Its Present Social Value

Once the inputs and outputs in the various years of the project's life have been listed, together with the accounting prices and the shadow

1. We have used in term *shadow wage rate*, rather than *accounting wage rate* to emphasize the special nature of this accounting price.

wage rate, we can measure the excess of benefits over costs in each year — the social profit. We might have something like the following simplified example :

Thousand Rupees.

YEAR	INPUTS[1]	OUTPUTS[1]	WAGE BILL[2]	SHADOW WAGE ÷ ACTUAL WAGE	SOCIAL PROFIT
1	2	3	4	5	3 - 2 - (4 × 5)
1	2,000	0	1,000	0.5	—2,500
2	2,500	1,000	1,500	0.5	—2,250
3-17	1,000	2,000	500	0.5	750

1. Valued at accounting prices (world prices, and estimated accounting prices for non-traded commodities). Inputs here include everything other than unskilled labour.
2. Actual value. The correction to be made because consumer goods are purchased at prices different from the accounting prices used in columns 2 and 3, is included in the factor for changing the actual wage rate to a shadow wage rate (column 5).

The final column, showing social profit, has to be reduced to a single figure, the *present social value* (PSV), by discounting each year's social profit at a suitable interest rate.

In choosing suitable interest rates, the main considerations are two :

i) Whatever 750 thousand rupees in, for example, three years' time is worth to the economy now, it certainly does not depend upon the particular project under consideration. If another project promised the same social profit in three years' time, that would be equivalent to the same quantity of foreign exchange available to be used for any purpose. So the present value must be the same. Therefore, *future social profit must be discounted in exactly the same way for all projects.*

ii) If 750 thousand rupees in three years' time is worth 500 thousand rupees to the economy today, and there is a project that will yield 750 thousand rupees in three years' time for an expenditure of 499 thousand rupees today, then that project should be undertaken. That is what is meant by saying the present value is 500 thousand rupees. In other words, *the discounting procedure must be such that all mutually compatible projects whose present social value is positive can be undertaken ; and only these.*

Suppose, for example, that the accounting rate of interest was 10 per cent per year, and was expected to remain constant. For the project described in the above example, we should calculate :

$$\text{PSV} = -2{,}500 - \frac{2{,}250}{1.1} + \frac{750}{(1.1)^2} + \frac{750}{(1.1)^3} + \ldots + \frac{750}{(1.1)^{16}}$$

$$= 480, \text{ approximately.}$$

This implies that the project should be undertaken. At the same time, many other projects will yield a positive PSV with an interest rate of 10 per cent : they all ought to be undertaken too. If 10 per cent is actually too small, too many projects would be accepted — more than the saving of the nation makes possible. We should find ourselves with a balance of payments

deficit and a tendency to inflation. On the other hand, 10 per cent might be too large. We might not use up all the saving that the nation would have been willing to do. The result would be a balance of payments surplus, and an increase in the extent to which producers find themselves with excess capacity.

At any time, there is a certain level of investment funds that the government can allow producers to use. Ideally, the rate of interest should be such that just this amount is used. Other means of rationing the funds should be used only as temporary expedients[1]. If, for example, the interest rate was low, and each public sector undertaking chose projects so as to get as high a PSV from its investments as possible, the interest rate would not reflect the relative social value of social profit today and social profit tomorrow : they would exaggerate the desirability of postponing social profit. In other words, there would be too great a tendency to encourage long-lived projects. It would have been better to put investment funds into quicker-yielding projects, the profits from which would have allowed further investment sooner, and so overall have allowed a better pattern of consumption.

Thus the two rules enunciated above tell us how to discover whether the *accounting rate of interest* (ARI) has been correctly estimated. This completes our account of the general principles of project evaluation. But we should like to add three remarks :

1. There is no reason why the accounting rate of interest should be constant as was assumed in our example above. Often one can assume it is approximately constant. But sometimes it should vary considerably from year to year. A unit of social profit next year might be worth 90 per cent of a unit of profit this year, while a unit of profit two years from now might be worth 95 per cent of a unit of profit next year (and therefore 85.5 per cent of a unit of profit this year). It is more awkward to have to tell the different public undertakings and government departments to do this more complicated kind of discounting. Yet, in certain circumstances, it might be highly desirable. We shall return briefly to this point in Chapter XIV.

2. It was said above that the rate of interest should not be so high that available savings would exceed investment. But neither should the interest rate be too low. In the first place, the interest rate should not be lower than the rate at which the country could lend funds abroad ; there is no point in undertaking an investment project if the country could do better for itself by investing the funds on the New York Stock Exchange ! In the second place, it might actually be desirable to use some of the funds available for investment to finance increases in consumption instead. Eventually, any country must hope that it will be in this position — when it can do as much investment in new capital as it wants, and not feel that the necessity of providing consumption for those who are fortunate enough to have good regular jobs is an undesirable diversion of resources from better uses. Then the accounting rate of interest will be equal to the consumption rate of interest, and investment will be less than maximum possible saving. But we think that this is not, in most of the developing countries, likely to happen in the near future.

1. The ways in which this rationing can be done in the short run will be discussed in Chapter XIV.

3. Finally, it should be emphasized that the principles outlined in this Chapter are based on a number of simplifying assumptions. It is easiest to do a project analysis on the lines suggested when these assumptions are more or less satisfied. In particular, it is easiest to do it when indirect effects — on consumption and production elsewhere in the economy — can be neglected. Of course, this is most plausible, when the important inputs and outputs of the project — apart from labour — are traded goods. And that is very often the case in the kind of industrial projects that come up for examination. But sometimes these effects, and others that have also been neglected, may be rather important.

8.7 The Variety of Projects, and Flexibility of Operation

In this Chapter, we have been talking about the decision whether or not to undertake a particular project, proposed in a particular form. But often there are a number of alternative projects, i.e. different ways of producing the same product. Then the PSV for each proposal needs to be worked out, and the one with the largest PSV chosen. As was pointed out in 5.6, there is often a considerable range of choices available, but for only a few will a detailed cost-benefit calculation be done.

If the different ways of making a product — say, cotton textiles — are not mutually exclusive, it is rather odd if several of them come out with a positive PSV. For a positive PSV implies that the project ought to be undertaken. What can it mean if highly capital-intensive methods of producing the textiles have a positive PSV, while a rather less capital-intensive method gives a larger PSV per unit of planned output? Obviously, in this case, we can always get a larger PSV by using the less capital-intensive methods, so our calculations ought not to tell us to undertake more capital-intensive production as well. This might have happened because the ARI was set too low — so that projects which should not be undertaken, nevertheless look acceptable. If this is not the case, it follows that the accounting price for cotton textiles is too high. Indeed, the present social value of producing them, *by the best method,* should be very small — only just positive. If cotton textiles are exported, the accounting price is equal to the marginal export revenue. This can be reduced by producing and exporting more. If this were done, only one method would be the best. In anticipation of this, the accounting price can be reduced until only one method is acceptable.

In an industry like the cotton textile industry, it is to be expected that different plants will have very similar production capabilities and performance. The cost-benefit methods described can be used to decide what kind of methods to employ. This leaves the problem of what quantity of cotton textiles to produce. The above argument shows that production should be planned so that the accounting price will be just high enough to give a positive PSV for the best method of production. So the cost-benefit rules can be used to suggest, for example, just how far exporting in any particular line should be pushed[1].

1. This only works perfectly satisfactorily if we exclude one (theoretical) possibility, by assuming that the *accounting price for the product decreases as the amount exported is increased.* Even although the actual price for the exports will be lower if more is exported, an exceptional case, where at a certain level of exports a further increase would increase the accounting price (which is equal to the marginal revenue), is possible — but unlikely.

Another by-product of the arguments of the present Chapter is the set of rules for operating projects once they are in commission. We have seen what principles govern the calculation of social profit. Obviously projects should be operated so as to yield as high a social profit in each year as possible. If accounting prices turn out to be different from what was expected, a response may be made to these changed circumstances in the way that the project is used. Lorries might be equipped with tires made of artificial rather than natural rubber; replacements of parts of an assembly line might be of new design; means might be found for economizing in the use of labour if the shadow wage rate should be higher than expected.

In particular, rules can be derived for deciding when the project should be closed down, or particular pieces of equipment scrapped. Certainly the project should be shut down if the social profit has fallen to zero, and will continue to be negative. Indeed, the project should most probably be closed down before that time, since parts of the plant may have a second-hand or scrap value sufficiently high to make further operation too expensive an 'investment'. In principle, calculations to check whether the operation of the project should continue should be carried out fairly frequently.

It is likely to be easier to carry out cost-benefit calculations for the purposes of investment planning in terms of accounting prices, than to have the day-to-day or even year-to-year operation of the project governed by the same prices. Even so, it may often be useful to know what the correct rules are. And sometimes changes in the operation of a particular project may involve expenditures comparable to those required for the establishment of some new projects, and may therefore be of comparable importance.

8.8 Summary

In this Chapter, we have attempted to justify the rules that were sketched in Chapter VII. The reader whose main concern is with the public sector, and who is prepared to neglect the problems of economies of scale, may now want to go straight to Chapters XII-XIV, where we discuss the methods he could use to put numbers to the various accounting prices whose use has been suggested. But the questions we have neglected so far can be quite important. We shall deal with some of them, in Chapters IX, X, and XI, before tackling the more practical problems of estimation.

Chapter IX

THE PRINCIPLES: FURTHER CONSIDERATIONS

9.1 Large-Scale Production

If accounting prices would be pretty much the same whether or not the project was set up, then it is legitimate to measure the social value of production by multiplying the levels of the various inputs and outputs by the corresponding accounting prices. The accounting price for cotton cloth is supposed to tell us the value, in terms of foreign exchange, of producing an extra unit of cloth; if we intend to produce a million units, and the extra foreign exchange earned will be the same for each successive unit, the total gain in foreign exchange is indeed the quantity produced times the accounting price (in this case, the export price).

For fairly small projects, this is a reasonable assumption. And even with quite large plants, any effect on accounting prices can usually be neglected when choosing the best means of production: e.g., the choice between nuclear and thermal power stations. In this latter case, as explained in the previous Chapter, the choice of the best method will also give the accounting price for the output, and the only task remaining is to estimate the demand that should be supplied at that price. This leaves the case where the whole of domestic production might be done in one or two plants, not necessarily large enough to make full use of all possible economies of scale.

There are a number of industries where, subject to the provision of a reasonable variety of products, one usually wants to produce on as large a scale as possible. Aircraft, automobiles, computers, and railways, are all examples where large 'overhead' costs must be incurred if any production is to take place (at a reasonable cost). The greater is production, the greater is the number of units of output over which these overhead costs are spread. The reason why a production plant in these industries is not always of enormous size, is simply that the limited market and the presence of other firms make production on too large a scale unprofitable. Naturally, this may be an extremely important problem for small countries. Often large-scale production would commit them to attempting to export in very risky markets. [1]

We shall not deal with all the problems of deciding whether, when, where, and to what extent, it is worth venturing into large-scale production.

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1. It may be very advantageous for several countries to co-operate in large-scale investment so that they do not all try to make automobiles, for instance, but benefit from having all their requirements produced in a single plant.

We shall simply explain how a particular proposal for a large-scale plant can be evaluated, and indicate only very briefly the nature of the alternative plants that might have to be considered, and the extension of our methods that might be used to choose amongst them.

We are presented, then, with plans for a very large project : large in the sense that whether or not it is undertaken makes a substantial difference to the price of at least one of its outputs or inputs ; but not so large that it enjoys all the economies of scale. To fix ideas, let us suppose that the problem is whether or not to establish a steel foundry. We recall that our first principle is to examine and attempt to quantify the benefits and costs resulting from the actual changes in the economy that the establishment of the project will lead to. We measure these changes in terms of the foreign exchange they earn or use. So we examine the effect on the foreign exchange balance if we adopt a large-scale steel foundry. To bring all the main points out at once, let us suppose that at present the country is importing all its requirements of steel, but that the proposed steel foundry is so large that a substantial part of its output will be available for export if the scheme is adopted.

Let us take it that the changes in inputs required are not so large as to lead to any significant change in their accounting prices. This might not be realistic if the country had to change from being an iron ore exporter into an importer, or if it had to go further afield for imports of coking coal, but it is easier to see what is going on if we concentrate on the output, and anyway the same principles apply when further complications are introduced.

The gains to the country can be divided into three parts :

a) the foreign exchange saved by doing no more importing. This is equal to the total foreign exchange that would be spent on the relevant kind of steel imports, if the project were not undertaken ;

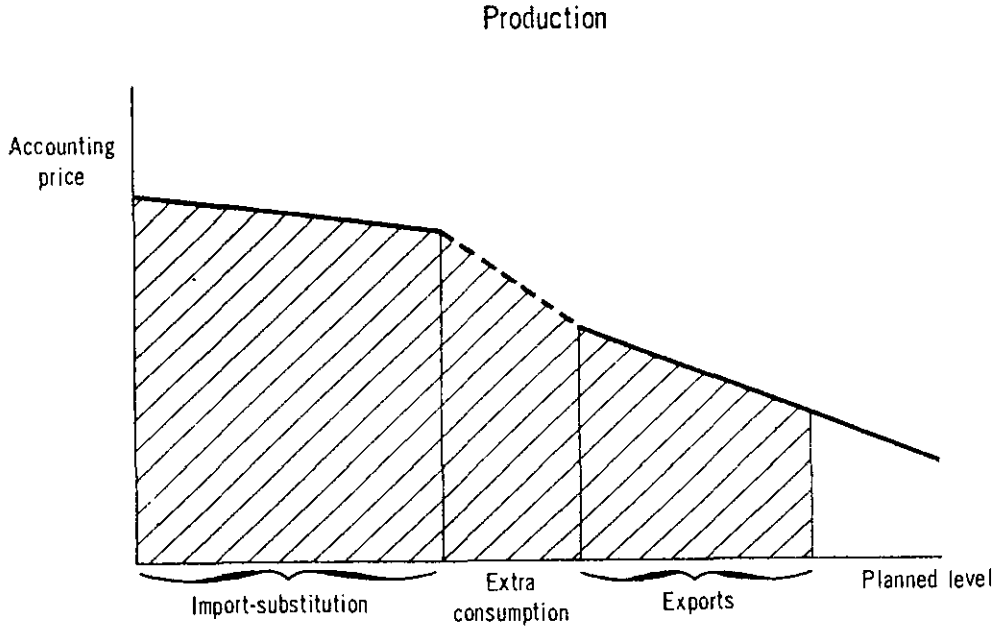
b) the earnings of foreign exchange as a result of exporting some of the production if the foundry is established. This would be estimated by multiplying the excess of production over domestic demand by the price that we can expect to receive. Domestic demand is the amount of steel that will be used if the accounting price is the export price of steel (less a possible allowance for some price sensitivity of export demand) ;

c) the benefits to the country of using more steel than it otherwise would have done. More steel will be used because the accounting price for steel is lower when it is being exported instead of imported.

The part of the benefits that is difficult to estimate is the last. The benefit is *less* than could have been obtained from the foreign exchange required to import the extra steel that will be used if the project is set up : for, in fact, the country would have chosen *not* to import more steel. On the other hand, the benefit is *more* than could be obtained from the foreign exchange that could be earned by exporting the extra steel consumed ; since in fact, the choice will be not to export so much. If the import and export prices of steel are fairly similar, or if the change in the domestic use of steel would not be very large, one could take the average of the two figures without fear of seriously distorting the assessment. Only exceptionally would this rough means of approximating to the benefit be misleading. Since it is very troublesome to make any more accurate assessment, it is as well to

use this simple method. As it happens most of the products that enjoy important economies of scale are easily traded.[1]

The following diagram may be a convenient way of remembering the various elements in this calculation. The quantity of domestic production is measured on the horizontal axis, marginal import cost and marginal export revenue on the vertical axis. The falling continuous lines show the way in which the price paid for imports, or received for exports, depends upon the planned scale of production. The dotted line represents the 'averaging' method of estimating the value of the increased domestic use of steel.



It is the total area under the curve — shown shaded in the diagram — that measures the estimated benefit of the planned output, in terms of foreign exchange.

In this way we can estimate the benefit of the project in each year: after allowing for the cost of inputs, this gives the social profit, which can then be discounted in the usual way to obtain the PSV. If it is positive, there is certainly a gain from undertaking the project, as compared to using the investment funds for some other project in a different sector of the economy.

But that is not the last word. It might be better to build a larger or a smaller version of the project, or to build the project at a different time. It is the trouble of working out these various alternatives that is the real nuisance in dealing with projects of this kind. Yet, since the projects are by definition large, they are usually potentially very important, and may therefore be accorded particularly careful attention. To do a thorough job of it, one must really work out the PSV of a number of different plans for the whole industry — say, for steel production — over the foreseeable future. One plan might involve building relatively small plants at fairly frequent intervals; another might involve building one very large plant each

1. The exception of railway transport is not treated in this Volume.

decade. The second version might leave the economy with some excess capacity for a number of years, and yet still be the better plan overall. At least two or three different programmes of investment of these kinds should be considered. Furthermore, the scale of the plant to be built now should be such that a small increase or decrease in the scale would not give a better investment; and it should be built now only if the PSV of waiting for a year, and then beginning the investment, would not be higher.

9.2 Mutually Exclusive Projects and Timing

In Chapter VIII interest centred on the question whether to do the project or not. This is the most important problem, since the main concern of any economic administration is to avoid bad projects.

But sometimes groups of projects are mutually incompatible: mutually incompatible, not because there are insufficient funds to go round (that is a problem that has to be disposed of by using a sufficiently high rate of interest), but because it is not physically possible to carry out all the projects in the group. Apart from the rather basic comparison between alternative methods of making the same product, examples of this kind of incompatibility are rarer than might be thought at first sight. But a case in point would be the bore of an oil or natural-gas pipeline. The choice in such a case is not merely whether or not to lay a pipeline at all, but also a choice of the best size of pipeline.

In the case of incompatible projects there is no need to abandon the fundamental measure of PSV. As between any two incompatible projects, the rule is to choose the one with the higher PSV. This is not at all the same criterion as for a firm that has to spend a limited budget on a selection from a rather large range of projects (see 1.2 on the 'profitability ratio'). But, of course, that is not the kind of situation faced when comparing alternative ways of developing a river basin, or of reconstructing a port. If the better project requires a larger sum to be spent upon it in the early years, the government will, if it is sensible, divert resources from elsewhere to make it possible. But it should be remembered that the right choice might be: none of them! Projects should not be undertaken unless they have a positive PSV.

The question mentioned briefly at the end of the last section, whether a proposed project should be started as soon as possible, or postponed for a year or two, is to be answered in a precisely similar way.

The timing of investment projects can be very important. It arises whenever the project would occupy a particular site that might in retrospect have been better used by waiting for a few years until technically superior methods of production were available. It also arises, as already seen, if there is a limited market for a commodity that can be more cheaply produced in larger scale plants. Then one should wonder whether to postpone establishing the project until it is worth establishing a larger scale one.

The appropriate procedure is to calculate the PSV (i.e. the social value as of 'today', not as of the planned starting date), not only on the assumption that the project will be begun as soon as possible, but also on one or two alternative assumptions about the starting date (allowing for reasonable expectations about the techniques that will then be available, changes in the prices for inputs and outputs, and so on). Common sense

will have to be relied upon to indicate whether it is really worth considering the possibility of postponement, and how many alternative proposals should be worked out. Usually, it should be enough to work out one alternative PSV for the project postponed by about two years. It is unlikely that one should postpone for a longer period, if undertaking the project today is a better proposion than starting it two years from now.

Often, the timing problem need not be considered at all. It is quite irrelevant that another project of more advanced type can always be started next year, even if this project is started this year. That is the usual situation in industry (apart from the problems of large-scale production already alluded to). It is all too easy to think that investment in this textile mill should be postponed because prospects will be better later, when in fact these better prospects can perfectly well be taken up when the time comes, even if the proposed textile mill is built this year. (But one must allow for the fall in price which better methods will bring about, when evaluating this year's project.)

9.3 Finance

So far, all questions of finance have been ignored. Except for cases when foreign loans or grants are tied to the project, and would not be forthcoming for other purposes (in which case they have no ' opportunity cost '), this neglect is justifiable. For, if the inputs required for the project can be provided without the overall demand for resources exceeding the available supply, the government is well advised to print money or issue bonds in order to finance the project, if that is necessary — by so doing, the government will be avoiding deflation, not encouraging inflation. Indeed, if the project is found to be worth doing, after consideration of the real changes in the economy that it brings about, then means ought to be found for financing it even if it is in the private sector.

However, the particular means of financing a project may have real effects. If a project is financed by an increase in the national debt, instead of by taxation, the reduction in private consumption, necessary to release the resources to make the project possible, must be induced by raising interest rates on government debt, instead of by simply taking the resources away. This raises the volume of future transfer payments to which the government is committed, and therefore probably increases the commitment to consumption. It might also have a discouraging effect on certain parts of private investment. These arguments might somewhat weaken the case for undertaking investment projects that are in any case a little doubtful.

Foreign finance raises quite different questions. If a loan is available, by way of foreign assistance, to finance part of the costs of a project, *but is not otherwise available to the country,* it should be brought into consideration from the beginning. Thus, if the generators for a hydro-electric scheme are being provided under a credit which could not otherwise be drawn down, then the foreign exchange cost to the country is not the purchase price of the generators now, but the interest on and repayments of the loan, which will arise only later. The project, with its associated loans, can be evaluated by ignoring the initial cost of items provided under the loan arrangements, and entering in the list of input costs the servicing costs of the loan. An example may make this clearer :

The Example of Section 8.6 : but including a Foreign Loan

(A loan of 1,000 is made in the first year, at 5 per cent interest to be paid as it arises, repayment of principal to be made in the twentieth year.)

YEAR	INPUTS	OUTPUTS	WAGE BILL	SHADOW/ ACTUAL WAGE	SOCIAL PROFIT
1	1,000	0	1,000	0.5	— 1,500
2	2,550	1,000	1,500	0.5	— 2,300
3-17	1,050	2,000	500	0.5	700
18-19	50				50
20	1,050				— 1,050

If the items in this table are compared with the original analysis of this project (in 8.6), it will be seen that payments arising out of the loan are added to the input column, and the actual receipt of the loan is subtracted. Suppose that the ARI is 14 per cent. At this rate, the project would not be worth undertaking without a tied loan : without such a loan, the PSV at 14 per cent would be − 527. But when the loan is included, the PSV of the two taken together, i.e. of the stream of social profits shown in the above table, is + 71.

Usually, it would be best to evaluate the project and the loan separately, even when they are supposedly tied to one another. If the project is not worth while on its own, it might be possible to get the loan tied to a more desirable project. It is even possible that the particular terms of the loan might render it undesirable, for example because it is tied to the purchase of equipment that is much more expensive than is necessary, or because it is tied to a particular project that would exclude another project with a higher PSV. If the PSV of the loan is worked out, and also the PSV of projects to which it might be related, it is easier to see just what is involved in the decision to accept the loan.

9.4 Indirect Effects

Our guide in evaluating investment proposals has been to consider the changes in demands and supplies in the economy, and in the commitment to consumption, that the establishment of a particular project would bring about. In theory, these changes could take place anywhere in the economy : in practice, it is obviously easier to deal only with changes that can be visualized as a direct result of the project — the actual increased output of cement, the increased use of electricity, the extra consumption of the men employed on the job. etc. But there might be important effects elsewhere. It is convenient to distinguish three kinds, as in the following sections.

9.41 *Effects on Consumption*

If the project is undertaken, various prices will be different from what they might have been. The difference may well be small, but the effect might be spread over a very large number of producers and people, so the total result might be substantial. In particular, the price changes might have some effect on the volume of consumption as well as on the distribution of consumption. Two examples will suggest the complicated nature of these effects.

Suppose the economy is a major producer of cocoa, so important that the amount of cocoa it produces has a significant effect on the world price of cocoa. Suppose that, as a result of some particular government programme, there will be more cocoa. The world price of cocoa will be a little lower as a result. Then other cocoa producers are going to lose money — including cocoa producers in the country we are discussing. These producers will somewhat reduce the employment they provide, and will reduce their own consumption. This reduction in consumption in the economy is induced indirectly by the increase in cocoa production, an effect brought about through price changes.

The tendency for cocoa prices to fall when production is increased is, in itself, a reason for somewhat restricting output. This was discussed in Chapter VI, where it was suggested that export taxes might be imposed on agricultural products for which foreign demand was imperfectly elastic. But the point we have just been making is different. The expansion in cocoa production (in the project we are considering) will, besides inducing the inevitable increase in consumption by the additional employment it itself provides, bring about some *reduction* in consumption elsewhere in the economy.

As a second example, consider the possible indirect effect of an increase in the production of electricity in a country where electricity is rationed by some means or other. Increased production might be allowed by the government to become available to households, either by a lowering of the price, or by making it easier to get connected. Households then increase the value of their consumption. They may buy less of other things, but the price reduction (or widened choice) makes them better off.

This example differs from the previous one in an important respect: for it is more likely that government tax possibilities will be affected. It may be possible for the government to remove by taxation sufficient income to return these middle-class households to their previous consumption level. If it is partly a desire to allow the middle-classes a certain consumption level which, among other considerations, prevents the government from imposing as much taxation as it would otherwise think right, then it is quite plausible that the effect of the various indirectly induced increases in consumption can be counteracted.

In principle, these effects should be allowed for, if there is any reason to think them important. The government may be able to counteract them, if it thinks them harmful, and so its attention should be drawn to glaring examples. But these effects do occur very generally, and will often work in both directions; since it is seldom easy to take them into account, it is better to ignore them if there is reason to think they will be small and scattered.

If we were dealing with agricultural projects, we should want to say more about all this. Some agricultural programmes might have their main effect upon the commitment to consumption, and particularly through their effect on the distribution of consumption between rich and poor farmers, and between town and country. A programme of fertilizer subsidies might be valuable, not only for the extra production of agricultural goods that it would bring about, and for the saving out of their increased incomes by the farmers who benefit; it might also be an important weapon for improving the distribution of income between large and small farms, or even — through its effects on agricultural employment — between agricultural labourers and

farmers. We shall not attempt to analyse any such example in detail. Such questions are clearly among the most important to be considered by economists in the developing countries. But they do not impinge upon the choice of industrial projects unless, for some reason, industrial production decisions affect the possibility of undertaking such programmes. In principle, they should not. If it is good to subsidize fertilizers, the decision whether to make the additional fertilizers available by importing them or by producing them domestically is an independent one. The decision should not usually affect the availability of fertilizers significantly.

However, as remarked in 8.42, goverments sometimes impose quotas on the import of such commodities, even though accounting-price arguments would convict them of inconsistency and irrationality. In such a case, the production decision might very well have important indirect effects on both the level of consumption to which the economy is committed, and also on the distribution of consumption, both within agriculture, and between rural and urban areas. The proper analysis of any such case clearly requires special economic expertise : one cannot reduce it to simple rules.

9.42 *Effects on Production*

Naturally, the changes in availability brought about by a project can affect private investment, and other production decisions. More cement may mean a fall in its price, thus encouraging its use by other producers ; or the projects may raise the wages of certain scarce categories of skilled labour, and so discourage other firms employing them. The effects of this on project choices in the public sector can safely be ignored. They will be influenced by such small price changes only if the project in question has a very small PSV anyway ; but this may not be true of producers who use different criteria — for example, private profit, which, as we have seen, may be very different from social profit. The project might, as a sort of by-product, encourage investment projects that are socially desirable, but which private businessmen had not previously thought profitable enough to be worth the effort. For instance. railways are often seen as a valuable source of encouragement to private businessmen who would not be accessible to theoretically better forms of promotion. On the other hand, the project might make profitable other investments of low, or even negative, social value. For example, the domestic production of aluminium might encourage wasteful domestic production of kitchen utensils, if there is a tariff on them.

However, the above argument is usually more tempting than convincing. If we have no reason to think that there will be a balance of desirable (or undesirable) effects on private production decisions, we are right to ignore the theoretical problem. Yet, it is a question that someone should ask. As economists assemble a more thorough quantitative record of the developing economies, it will become possible to identify particular relationships of this kind. At present, it is important not to allow ignorance to generate unwanted optimism or pessimism about these indirect effects of public investment.

9.43 *External Economies and Diseconomies*

There remains the whole vexed issue of effects on the rest of the economy that are not mediated through the price system (or whatever other systems for controlling allocation may be being used). We shall deal with this problem in Chapter XVI.

Chapter X

THE PRIVATE SECTOR

We have insisted that the methods explained in the previous chapters of Part II are intended as a means of evaluating public sector projects. In fact, they can properly be used for private sector projects too, with only one modification, which we now discuss.

10.1 The Social Profit of Private Enterprise

If the government could not influence private sector investment decisions, the question of evaluating private investment projects would not arise. In fact, there is often some kind of licensing system for certain classes of investment decision. It may be enforced either directly or through control over foreign exchange expenditures. Also, in the case of many of the most important private sector projects, public money including foreign aid is involved, in which case the approval of the government or one of its agencies must be sought.

At first sight, it appears that these arrangements have the major drawback that the government can only reject proposals made by private industrialists, and cannot at all easily make proposals of its own. However, this is no more than a half-truth (see 6.2). Even if it were wholly true, there would still be a good case for carrying out social cost-benefit studies : if a proposed project has a negative PSV, it is better that it should not be undertaken. In fact, the government can and does influence private sector project design and initiatives in many ways. The influence exerted will surely be more beneficial if it is backed up by the appropriate investment criteria.

Private sector projects are very like public sector projects. They have inputs and outputs, some of them traded, some not traded ; they use skilled and unskilled labour : the problem of finding the right accounting prices is in no way changed by the fact that the project is in the private sector. But there is one important respect in which private sector projects differ from public sector projects. The consumption induced by undertaking the project will not come only from wages and salaries. In private industry, part of profits is consumed also. To be more precise, the pattern of consumption of those who provide the funds for the project, and are entitled to its profits, is changed. Possibly, they will consume less at the time when the project is begun — like farmers who postpone building a new house so that they can have a new tube well ; certainly, their consumption will later be increased if the project makes the profit that is expected of it. This consumption is good in itself of course ; but less good than the extra investment that would have been possible with the same resources. We can say quite confidently that this consumption cannot be *more* valuable than the consumption provided

to wage earners and agriculturalists by wage payments — not unless the owners or shareholders are a remarkably unrepresentative group, e.g. if all the shares in the firm are owned by a worthy charity. But the shareholders of industrial projects are nearly always relatively wealthy men ; on average, likely to be much better off even than salary earners. The situation may be quite different in peasant agriculture, but we are not dealing with that here.

Most governments take the view that extra consumption for rich men is less valuable than for poor men. The relative weight is, perhaps, a difficult problem. At the least, one would suppose that, if the rich man is twice as well off already as the poor man, the weight to be given to any extra consumption provided to him would be less than half the weight given to the poor man's consumption : for this is saying only that the same proportional increase in consumption should be given a smaller weight for a rich man than for a poor man. If the average shareholder is ten times as well off as the average peasant farmer, we should expect the consumption of that shareholder — though it is a positive good, no doubt — to have a very small weight compared to the consumption provided by wage employment, and an even smaller one when compared to the possibility of reinvestment.

Clearly these considerations vary in their force from country to country. But there is a strong case, in most developing countries, for regarding consumption by owners and shareholders as a *cost*. If these goods and services were not consumed, their equivalent could be used for investment, with gains perhaps ten or twenty times greater, on any reasonable method of evaluating them. The obvious approximation is to regard the consumption as pure cost (though, presumably, from the shareholders' point of view, it is the end to which the investment project is designed). This cost can be regarded as a payment made for getting the project undertaken ; it is like interest paid to get a loan. The benefit from a loan is the profit it makes possible, *less* the interest that has to be paid. So in this case, the consumption that has to be provided to the owners is the cost that the country has chosen to pay. Admittedly, the payment of private profit should probably be regarded mainly as a payment for efficient management, or, more nebulously, for ' centres of non-governmental power ', rather than as a payment for increased availability of investment funds (for private saving might not have changed much if the project had been in the public sector). This does not weaken the argument. If one has to pay a price, it is a cost, whatever one gets for the money.

The easiest way to estimate consumption out of profits is to estimate the proportion of profits that is usually consumed in the private sector[1]. Such an estimate might be based on a sample survey (though one must allow for the problem that the rich are bound to be under-represented in such a survey), or on general report and impression. One cannot hope to be very accurate, and guesswork is therefore likely to be quite useful.

One can proceed as follows :

1. Estimate the increase in the incomes of owners, shareholders, creditors, etc., associated with the project in each particular year. Since,

1. This is not strictly satisfactory. If a family receives dividends or a share of profits, it will not consume them all at once. The part saved will, however, also result in increased consumption later. Thus the project commits the economy to providing consumption not only in the year the dividends are paid, or the capital gains earned, but also in later years. However, these subtleties can safely be neglected in practice.

in the long run, capital gains are important, it is best to estimate this increase in income by subtracting depreciation and taxes paid by the firm from the total money profits to be expected in the year.

2. Estimate *disposable* income, by subtracting estimated income taxes, and other direct taxes, paid by the recipients of this income. (Tax holidays, investment allowances, and the like, may have a very large effect on the tax paid by a particular corporation : but, where such adjustments are hard to estimate, the average rate can be used).
3. Relying on sample surveys or guesses, estimate the proportion of disposable income that is likely to be spent on consumer goods and services, thus getting the *market value* of consumpion generated.
4. Convert to accounting price terms — in principle, by revaluing a typical high-income consumer budget at accounting prices ; but in practice, one might just use the standard conversion factor (see 12.4).

For a ' normal ' year, when the project is working at full capacity, a typical calculation might go as follows :

Value of outputs	1,000,000	
Value of material inputs	400,000	
Wages and salaries	200,000	
Gross Profit, before tax	400,000	
Depreciation (this is what the project expects to be allowed for tax purposes, and is probably the best available indication of the fall in the project's ' market value ' during the year) . . .	200,000	
Company tax, at 30 per cent	60,000	
Gross Income from the asset	140,000	
Personal direct taxes (40 per cent) of gross income	56,000	
Disposable income generated	84,000	
Consumption expenditure (60 per cent of disposable income) . . .	50,400	
Consumption, at accounting prices (70 per cent of Consumption Expenditure)		35,280

Such a project might have the equivalent of an annual social profit (apart from this consumption) of, say, 300-500,000. Thus, in this example, consumption induced by profits would not be a very large additional item of social cost. This might be normal for a large project in any economy where taxes are imposed efficiently. However, this cannot be taken for granted, and such a calculation as the above should usually be carried out. Frequently, it may be possible to get more specific information than the above calculation suggests, with a consequent improvement in the estimates.

It will be noticed that all these calculations refer to later years of the project. In the first year or two, there are no private profits : on the contrary, the project uses investment funds. In the case of large new industrial ventures, one does not expect that private consumption will be reduced in order to provide the investment funds. If the project is not

undertaken, the saving will be done anyway (and will, in effect, finance other projects). Nevertheless it may sometimes be desirable to allow for a reduction in private consumption during the investment period of the project : for instance, if the project is to be undertaken by an existing firm, then the firm may pay out less in dividends in order to reduce its need to borrow.

But, even if private saving is unchanged, one should still consider what benefit those who provide the saving would otherwise get from it. In comparing different private sector projects, this does not matter : one is simply comparing the different amounts of extra consumption that the owner's or shareholder's capital allows him to enjoy, and there should not be very much variation here. But one also wants to compare the project with public sector projects. If this private saving were to finance public sector investment projects, it would earn whatever those who lend to the government earn on their capital — say, the rate of interest on long-term government bonds. Or, alternatively, the government would be lending less to industry (e.g. through development banks), and would therefore not receive so much in interest payments. In either case, the savings of these private individuals will still allow some future consumption, though not normally as much as if it had been possible to buy shares in private industry.

What will it amount to ? Perhaps the saver would get 5 per cent on his savings : part of that would be taxed away, and of the remainder, part would be saved again. But 2-3 per cent on capital should be allowed as consumption that the profit earner would have been getting anyway, and should therefore be subtracted from the initial estimate, made on the lines suggested above.

It may be thought that the government could tax away this saving if the private sector did not use it for its own investment projects. But we are assuming that the government has already arranged to do as much taxation as it feels it can ; and how much it can do is unlikely to be affected by the extent of private investment. Also, we must suppose that the interest rate on government bonds is as low as the government feels it can push it.

Finally, we should remark that the particular arrangements that the government may come to with private producers in order to encourage desirable projects — the ' promotion ' we spoke of in Chapter VI — will have some effect on the estimates of the consumption commitment arising as a result of the profits. If the project is made more profitable than it had originally seemed to be, and therefore more attractive, the extra attraction must be in the extra consumption it makes possible for some people. This extra consumption reduced the PSV of the project, while it increases its private attractiveness. For this reason a project that had seemed worth special governmental encouragement might actually have a negative PSV when the cost of promotion is allowed for. In many cases, the cost of promotion will not be so great as to cancel out the original case for the project. But it should be allowed for.

10.2 How Much Public Enterprise ?

One difference between public and private enterprise, then, is that the latter may commit the economy to additional consumption, which is therefore an additional cost to be set against the social benefits of the project. So long as savings are worth more than consumption, there is a *prima facie*

case for having a project in the public sector on these grounds. However, there are two kinds of argument that may tell the other way.

1. It cannot be assumed that the same performance will be obtained from a project, regardless of the kind of organization and ownership. In some countries, private enterprise may be more efficient than public enterprise, partly because it is less vulnerable to special interest groups (such as labour, urging over-lavish employment policies), partly because the motive force of private profit may encourage better methods of organization and a more active search for cheaper methods of production. But this is not a general law. Cases can be examined on their merits.
2. The public sector may not always make the best use of the revenue it receives. It has been assumed that an increase in the profits accruing to the state will not result in any increase in public consumption or in any reduction in other revenue. This is not always reasonable. First, by generating profits, the project does somewhat ease the problems of the minister of finance; it is thus possible that tax increases will not be pursued with quite so much vigour. Secondly, expenditures on public consumption — police, parks, armaments, and so on — may tend to increase if government revenues increase, even if the revenues are surpluses generated by public enterprises. While these reactions are irrational, they cannot therefore be assumed not to happen. But, against these arguments, it may be pointed out that saving in the private sector also tends to ease the minister of finance's problems. Also, public consumption expenditures have all along been competing with investment demand for the available funds, so that one should perhaps assume that a million rupees of public consumption has the same social value as a million rupees of investment.

Argument on such issues tends to be inconclusive, and, indeed, such considerations would be hard to allow for. We do not think that the balance of the arguments is at all clear, and doubt whether it is desirable to make any adjustment in the estimate of PSV on this account.

Many factors, other than the calculation of pure economic benefit, influence the division between the public and private sectors, including, of course, ideology. If the government holds that a certain share of total investment should be done in the private sector, or in the public sector as the case may be, it has to be accepted that some private projects will be undertaken that are less desirable, on a social cost-benefit analysis, than some of the possible public sector projects that are not being undertaken; or *vice versa*. Alternatively, whole industries may be restricted to the private sector, others to the public sector. These two cases require a slightly different approach to project evaluation.

The second case — when certain industries are committed in advance to the private or public sector — is easy. It is true in this case that the public and private sectors have to compete against one another for investment resources. The ARI will have to be set high enough to ration investment resources between them. That is, one must use the same rate of interest to evaluate projects, whatever sector they are in. If private sector projects tend to show higher PSVs than public sector projects, more investment should be done in the private sector. Once the industrial responsibilities

of the private and public sectors are determined, the allocation of total investment funds between the two should be determined by the PSV criterion.

But if, on the other hand, the share of total investment between the two sectors is determined in advance, it would be necessary to use different interest rates for the two sectors. The difference between the two ARIs would indicate the extent of the economic cost involved in making this prior commitment on the division of investment resources.

It may be asked whether the size of the public sector is not in fact constrained by finance, and in particular by the tax receipts of the government : in other words, whether a cut in private investment makes an equivalent quantity of real resources available for public sector investment. We have already touched on this, when considering whether there might be some reduction in private consumption by those who undertake private investment ; if this were so, savings would be less if the project were diverted to the public sector.

A fall in savings may well result especially if the private investment which is discouraged includes investment by small-scale family concerns, individuals, and partnerships — for such people may well make an effort to save if there is real investment they want to do themselves, but not otherwise. Some fall in savings is also likely if existing corporations, even large scale ones, are discouraged from investment ; for there is evidence that companies which have a large investment programme pay out less in dividends, and so save more. On the other hand, if it is a matter of creating a brand new enterprise, there is not much reason to suppose that there would be any less saving because it was placed in the public sector : for this is mostly a matter of attracting the savings of ordinary portfolio investors, which the government can do as well as private entrepreneurs. Indeed, in countries where there is no developed capital market, the government is better placed to attract savings, and sometimes such public borrowings are actually channelled into private investment.

Whatever constraints there are, it will sometimes have to be decided whether a particular project should be undertaken in the public or the private sector. This may not be a straightforward matter of comparing the PSVs in the two cases, since other considerations may be involved. Yet, ideally, as we have seen, the measurement of social profit should include allowance for *any* factors that would tend to weight the scales in favour of the public or the private sector. The argument that it is desirable to take decisions on the basis of systematic methods, and on the basis of serious attempts to quantify all relevant variables, applies to this decision, as much as to a decision about the overall allocation of the investment budget between the sectors.

Even so, it must be admitted that there are elements in this kind of decision that are very hard to quantify. As we have seen, the extent of private saving may depend upon the extent of the opportunities allowed for investment in the private sector. In a country where the supply of saving is regarded as being too small, this is no negligible consideration. Then there is an old argument, still a matter of concern, though not one on which much quantitative research has been done, that the existence of opportunities for private enterprise encourages men — and women — with unusual managerial skills, and the ability to take intelligent risks, to undertake industrial management ; and encourages those who provide the funds for

investment projects to employ managers of ability. It is to be expected that at any time, in most countries, the assignment of nearly all industrial opportunities between the public and private sectors can be taken for granted, and particular investment projects be evaluated on the assumption that they will be in one or the other. This is not to say that, in extreme cases, project planners should not point out the existence of substantial gains to be had if the form of ownership of the project was changed.

Many private sector investment projects do not, strictly speaking, come within the range of this Manual : particularly those in the agricultural sector. In fact it is extremely important that the assessment of agricultural investment projects should be carried out on the same principles as those used for industry ; but there are many special features of such evaluations, and we shall not go into them. Nevertheless, we would like to emphasize that the rate of interest used to evaluate projects in industry should also be used in the agricultural sector — assuming investment can be diverted from one sector of the economy to another without great difficulty. Planners ought certainly to try to check whether more or less investment funds should be channelled into the agricultural sector, in the light of the accounting rate of interest used in industry, and the opportunities that appear to be available in agriculture. Such decisions cannot reasonably be made in advance, before the available projects are known.

10.3 The Influence of Taxes and Exchange Rates

Even although the government may be unwilling or unable to raise the total of taxation beyond a certain point, there is always some scope for choosing between different possible ways of raising tax revenue. The particular way in which it is done influences private production decisions. Public sector production decisions might be taken entirely on the basis of the investment criteria we have been developing : since market prices are ignored if they are inappropriate, too much tax on one input and too little on another will not distort the investment decision. Private producers, however, are interested in private profit, and therefore influenced by prices as they are. Tax rates on the various goods and services in the economy are the most important way of influencing these actual prices, so as to achieve what is wanted.

The above subject has been fairly fully discussed in 6.3, and we do not want to go further into what is a quite different field from the one we are dealing with in this Manual. We need only re-emphasize how desirable it is that, if possible, the actual prices private producers have to deal with should be equal to or at least equi-proportional to the accounting prices ; and that this point should always be considered when new taxes are proposed. But it is impossible to say, in the case of any particular country, how far it is inevitable that taxation must interfere with the ideal price structure, without making detailed studies of that particular economy.

Finally, it should be noticed that the choice of the exchange rate between the domestic currency and other currencies may itself have an important influence on private production decisions. The exchange rate would not matter at all if domestic prices adjusted themselves easily and quickly to world prices : if the money level of wages remained at the level that enabled workers to maintain their real consumption at the minimum

necessary amount, and the prices of public sector products like electricity and transportation always provided just the correct return on the foreign exchange cost of the inputs that go into their production. But, usually, there are domestic prices, particularly the wage rate, that tend to get out of line with world prices. If the government does not adjust the exchange rate in response, first the real wage rises, then the balance of payments goes wrong (because the higher wages encourage demand), and then special measures, such as quotas or increased tariffs, are unsystematically imposed. The result, even if the balance of payments is quickly brought under control, is likely to be increased distortion in the actual market prices, as compared to the accounting prices. Since unnecessarily high real wages imply an undesirably high commitment to consumption, and consequently fewer people with regular jobs then otherwise, any rise in money wages unmatched by an equivalent rise in the prices of wage goods is to be avoided : frequent adjustment of the exchange rate is a good way of avoiding it.

10.4 Conclusions

The main arguments in this Chapter have led to the following conclusions :

1. The same rate of interest should be used for project evaluation in the private and public sectors. If it seems that many projects are being undertaken in one sector which can be justified only at an interest rate significantly less than that which justifies projects in the other sector, there is a strong case for changing the allocation of investment funds between the sectors.

2. When evaluating projects in the private sector, the increases in consumption resulting from the profits generated by the projects should be treated as a cost when calculating the social profit. Thus projects that could be carried on equally well in the public sector will have a higher PSV if they are kept in the public sector. However, the increase in consumption induced by profits may be quite small.

3. The investment decisions taken by private business can be kept well in line with the public interest if the prices received and paid by private business are, as near as possible, in the same proportions to one another as the corresponding accounting prices. In general, the tax system should be designed to make and keep this correspondence as close as possible. In particular, sales of goods and services from one firm to another should be tax free except insofar as it is administratively impossible to tax the goods at a later stage in production.

Chapter XI

SOME POSSIBLE OBJECTIONS

Some readers may suspect that the principles of project appraisal, as we have expounded them, are too simple. Other economists have used concepts, such as the shadow price of foreign exchange, and the shadow price for saving, which we have found unnecessary. Some economists have also argued that particular kinds of commodities should be favoured specially, though opinion varies as to whether the special favours should be accorded to food or to capital goods. We have presented no simple and attractive prescriptions of that kind. We try to explain these apparent gaps in the present Chapter. The reader who is more concerned with practice than with theory, is warned that he may find the discussion a little academic, and he might be well advised to go straight to Chapter XII.

11.1 The Balance of Payments

Despite the discussion in Chapter VII, the reader may still be wondering whether the foreign exchange shortage, from which the developing countries are supposed to suffer, has been properly allowed for in our investment rules. Briefly, the answer is that non-traded goods have been given their appropriate accounting prices, which measure the foreign exchange cost or earnings they represent : thus import-substitution and exporting is encouraged to the maximum desirable extent. Labour may be priced above its ' opportunity cost ' in terms of foreign exchange, because of the possibly undesirable commitment to consumption which its employment incurs. So again, producers are encouraged to use labour, instead of imported inputs, to the maximum desirable extent.

It may be conceded that there is considerable force in our arguments that *all* the inputs and outputs associated with a project involve effects on the balance of payments ; so that there is no reason to discriminate against, for example, those inputs that happen to be directly imported. But a sense of severe foreign exchange shortage is likely to remain. If a ' shadow price for foreign exchange ' is not used to deal with it, what is the remedy ?

Consider first the producers whose decisions are not directly influenced by government, and the consumption decisions of households. All these decisions are, of course, influenced by the taxes on particular commodities, and by the exchange rate or exchange rates. For instance, it was suggested in the previous Chapter that the exchange rate should be set so that the real value of workers' consumption is as low as the government is willing or able to let it be. Private investment decisions are also affected by indirect governmental influence, e.g., by monetary policy, and direct taxes.

Whatever indirect government influence there is, whatever taxes and exchange rates there are, the result of all these private decisions, taken alone, is a certain net demand for foreign exchange. That is, we can value all the demands of these private producers and households in terms of accounting prices ; and value all the supplies they make available in terms of accounting prices ; and the sum of all the demands, less the sum of all the supplies, is the net demand for foreign exchange. If the demand by the public sector, and producers whose decisions are directly determined by the government, was, in terms of foreign exchange, just equal to the total supplies they themselves made available, the net demand for foreign exchange by the rest of the economy would be the balance of payments deficit before allowing for capital inflow.

In fact, the public sector, along with the producers under its control, must adjust its net demand for foreign exchange so that the net demand of the whole economy can be met by the inflow of long-term capital — foreign borrowing and assistance, less repayments. The accounting price that makes sure the net demand of the public sector is no greater than the available resources, is the *accounting rate of interest.* A really acute foreign exchange crisis would be reflected in a high ARI, which would discourage the part of the economy controlled by government from undertaking projects with large initial foreign exchange requirements.

Despite what has been said above, some economists and others may still not feel satisfied that our methods make proper allowance for a weak balance of payments position in all circumstances. They may have in mind either one of two fairly common situations.

In the first situation, a country may avoid a balance-of-payments deficit, or default on foreign loans, only by depressing the level of domestic demand and output, and perhaps also by borrowing abroad at a rate which cannot be maintained. A devaluation may, perhaps, be anticipated within a year or two at most. Now clearly, if a devaluation will take place, and will have some different effect on the social profitability of different projects, then this should be reflected in the choice of projects now. This is, indeed, very much the situation in which project evaluators in developed countries may resort to the use of a shadow exchange rate : they act or choose as if foreign exchange is worth more than its present price suggests. The government may directly encourage foreign sales by the public sector, and discourage the purchase of foreign goods (e.g. public airlines may be forced to buy indigenous aircraft, and the defence authorities may be refused permission to buy foreign weapons, and so on). In this way more use is made of domestic labour, and less use of foreign inputs ; provided that the additional consumption of new wage earners is not too great.

In our system, traded goods are valued directly at their foreign exchange equivalent. Devaluation makes no difference. What, then, is the equivalent in our system of anticipating a devaluation by using a shadow rate of exchange ? A *successful* devaluation operates by reducing the value of consumption at world prices, thus reducing the foreign exchange cost of employing labour. In our system, a successful devaluation would, therefore, reduce the shadow wage : and, if a devaluation is anticipated, a lower shadow wage than otherwise must be employed. This, in turn, will reduce the accounting price of all non-traded resources. In fact, all non-traded resources will be 'devalued', which is as it should be.

The second situation which may be envisaged is one where the currency is overvalued, in the sense that actual prices give too little encouragement to use home-produced goods instead of imported or exportable ones ; but no devaluation can be anticipated. The situation is kept under control by quotas and other devices which directly influence imports, exports, and financial transactions with foreigners. The question may be asked whether, in this situation, our system makes proper allowance for the fact that domestic resources, especially labour, cost too much relative to foreign resources. The answer is very similar to that applicable to the previous case discussed. Given the level of investment, the various controls can be successful only insofar as they reduce domestic consumption measured in world prices. This will be reflected in our estimation of the shadow wage (and also in our estimate of consumption out of profits). Non-traded resources will be given lower accounting prices than they would be given if consumption was not reduced by the controls.

The essential point is that we revalue *all* resources in terms of the foreign exchange cost which their use results in (or which their production saves). Once such revaluations have been adopted, the right way to control the balance of payments is to concentrate on high-yielding projects, and not try to do more investment than saving, tax policies, and foreign aid, allow. In conditions of emergency, it may be possible to cut consumption by more than would normally have been feasible. This may perhaps make some investment projects previously entered into — making refrigerators or motor cars, for instance — temporarily redundant. But usually what is felt to be a chronic balance of payments crisis is just a situation in which one wishes one was better off, and is conscious of the projects one would like to see undertaken, for which no resources are being made available. The best solution is more foreign assistance or improved opportunities for exporting. Failing that, a high ARI or increased taxation, must be used.

11.2 The Relative Welfare of Different Generations

We have seen that the choice between different investment projects involves, implicitly, a choice among various possibilities of providing consumption in different years. It seems, therefore, that people must — through their government, for instance — decide how they will weigh the welfare of future generations against the welfare of the present generation, and that the relative weight that is given to present and future will influence the choice of investment plans. Few of the important choices of governments can be made on purely technical considerations, without making basic value judgments. But it may be puzzling the reader to know how this particular value judgment — concerning the present versus the future — has found its way into the system of investment rules proposed.

It is important to clarify this issue because some other ways of presenting the theory of investment appraisal put more emphasis than we have done upon the basic judgment about how consumption ought to be distributed between generations. We have in mind particularly the class of methods of investment appraisal that use the concept of a ' social discount rate ', which we have called the ' consumption rate of interest '. The consumption rate of interest (CRI) describes the relative weight to be given to consumption in different years. If the CRI is, currently, 5 per cent, that means that an extra rupee of consumption for society next year is worth

5 per cent less than an extra rupee of consumption for society this year. If the net outputs of a project are expressed in terms of consumption, it is suggested that one should calculate the present value of these outputs by using the CRI. To convert the parts of these net outputs that are not actually committed to consumption to an equivalent quantity of consumption, one must use a 'shadow price of saving'. In particular, this must be done with the initial investment cost[1].

We fully accept that if the results of an investment project can be expressed entirely in terms of the consumption it provides (in different years), the appropriate way of bringing together all the benefits is by calculating the present value of the extra consumption, using the CRI. But, with the kind of project with which we have to deal, a substantial part of the gains from investment projects is available for reinvestment in further projects, and this part of the gains may be considered to be more valuable, often much more valuable, than the additional consumption that has to be provided out of the gains. It fits in better with our use of foreign exchange as a yardstick, and actually gives rise to much simpler rules for investment appraisal, to compare the value of the consumption directly with the value of that part of productive gains that can be used for *any* purpose (public savings reckoned in terms of foreign exchange), and can therefore be used for the most desirable purpose. This is the function which the shadow wage rate performs. It is at this point that the awkward problem of comparing the welfare of generations enters into our system of investment appraisal. A low shadow wage favours the sort of project which most encourages quick increases in consumption ; and a high shadow wage favours projects which add little to consumption in the immediate future, but make possible greater increases later.

There is another advantage attached to concentrating these welfare problems into a shadow wage rate. It is then easier to see just how precise our judgment of the relative worth of different generations really needs to be. Very large changes in the shadow wage rate would certainly make a difference to industrial project choices, but even changes of 25 per cent might make quite a small difference : and changes of that magnitude can reflect radically different judgments about the CRI. In fact, when more investment is agreed to be the most urgent need of a country, projects that yield a high return in reinvestment are what is wanted. Compared to this, a precise assessment of changes in the value of extra consumption to successive generations, such as is implied by asking the government to determine a CRI, is less urgent. To that extent, the problems of developing countries are less ambiguous, and should be subject to less dispute, than those of developed countries.

The precise way in which the shadow wage rate reflects these welfare judgments, and its relation with the CRI, will become clear only in the next three chapters, where we discuss the quantification of these important variables. But we believe that it is on the shadow wage rate that disagreement about essentials should be concentrated.

In the preceding argument it has been assumed that the government of the country in question will consider that part of the gain from a project which is not consumed as more valuable than that which is. It will be

1. See, e.g., S.A. Marglin : *Public Investment Criteria,* London, 1967.

remembered that in 3.1 it was said that it is up to the government to decide whether it wants to use project selection as a way of helping it to raise savings, and hence investment, in the future. In effect, we have been assuming that the government *will* want the criterion for project selection to be properly influenced by what it considers to be the shortage of savings.

But if, contrariwise, a government believes that the current balance between consumption and investment is satisfactory, and that it is likely to remain so, the methods of investment appraisal we are describing are still perfectly relevant. The accounting wage rate should then be put equal to the marginal productivity of labour in agriculture (or wherever the labour is being drawn from) : this certainly avoids some of the more troublesome aspects of the problem of estimating it. All our arguments are still valid, though. Thus, it is of the first importance to evaluate projects consistently, to use world prices where possible, and to use uniform interest rates for calculating present values, sufficiently high to prevent the overall demand for goods from exceeding the supply. There are, in this case, further points to be made about how the government can check its view that the current relation between consumption and investment is satisfactory. These we shall briefly indicate in Chapter XIII, where the present sketchy argument will be filled in.

11.3 The Kind of Product

It is hard to get used to the idea that the particular kind of product that is produced by a project does not seem to matter. This is more appearance than reality. In fact, we are very interested in the kind of goods produced, but we want their value to the economy to be reflected in their accounting prices, not in a vague impression of their worth.

For example, it may well be true that a country that is anxious to have rapid growth, and is willing to impose the taxes that will finance the growth, must specialize in the production of capital goods, heavy metals, and the like. But that cannot be known for certain in advance. Unexpected export opportunities may be discovered in the process of searching for projects and evaluating them, and these may be exploited to finance the import of capital goods. Or, it may turn out that some kinds of capital equipment should be made in the country, while it is cheaper to import others from abroad. It is impossible to make sensible decisions among the whole possible range of investment projects by relying on the intuition that fast growth must require the country to favour the production of capital goods. It can be very wasteful to try. (See 5.2 on the sometimes misleading role of intuition, hunch, strategies, etc.)

Similarly, any feeling that the *production* of luxury consumer goods should be especially discouraged, is to be resisted. That their *consumption* should be discouraged goes almost without question : high taxes on them are a very effective way of taxing the rich, and thereby reducing their consumption. But if production of these goods is restricted, or not allowed at all, waste and inefficiency may result, rather than a reduction in the cost to the economy of supporting the wealthy. If the wealthy cannot get these goods, they may just buy others, or find various means of evading import restrictions. So, it is seldom desirable to prevent the consumption of such goods altogether, for then demand is diverted to other consumer goods, like

food, clothes, or housing, that are urgently wanted for other income groups. If, after high taxes are imposed, the remaining demand for refrigerators is large enough, and efficient enough management is available, it may pay to make the refrigerators domestically. In the end, more resources may be available for more directly desirable investment projects, as a result. Such considerations as these should guide the government's tax policy. If those responsible for production decisions are also trying to influence things by the back door, more confusion than good is likely to result.

Chapter XII

THE ESTIMATION OF COMMODITY ACCOUNTING PRICES

In this and the following chapters, we shall attempt to substantiate our view that the methods we have described are practicable. In doing so, we shall not only carry the reader to the point where he could use the method to evaluate particular projects ; we shall also tie up a few loose ends that have been left earlier on.

The accounting prices of commodities, it will be remembered, are based, directly and indirectly, on world prices. The problems can be quite different from one commodity to another. Fortunately, only a few commodities will be of the first importance in any particular project : many of the inputs and outputs can be dealt with very crudely, without fear of seriously distorting the final decision. We begin by discussing a feature common to all prices : change.

12.1 Prediction

When evaluating investment projects, one is looking into the future. Since the kind of project dealt with is often expected to have a life of several decades, it is necessary to look rather a long way into the future, and prices could change by large amounts. There may be no particular reason to think that the price is more likely to move up than down, more likely to change by a large amount rather than a small, although one can be sure it will change. The way in which this uncertainty about price movements should influence the result is a topic reserved for Chapter XV.

Risk apart, if there is no good reason to think that a price will most probably change in one direction rather than the other, the calculations must be made on the assumption that it will remain constant. It saves a lot of time and trouble to decide quickly that one is ignorant, when one *is* ignorant. But first one must try to learn about the probable changes in the most important prices. Bad mistakes may sometimes be avoided by noticing that there is good reason to think that some particular price will be higher or lower in the future.

The following are examples of the kinds of reasons that might justify project planners in thinking that a price will probably be rising or falling :

1. When the past behaviour of the price of some important raw material, or of the output, is examined, there may be clear evidence of an upward or downward trend. (This applies also to inputs other than materials, but insofar as machinery is installed early in the life of the project its price can usually be predicted quite

accurately.) Many people are much too quick to see a trend in figures for two or three years ; on the other hand, some people never see a trend in *any* series of figures ! Clear evidence of a trend can be had only from quite a long series of years — preferably at least ten. After all, this trend is going to be extrapolated for two or three decades in the calculations. If fluctuations in the price have been large in relation to any plausible trend during the years for which evidence is available, one should be wary of drawing conclusions. If the input is really important, it may be advisable to call in the help of a trained statistician. But one should not assume that the price will most probably remain constant just because the evidence of a trend is weak. It is no better to assume wrongly that there is no trend, than to assume wrongly that the price will be rising by 2 per cent per annum. If the immediately available evidence is uninformative, one ought to look for more — if not more data on past prices, then evidence of the kind discussed below.

2. Statistics of past prices are not the only information that can help in forecasting the future behaviour of prices. For example, it may be known that recent improvements in technique are likely to make steel much cheaper soon ; or that recent increases in steel-producing capacity have outrun demand, so that prices are likely to fall in the immediate future ; or that some raw material is likely to be in increasingly short supply (with consequent rising price), because new techniques are leading to an increased demand for it. Reasons of this kind, which have to do with general knowledge about the changing conditions of supply and demand, can also provide useful support to forecasts of prices based on statistics from the past, or a valuable warning not to be guided by what has happened in the past. For example, if prices of raw materials of importance in armaments have been rising, but the conflicts that have given rise to the special demand have recently been much reduced, one will want to use the past data with great care.

3. We know also that the price that will have to be paid for an import, and the price that will be received for an export, may depend upon the quantity the country is importing or exporting. Certainly, the accounting price will change if a commodity that was being imported is no longer imported (because of the expansion of domestic capacity), or one that has previously been sold only in the domestic market begins to be sold abroad. It must be assumed that when the quantity of a commodity produced domestically changes substantially, the accounting price will have to change too. It follows that forecasts of at least some of the accounting prices, that are required for evaluating a project, will depend upon the expected changes in production in this and other sectors of the economy. For example, if the country is going to adopt a special programme of expansion in the cultivation of raw cotton, it being hoped that it will soon be an exporter of all but the finest grades, although most of the cotton required by the textile mills is now imported, then the accounting price for cotton will probably be falling. (Of course, if there were in any case a tendency for the

world price of raw cotton to rise this would have to be balanced against the effects of developments within the home country. And in that case, the prices of cotton textiles would be expected to rise also.)

These different kinds of information are progressively harder to quantify. Since one cannot meaningfully compare one consideration with another, unless they have been quantified, it is necessary at least to make intelligent guesses. As experience of using these techniques to make forecasts of accounting prices accumulates, the guesses can become more intelligent. What is of the first importance is that the possibility of changing prices should be kept in mind, and that it should never be assumed that the price of an important input or output will remain constant unless there really is, on balance, no good reason to think the contrary.

12.2 Traded Goods

The previous section provided a necessary prologue to the business of making actual estimates. We begin now to discuss the estimates of simpler cases. Let us first see in what form we are likely to get information about the inputs and outputs. At some point in the preparation of estimates, the amounts of the main inputs and outputs must be given in physical terms — so many tons of a particular kind of steel, so many machines of a certain specification, and so on ; but some parts of the costs are likely to be estimated in money terms, the estimate being based on the contractors' or surveyors' experience. These rough estimates in money terms will sometimes refer to quite specific items — collections of tools, say, or small items of construction. It will then be fairly easy to see whether the actual goods and services concerned are traded goods and services, or not. But there are bound to be some items which cannot be so assigned : for example, the usual allowances for unexpected additional costs. These last items must be adjusted to fit the calculations in a fairly rough-and-ready way, increasing or reducing them by an appropriate factor. Since a number of non-traded commodities have to be treated in exactly the same way, the details are left until the next section.

Consider now, an imported commodity, such as a piece of machinery. For a definite item like this, one can find out what has to be paid for it at the port : this is the c.i.f. (cost, insurance, freight) price, the one that is used for customs purposes and the like. The further cost of getting the machinery off the ship at the port and to the site of the plant, is known as the port-to-user margin. The service of getting commodities from port to user is a non-traded good, consisting partly of transport costs, partly of handling charges, partly of the services of traders, agents, insurance, etc. The method used here is to divide the port-to-user margin into two parts, one the transport cost, the other all the rest. The actual cost of each of these two parts then has to be adjusted so that transport and services are valued, as near as possible, at their accounting prices. It is best to keep all these transport and trade or port-to-user margins separate from the c.i.f. costs of the inputs, and add them up separately. One can later value these subtotals by using the appropriate accounting prices. (We deal with the accounting prices for transport and trade in the next section, since they are non-traded commodities.)

A similar procedure applies in the case of an exported good. The commodity — cotton textiles, say — is valued at its f.o.b. (free on board) price — the price that is received for delivering it on board ship at the port[1]. The cost of the transport and trade services involved in getting it from the plant to the ship is converted to accounting price terms and entered into the calculation as a cost. In none of these cases are taxes or subsidies included.

A brief word on more complicated cases may be useful. If the input is imported, or the output exported, it is obvious what the transport margin is. It is not so clear if the input comes from a home producer, although some users of the same input import their requirements. When transport costs are small, the costing can be done as though the equipment was actually imported; but if transport costs are large, one must be more careful.

Users near the port of entry will use imports; users near the domestic factory will use home production. One has to guess how far imports will penetrate into the country. At the furthest point, the prices of imported and home-produced versions, including transport costs, must be the same. Therefore:

> Price at factory = Price at port *plus* transport cost to furthest point to which imports penetrate *minus* transport cost between that point and the factory.

Finally, the price to the user of the home-produced version is the price at the domestic factory, plus the transport cost from there to the user. Usually one would work out the factory price by using the normal route from port to factory. The dividing point along this route between users of imports and users of domestic production will depend upon the proportion of total use provided by domestic production.

Another complication arises when the home-produced commodity is of a different kind or quality from those that are being imported. This is very common. Home-grown varieties of raw cotton can be used for some purposes, but certain kinds of cloth (perhaps export patterns) require a higher quality raw cotton, which is imported. Heavy-duty electric motors may be imported, while smaller ones are made in the country.

In such cases, it is wrong to look up the average c.i.f. price of cotton or electric motors, and use that to value the domestic production. Theoretically, the correct price is then the export or f.o.b. price, if, e.g., the light electric motors are in fact exported (or would be exported if the country had an ideal commercial policy). If export is a very unlikely possibility, then it should be valued as a non-traded good (see 12.3). But if it is a small item, or if the commodity in question could in some uses be substituted for imports, even if not in all, then one would not go far wrong in taking the c.i.f. price of the imported variety and multiplying it by the ratio of the domestic market price of the home variety to the domestic market price of the imported variety.

A slightly different case arises with final consumer goods, which have the same basic uses, but where the quality is different, or where consumers'

1. It may be important in such a case to estimate the marginal revenue from exporting instead. To do that, one has to estimate the effect of a further increase in exports on the price received, and then deduct the net effect of this on export earnings.

preferences are such that the imported and home-produced varieties sell at different prices. A good example is American wheat, which sells at a discount compared to indigenous wheat in India and other countries.

Let us suppose the discount is 20 per cent, and ask what happens if some extra quantity of wheat is produced, and hence decide how to value it. Let us take it that the extra quantity saves an equal tonnage of imported wheat costing 1 million rupees of foreign exchange. But the extra quantity of domestic wheat will actually sell for 1 1/4 million rupees (this assumes that the government previously made no profit or loss on the imported wheat — and also, for simplicity, ignores transport costs). People pay an extra 1/4 million rupees, because they prefer the domestic variety. This will reduce their consumption of other things by roughly the same amount. This in turn will save some more foreign exchange, how much depending on the foreign exchange cost of consumption in general (this may be estimated by applying the standard conversion factor — see 12.4 —; or, more accurately, by the method given in 13.92). Suppose the foreign exchange cost of consumption is 2/3 of its domestic value, then the extra foreign exchange saving is $1/4 \times 2/3 = 1/6$. Consequently the accounting value of the extra quantity of domestic wheat is 1 1/6 million rupees.

The above was an agricultural example, and makes assumptions which may not be true even in this case, and would surely not be true in other cases. First, it assumes that if people consume an extra ton of more expensive domestic wheat, they will consume just one ton less of imported wheat, and that they will reduce other expenditures in an average sort of way. If it was thought more probable that expenditure on wheat, domestic and foreign, would remain constant, then the whole 1 1/4 million rupees of extra expenditure on domestic wheat would save foreign exchange. Secondly, the example assumes that there is no tariff on wheat, but considerable tariffs or quotas on other consumption goods; and this is not likely to be generally true. In fact, each case has to be treated on its merits, remembering that the crucial question is, always, how much foreign exchange is saved (or earned).

For industrial goods, it is more often the home product which sells at a discount. Thus a domestic car may be worth less than an imported one, although both claim to be the same model. The accounting price of the home product is then less than the foreign exchange value of the imported model, the difference being calculated in the same sort of manner as in the previous example.

As a final complication worth discussing, the project evaluator will sometimes be puzzled by the fact that there may seem to be quite a wide range of import prices for a particular product. This could be because of a difference of quality, but might also be for other reasons, for instance, differences in the size of the consignment, or because the goods were not bought at the same time. It could also be simply irrational — someone has paid more then he need have done. The project evaluator should always try to estimate the lowest price at which imports of a given quality are likely to be actually obtainable at the relevant times. This will not always be the same as the lowest price at which a good has been recently imported: sometimes, for instance, foreign firms may make sales at abnormally low prices (perhaps because of excess capacity), or because of some subsidy scheme of a foreign government which cannot be relied upon to last. But,

equally, it is easy to imagine circumstances in which some recent import prices are higher than can reasonably be relied upon in the future. All this is inevitably a matter of wide knowledge, and nice judgment, about which it is impossible to generalize[1].

The above paragraph applies also to exports — except, of course, that it is the highest price which one can expect to obtain, which is relevant.

12.3 Non-Traded Goods: The General Method

In Chapter VIII, we argued that the basic rule for determining the accounting prices of non-traded goods was that domestic supply should equal domestic demand, after allowing for the influence of the accounting prices themselves, and any restrictions on demand the government may impose[2]. One should not be too ready to assume in advance that a commodity is certainly going to be non-traded. But there are many important commodities that almost certainly will be non-traded: above all, electricity, construction and civil engineering, transportation, and services.

The case of construction is, in principle, one of the easiest. We have only to estimate the accounting cost of the inputs required for doing the construction (see 8.41) — the labour, the raw materials, and the services of the various bits of machinery. Labour we shall come to in due course. Raw materials are usually traded goods, and if not, can be treated by one or other of the methods we are discussing. Machinery requires rather careful treatment. A bulldozer may be used on a project for a number of years, but will not be worn out at the end of that time, so we must evaluate the services it provides in each year. The price of these services should be just high enough to justify the initial expenditure on the bulldozer. One can estimate the number of hours a bulldozer should work in a year, and how many years it will last. The price per bulldozer-hour should be falling from year to year at the same rate as the prices of bulldozers themselves may be expected to fall. Then the price of a bulldozer-hour is set at such a level that the PSV of the services of the bulldozer will just equal its cost (import cost, most probably)[1].

We should emphasize that the above method is correct only if there are no spare bulldozers that would otherwise be idle. Since construction

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1. Sometimes, an aid or a trade agreement may cause the lowest price at which an import could be obtained to become irrelevant. In the simplest case of a loan which is tied to the project in question, the price of imported capital goods is irrelevant. The cost becomes the cost of servicing the loan. There are, however, more difficult intermediate cases about which we cannot generalize. Common-sense, allied to the principle that it is the saving or earning of freely usable foreign exchange which matters, should provide a guide in difficult cases.

2. If domestic production were less than demand when the cost of importing is used as the accounting price, that should indeed be the accounting price, and the commodity is a traded good. Similarly, domestic production of exported goods, and those that will be exported, will be greater than domestic demand if we use the marginal revenue from exporting as the accounting price.

3. Suppose that bulldozers can be expected to provide $h_1, h_2, h_3, \ldots, h_T$ hours of usefull work in the successive years of their lives, and that the price of new bulldozers is expected to fall by $100g$ per cent per year. If a new bulldozer today costs C rupees, and the ARI is $100r$ per cent per year, today's accounting price for a bulldozer-hour, p, is given by $C = p\left[\frac{h_1}{(1+g)(1+r)} + \frac{h_2}{(1+g)(1+r)^2} + \ldots\ldots + \frac{h_T}{(1+g)^T(1+r)^T}\right]$.

work is normally a rapidly expanding activity, we should hardly expect construction machinery to have no other use. But, sometimes, an earlier mistake may have left the economy with a temporary glut of one particular kind of machinery, which commands no second-hand market abroad. In that case, using the machinery does not involve any cost to the economy.

Thus, if the major construction work associated with a project can be costed in detail, then the labour used can be regarded as labour used by the project, and so can the services of the machinery used, and the raw materials. The cost in terms of accounting prices can then be calculated using the methods indicated. If the construction is supplied by the private sector one should also make allowance, as explained in Chapter X, for the consumption out of profits by engineering contractors, labour agents, and so on.

But when construction costs are small, or estimates are not available broken down into various parts, it will be useful to have available a *construction conversion factor* (CCF), which can be used to revalue the actual money cost of construction work to its cost in accounting-price terms. This can be done only roughly, but it would be a great convenience for project planners if a typical construction programme were costed in terms of accounting prices, and the result compared with its actual money cost to the enterprise. The estimate could be done for an imaginary construction project, in consultation with firms in the construction industry, or the relevant government departments ; or it could be based on the actual construction work done for a number of public-sector projects, for which detailed information is available.

Sometimes, information on construction costs will be available only in the usual accounting form, where the characteristics of capital equipment are not given in detail, and are merely reflected in figures for depreciation. Depreciation *plus* interest charges on the book value of capital should, ideally, give the cost of the services of the capital equipment for a year. But tax laws and accountants' conventions have a considerable effect on the figures for depreciation. This is not, therefore, a very satisfactory means of estimating the value of the equipment's services. One may nevertheless have to shut one's eyes to the unsatisfactory nature of the figures, and calculate the normal annual cost of providing a million rupees of construction work on the basis of data for current inputs, labour costs, depreciation, and the value of fixed and working capital. The accounting-price value of the million rupees of construction work would then be obtained as follows :

raw material and miscellaneous inputs, converted to accounting prices ;

labour costs, measured at the shadow wage rate ;

value of consumption out of profits, measured at accounting prices ;

annual depreciation, converted to accounting-price terms by using the ratio between the accounting-price cost of the machinery, etc., and its actual costs ;

interest cost, evaluated by charging the ARI on the value of capital stock, both fixed and working capital, converted to accounting-price terms.

The sum of these items would give an estimate of the social cost of the million rupees of construction work. The CCF is obtained by dividing by a million.

Electricity generation and transmission is a more complicated case than construction, because it costs more to supply electricity at peak times than at others, and the older or less efficient methods of producing electricity may be used only at peak hours. Also, when hydro-electric and thermal power stations form part of a single grid, it may be quite a complex matter to identify the cost of making electricity available in a certain place at a certain time.

If the input of electricity is an extremely important item, as in the case of the manufacture of some non-ferrous metals, then more expert calculations, than can be dealt with here, should really be carried out. But, in the case of a large number of projects, where electricity is neither extremely important nor negligible, the following rather crude method should be adequate.

First, make some convenient division of the day, and the week, into peak hours and off-peak hours. The normal practice of charging by the electricity authority may give some guidance. Then it can be assumed that the accounting price for off-peak electricity is given by the accounting cost of the current inputs on the least efficient plant that has to be used — neglecting the capital equipment, that is. Although this neglects some costs such as wear and tear, it is not likely to be seriously inaccurate. Next, a typical power station can be costed. To do this one must estimate for how many years of its life it will be providing off-peak electricity ; and one must estimate the rate at which the peak and off-peak prices of electricity will be falling over time. For simplicity, it is assumed that both fall at the same rate (this is not a very good assumption, but then the method is admittedly crude). Finally, today's price for peak-hour electricity is determined by the requirement that this typical power station should just break even, that is, have a zero PSV. From that everything else follows[1].

Since we are trying to estimate future accounting prices, calculations of the kind described must, in principle, be made on the basis of the techniques expected to be in use at the relevant date. If current techniques are not the best available, there will be time to change, and we should perhaps base our estimates on the lowest-cost techniques for the industry ; provided we have good grounds to think that the best techniques will get used. In practice, when the system of project planning in terms of social cost-benefit analysis is just beginning, it is hardly worth while to do a very

1. Assume C = cost of the plant at commissioning date, interest at the accounting rate of interest being charged on earlier expenditures.
   h = number of peak hours operated per annum (this will not in reality be constant : an average, weighted towards the present, should be taken).
   T = number of years the plant is expected to be in use at peak hours.
   t = number of years for which the plant will operate during off-peak hours.
   k = number of off-peak hours per annum that will be worked during the period t (this, like h, may also vary with time — a similar average can be taken).
   g = annual rate at which accounting prices are expected to fall.
   r = ARI per annum.
   α = running cost at the time of comissioning.
   p = accounting price per kwh of peak electricity at the time of commissioning.

detailed analysis of alternative methods of production when estimating accounting prices. The business of project evaluation can perfectly well be begun using accounting prices based on the techniques currently used in these industries. The accounting prices can be revised later, if it is found that other methods of production are better.

It is not true in all industries that production could have been expanded without any change in the cost per unit of production. It is not true in railway transport, for instance. (Indeed it is not always strictly true in the cases already examined, and special treatment is needed when this convenient assumption is too unrealistic.) Thus, what we really want to know, when estimating the accounting price for railway transport on a particular route, is what it would cost to provide the extra transportation that will be required if the project we are interested in should be undertaken. But transportation will often be too unimportant a part of costs to justify a very careful analysis of this point. So, for many cases, a conversion factor for transportation, as for construction, is a useful tool. It might well be estimated by applying to the railways the same kind of calculations as discussed in the cases of construction and electricity.

But, sometimes, there would be a difference. The kind of situation we have in mind is one where a railway line is relatively under-utilized, so that traffic on the line could be expanded quite easily, without the necessity of laying new track, re-arranging signalling, expanding handling facilities, and the like. In that case, the accounting price for railway transport should be just the price that is necessary to cover the additional costs of new inputs — new locomotives, workers, rolling stock, and so on. However, one has to be rather careful when doing this kind of calculation, as it is easy to miss out some quite important costs : for instance, an expansion in traffic as a result of carrying raw materials to a new factory may result in slowing down deliveries to other factories on the line. Similarly, new traffic on a road may well greatly increase costs of maintaining it to an adequate standard.

We cannot go any further into the details of estimating accounting prices in particular cases where costs of production are available. Each case has its own peculiarities. Usually, quite rough overall calculations will do. But it is as well to remember that the general principle is not simply that

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q = accounting price per kwh of off-peak electricity at the time of commissioning.

Since, by assumption, q is equal to the running cost of a plant t years old, it follows that : —

$$q = \alpha (1 + g)^t \qquad (1)$$

Up to time t, the social profit of the plant in the year ending at time n is

$$ph (1 + g)^{-n} + qk (1 + g)^{-n} - \alpha (h + k)$$
$$= ph (1 + g)^{-n} + \alpha k (1 + g)^{t-n} - \alpha (h + k)$$

After t and up to T, the social profit is

$$ph (1 + g)^{-n} - \alpha h$$

Summing, discounting, and setting the result equal to C, we have

$$C = ph \sum_{n=1}^{T} (1+g)^{-n} (1+r)^{-n} - \alpha h \sum_{n=1}^{T} (1+r)^{-n} + \alpha k \sum_{n=1}^{t} [(1+g)^{t-n} - 1] (1+r)^{-n} \qquad (2)$$

q is estimated from equation (1), and p from equation (2).

the accounting price should make a typical undertaking in the industry just worth while, but that it should make the best method of having greater production in the industry just worth while.

12.4 Non-Traded Goods: The Standard Conversion Factor — a Short Cut

When a particular input (or output) is likely to be rather unimportant in the overall evaluation of the project, or when — as in the case of many trade and other services — it is difficult to get hard information about the methods of production, one has to resort to cruder methods. In such a case, one may be able to estimate the actual cost of the input, but one wants to make a correction for the extent to which the actual prices are overstating or understating the social cost.

The actual prices paid cover the cost of imported inputs, including import duties, the market cost of various other inputs, the cost of labour at the ruling wage rates, profit, and tax payments. To get the accounting price of the inputs, we would like to subtract import duties and other indirect taxes, the excess of actual wages over shadow wages, the excess of profits over that required to cover the accounting rate of interest, and to add on some allowance for the consumption out of profits by those involved in providing the services. This is hard work. It might be worth doing for a few commodities, but certainly not for all.

Instead, one can take an average of the proportions by which the domestic prices (net of purchase or excise taxes) of traded goods exceed their world prices, and use this average proportion to convert the actual prices of these goods and services into accounting prices. This would be averaging over a mixture of commodities, some of which have the same accounting price as actual price — for example, exported commodities with a perfectly elastic world demand, and not subject to any tax or subsidy; and some of which have an actual price many times the accounting price — for example, imported goods that are subject to severe rationing. Since the ratios may be so disparate, it may be worth taking some care to ensure that the average is a sensible one. For example, if it is obvious that the production of a commodity depends very much upon imported inputs, one should reduce actual prices to accounting prices by applying a factor that is based mainly upon imported commodities. Similarly, if one is dealing with some raw material derived from a crop quite similar to other agricultural products that are exported, the appropriate factor should be based on exported agricultural commodities.

But, quite often, it would be very troublesome to discover for some fairly unimportant input what inputs had gone into its production, or what kinds of production it directly replaced: in that case a crude average of the accounting-price/actual-price ratio for a representative selection of traded commodities would suffice. There is, therefore, some advantage in having available a *standard conversion factor* (SCF), calculated as the average of the ratios for a wide and representative collection of commodities (which need not necessarily be restricted to traded commodities). The calculation of such a factor is a very useful preliminary to project evaluation. It can then be applied to all unimportant or doubtful cases.

12.5 Non-Traded Goods: Revisions of Accounting Prices

We have seen that the general rule for the production of non-traded goods is that demand should be satisfied when the price charged is set equal to the marginal social cost — after allowing for any tax (or tax element in the price) which the government may wish to impose. Thus, if there are no overriding fiscal or social considerations, we require ideally both that supply equals demand, and that the marginal social cost equals the price charged.

Now if we set the price equal to the marginal social cost there may be excess demand. This means that too little, say electricity, is being produced. It also means that, *so long as this condition of inadequate supply holds,* the social value of electricity is higher than the estimated marginal social cost of supplying it: indeed, the social value becomes the price which equates the existing inadequate supply to the demand. As we have seen, there may be a case for restrictions on use, or rationing. But if, despite this, there is still excess demand, then the social value must equal the price which equates supply and demand.

There may also be a deficiency of demand. This implies that too much electricity capacity has been installed, and that electricity is worth less than the long-run marginal social cost. In fact, while such conditions hold, its social value is no more than the accounting cost of the current inputs of fuel and labour required to make it (capital costs become irrelevant as there is already too much capacity).

The above paragraphs strongly suggest not merely that actual prices should be adjusted so that supply equals demand (provided the price falls no lower than the cost of current inputs), but that accounting prices should also vary, and that supply and demand should therefore be used as guides for the revision of accounting prices which were initially based on the methods discussed in 12.3 and 12.4 above. But before coming to any such conclusion, let us recall the purpose of an accounting price for e.g., electricity, in project selection. If the accounting price for electricity is high, then the project which uses a lot of electricity is less likely to pass the test, and *vice versa* — and hence the demand for electricity is less than it otherwise would be. But projects generally last a long time. If the shortage of electricity is merely temporary, it would be wrong to put a scarcity value on electricity when the project will probably be using very little until it is in operation several years hence. Equally it would be wrong to put a low accounting price on electricity just because there is, temporarily, excess capacity.

The case of electricity (here assumed to be in the public sector) is therefore one where very temporary considerations of excess demand or supply should not influence an accounting price which had been worked out by the method of 12.3 above. What has gone wrong is not the estimated accounting price, but rather the supply programme.

On the other hand, it does not at all follow that one should always ignore supply and demand. The case might be quite different for construction (assumed to be a private sector activity). If the prices charged by contractors have risen since the estimates of accounting prices were made, this could indicate that the costs, on which the estimates were based, were too low to ensure a sufficient long-run supply. Accounting prices for inputs from the private sector must always be based on actual prices, and consequently

a change in actual prices, in response to changes in conditions of supply or demand, will normally indicate a need to change the accounting prices — unless, of course, there is evidence to suggest that temporary conditions are affecting the price. One is always forecasting accounting prices in project selection: and new events often make it sensible to change the forecasts.

It hardly need be added that, in inflationary conditions, frequent reassessments of accounting prices will be necessary. This would not be the case if inflation affected all prices to the same extent, but this is not the case. Also, of course, revisions must all be made contemporaneously. One does not want to use a new price for labour in conjunction with an out-of-date one for electricity.

To conclude, no automatic method of adjusting the accounting prices of non-traded goods can be recommended. Fluctuations of all kinds affect an economy from year to year, and necessarily affect the balance between supply and demand, and relative prices and scarcities. It would not be wise, therefore, to put too much weight upon the events of one year. No year's evidence should be neglected, but nor should it be given full weight. One should use caution in changing the forecasts of accounting prices. Otherwise, the fluctuations in the predictions may themselves become so bad that no one would place any confidence in them. Fortunately, there appears to be a certain regularity in the operations of economic systems, sufficient at any rate to allow more success in the prediction of demands and prices than random guessing would allow. It may be hoped that economists and statisticians will be able to provide increasingly satisfactory methods of making these forecasts. Every country should acquire a staff of experts, trained and experienced in these matters. Of course, anything like complete accuracy is impossible, precluded by the intrinsic uncertainty of economic relationships and reactions. But common sense, and a determination to rely on observations, can take one a long way.

12.6 Non-Traded Goods: The Special Case of Skilled Labour

We shall come to unskilled labour in the next Chapter, and in that category we can also include many grades of semi-skilled labour, and even skilled labour where the skills required are easily and quickly learnt on the job.

What we are concerned with now is the higher grades of skilled labour: office staff, management, professional services, and so on. Such workers are 'produced' by expensive training and education. Despite the brain-drain, which applies to only a few professions, these are mostly non-traded services, produced and used within the economy. (When highly-trained labour is hired from abroad, it is quite easy to calculate the foreign-exchange cost of employing it, allowing for any direct or indirect taxes paid to the government.) It would be unreasonable, however, to apply the standard conversion factor to expenditures on these inputs without further thought, since they are so different, in many ways, from the other categories of non-traded goods and services.

To fix ideas, suppose that the project will employ a certain number of staff managers at various levels. What is the cost to the economy of this increase in the use of highly-qualified manpower? The two following extreme cases may be distinguished:

1. It is possible that the educational system will be able to increase the number of qualified people by the time they are needed. The effect of the increased demand for staff is then threefold. First, the educational system sustains certain costs to produce the extra manpower. Secondly, these salaried men and their families consume more than they otherwise would have done. Thirdly, the economy loses production elsewhere as a result of their diversion first to training, and then to these highly-skilled jobs.

The first element is hard to estimate without doing a detailed costing of the educational system. It is likely to be quite high, a substantial fraction of the total salary payment. The second element is certainly high too. The case is analogous to that of consumption by profit earners. Salary earners may not always have incomes comparable to major shareholders, bankers, and industrialists ; but they often have incomes much higher than their unskilled fellows. It would be a little extreme to regard the value of their consumption as entirely a cost : but it is not a completely unreasonable approximation[1]. The third element in the cost, (the production foregone elsewhere), will be a small part, on the reasonable assumption that the educational system transforms the men from the unskilled labourers, or the hangers-on, they would otherwise have been, into highly-skilled labour.

The value, in accounting prices, of a typical salary earner's consumption, can often be calculated using consumer budget studies. Or, if time does not allow so detailed a calculation, the SCF can be applied to a rough estimate of the money value of a salary earner's total consumption. To this must be added a substantial addition to allow for the costs of education and training — which could add anything from 50 per cent to 150 per cent. But this last item is extremely uncertain, and must depend upon guesswork in the particular situation.

2. The second case, at the other extreme, is when the educational system cannot be expected to respond at all, either because it is not geared to providing the relevant kind of labour — e.g. gifted managers — or because the skills required are intrinsically rare. In this case, one might think at first sight that the accounting price should be set high enough to discourage employers from wanting to employ more of these specially skilled people than will actually be available. That is correct if the entire economy is under public control, for this discouragement to producers can then be exercised without increasing the real income of the salary earners themselves. But, if the private sector is important, this may not be so easy ; because increased demand by the public sector may lead the private sector to offer more attractive salaries, with the result that the total real incomes of salary earners, and therefore their consumption, is increased. This would be a further cost.

Any actual case will come somewhere between the two extreme cases described above. There will be an increase in the total numbers of highly-trained or especially able workers ; but there will also be some tendency for their incomes to be raised by any extra demand. In the one case, the education and training is an extra cost to the economy ; in the other, the extra consumption arising from the general rise in salary levels is an extra cost. It follows that the accounting price should be substantially greater than the value, in accounting prices, of the salary earner's consumption.

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1. We shall return to this point in Chapter XIII.

Bearing all this in mind, and also the convenient fact that salary payments are almost always a relatively unimportant part of the total costs of a project, so that minor adjustments are not worth making, it is probably not seriously incorrect to charge actual salary payments to the project (i.e. to make no reduction on account of the direct and indirect taxes paid by salary earners). Accordingly, that is what we suggest that project planners do. It is certainly not an issue on which a great deal of time should be spent.

12.7 Conclusions

We can summarize the suggestions of the present Chapter in relation to a particular project by proposing the following set of rules :

1. Divide the list of inputs and outputs of the project into traded and non-traded goods and services. In the case of traded goods, separate out the transport and trade margins (essentially the cost of getting the goods between ship and factory, although some detailed problems of particular cases were discussed above).

2. Convert the traded inputs and outputs to f.o.b. or c.i.f. terms as the case may be, allowing for the effects of inelastic export demand where necessary. If a complete breakdown into individual kinds of goods and services is not available, or c.i.f. or f.o.b. prices cannot be obtained in sufficient detail, one can use the average proportionate difference between domestic prices and world prices for suitable categories of traded commodities.

3. Look up the appropriate accounting prices for transportation, construction, services (including trade), and skilled labour. These would be given in the form of previously worked out conversion factors by which the money estimates of these inputs and outputs are to be multiplied. These conversion factors should be revised from time to time.

4. Insofar as these conversion factors are not available, or applicable, estimate them by one of the following methods :

   i) calculate the price that would just cover input costs at world prices ;
   ii) apply the standard conversion factor (SCF), based on the average ratio of world prices to domestic prices for a representative selection of commodities ;
   iii) consider adjusting previously estimated accounting prices up or down accordingly as to whether there appears likely to be an excess of demand over supply, or supply over demand ;
   iv) in the case of categories of labour that are likely to be in short supply, make a rough guess at the accounting price on the basis of the considerations sketched in section 12.6. Usually, the actual cost can be used.

5. Apply the conversion factors to the remaining inputs and outputs, using the SCF for all expenditures whose nature cannot be identified.

Chapter XIII

THE ESTIMATION OF THE SHADOW WAGE RATE

The extent of employment in the industrial sector of the economy may have some effect on production elsewhere ; but, as we have seen, its effect on the commitment to consumption may be even more important. The shadow wage rate should reflect both considerations. The higher it is, the less industrial employment there will be (in the immediate future) : there will be more production elsewhere and less consumption in the economy as a whole. In the present Chapter we explain how these effects can be estimated, and their cost properly set against the benefits of the project. In particular, we discuss how the relative value of consumption and investment can be assessed.

Probably one need not seek a very precise estimate of the shadow wage rate. Labour costs are sometimes a suprisingly small proportion of the value of output. In any case, an adjustment of 10 per cent, or even 25 per cent, in the cost of labour will usually have a much less dramatic or important effect on project choices than the adjustments in commodity prices suggested in the previous Chapter. Granted that a crude estimate is likely to be sufficiently accurate for most practical purposes, some of the variables that are in theory relevant can in practice be ignored. Indeed, it may be quite satisfactory to make a rough guess on the basis of the general features of the economy. If not, certain formulæ given later in the Chapter may be directly applied. More precise estimation requires more information, and, in particular, experience of the kinds of projects that tend to be available. Since these details seem to us less important, we have put them in an Appendix to the Chapter.

Throughout, we shall measure inputs and outputs, when valued at accounting prices, in ' dollars '. This emphasizes the difference from market values, which are spoken of as so many ' rupees '. Usually, one would carry out a cost-benefit analysis in terms of the domestic currency, making appropriate adjustments when accounting prices differ from actual prices.

13.1 The Consequences of Employment

Suppose that one more man is employed in industry. The social significance of this event depends on where he comes from, how his departure affects the situation he leaves behind, how much he was paid, what he does with the money, and whether the earnings of others are affected by his arrival. The answer to these questions may be quite different in different developing countries. Without discussing specific countries, we shall suggest what one needs to know about the labour situation, and how

this information should be brought to bear upon project analysis. We shall tend to emphasize those conditions that we think are most commonly met with ; but the methods that will be explained do not depend on any narrow view of the structure of developing countries.

The main effects of moving a man into industry are :

1. Production elsewhere falls. The man might previously have been a peasant, a schoolboy, a domestic servant, a small trader, or unemployed. And his move will change the occupations of others. On average, the labour available to agriculture is changed, and it is convenient to estimate the value of the change in production by the AMPL — the marginal product of labour in agriculture, measured at accounting prices. The AMPL, which we shall denote by 'm', may be very small, but is unlikely to be zero. It seems that, even in the most densely populated parts of the world, agricultural production is still affected by the number of people available ; despite this fact, others may well be better fed when there is one mouth less to feed, and may do more productive work as a result. In the poorest and most densely populated areas of Asia, m may be very small. Elsewhere it may be substantial.
2. The man's consumption was probably greater than his marginal product. Families share their income, and rural charity may not be negligible. So, let us call his consumption $\$ (m+a)$. Now a, the excess of his consumption over his marginal product, will accrue to those who stay behind. It seems reasonable to assume that they increase their consumption by this amount.
3. The consumption of the man (and his family) is increased, since he is now paid a wage. We might assume, as an approximation, that the entire wage is consumed. (In any case, most of his saving would cause an increase in future commitments to consumption.) If income taxes are paid, they would have to be allowed for. Let us call the new consumption level $\$ c$.
4. Industrial production is increased. This is taken care of automatically in the rest of the cost-benefit calculation.
5. The general level of wage rates may have had to change a little as a result of the increased employment. This is usually considered unlikely in developing countries, but the possibility ought to be considered. (It may seem a trivial consideration, but if one thinks in terms of employing a million extra men instead of just one, it could be important : even a small change in the wage rate, spread over the whole wage bill of the industrial sector, can be a significant matter.)

Ignoring the last possibility (5) for the moment, we can summarize the effects. Agricultural production is reduced by $\$ m$; the amount of the goods and services that is committed to consumption is increased by $\$ (c-m)$; of this increase, $\$ a$ goes to those remaining outside the industrial sector, and $\$ (c-m-a)$ is consumed by the new industrial worker and his household. The advantage of providing extra consumption in these two ways has to be weighed against the advantage of being able to use the extra production for investment. If industrial output could have been raised by $\$ (c-m)$ without employing an extra man, then the whole amount

would have been available for reinvestment — instead of being consumed now. In this relative sense, the extra employment in industry reduces the amount available for investment by $ $(c - m)$.

13.2 The Value of Investment Compared with the Value of Consumption

Investment provides future consumption: apart from profits in the private sector, it is provided through the industrial employment associated with the new project, and with the further projects that can be started later as a result of the investment made possible by the social profits of the new project, and so on. Also some part of the increased government revenues may be used to provide additional consumption for the exceptionally poor or deserving, and this use may become more substantial as the development of the economy proceeds. The aggregate of all this later consumption has to be compared with the extra consumption that could take place today if fewer resources were used for investment. The kind of comparison that is involved can be illustrated by two contrasting examples:

1. In the first imaginary country, the marginal productivity of labour in agriculture is zero. Population is growing so rapidly that, despite expansion of the industrial sector, and advances in agriculture, the standard of living in the agricultural sector is not expected to grow in the near future. Nor is the industrial wage rate expected to rise (or fall), but it is already sufficiently high to ensure for an industrial employee a standard of living twice as high as the average in agriculture. Industrial investment projects are currently yielding net rates of return of 15 per cent, and seem likely to continue to do so. A third of these returns is committed to wage payments, which are consumed, but virtually all the rest is available for further investment. (The last assumption is made only for convenience.)

In these circumstances, a million dollars of investment provides, in the first year, a hundred thousand dollars of further investment and fifty thousand dollars of additional consumption for wage earners and agriculturalists[1]: and as the investment grows each year by 10 per cent, so also does the consumption provided. So, by giving up a million dollars of consumption now, it is possible to get $ 50,000 of consumption next year, $ 55,000 the year after that, and so on, growing at 10 per cent each year. After ten years, a total of about $ 800,000 of consumption will have been enjoyed, and the initial million dollars invested has grown to over 2.5 million dollars.

On our assumptions, the individuals who benefit in ten years' time are no better off than those of today. It might therefore be argued that in such a country consumption in ten years' time is worth as much as consumption today. But the present generation may not think so, and politicians and planners might therefore take a slightly different view. Even so, future consumption could hardly be discounted very strongly. If it is not discounted at all, and if the 2.5 million dollars of investment could be converted into at least as much consumption (a very pessimistic assumption), then the above calculation shows us that a million dollars of investment today is worth at

1. Denoting the number given employment by a million dollars of investment by n, we have $n(c-m) = 50{,}000$ in this case, and $m = 0$.

Denoting the saving generated per unit of investment by r — we call this *the rate of reinvestment* — we have $r = 10$ per cent in the present example.

least 3.3 million dollars of consumption. In fact, pursuing the calculation another ten years, so as to take in twenty years in all, it would result in a much larger figure : by that time the accumulated total of all consumption, *plus* the accumulated capital stock, would amount to over 9 million dollars. No doubt at this stage, it ceases to be plausible to assume that neither industrial wages, nor the rural standard of life, have improved for twenty years. On the other hand, there is still a lot of the future to come. Let us, for the sake of argument, use that figure of 9 million dollars worth of consumption arising from one million dollars of investment today : it is high, but certainly not absurdly high[1].

In this case, the benefit arising from the consumption enjoyed as a result of employing one more man is one ninth of the benefit which would result from investing an equal sum. If we assume that the government is incapable of *both* getting the additional employment, *and* the investment (by successfully restraining consumption in other ways)[2], then it follows that we must subtract, from the net total of the other inputs and outputs, all but a ninth of the consumption to which the economy is presently committed as a result of employing labour. The shadow wage rate (SWR) is therefore eight-ninths of the value of the consumption of the wage earner and his family[3]. If we assume that wage earners consume all their earnings then it further follows that *the* SWR *is eight-ninths of the actual wage rate (measured at accounting prices).*

2. Our second imaginary economy is quite different. A fairly rapid growth is expected in both the agricultural and industrial sectors, and

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1. Those employed on the original project, and the further projects made possible by the savings it generates, consume an amount \$ 50,000.$(1.1)^{t-1}$ in year t. At the end of that year, there are projects in operation that would cost \$ 1,000,000.$(1.1)^t$ to build anew : if consumption rather than investment had been wanted in year t, this amount could have been made available for consumption. In the first few years (or decades) we much prefer investment, because consumption next year or in ten years is almost as valuable as consumption today. Later on, when standards of living are growing, this will not be so, and eventually there will be little to choose between having more consumption and having more investment. Paradoxically, this happens at a time when consumption is considerably less valuable than it is today. Suppose that after T years, we are more or less indifferent between further consumption and further investment. If \$ 1 of consumption in year t has the same value to society as \$ D_t of consumption in year 1, the value of \$ 1 million of investment now, which we denote by 1,000,000 s_o, is therefore
50.000 $[1 + 1.1D_2 + (1.1)^2D_3 + \ldots + (1.1)^{T-1}D_T] + 1{,}000.000\ (1.1)^TD_{T+1}$.
In the present example, D_t is thought to be fairly constant for a number of years. We play safe and estimate s_o by making D_t constant, and taking a value of T that is really much too small. It turns out that taking T any larger would make no difference to the SWR.

It should be noticed that $(D_{t-1} - D_t)/D_t$ is the consumption rate of interest (CRI) at t, which we shall denote by i_t.

It will be noticed too that s_t, the value of investment in terms of consumption at t, would be falling over time.

2. If the government could do that, we should not be in the position described, with negligible AMPL and high industrial rates of return.

3. The man's consumption is worth $1/s_o$ (in this case 1/9) of the same amount of investment. Employing the man reduces savings by c (the increase in consumption, *plus* the reduction in agricultural production), and increases consumption by $c - m$. Hence, the cost of employing the man is

$$c - \frac{1}{s_o}(c - m)$$

This is the shadow wage rate. In the present case, $m = 0$.

the agricultural sector is already feeling a shortage of labour induced by growing industrial employment.

A man living in the agricultural sector consumes an amount equal to the AMPL ($a = 0$). The consumption of an industrial worker is only 50 per cent higher than the AMPL. Both are expected to grow at 4 per cent year. Investment is high, since private saving and taxation are quite large even in the agricultural sector: indeed, it is thought that in ten years' time investment will no longer be a more valuable use of resources than consumption, and some of the profits from investment will begin to be distributed for consumption. A million dollars of investment in this economy can be sure of providing an annual output, less material inputs, of 25 per cent, i.e. of $ 250,000; but $ 150,000 of this has to be paid in wages[1].

What are the consumption gains from undertaking a million dollars of investment in this economy? Each year the investment generates 10 per cent that is ploughed back into further investment, so that investment grows at 10 per cent per year for ten years. At the end of that time, it does not matter what is done with the annual output, since investment and consumption are equally valuable from society's point of view. The $ 150,000 paid in wages in the first year provides an increase in consumption of $ 50,000, the rest being lost through the reduction of agricultural output resulting from the movement of labour into industry (the wage earner is assumed to pay no taxes and to save nothing). This $ 50,000 grows by 10 per cent each year. The results can be summarized:

1st year:	50,000 dollars	
2nd year:	55,000 dollars	
3rd year:	60,500 dollars	
.....		
10th year:	117,900 dollars	(being the value of the
11th year:	2,593,700 dollars	investments that have accumulated)

Now consumption provided ten years from the present is, in this case, certainly not as valuable as consumption provided now, since in ten years' time the population will have been enjoying annual increases in their consumption per head of 4 per cent — that is, the average level of consumption will have increased by 48 per cent at the end of the ten-year period. So, quite apart from being further away in time, the population in ten years' time will be considerably better off, and to that extent less deserving. Let us suppose that the weight to be given to future consumption is falling at 10 per cent per year (that is, to use a terminology mentioned earlier, the consumption rate of interest might be taken to be 10 per cent)[2]. Even if this is on the high side, it might be agreed to be the right order of magnitude. Let us see what it would imply.

Discounting at 10 per cent, the stream of consumption listed above would be worth 1.5 million dollars of consumption in the first year. That is,

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1. Thus $cn = 150{,}000$, $mn = 100{,}000$, $n(c - m) = 50{,}000$, $m/c = 2/3$, $\frac{c-m}{c} = 1/3$.

2. Thus, in this example, $D_t = D_{t-1}/1.1$; and $T = 11$.

it is 50 per cent better to invest than to consume[1]. Translating into terms of the shadow wage rate, we see that the wage bill of $ 150,000 represents a reduction in output of $ 100,000 and a net increase in consumption of $ 50,000 — consumption which, as we have just seen, has 2/3 of the value the same resources would have had if invested. Thus the social cost of the labour is $100{,}000 + 1/3 \times 50{,}000 = 116{,}666$ dollars[2]. So, in this case, we multiply the wage bill by a factor $\frac{116{,}666}{150{,}000}$, which is seven-ninths[3]. If the CRI had been 8 per cent, we should have found that a million dollars of investment was worth 1.77 million dollars of present consumption. This would have increased the accounting wage bill only from $ 117,000 to $ 122,000. Once again, this all depends on the assumption that the government cannot so arrange things that more industrial employment does not entail more consumption.

There is no point in multiplying examples. These two should have made clear what is involved in the shadow wage rate. A very exact analysis in any particular case could involve quite complicated mathematics, and troublesome decisions about the relative weight to be given to present and future consumption. We do not want to pretend that such issues can always be avoided. But it does seem to us that a useful decision about the shadow wage rate can be made without going into the problems too deeply. We shall first list the main considerations that affect it, and suggest how a fairly casual appreciation of these may allow a rough but useful estimation.

13.3 The Main Considerations

We begin with the most obvious influences :

13.31 *The Marginal Productivity of Labour*

We have measured the marginal productivity of labour by the AMPL, the marginal product in agriculture. It appears that the SWR has to be greater than, or, exceptionally, equal to the AMPL. This can be seen, say, from the formula $\text{SWR} = c - \frac{1}{s_o}(c - m) = m + (c - m)\left(1 - \frac{1}{s_o}\right)$. Furthermore, the greater is the marginal product, the greater is the shadow wage (other things being equal, of course) ; because then the consumption benefits provided by increased employment are smaller.

13.32 *The Consumption of the Wage Earner*

On our assumptions, which for the moment include the assumption that the size of industrial employment has no effect on the real wage rate, the SWR is not greater than c, the consumption at accounting prices of

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1. i.e., $s_o = 3/2$.
2. The shadow wage bill $= n \times \text{SWR} = nm + n(c - m)\left(1 - \frac{1}{s_o}\right)$
3. $\frac{\text{SWR}}{\text{Actual Wage}} = \frac{m}{c} + \frac{c - m}{c}\left(1 - \frac{1}{s_o}\right)$

the wage earner and his household. The greater is c, the greater is the SWR, since more consumption, though good, is not as good as more investment. The SWR is also greater, the faster the consumption of the wage earner is expected to increase. Not that c should necessarily be expected to increase. Sometimes it is too high, and reasonable government policies such as devaluation may be expected to reduce it in the near future.

13.33 *The Consumption Level in the Agricultural Sector*

One would usually neglect the rural consumption level as an influence on the shadow wage rate, but for completeness it should be mentioned. If, for given marginal productivity, and given wage earner's consumption, the rural consumption level is greater, the SWR should be less (though not usually by much) ; for then a greater part of the consumption benefits accrues to those in the agricultural sector rather than to industrial wage earners ; and in most countries, especially the developing countries, the latter group is significantly better off than the former. In other words, the more that the creation of employment does for the rural sector (indirectly), the better it is.

13.34 *The Returns to Industrial Investment*

It was apparent from both the examples we considered that the relative value of devoting resources to investment and to consumption — which is the main determinant of the shadow wage rate — depends on what exactly can be achieved by investment projects ; more precisely by what the economist calls ' marginal ' investment projects, those that would get undertaken if a little more investment was done. These projects provide both consumption and further investment as a result of the increase in available goods and services they bring about. Such a marginal project is more valuable, the more it produces per unit of investment cost, of course ; and more valuable, the greater the proportion of its (net) production which is not committed to consumption.

So we are the more anxious to avoid unnecessary commitment to consumption — by employing people — the higher are the returns available on investment. That is, the SWR is greater, the greater are the returns on investment. If we knew it, the accounting rate of interest should be a helpful indicator of these returns.

These then are the straightforward, obvious, influences on the level of the shadow wage rate. To tie everything together, we have to bring in the relative weight that we want to give to present and future consumption — that is, the CRI. These considerations lead us to the final two sets of influences.

13.35 *The Rate of Growth of Consumption Levels*

It is likely to be generally accepted that the provision of consumption in later years should be given less weight, the faster consumption levels are increasing. If future consumption is given less weight, investment projects with given performance are less valuable. Consequently, consumption today

is more valuable in comparison to investment (though not more valuable than investment). It follows that the shadow wage rate is less, the faster consumption levels are expected to increase.

The relevant consumption levels here are the consumption of the wage earner and the consumption of the agriculturalist, for it is they who are benefiting from the increased consumption associated with the project. It is quite possible that consumption per head in the country as a whole should be increasing without any increase in consumption per head *within* either of these groups, or indeed within any group ; for the increased consumption per head may simply represent a movement of individuals from one group to another. It is particularly noticeable in the developing countries that increased industrial employment tends to provide increased economic benefits largely by shifting some from relative poverty to relative comfort, rather than by spreading the consumption over the whole population. Not everyone jumps straight from agricultural unemployment to industrial employment, but one expects that the consumption of agriculturalists and wage earners, each taken as a separate class, will grow more slowly than overall consumption per head.

The lower growth rates are the ones that are relevant for our purposes. The social benefit of extra employment depends upon the consumption levels already achieved in the two groups, since it has the effect of moving people from one to the other[1]. The consumption rate of interest should be lower, the lower are these growth rates.

13.36 *The Time Until Investment is at the Desired Level*

It was clear from both the above examples that one must be able to guess how long it will be before the economy has reached a stage where the share of investment in the national product is adequate. The assessment of the relative value of consumption and investment today depends upon some such judgment. Initially, the government will probably feel unable to collect all the revenue it would like to collect, perhaps for political reasons, or because collection costs are too high, or because of serious adverse effects on the productivity of labour. As tax administration, industrial profits, and the political security of the government, improve, the economy moves towards a point where the government no longer wishes that it could raise more revenue. In taking this decision, the government would have to take into account the distorting effects of taxation : it is hard to tell how this would affect the value of investment in terms of consumption, but it is possible that s_T might be a little above 1 for this reason. However, the difference from 1 would be relatively unimportant, and may conveniently be neglected. We may say, in brief, that the year T is the first year in which the government might decide that some of the social profit accruing to it, after wages have been paid, should be used to increase the consumption of precisely those groups that benefit from additional employment.

In principle, T should be estimated by means of the same considerations that were used to compare the value of undertaking marginal investment projects with the benefits of consuming the resources instead. But the

1. This is also the reason why the gap between the two levels should not be greater than necessary. For a given increase in aggregate consumption, more people can move and hence benefit, the smaller is the gap.

details of such an analysis could, it may well be imagined, be rather complex. Fortunately, only a rough guess is required. At least we can say that T has to be greater, the more difficult it is currently to generate saving. In a developing country it may be difficult to generate saving for a number of reasons. It may be difficult, or unpopular, to tax agriculture, which is usually a large part of the economy ; it may be difficult, or politically unwise, to tax industry, or to generate large surpluses in the public sector. The more pressing and serious these problems seem, the further away must be the date at which the government can hope to feel content with the level of investment that has been achieved. Foreign aid can ease these problems considerably, since it acts as a substitute for domestic saving.

The limiting case is, of course, when the government either already considers savings and investment to be high enough, or specifically does not wish to use project selection to assist in raising the rate.

The precise role that is played by the date when investment is at the desired level was made clear in the second example given above. A careful consideration of that example will show that the value of investment now is greater, the further away is that date. This is indeed common sense. If the date in question is far away, investment will continue to be more valuable than consumption for a long time, and the value of an investment project with given physical performance will therefore be greater than it would have been if, quite soon, the part of its production available for investment was no more valuable than the part committed to consumption. It follows that the shadow wage rate is greater, the more distant is the date when investment is expected to be satisfactory. Roughly speaking, the shadow wage rate is greater, the less developed is the country. In particular, it is greater, the less foreign assistance the country is receiving.

13.4 How to Quantify the Shadow Wage Rate

13.41 *A reasonable guess*

In the light of the above, let us consider how much disagreement we might expect about the level of the shadow wage rate. It certainly lies between the marginal productivity of labour in agriculture on the one hand, and the consumption of a wage earner and his family on the other. If these two are close together, there is no need for further discussion ; one or the other, or the average of the two, will do quite well. To a useful approximation, this was the situation in our second example. It should be remembered that the price level is often higher in urban areas than in rural areas, so that apparent differences in income levels between rural and urban workers are often rather less than they appear.

If, on the other hand, the marginal productivity of labour in agriculture is reckoned to be rather low, in comparison with the consumption of urban workers, one has to bring in the other considerations listed. If, as in the first example, growth is expected to be slow — growth in consumption levels, that is, rather than overall growth —, if the returns on industrial investment are quite high, and if investment is not expected to be at a satisfactory level for some decades yet, then there will not be much room for dispute that the shadow wage rate should be closer to c than to m. Whether it is put equal to $3\,c/4$ or $7\,c/8$ may not be of great practical importance.

Intermediate cases are more troubling, of course. If a country is really backward, returns on investment projects might be low (if they are too low, the country will do better to invest abroad), and yet lavish foreign aid might make the prospects for growth in consumption levels rather promising. There are indeed countries with a fairly high level of foreign aid, where profits are not ploughed back into investment at a very high rate, but where the level of development is sufficiently advanced to allow the prospect of a respectable rate of growth of consumption levels, at least in the near future. In such cases, the SWR might be quite close to the AMPL. Only in very extreme cases should a SWR equal to the AMPL be considered (for industrial projects, that is), but it could easily be as low as $m+1/4\ (c-m)$. If one does not want to get involved in tendentious and sophisticated arguments about the exact weight to be given to the different considerations, one could be content with a guess at the appropriate level, based on a judgment of the extent to which the different considerations pull together, or tend to cancel one another out. In a completely obscure situation, the average of c and m might be used.

13.42 *A useful formula*

An accurate estimate of the shadow wage rate presupposes an accurate estimate of the value of new investment, which in turn requires knowledge of the projects that are available, and of the ARI that discriminates between those that the economy has sufficient resources to undertake and those that it has not. But the ARI itself depends upon the SWR ; for the greater is the SWR, the smaller is the ARI required to give a zero PSV to the marginal projects. In theory, the two therefore have to be determined simultaneously ; which, in practice, would be a great nuisance. It thus seems best to make an initial estimate of the SWR, since this does not depend very sensitively on the assumptions made in order to calculate it. In particular, it does not seem to depend very sensitively on the ARI. No doubt, if the actual ARI turned out to be wildly inconsistent with the assumptions made when estimating the SWR, that initial estimate would have to be revised ; but we suspect that this will not usually happen. The precise relationship between the ARI and the SWR is explained in the Appendix to the Chapter. In this section, we show how an estimate of the SWR may be derived on the basis of crude assumptions about the investment prospects of the economy.

Let us suppose that there is a marginal project available that has a rate of reinvestment r (this is the return on the project that is not committed to consumption), and employs n men per unit of investment cost. Suppose also that in later years similar projects are available, with reinvestment rate r, and consumption commitment $(c-m)\,n$. (This allows the possibility that increased efficiency in the use of labour reduces labour requirements at a rate that just balances the rate of increase of $c-m$. Since we shall be looking forward over rather a long period, T, this convenient simplification may not be too misleading). We discuss how suitable r and n may be estimated in section 13.93 below.

We also assume that the CRI, i, is constant : this is not a very good assumption, but we can think of i as the average CRI over the next T

years. Then, using the same arguments as in the second example above[1], we find that, approximately,

$$s_o = \left(\frac{1+r}{1+i}\right)^T \left(\frac{(c-m)\,n}{r-i} + 1\right) - \frac{(c-m)\,n}{r-i}$$

Then, using the formula,

$$\text{SWR} = c - \frac{1}{s_o}(c-m)$$

we can estimate the shadow wage rate.

A typical calculation will demonstrate the use of this formula. Let us take a case where the industrial sector is already fairly large, but the marginal productivity of labour is still reckoned to be low, at any rate in relation to c. The rate of reinvestment is fairly low, but wages are high :

$m/c = 0.25.$

$r = 0.05$ (i.e. 5 per cent per year).

$nc = 0.25$ (Consumption out of the wage bill is five times the saving generated.)

$T = 20$ (Two decades until consumption and investment are equally desirable.)

$g = 0.02$ (Consumption levels are growing at 2 per cent per year within the two consumer groups we are primarily interested in.)

We still have to decide about i, the CRI. It should depend upon the growth rate g : a plausible figure would be twice the growth rate, but higher and lower figures are certainly possible[2]. We shall take $i = 4$ per cent in the present example. Using these figures, we calculate that $\frac{\text{SWR}}{c} = 0.86$

It will be noticed that the shadow wage rate again comes out high. This is no coincidence. The formula usually gives high values for the SWR

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1. We begin with a unit of investment, which we may think of as being concentrated at the midpoint of a year. It begins to produce at once, and continues to do so for T years. During that time, the amount invested grows at a rate r per year. At the end of the T years, this accumulated capital is just as valuable as the same amount of consumption. Discounting to the midpoint of the first year, the final capital is worth

$$\left(\frac{1+r}{1+i}\right)^T.$$

The total of the consumption provided during the first twelve months of production should, properly, be discounted back six months to the date at which the investment is undertaken, but this is an unnecessary refinement. Ignoring the six months' discount for this and later years, the present value of all this consumption is, in terms of the initial year's consumption,

$$(c-m)\,n\left[1 + \frac{1+r}{1+i} + \left(\frac{1+r}{1+i}\right)^2 + \ldots + \left(\frac{1+r}{1+i}\right)^{T-1}\right]$$

This geometric progression can be summed, to give

$$\frac{(c-m)\,n}{r-i}\left[\left(\frac{1+r}{1+i}\right)^T - 1\right].$$

Combining this with the expression for the present value of the final capital, we obtain the formula given in the text.

2. The estimation of all these variables is discussed in 13.9 below.

if T is at all large. If $T = 0$, which implies either that savings are already high enough, or that the government does not wish to use project selection to help raise savings, then the formula reduces to $SWR = m$, which is as it should be. But if these conditions do not hold true, then T does not need to be very large for the SWR to approach quite close to c, even when m/c is small. Suppose, for instance, that $m/c = 1/4$, as in the above example : rather a low figure. If the government expects that it will take at least 10 years before savings are as high as desirable, which is quite a short time for a country as poor as is suggested by $m/c = 1/4$, then a SWR of about 3 $c/4$ would be consistent with a figure for initial consumption generated per unit of investment (cn) of about 1/4 — a plausible order of magnitude.

One would want to use a lower figure than $3c/4$ if (a) T is quite small — the economy is nearing a position in which planners will be satisfied with the rate of investment, and (b) the marginal productivity of labour is still considerably less than the urban wage rate. But even in these cases, there is an argument that may tell the other way, one that until now we have neglected so as to avoid thinking about too many problems at once. We deal with this last point in the next section.

Finally, we should remark that our crude calculation also gives an estimate of the ARI. To a reasonable approximation, it implies a current ARI,

$$R = r + \frac{1}{s_o}(c - m)\, n\ ;$$

i.e. the sum of reinvestible social profit per unit of investment and social profit consumed per unit of investment. This value would have to be compared with the value of R found in practice, when the SWR is revised. Any large difference would indicate that the values of r and n had been ill-chosen, and do not represent a marginal project in fact.

13.5 The Effect of Increasing Employment on the Wage Rate

In 13.1 above, when discussing the various consequences of increasing employment, we included, as the final point in our list, the possibility that wage rates may rise as a consequence of the increased demand for labour. It is, of course, possible that industrial wage rates, and the consumption they allow, will rise over time for reasons that have little or nothing to do with the demand for labour by industry. Changes in government legislation, in the strength of trade unions, acting either directly or through political action, may push up wage rates quite substantially : the mere fact that wages are known to be rising is not clear evidence that they are rising *because* the demand for labour is increasing[1]. But a time is sure to come when the increasing demand for labour will bring about increases in wage rates, either as a result of undertakings competing against one another for labour that is becoming increasingly reluctant to leave the agricultural sector, or because a larger labour force strengthens the bargaining power of labour.

1. In fact, real wages seem to have remained fairly constant in many developing countries.

If wages have to rise when labour demand increases — if, say, a 1 per cent increase in the requirements of labour by industry increases the wage rate that has to be paid by 1/2 per cent — the effect is that an increase in employment, as a result of establishing a particular project, not only leads to increased consumption by those who get the new jobs; it also commits the economy to allowing *all* wage earners increased consumption. On the particular numerical assumption just mentioned, consumption will increase by 50 per cent more than c. This increased commitment to consumption involves, of course, a cost. There may be some reduction in consumption out of profits, since profits are reduced by the increase in wages. But one must expect, under these circumstances, a substantially lower investible surplus than would be guessed by looking only at the direct effects.

It is hard to see how to estimate these indirect effects until there is considerable experience of the relationship between employment and wage rates (that is, real wages — changes in money wages have to be compared with changes in prices). Probably, it need never be a *very* important consideration. For, once a country has reached a stage in its development at which wage rates and industrial employment are mutually related, it is likely to be able, if it chooses, to moderate the effect of increased industrial employment on consumption by using the tax system appropriately. Yet, increases in industrial employment may have some effect upon the real wages of industrial workers, and therefore upon their consumption; since this is, relatively speaking, undesirable, it provides another reason for somewhat discouraging the use of unskilled labour by keeping the shadow wage rate sufficiently high.

The general conclusion to be drawn is that countries should avoid assuming that the shadow wage rate is low. The arguments of the present section reinforce the arguments of the last.

13.6 Changes in the Shadow Wage Rate

The methods explained above allow us to estimate the shadow wage rate as a proportion of c, the wage earner's consumption. The same methods can, in principle, be used to estimate future shadow wage rates — which are needed in order to evaluate future social profits. But it would be intolerable to have to perform the same kind of calculation, along with associated estimations of the marginal productivity of labour in agriculture, the consumption of industrial wage earners, returns on marginal investment projects, and so on. It saves a lot of trouble, if one can justifiably assume that the ratio of the SWR to wage earner's consumption at accounting prices, which we shall now denote by k, is not likely to vary very much. There is some reason to think that this will be true in many developing economies.

As the date approaches when investment is expected to be at a satisfactory level, k will fall for that reason, since marginal investment projects become less valuable in comparison to the consumption they displace. On the other hand, a rising marginal productivity of labour in agriculture is a reason for increasing k; and so is a rising level of consumption among industrial wage earners. In most countries, these would be expected. Thus, k is pulled in different directions by different influences, and is really as likely to rise as to fall. If the planners assume that it will

be roughly constant, they are not likely to be far wrong, although it cannot be denied that there might be a trend.

Therefore, to guard against possible distortions in investment decisions, it is probably wise to use an estimate for k that is based on estimates of the state of the economy in about five years' time : this would give something like the average value of k during the period that is of most importance in investment appraisal. One should not allow temporary crises and other exceptional circumstances to affect one's estimates of such a planning parameter as k.

13.7 The Shadow Wage Rate and the Promotion of Industry

We have argued that quite often the SWR will be close to c. But c is measured in terms of world prices, and is in any case lower than the wage rate actually paid to urban workers by the amount of direct taxes. So the ratio of c to social income of the firm (i.e. its outputs less non-labour inputs, valued at accounting prices) may be less than the ratio of the actual wage rate to the actual income of the firm (net of material inputs). The SWR will be less again. Thus, although we are not suggesting a SWR so low as to encourage radically labour-intensive methods of production, we *are* recommending a system of evaluation which gives greater encouragement to employment than do market prices and actual wages.

If the prices of the material inputs and outputs of industry were raised by some means, the extra encouragement to employ more labour would be provided automatically, so long as wage rates did not increase as well. Now, in Chapter VI, it was pointed out that a lower exchange rate for industry, or a system of tariffs-cum-export-subsidies, was quite a good substitute for a subsidized wage rate. Such arrangements put up the prices of industrial products by more than they put up the prices of the commodities that wage earners buy, and therefore allow the kind of situation we want. Insofar as industry uses agricultural products which remain at the previous lower prices, the scheme is not perfect ; but it could go a long way towards providing the desired incentives to private industry. It should be remembered that such a scheme may increase the value of consumption out of profits, and therefore to some extent cancel out the more obvious benefits. But so long as consumption out of profits is not important, this does not matter.

It is also possible that a system of dual exchange rates would have the effect of reducing c, the value of wage earners' consumption measured in accounting prices, because wage earners may be more sensitive to the prices of agricultural commodities than to the prices of industrial commodities. However, this is not certain and it would be unwise to place too much reliance on consequences of this kind.

13.8 Higher-Paid Workers

Until now, we have spoken as though all workers earned the same income. In fact, of course, many workers earn substantially more than the normal wage rate. Such a one has a higher c, but, we may suppose, had the same marginal productivity in his previous occupation. (We exclude here the more highly qualified labour discussed in the previous Chapter.)

The loss in savings, due to this consumption, is the consumption of the worker, c. The benefit from the increased consumption consists, as before,

of two parts : the improved situation in the rural sector, and the gains from the increased consumption of the worker himself and his household. The extent of the improvement in the standard of living in the rural sector will be about the same as in the case of a lower-wage worker ; but the worker himself gets a larger increase in his standard of living. Taking the two together, one can be fairly sure that the benefits are not proportional to c : a 5 per cent higher c might go with 2 or 3 per cent higher consumption benefits. Consequently, the shadow wage rate for such a worker should be a somewhat higher proportion of his consumption when that consumption is higher.

If k is close to 1, these considerations can be ignored : the same k should be applied to all labour costs. If k is lower — say around one half — some more satisfactory rule of thumb might be wanted. Assuming that a 10 per cent increase in the consumption of a wage earner brings about a 5 per cent increase in the value of the resulting consumption benefits, we should say that a worker whose consumption, c', is larger than c, the normal consumption of a worker, costs the economy

$$c' - \frac{1}{s_o}(c - m + (c' - c)).$$

Such refinements are not likely to be of great importance. Unless the other elements in the project analysis are being done with unusual thoroughness, it should be perfectly satisfactory to treat labour costs as though all workers earned the average wage rate. After all, the considerations outlined in this section will tend to balance out, comparing low-paid workers with higher-paid workers.

13.9 Estimating the Relevant Variables

13.91 *The marginal productivity of labour in agriculture : m*

Ideally, to estimate m it would be necessary to obtain a great deal of information about the agricultural sector — comparing production on a great many different fields in order to discover how much extra production one gets, on average, if one more man is employed. Unfortunately, so much data about individual plots would be required to get a good estimate of marginal productivity in this way that few countries can adopt such a direct method. The trouble is that agricultural production tends to vary so much from plot to plot, according to particular land and weather conditions, the skill of the workers, and the farmer or managers, that one needs a very large number of observations before one can average out these differences. The problem is made yet more difficult because it is hard to get accurate information about the quantity of produce and the number of hours worked. In any case, there are large differences from one region of a country to another.

If one cannot estimate the marginal productivity directly, what can one do ? One always has some relevant information. For a start, most countries have estimates of total agricultural production, and of the agricultural labour force. They may not be very accurate, but they will be accurate enough for our purposes. From them, one can at once deduce the *average* productivity of labour : the amount produced per man employed. (We ought to value the production in terms of accounting prices — this may

be quite easy if agricultural products are imported and exported without tax or subsidy.) Now the loss in production if one man goes away must surely be less than the average production per man ; those who remain can work more intensively, and share the work out differently ; and there is more of other inputs such as fertilizers for each remaining worker. So the average productivity is greater than the marginal productivity. Since it is probably a lot larger, this does not at first sight seem very helpful ; but in many countries the average productivity in agriculture is rather low, so that this figure is nevertheless quite a help. If nothing else is possible, one can take half the average productivity as a measure of the marginal productivity, and one may not go far wrong by so doing.

But usually one can do a little better than that. Statistics may be available on the wages received by agricultural labour. During harvest time, and whenever there is an unusually large demand, different farmers may be competing for labour, bidding the wage up against one another, so that it gets close to the maximum amount a farmer would be willing to pay — which is the value of the extra output the man can produce. So, at these times, it may not be unreasonable — especially in the absence of any other information — to take the wage rate as a measure of the marginal productivity of a man-day of labour. (One has to include in the wage any payments in kind, including meals provided and the like — so one cannot just use the published statistics without thought.)

At other times of the year, there may be many men who would like jobs. If this is true — and it is as well to be on one's guard against accepting the appearance of unwilling idleness for the reality, since a man may be idle because he chooses to be idle given the current wage rate, or because he is too ill-fed to be able to work — we may take the marginal productivity of labour at such times to be zero.

Armed with the above information, the next step is to estimate the number of days in the year on which labour in the agricultural sector is more or less fully employed. Having found out what the effective wage rate is on these days, one then multiplies the number of days by the wage rate to obtain an estimate of the marginal productivity of a man-year in agriculture. This calculation can be performed with varying degrees of sophistication. If one is in a hurry, one can do a quick sum in one's head, on the basis of hearsay and general impression ; or better, given the time, one can study data from the agricultural ministry rather carefully, or even conduct extensive surveys. It is a question of common sense how far such sophistication should be carried, bearing in mind that the argument behind the estimate is, anyway, rather crude.

The above account neglects many complications. Agricultural wage rates seem, quite often, to vary considerably from place to place ; different kinds of agricultural labour are paid for at quite different rates ; large plantations pay different rates from peasant farmers (perhaps to obtain better labour) ; convention and bargaining power affect the actual rates paid. But there is seldom better information available, and this method should give estimates that are accurate enough for the purpose.

13.92 *Consumption levels : c*

It is rather easier to estimate c than m, though, in some countries, most of the relevant data may be lacking. One proceeds in three steps :

1. First, wage rates paid in the relevant industry are estimated. It will be remembered, from an earlier section, that we want to estimate the probable level of real wages in about five years' time. To do that, the recent history of wage rates, and the prices of goods purchased by wage earners, may be examined. On the basis of these statistics, an intelligent guess at future real wage rates can be made.
2. Secondly, the proportion of the wage that is spent on consumer goods should be estimated. First, any income tax, compulsory saving, and social insurance, should be subtracted (but at the same time one ought to add back the average payment made to workers on account of accidents, etc., covered by insurance schemes). Then it may be possible to estimate the average proportion of his income that a wage earner is likely to save — that is, what he does not immediately spend on consumption. It must be remembered in this connection that workers may save in order to spend more only a little later ; so that while some are saving at any one time others are dissaving. Since the amount of a wage earner's saving will seldom be at all large, there is no point in spending much effort on making accurate estimates here ; and if one knows nothing about saving behaviour, one may perhaps forget about the whole thing, and assume that the workers' whole disposable income is spent on consumption.
3. Thirdly, having obtained an estimate of the wage earner's consumption, it must be revalued in terms of accounting prices instead of in terms of current actual prices. This can be done by doing a detailed analysis of the average wage earner's consumption budget. (In a number of developing countries, sample surveys have been carried out which show how much of his expenditure a wage earner and his family devote to the various categories of consumer goods.) One would then use known accounting prices to evaluate his expenditure on each of the main categories of consumer goods. Alternatively, the standard conversion factor (see 12.5 above) can be applied to the estimate of his total consumption expenditure, perhaps adjusting it a little to allow for obvious differences between the wage earner's budget and the usual pattern of industrial inputs.

The estimate of c and hence k might in principle vary from project to project according to the conditions in the particular industry or town. It might also vary from region to region, and one might want to encourage projects in a relatively backward region of the economy, to provide a lot of employment, while discouraging employment in other regions. But if this is not the case, little harm could result from applying a single estimate to all industrial projects.

13.93 *The marginal project : r and n*

It is rather harder to estimate r and n. But, since one can make a rough estimate of the shadow wage rate without knowing more than that r is fairly large[1], a country that can get no reliable information about r need not despair : it can forget about the problem. The suggestions we now

1. i.e., substantially larger than $i - (c - m)n$.

make about the estimation of r and n are intended for countries that are fairly well endowed with data about industry.

There are two possible sources for the information needed. First, planners may have assessments available of a number of existing projects, some of which are, or were, marginal from the government's point of view. If the data on one such project is put together in the manner required for project evaluation — that is, the inputs and outputs are evaluated at accounting prices, the unskilled labour input is specified separately, and c is estimated — it can be roughly summarized by saying that it is equivalent to a project with a constant rate of reinvestment and a constant wage bill. Sometimes, the project itself will have a very long life, and both wage bill and investible profit will be fairly constant. If not, approximately equivalent figures can be derived. This can be done well enough by taking some rate of interest (it ought to be about the level we expect the accounting rate of interest to be), discounting investible returns and wages separately to obtain their ' present values ', then converting them to equivalent annual rates by using this rate of interest. Explicitly, if the project generates savings S_1, S_2, S_3, ... in successive years, this is equivalent to a constant annual rate of saving generated equal to

$$R \cdot \left[S_1 + \frac{1}{1+R} S_2 + \frac{1}{(1+R)^2} S_3 + \ldots \right],$$

where R is the interest rate being used. One does just the same with the wage bills.

One can also get a useful impression of the rate of reinvestment from a census or survey of manufacturing industry, or from statistics about particular public sector industries. A census of manufacturing industry lists, for each industry, the value of output, and the value of the main inputs, including labour. It will usually include figures for depreciation also — calculated by accountant's methods of course — and for the book value of capital in the industry. All of these figures are obtained using market prices, which may not be the same as accounting prices. However, enough has been said above, about the way in which project data can be converted to accounting price terms, to show what can be done with census data. In the case of the capital stock, part will be machinery, part buildings, and part stocks and work in progress. Machinery is often imported duty free, and will therefore already be in accounting price terms. The value of buildings will have to be converted to accounting prices by using the construction conversion factor. Common sense will show what should be done with stocks (an important item).

After suitable adjustment, this data can be used to prepare approximate estimates of the rate of reinvestment r, and the employment-capital ratio n, for all industries covered. The allowance for consumption out of profits can only be rather rough ; but essentially the procedure is exactly the same as is used when evaluating a project (though the information may be less detailed in a census). An estimate of the rate of reinvestment can be obtained by subtracting from the estimate of gross social profit, the listed estimate of depreciation (adjusted like the figure for capital), then dividing by the adjusted value of capital. The use of these book values of capital and depreciation is not by any means satisfactory, but no alternative method is any better using this data.

In using calculations of this kind to estimate r and n, it is as well to remember that some industrial investment in the past has been unlucky, or even unwise. In some sectors, the rate of investible return may well be negative. While evidence of this kind has an obvious significance for future investment planning, it should not be taken to show that the rate of reinvestment on marginal projects is actually negative. An average of results in different industries may be thought to iron out the uncertainties of past investments quite satisfactorily. At a time when careful investment planning is just beginning, such an average may well underestimate the r on marginal projects, since it may give too much weight to unsatisfactory investment in the past. But planners will usually find that they can use such estimates to make a sensible prediction for the future.

13.94 *The consumption rate of interest : i*

The consumption rate of interest tells us the rate at which the weight to be given to the extra consumption provided through industrial employment is expected to change through time. There are three elements to be considered :

1. *Impatience.* The government may want to give future consumption a smaller weight merely because it is in the future, regardless of the standard of living of those who receive the extra consumption. It is often argued that this is hard to defend, and we have some sympathy with that view. In any case, it would probably not mean an addition to i of more than 2 or 3 per cent per annum.
2. *The growth of wage earners' consumption.* As c rises — if it rises — each $ 1,000 of additional consumption is spread over fewer people : even although each gets more, the total benefit from the additional consumption is somewhat reduced. But the benefit of the additional consumption falls more slowly than the growth rate of c. This element in the estimate could be put at anything between half and three-quarters of the growth rate of c.
3. *The growth of rural consumption levels.* As agriculturalists get better off, the weight to be given to increases in their consumption falls. It is a reasonable rule of thumb to take the rate at which the weight falls to be proportional to the rate of growth of their consumption per head : perhaps two or three times that rate of growth. There is no question that this is a difficult proportion to decide. A little more is said on the question in the theoretical Appendix to this Volume. But, sometimes, the estimate of the SWR will not depend very much on this decision.

The last two elements in the calculation are based on observable growth rates. Estimating growth rates of the various components of national income is nowadays a normal activity of most governments, so that there should be no trouble about obtaining an estimate, at least for the expected growth of overall output, and possibly for the rate of growth of consumption as well.

We should emphasize again, though, that the relevant rates of growth will be lower than the rate of growth for aggregate consumption. The estimates used must be consistent with the rate at which population is expected to move from rural to urban areas. Suppose, to take an imaginary

example, it is expected that aggregate consumption will be growing at 5 per cent per annum, and population will be growing at 3 per cent per annum, so that aggregate consumption per head will be growing at 2 per cent per annum. Suppose, further, that 10 per cent of the labour force is employed in the 'modern' sector, industry, government, etc., at wages three times the level ruling in the rest of the economy; and that employment in this sector is expected to grow at 10 per cent, and the wage rate at 2 per cent, per annum. On these assumptions, the following figures can be computed:

	YEAR 1			YEAR 2			PERCENTAGE INCREASE		
	MODERN SECTOR	TRADITIONAL SECTOR	TOTAL	MODERN SECTOR	TRADITIONAL SECTOR	TOTAL	MODERN SECTOR	TRADITIONAL SECTOR	TOTAL
Consumption	25	75	100	28	77	105	12.00	2.67	5.00
Employment	10	90	100	11	92	103	10.00	2.22	3.00
Consumption/ Employment	2.500	0.833	1.000	2.545	0.837	1.020	1.80	0.48	2.00

Thus, although overall consumption per head has grown by 2 per cent, that in the traditional sector has risen by less than 1/2 per cent, and that in the modern sector by 1.8 per cent. Alternative figures would show that a 2 per cent overall growth rate is consistent with a rise of less than 1 per cent in each sector.

If we estimate the CRI as the sum of two thirds of the growth rate of c, and thrice the growth rate of a, we obtain $i = 1.2 + 1.4 = 2.6$ per cent. Even with an 'impatience' addition of around 2 1/2 per cent, we would have $i = 5$ per cent.

13.95 *The time during which investment is too small*

As we have seen, a good estimate of the shadow wage rate depends upon a reasonably accurate prediction of the time during which, in the view of the government, extra investment will be more valuable than extra consumption. But how to make such a prediction? One can ask: when does the government intend to take no further action to increase the share of investment in the national product? One can ask: when does the government expect to have a tax system flexible enough to provide it with all the tax revenue it wants? (The second question is not so satisfactory, since, as we have seen, the government may have purely political reasons for limiting the amount of tax revenue.) One can ask, putting the first question a little more specifically: what proportion of the national product would the government like to be able to invest, and how long can we expect it to be before that proportion is in fact being invested? Thinking about questions like these is probably the most fruitful way of estimating T.

13.10 Summary

Much of what we have said in this Chapter has suggested that the developing countries can safely assume that the shadow wage rate is quite high, not far below the consumption level of the workers on the project.

This simple answer to the very complicated question — how large should the shadow wage rate be ? — is most important, and allows project planners to use methods of cost-benefit analysis without necessarily having to enter into a complicated analysis of the shadow wage rate. We have, however, tried to indicate how a more complete analysis could be carried out. We have suggested a fairly simple formula for the shadow wage rate, which, though based on crude assumptions, takes account of the main relevant considerations in a quantifiable manner. We then went on to outline the methods that can be used to estimate the various numbers that are required when carrying out a reasonably accurate estimate of shadow wage rates. We have not gone deeply into the more difficult issues in the economic theory of ' optimum growth ', which would have to be discussed in a thorough treatment. The more rough and ready methods outlined can, in any case, achieve a great deal.

Appendix to Chapter XIII

THE SHADOW WAGE RATE, AND THE ACCOUNTING RATE OF INTEREST

The accounting rate of interest — or, more precisely, the accounting rates of interest discount the social profits of a marginal project to zero: that is, they discriminate the desirable from the undesirable projects. The ARI therefore gives information on the nature of marginal projects. We discount social profits in year t by multiplying them by the factor

$$A_t = \frac{1}{(1 + R_1)(1 + R_2) \ldots (1 + R_{t-1})} \qquad (A_1 = 1) \quad (1)$$

where R_1 is the ARI between now and next year, R_2 the ARI between next year and the following year, and so on. We emphasize that R_t need not be constant; indeed, we expect the ARI to fall eventually (perhaps after an initial rise as the economy becomes more efficient, both in production and taxation).

Suppose there is a marginal project that involves doing one unit of investment in year t, and getting additional output, all available for investment, of x in year $t + 1$. No doubt such projects are hard to find, but we can imagine changing investment plans generally, doing a little more or a little less of various marginal projects, so that the final result is one more unit of investment done in year t, and x more units of investible funds available in year $t + 1$. Because of the definition of A_t and A_{t+1}, it must be true that

$$A_t = A_{t+1}\, x. \qquad (2)$$

Let one unit of investment in year t be worth to society the same as s_t units of consumption in that year. Recollecting the definition of the consumption rate of interest, and the corresponding discount factor D_t, which expresses the weight given to consumption in year t, we see that the benefit of the marginal project is $D_{t+1}\, s_{t+1}\, x$, and its cost to society $D_t s_t$. Since it is marginal, the costs and benefits of the project must just balance. So

$$D_t s_t = D_{t+1}\, s_{t+1}\, x. \qquad (3)$$

Comparing the two equations with x in them, (2) and (3), we conclude that

$$A_{t+1}/A_t = (D_{t+1}/D_t)\,(s_{t+1}/s_t). \qquad (4)$$

Now $A_{t+1}/A_t = 1/(1 + R_t)$ and $D_{t+1}/D_t = 1/(1 + i_t)$. Equation (4) can therefore be written:

$$s_t/s_{t+1} = (1 + R_t)/(1 + i_t). \qquad (5)$$

This shows that the value of investment, as compared with consumption, is falling so long as the ARI is above the CRI. If the two should be

equal, the value of investment in terms of consumption remains constant. In particular when, in the long run (i.e. once T years have passed), s_t remains constant at approximately one, R_t and i_t are, and remain, equal: this is a necessary condition for the relative magnitude of consumption and investment to be perfectly satisfactory.

We can deduce from (5) a formula for s_1:

$$s_1 = \frac{(1 + R_1)(1 + R_2) \ldots (1 + R_T)}{(1 + i_1)(1 + i_2) \ldots (1 + i_T)} = D_{T+1}/A_{T+1}. \quad (6)$$

s_1 and s_0 are near enough the same for all practical purposes. Equation (6), therefore, gives us the relationship between the SWR, the ARI, and the CRI. It makes clear that one requires estimates not only of current but also of future interest rates if one is to use them to estimate the SWR. But at least we know that R_t and i_t will eventually be equal: in particular, $R_{T+1} = i_{T+1}$. We may be prepared to assume that the difference between R and i decreases steadily from now until T years from now. In that case, we have approximately

$$s_1 = (1 + \frac{1}{2}(R_1 - i_1))^T \quad (7)$$

Estimates of the SWR have to be revised periodically. As experience with cost-benefit methods accumulates, it will become possible to predict future ARIs with some degree of confidence. Equation (7) might then be a helpful adjunct to the more direct, but more aprioristic, methods of calculation explained in the body of the Chapter. At any rate, it provides the kind of check on the relationship between the different accounting prices used in project evaluation that is particularly helpful as an overall check on the particular estimates being used.

Chapter XIV

THE ACCOUNTING RATE OF INTEREST, AND THE ORGANIZATION OF INVESTMENT APPRAISAL

The accounting price that, above all, holds the different sectors of the economy together, ensuring that the balance of benefits and costs in one project is properly compared with the balance of benefits and costs in all alternative projects, is the ARI — the accounting rate of interest. Setting the ARI is very much a job for the central government, whose responsibility is that the resources available for investment should be properly allocated. The question whether one ought to set investment budgets for the main sectors of the economy is closely related to the estimation of the ARI : we shall discuss this question too.

14.1 The Function of the Rate of Interest

The rates of interest allow us to *weight* the annual estimates of social profit generated by a project. We know it is better to have social profits earlier rather than later. To allow for that, the social profit provided by a project in year t — call it P_t — is multiplied by a *discount factor* R_t, equal to that fraction of a rupee which society would be willing to pay today for the certain prospect of one rupee in t years' time. If r_1 is the rate of interest between now and next year, r_2 the rate of interest between next year and the year after, and so on, R_t is given by the formula

$$R_t = \frac{1}{(1 + r_1)(1 + r_2) \ldots (1 + r_{t-1})}$$

If the accounting rate of interest is constant, that implies discounting every year's social profits back to the previous year at the same rate, so that

$$R_t = \frac{1}{(1 + r)^{t-1}}$$

The ARIs are supposed to be high enough to ensure that project planners do not want to undertake more projects in total than can be financed by the available resources ; and low enough to encourage them to use the available resources to the full. There is therefore no particular reason to expect that the ARI will be constant from year to year. But, as remarked in 8.6, it is very convenient to assume that the ARI will be *approximately* constant. For then the central government need suggest only

a single number — the ARI — to the various departments and undertakings in the economy. The calculation of PSVs is then more straightforward, and it is relatively easy to tell, after the event, whether the announced ARI has been too small or too large. If one had to worry about predicting a different interest rate for every year in the future, it would be very difficult to decide which of them to change if too much or too little investment resulted.

Even so, it is not altogether impracticable to attempt to estimate different ARIs for different years. Econometricians could develop growth models that would enable such estimates to be made ; and no doubt they will do so. One can easily imagine circumstances that would justify planners in using higher rates of interest for some years than for others. Any special emergency would suggest measures of this kind. If there was a bad harvest, a sudden but probably temporary deterioration in the terms of trade, or a temporary reduction in the level of foreign assistance, it would most probably be necessary for the economy to reconcile itself to a lower than normal rate of investment for a year or two. Consequently, producers would need to be prevented from undertaking too much investment. The fact that the prospective demands for the products of many industries would be less than expected might reduce investment in any case : but probably more discouragement would be required, involving the postponement or abandonment of some projects.

But, if the emergency were known to be temporary, rates of interest appropriate to the more distant future need not be raised. Ideally, the ARIs for a year or two would be set high — r_1 and r_2, perhaps — but the later ARIs kept at a normal level. This kind of short-term action should, if the system of project evaluation is working effectively, have the effect of postponing many projects — which is exactly the effect that is wanted. If all ARIs were raised, the result would be a general discouragement to investment projects, both those that would pay off quickly and those with long gestation lags and productive lives. That is not satisfactory, since quick-yielding projects should be encouraged in a period of emergency, and slower-yielding ones postponed until the economy has more investible resources available.

The converse case also arises, when the economy is enjoying a particularly high level of foreign assistance and hence investment, which is expected to continue for a number of years, but is certainly not a permanent and reliable gift. In that case, the ARI over the next few years might be quite low, whereas more distant social profits might be discounted much more sharply. Indeed, a steady improvement in the efficiency with which investible resources are likely to be used would in itself be a reason for a steadily increasing ARI, so as to get the available investible resources used now, but without committing the economy to long-lived inefficient equipment that would still be in use when the economy was actually in a position to use more sophisticated techniques.

We do not think that ARIs would have to vary very substantially over time, however : indeed, any over-vigorous attempt to use interest rates to achieve the kinds of more complex policies sketched above might lead to worse results than reliance on the simple method of setting one interest rate, and asking project planners to use it to calculate PSVs until such time as the central planners suggest a different rate. Simple methods are always to be preferred unless there are clear and substantial gains to

be had from a more subtle technique. It is best that those responsible for project analysis should first learn their trade using a single ARI, which can be changed from time to time as the planners find reason to do so.

14.2 The Initial Estimate of the Rate of Interest

If possible, one should base an initial guess at the ARI on some knowledge of the projects available to the economy. This might become available in various ways :

1. If indirect taxes have a fairly uniform effect, with little discrimination between imported and exported commodities, and if the SWR is close to the wage rate (adjusted to accounting-price terms), the rate of return currently being earned in the economy should be quite a good guide to the accounting rate of interest. The rate of return might be estimated from company accounts, or from industrial surveys, or by asking business men. But in most developing countries, this would hardly be a sufficiently good estimate.

2. Some information about projects that have been accepted in the past will be available to the planners. They could go back over some of the more recent project reports, calculating rough estimates of the social profits resulting (using accounting prices, that is), and deducing the ARI that would have made these previously accepted projects just worth while in terms of a social cost-benefit calculation. In fact, some of these previously accepted or adopted projects will be obviously unsatisfactory when looked at in the light of accounting prices. Common sense should allow the planners to ignore the more unsatisfactory of their previous decisions, and allow them to gain a rough idea of the probable level of the ARI from these trial calculations.

3. Information from industrial censuses and surveys, and similar information available within government departments, can be used to estimate the rate of return in different industries. The use of data of this kind has already been suggested — in 13.93 — in connection with the estimation of the ' rate of investible return '. In that case, the problem was to estimate the amount of saving generated per unit of investment. Once the SWR is estimated, as well as the commodity accounting prices, it is possible to prepare estimates of social profit generated in each industry, per unit of capital. It is to be expected that some industries will have a very low social profit per unit of capital invested : others, quite possibly, a very high rate of profit. These differences are partly the result of past mistakes, partly the result of inevitable unexpected contingencies, good and bad. One has to judge what prospective rate of profit would just cut off the demand for investment at the right level. As a rough guide, one could take the average of all these estimated rates of profit. Although that is not entirely satisfactory, it should not be a wildly inaccurate estimate of the ARI.

4. Information about prospective projects can also be used. The authorities should encourage those responsible for particular sectors of the economy to provide preliminary outlines of project proposals, sketching the probable benefits and costs in rather general terms, but giving quantitative estimates. In fact, this is a necessary part of any system of project selection, since thoroughly detailed proposals will be prepared only for projects that

have already been accepted in principle, subject to a final cost-benefit check.

While large numbers of preliminary proposals of this kind cannot all be brought together on the desk of the minister for planning, the central office of project selection (COPS) — see 5.5 — can be asked to sift the proposals, and report the rate of interest that they think would probably be appropriate for them, in the light of the proposals made. At the same time, the departments would have to submit preliminary estimates of the investment outlays that would be involved. The COPS must compare these investment ' demands ' with the available savings. It should not be difficult, after some discussion with departments, to arrive at a fairly satisfactory preliminary impression of the appropriate value of the ARI.

These methods are all rough. It may be best to start not with a single estimate of the ARI, but with three — high, low, and medium. Then projects could be accepted at once — or preliminary proposals approved for the preparation of detailed plans — if they turned out to have a positive PSV at all three of the suggested interest rates. Projects that came out with a negative PSV whichever of the three was used, could be rejected straight away. The others could be put aside for later decision, when the government might have a better idea of the probable balance of resources, in the light of the number of projects that have been approved.

If the above was done, it might be necessary to use different accounting prices for construction, electricity, and so on, according to the particular interest rate being used, since the accounting prices of such non-traded goods depend upon a prior estimation of the ARI. However, a rough guess at the ARI would probably suffice for estimating these accounting prices, except in these cases where the input of, say, electricity, was so important that the production of the input had better be considered part of the project proper.

If a country is large enough, and economically sufficiently advanced, to be able to contemplate setting up a large-scale industrial plant, and if it can expect to operate a modern industrial plant quite efficiently, it would be surprising if the ARI were less than 10 per cent. After all, the level of wages in the developing countries is usually considerably lower than it is in the industrial countries, so much lower that the inevitably lavish use of labour in the developing countries will seldom completely offset the advantage of low wage rates. If the developing countries could do the same things as the developed countries, and do them as well, they should earn higher rates of return than are enjoyed by industry in the developed countries (quite apart from the results of special protection). Unfortunately, it takes time to learn to operate new techniques efficiently, to produce goods of standard quality, and of the right quality, and to cultivate satisfactory export markets. But even taking all that into account, it would be surprising if the more developed of the developing countries could not achieve at least 10 per cent; some may find even 15 per cent more appropriate. But others, less fortunate in their opportunities for large-scale production, less efficient in their industrial operations, may well find that they have to set interest rates as low as 6 to 7 per cent. It would seldom be worth going below 5 per cent since returns of that order (after allowing for inflation) can be earned, with reasonable security, in the international capital markets to which any country has access.

In saying all this, we are assuming, of course, that all estimates of the social profits that are to be discounted at the ARI are being made at 'constant prices'. That is to say, particular accounting prices are being estimated in relation to the present general average of accounting prices. It is essential that all project analyses should be carried out in terms of price estimates that assume the general level of import prices is constant. This is the natural thing to do, and is no more than a convenient convention. It carries the implication, of course, that the ARI must be compared not with the actual rate of interest obtainable in world capital markets, but with the real rate of interest; which is calculated by making an appropriate allowance for world inflation, i.e. a general increase of, say, dollar prices.

14.3 Periodic Adjustments of the ARI

Once given an initial estimate for the ARI, one can set the system of project evaluation in motion. If too few investment projects seem, on a careful evaluation, to promise a positive social value, the ARI must be reduced: conversely, it must be raised if the PSV test turns out to be too lenient, allowing more projects than the economy has investible resources available to finance. Meanwhile, one cannot follow the PSV rule blindly, and so we have suggested postponing decisions on projects that appear to be marginal, leaving the final decision until the position seems to be clearer.

It is therefore important that project assessments — at any rate the first rough calculations — should be done well in advance of the date when work is intended to start. There is no advantage in postponing projects beyond the date that had originally been intended, merely because the planning commission, or some other government department, cannot make up its mind about them. Developing countries have sometimes suffered from undue postponement of projects, often because the complicated business of arranging foreign assistance has taken too long. The advantages of using a more systematic procedure for project appraisal would be sensibly diminished if the system merely resulted in an increase in what might later turn out to be undesirable delays. Certainly, if it is possible, the government would be wise to have before it at any time a fairly large number of reasonably good project proposals, whose appraisal has been completed. Approval could then be granted quickly, or held up, according to the state of the economy. But it does seem desirable that planners should, in general, impose upon themselves dates by which decisions on particular projects must be reached — remembering that postponement is a possible decision.

Planners can be guided in these final decisions by estimates of the investment expenditures that are proposed for various future years. It is as well to prepare estimates of the total level of investment expenditures to be allowed in each year of a plan — or, let us say, for each of the next two or three years. In fact, when the time comes, it will inevitably be found that some projects were started later than was intended, while others required more or fewer resources than was expected; consequently, the amount of investment that can be undertaken without undue strain on the balance of payments and the domestic price level, is more or less than was initially predicted. As a result, there may have to be last-minute changes in the ARI, in the light of the investment budget as it appears at the time: a few project decisions will be finalized only then.

Last-minute changes in investment plans are, potentially, wasteful. It is quite possible that these ' short-run ' fluctuations in the balance between the country's productive capacity and the demand for its products can be met to a large extent by a combination of fiscal and monetary policy and changes in foreign exchange reserves ; the government can temporarily reduce consumption below the level it regards as normal, and it can afford to allow a temporary reduction in foreign exchange reserves.

Since this flexibility is, in some degree, available, it is sensible to allow a certain flexibility in the administration of the investment budget. If new investment proposals are particularly attractive one year, it would seem good sense to allow more of them to go ahead than the government's estimate of allowable investment expenditure would, strictly, allow. Also, this flexibility means that the government need not postpone all marginal investment decisions until absolutely the last moment, on the assumption that an exact balance between production and use must be maintained. In a country with a flexible tax system, and satisfactory foreign exchange reserves, investment decisions might be changed *both* in the light of any observed excessive or inadequate demand for investment resources by the projects being undertaken, *and* in the light of forecasts of the future balance between investment expenditures and available resources. The preliminary outlines of proposals, recommended in the previous section, are essential raw material for the preparation of good forecasts of this kind.

14.4 The System of Organization : Investment Budgets

The government will have to keep the investment requirements of different industries and departments under fairly close control, in order to prevent the economy from becoming too inflationary or deflationary. But it will also have to decentralize the operation of allocating investment. Investment budgeting can be used to reconcile these requirements. An estimate of the total (public sector, or at any rate government-approved) investment to be undertaken in each of the next two or three years can be prepared, and allocated among the various ministries and agencies responsible for investment in the different sectors of the economy.

The use of such budgets is, at first sight, inconsistent with the general aim of getting decisions made in the light of prices, without any artificial constraint being placed on any sector. We suggest it only because it may be hard at first to get the necessary control over investment intentions merely by use of the ARI. The aims of social cost-benefit analysis can be met provided the following conditions are satisfied :

1. Not too many individual departments and agencies should be given investment budgets. If the individual budgets are too small, they should, ideally, be changed considerably from year to year, and would in any case be very hard to estimate accurately. They would therefore tend to frustrate the aim of achieving consistency among investment decisions.

2. Investment decisions, within the investment budgets laid down, should be made on the basis of PSV calculation, using the ARI. In some sectors, there will be many satisfactory proposals, and the budget will be strained : while in others, projects that look doubtful, in the light of the PSV calculation, will actually get undertaken. Some method must then be used to

choose among the good projects, if there seem to be too many of them, and to decide if any of those with negative PSV should actually be undertaken where there are too few. It does not matter greatly what rule is used for this purpose, so long as it is simple and consistently applied. The most convenient is to choose the projects that have the largest ratio of PSV to discounted investment cost. This social profitability ratio is easy to calculate, and provides an unambiguous rule[1].

3. The budgets must be operated flexibly. The budgets of departments that find themselves flooded with highly desirable projects should have their budgets increased as soon as possible. Better, they should be willing to sanction projects that will commit them to overspending the budget if the projects in question have a substantial PSV. Departments should be encouraged to ask for increases in their budgets whenever a good case can be made, and decisions on increases should be made quickly. Similarly, departments should be discouraged from undertaking projects with PSV much below zero, and their budgets should be reduced when there is, as a result, a tendency to under-utilize them.

4. The budgets should cover a number of years — three at least. This allows departments to plan ahead, as they must, and tells them whether it is better to postpone a project or to apply for an increase in the budget to finance it.

5. The budgets should be adjusted not only in the light of experience with them, and with the overall balance of the economy, but also in the light of expectations. In other words, they should be influenced by some kind of long-term plan. Otherwise, they may be adjusted too slowly and too late, and particular departments may be insufficiently encouraged to stimulate rapid expansion in the sectors for which they are responsible when that is going to be required by the rest of the economy.

When all this is said, there is still some reason to prefer a system in which departments are allowed to initiate any project that shows a positive PSV at the currently estimated ARI, provided there are frequent and thorough checks both on the performance of the projects undertaken, and on the methods used to evaluate their potential. This system has the advantage that the departments can actually be charged interest at a rate equal to the accounting rate of interest so that the natural urge to make a profit (which can always be enhanced by profit-related incentives) encourages those responsible to make careful decisions. But it must be admitted that such a system is likely to increase the variations in investment expenditure from year to year, with the disadvantages mentioned earlier. Governments are prone to exaggerate the extent to which these disadvantages really involve human suffering, as opposed to bureaucratic inconvenience. Nevertheless, some checking of the overall budget seems to be desirable.

Whichever system is used, what is wanted is an arrangement which ensures that most of the available investment projects that have a positive present value, given a particular interest rate, are undertaken; while few that do not have a positive present value are accepted. If, in the particular circumstances of a particular country, the system in operation does not

1. Apart from the use of accounting prices, it is the same thing as the 'profitability ratio', mentioned in 1.2, *minus* unity.

achieve this end — allowing for inevitable errors and uncertainty — some other system should be tried.

14.5 The System of Organization: Consistency and Plans

The total amount of investment undertaken in any sector of the economy depends not only upon the accounting rate of interest, but also upon the estimates of future demand for the products of the industry. Small errors in the estimation of the ARI may not have much effect upon the total of proposed investment expenditures, so long as the demand for products is accurately predicted. If a country has the resources of trained personnel to enable it to carry out some check on the consistency and reasonableness of these estimates of future demand, it is most desirable that it should be done. Indeed, the estimates for many important commodities are perhaps better made by a central planning office than by individual producers or even the ministry concerned.

It is now usual, in many Western economies, for estimates of future demand to be worked out jointly by the government and the industry concerned. This kind of 'planning' is, indeed, a most important development in the possibilities of economic organization. It is beyond the scope of this Manual to discuss the techniques for organizing such planning, or for relating it, as it should be related, to the system of project appraisal that we have been describing. Something was said about the relation between the two systems in Chapter VI, and we shall say no more here.

It should be emphasized, however, that, in the long run, the methods of planning, the methods for predicting the future performance, structure, and possibilities of the economy, can also be developed to provide estimates of the ARI, of the SWR, and of some of the more important non-traded commodity accounting prices. The methods of project appraisal described in this Manual, depending as they do on relatively crude methods of estimating accounting prices, can be thought of as a first step in the harnessing of the whole range of production decisions to social ends. However, this first step is likely to be the most valuable. The methods suggested do not depend upon the prior analysis of reliable and sophisticated planning models. They are practicable: and are likely to be accurate enough to exclude all definitely bad projects, and allow all definitely good ones. Small mistakes on marginal projects are less important.

14.6 Summary

The ARI needs adjustment from year to year, in the light of the difference between the demand for investible funds and the funds that can actually be made available. Initial estimates can be made, using whatever information is available about past projects and current project proposals. One can begin with several trial estimates of the accounting rate — at least a high one and a low one. Alternative calculations can be carried out, and final decision on some of the projects postponed until the information on most of the potential projects is available.

Adjustment of the ARI in subsequent years should depend not only on the difference between the demand for and supply of investible funds, but also on any observed tendency for the ARI to rise or fall over time. The

situation is analogous to the problem of adjusting other accounting prices ; but more attention should be given to the problem in this case, since this periodic adjustment is the main way of estimating the ARI.

If it is desired to keep a closer control over the total investment requirements of projects from year to year, a system of investment budgeting can be used. Such a system must be operated flexibly : but, as a rule, individual departments should choose the investment projects that have the largest ratio of PSV to discounted investment cost. It is of the first importance, however, that the main burden of choosing between investment projects in different sectors should be borne by PSV calculations based on the announced ARI, with the investment budgets acting only as a temporary check to any sudden tendency to overburden the balance of payments, and as a means of preventing any unpredicted deflationary shortfall in investment demand.

It is likely to be easiest to assume one constant rate of interest, to be used for discounting all future social profits back to the present. Of course, it will then be found that this rate of interest varies from year to year. Insofar as these changes in the accounting rate of interest are found to be fairly systematic — if, for example, there is a persistent tendency for the accounting rate of interest to fall as development proceeds — it would be possible to use more sophisticated discounting procedures, in which r_t is smaller for larger t. Then particularly long-lived projects would have their later social profits discounted rather less than they would have been if a constant rate of interest had been used. This more sophisticated method of calculating social present value — though in principle correct — is likely to commend itself only for the evaluation of very important or very long-lived projects, since in general it cannot be expected that the use of a varying interest rate will greatly increase the economic well-being of the country. There is always some advantage in using simple methods of calculation.

Chapter XV

INVESTMENT DECISIONS UNDER UNCERTAINTY

It is not unnatural to discuss investment projects, as we have done in earlier chapters, on the assumption that their costs and benefits are known in advance. Most people who have experience of industrial projects are willing to put some kind of figure to the quantities of outputs and inputs that a project is likely to provide and require. But one can never be certain of the outcome. Sometimes the estimates even of quite important costs and benefits can be little better than informed guesses. Project planners ought to pay some attention to this uncertainty. We now consider what they should do about it.

The uncertainties of particular projects are often rather insignificant, when measured against the total performance of the economy, important though they may seem to those responsible for the investment decisions. Usually it will do little harm if uncertainties are ignored. But there are some important exceptions to this general rule. Furthermore, it has to be decided what particular figure to put to costs or benefits when there is considerable uncertainty about the outcome, a problem we have ignored in earlier chapters. There is no guarantee that the estimates which the engineers provide are, even approximately, the correct average of the various possibilities. We must decide what kind of average is appropriate, and how to get it. We must also decide what to do when the uncertainties are, for one reason or another, so important that they cannot reasonably be ignored.

The theory of choice under uncertainty is a difficult subject, and there is some disagreement among economists and statisticians on quite fundamental issues. We shall avoid the more controversial and difficult parts of the subject, and try to take the most sensible view of what is relevant to practical decision-taking, even when our suggestions would not be universally accepted. The reader will have to decide whether he finds our arguments convincing.

15.1 The Varieties of Uncertainty

The uncertainties of a particular project arise from many unpredictable influences. One cannot perfectly predict future technology or tastes, or the actions of the government : any of these can quite easily falsify the assumptions upon which the project design is based. And of course the project itself may not perform in the way expected.

One of the most important distinctions to bear in mind is that between uncertainties about the project itself and uncertainties about the environment

in which it operates — that is, about the rest of the economy and the rest of the world. These two sources of uncertainty are likely to act independently of one another. The price of the output may depend on what is happening to the demand for that commodity in the developed countries, whereas the quantity of output that *can* be produced depends upon the success with which the project is being operated.

But the quantity of output that *will* be produced certainly depends upon what happens to prices : the project managers may decide to operate it in a different way from what was originally intended because economic conditions turn out diffirently — indeed they might even decide to close it down. Similarly, the prices paid for some of the inputs might depend upon the project's demand for them, which in turn depends upon how well it operates. So there is a process of mutual adjustment between the economic environment and the performance of the project, which means that prices and quantities depend upon one another. It is, nevertheless, useful to think of the uncertainties about prices and quantities separately.

In the world at large, it may be thought that the most important source of uncertainty is the unpredictability of consumer tastes. It is easily exaggerated. Many of the troubles of industrial firms producing consumer goods arise from the competition of too many firms trying to supply a limited potential market, or from trying to sell a new design or invention of uncertain appeal. The more basic consumer demands can be predicted with tolerable accuracy, apart from temporary fluctuations. In any case, these uncertainties are usually as likely to go in favour of the project as against it : a consumer product is as likely to prove more popular than planners expected, as it is to be less popular — provided the planners have made a reasonably objective assessment of possibilities. The importance of this remark will appear in due course.

Uncertainties in export markets may be rather large, in part because of unexpected changes in the tastes of foreigners. Yet the cases that spring to mind arise mainly from changes in technology or government actions. Changes in tinplating techniques affect the demand for tin ; developments in plastics threaten disaster for jute producers ; new import restrictions can destroy a market overnight.

It is understandable that the governments of developing countries should get the impression that such changes are usually adverse to them. Even if the prices of primary products have not shown, in the long run, any clear tendency to fall relative to the prices of manufactures, technological developments have usually seemed to be unfavourable. It is difficult to tell whether this is true, or an illusion. Certainly, at some time, new inventions and industrial processes created the demand for petroleum, rubber, bauxite, and so on ; but that era may have passed. On the other hand, new technological developments may be as likely to increase as decrease the value of the new industrial products that the developing countries are beginning to produce.

The important lesson to be drawn from past experience is not so much that the developing countries live in a very risky world : it is not at all clear that, as a group, their risks in international trade are greater than the risks of the industrial countries. The lesson is that there are risks and uncertainties which can be taken account of. One should not assume that things will turn out for the best. The various plausible possibilities can be

weighed up, and the prospect of high or low prices (or high or low sales) assessed. It is usually possible to make some guess at the kinds of changes in world technology that can affect the value of a project. In fact, it is quite normal to consider the most important of them when discussing a new project. The temptation to be avoided is that of putting detailed figures only to the most favourable of the likely possibilities : mere worry about the other possibilities is an inadequate way of allowing for them. When risks are considerable, a systematic description of all the likely possibilities is a sensible preliminary to a detailed evaluation of the project. In the next section, we discuss ways in which the extent of uncertainty can be described quantitatively. After that, we suggest how the actual evaluation of a risky project can be carried out.

Finally, let us remind ourselves that some uncertainties are outside the control of planners, while others can easily be influenced by their policies. The extent of the risks associated with a project may be reduced either by making advance arrangements to deal with adverse contingencies — as with lifeboats on ships — or by insurance arrangements (e.g. with foreign countries), or by substituting a less risky project for the one first considered, or in many other ways. In principle, decisions of all the above kinds are taken care of, if we know how to evaluate investment and similar expenditure decisions. If the riskier project is better, we should undertake it all the same. If the insurance arrangements are worth while, the value of the investment project plus insurance arrangements will be greater than the value of the project taken alone. Special expenditures to meet adverse contingencies will be worth-while investments in themselves, and will enhance the value of the main project. We shall therefore refer directly to the possible control of uncertainty only occasionally. But it is always to be remembered that careful planning against particular undesirable contingencies may be much better than replacing a risky-looking project with a more timid alternative.

15.2 The Description of Uncertainty

For each possible future of the project, and the economy, one can in principle calculate the present social value. With some trouble, all reasonable possibilities could be allowed for in this way, and one would have estimates of the range of possible PSVs. We shall later consider whether this is a sensible practical procedure. Practical or not, it is certainly not sufficient. It takes one some way towards describing the prospects for the project, but not far enough to make a decision (unless it cannot possibly have a positive PSV, or cannot possibly have a negative PSV). Much more can be said, and needs to be said.

It was important to remark on the inadequacy of a mere list of possibilities, because it is sometimes suggested that planners ought to make a number of calculations, in particular PSV calculations, on the basis of alternative assumptions. It is thought that such a ' sensitivity analysis ' helps in some way to get more sensible decisions made ; but it is unclear how it is supposed to affect the decision. Possibly, projects that have a very wide range of present values are to be rejected. But we have not yet come across any reason to suggest why that should be done. Indeed, it will later be argued that this might be a most unfortunate policy, and, it should

certainly not be adopted unthinkingly. A sensitivity analysis can certainly be a great help in deciding whether a more careful examination of the various possibilities is desirable, so as to reduce uncertainty before a decision is made, but it does not do more than that.

A list of possibilities is thus only the beginning of an adequate description of an uncertain prospect. The description must be completed by means of the quantitative language of probabilities.

In the right context, no one concerned with investment decisions has any difficulty in understanding probabilities: they provide the natural language for describing games of chance, and for describing those risks that businesses are accustomed to insure against. But many people doubt whether probabilities can be used to describe the main uncertainties involved in investment decisions. How, it may be asked, can one hope to estimate the probability that the price of jute bags will have risen next year, far less estimate the probability that it will have risen by between 10 per cent and 11 per cent?

Yet one really cannot fully compare different investment projects without estimating the probabilities of the different outcomes or possibilities. In some cases, there is no great difficulty in estimating the probabilities for the project — as, for instance, the construction of a dam, where the main uncertainties about rainfall in the catchment area can quite easily be described by probabilities. But the dam has to be compared with other projects, for instance, a project in the export trade — where one is unaccustomed to using probabilities. There may be no more uncertainty about the second project; merely unwillingness, because of the *kind* of evidence available, to use probabilities in describing its potential. How then can one decide between two such projects — far less compare either with the whole population of potential projects? One could, like a board of directors, listen to an account of some of the relevant evidence about future possibilities; or merely hear a rather vague account of someone's views on the possibilities, perhaps on the most probable course of events. Then a decision might be made without any formal analysis. But this is an unsatisfactory procedure: all the reasonable possibilities may not have been fairly considered; evidence about the probable course of events may have been mixed up with particular value judgments about the alternatives. It is an undisciplined process, and it is therefore impossible to check the logic involved.

The mere fact that people, faced with the necessity of deciding, are prepared to make decisions; and are able to make some use of the evidence; implies that they are, in effect, putting numerical probabilities to the various possibilities. An imaginary observer, who kept a careful record of all the investment decisions made by a consistent person, including decisions involving projects about whose probabilities there was no reasonable doubt, would be able — with enough observations — to deduce the probabilities implicitly used.

Another way of putting this argument, a way that is more relevant to the immediate problem, is to say that thought about investment choices can be formalized by expressing the bearing of the evidence on the relative likelihood of the various possibilities, in terms of numerical probabilities. This need not lead to different decisions except insofar as such systematic thought convincingly reverses the results of previous intuition.

Seen in this light, probabilities provide us with a quantitative language for describing uncertain possibilities : and particular numerical probabilities express our conclusions about the bearing of available evidence on the possibilities we are interested in. Unfortunately, we often know rather little about the way in which evidence is relevant to these possibilities. There may be a great deal of data about export prices and demand during the last twenty years, and yet known theories do not allow a very complete use of this data in describing future possibilities. If this leads to doubt about the usefulness of the language of probabilities, one should reflect that very often one probability distribution is *clearly* better than another. For instance, the statement that the terms of trade of developing countries in Asia are as likely to rise as to fall during the next decade, is certainly a better description of the possibilities than the statement that they will certainly deteriorate by 5 per cent per year during that time. Many probability descriptions for any particular prospect can be rejected out of hand, and one can usually find a description that is at least as good as any other. There is no other usable way of expressing empirically based knowledge about uncertain possibilities in a way that is independent of opinions about the goodness or badness of the possible results.

15.3 Using Probabilities

One should know something of the theory of statistics when the particular probabilities to be used play a very important part in the final decision. If not, it is still helpful to have in mind the main ways in which probabilities can be estimated, even when very rough approximations are adequate (as is frequently the case). The following methods are worth distinguishing, although from some points of view they are very similar to one another :

1. Probabilities may be available from actuarial evidence, or can be simply allowed for since the risks in question are normally insured against. This case is the model that one copies in order to have a general language for uncertainty. If large numbers of similar instances have happened in the past, insurance companies can predict with high probability the number of claims they will have to meet in the year, and are therefore willing to make a fixed charge for the promise to pay in the event of loss. Fire insurance is a well-known example. The probability of a fire destroying a factory building is known, within relatively small limits. The undertaking may not want to take out all the insurance it could — it may carry some of the risk itself ; or it may have taken special precautions, or have special knowledge that suggests the probability is actually less than the insurance company uses for factories chosen at random. But it is clear that there are risks of this kind, where estimating probabilities is not difficult.

2. Even although the risks are not easily insurable, so many instances may be known from past experience that the appropriate probability can be estimated without significant disagreement. We have already mentioned the example of building a dam : probabilities can usually be established for the various possible amounts of rainfall in the catchment area. The following example is closer to our subject. If the planners kept good records of the projects undertaken in the economy, the results could be

compared with actual performance. Once a reasonably large body of experience had formed, and provided that the period considered was not exceptional in some obviously relevant way, the frequency with which the original figures overestimated and underestimated actual social profit could be established. Specifically, one might find that in two cases out of ten, social profit exceeded predicted social profit; in four out of ten, it was not more than 5 per cent less than predicted social profit; in another three out of ten it was between 5 per cent and 50 per cent less than the predicted level. This kind of information would clearly be very helpful in allowing probabilities to be estimated. In a particular project, special information may override the general evidence. But for frequently occurring items, like construction costs, delays in completion, repair time of equipment, and so on, such information could be valuable. We shall see shortly that in many cases one can simply make an adjustment in the initial estimate of cost or benefit, rather than use a whole probability description; but the principle is worth bearing in mind.

3. Statistical techniques can be used to establish *probability distributions.* The probability distribution of some quantity — say the export sales of tea — is the whole probability description of its possible values, that is, a statement, for example, of the probabilities that the variable will be greater than any stated number. Statistical methods usually assume that the probability distribution has some general kind of shape — e.g., a 'normal distribution' — and then use the available evidence to decide which particular form of this distribution is the correct one. Since these methods are technical, we shall not pursue the possibility any further.

4. Those responsible for estimating the probable course of the project may simply agree upon probability distributions for future social profits — and so on a probability distribution for the PSV — as a fair, but approximate, expression of their opinions or hunches. When there is evidence that cannot be dealt with in any of the ways mentioned above, this method can be very useful. Non-statistical evidence can also be given quantitative expression. For instance, the managers of the project might well be willing to agree that there is a five to one chance that a particular piece of equipment will arrive on time. Many important kinds of relevant evidence — impressions about the trustworthiness of contractors, rumours about future developments in the markets, knowledge of the difficulties of breaking into new markets — can be brought to bear in this way.

It will turn out, fortunately, that a very precise knowledge of the probabilities is not required in the assessment of most projects. What is important is the estimation of 'average values', to which we now turn.

If a man has equal chances of winning or losing R.1 in some gamble, the *expected value* of the gamble is zero; if he had had a 2/3 probability of winning, the expected value would have been R.1/3. The minimum premium a fire insurance company can charge is the expected value of the claims it must meet: it is obtained by multiplying by its probability each possible size of claim, and adding the result. In other words, the expected value is the natural average value: the value that is to be expected on average, taking one possibility with another. Whenever one assigns probabilities to the various possible values of a variable, one can calculate the expected

value of the variable in the same way. In symbols: if the variable X (the price of steel, say) can take the values x_1, x_2, x_3 ..., its expected value is defined to be $p_1x_1 + p_2x_2 + p_3x_3$ ..., where p_i is the probability of taking the value x_i.

So, once we have estimates of the probability distributions for social profits in all the years of the project's potential life, we can, in principle, calculate the expected value of social profit — the *expected social profit*, for short — in each year. Similarly, we can estimate the *expected present social value* (EPSV). This is, in many ways, the most natural summary measure of the prospects of the project, either year by year, or as a whole. Yet it is not the whole story. A project about whose prospects there is very great uncertainty might have the same EPSV as a project whose results were known with near certainty in advance. On the face of it, one would not expect to regard the two projects as having an equal claim on investment funds: the relative uncertainty of different projects seems to be relevant to the investment decision. Indeed, it may be tempting to say that very uncertain projects are very undesirable, unless ther EPSV is very high.

This is, no doubt, a sensible point of view for an individual, who may perhaps dislike excessive uncertainty as such, and will almost certainly attach less weight to an increase in his wealth than to an equal decrease, so that equal probabilities of an increase and an equal decrease may provide a prospect less satisfactory than the certainty of unaltered wealth. It does not follow that the same considerations are appropriate, or have the same force, in the case of production decisions by a public enterprise. The question therefore arises whether a producer, taking his decisions for the good of society, should pay any attention to the extent of uncertainty involved; or should simply attend to the EPSV.

15.4 Investment Criteria: the Simplest Cases

Suppose that in a particular year a project has equal probabilities of making a hundred units of social profit, and of making zero social profit. Perhaps it is a bicycle factory, and it is hoped to sell its output in a new export market; if that falls through, the bicycles will have to be sold at home where the market is already well supplied, so that the social profit would be, say, zero. The factory may be producing a substantial proportion of the country's bicycle output, but the social profit will, at best, be only a small proportion of the total value of production in the economy.

Social profit measures the value of the project in a particular period in the following sense. If the government had available to it an equal amount of purchasing power, which it could use to purchase goods and services in world markets for the purposes it thinks best, that would be just as good as having the project operating. Thus the social profit represents an equal amount of freely usable foreign exchange, i.e. purchasing power not committed to the provision of consumption. The bicycle factory itself makes only a small contribution to the total production available to the economy, measured in terms of freely available foreign exchange. Abstracting entirely from the fun of gambling, or the nastiness of risk-taking, as such — neither of which should be relevant to decisions taken for society — the chance of a relatively small gain should just about balance an equal chance of a small loss of equal magnitude. Spread over all the individuals who will

benefit, the gain should be just about equal in importance to the loss for each of them.

Thus the appropriate measure of the benefit provided by the bicycle factory is its expected social profit, namely 50 units. It is obvious enough that this is a very convenient measure; and the above argument should have convinced the reader that it is a sensible measure. It is also a consistent way of evaluating benefits. For there will, in general, be a great many relatively risky projects in the economy, each of them making a small contribution to the country's income, though for many the extent of uncertainty is quite large relative to the expected social profit. Looking at the sum of all such projects, the uncertainty of the whole is much less than the uncertainty of the parts. When one project turns out badly, compared to its expected value, another will have turned out unexpectedly well. The resulting extent of uncertainty is likely to be quite small compared to the level of national income.

One can easily verify general appeal to the 'law of large numbers', by looking at the fluctuations in the national income of some particular country from year to year. Usually, the level of the national income is at most 2 or 3 per cent different from what would have been expected two or three years before. Considering that many projects turn out very much worse than expected — a large anticipated profit turning into a large loss when the figures are counted up — there is a very striking difference between overall uncertainty in the economy, and the uncertainty associated with particular production projects. The addition to overall uncertainty arising from the project is certainly nothing like as large as the apparent uncertainty of its own social profit.

This, then, is our first rule: *in the absence of special reasons to the contrary, one should measure the value of a project to the economy by its expected present social value.* We shall usually measure the EPSV by estimating the expected level of all the various inputs and outputs, then evaluating them by means of the expected accounting prices, and discounting in the usual way. This assumes that any uncertainty about the accounting prices is essentially independent of uncertainty about the level of outputs or inputs: an assumption that is not strictly correct, since project performance can be adjusted to adverse circumstances. But that is usually a small consideration. It will be discussed more fully later.

15.5 More Difficult Cases

In certain cases, for one reason or another, some of the assumptions on which the above argument is based will be false.

1. The accounting price of one of the outputs (or inputs) may depend quite sensitively on the amount being produced (or used). For example, the price at which a bicycle factory can expect to sell its products abroad may depend on the number it is trying to sell. In that case, we want to value the output by the expected earnings of foreign exchange (making allowance for any change in consumption commitments when necessary), and that need not be the same as the expected output multiplied by the expected accounting price. For example, the price of bicycles might fall off quite sharply if more than a certain number are sold, but not increase

very much if fewer are sold. If the output to be achieved is rather uncertain, one must make due allowance for the relatively small contribution that an excess of production over the expected level would make to foreign exchange earnings.

Once the problem is stated, the solution is of course clear : one should, in such a case, not think in terms of valuing expected output, but estimate directly the expected level of foreign exchange earnings. Since this kind of situation will arise mainly in dealing with exportable commodities, its treatment is fairly easy. But one can imagine more difficult cases. For example, the provision of a new railway line or road in an area that has formerly had very poor quality transport facilities raises questions of very much this kind. However, we are primarily concerned in this Manual with industrial projects, and will therefore not discuss these more detailed problems of investment in infrastructure.

2. The output of the project may be closely related to the overall performance of the economy. For instance, it may be more useful if there is a substantial increase in consumer incomes ; or, perhaps, it will be more useful if — say — poor rains spoil the harvest, with a substantial fall in the national income. What one should do here is to estimate the expected value of the quantity produced multiplied by the accounting price. If the project is likely to produce a lot under just those conditions when the output is worth most, its value is naturally greater than that estimated by taking the expected output and multiplying it by the expected accounting price. For, when prices and output are not independent, this latter procedure does not properly estimate the expected social profit ; whereas calculating the social profit directly, and estimating its expected value does. Probably this case seldom arises when dealing with industrial projects.

3. Uncertainty about the results of a particular project may actually be undesirable in itself. We are on the edge of irrational feelings here, but it must be admitted that sometimes uncertainty as such is unpleasant or may have unpleasant consequences. For example, the project may be tied to foreign aid from some particular government, whose future attitude to the country may be strongly influenced — however irrationally — by the performance of its own pet projects. In this case, some weight must be given to projects that are more likely to perform satisfactorily. (Of course, it is always possible that the country would react so well to an extremely successful project that it is worth taking special risks for the sake of such a reaction.)

Again, the failure of a project might have unpleasant consequences for the particular area in which it is sited, whereas its success would lead to increased incomes in a rather more diffused and evenly distributed way. It would not be unreasonable in such a case to attempt to insure against such failure : although it might well be cheaper to adopt a risky project with the promise of special aid, or priority in the siting of new projects, if the first project should be a failure.

On the whole, the above kind of argument should be used with caution, since it is seldom likely to be of great importance. If it does seem to be important, some kind of *ad hoc* adjustment or allowance must be made, since the task of carrying out a precise analysis would be exceedingly complicated.

4. The extent of uncertainty may not be small in relation to the national income. This might well be true of a small country. There are countries where the value of annual production in a single plant accounts for more than a quarter of the national income : fluctuations in the export price of the commodity produced — copper, aluminium, or asbestos — may be a large part of the uncertainty of national income.

In general, people give more weight to a substantial reduction in their income than to an equal increase. This is proved by their willingness to take out insurance, and the fact that they frequently prefer securities with a low yield and low risk to risky stocks and shares that have a high expected return. Consequently a government must, acting on behalf of the citizens of the country, tend to prefer a more certain *national* income, even at some cost in terms of a lower expected value. It is therefore right that projects which add significantly to aggregate uncertainty in the economy should be somewhat penalized in the system of project evaluation. No government would want to insist that all farmers in the country should adopt a new crop variety as yet largely untested, even though it offered the prospect of much higher yields : the risks of crop failure would be too great, and the possible consequences too awful.

Our earlier argument turned to a great extent on the assertion that most projects, uncertain though they may be in themselves, bring about an insignificant increase in the aggregate uncertainty of the economy's prospects. In that case, one can avoid the awkward question of putting a figure to the social cost of the uncertainty. Fortunately the case of a project which is very large in relation to the economy, will arise only rarely ; nevertheless something must be said about this controversial question.

The difficulty is that, on the one hand, there is no way of dealing with the problem precisely, without bringing in the mathematical theory of probability ; while, on the other hand, the answer must depend upon the extent to which a country ought to avoid uncertainty — a disputable matter. This latter question turns upon the extent to which it seems desirable to take a chance of getting higher incomes at the risk of actually getting lower incomes : a question analogous to the one about giving up some present lower income to get a larger increase in future higher income. But it can be said with some confidence that, on almost any plausible weighting, it is unlikely that a large allowance for uncertainty ought to be made. A reduction in the value of the project by a few per cent is the most that one would expect[1].

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1. The following example shows the orders of magnitude involved. (We have to use the somewhat technical notion of ' utility '.) Suppose a country's national income is $ 400 million. A large project is being considered. In the year in question, the planners have estimated that it will provide the economy with :

$ 125 million, with probability one quarter ;
$ 100 million, with probability one half ;
$ 75 million, with probability one quarter ;

The utility of national income x is taken to be $A - \frac{1{,}000}{x}$. (The constant A is actually irrelevant.)

In terms of this assessment of the relative utility of the different prospects, we see that the country can expect :

utility level A — 1.905 with probability one quarter ;
utility level A — 2 with probability one half ;
utility level A — 2.105 with probability one quarter.

Those in charge of a particular industrial sector or a particular project may be very impressed with the importance of the project for the economy. We have argued that the uncertainty of the project may nevertheless not be important for the economy as a whole. The output of the particular project should not be seen as an indispensable element in the total output of the economy, but as a contribution to the total value of production : if this project does not do as well as it might have done, the short fall may easily be made up by another project that does better than expected. The other project might be making an entirely different product : but, by introducing accounting prices, we have given ourselves a measuring rod that takes into account the many ways in which having more of one commodity can compensate for having less of another. Thus, although at first sight it seems that most of the risks and uncertainties of investment projects cannot possibly be insured against, it turns out that the mere number of projects being undertaken does provide a sort of insurance against the risks of each particular project. Therefore, the important measure of the social benefit the project provides is its EPSV. Only very occasionally will it add so much to the overall uncertainty of the economy that some reduction in the present value must be made. We have mentioned the various exceptions, but the basic rule will usually apply.

Yet, in a sense, the basic rule is not very simple. The definition of EPSV is something we reached only after we had decided we could describe uncertainty by means of numerical probabilities. In principle, the EPSV looks as though it would require a great deal of difficult estimation and guesswork, and extensive calculations. In the next section, we consider how it might be estimated in practice, and conclude that the difficulties are not so bad as they may seem.

15.6 Practical Methods

There are three important things to remember when one is contemplating the potential of a project. First, there will be uncertainty about both prices and quantities of inputs and outputs : and these uncertainties arise from different causes. Secondly, it will be possible to adjust the day-to-day and

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Averaging, we compute its expected utility level to be :

$$A - 2.0025.$$

This is the utility that would have been provided by a sure prospect of a \$ 499.375 million national income, corresponding to a project yielding \$ 99.375 million for certain. Thus the correction that must be made to the average social profit of the project on account of uncertainty is only \$ 625,000 — less than one per cent of the project's expected value.

Even if the project had been much more uncertain, yielding \$ 50 million, \$ 100 million, and \$ 150 million with equal probabilities, the deduction to be made from the expected social profit of \$ 100 million on account of uncertainty is only \$ 3.25 million. It is hard to believe that projects of this relative size and uncertainty ever present themselves for consideration by the governments of developing countries. Perhaps they should.

This topic is briefly treated at the end of the theoretical appendix to the Volume. It is there shown that the deduction to be made on account of uncertainty should be a proportion of profits equal to :

$$\frac{\text{Expected profits of project}}{\text{Expected national income}} \times \left(\frac{\text{Standard deviation of profits}}{\text{Expected profits}} \right)^2 .$$

multiplied by a constant, which may reasonable be taken to be unity.

year-to-year running of the project so as to take fullest advantage of, or suffer least disadvantage from, the actual development of accounting prices. Thirdly, the project will have been designed to perform best — in terms of social profit — when prices are at their expected levels : it will not be possible later to take as full advantage of relatively unexpected price movements as would have been possible if the project had been designed with them in view. In other words, the flexibility that any project provides in operation is limited.

How do these various considerations influence expectations about the performance of our imaginary bicycle factory ? We estimate the expected value of future prices : balancing one possibility against another, we think that the accounting price of a bicycle will not fall very much, and we have made predictions of the shadow wage rate, the world price of steel, and so on. It is possible that the accounting price for bicycles will rise : in that case, the output would not only be worth more, but would also be stepped up beyond the planned rate of production (at the expense of more cramped less efficient working conditions, more frequent machinery breakdowns and replacements, the use of less satisfactory labour, and so on). Thus the social profit in a year when the price of bicycles was above its expected value would be greater both because of the increased price, and also because advantage would be taken of it. If, on the other hand, the price of bicycles was lower than its expected value, it might not be worth while to replace worn-out machinery, nor to continue operating capital equipment for quite so long. Machinery becomes obsolete earlier when its output is less valuable, since rising labour and repair costs more quickly reach the level where the value of output ceases to cover them.

The same kind of considerations apply if the price of the steel used is unexpectedly high or unexpectedly low, or if the shadow wage rate moves more or less than was expected. If steel turns out to be unusually expensive, it may be possible to change the design of the bicycles so as to use less of it ; if labour is unexpectedly cheap (in terms of the shadow wage), it may be possible to make more use of it, and less use of machinery.

If the world price of bicycles fell very low, the factory might be better used for some different purpose ; or it might even be abandoned. On the other hand, capital equipment is often used long after one would have expected its useful life to be over, either because it has proved more durable or efficient than had been thought at first, or because the demand for its products has been unusually high. If the factory is used for some other purpose, it will naturally not be as suitable as if it had been designed specially for this different kind of operation when it was first built. Similarly, although a machine or a factory may be used for longer than its anticipated life, a different kind of machine or factory would have been chosen in the first place if the conditions resulting in this longevity had been correctly foreseen.

The extent to which the project has flexibility that will allow advantage to be taken of relatively unexpected developments in the structure of accounting prices will vary from project to project. A bicycle factory consists of such a varied assortment of buildings and bits of equipment, that there will usually be plenty of scope for making quite good use of it whatever happens — provided there is good management. On the other hand, a power station imposes on its management a rather rigid relationship

between the output of electricity and the inputs. Production may not turn out as expected, but there is relatively little that can be done to adjust production performance to the developing price structure, except that the length of time for which it is operated each day, each year, and over its working lifetime, can be varied. Projects that provide no flexibility are extremely rare : and it is seldom necessary to keep a factory working when its social profit would be negative. On the other hand, the economy must to some extent put up with the existence of unsuitable capital equipment, and can do nothing about its regrets that it had not known what would happen to prices before the investment decisions were made.

We can now consider how to prepare the necessary evaluation of the project. It can be done at various levels of sophistication, depending on the reliability of the data, the importance of the project, and so on. We shall suggest three methods, of varying thoroughness :

1. When estimating inputs, outputs, and accounting prices, the project evaluator has to think in terms of estimating *expected* inputs, outputs, and accounting prices. To repeat our earlier discussion, this implies that he must average the various possibilities, using as weights the probabilities that these possibilities will occur. But, in order to do this fairly accurately, it is not usually necessary actually to set down all the possibilities, and assign probabilities to each. It will be enough if he has a clear idea what he is trying to estimate, which are the expected outcomes, not the most probable ones. He must not be optimistic — giving too much weight to the more favourable possibilities ; nor should he be pessimistic, giving too much weight to the less favourable possibilities. It does not require much practice to avoid unreasonable estimates, which no one would accept as estimates of the expected outcomes : and, very often, there will be little significant disagreement about an estimate ; once it is understood what one is after, and that great accuracy would be out of place.

In a few cases, it may be desirable to ask oneself, say, what level of output has only a one in ten chance of being exceeded, and of not being exceeded ; and what level of output is as likely to be exceeded as not. When one has a clear notion of the probable spread of possible results, in this kind of way, one can roughly estimate the expected value — say, by giving a 20 per cent weight to each of the two extreme estimates, and the remaining 60 per cent weight to the medium estimate.

In other words, one sets about estimating the various inputs and outputs and accounting prices in more or less the same kind of way as was described in detail in Chapter XII, except that one takes some care to make one's estimates ' medium ' ones, in the precise sense of ' expected values ' as defined by probability theory. Having done so, one can work out the PSV.

The figure, worked out in the above manner, will be an *underestimate* of the EPSV, since the various estimates of social profit will be underestimates of expected social profit, especially for later years when prices are likely to be considerably different from expected prices, and the scope for adjustment to take advantage of the prices therefore greater. In cases where flexibility is low, and extremely careful evaluation of the project is inappropriate, the first straightforward calculation of social profit value may be accepted as a good evaluation of the project. If flexibility is likely to be of some importance, one might adjust the estimate upwards by some

reasonable percentage. But if the adjustment one is tempted to make is at all large, a more careful evaluation must be done. A rough adjustment of this kind is best made by using an interest rate a little smaller than the accounting rate of interest, since it is in more distant years that the gains from flexibility are likely to make the most important contribution to the project. A reduction in the interest rate of no more than 1 per cent would certainly be large enough for this purpose.

2. If a more careful evaluation is necessary, those responsible for evaluating the project will have to examine various alternative possible developments of the project in detail. At least three alternative developments should be considered : one in which prices move more favourably than the expected possibility, one in which prices move less favourably, and the expected movement itself. Of course, as we have seen, there are many different prices relevant to the decision about a particular project, and each of them can change in many different ways ; it is no easy task to choose three sensible possibilities, especially when one remembers that not all prices will move more favourably than the expected movements, nor will they all be less favourable than expected.

It will be best to deal with the social profit in each period separately, first calculating it on the assumption that prices are at their expected levels, and outputs and inputs at the levels intended : in addition, one will calculate estimates of social profit on adverse assumptions, and on favourable assumptions. In making the favourable assumption one might assume that all the relevant prices are a little more favourable than their expected values — say, at such levels that there is a probability of about a third for each one that the price might have been even more favourable. Using these prices, and estimating the expected inputs and outputs that will be used and produced under these circumstances, one will get a *very* optimistic estimate of social profit. Similarly, one can prepare a very pessimistic estimate of social profit by assuming that all prices are somewhat less favourable than their expected levels. One cannot without considerably more trouble say precisely what is the probability that social profit would be even higher than the optimistic estimate, or even lower than the pessimistic estimate. But these two probabilities will be roughly equal, and one will therefore have a good idea of the range of probable social profits. One might give the two extreme estimates weights of 25 per cent, and the mean estimate a weight of 50 per cent in averaging to estimate the expected social profit. Once expected social profit has been estimated, one has only to calculate the present value in the usual way, and the evaluation is complete.

Clearly this same method can be carried out with even closer attention, but some expert knowledge of probability theory and statistics would seem to be required for very thorough calculations. In any case, the extra accuracy obtained by the attention to extreme cases we have suggested will almost certainly be sufficient for all but the most important cases.

3. Finally, it may occasionally be necessary to deal with the exceptional cases in which the spread of risks is relevant to the investment decision. It is, unfortunately, much more exacting to estimate the probabilities of alternative levels of social profit or social present value than to estimate the expected levels. For these probabilities arise from the coincidence of

many different events, each with its own probability. Yet it is certainly desirable to have some kind of estimate of the degree of uncertainty of the PSV of a project — that is of the extent to which the PSV is likely to differ from the EPSV. The only simple procedure available is to use the pessimistic and optimistic estimates of social profit prepared in the way described above, and discount them so as to get pessimistic and optimistic estimates of the PSV. It must be emphasized that these estimates would be *extremely* pessimistic and optimistic, since they are calculated on the assumption that — in the optimistic case, for example — everything goes a little better than expected in every period. Since there are sure to be many adverse circumstances, the calculation is very optimistic even if the individual price and quantity levels used are independently quite probable.

For this reason, the above sort of estimate of the probable spread of the PSV around its expected level is not altogether satisfactory. However, it can still be a useful indication of the *relative* riskiness of different projects, provided it is born in mind that it may give to the casual observer an exaggerated impression of the risks involved. Let us call the difference between the pessimistic and optimistic estimates of social present value the *range* of the project. The ratio of the range of the project to the gross national product of the economy is an index of the project's riskiness. One might want to reduce the PSV by a percentage related to this ratio. The precise extent of the adjustment is not easy to determine, particularly since it depends upon the planner's view of the desirability of taking risks with the economy. We think that an adjustment of $\frac{10 \times \text{range}}{\text{GNP}}$ per cent is the right order of magnitude. We present this suggestion as no more than a very rough rule of thumb, which would allow a consistent treatment of very risky projects. Fortunately, it would not seem that such a correction would need to be applied very often, or would even make much difference to a decision if it were applied.

15.7 Common Rules of Thumb: Some Comments

One rule of thumb that will be familiar to many who have to do with investment projects is the use of the 'pay-off period'. If this method for choosing investment projects is used, projects are accepted only if their profits will pay for the initial investment cost within a specified period of time — two to five or more years, depending upon the industry. The rule may be used in conjunction with other methods. For example, projects whose present value is greatest may be preferred, but the profits will still have to pay for the initial investment cost within the specified time. A similar, but not identical, method is often used in the centrally-planned economies. The method is sometimes justified on the grounds that one must have some rule for choosing among investment projects, and this is really the simplest possible. One may agree that it is the simplest possible, without feeling that it has much to recommend it when other methods, particularly that of discounting profits, are quite simple and capable of being given a much more satisfactory justification. It is also recommended as a way of avoiding paying too much attention to the later profits of the project, which are often thought to be much more uncertain than profits in the first few years of the project's life.

We do not think that the method has much to recommend it. It allows no satisfactory way of comparing projects in different industries, where different pay-off periods must often be used. It gives altogether too little weight to what is likely to happen after the pay-off period has elapsed. To take only one example: many project choices are affected by the life of the investment — a brick factory, say, is a better investment if there is likely to be a continuing and growing construction programme in the immediate neighbourhood than it would be if the relatively certain immediate demand was unlikely to be continued into the more distant future. It is hard to see what advantage there is in ignoring such considerations, or in allowing for them in a merely *ad hoc* way.

The other quite common rule of thumb for allowing for uncertainty is the use of a risk premium. The rate of return of the project is calculated; then a few percentage points are subtracted from it, more if the uncertainty seems to be large, less if the prospects seem fairly dependable. This procedure amounts to calculating the present value of the investment project using a rate of interest that is larger than the basic rate of interest used for relatively riskless projects. The addition to the rate of interest reflects the project planners' impression of the degree of uncertainty involved: it is not derived by any formal argument or use of the evidence. But the mere fact that it is a rough and ready method, relying on impression rather than analysis, is not necessarily a conclusive argument against it, since the relevant evidence is in any case rather hard to interpret.

Our objection to this method is that it may well lead to unjustifiable results, in particular an undue reluctance to undertake risky projects. To see exactly what sort of influence on project choice the use of risk premiums may have, let us consider how it might be justified. Clearly, the estimates of profits used in applying the method cannot be the expected value of profits: for, as we have argued above, one would scarcely ever want to discount future expected profits by more than the accounting interest rate, and might sometimes want to discount them by less. Admittedly, the profit estimates that are to be discounted at this inflated interest rate are those based on engineers' estimates of the project; and it may be assumed that these are, compared with expected profits, optimistic estimates. If the risk-premium method is to be justified, it must be argued that the engineers' estimates of profits are more optimistic the further ahead they look — because discounting reduces estimated profits more the farther in the future they lie.

At first sight this is quite a plausible suggestion. To a large extent, engineers are accustomed to assume that existing prices and circumstances will continue into the future. It may be thought that changes are likely to be unfavourable to the project, since it is designed with today's circumstances in mind. Then it will not be surprising if engineers' methods, being somewhat short-sighted, are over-optimistic about the more distant future. This argument might be supported by the general impression that preliminary estimates of project cost and benefits often turn out to have been over-optimistic when one looks back over the history of a project.

There may well be something in this argument (although a lot depends not only on the particular engineers who are preparing the estimates, but also on the particular circumstances of the industry in question, rather than its degree of uncertainty as such). But there is one particular consideration

that may suggest that this is the wrong conclusion to draw from any apparent tendency for projects to turn out worse than the fond hopes of their designers had suggested. It seems to be much more generally true that the initial costs of projects are serious underestimates than that the eventual running costs are usually underestimated (in real terms — allowing for inflation, that is). Construction costs are notoriously subject to error, especially in the developing countries, but not only there ; there are everywhere complaints about unexpected delays — delays of a kind that are less likely to occur when the project depends on regular deliveries of raw materials, instead of once-for-all deliveries of pieces of special equipment. Designers, it is often suggested, are inclined to underestimate the number of special problems that will have to be overcome before the project will be working properly, and the time that will be required to trace the faults and find satisfactory remedies for them. Of course, the regular running of established projects also throws up difficult problems ; hesitations and delays are not unknown in mature plants. But it is hard to see why one should expect later costs and benefits to be more optimistically estimated than earlier ones, even if there is perhaps more excuse in the former case.

It seems much better, therefore, to try to consider the various elements in the situation systematically, and to prepare, quite deliberately, estimates of the expected level of costs and benefits throughout the possible life of the project. In the first place, these must be based on the designers' estimates. But it will often be possible to get further information, and to consider circumstances peculiar to the industry, when revising these initial estimates into estimates of expected social profit. It is in any case an extremely important part of the project planner's job to consider critically the various elements of the designers' estimates : he should expect to make a complete revision of the original estimates as he goes along.

The use of rules of thumb such as we have been discussing is based on a general impression of the relationship between initial estimates and final performance. The rules make some attempt to adjust the initial estimates for biases inherent in them. Although we advocate a more thorough and searching analysis of the estimates, we should also like to emphasize the great importance of using information about the relation between initial estimates and actual performance. We have drawn attention to this matter already, when we suggested that it might be possible to adjust initial estimates of construction costs to take account of any observed general tendency to underestimate them. We do think that it is possible to keep careful and systematic records of previous experience, so that this kind of adjustment could be made in a systematic and verifiable way : it is not necessary to rely on hunch and impression entirely, although they will always play some part in investment appraisal.

Chapter XVI

EXTERNAL EFFECTS

16.1 Introduction

The phrase ' external economies ' has been widely used in cases where the social profitability of a project is thought to be higher than the private profitability — sometimes, rather regardless of the exact reason for such a supposed difference. Similarly, of course, ' external diseconomies ' may be used to refer to the opposite case. But it is the external economies which have been emphasized for developing countries — perhaps in defence against the criticism that industrialization is over-emphasized in developing countries.

In this Chapter, we shall naturally not concern ourselves with all such differences. Naturally, because our system of cost-benefit analysis is precisely supposed to allow for many of them. The question that arises is therefore ' What costs and benefits, if any, have escaped the analysis which has thus far been propounded ? '

We have proposed a system of valuing the inputs and outputs of a project according to a set of accounting prices supposed to measure social costs and benefits. The question of the previous paragraph can thus be divided into two questions :

a) are there inputs and outputs which we have failed to include — what we may call ' hidden ' inputs and outputs to distinguish them from the obvious ones which we have certainly included ? and

b) have we mis-valued the obvious inputs and outputs, because they themselves have ' hidden ' benefits or costs for society ?

We are not, in this Chapter, concerned with benefits (or costs) which may be common to all industry, and which are so unidentifiable or unmeasurable that there is no way of saying whether one project may produce them any more or less than another project of comparable size. These generalized external economies of industrialization, such as the influence of industrialization on traditional attitudes of thought and behaviour may, if they exist, be a reason for giving some special encouragement to industry *vis à vis* agriculture and handicrafts. But, in our present state of ignorance, they do not seem to present any reason to prefer one sort of manufacturing project to another (except, possibly, labour-intensive ones). Now it is here taken for granted that developing countries, for good or ill, wish to give special encouragement to industry as such : and are concerned precisely with the choice between different industrial projects. So our concern is only with external effects which seem likely to vary from project to project.

In the following sections, we deal first with the 'infant industry' argument, the validity of which partly depends on the existence of external economies. Then we turn to a discussion of particular external effects, dividing them into those related to outputs, and those related to inputs. This provides a convenient arrangement of the discussion.

16.2 The Infant Industry Argument

A new industry is difficult to establish in the face of competition from an established industry abroad: the managers and workers lack experience, and even if techniques can be acquired the know-how that goes with them always takes time to learn. Thus costs will inevitably be high for some years. But, in some cases at least, these disadvantages will prove to be temporary. The industry will become competitive. This argument has been applied in highly developed high-wage countries as much as to the developing countries. But the case is stronger for the least developed countries, because it is surely harder to acquire industrial know-how and suitably trained labour in a non-industrial environment[1].

But the fact, if it is a fact, that the industry in question will eventually become a good industry for the country in question is not necessarily a good reason for starting it. No doubt, many industries which are relatively footloose as far as resources are concerned, could eventually have a comparative advantage in almost any country. (It may be chance — e.g. a fortuitous invention — which determines where they first become established.) But, given that others have got a start, the cost of catching up may be too high, from the point of view of dynamic advantage.

Supposing the putative infant industry is in the private sector, it thus still remains true that there is no good reason to give it special encouragement, unless a divergence of social and private advantage arises. This divergence must stem from one of three reasons: either (1) the private entrepreneur over-discounts the future from the social point of view (or makes a socially excessive allowance for risk); or (2) he fails to anticipate increasing profits through lower costs; or (3) he expects to be unable to reap all the benefit from lower future costs because the process of learning cannot be kept to himself, i.e. 'internalized', so that domestic competition will spring up: or, more generally, the learning process spills over and benefits the rest of the economy, and he receives no reward for this even if it does not actually increase competition so far as his own product is concerned. Of these three reasons, the first two will already have been allowed for in carrying out, whether for the public or private sectors, a project analysis along the lines suggested in this Manual. Thus project evaluators will discount the future and allow for risks, taking the point of view of society. It is only the third reason which concerns us here, and this is also the reason which raises the problem of external economies.

What has to be assessed is the extent to which the adoption of a new process or technique by one project will make it easier and quicker for others to learn to achieve good results. Furthermore, if this consideration is to be

1. It should be noted that it is hard to keep the 'infant industry' argument distinct from that of external economies arising from labour and management training — but we treat it as distinct.

worth taking into account, there has to be both (a) a presumption that this kind of external economy will differ significantly from project to project, or industry to industry, and (b) some way of quantifying the effect.

There appears to have been little or no research on this aspect of the infant industry argument. As a result it is difficult to say anything at all helpful. Clearly, any new industry, or new process in an old industry, *can* generate some such external economies. But the question remains as to whether they are important, and whether they vary very much with the type of industry or process. It would seem that the process must be skill-intensive in some way, and that the skill must not be too easy to learn except by 'doing'. Further, if it is very specific to the product, then it must be expected that the number of firms manufacturing the product will be increasing. But such generalities do not get one far. In any case, however, the relevant communication of skills must be by training people on the job. The training of managers, workers, and technicians, can be regarded as a kind of output of the project. This brings us to the next section.

16.3 External Economies related to the Output

16.31 *Extraordinary Outputs*

As already suggested, the first question is whether there are outputs not ordinarily counted as such, which may consequently be overlooked. Economists have long searched their imaginations to find examples of extraordinary good outputs. Perhaps the most famous are the fruit farmers who 'produce' blossom on which bees feed, which is good for honey output: and forest planters who may change the climate, and make rain. It has been noticed that examples are much easier to find in agriculture than in industry. The most plausible case in industry seems to be labour-training (including skilled labour). In general, people improve their skills by being employed in a manner which increases their value to other employers, or sometimes to themselves if they leave and set up in business themselves. When a man leaves a firm, the latter will thus have added some value to the man. Is it in any way recompensed for this 'product'? The answer is, only to the extent that it may have got the man cheap in the first place in anticipation of the training (e.g. apprenticeship). For even if the man stays with the firm that trains him, the latter is likely to have to pay him more, as a result of the training it itself has provided, in order to keep him. It should not be impossible to make a rough quantitative estimate of this external economy when appraising a project. The main question is whether it is worth doing. Our impression is that the present value of such training is usually likely to be small compared to other project items.

Most of the other extraordinary outputs which have been thought of are bad. They include the production of atmospheric pollution by smoke, and water pollution by effluents. If significant or measurable, these should, of course, be counted as costs.

16.32 *Undervaluation of Ordinary Outputs*

It is quite common for certain outputs to be sold for less than their social value, for administrative or political reasons. This is most usual

in the case of so-called infrastructural projects. Thus roads are usually supplied free. Irrigation water is either free, or sold for much less than its worth. Public electricity undertakings as often as not lose money : and so on. No one conducting a cost-benefit analysis would think of ignoring the above sort of divergencies between the price charged, and the social value of the output, which must then be estimated by some other means.

In industry, deliberate undercharging is much less common. It is also unusual for it to be administratively difficult to charge people as much as they would be willing to pay.

More subtle reasons why one might underestimate the value of some industrial outputs have been suggested. These suggestions concern the domestic output of intermediate and capital goods. In this connection, the concept of ' forward linkages ' has received wide attention, a ' forward linkage ' being the market relationship between two firms considered from the seller's point of view. (A ' backward linkage ' is the same relationship seen from the buyer's point of view.)

Consider a new project which uses a cost-reducing innovation. Now it is possible that in practice some of the benefit of the cost-reduction will be passed on to other industries. But there is no reason, so far, why a project analysis should go wrong : the output would be normally valued at the old price, which would properly account for the benefit[1]. It is true that the private sector entrepreneur may have insufficient incentive, if the benefits of his improvement are competed away too soon (which it is why one has patent laws). On the other hand, it has been suggested, not so much that the benefit of a given project may be underestimated, as that the size of the investment is likely to be too small, because increased demand arising as a result of the spillover of benefits to other firms or industries (called, sometimes, pecuniary external economics) is not allowed for. This argument raises the whole question of investment planning, and of whether, when information is inevitably limited, planning or the price mechanism produce better results for investment. But, in itself, it does not seem to be a very strong argument, for investments generally anticipate increasing demand, and that part of the increased demand, due indirectly to the investment itself, is liable to be lost in the wash. Much depends on the market conditions facing the investor, and his attitude. At all events, excessive investment in capacity often arises in industries where one might expect the opposite, according to the above argument. There seems to be nothing in this argument, which should make us want to modify what has been said : that demand should be estimated as well as it can be, with or without the help of planning.

Still on the subject of ' forward linkages ', it has been maintained that the production of intermediates encourages others to make investments which use these inputs, and that this is an advantage. What is undeniable is that lack of an input can inhibit otherwise profitable and socially beneficial

1. This assumes that the new investment is small. If the investment is one which realizes economies of scale, and is large, then the anticipated price of the output after the investment may be significantly less than before — as a result of increased supply. In this case the new price is taken into consideration by the private producer : but the mean of the two prices is a better measure of benefit in an appraisal from the social point of view (see 9.1).

investment. This is the whole argument in favour of providing a suitable infrastructure, which can be commonly used by manufacturing firms, in the case of non-tradable inputs which can best be produced on a scale which requires their use by many customers. But there is nothing here which implies that the rules suggested for the production of non-tradable inputs require any modification. Such things as transport and power should be available at prices which equal the social cost of providing them. But it should not be thought that the more provision of such things will result in any use being made of them. There is a number of monuments to this mistake in developing countries.

The same argument has been extended to tradables, particularly steel. Domestic production of steel is supposed, somehow, to be more conducive to the use of steel and hence more of an encouragement to investment in socially profitable steel-using industries, than imports of steel. Why should this be the case? If it were true, then domestic steel should be valued at a somewhat higher accounting price than would be arrived at by the methods explained in 8.1 or 8.31. Several reasons may be suggested: first, that imports are unreliable because quotas may be imposed: secondly, that domestic suppliers will be keener to sell, and so may offer special terms: thirdly, that smaller stocks can be held if a closer-to-hand supply is available.

Take the first reason. Our position is that if steel passes the project selection criterion, *which takes full account of any scarcity of foreign exchange*, then domestic steel will be available; but if it does not, then foreign exchange will be available to import it. In that case, there is no reason for government restrictions on imports. Admittedly, one must allow for some fluctuations in foreign exchange earnings, and for miscalculations of its availability: and temporary import quotas may therefore become desirable: but the last things which should be allowed to suffer from such quotas are basic materials and intermediates. The government is certainly handling the economic affairs of the country badly if restrictions have to be imposed which do damage to domestic production. Despite this, we are well aware that the governments of many developing countries have given higher priority to imports for creating new capacity than to imports of parts and components, with resultant underutilization of existing capacity. Nevertheless, as already remarked, it is extremely difficult to produce rational criteria for project selection on the assumption that governments will behave irrationally (in very varying ways about which it is difficult to generalize).

Turning to the second argument, the main commercial factor in promoting sales is undoubtedly the price. A domestic plant is not likely to be able to promote the use of its product much more than an importer of the same product, unless it can offer a comparable price. But if, to be competitive, a price has to be charged which is less than the properly calculated social cost of making the product, then the encouragement given to the use of this product is likely to be a cost not a benefit to society. The exception would be if the steel-using industries themselves showed a social profit large enough to offset the social loss involved in supplying the steel; if, that is, these industries passed the project selection criterion. But, in that case, these industries should be started anyway, either because they would be directly chosen in the public sector, or because the government gave

sufficient encouragement to industrialization in the private sector in the ways discussed in Chapter VI. In short, the desirability of starting industry A, which uses the output of B, is no good reason for starting B, if B does not pass the test. Industry A can always be started using imported inputs. Finally, one must remark that, in practice, this 'forward linkage' argument often works the opposite way to that supposed. Wrong intermediate industries are established, excessive protection is put on to let them survive, and the result is that the output is sold at a price which is higher than the socially optimum price, so that industries which use the product are put at a disadvantage.

The final argument suggested was that steel-using industries can hold smaller stocks if there is a domestic source of supply. It is often true that larger stocks of imported goods than domestic goods need to be held somewhere. In general, imported goods may require additional services, such as port-handling, and more stock-holding (internal transport can go either way), compared to domestic goods. To this extent, domestic goods should have a (slightly) higher accounting value put upon them than the c.i.f. price. Where it seems worth making an estimate of the difference it should be done.

This argument about stock-holding is really a special case of a more general one. It is often more advantageous to have a close source of supply, rather than a distant one — quite apart from the transport cost, which is, of course, allowed for in our methods of evaluation. This is particularly the case with non-standard items, which cannot be ordered from a catalogue or by written specification; where the purchaser needs to discuss his requirements with the manufacturer; or where services are required only occasionally, but then urgently — e.g. repair services. These advantages of proximity will normally be reflected in the price which the supplier can charge: a local repair-shop, or a manufacturer who will make a one-off piece of equipment to experiment with, can charge more than a distant or mass-producing firm could, while remaining competitive. In general, this can be allowed for if there is evidence that firms will pay more for local supplies than imported supplies. If, for instance, there is market evidence that there is a 'natural' 5 per cent preference for local supplies of some good, then its accounting value can be set 5 per cent above its c.i.f. value.

It should be noted that the above is likely to apply *least* to goods of standard specification like oil products or steel; and more to non-standard engineering products, textile materials, and any goods where technical changes in the manner of their use, or changing consumers' tastes, play an important role. It is also worth noting that imported supplies are often preferred in developing countries, rather than the reverse. This may be because the imported article, though nominally the same, is of better quality. It may be because the local supplier more than offsets his natural advantage by being unreliable in delivery, quality, and generally by failing to keep his promises. On the other hand, the preference for imports may sometimes be due to prejudice.

The advantages of proximity may apply rather less to a country, than to a region or town. Sometimes, it is easier to get something from abroad promptly, than it is to get it from another part of the country. We consider this again briefly in 16.4.

16.4 External Economies Related to Inputs

16.41 *Extraordinary Inputs*

In theory, if a project receives some beneficial input for which it does not pay, this should be counted as a cost, and the producer of the benefit should receive an equal recompense : and similarly if it is harmed, e.g. by another's smoke, its costs should be reduced by an appropriate amount. But, as already indicated in 16.31, such external effects are unlikely to be significant so far as industry is concerned.

16.42 *Wrong Valuation of Inputs*

It is possible that the general development of the economy will reduce the real cost of some of the inputs of a project. But this is a matter of proper estimation of future accounting prices and is not an ' external effect ', unless the initiation of the project itself causes changes in the real cost of its inputs. This can happen if the demand of the project for an input is either (a) sufficient to result in the establishment of a socially profitable project to produce the input, or (b) sufficient to realize economies in the production of the input, when the latter is already produced domestically. These kinds of effect, *via* new demand for inputs, are often referred to as economies resulting from backward linkages.

The first case could arise if there was previously no domestic demand for the input, while it could not have been produced for export with adequate social profitability because of transport costs or foreign protection. But, given a domestic demand, the input can be produced at a lower social accounting cost than the import price. Now the project under consideration might show inadequate social profitability if the input were reckoned at the c.i.f. price (there being no domestic production) ; but it would pass the test if, anticipating its production, one treated the input as a non-traded good (*ex hypothesi* its accounting cost is then lower than the c.i.f. price).

To illustrate the above paragraph, it might be socially profitable to produce refrigerators together with electric motors ; but if one evaluated a refrigerator project based on imported motors, and an electric motor project without the refrigerator demand, neither separately would pass the test.

Now, supposing that the refrigerator project is under examination, the methods of evaluation proposed need no modification, provided that it is realized that domestic electric motor production will spring up as a result : given this, the proper accounting price will be put on the motors. If, say, the main project (refrigerators) is in the public sector, and the input-supplying project or projects will be in the private sector, it may be as well to ensure that it or they in fact get started by offering long-term contracts, credit, etc. If there is no question of either project being in the public sector, it can happen that neither gets started since each waits upon the other. In this case no question of project appraisal will arise, but an opportunity is missed. But that such opportunities can be missed, is no proof that they often are. After all, either the refrigerator man can decide to make motors himself, or the motor man can make refrigerators. True, such ' vertical integration ' requires more capital, and this might be a stumbling block : on the other hand, if each of the men can raise capital for his own part of the business, it is not inconceivable that they should amalgamate their projects, or at least make a contract.

A very similar situation arises when some of the inputs of the project are already made at home. In this case, the increased demand for them may result in economies of scale, and these economies may be external to the project. They will be external if the resulting benefit is not passed back in the form of lower prices. Does our method of project appraisal, as described in earlier chapters, automatically take account of this kind of benefit? Probably 'yes', but let us consider the matter further. Suppose some of the input is imported and will continue to be so for some time. In this case, it is valued at its c.i.f. price, which makes no allowance for induced economies of scale; but this seems to be correct, for if the good is still imported, then the economies of scale could in any case have been realized by further import substitution, and are not attributable to the project. On the other hand, if the import price tends to fall as less is imported, complete import substitution may not have been a correct policy despite domestic economies of scale (in this case we would have used the marginal cost of importing as the accounting price for the input, and not the c.i.f. price). Similarly, if the input is an export commodity, economies of scale can arise as a result of the project, provided that the export market is not perfectly elastic, which will seldom be the case. Economies of scale can also, of course, arise if the good is not traded at all. Thus the question whether our methods already take account of such economies boils down to the question of whether they will be correctly anticipated, if they arise, and so be allowed for in the *future* accounting prices of inputs. There is really no matter of principle involved. The more important question is whether they are likely to be very significant, and whether it is sensible to spend much time on enquiries and research which would enable one to make some sort of rough estimate.

Much has been made of the benefits to be expected to result from backward linkages. One has been told that a project which was manifestly socially unprofitable at the time, would surely become (socially) profitable when the heavy dependence on imported components was reduced — without a shred of evidence being offered, as if the matter was self-evident. Again, it is sometimes argued that motor car assembly must be a good thing for developing countries to promote, because it leads to the manufacture of the component parts. Governments may require that increasing percentages of the value of the final product result from domestic manufacture as time goes on.

Some warnings are in order. If the establishment of backward linkages is sought for its own sake, without economic appraisal, then the social profitability of a project, whose costs consist to a considerable extent of the purchases of parts, is likely to be reduced not raised. For instance, some parts may need to be made on a much larger scale, than is required for their assembly into a particular final product. This seems to be notably the case in the motor car industry. It is for this reason that it is often referred to as, essentially, an assembly industry. It is also worth remarking that it seems to be increasingly the case, even in industrialized countries, that imported components are incorporated in a final 'national' product. Even so considerable a component as the engine is sometimes of foreign manufacture, where the scale of output is small. This is still more notably true of aircraft. Since slogans such as backward and forward linkages seem to be influential, it might be as well to add the slogan 'trade in

intermediates'. Finally, it should not be imagined, even when it seems likely that small-scale manufactures could supply components for a new venture, that there is anything automatic about this. One of us when visiting a vast new industrial project, which had been operating for more than two years, pointed to an adjoining empty area apparently reserved for some industrial use, and asked what it was for. He was told that it was reserved for the industries which would grow up to supply the project.

We shall end this section by asking whether there is any way of deciding *a priori* how important the external effects arising from backward linkages might be. Let us make up a very simple hypothetical project. All figures are in accounting prices. Rs. 50 million of capital is spent in year one : thereafter, in every year for ever, sales are Rs. 15 million and current costs are Rs. 10 million. Discounted at 10 per cent this flow of social profit gives Rs. 50 million of present value, equal to the capital expenditure. Hence the present social value is zero.

Now suppose that 10 per cent of current costs is in respect of purchases of a component, not subject to economies of scale, which was previously wholly imported, but which is now going to the made domestically as a result of our project. The project thus spends Rs. 1 million per annum on this item, at c.i.f. prices. Now the new domestic production is unlikely to reduce costs by more than, say, 15 per cent. If the component could have been made much more cheaply than this, it is reasonable to assume that it would have been worth making for export. Let us suppose that production of this component starts at the same time as the project. This is a very favourable assumption, because if this really were to happen its production would have to be planned in conjunction with the project — in which case any sensible project appraisal would reckon in these external benefits, which we are now assuming to be forgotten or at least ignored. On these assumptions, annual current costs are overestimated by Rs. 150,000 per annum.

Assume now that a further 10 per cent of costs is in respect of purchases of inputs which are not specific to the project (i.e. have other uses), where economies of scale are consequently realized. The increased demand is thus Rs. 1 million. How large a percentage increase in output of the item or items this represents, depends on the previous size of the market. It would seem to be extreme to assume that average costs might fall 20 per cent, as a result of such increased demand. Nevertheless, this might happen if the increased demand was, say, in respect of one item whose output was thereby doubled : so this is the assumption we shall make. But Rs. 200,000 of consequent saving cannot be reckoned for every year of the life of our project. Since the item is non-specific, the general development of the economy would have caused the realization of the economies of scale anyway. The project under examination only advances the realization. Its contribution to these economies of scale thus falls away from the maximum figure of, say, 20 per cent, after a year or two (when the new capacity is created to meet the increased demand caused by the project) to a negligible amount after, say, 20 years. As a rough allowance for both the delay in the realization of such economies, and their decreasing importance, one might reckon that the 20 per cent mentioned is the equivalent of 10 per cent for every year of the life of the project. Consequently another external economy of Rs. 100,000 is realized.

This adds up to a total of Rs. 250,000 external economies per annum

for ever : which compares with projected sales of Rs. 15 million, a projection which is most likely to have a range of at least *plus* or *minus* 10 per cent, i.e. Rs.1 ½ million. Thus even such a crude hypothetical example as this does make one wonder whether it is worth spending a lot of time on trying to estimate external economies. It may be far more important to spend the time improving the ordinary estimates of sales and costs.

16.5 Industrial and Spatial Complexes

Both of these have been mentioned *en passant*. The manufacture of refrigerators and electric motors could be considered as a rudimentary ' complex '. Any set of plants such that one buys most of the output of all the others, or all but one or two plants sell most of their output to another member or members of the set, seems to be what is meant by this rather vague term. People, for instance, speak of a petro-chemical complex. Where such a set of linked projects can be set up, it may be advisable to do a cost-benefit appraisal of the whole complex. This is because the situation already discussed in the refrigerator and electric motor example may arise. In other words, a set of plants may be sufficiently socially profitable ; but taken one by one, and without the local market provided by other plants, no constituent plant would be socially profitable. In extreme cases, this is obvious enough, as when a product is very expensive to transport, and can be used only as an input into another process — e.g. some of the gases in a petro-chemical complex. But, with such a complex, it is also advisable to look at each plant separately whenever the result is not obvious — whenever, that is, an input can be purchased outside the complex, or an intermediate output sold outside it. The complex should not be regarded as *technically* determined. Sometimes, an input might be better imported. Sometimes, it might be profitable to produce more of some intermediate than needed by the complex, and sell it as well as the final product.

We have also briefly mentioned the economies that can result from physical proximity, independently of vertical technological linkages. This is what we mean by spatial complexes. If one is designing a spatial industrial complex from scratch, like decorating a completely bare room, then it becomes useful to know what benefits derive from proximity. What industries or plants gain by being close to each other ? There appears to be very little empirical work indeed which helps to answer this question. Ordinary transport economies are obvious enough ; so also are the diseconomies, e.g. locating oneself near any input may mean increasing ones distance from the market for the final product. Other slightly less obvious economies arising from proximity are all analogous to transport economies. They arise from the need, for technological or commercial reasons, of rapid communication, often face-to-face with other firms ; or from the need to acquire a special service very quickly, as when a machine breaks down.

But the above sort of economies are not, usually, external economies : that is, a firm in an industrial cluster can charge appropriately for the services it renders locally ; and it would take account of the benefits it would receive, and pay for, as a result of joining such a cluster, when deciding on its own location (as already seen, the benefit of being able to draw on a trained labour force may be an exception, and constitute the receipt of a

genuine external economy). Thus locational problems arise more if one has to *design* a spatial complex *ab initio*, for then one has to anticipate and allow for a whole pattern of relationships which need not be ' external '. This is a problem which lies beyond the scope of this Manual.

16.6 Conclusions

Bearing in mind that we are essentially comparing industrial projects with each other, we feel that differences in those external effects, which are not in any case allowed for in our type of cost-benefit analysis, will seldom make a significant difference. We believe that this conclusion may be more readily acceptable in the light of our recommendation that where linkages between projects are very close, then they should be examined together (as well as apart), the whole being regarded as a ' complex '.

If, however, the project analysers have a suspicion that there may be rather powerful external effects to an individual project, one way or the other, then they should try to quantify them however roughly. Even a back-of-an-envelope calculation may serve to show either that the initial suspicion was unjustified, or that further work might need to be done. If it is thought that the presence of external effects will be strongly claimed by opponents or proponents of a project, every effort to achieve a sensible, albeit rough, quantification should be made. Otherwise, wild exaggeration is all too easy.

There will no doubt sometimes remain possibilities of strong external effects, which nevertheless defy any attempt at plausible quantification. There is, finally, no alternative to mentioning such possibilities in a qualitative or literary manner.

Chapter XVII

CASE STUDIES

Introduction

This Chapter consists of two case studies in which the principles discussed in Chapters VII to XI are applied. Before proceeding to the case studies it should be emphasized that several parts of the analysis were not carried out in the detail, and with the knowledge, which should be expected of planners in the particular countries concerned. These remarks apply particularly to (a) the inputs of construction and electricity, (b) the factors which lead up to a decision as to the shadow wage rate. We also had to guess the rate of discount which the country might wish to adopt. The values attached to these variables are not, of course, intended as recommendations. Particular values are given because some figures had to be adopted to carry the analysis to a proper conclusion. But we did not adopt merely arbitrary values : but rather those which, with our limited knowledge, seemed reasonable.

It is, perhaps, worth mentioning that over twenty case studies of projects, or actually operating plants, in developing countries, have been carried out by the OECD Development Centre, although some with less meticulousness than the two here presented. They seem to show social rates of return which vary from being actually negative, to yielding close to 50 per cent, which is the case with the machine-tool project for Mexico studied below.

No. 1. CASE STUDY OF A RAYON PLANT FOR PAKISTAN

The data used came mainly from the "Feasibility Report for the Establishment of a Rayon Staple Plant in Pakistan with a capacity of 20 tons/day", prepared and kindly made available by Ing. A. Maurer S.A., Bern. The original feasibility report was not, of course, prepared by Ing. A. Maurer S.A. as a cost-benefit analysis, but with regard to its profitability, since their client was a private firm. The prices of chemical inputs were obtained from a recent copy of *The Chemical Market Newspaper*, the prices of synthetic fibres from *Skinner's Record of the Manmade Fibres Industry*, quotations of transportation and insurance costs by telephone from a variety of shipping companies.

Rayon, the first man-made fibre, is derived from cellulose obtainable from plants. Cellulose is insoluble in water, but with suitable chemical treatment it is possible to obtain the cellulose in soluble form and convert it to useful fibres. Thus rayon staple can be produced from naturally grown raw materials (forest trees, reeds, straw) or, as in this case, from cotton linters, the residue from the cotton crop. The rayon pulp (linters basis) is treated with caustic soda, sulphurized with carbon disulphide, and dissolved in soda lye to the so-called 'viscose' solution. This solution is pressed through the tiny holes of the spinning jets into an aqueous solution of sulphuric acid, salts of sodium, and zinc, where it coagulates, forming an endless cable of filaments which are cut, washed, dried, and finished for sale.

The process is quite old and very well known; but in Europe and the United States, rayon staple fibre is made from the much cheaper wood pulp, since its manufacture from cotton linters would be uneconomical. In Pakistan, however, cotton linters is the cheapest *locally* available raw material, since the processing of wood into wood pulp on the small scale required would be both very complex and much more costly. The final product, rayon staple fibre, has certain advantages over both natural fibres and synthetic fibres derived from petro-chemical sources; and it is usually used mixed with other fibres.

The plant is designed to produce 20 tons of fibre a day in continuous-process, three-shift operation, and is expected to operate 350 days per annum — two weeks a year being enough for maintenance and cleaning. Full-capacity annual output is therefore 7,000 tons; and the builders consider it feasible for the Pakistani firm to operate it at full capacity. The contract proposed is a 'turn-key' contract, which provides for the engineering firm to design and build the plant, train local staff, and hand the plant over in fully operating condition, with quantity and quality of output guaranteed.

All the data in the tables are in Pakistani rupees, mainly because the original project was written in rupees and, by expressing accounting

values in the same currency, the private and the social benefit calculations become easily comparable. But this should not blind the reader to the fact that all accounting prices were derived from foreign currency equivalents as explained in earlier chapters. These were converted to rupees at the official exchange rate (although any arbitrary exchange rate would have done as well, so far as the calculation of present social value is concerned).

The main summary Tables A 1 and A 2, giving investment and operating costs respectively, are arranged in four columns. The first column consists of the original project figures. The second column labelled ' accounting values (excluding unskilled labour) ' contains our estimates of these. The third column contains wage payments at their actual estimated values. Labour was kept separate so that anyone could calculate the present social value at different possible shadow prices for labour. The fourth column is merely the difference between the sum of columns (2) and (3) and column (1). It consists largely of taxes and subsidies.

As explained in Chapter VII the accounting values are based on world prices, c.i.f. or f.o.b. depending on whether the good is an import or export. But since we are dealing with a hypothetical situation (broadly speaking, one in which the country has adopted an optimal foreign-trade policy, and where our rules for project selection have been in force for some time) we needed to ascertain, not whether an item was actually imported or exported, but whether it would be in such an optimal situation. As a rule of thumb all manufacturing equipment and natural resources not available in the country (e.g. oil) were treated as imports or potential imports (for short we call actual or potential imports, exports, or traded goods, ' importables ', ' exportables ' and ' tradables ' respectively) ; for other materials and staple products quoted f.o.b. New York or London prices were used as a reasonable approximation to both the c.i.f. actual price of importables and the f.o.b. actual price of exportables[1]. The accounting price of the main material input, cotton linters, was, however, particularly difficult to estimate, and also particularly important. We therefore discuss it here in the text.

The world market price of cotton linters f.o.b. New York (and apparently also f.o.b. Karachi) was Rs. 952 ($ 200) a metric ton[2]. The world market, however, is very small. Total world trade is of the order of $ 16 million and Pakistan's exports are less than $ ½ million : this means that the operation of this single and relatively small Pakistani plant would absorb 10 per cent of total world trade, assuming an average world price of $ 200, or 6 ½ per cent with an average world price of $ 125. One cannot, therefore regard the world price of cotton linters as given, and uninfluenced by the decision whether or not to build this plant ; accordingly, the world price of linters cannot be used for valuing its input in a social cost-benefit calculation, because it does not reflect its social marginal cost.

As already mentioned, in Western countries, rayon staple fibre is more economical to manufacture from wood pulp. In Pakistan, the processing of lumber into wood pulp would be too costly on so small a scale ; but it would be cheaper to manufacture the fibre from imported pulp than from cotton linters at their world price. More exactly, if Pakistan could export

1. Insurance and freight was of the order of 5 per cent in all cases ; and the cheapest supplier's actual price is often this much below the quoted world market price.

2. The prices used in the study are those of late 1966 or early 1967.

and sell abroad its cotton linters at the world price of $ 200/ton, use part of the foreign exchange so obtained to import wood pulp out of which to produce rayon staple fibre, she would save $ 90 in foreign exchange per ton of fibre produced (less the insignificant cost of shipping the linters).

The smallness of the world market for linters renders this impossible. No estimates are available of the price elasticity of world demand for linters ; it was assumed, therefore, that the marginal revenue from exporting linters, which is the social marginal cost of using them domestically, could not exceed the level at which fibre production from domestic linters would be no more costly than fibre production from imported wood pulp. This level was estimated to be $ 125 a ton. At any higher accounting price, it would pay Pakistan to export her linters and run the plant on imported wood pulp. This gives an upper limit. At this price or higher, the plant would or should use wood pulp. It also happened that $ 125 was the average recent actual price obtained for United States exports of cotton linters as distinguished from the *quoted* New York price of $ 200. Without knowing more about the supply position from other cotton-growing countries, it was very difficult to say whether Pakistan could sell the 8,400 tons per annum which the project would use at around $ 125 — but, since this price was already only five-eights of the quoted price it was initially treated as both a maximum and a minimum. However, the calculations have also been reworked to show how low the accounting price of cotton linters would have to be if the project was to yield as much as 10 per cent in real social terms.

The notes to Tables A 1 and A 2 explain the assumptions made in making the division of costs between columns (2) and (3), and in arriving at the accounting prices used for column (2), in the case of tradables (apart from cotton linters which has already been considered), and minor non-tradable items. The two main non-tradables, civil engineering and electricity, required separate treatment (internal transport was not allowed for, for lack of data; but it is extremely unlikely that this neglect could make a significant difference to the results). Their treatment was carried out, so far as possible, according to the principles outlined in 12.3. This is all described in the two notes on Civil Engineering and Electricity at the end of the case study. At various points in the calculations use was also made of a standard conversion factor as described in 12.4. Thus, where no better estimate could be made, domestic values were converted to accounting values by subtracting from the former the weighted average price differential between the domestic value of tradables (both imported and exported) and their world-market value converted at the official exchange rate. We used Prof. S.R. Lewis's estimates of price differentials for Pakistan, and Pakistani official trade statistics[1]. The price differential for each item was weighted by the value of trade ; and the weighted average so obtained was rounded, giving an average of 60 per cent of the world price to which it is added, or of 37 ½ per cent of the domestic price of which it forms part.

Attention is also drawn to footnote 18, 19 of Table A2 which discusses the maintenance and replacement provisions. The most usual way of dealing with a project is to assume a life, and allow for maintenance, and for major replacements when they are likely to occur, and finally bring

1. Lewis and Guisinger, *Measuring Protection in a Developing Country : The Case of Pakistan*, December 1966 (mimeo.) ; W. Tims, *Industrial Growth During the 3rd Plan*, 25/7/65 (mimeo.)

in a positive value at the end representing the scrap value of the plant. In this case, however, it was easier to estimate an annual sum which would keep the plant fully competitive for ever. For ever sounds a long time : but in practice it would make virtually no difference if a life of, say, 50 years had been assumed.

Table A3 takes the investment costs of Table A1 and phases them over the two and a half year expected construction period.

Table A4 shows the time profile of the project bringing together investment costs and operating costs and benefits. The first two rows are taken from Tables A2 and A3. The third row introduces the shadow wage rate, which was estimated as follows. First, consumption out of wages at accounting prices was estimated. Assuming that unskilled labour would consume all its wages, and applying the standard conversion factor, consumption at world prices would be 62 ½ per cent of the actual wage. Thus where w is the actual wage, and c consumption at accounting prices, we have $c = \frac{62.5}{100}w$. From the discussion of Chapter XIII, it appeared that the shadow rate for Pakistan expressed as a percentage of c should be rather high, and so 80 per cent was chosen. The shadow wage is therefore equal to $\frac{8c}{10}$, i.e. ½ w. The figures of row (3) of Table A4 are therefore half those of row (1). If anything, 50 per cent may be on the low side, because the standard conversion factor almost certainly underestimates the ratio of world to domestic prices for the typical family budget of an unskilled worker. However, it makes rather little difference to this project what shadow rate is chosen, because labour costs, especially in investment expenditures, are a small proportion of the total.

Row (4) of Table A4 is the array of social profits which must be discounted to find the present social value. Rather arbitrarily an ARI of 10 per cent was chosen in the belief that Pakistan's investments ought to be yielding at least this much. The upshot is that the social present value is negative, *minus* Rs. 18,063. In arriving at this final value, we discounted Year 1 by nothing, Year 2 by $\frac{10}{11}$, Year 3 by $\left(\frac{10}{11}\right)^2$, and so on. If expenditures and receipts are evenly spread over the years, this in effect means that we have discounted to a point of time roughly six months ahead. No great distortion is likely to result from this, provided the same procedure is applied to all projects.

Since the present social value was negative at 10 per cent, the social internal rate of return was also calculated. This turned out to be 5.4 per cent . The private rate of return given a 100 per cent tariff, had been estimated to be 12.3 per cent.

Some readers may wonder that no allowance has been made for external economies, discussed in Chapter XVI. In truth, we could think of no external economies except labour, and perhaps management, training. But, relative to other industrial projects these would probably be less than normal, partly because it is relatively capital-intensive so that the up-grading of unskilled labour is not large compared to the investment expenditure, and partly because the techniques are simple, specialized, and standardized,

so that the practical engineering and administrative experience involved is unlikely to be at all catalytic.

Finally, there is the question of risk — the risk that our estimates are wrong. It is on balance clear that this is rather a low risk project. Since the techniques are long-established, and the consulting firm has vast experience of erecting such plants in many countries, including many developing countries, their predictions can be taken as being as accurate as any such are likely to be. We can only have erred on the side of optimism in accepting their view that the plant could operate continuously at 100 per cent capacity after two and a half years.

It is also clear that the supply and marketing risks are small: the most costly material input is domestically supplied, and the output is for a domestic market which would be assured if the plant were built. There is also rather unlikely to be any fall in the accounting price of the output, since rayon is a long-established product with settled techniques and very unlikely to be superseded. The chief risk in our calculations is undoubtedly the price of cotton linters. As we saw, the *present* accounting price assumed cannot have been too high, for if it were any higher the plant could operate on imported wood pulp. On the other hand, it is possible that wood pulp would get more costly over the years, so that the maximum price of cotton linters could rise, and make the assumed accounting price too low. As against this, it may be that now or in the future the alternative use value (for export) of cotton linters is less than $ 125 per ton. Since the project has negative present value at this price (at a 10 per cent rate of discount) it becomes interesting to work out how low the value of cotton linters would have to be, to give the project a positive present value at a 10 per cent discount rate. This calculation has been done, and the answer is that the price must be about 39 per cent lower, or about $ 76 per ton.

There is a danger in calculating, as above, the value of an uncertain price which is just low or high enough to make the project viable (or definitely not viable). This is because it may set people arguing that this is the right price. But, bearing this in mind, it is quite a useful thing to do, because sometimes the price that would have to be assumed is plainly absurd.

What do we conclude from this case study? Plainly, that the project was unacceptable, unless further studies of the market for cotton linters showed that the marginal revenue obtainable from exporting linters was no more than $ 75 per ton, and that no alternative domestic use existed in which it would have a higher social value than this. This conclusion would, of course, be modified if Pakistan should fix on some other discount rate than 10 per cent.

TABLE A1. INVESTMENT COSTS

Thousand Rupees.

ITEM	VALUE AS STATED IN PROJECT REPORT	ACCOUNTING VALUES FOR GOODS AND SERVICES EXCLUDING UNSKILLED LABOUR	UNSKILLED LABOUR (actual value)	THE REST (2) + (3) — (1)
	1	2	3	4
1. Imported equipment	22,000	22,000	—	—
2. Duty on above	4,975	—	—	4,975
3. Locally produced equipment	4,900	4,900	—	—
4. Local labour, works and tools	1,200	120	1,080	—
5. Foreign labour during start-up	700	700	—	—
6. Total cost of equipment	33,775	27,720	1,080	4,975
7. Engineering services	2,400	2,400	—	—
8. Civil engineering and works	11,000	4,400	2,420	4,180
9. Land	150	94	—	56
10. Lighting and fire equipment	350	350	—	—
11. Contingencies	500	367	37	97
12. Working capital	4,100	2,378	164	1,558
13. Management and overheads during start-up	1,500	938	—	562
14. Total investment cost	53,775	38,647	3.701	11,428

1. Imported equipment, c.i.f.

3. Local equipment, Pakistani price. Imported equipment would have cost about the same in Europe but insurance and freight would have added 15 per cent. It was hard to say whether the Pakistani equipment, or whatever the suppliers would have produced otherwise, should be valued c.i.f. or f.o.b. We have compromised with the actual value which is between the two.

4. It was assumed, somewhat arbitrarily, that 90 per cent constituted the cost of labour, 10 per cent the rental of works and tools.

7. This is payments to foreign consultants and therefore tradable.

8. The total was split into 40 per cent tradables, 22 per cent labour, and 38 per cent the rest. (See Note on Civil Engineering for the calculations on which this division was based.)

9. Conceptually, the cost of land is the capitalized value of its marginal product in producing tradables in alternative uses. Its domestic cost was converted therefore into tradable value by subtracting from the figure as given in the project report an estimated 37½ per cent average tariff-cum-subsidy. (See the text for explanation of this figure.)

11. Since the presence of a 'Contingencies' item implied that some of the preceding expenditures may have been underestimated, the total, as stated, was divided between the three columns in the same proportions as all the preceding items taken together, namely 73 1/3 per cent, 7 1/3 per cent, and 19 1/3 per cent.

12. Working capital was split between the three columns in the same proportions as total operating cost, namely 58 per cent, 4 per cent, and 38 per cent. (See line 20, Table 2).

13. The domestic cost was diminished by subtracting the 37½ per cent average-tariff-cum-subsidy.

TABLE A2. ONE YEAR'S OPERATING COSTS AND RECEIPTS AT 100 PER CENT (7,000 TONS CAPACITY)

Thousand Rupees.

	VALUE AS STATED IN PROJECT REPORT	ACCOUNTING VALUES FOR GOODS & SERVICES EXCLUDING UNSKILLED LABOUR	UNSKILLED LABOUR (actual value)	THE REST
	1	2	3	4
1. Cotton linters	See	4,998	—	
2. Chlorine	note	48	—	
3. Sodium bisulphate	to	17	—	
4. Sulphur	item	870	—	
5. Charcoal	6	92	—	
6. Total of above	13,019	6,025	—	6,994
7. Caustic soda	4,200	2,930	—	1,270
8. Other chemicals	630	472	—	158
9. Filter materials	315	197	—	118
10. Packing materials	154	96	—	58
11. Maintenance materials	385	241	—	144
12. Electricity	1,803	1,442	433	—72
13. Steam	1,740	870	—	870
14. Technical and administrative staff	445	445	—	—
15. Other labour	570	—	570	—
16. Overhead expenses	770	480	—	290
17. Total 'cost of production'	24,031	13,198	1,003	9,830
18. Maintenance and replacement of equipment	3,378	2,772	108	498
19. Maintenance and replacement of building	330	132	73	125
20. Total operating cost	27,739	16,102	1,184	10,453
21. Total receipts	36,492	18,957	—	17,535
22. Net revenue	8,753	2,855	—1,184	7,082

NOTES TO TABLE A2

1 to 5. These values are the product of quantity needed and world price. All prices are given in rupees per metric ton. The price of cotton linters has been discussed in the text. Other prices taken were chlorine, 343; sodium bisulphate, 238; sulphur, 200; charcoal, 262; caustic soda, 465. The first four of these were f.o.b. Europe, and the last c.i.f. Karachi.

6. The project report did not list the costs of the inputs numbered 1 to 5, but only of the intermediate products (linters pulp, sulphuric acid and carbon disulphide) obtained from them. Subtotals 6 show the relation between the tradable value of inputs 1 to 5 and the domestic value given in the project report for the intermediate products produced with their aid. (The figure in column 1, however, is smaller than the corresponding figure in the project report by the cost of the electricity (Rs.487,000) and the steam (Rs.480,000) required to process the primary inputs into the intermediates. It seemed appropriate to include these figures in items 12 and 13.) The large difference between the domestic and the tradable value of these items is due partly to the low valuation of cotton linters which is explained in the text, partly to the use of world prices for the other inputs, while the project was based on prices prescribed by the Pakistani firm for which the report was prepared.

7. Here, too, the price used in the project report was prescribed by the Pakistani firm.

8. Since the Pakistani import duty on chemicals was 33 per cent (cf. Lewis and Guisinger, *loc. cit.*), the domestic value was reduced in the ratio of 1.33 to 1 to obtain the tradable value.

9, 10, 11. All these items were reduced by the 37½ per cent average tariff-cum-subsidy.

12. The estimated value was split into 80 per cent tradables, 24 per cent labour, and *minus* 4 per cent rent and taxes. (See Note on Electricity Costs for the derivation of these ratios.)

13. The steam in the project is derived from heating water by burning local natural gas. No data were available on the economics of this process and it was not clear whether the natural gas should be regarded as a tradable, a close substitute for tradables, or as a free good, which if not used would burn to waste or be stored underground indefinitely. As a compromise, 50 per cent of the stated value was entered as tradable.

14. Bearing in mind the discussion of 12.6 where it was argued that the application of the standard conversion factor to skilled workers might understate their social cost, it was assumed that accounting values were equal to actual values.

16. Assumed to consist mainly of office supplies, packing of final product, etc. The value stated in the project report was diminished by the 37½ per cent average tariff-cum-subsidy.

18, 19. These two items represent 10 per cent and 3 per cent respectively of the 'total cost of equipment' and of 'civil engineering and works' as given in Table A1. The percentages are the same as those used in the project report. We tried in vain to separate physical maintenance from technical obsolescence, and to deal with the latter by projecting a fall in output prices relative to input prices. Technical progress apparently is slow in this industry; and our consultants found it easier to estimate what rate of spending on maintenance and replacement would keep the plant competitive than to estimate the future trend of relevant prices. Also, much of the equipment needs frequent replacing due to corrosion; and it is easy then to replace it with improved equipment. In this project, therefore, it seemed unrealistic to assume that the plant would remain unchanged until scrapped, and realistic to assume that adequate maintenance and replacement would keep it indefinitely as competitive with new plants as it was at the start of its life. Row 18 is broken down in the same proportions as Row 6 of Table A1, namely 82 per cent, 3 per cent and 15 per cent; 19 in the proportions derived in the Note on Civil Engineering namely 40 per cent, 22 per cent, and 38 per cent.

21. The value of receipts at world prices was found by multiplying 7,000 by Rs. 2,708.14. (This price is based on that of 22d. per lb. given in *Skinner's Record of the Manmade Fibres Industry*, February 1967). The value at market prices is as estimated in the project report which assumed a tariff of 100 per cent.

TABLE A3. THE PHASING OF INVESTMENT COSTS AS IN TABLE A1 OVER THE 2½-YEAR PROJECTED CONSTRUCTION PERIOD

Thousand Rupees.

	1st YEAR			2nd YEAR			3rd YEAR		
	1	2	3	1	2	3	1	2	3
1. Imported equipment	7,333	7,333	—	14,667	14,667	—	—	—	—
2. Duty on above	1,800	—	—	3,175	—	—	—	—	—
3. Locally produced equipment	1,633	1,633	—	3,267	3,267	—	—	—	—
4. Local labour, works & tools	120	120	—	1,080	—	1,080	—	—	—
5. Foreign labour during start-up	—		—	—	—	—	700	700	—
6. Total cost of equipment	10,886	9,086	—	22,189	17,934	1,080	700	700	—
7. Engineering services	200	200	—	1,100	1,100	—	1,100	1,100	—
8. Civil engineering & works	7,000	2,800	1,540	4,000	1,600	880	—	—	—
9. Land	150	94	—	—	—	—	—	—	—
10. Lighting & fire equipment	—	—	—	250	250	—	100	100	—
11. Contingencies	—	—	—	250	183	18	250	183	18
12. Working capital	—	—	—	2,000	1,160	80	2,100	1,218	84
13. Management and overheads during start-up	200	125	—	800	500	—	500	313	—
14. Total investment cost	18,436	12,305	1,540	30,589	22,727	2.058	4,750	3,614	102

1, 2, and 3 correspond to the similarly numbered columns of Table A1.

TABLE A4. TIME PROFILE OF THE PROJECT

(cost minus, benefits plus) Thousand Rupees.

	YEAR 1	YEAR 2	YEAR 3[1]	YEAR 4 AND ALL SUBSEQUENT YEARS
1. Labour — actual value (sum of cols. 3 of Tables A2 and A3)	— 1,540	— 2,058	— 694	— 1,184
2. Accounting values (sum of cols. 2 of Tables A2 and A3)	— 12,305	— 22,727	— 2,187	+ 2,855
3. Labour at shadow wage equal to 50 per cent of actual wage (see text)	— 770	— 1,029	— 347	— 592
4. Total of rows (2) and (3)	— 13,075	— 23,756	— 2,534	+ 2,263
Present value of row (4) at 10 per cent discount	18,063			

1. In principle, the investment costs come in the first half of year 3, and the operating costs and benefits in the second half. In the Table they have simply been lumped together as if they were all spread over the whole year. This procedure very slightly exaggerates the present value of the project.

THE SUBDIVISION OF THE VALUE OF CIVIL ENGINEERING (CONSTRUCTION) INTO ACCOUNTING VALUES, LABOUR, AND THE REST

Following broadly the method of 12.3, the social cost of providing construction was calculated by using the 1963/4 input/output table for Pakistan which gives the following figures :[1]

		Million Rupees
	Total sales	4,197.46
1.	Payments for : imports c.i.f.	536.63
2.	indirect taxes on imports	117.53
3.	other material inputs	896.89
4.	electricity etc.	1.83
5.	service inputs	558.58
6.	Value added	2,086.00

Of the inputs, *Item 1* clearly represents tradable values, and *Item 2* is to be ignored; all the others have to be subdivided into their constituent parts.

Item 3 was divided by 1.8 to obtain its tradable value (896.89 ÷ 1.8 = 498.27) both because 80 per cent is the estimated weighted average price differential between the c.i.f. and internal values of all imports into Pakistan in 1963-4 and because it is the estimated unweighted average price differential between c.i.f. and internal values of intermediate goods imports into Pakistan in 1963-4.[2]

Item 4. This, a very minor item, was assumed to consist of 75 per cent tradables and 25 per cent labour, these being approximately the proportions arrived at in the Note on Electricity, which follows.

Item 5, which contains virtually no input of materials,[3] was assumed to consist of 1/3 administrative services, 1/3 labour, and 1/3 monopoly profits. The first of these was assumed to be fully tradable (there is no duty on imported services). Quite a large part of monopoly profit would accrue to the government as tax, or be saved: the remainder should be treated as a cost, in accordance with the discussion of 10.1, after applying the standard conversion factor. We have therefore added back one-third of monopoly profits to 'tradable values', and consequently divided the total in the proportions 4/9, 3/9, and 2/9, between tradable values, labour, and the rest.

Item 6. Value added consists partly of the cost of labour, partly of the interest and amortization on capital invested, and partly of rents and profits. As to the share of labour, the number of workers in construction can be estimated at ½ million,[4] their average annual earnings at Rs. 1,300[5], which makes the wages bill in value added Rs. 650 millions.

To estimate interest and amortization on capital invested one must first obtain the value of capital invested. This can be estimated roughly by applying to our figure of total sales the capital-to-gross-output ratios available for *India's* construction

1. Cf. Pakistan Planning Commission, National Economic Section : *Methodology of Estimating Import Requirements*, Appendix A, 1965.
2. These statements are based on data given in Prof. S.R. Lewis : *Measuring Protection in a Developing Country ; the Case of Pakistan*, December 1966 (mimeo), see p.42, Table V, Col. 2.
3. Cf. column 23/30 of the input-output table referred to above.
4. Mahbub Ul Haq, *The Strategy of Economic Planning*, Oxford University Press, 1966, p. 248.
5. *Pakistan Statistical Yearbook*, 1964, p. 74, and *Statistical Digest of East Pakistan*, No. 3, 1965, p. 279.

industry 1959[1]. These ratios, separating the different types of investment in India's construction industry, are as follows:

Heavy equipment	.08
Other equipment	.10
Construction	.04
Stocks	.60

Therefore the value of the different types of investment in Pakistan's construction industry were estimated as:

	Million Rupees
Equipment	755.54
Construction	167.90
Stocks	2,518.47

As to the annual cost of utilizing this investment, for equipment 10 per cent depreciation and 10 per cent interest, for construction 2 per cent depreciation and 10 per cent interest, for inventories no depreciation and 10 per cent interest was assumed. It should be noted that the rate of interest used is a guess as to the minimum accounting rate which Pakistan should be using (an accounting rate has to be used here as pointed out in 12.3).

The annual cost so obtained (shown in the first column of the table below) was next broken down into its constituent parts. For equipment, the accounting value was assumed to be 50 per cent, the remainder being import duties, taxes, etc. For the annual cost of construction and stocks, the share of accounting values and labour was assumed to be the same as their respective shares in the non-capital inputs of the construction industry: 47 per cent, and 30 per cent respectively. These figures could have been improved by an iterative procedure but, given the small size of the item, this did not seem worth while.

The above yields the following breakdown:

ANNUAL DEPRECIATION AND INTEREST COST OF INVESTMENT IN THE CONSTRUCTION INDUSTRY

Million Rupees.

ITEM	TOTAL	ACCOUNTING VALUES	LABOUR	THE REST
Equipment	151.11	75.56	—	75.56
Construction	20.15	9.47	6.05	4.63
Stocks	251.84	118.36	75.55	57.93
	423.10	203.39	81.60	138.12

There is, finally, a residual of Rs. 1,013 million which should consist of profits, rent, and corporate taxation. In accordance with Chapter X, and the footnote to Item 5 above, some part of this (the induced consumption at world prices of the profit earners) should be added back to 'accounting values' as a cost. Quite arbitrarily, Rs. 200 million was added back in this way — more to follow the right procedure than because this was a real estimate.

1. Jan Sandee, *A Demonstration Planning Model for India*, Asia Publishing House, 1960 p. 14.

The complete breakdown of the industry's cost can now be shown to be as in the following table :

ITEMS FROM INPUT/OUTPUT TABLE	ACCOUNTING VALUE	LABOUR	THE REST	TOTAL
	1	2	3	
1	536.63	—	—	536.63
2	—	—	117.53	117.53
3	498.27	—	398.62	896.89
4	1.46	.29	.08	1.83
5	248.25	186.19	124.13	558.57
6. A. Labour	—	650.00	—	2,086.00
B. Interest & depreciation	203.39	81.60	138.12	
C. Profits & rent	200.00		812.90	
Totals	1,688.00	918.08	1,591.38	4,197.45
Rounded per cent	40	22	38	100

The percentages shown in the last row were used for the breakdown of Item 8 in Table A1.

NOTE ON ELECTRICITY

THE SUBDIVISION OF THE VALUE OF ELECTRICITY COSTS INTO ACCOUNTING VALUES, LABOUR, AND THE REST

As with civil engineering, use was made of the input-output table for Pakistan for 1963-64[1], which shows the receipts for sales, and payments for inputs, of the electricity, gas, and water industries, as follows :

		Million Rupees.
	Total sales, net of sales within electricity, gas, and water	372.40
1.	Payments for : imports c.i.f.	26.92
2.	indirect taxes on imports	9.46
3.	other material inputs	54.46
4.	service inputs	42.18
5.	Value added	239.38

Of the inputs, *Item 1* clearly represents tradable values, and *Item 2* is to be ignored ; all the others have to be subdivided into their constituent parts.

Item 3 has been divided by 1.8 to obtain its tradable value (54.46/1.8 = 30.26) both because 80 per cent is the estimated weighted average price differential between the c.i.f. and internal values of all imports into Pakistan in 1963-4, and because it is the estimated unweighted average price differential between c.i.f. and internal values of intermediate goods imports into Pakistan in 1963-4[2]. This is the same treatment as for the similar item in Civil Engineering.

Item 4 was also treated in the same way as the similar item for Civil Engineering, namely, it was assumed to consist of 4/9ths tradable values, 1/3 labour, and 2/9 the rest. Hence 18.75, 14.06, and 9.37, was entered for each of the three categories.

Item 5. Value added consists partly of the cost of labour, partly of the interest and amortization on capital invested, and partly of rents and profits. As to the share of labour, the *Pakistan Statistical Yearbook for 1964* gives Trade Union membership in electricity in all Pakistan in 1961 as 7,086. The employment in gas and water should be added to this, and also non-union employees. No estimates for these are at hand, and so total employment has been rather arbitrarily assumed to be 25,000 in 1963-4, of which 700 are put in the administrative and professional category at an average salary of Rs. 3,600 per year, and 24,300 are assumed to be ordinary labourers earning Rs. 43,000 in all. Thus direct skilled labour is estimated to be Rs. 2.52 millions. As before, accounting values were assumed equal to actual values for this category of labour.

To estimate interest and amortization on capital invested, one must first obtain the value of capital invested. This can be estimated roughly by applying to our figure of total sales the capital-to-gross-output ratios available for *India's* electric power industry in 1959[3]. These ratios, separating the different types of investment, are as follows :

Heavy equipment	1.30
Other equipment	1.90
Construction	3.20
Stocks	—

1. Cf. Pakistan Planning Commission, National Economic Section : *loc. cit.*
2. Cf. S.R. Lewis, *loc. cit.*
3. Cf. Jan Sandee, *loc. cit.*

Therefore the value of the different types of capital stock in Pakistan's electric power industry are estimated as :[1]

Million Rupees.

Equipment	1,191.68
Construction	1,191.68
Stocks	—

As to the annual cost of utilizing this capital stock, for equipment 5 per cent depreciation and 10 per cent interest, and for construction 2 per cent depreciation and 10 per cent interest, are assumed. For equipment, the average domestic value is taken to be 1.1 times the c.i.f. value. This is a relatively small 'up-lift', since it is assumed that the imported equipment comes in duty-free, and accounts for a large proportion of total equipment. For construction, use is made of the Note on Civil Engineering, which allocates 40 per cent to tradables, 22 per cent to labour, and 38 per cent to the rest.

The above yields the following approximate breakdown :

ANNUAL DEPRECIATION AND INTEREST COST ON CAPITAL IN THE ELECTRICITY INDUSTRY

Million Rupees.

ITEM	TOTAL	*of which :*		
		ACCOUNTING VALUES	LABOUR	THE REST
Equipment	178.75	162.50	—	16.25
Construction	143.00	57.20	31.46	54.34
Total	321.75	219.70	31.46	70.59

The sum of tradable values and labour, together with the direct labour estimated earlier, accounts for Rs. 296.68 millions (= 219.70 + 31.46 + 2.52 + 43.00), more than the total of Rs. 239.38 million of value added. The implication is that electric power does not earn 10 per cent interest, which seems not implausible. Hence there is a subsidy to electric power, or a negative transfer so far as the value added element is concerned, of − Rs. 57.30 millions (at current market prices the subsidy implied by these calculations is even larger, namely the difference between Rs. 239.38 millions and Rs. 367.27 millions (= 321.75 + 2.52 + 43.00) L.E./Rs. 127.89 millions).

The complete breakdown therefore of the industry's total sales receipts becomes the following :

ITEM FROM INPUT/OUTPUT TABLE	ACCOUNTING VALUE	LABOUR	THE REST	TOTAL
	1	2	3	
1	26.92	—	—	26.92
2	—	—	9.46	9.46
3	30.26	—	24.20	54.46
4	18.75	14.06	9.37	42.18
5. A. Skilled labour	2.52	—	—	239.38
B. Unskilled labour	—	43.00	—	
C. Interest & Depreciation	219.70	31.46	70.59	
D. Profits & Rent	—	—	− 127.89	
Total	298.15	88.52	— 14.27	372.40
Rounded per cent	80	24	— 4	100

This breakdown was used for Item 12 in Table A2.

1. The capital-to-gross-output ratios are multiplied by total sales of Rs. 372.4 millions, even though the latter includes sales of gas and water.

No. 2. CASE STUDY OF A MACHINE-TOOL PLANT FOR MEXICO

1. Summary of the Project Analysis

This case study is based on a project analysis carried out between November 1966 and March 1968 in the 'Gerencia de Programación Industrial' of Nacional Financiera, S.A., in Mexico City. Technical assistance for this study was provided under a programme of the Federal Republic of Germany.

Primary investigations showed that there were thirteen firms producing machine tools of more than local or regional importance. Only two of them could be called 'machine-tool factories', the others producing machine tools either as a by-product or on a workshop scale. Although both the quantity and value of machine-tool production rose considerably between 1962 and 1966, it was unlikely that existing production facilities would expand sufficiently to be able to meet Mexican demand. This was due to lack of know-how and experience, the difficulties involved in raising finance, deficiencies on the part of management, and the poor quality of the machine tools produced.

Using Mexican imports as a guide to the potential demand was not easy. In part this was because machine-tool imports were not separately classified in Mexican import statistics until 1961. Moreover, since then, figures were available only for weight and value, and there was no breakdown into the number of different kinds of machine tools imported. A further difficulty was that the recent trend had been distorted by the once-for-all demand resulting from the build-up of the Mexican automobile industry.

To clear up the problems arising out of these difficulties, primary investigations were carried out amongst the importers of machine tools, the Mexican automobile producers, and their component suppliers. The results of these investigations were taken into account in Table B1 in which column (1) gives total imports, column (2) imports of the automobile industry, and column (3) the 'normal' trend of the imports, as it would have been without the build-up of the automobile industry [i.e. (1) — (2)] for the years 1961-1966.

Since the data on Mexican production of machine tools were not all available until the end of the project study, the calculation of future demand had to be based on the import data alone. This seemed reasonable in that Mexican production represented only 2.5 per cent in 1962, and 7.2 per cent in 1966, of Mexican imports of machine tools, excluding those of the automobile industry.

On the basis of a projection of the import figures in columns (3) of Table B1, the future demand for machine tools was estimated as 388 m.

pesos in 1970, 646 m. in 1975, and 1,000 m. in 1980. Column (3) excludes the imports of the automobile industry. However, since this sector had no plans for major new investments, and would not have to start replacing obsolete machinery until 1973-74, this was not thought to be an important omission.

Table B2 gives the breakdown of the demand for machine tools into units of the different types for the years 1965, 1970-75, and 1980. The figures for 1965 came from primary investigations. The predictions for the other years tried to take account of the likely effect of technical change on the composition of demand, and also included information based on primary investigations.

An investigation into the technical problems involved in the production of the different types of machine tools formed the basis for the determination of the production programme of the project. The following approach to full-capacity operation was envisaged: in the first year only the prototypes of the different types of machine tools would be built; in the second year 15 to 20 per cent; in the third year 60 per cent; in the fourth year 100 per cent. Table B3 gives the production programme for the period 1969-1975. The firm's anticipated share of the market differs for the different products mentioned in Table B3.

The plant is to be located at Guadalajara. This site was chosen in preference to two other possibilities, Mexico City and Monterrey, after an investigation covering such matters as the availability of skilled labour and transport facilities, and the proximity of producers and distributors of components, such as castings, bearings, electric motors, etc.

The plant is to concentrate on the machining of the raw materials and semi-finished parts, and the assembly of the machine tools. Thus it will buy from outside not only the special and small parts, like electric motors, equipment, pumps for the coolant, bearings, screws, etc., but also iron and steel castings. This is justified by the fact that the prices for castings are relatively low in Guadalajara (compared to Mexico City and Monterrey), and their quality sufficiently high. This makes possible a saving on capital costs and the costs of the start-up of the foundry, such as labour training.

2. Cost-Benefit Analysis

The layout follows closely that of the previous case study. Capital expenditures, and operating costs and receipts, are given in separate tables (B5 and B6), both phased over time. These are each divided into four columns: (1) actual estimated expenditures at Mexican prices; (2) the accounting value component of (1); (3) wage payments; and (4), which is the difference between column (1) and the sum of columns (2) and (3). Notes to these tables give the assumptions on which the figures in column (1) are allocated between columns (2), (3), and (4).

In this project, the imported production machinery and auxiliary installations are financed by tied supplier credits not available for any other purpose. The foreign exchange cost of this part of the investment is thus measured by the actual down-payments on purchase (15 per cent), and then by the interest and repayments on the three separate credits granted[1]

1. The terms were as follows: 15 per cent downpayment, 85 per cent to be repaid in 4 instalments over a period of 5 years (no repayment in the first year), interest of 8 1/2 per cent per annum being paid on the outstanding amount of the loan.

(see 9.4). This feature of the capital cost is shown in Table B4, the last row of which is then carried forward to Table B5, Row 5.1.

There follows a Summary Table B7, where the receipts and an accounting wage rate (equal to 75 per cent of the actual wage) are introduced, whence present values and the internal rate of return can be calculated. The discussion of Chapter XIII suggests that a shadow wage rate rather close to the level of consumption at world prices should be chosen. If workers do not save, this latter would be about 85 per cent of the wage (see Table B5, Note 1). The actual wage bill is also given so that anyone can apply a different shadow wage easily.

The upshot is that this project shows a large social present value when discounted at 10 per cent. The internal social rate of return is spectacularly high, at 44-45 per cent. The private internal rate of return, 18-19 per cent, would also seem to be high enough to make this an acceptable investment for most private entrepreneurs. Both of these rates are, of course, raised as a result of the 'gearing' introduced by the tied loan at 8 ½ per cent.

Even if no shadow wage rate was introduced, the estimated social rate of return would be 36 per cent, still much higher than the private rate. This divergence is not due to any external economies, for nothing has been allowed for them. The fact is that the Mexican price system is such as to introduce a strong bias against this project — but, fortunately, not so strong as to make it unviable from a private point of view. In other words, the price system operates to give *negative* protection to this industry.

How does this arise? First of all, the final product is not protected at all. Imports of machine tools came in without duty. Thus negative protection was inevitable, since the general protective system raises the prices of the inputs above their world levels. The relative contribution of the various divergencies of private and social costs to the result can be assessed by looking at the size of the items in the residual column in the tables. It is clear that the largest divergencies lie with steel and steel castings, where the residual figure rises in 1975 to about 7 ½ per cent of total operating costs, and to 60 per cent of the total residual. In other words, the project has to buy these inputs at well above world prices while it sells its output at world prices: this constitutes negative protection. The same is true of iron castings, electrical equipment, and other parts, though these are much less important. Foreign personnel cost the project considerably more than the economy insofar as they spend part of their income in the country on services and on goods whose prices are much higher than their c.i.f. prices, because of high taxation and for other reasons. On the capital side, construction costs are reckoned to be higher for the project than their real cost to the economy. Other divergencies are relatively small.

Although some of our estimates of social costs have been made in a rough and ready manner, there seems to be no doubt that the social returns of this project are very considerably higher than the private returns: and that there is a large margin before any failure in the performance of the project, as compared with the engineers' supposedly conservative projections, could make it a disappointment. It should clearly be accepted, and it is in fact understood that it is to be undertaken.

TABLE B1. MEXICAN IMPORTS

	1961			1962		
	1	2	3	1	2	3
Total	64.0	(—)[1]	64.0	98.8	(—)	98.8
Subtotal: Metal-cutting Machine Tools	46.3	(—)	46.3	73.9	(—)	73.9
Lathes	22.9	(—)	22.9	34.7	(—)	34.7
Milling Machines	5.8	(—)	5.8	9.0	(—)	9.0
Shaping, Slotting, and Broaching Machines	2.1	(—)	2.1	4.2	(—)	4.2
Grinding Machines	7.6	(—)	7.6	11.7	(—)	11.7
Sawing Machines	1.8	(—)	1.8	3.2	(—)	3.2
Drilling Machines and Boring Mills	2.1	(—)	2.1	9.0	(—)	9.0
Threading Machines	4.0	(—)	4.0	2.1	(—)	2.1
Subtotal: Metal-Forming Machine Tools	17.7	(—)	17.7	24.9	(—)	24.9
Group I[2]	4.6	(—)	4.6	11.3	(—)	11.3
Group II[3]	11.4	(—)	11.4	9.4	(—)	9.4
Group III[4]	1.7	(—)	1.7	4.2	(—)	4.2

Source: Anuario Estadístico del Comercio de las Estados Unidos Mexicanos and Gerencia de Programación Industrial of Nacional Financiera, S.A., Mexico-City.

Columns 1, 2 and 3 are explained in the text.

1. The marks (—) mean that the imports of the automobile industry were negligible (i.e. less than 0.1 m. Pesos).

TABLE B2. FUTURE MEXICAN DEMAND FOR MACHINE TOOLS

Units.

TYPE OF MACHINE	1965	1970	1971	1972	1973	1974	1975	1980
Lathes	650	1,000	1,063	1,126	1,189	1,252	1,315	1,525
Turret Lathes	110	195	210	225	240	255	270	350
Automatic Lathes	120	210	226	246	258	274	290	380
Vertical Boring and Turning mills	15	25	27	29	31	33	35	45
Vertical Milling Machines	140	245	266	287	308	329	350	440
Universal Milling Machines	90	165	179	193	207	221	235	305
Horizontal Milling Machines	30	50	54	58	62	66	70	90
Shaping Machines	170	230	241	252	263	274	285	335
Planing Machines	20	30	32	34	36	38	40	50
Surface-grinding Machines	65	125	136	147	158	169	180	230
Exterior- and Interior-Grinding Machines	40	60	63	66	69	72	75	90
Centerless Grinding Machines	10	20	22	24	26	28	30	40
Tool-Grinding Machines	55	125	137	149	161	173	185	240
Belt-Sawing Machines	90	150	161	172	183	194	205	255
Circular-Sawing Machines	45	70	77	84	91	98	105	130
Power Hacksaws	55	60	61	62	63	64	65	65
Drilling Machines with Reduction Gear	230	400	432	464	496	528	560	720
Radial Drilling Machines	50	90	98	106	114	122	130	170
Hydraulic Presses	75	125	136	147	158	169	180	235

Source: Gerencia de Programación Industrial of Nacional Financiera, S.A., Mexico-City.

S OF MACHINE TOOLS, 1961-1966

Million Pesos.

1963			1964			1965			1966		
1	2	3	1	2	3	1	2	3	1	2	3
145.0	12.0	133.0	347.9	174.9	173.0	412.9	215.0	197.9	307.9	76.0	231.9
109.7	11.0	98.7	290.1	161.9	128.2	314.4	169.0	145.4	229.5	58.0	171.5
51.8	6.5	45.3	86.6	30.5	56.1	117.2	54.5	62.7	80.1	6.5	73.6
16.6	3.0	13.6	58.9	39.5	19.4	52.5	28.3	24.2	43.3	14.6	28.7
6.1	0.9	5.2	13.7	7.6	6.1	12.0	5.4	6.6	9.2	2.3	6.9
15.9	(—)	15.9	50.8	27.6	23.2	52.6	26.5	26.1	49.4	15.6	33.8
4.4	0.6	3.8	6.8	1.7	5.1	7.8	3.1	4.7	6.5	1.7	4.8
11.9	(—)	11.9	62.2	47.5	14.7	61.8	44.5	17.3	33.3	13.5	19.8
3.0	(—)	3.0	11.1	7.5	3.6	10.5	6.7	3.8	7.7	3.8	3.9
35.3	1.0	34.3	57.8	13.0	44.8	98.5	46.0	52.5	78.4	18.0	60.4
21.2	1.0	20.2	36.4	9.0	27.4	56.2	26.0	30.2	41.0	13.0	28.0
10.6	(—)	10.6	(—)	(—)	7.2	20.1	8.0	12.1	28.8	5.0	23.8
3.5	(—)	3.5	14.2	4.0	10.2	22.2	12.0	10.2	8.6	(—)	8.6

2. Group I of the metal-forming machine tools includes hammers, eccentric presses, punch presses, and other kinds of presses.
3. Group II includes bending machines, press breaks, and shearing and cutting machines.
4. Group III includes riveting machines, wire-drawing machines, wire-straightening and wire-cutting machines, and machines for making screws, nails, pins, clamps, and supporting disks.

TABLE B3. PRODUCTION PROGRAMME, 1969-1975

Units.

	1969	1970	1971	1972	1973	1974	1975
Drilling Machines (2 types) . . .	2	39	130	232	248	264	280
Radial Drilling Machines (2 types)	2	13	37	85	91	98	106
Lathes (4 types)	4	60	256	450	476	502	528
Shaping Machines (2 types) . . .	2	37	116	203	210	219	228
Belt-Sawing Machines (2 types) . .	2	27	87	155	165	175	185
Hydraulic Presses (2 types)	2	19	64	118	126	135	144

TABLE B4. OUTSIDE FINANCING

Thousand Pesos.

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Imports of Capital Equipment . . .		6,800.0	2,000.0	7,550.0										
Down Payment (15 % of above)		1,020.0	300.0	1,132.5	—	—	—	—	—					
Annual Payments (interest included) for														
1969 Loan . . .		—	491.3	1,936.3	1,813.5	1,690.7	1,567.8	—	—					
1970 Loan . . .		—	300.0	144.5	569.5	533.4	497.3	461.1	—					
1971 Loan . . .		—	—	1,132.5	545.5	2,149.9	2,013.5	1,877.1	1,740.7					
Total Payments .		1,020.0	791.3	3,213.3	2,928.5	4,374.0	4,078.6	2,338.2	1,740.7					

TABLE B5. CAPITAL COSTS

P = Value at Market Prices ; T = Tradable Value ; L = Labour ; R = Residual. *Thousand Pesos.*

ITEM \ YEAR BREAKDOWN	1968				1969				1970				1971			
	P	T	L	R	P	T	L	R	P	T	L	R	P	T	L	R
FIXED CAPITAL COSTS																
1. Land :	1,000.0	609.9	175.0	215.1												
2. Planning	250.0	230.0	—	20.0									150.0	138.0		12.0
3. Buildings					1,625.0	812.5	406.3	406.3	350.0	175.0	87.5	87.5	625.0	312.5	156.3	156.3
4. Indigenously Produced Auxiliary Equipment					239.0	181.9	—	57.1	379.7	239.0	—	90.7	196.0	149.2	—	46.8
5. Imported Production & other Equipment :																
I. Production and Auxiliary Machinery					1,020.0	1,020.0	—	—	791.3	791.3	—	—	3,213.3	3,213.3	—	—
II. Tools					280.9	280.9	—	—	85.9	85.9	—	—	371.8	371.8	—	—
III. Spare Parts					112.4	112.4	—	—	34.4	34.4	—	—	148.7	148.7	—	—
6. Office and Design-Development Equipment					270.0	222.2	—	47.8	120.0	96.1	—	23.9	110.0	88.5	—	21.5
7. Other Installations					630.0	518.1	—	111.9	300.0	246.7	—	53.3	290.0	238.5	—	51.5
8. Contingencies					200.0	135.4	19.4	45.2	400.0	292.0	16.0	92.0	500.0	365.0	20.0	115.0
BUILDING OF WORKING CAPITAL																
9. Raw Materials & Semi-finished Products					23.8	18.3	—	5.5	247.4	199.2	—	48.2	636.7	516.1	—	120.6
10. Parts					4.9	4.4	—	0.5	51.1	45.5	—	5.6	127.9	113.3	—	14.5
11. Auxiliary Materials					1.2	1.0	0.1	0.1	8.2	6.7	0.5	1.0	22.1	18.0	1.2	2.8
12. Finished Parts and Machine Tools					231.0	231.0	—	—	623.4	623.4	—	—	1,152.3	1,152.3	—	—
13. Training Costs					120.0	—	120.0	—	400.0	—	400.0	—	500.0	—	500.0	—
14. Total	1,250.0	839.9	175.0	235.1	4,758.2	3,538.1	545.8	674.4	3,791.4	2,885.2	504.0	402.2	8,048.8	6,825.2	677.5	541.1

	1972				1973				1974				1975				1976			
	P	T	L	R	P	T	L	R	P	T	L	R	P	T	L	R	P	T	L	R
1.																				
2.																				
3.																				
4.	90.0	68.5	—	21.5																
5.																				
I.	2,928.5	2,928.5			4,374.0	4,374.0	—		4,078.6	4,078.6	—	—	2,338.2	2,338.2	—	—	1,740.7	1,740.7	—	—
II.																				
III.																				
6.	70.0	55.7	—	14.3																
7.	80.0	65.8	—	14.2																
8.	400.0	304.0		96.0																
9.	734.6	591.2	—	143.4	159.6	132.0	—	27.6	106.1	84.4	—	21.7	174.5	137.7	—	36.8				
10.	158.9	143.1	—	15.8	28.3	25.4	—	2.9	4.3	3.8	—	0.5	46.0	41.7	—	4.3				
11.	27.2	22.0	1.4	3.8	2.6	2.1	0.1	0.4	4.5	3.7	0.2	0.6	2.6	2.1	0.1	0.3				
12.	1,203.8	1,203.8	—	—	339.7	339.7	—	—	60.4	60.4	—	—	480.2	480.2	—	—				
13.																				
14.	5,693.0	5,382.6	1.4	309.0	4,904.2	4,873.2	0.1	30.9	4,253.9	4,230.9	0.2	22.8	3,041.5	2,999.9	0.1	41.4	1,740.7	1,740.7	—	—

Notes

FIXED CAPITAL COSTS

1. Land

The site of the plant lies in the Industrial Zone of Guadalajara, where land, already developed by the Government, costs 40 - 60 Pesos per square metre. Assuming a mean price of 50 Pesos, the cost of the 20,000 square metres needed will he 1 million Pesos. Of the 50 Pesos, about 15 represent the value of the land, and 35 that of its development.

We have assumed that the market price of land represents the capitalized value of its marginal product at domestic prices, and have divided this by 1 plus the weighted average of the difference between the Mexican and US prices of tradable goods (1.154) to obtain its accounting price. Since land is only a small fraction of the project's total costs, we have ignored the complications arising from the fact that it would have produced non-tradable as well as tradable goods. The comparison is made with US prices, since the US is Mexico's principal supplier. (15.4 per cent is the weighted average of the difference between US and Mexican prices for the first 35 sectors of the Mexican input-output table in 1960, the weights used being the values of total sales. This estimate was calculated for an IBRD study of the structure of protection in Mexico by Gerardo Bueno.

The development costs we have broken down into tradable value, labour, and residual components, in the proportions 50, 25, and 25 per cent, derived for civil engineering on the basis of an analysis similar to that carried out in the previous case study.

2. Planning

This consists of the expenditure on the planning and co-ordination normally incurred in the establishment or enlargement of a production unit. In this case it is estimated that (*a*) 60 per cent of the expenditures will be due to preparation of the project, consultants' fees, and planning at the factory itself ; (*b*) 20 per cent to travelling abroad ; and (*c*) 20 per cent to travelling in the country and miscellaneous items.

Item (*b*) clearly consists entirely of tradable value. We have broken down (*c*) in the proportions 60 per cent tradable value and 40 per cent labour, derived for Mexican rail and motor transport in an analysis similar to those of civil engineering and electricity in the previous case study. Item (*a*) probably consists of expenditures partly on foreign consultants and partly on Mexican managerial staff. However, since these proportions are not known and the item in question is an insignificant fraction of the project's total costs, we have taken the value of this item at domestic prices as representing its value at accounting prices.

3. Buildings

The cost of buildings has been estimated on the basis of the average prices of different kinds of construction in Guadalajara, which are approximately 500 Pesos per square metre for office buildings and approximately 400 Pesos per square metre for factory buildings. (The cost of painting, electrical appliances, basements for machines, etc., are included in these figures.) Given an area of 1,000 square metres for the plant's offices and 5,000 square metres for its production facilities the total construction costs amount to 2.5 million Pesos. They have been broken down into 50 per cent tradable value, 25 per cent labour, and 25 per cent residual. These proportions were derived in the analysis of civil engineering referred to in Note 1.

4. Indigenously Produced Equipment

This item consists of auxiliary equipment, namely those installations which are necessary for the fabrication of machine tools but do not enter directly into the production process, such as those for hardening, tool-making, painting, oiling, quality control, storing, and repairing. Some of these installations will be imported (see Note 5 below), but indigenous products worth 904,700 Pesos will also be purchased. This item has been divided by 1.314 to obtain its value at accounting prices. 31.4 per cent is the weighted average of the differences between US and Mexican prices (expressed as a percentage of the former) of non-electrical and electrical machinery in 1960 given in the IBRD study referred to in Note 1. (The weights used are the values of total sales.)

5. Imported Production and Auxiliary Equipment

Row I does not consist of actual investment expenditures but of the cash outflow due to imported capital equipment given in Table B4. For reasons explained in Section 3 of the Introduction, it is this outflow which is used in the calculation of the social internal rate of return. Rows II and III give actual expenditures out of the firm's own resources. Rows I, II, and III are all imported duty-free and thus consist entirely of tradable value. (For the meaning of 'auxiliary equipment' see Note 4 above.)

6. Office and Design Department Equipment

120,000 Pesos of this expenditure will be on imported goods (70,000 Pesos in 1969, 20,000 Pesos in 1970, 20,000 Pesos in 1971, and 10,000 Pesos in 1972), and 450,000 Pesos on domestic products (200,000 Pesos in 1969, 100,000 Pesos in 1970, 90,000 Pesos in 1971, and 60,000 Pesos in 1972). The imported goods enter Mexico duty-free and thus consist entirely of tradable value. The domestic products have been divided by 1.314 to obtain their tradable value (see Note 4 above).

7. Other Installations

This item consists of such installations as a transformer station, a gas tank, means of transport, the equipment of working places, canteen, etc. Almost all these products can be purchased from domestic producers. They consist mainly of metal products and have been divided by 1.216 to obtain their tradable value (21.6 per cent is the difference between Mexican and US prices of metal manufactures derived in the IBRD study referred to in Note 4 above).

8. Contingencies

Thus it is broken down in the same proportions as items 1 to 7 combined, namely 67.7 per cent, 9.7 per cent, and 22.6 per cent, in 1969 ; 73 per cent. 4 per cent, and 23 per cent, in 1970 ; 74 per cent, 3 per cent, and 23 per cent, in 1971 ; and 76 per cent, 0 per cent, and 24 per cent, in 1972.

THE BUILD-UP OF WORKING CAPITAL

The figures represent annual increases. The circulating capital necessary for the different items (except items 12 and 13) is broken down the same way as the corresponding items in Table B6. Finished parts and machine tools (12) are treated like receipts, and the treatment of training costs (13) is explained in the notes below.

9. RAW MATERIALS AND SEMI-FINISHED PRODUCTS

The stocks of the different kinds of raw materials and semi-finished products are as follows :

iron castings sufficient for	:	1	month's production[1] ;
steel castings sufficient for	:	1½	months' production ;
steel sufficient for	:	1	month's production ;
other metals sufficient for	:	2	months' production.

The resulting values are given in the following table :

INCREASES IN CIRCULATING CAPITAL OF RAW MATERIALS AND SEMI-FINISHED PARTS

Thousands of Pesos.

	IRON CASTINGS			STEEL CASTINGS			STEEL			OTHER METALS			TOTAL		
	P	T	R	P	T	R	P	T	R	P	T	R	P	T	R
1969 . . .	5.6	5.6	—	7.0	3.9	3.1	9.0	7.0	2.0	2.2	1.8	0.4	23.8	18.3	5.5
1970 . . .	64.7	64.7	—	45.5	25.7	19.8	88.0	68.3	19.7	49.2	40.5	8.7	247.4	199.2	48.2
1971 . . .	214.5	214.5	—	135.8	76.6	59.2	230.6	179.0	51.6	55 8	46.0	9.8	636.7	516.1	120.6
1972 . . .	218.8	218.8	—	150.9	85.1	65.8	281.9	218.9	63.0	83.0	68.4	14.6	734.6	591.2	143.4
1973 . . .	68.5	68.5	—	34.7	18.8	15.9	38.1	29.6	8.5	18.3	15.1	3.2	159.6	132.0	27.6
1974 . . .	32.0	32.0	—	23.3	12.6	10.7	41.4	32.1	9.3	9.4	7.7	1.7	106.1	84.4	21.7
1975 . . .	77.7	73.6	4.1	46.7	24.3	22.4	31.9	24.8	7.1	18.2	15.0	3.2	174.5	137.7	36.8

10. PARTS

The stocks are as follows :

Electrical motors and equipment sufficient for	:	½	month's production ;
Special tools and equipment sufficient for	:	2	months' production ;
Others sufficient for	:	2	months' production.

The resulting values are given in the following table :

INCREASES IN CIRCULATING CAPITAL OF PARTS

Thousands of Pesos.

	ELECTRICAL EQUIPMENT AND MOTORS			SPECIAL TOOLS & EQUIPMENT			OTHER (SCREWS, BEARINGS, NUTS, ETC)			TOTAL		
	P	T	R	P	T	R	P	T	R	P	T	R
1969	1.3	1.1	0.2	2.3	2.3	—	1.3	1.0	0.3	4.9	4.4	0.5
1970	15.6	13.0	2.6	21.9	21.9	—	13.6	10.6	3.0	51.1	45.5	5.6
1971	37.2	31.0	6.2	54.0	54.0	—	36.5	28.3	8.2	127.7	113.3	14.4
1972	37.8	31.5	6.3	78.8	78.8	—	42.3	32.8	9.5	158.9	143.1	15.8
1973	5.7	4.7	1.0	14.0	14.0	—	8.6	6.7	1.9	28.3	25.4	2.9
1974	1.7	1.4	0.3	1.5	1.5	—	1.1	0.9	0.2	4.3	3.8	0.5
1975	6.0	5.0	1.0	25.3	25.3	—	14.7	11.4	3.3	46.0	41.7	4.3

11. AUXILIARY MATERIALS

Stocks are carried amounting to two months' consumption.

12. FINISHED PARTS AND MACHINE TOOLS

Stocks are carried amounting to one month's output.

13. TRAINING COSTS

The semi-skilled and skilled workers employed by the project have to be trained for about 6 months. Since the equipment used for training purposes has already been included under item 4, in the absence of other information we have assumed that these costs consist entirely of labour.

1. We are assuming that the casted parts will be aged artificially. Otherwise, they should be stored for six months, so that they are freed from the internal stresses that result from founding.

TABLE B6. OPERATING COSTS

Thousand Pesos.

ITEM \ YEAR BREAKDOWN	1969 P	1969 T	1969 L	1969 R	1970 P	1970 T	1970 L	1970 R	1971 P	1971 T	1971 L	1971 R
1. Labour Costs :												
(a) Foreign Personnel	1,015.0	820.6	20.8	173.6	1,405.9	1,017.2	41.6	347.8	1,637.2	1,323.7	33.6	279.9
(b) Mexican Admin. Personnel	697.2	604.2	—	93.0	1,800.0	1,559.8	—	240.2	2,465.7	2,136.7	—	329.0
(c) Mexican Skilled & unskilled Labour	504.2	—	504.2	—	1,774.0	—	1,774.0	—	5,088.7	—	5,088.7	—
2. Raw Materials & Semi-Finished Products :												
(a) Iron Castings	67.0	67.0	—	—	843.1	843.1	—	—	3,418.3	3,418.3	—	—
(b) Steel Castings	56.5	31.9	—	24.6	420.5	237.2	—	183.3	1,506.2	849.5	—	656.7
(c) Steel	108.0	83.9	—	24.1	1,164.3	904.0	—	260.3	3,930.8	3,051.9	—	878.9
(d) Other Metals	13.2	10.9	—	2.3	308.3	254.0	—	54.3	643.3	529.9	—	113.4
3. Parts :												
(a) Electrical Equipment including Motors	31.5	26.3	—	5.2	404.5	337.1	—	67.4	1,298.7	1,082.3	—	216.4
(b) Special Tools	13.5	13.5	—	—	145.0	145.0	—	—	469.0	469.0	—	—
(c) Other (screws, etc)	7.9	6.1	—	1.8	89.6	69.6	—	20.0	309.5	240.3	—	69.2
4. Auxiliary Materials & Utilities	13.4	10.8	1.6	1.0	77.2	675.6	5.0	9.2	244.5	199.5	13.7	31.3
5. Maintenance & Replacement					699.1	63.0	8.1	25.4	939.7	889.2	9.9	40.6
6. Administration & Office	85.0	66.5	5.0	18.5	240.0	189.0	13.3	37.6	225.0	167.7	18.3	38.9
7. Licences	—	—	—	—	195.8	195.8	—	—	702.2	702.2	—	—
8. Others	28.7	19.2	5.7	3.7	113.0	76.8	21.5	14.7	253.4	166.7	57.3	29.4
9. Production of Parts	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	2,641.1	1,760.9	537.3	342.7	9,680.3	6,557.2	1,863.5	1,259.4	23,132.2	15,226.9	5,221.5	2,683.7

	1972 P	1972 T	1972 L	1972 R	1973 P	1973 T	1973 L	1973 R	1974 P	1974 T	1974 L	1974 R	1975 P	1975 T	1975 L	1975 R
1. (a)	860.5	622.2	25.5	212.8	785.4	635.0	16.1	134.3	230.3	167.8	6.7	55.8	163.1	131.9	3.3	27.9
(b)	2,813.8	2,429.7	—	384.2	3,145.4	2,725.7	—	419.8	3,185.4	2,760.3	—	425.1	3,413.3	2,957.8	—	455.5
(c)	7,879.9	—	7,879.9	—	9,055.9	—	9,055.9	—	9,460.2	—	9,460.2	—	10,836.1	—	10,836.1	—
2. (a)	6,043.4	6,043.4	—	—	6,865.5	6,865.5	—	—	7,250.2	7,250.2	—	—	8,181.2	7,754.7	—	426.5
(b)	2,713.8	1,530.6	—	1,183.2	2,991.4	1,620.5	—	1,370.9	3,177.7	1,721.4	—	1,456.3	3,551.6	1,849.8	—	1,701.8
(c)	7,314.0	5,678.6	—	1,635.4	7,771.5	6,033.8	—	1,737.7	8,268.0	6,419.3	—	1,848.7	8,651.1	6,716.7	—	1,934.4
(d)	1,140.9	939.8	—	201.1	1,250.7	1,030.2	—	220.5	1,307.0	1,076.6	—	230.4	1,416.5	1,158.6	—	257.9
3. (a)	2,205.8	1,838.2	—	367.6	2,341.7	1,951.4	—	390.3	2,383.0	1,985.8	—	397.2	2,526.1	2,105.1	—	421.0
(b)	942.0	942.0	—	—	1,026.0	1,026.0	—	—	1,035.0	1,035.0	—	—	1,187.0	1,187.0	—	—
(c)	563.1	437.2	—	125.9	615.2	477.6	—	137.6	621.5	482.5	—	139.0	709.6	550.9	—	158.7
4.	438.4	356.7	20.9	60.8	461.7	375.9	22.8	63.0	484.4	394.5	24.8	65.1	507.6	413.6	26.7	67.3
5.	1,645.5	1,579.1	13.0	53.4	1,664.7	1,594.3	13.0	57.4	1,664.7	1,594.3	13.0	57.4	1,664.7	1,594.3	13.0	57.4
6.	270.0	199.0	23.3	47.6	280.0	207.8	23.3	48.8	290.0	216.6	23.3	50.0	305.0	229.8	23.3	51.8
7.	1,257.6	1,257.6	—	—	1,400.1	1,400.1	—	—	1,486.5	1,486.5	—	—	1,573.4	1,573.4	—	—
8.	526.3	347.4	115.8	63.2	527.3	342.7	121.3	63.3	510.1	331.6	117.3	61.2	512.2	323.7	125.0	63.5
9.	461.0	304.3	101.4	55.3	1,106.5	719.2	254.5	132.8	1,875.5	1,219.1	431.4	225.1	2,818.8	1,781.5	687.8	349.5
Total	37,076.0	24,505.8	8,179.8	4,390.5	41,289.0	27,005.7	9,506.9	4,776.4	43,229.5	28,141.5	10,076.7	5,011.3	48,017.3	30,328.8	11,715.2	5,973.2

The operating costs in 1975 are assumed to remain constant in perpetuity.

NOTES TO TABLE B6

1. LABOUR COSTS (compare Section 12.6)

a) *Foreign Personnel.* The expenses for the foreign personnel were calculated on the assumption that from mid-1969 until mid-1971 five engineers, three technicians, and five foremen, from mid-1971 until mid-1973 three engineers, two technicians, and three foremen, and from mid-1973 until mid-1975 one engineer and one foreman would be employed under two-year contracts. The expenditure shown in Table B6 is divided into three parts : travelling expenses, salaries, and pay-roll tax.

The travelling expenses occur at the beginning and at the end of the two-year contract. They have been calculated for voyages from Europe to Mexico on the assumption that the average family of the foreign employee consists of three persons. The amount provided for travelling is 24,000 Pesos at the beginning and 24,000 Pesos at the end of the contract per family. Thus the total expenses on this account are 312,000 Pesos in 1969, 504,000 Pesos in 1971, 240,000 Pesos in 1973, and 48,000 Pesos in 1975. As travelling expenses within the country are negligible, these amounts are taken as consisting entirely of tradable value.

As for salaries, it is assumed that the foreign personnel will spend as much in the country for their living expenses as the Mexican personnel of the same grade, and that the rest of their salaries will be remitted abroad. Therefore, the foreign engineer receiving 12,000 Pesos per month will remit 45 per cent of his salary, and the foreign technician or foreman earning 7,000 Pesos per month will remit 35 per cent. This is an expenditure of foreign exchange, and thus can be treated as consisting entirely of tradable value. The total amounts involved are 279,600 Pesos in 1969, 559,200 Pesos in 1970, 450,300 Pesos in 1971, 341,400 Pesos in 1972, 217,800 Pesos in 1973, 94,200 Pesos in 1974, and 47,100 Pesos in 1975.

The pay-roll tax on the salaries of the foreign personnel is 7,000 Pesos in 1969, 13,900 Pesos in 1970, 11,200 Pesos in 1971, 8,500 Pesos in 1972, 5,400 Pesos in 1973, 2,300 Pesos in 1974, and 1,100 Pesos in 1975. These figures are included in the residual.

The remainder of their salaries have been rather arbitrarily broken down in the proportions 55 per cent tradable value, 5 per cent labour, and 40 per cent residual. These proportions are designed to take account of the fact that part of the expenditure of foreign personnel will be on non-tradable goods, and a considerable part on highly taxed imported goods.

b) *Mexican Administrative Personnel*

In section 12.6 we have recommended that the value of administrative personnel at accounting prices should be greater than the value of their consumption at accounting prices. We have here taken the value of the salaries at accounting prices as an approximation (actual salaries divided by 1.154 — this deflation is explained in note 1 to Table B5). Since Mexican salaries for such people are rather high, savings can be expected to be significant, and this implies that our figure is significantly higher than the value of their consumption at accounting prices. Salaries are assumed to rise by 7 per cent every two years until 1975, when all prices are taken to remain constant.

c) *Mexican Skilled and Unskilled Labour*

These wages are all entered into the second column despite the fact that they include some skilled personnel. The wages or salaries of the latter could not be a large enough part to distort the result significantly. Wages are assumed to rise by 10 per cent every two years until 1975.

2. RAW MATERIALS AND SEMI-FINISHED PRODUCTS

The costs of the raw materials and semi-finished products used by the project were calculated by multiplying quantities by unit prices. These prices have not been constant in the recent past, and there is no reason to suppose that they will not continue to change. Thus we have assumed that they change discontinuously every two years .

a) *Iron Castings.* We have used average prices of 3.75 Pesos/kg. in 1969 and 1970, 4.00 Pesos/kg. in 1971 and 1972, 4.30 Pesos in 1973 and 1974, and 4.60 Pesos/kg. in 1975. (The 1969-70 prices are based on primary investigations). Differences in prices for pieces which are more or less difficult to found, and thus more or less expensive, have been taken into consideration.

Iron castings of normal dimensions are usually bought on the home market. Comparison with American domestic prices shows that the Mexican ones are lower. However, German prices plus transport costs give an average c.i.f. price of 4.15 Pesos/kg. which is below the average prices of the 1973/74 and 1975 periods. But this c.i.f. price takes no account of the inconvenience of buying castings abroad. This inconvenience results from the need to keep bigger stocks, payment of the transport costs for defective castings, and the lack of close contacts with suppliers. (The defection rate for castings is usually about 2 to 5 per cent, and is due to air bubbles, etc.) Calculating this cost with any precision is difficult, but it can be assumed that it is of the order of 5 per cent of the average c.i.f. price. (This illustrates the remarks about the advantages of having a close source of supply in section 16.2.) This raises the c.i.f. cost to 4.36 Pesos/kg. Thus in 1975 we should divide the value of iron castings by 1.055 to obtain its tradable value. In other years we have treated the item as consisting entirely of tradable value.

b) *Steel Castings.* The prices for steel castings are assumed to be 12.00 Pesos/kg. in 1969/70 and in 1971/72, 12.50 Pesos/kg. in 1973/4, and 13.00 Pesos/kg. in 1975. The plans for the production of steel castings in Guadalajara have not yet been realized. Therefore, it is assumed that in 1969 and 1970 the project will have to be supplied from Monterrey and that production in Guadalajara will only start in 1971. Thus the price for the first two-year period includes land transport from Monterrey to Guadalajara. Transport by train amounts to 183.60 Pesos per wagon, which has a load capacity of about 40 tonnes. Since only 4.7 tonnes are needed in 1969, and 56.5 tonnes in 1970, the transport costs are negligible.

The c.i.f. price of steel castings is 6.45 Pesos/kg., or, if the inconvenience of not buying from a local supplier is considered to be 5 per cent of this price, the c.i.f. cost is 6.77 Pesos/kg. On the assumption that this price does not change, the Mexican price is 1.773 of the c.i.f. price in 1969/70, and 1971/72, 1.846 of it in 1973/74, and 1.920 of it in 1975.

c) *Steel.* The costs of steel were calculated by multiplying the quantities of the different types required by their prices per kg. The average prices which we have used are 6.56 Pesos/kg. in 1969/70, 6.54 Pesos/kg. in 1971/72, 6.53 Pesos/kg. in 1973/4 and 1975. The average price is assumed to decrease because it is government policy that the price of normal steel should remain constant, whilst it is probable that the prices of the more expensive special steels will decline.

According to the IBRD study to which we have already had occasion to refer on page 242, the average difference between the domestic and US prices of iron and steel was 28.8 per cent of the

latter in 1960. Since more recent data are not available, it is assumed that this differential also holds for the 1969/70 period. If world prices are assumed to remain constant, the fall in Mexican domestic prices is so small after 1969/70 that we have continued to use the 28.8 per cent differential thereafter.

d) *Other Metals.* This has been divided by 1.214 to obtain its tradable value, 21.4 per cent being the unweighted average of the differences between US and Mexican prices of copper and aluminium (expressed as a percentage of the former) given by the IBRD study.

3. PARTS

This represents the cost of the different parts of the machine tools which are not manufactured in the enterprise but bought outside.

a) This consists of electrical appliances and electrical motors. It has been divided by 1.2 to obtain its tradable value. 20 per cent is the arithmetic average of the differences between the US and Mexican prices of electrical machinery and appliances in 1960 (expressed as a percentage of the former) in the IBRD study mentioned in Note 2 (*c*) above.

b) Includes duty-free imported goods only, so that it consists entirely of tradable value.

c) This consists of products, the main component of whose value is steel. Thus we have divided this by 1.288 to obtain its tradable value (see note 2 (*c*) above).

4. AUXILIARY MATERIALS AND UTILITIES

The annual costs of auxiliary materials and utilities were estimated on the basis of the approximate value of these items needed per unit of output, multiplied by the total output per annum. They are given in the following table.

ANNUAL COSTS FOR AUXILIARY MATERIALS AND UTILITIES

1,000 Pesos.

	1969	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*
a) Lubricants, Gas	4.8	9.8	19.6	28.5	30.1	31.1	32.6
b) Coolants	1.0	2.5	4.0	5.0	5.2	5.4	5.6
c) Paints	2.0	29.0	105.0	200.0	210.0	220.0	230.0
d) Packing Materials	—	19.0	70.0	135.0	140.0	145.0	150.0
e) Electricity	3.2	14.5	43.5	67.5	74.0	80.5	87.0
f) Water	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Total	13.4	77.2	244.5	438.4	461.7	484.4	507.6

a) Lubricants have been divided by 1.06 to obtain their tradable value. 6 per cent is the difference between US and Mexican prices of petroleum and coal products in 1960 (expressed as a percentage of the former) estimated in the IBRD study referred to above. In the absence of other information we have used the same deflation for gas.

b) In the absence of information on the proportions of the different kinds of chemicals of which the coolants consist, we have divided by 1.24 to obtain their tradable value. 24 per cent is the arithmetic average of the differences between US and Mexican prices of basic and other chemicals in 1960 obtained from the IBRD study.

c) Paints have been divided bij 1.256 to obtain their tradable value. 25.6 per cent in the difference between US and Mexican prices of other chemicals in the IBRD study.

d) Packing materials have been divided by 1.25 to obtain their tradable value. 25 per cent is the arithmetic average of the difference between US and Mexican prices of other textiles and paper products, given in the IBRD study.

e) Electricity was broken down in the proportions 85 per cent, 30 per cent, and — 15 per cent, estimated in an analysis similar to that made in the Case Study of the Pakistan Rayon Plant above.

f) We have assumed that the project has been charged for its water supply at a rate which covers its marginal cost at market prices, and that this cost consists mainly of construction. Thus it has been broken down in the proportions, 50 per cent, 25 per cent, and 25 per cent (see note 1 to Table B5).

5. MAINTENANCE AND REPLACEMENT EXPENDITURE

Thousand Pesos.

YEAR	PRODUCTION EQUIPMENT		OFFICE EQUIPMENT		BUILDINGS		TOTAL	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*
1969	—	—	—	—	—	—	—	—
1970	396.3	645.0	13.5	21.6	—	32.5	409.8	699.1
1971	523.6	869.0	19.5	31.2	10.0	39.5	553.1	939.7
1972	1,104.3	1,553.5	25.5	40.0	10.0	52.0	1,139.8	1,645.5
1973	1,121.5	1,567.1	28.5	45.6	10.0	52.0	1,160.0	1,664.7
1974	1,195.8	1,567.1	28.5	45.6	10.0	52.0	1,234.3	1,664.7
1975	1,252.0	1,567.1	28.5	45.6	10.0	52.0	1,290.5	1,664.7

(The figures in 1975 are assumed to remain constant in perpetuity).

The columns (*a*) in the above table given the project authority's estimates of maintenance and replacement expenditure. However, these take account of small-scale day-to-day expenditures only, and do not allow for the effects of technical change on the prices of its inputs and outputs. We have thus had recourse to the notion used in the Case Study of the Pakistan Rayon Plant above (Table A2, notes 18 and 19), namely the annual rate of expenditure that would keep the plant indefinitely competitive. Annual rates of expenditure of 8 per cent of the value in the previous year for equipment, and 2 per cent for building, have been assumed to be sufficient for this purpose. The resulting figures are given in column (*b*) in the table above.

6. Administration and Office

These costs consist of (*a*) administration and sales (excluding the wages and salaries of the personnel involved), and (*b*) stationery, pamphlets, etc. (*a*) amounts (in thousands of Pesos) to 15 in 1969, 40 in 1970, 55 in 1971, and 70 from 1972 onwards, and is broken down in the proportions 1/3, 1/3, and 1/3, derived for services (cinema and other entertainment, transport and communications, rents of housing, hotels and restaurants, credit, insurances and finance, and miscellaneous services) in an analysis similar to that carried out for civil engineering and electricity in the Case Study of the Pakistani rayon plant. (*b*) has been divided by 1.13 to obtain its tradable value. 13 per cent is the difference between the prices of printing in the US and Mexico (expressed as a percentage of the former) derived in the IBRD study.

7. Licences

This item represents the amount which has to be paid for the foreign licences. It is an expenditure of foreign exchange, and thus consists entirely of tradable value.

8. Miscellaneous

This consists almost entirely of 'contingencies', namely an allowance for underestimates in the figures already given, and is broken down in the same proportions as all the other items combined.

9. Production of Spare Parts

No allowance is made elsewhere in this table for the costs of producing spare parts for the firm's customers. The figures given in row 9 are the outcome of primary investigations into Mexican industry's requirements for spare parts. They have been broken down in the same proportions as items 1 to 8 combined.

TABLE B7. SUMMARY OF THE TIME PROFILE OF THE PROJECT

Thousand Pesos.

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1. Value of Sales										
a) Machine Tools	—	—	6,526.8	24,405.9	41,919.6	46,668.8	49,551.3	52,477.7	52,477.7	52,477.7
b) Spare Parts	—	—	—	130.5	598.7	1,437.1	2,435.7	3,660.8	3,660.8	3,660.8
c) Total	—	—	6,526.8	24,436.4	42,518.3	48,105.9	51,987.0	56,138.5	56,138.5	56,138.5
2. Total Capital Costs at Market Prices including Labour	1,250.0	4,758.2	3,791.4	8,043.8	5,693.0	4,904.2	4,253.9	3,041.5	1,740.7	—
3. Accounting Value of Capital Costs excluding Labour	839.9	3,538.1	2,885.2	6,825.2	5,382.6	4,873.2	4,230.9	2,999.9	1,740.7	—
4. Total Operating Costs at Market Prices including Labour	—	2,641.1	9,680.3	23,132.2	37,076.0	41,289.0	43,229.5	48,017.3	48,017.3	48,017.3
5. Accounting Value of Operating Costs excluding Labour	—	1,760.9	6,557.2	15,226.9	24,505.8	27,005.7	28,141.5	30,328.8	30,328.8	30,328.8
6. Skilled & Unskilled Labour Costs	175.0	1,083.1	2,367.5	5,899.0	8,181.2	9,507.0	10,076.9	11,715.3	11,715.2	11,715.2
7. Skilled & Unskilled Labour Valued at Shadow Wage Rate	131.3	812.3	1,775.6	4,424.3	6,135.9	7,130.3	7,557.7	8,786.5	8,786.4	8,786.4
8. Net Receipts at Market Prices	—1,250.0	—7,399.3	—6,944.9	—6,739.6	—250.7	+1,912.7	+4,503.6	+5,079.7	+6,380.5	+8,121.2
9. Net Social Profits	—971.2	—6,111.3	—4,691.2	—2,040.0	+6,494.0	+9,096.7	+12,056.9	+14,023.3	+15,282.6	+17,023.3

NOTES TO TABLE B7

1. Primary investigations showed that the Mexican market prices of both imports and domestic production of machine tools included a wholesalers' margin. The estimate of receipts is made on the basis of these market prices less 27 per cent, this being about the average wholesalers' margin. If past experience is any guide, machine-tool prices will rise in the future. It was assumed that they would rise by 5 per cent in 1970, and another 5 per cent in 1973.

Other Latin American countries (especially Argentina and Brazil) produce most kinds of machine tools, and Mexican duties on imports from them are usually zero. The average domestic price was estimated in primary investigations to be 6 per cent higher than the c.i.f. price. However, it is probable that the production of this plant will be of a higher quality than that of most of its Latin American competitors. We have therefore made no deduction on this account.

It might be wondered whether, in making purchases from Brazil and Argentina, Mexico has been buying on the cheapest market. It is true that some preference has been given to these countries under LAFTA. On the other hand, it is believed that USA prices for the kind of tools which will be produced are higher than these Latin American prices. Furthermore, it appears that these tools are competitively priced with, and recently of as good a quality as, comparable machine tools which have been imported from Europe.

2. and 3. See Table B5.

4. and 5. See Table B6.

6. The figures are the sums of the total labour components of capital costs (Table B5) and operating costs (Table B6).

7. This row gives the figures in row 6 multiplied by ¾.

8. This row = row 1 (*c*) — (row 2 + row 4).

9. This row = row 1 (*c*) — (row 3 + row 5 + row 7).

The values in 1977 are assumed to continue in perpetuity.

APPENDIX FOR PROFESSIONAL ECONOMISTS

THE THEORY OF INDUSTRIAL INVESTMENT CRITERIA FOR LESS-DEVELOPED ECONOMIES

In this Appendix we discuss the models that have guided us in formulating the cost-benefit methods proposed in Part II of this Volume. We first discuss, briefly, the constraints on possible saving, and in particular the determination of industrial wage rates. Next we examine the problem under the simplifying assumptions that all production is public, there is a single consumer good, no international trade, one kind of labour, and no uncertainty. These assumptions are then relaxed.

1. It is thought, in most of the less developed countries, that the average consumption expenditure of the industrial labour force and their dependants is substantially greater than the average consumption expenditure of people in agriculture, services, trade, small-scale transport, and the like. Numerous explanations have been, or can be, given for this phenomenon, which is confirmed by available statistics.

a) The cost of urban housing and services, and of transporting food, etc., from rural areas may increase the cost of providing an urban family with the consumption it previously enjoyed in the village. If this were the whole explanation, a household that moves from rural to urban employment would impose an additional cost on the economy, represented by its increased consumer expenditure, but would not necessarily be any better off. Where there is an excess supply of labour to the industrial sector — as is frequently observed — this cannot be the whole explanation.

b) It may be necessary to pay a premium to attract labour into modern industry from traditional sectors, to persuade sufficient families to sustain the ' dislocation costs ' that may be supposed to be associated with this shift in employment. On this view, the difference in consumption levels would be related to the rate of expansion of the industrial sector. Again, it is unlikely to be the whole explanation where there is a substantial excess supply of labour to the industrial sector.

c) Industrial workers, being in a position to organize for industrial or political action, may be able, by threat of costly inconvenience or violence, or through their influence on government, to keep their earnings relatively high. The threat need not necessarily be made : it need only be perceived.

d) The labourer's ability and effectiveness as an industrial worker depends upon his consumption — upon his share in the family's food, upon his susceptibility to disease, upon his freedom from financial worry, upon the fatigue resulting from long and uncomfortable commuting or poor living conditions, or even upon the mood and morale induced by his relative standard of living. In most less developed countries, these relationships are presumably of substantial importance. If employers are aware of them — as many are, and public sector employers should be — they may have good reason to pay wages so high that there is a considerable excess supply of labour to the industrial sector.

e) A little experience may render the industrial worker more useful to the employer. Unless they are employed, workers cannot acquire experience: thus the number of experienced workers is limited by the amount of previous employment. It is possible therefore that employers, in competing for experienced labour, or labour of proven ability, would drive real wages above what they would otherwise have been, and in particular above the wage that would have provided the same consumption level as rural income opportunities. At any rate, a few firms will usually find it profitable to 'cream' sections of the labour market by offering unusually attractive wages or working conditions, thus pushing up the average wage level.

Whether it is possible for the government to exert influence to reduce industrial earnings depends upon its ability to tax, and on political circumstances. If the rural sector cannot be taxed effectively, the first two reasons operate to keep wage rates high. If the government looks to industrial workers for political support, or fears the results of their opposition, the third reason will operate. If effective industrial labour requires consumption, as the fourth argument suggests, it will not be desirable for the government to reduce the workers' consumption too far, however complete its control over the economy.

In any case, most governments in the developing countries find their ability — or willingness — to tax severely circumscribed. The costs of administration, or limiting the amount of evasion, render many taxes useless, and considerably diminish the effects of others. Many governments are sensitive to the wishes of particular groups — often high-consumption, middle-class groups; and in any case may be unwilling to follow the logic of the public desire for growth if that requires rapid increases, or changes, in existing taxes.

For these reasons, we assume that there are only limited possibilities of taxing the non-industrial sectors, industrial workers, the middle classes, and company profits. The precise assumptions of the models will appear in due course. It should be noted now that the limited possibilities of taxing the non-industrial sectors is taken to imply that when a family leaves these sectors, there may be an increase in the consumption of those remaining: for the consumption level enjoyed by such a family will generally exceed its marginal product, and the consumption of others will not be kept to its previous level either by taxation or saving, but will increase by most of the difference between the departing family's consumption and its marginal product.

2. In the simplest model, there is only one consumer good, only one kind of labour on offer to the industrial sector, and no foreign trade. The economy consists of two sectors, the industrial sector, and another relatively unorganized sector, traditional in its methods of production, which we shall call the non-industrial sector. The maximum amount of tax revenue and saving that can be raised from this non-industrial sector is denoted by A, which is taken to be exclusive of saving that is used to finance investment in the non-industrial sector. A depends upon the production and population of the non-industrial sector, and also upon the year in question. The total population (which is identified with the labour force available) is denoted by N, or N_t when it is desired to bring out the dependence upon time explicitly. We assume that the industrial sector employs L of the population : the remainder, $N - L$, is denoted by M.

Production of the consumer good by the industrial sector (less any input of the commodity into industrial production processes) in year t is denoted by X_t. Given an initial stock of capital equipment, the production frontier of the industrial sector can be described by a relationship (referring, possibly, to all $t > 1$),

$$F(X_1, L_1 ; X_2, L_2 ; \ldots ; X_t, L_t ; \ldots) = 0. \tag{1}$$

It should not be taken for granted that production ought to take place on the production frontier, i.e. that marginal rates of transformation should be the same in all production processes. That productive efficiency is desirable, in the case of the present model, can be shown (subject to some unimportant qualifications), but the proof is mathematical and is therefore omitted[1]. We may therefore assume that the optimum development of the industrial sector satisfies the production equation (1). It should be emphasized that our formulation of production possibilities covers the use of all kinds of capital equipment and intermediate commodities : but none of these are traded with the non-industrial sector in this first model. We shall assume that the function F is differentiable, so that it is meaningful to talk of marginal rates of transformation. The results can easily be generalized in the usual way to other cases.

The availability of consumer goods to the industrial sector is $X + A$, where A is the transfer from the non-industrial to the industrial sector, resulting from taxation, and any excess of saving over investment in that sector. The consumer goods available have to supply the consumption requirements of workers in the industrial sector, and also the current expenditures of government. We denote the latter by G. It is assumed that industrial workers consume the entire wage rate, which is denoted by c. Since there is no point in planning an excess supply of consumer goods (apart from short-term stock changes, which we neglect),

$$X_t + A_t = c_t L_t + G_t. \tag{2}$$

We also have an upper bound on A :

$$A_t \leq \bar{A}(L_t, t). \tag{3}$$

We can write $\bar{A}$ as depending only on L and t because production in the non-industrial sector, and population there, both depend on L and t.

1. Propositions of this kind are proved in P. Diamond and J. Mirrlees "Optimal Taxation and Public Production" M.I.T., Dept. of Economics, Working Paper, May 1968.

3. The several considerations outlined in Section 1 above put lower bounds to the wage rate, c_t. Even when the economy has reached a more advanced stage in its development, the supply of labour to the industrial sector will depend upon the wage rate being paid. In order to be able to achieve the desired level of employment, L_t, c_t will have to be not less than some minimum level, which will presumably depend upon the average consumption level in the non-industrial sector, on the level of industrial employment, and on t. Denoting the average level of consumption in the non-industrial sector by a_t, we have a constraint

$$c_t \geq W_1 (a_t, L_t, t). \tag{4}$$

It is plausible to specialize this constraint to the form

$$c_t \geq a_t W_1 (L_t, t). \tag{5}$$

This constraint covers all kinds of supply considerations, including those mentioned in 1 (a) and 1 (b) above.

If the considerations outlined in 1(c) apply, we shall have another lower bound to c_t, representing the level of real wages that the workers can insist upon as a result of their bargaining power and political influence. We write this in the form

$$c_t \geq W_2 (L_t, t). \tag{6}$$

The same form of inequality may be used to represent the considerations outlined in 1(d) and 1(e), considerations which lead one to suppose that production in the industrial sector depends upon the wage rate being paid. Even in the absence of other constraints — labour supply and so on — the wage rate should be at a certain 'optimum' level in order to exploit this relationship. (If there were different industries, the optimum wage rate might be different in different industries: but we neglect this complication.) The optimum wage rate depends upon production possibilities of course: given these, for a given level of employment there is an optimum wage rate, the precise considerations governing which will be discussed later; other constraints may make the wage higher, but any way we have a further constraint,

$$c_t \geq W_3 (L_t, t). \tag{7}$$

The whole wage theory of the model can now be put together in one constraint, writing $W (a, L, t)$ for the maximum of W_1, W_2 and W_3:

$$c_t \geq W (a_t, L_t, t). \tag{8}$$

This lower bound to the wage rate, W, might well be approximately constant for a lengthy initial period, if population were large, agricultural progress not rapid, and the political influence of labour weak. Later, if not at once, supply considerations will presumably dominate.

The labour supply constraint (4), if interpreted literally, assumes a uniform level of consumption per head in the non-industrial sector of the economy. Otherwise a_t might not be the relevant standard of comparison influencing the response of the labour force to the prospective industrial wage rate. We shall more or less neglect the complications arising from the unequal distribution of income in the non-industrial sector. But, it is quite easy to make some allowance for the consumption of the richest landlords, and other members of the middle class outside the organized sectors of the economy. Denoting their consumption by B, and the output of the non-industrial sectors (net of inputs) by Y, we have

$$a_t = (Y_t - A_t - B_t)/M_t. \tag{9}$$

Y_t will be a function of M_t and t. It will be convenient to write m_t for the derivative of Y_t with respect to M_t — i.e. for the marginal product of labour in the non-industrial sector at t.

4. The constraints binding upon the government in this simple economy are now specified in (1), (2), (3), (8) and (9). In general these constraints leave room for considerable freedom of choice. We therefore require to express our objectives by means of a function of the particular path of the economy, so that we can choose the feasible path that maximizes the objective function.

For definiteness, we use a rather special objective function in the analysis that follows: more general, or different, objective functions could be analysed with equal ease (or difficulty). The following function seems to capture the essential considerations. We suppose that the government would like to maximize a sum of annual 'utility levels', U_t, where the utility level in year t is related to consumption levels in the two parts of the economy, and the distribution of the population between them. U is therefore a function of c, a and L. It may also depend on t, because of the changing population of the country, and also as a result of possible impatience for benefits, i.e. the discounting of future utilities.

A plausible simplified utility function is

$$U_t = L_t u(c_t) + M_t u(a_t), \tag{10}$$

where u is a concave, increasing function (i.e. exhibits diminishing marginal utility). In this particular form, no allowance is made for the different population structure in urban and rural areas, nor for impatience for future utilities — i.e. for any desire to give greater weight to present than to future generations. The latter can be allowed for easily. But as it stands, the above form provides a convenient standard to express the benefits arising from changes in consumption levels and changes in the distribution of populations.

The objective is, then, the maximization of

$$U_1 + U_2 + U_3 + \ldots. \tag{11}$$

(In order to give meaning to the maximization, we shall suppose that U_t tends to zero for large t on the economy's optimum path: to achieve this, it may be necessary to subtract a constant from U — but that obviously does not matter. We do not enter into the technical considerations involved in defining the maximization of infinite utility sums, and checking that the maximization is possible.)

5. We proceed to derive conditions for this maximization, subject to the various constraints described above. For convenience, we speak of units of the maximand as utility.

We consider first those periods during which the maximum allowable level of taxation is undertaken: that is, the constraint (3), is binding. We shall also suppose, for the moment, that the upper bound $\bar{A}$ is independent of L. This will avoid cluttering the equations more than is absolutely necessary. The wage constraint (8) might be binding or not. Suppose that it is binding, and postpone the problem of checking whether or not it should be. Then (2), (3), and (8), give:

$$X_t = L_t W(a_t, L_t) + G_t - \bar{A}_t. \tag{12}$$

Here and later we suppress the explicit dependence of a function like W on t, since it is not immediately relevant. We substitute (12) into (1) to obtain a single constraint $F = 0$ depending upon L and a. a, of course, is a function of L given by (9).

Introducing a Lagrange multiplier p for this constraint $F = 0$, we must choose the employment levels, L_t, so that the derivatives of

$$U_1 + U_2 + U_3 + \ldots - pF \tag{13}$$

with respect to each L_t are zero. Differentiating with respect to L_t, we obtain

$$U_{L_t} - pF_{X_t}(W_t + L_t W_{L_t} + L_t W_{a_t} a_{L_t}) - pF_{L_t} = 0. \tag{14}$$

Here subscripts denote derivatives. In particular, F_{L_t} denotes the derivative of F with respect to L_t when all other L_t, and all X_t, are held constant. It will be noted that p is independent of t: it is thus the Lagrange multiplier that holds the different time-periods together. Having emphasized the dependence of everything else upon the particular time-period t, we now drop the explicit reference to t for the moment.

If the wage constraint (8) had not been binding, we could have chosen c_t independently of L_t, and L_t independently of c_t. Differentiation with respect to c_t would have given

$$U_c - pF_X L = 0. \tag{15}$$

Differentiation with respect to L_t would have given

$$U_L - pF_X c - pF_L = 0. \tag{16}$$

If the values of c and L that solve the equations (15) and (16) are inconsistent with the wage constraint (8), (8) must hold with equality, and equation (14) is the maximization condition, along with $c = W$. Then $U_c < pF_X L$. It is plausible that (8) should first be binding for a while, and then that (15) and (16) should perhaps give a possible policy from a certain date on.

In order to interpret condition (14), we notice that pF_X is the shadow price of the consumer good, discounted to the present, and $-pF_L$ is the shadow price of labour, discounted to the present. pF_X is the marginal utility of output in year t, pF_L is the marginal utility (presumably negative) of additional labour in year t. If a project yields a net output x of consumer goods in year t, and uses labour in quantity l during that year, the discounted social profit (in terms of utility) of operating the project in that year will be

$$pF_X x + pF_L l, \tag{17}$$

which is, if (14) is to hold, equal to

$$pF_X [x - cl - L(W_L + W_a a_L) l] + U_L l. \tag{18}$$

The present social value of the project is the sum of these quantities for all its operating life: the project is to be undertaken if the present social value is positive.

The quantity $L(W_L + W_a a_L)$ is the increase in the wage bill of the rest of the industrial sector brought about by increasing employment by one unit: this increase comes about if c is increased either because it depends directly on the total of industrial employment or through its dependence upon the standard of living in the non-industrial sector. Thus the

expression $x - cl - L(W_L + W_a a_L) l$ is the part of the net output of the project that is available for investment (i.e. for feeding labour employed on other projects) — it is the investible surplus. We shall write $c' = c + L(W_L + W_a a_L)$.

Formula (18) expresses social profit as the weighted sum of investible surplus and employment: employment is included because it has value in itself because of its direct influence upon utility (as expressed in the objective function). pF_X may be regarded as the discount factor (the rate at which it falls from year to year is the accounting rate of interest): we denote it by R_t at t. We see from (18) that the shadow wage rate w — such that the social profit is $R(x - wl)$ — is

$$\begin{aligned} w &= c + L(W_L + W_a a_L) - U_L/R \\ &= c' - U_L/R. \end{aligned} \tag{19}$$

If W is a constant independent of a and L, w is less than c.

If U has the particular form (10),

$$U_L = u(c) - u(a) + Lu'(c)(W_L + W_a a_L) + Mu'(a) a_L. \tag{20}$$

On the assumption that $A = \bar{A}$ is independent of L, we have from (9),

$$a_L = -a_M = (Y - A - B)/M^2 - Y_M/M = (a - m)/M. \tag{21}$$

If $L(W_L + W_a a_L)$ is small compared to the other terms in (20) — as is plausible at least for the more densely populated of the developing countries — we have the approximate relationship

$$U_L = u(c) - u(a) + (a - m) u'(a). \tag{22}$$

In this case, it is particularly easy to express the social profit as a weighted sum of investible surplus, consumption of industrial workers, and consumption of the non-industrial population: from (18) and (22) we obtain the following expression for social profit —

$$R(x - cl) + \frac{u(c) - u(a)}{c - a}(c - a) l + u'(a)(a - m) l. \tag{23}$$

$(c - a) l$ is the increase in the consumption of industrial workers, and $(a - m) l$ is the increase in the consumption of the members of the non-industrial sector. The modifications in formula (23) required to take account of the effect of increased employment on wage rates are easily made.

As one would expect, the weight given to workers' consumption, $[u(c) - u(a)]/(c - a)$, is less than the weight given to non-industrial consumption, $u'(a)$. (This follows from the concavity of the utility function u.) Whether or not $u'(a)$ is in turn less than R depends upon the kind of taxation of the non-industrial sectors that is possible. It seems intuitively clear that if $u'(a)$ is greater than R, it would be desirable to divert funds from investment to the consumption of members of the non-industrial sector, if it is possible to do so without increasing c: if this can be done, the tax revenue A will be reduced. Thus $u'(a)$ should always be less than R, or possibly equal to it if the tax revenue raised from the non-industrial sector is less than the maximum possible.

This can be seen more rigorously as follows. Consider the derivative of total utility with respect to A (taking account also of the production constraint $F = 0$ by means of the Lagrange multiplier p as before). At the optimum, a reduction in A should not be desirable: therefore the derivative

must be non-negative. If the optimum A is actually less than $\bar{A}$, the derivative should be zero. Thus

$$U_A + (1 - LW_a a_A) pF_X \geq 0. \tag{24}$$

with equality if $A < \bar{A}$. Using the special form (10) for U, we obtain

$$U_A = Lu'(c)W_a a_A + Mu'(a)a_A. \tag{25}$$

The partial derivative of a with respect to A is obtained from (9):

$$a_A = -(1 + B_A)/M. \tag{26}$$

If taxes can be varied without affecting middle class consumption, B, i.e. in such a way that $B_A = 0$, and if $W_a = 0$, we shall have

$$R = pF_X > \frac{L}{M} u'(c)W_a + u'(a) = u'(a), \tag{27}$$

as we expected.

The assumption $W_a = 0$ is reasonable if labour is in excess supply. $B_A = 0$ is probably not a very plausible assumption in the early stages of development, however. On the other hand, R may have to be rather high in the early years of development, so that for other reasons the inequality (27) will be satisfied. If it is satisfied, it follows at once from (23) that social profit is less than or equal to $R(x - ml)$. In other words, the shadow wage rate, w, is greater than or equal to m.

Since the net additional consumption in the economy resulting from the project is $c' - m$, it is natural to call

$$s = R(c' - m)/U_L \tag{28}$$

the shadow price of saving (in terms of consumption, that is). Introducing this definition into the formula for social profit, (18),

we get $R\left[\text{(saving, or investible surplus)} + \frac{1}{s}\text{(consumption)}\right]$. Since even in this model, consumption consists of two evidently distinguishable parts, s is not necessarily a very interesting number, but it will be useful to refer to it later.

6. We have seen that the present social value of a project is

$$\Sigma_t R_t (x_t - c'_t l_t) + \Sigma_t U_{L_t} l_t, \tag{29}$$

where $c' = c + LW_L + LW_a a_L$ is the increase in the aggregate wage bill per man employed. This form, (29), for the present social value, seems on the face of it to be the simplest one to use. Given our objectives, we can calculate the second sum for each project on the basis of our predictions of the future course of the economy. The discounting in the first sum must then be done in such a way that the aggregate of all investment projects undertaken, now and in the future, maintains a balance between the supply of, and demand for, consumer goods in each period. But these market clearing conditions are not in general sufficient to determine the correct discount factors R_t. *Given* R_1, market clearing should determine the remaining R_t; but R_1 itself would then have to be determined by other considerations. To put the matter crudely, it would be possible to use the present value rules in such a way as *either* to get long-lived, slow-yielding projects, and a low rate of aggregate gross investment; *or* one could get short-lived, quick-yielding projects and a high rate of aggregate gross investment (after the

initial period when investment may be more or less determined by the existing productive capacity.

In order to determine R_1 correctly — i.e. so as to achieve maximization of the objective function — the long-run development of the economy must be considered. In the long run the various special assumptions we have made about the minimum wage constraint, the excess supply of labour, the level of taxation, and so on, will no longer be satisfied. The situation will have become more complex in some ways. In order to obtain the exact optimum policy for our model, it would be necessary to work out the whole optimum path of the economy. That is not to say that the present policy for the economy would depend very much upon the assumptions that we make about future production possibilities, tax possibilities, and so on. Some assumptions must be made however.

In terms of the model as set out above, we expect that, on the optimum development path, the constraint on possible taxation will eventually cease to be binding, and possibly the wage constraint — which in due course will be simply a labour supply constraint (4) — will also cease to bind. Assume first that the wage constraint is binding. From (24) and (25) we know that

$$R(1 - LW_a a_A) = -(Mu'(a) + Lu'(c)\,W_a)a_A \tag{30}$$

if taxes on the non-industrial sector are not being pushed to the limit. On the assumption that the labour supply constraint takes the form (5), and that the other wage constraints are not binding, $W_a = W/a = c/a$. Using the formula for a_A, (26), we obtain finally

$$R = \frac{aMu'(a) + cLu'(c)}{aM + cL(1 + B_A)}(1 + B_A). \tag{31}$$

If $B_A = 0$, this is a weighted average of $u'(a)$ and $u'(c)$, the weights being proportional to total consumption in the two sectors. In that case $R > u'(c)$, and, by (15), the labour supply constraint must indeed be binding. If $B_A \neq 0$, in which case it must be negative, but presumably greater than -1, the value of R given by (31) might be less than $u'(c)$. This is impossible. Therefore (31) does not hold and the labour constraint is not binding. The wage rate, c, must be chosen so that $R = u'(c)$: the tax constraint must be binding.

We now discuss pF_L. This is obtained from equating the derivative of $U - pF$ with respect to L_t to zero. If the wage constraint is binding, we have the formula (14), which becomes

$$pF_L = u(c) - u(a) + Lu'(c)\left(W_L + \frac{c}{a}\frac{a-m}{M}\right) + u'(a)(a-m)$$

$$- Rc - RL\left(W_L + \frac{c}{a}\frac{a-m}{M}\right). \tag{32}$$

If $B_A = 0$, we can use (31) to write (32),

$$pF_L = u(c) - u(a) + R(a-m) - LW_L[R - u'(c)] - Rc \tag{33}$$

Now $u(c) - u(a) = (c-a)u'(b)$ for some b between a and c. Also, $R = u'(b')$, where, if $B_A = 0$, b' is between a and c. Thus if $c - a$ is small, we shall have, approximately,

$$pF_L = -Rm - LW_L[R - u'(c)]. \tag{34}$$

If R is close to $u'(c)$, or LW_L is small in relation to m, the last term can be neglected : in that case, the shadow wage rate is equal to the marginal

product of labour. (34) gives us a formula for the shadow wage rate when taxation is not pushed to the limit (remembering that $W = -pF_L/R$):

$$w = m + \frac{LW_L}{W} c\left(1 - \frac{u'(c)}{R}\right). \tag{35}$$

If c is close to a, and the elasticity of wage rates with respect to employment is not large, w will be little greater than m. If $B_A \neq 0$, w is increased (given L and other observations). It remains true that if c and a are close to one another, W should be close to m: thus consumption and saving are at that stage more or less indifferent.

Such a formula as (31) allows us to relate R_t and utility at some future date, if we are willing to make an estimate of the optimal position at that date. Given the objective function, we can therefore calculate R_T for some T. This is enough to allow market clearing to determine all the other R_t. Of course, the further future comes in implicity in the judgment that the particular state of the economy at time T will be optimal. We shall not here attempt a rigorous analysis of the optimal path in our model.

It should be emphasized that the initial value of R (or, equivalently, the initial value of the shadow price of saving, s) cannot be determined without relying upon some judgment of the long-run nature of the optimum growth path. That is why the variable T had to appear in the discussion in Chapter XIII. Indeed, one cannot expect to feel content with estimates of shadow wage rates until they are based upon the proper solution of optimum growth in a fully articulated model. It should be emphasized, however, that under certain circumstances the detailed specification of a long-run growth model would make little difference.

If we examine the basic formula (29) for the present social value:

$$\Sigma_t R_t (x_t - c'_t l_t) + \Sigma_t U_{L_t} l_t,$$

we notice first that the second term will surely be positive. Thus for marginal projects, the first sum will be negative. If one were to use a criterion in which the second sum in (29) was neglected (it so happens that, with our present assumptions, the criterion looks rather like the private present value, based upon private profits $(x_t - c_t l_t)$, one would end up with certain values of the R_t, given R_1. Assuming that most projects have negative profits initially (i.e. require initial investment outlays) and make positive profits later, the values of R_t $(t > 1)$ so obtained would be too high. The correct values of R_t would have to make the first sum in general rather smaller, and in order to achieve that, R_t would have to fall faster with t.

Another way of putting this conclusion is to say that the accounting rate of interest (the rate at which R_t falls as t increases) must be greater than the rate of reinvestment — the internal rate of return available if the consumption provided is neglected. Now the rate of reinvestment may sometimes be much higher than the rate at which U_L changes. Little change in consumption levels of the consuming groups might be expected, while considerable returns are nevertheless available to industrial investment. In such a case, where the constraints on possible taxation or on the possibility of reducing consumption are particularly acute, the second term in (29) may be initially rather unimportant. R_t and $U_L/(c - m)$ are eventually rather close together, but the former is falling much more rapidly initially, and is therefore much larger initially.

The case just sketched, although rather special, may nevertheless be quite common among less developed countries : however it is too soon to be sure about that. In such a case, at any rate, the shadow wage rate would be close to c, for the correct investment criterion would come rather close to the relatively simple rule : discount actual profits, and settle the discount rates at such levels that investment undertaken is just equal to the resources available.

7. Since it is reasonable that an economy, in which all production in the industrial sector is under government control, should pay attention, in setting wage levels, to the effects of consumption on production, we should examine the nature of this aspect of the optimization. The treatment adopted above, in which wages are supposed constrained by various considerations, including the effects of consumption on the productivity of labour, is not perhaps the most natural if the sole determinant of wage rates is this relationship. It is, however, correct, as far as the choice of production techniques with *given* wage rates is concerned. We must now discuss the determination of these wage rates.

We suppose that production possibilities are given by

$$F(X_1, L_1, c_1 ; X_2, L_2, c_2 ; \ldots) = 0 \tag{36}$$

The wage levels c_t can be determined only by deliberate choice when the other constraints, particularly the supply constraints are inoperative : we suppose them so. We suppose also that the opportunities to tax the non-industrial sector are fully exploited. Then, as before,

$$X_t = c_t L_t + G_t - \bar{A}_t. \tag{37}$$

We substitute (37) into (36), and then set the derivative of

$$\Sigma_t U_t - pF$$

with respect to c_t equal to zero :

$$U_c - pF_X L - pF_c = 0. \tag{38}$$

Notice that the marginal productivity of consumption is $-F_c/F_X$: it is therefore neater to write (38) in the form

$$-\frac{F_c}{F_X} = L\left(1 - \frac{U_c}{LR}\right). \tag{39}$$

Since, in the optimum position, the marginal productivity of consumption will be positive, it is clear that $U_c < RL$. This was the condition that was required, in our earlier incomplete treatment, for the wage constraint to be binding.

It will be recollected that, when U takes the simple form (10), $U_c/L = u'(c)$. Formula (39) gives us the extra relationship required to determine the optimum level of c : it gives the optimum level as a function of L and t — and production choices — as required. It may be noted that in the special case where the wage paid affects the productivity of the individual worker, in a way that is independent of the kind of production he is involved in, the production frontier can be described in the form

$$F\left(X_1, L_1 h(c_1) ; X_2, L_2 h(c_2) ; \ldots\right) = 0. \tag{40}$$

In this case, it is easy to show that the optimum level of c is given by the formula

$$\frac{ch'(c)}{h(c)} = \frac{R - U_c/L}{R - U_L/c}. \tag{41}$$

The right hand side here may often be quite close to one. At any rate, it is clear that the value of c given by equation (41) will not, in general, change very rapidly, or in a direction that can be unambiguously determined.

8. We consider now the introduction of many commodities into the model. If all commodities can be freely traded at fixed terms of trade — say in world markets — it is as though there were a single commodity, and everything said so far is valid. New problems appear when certain traded commodities are available at prices that vary with the quantity supplied or demanded, and other commodities cannot be traded at all. (The latter case is a special case of the former.)

So long as industrial production is entirely the responsibility of the public sector, we can regard the possibilities of foreign trade as an expansion of the production possibilities available to the public sector. They also affect the value of the non-industrial sector's production, and the opportunities for taxing that sector, but these changes need not trouble us, since they have no effect upon the previous analysis. What we want to know is the way in which the multiplicity of commodities can be allowed for in the investment criterion.

Intermediate goods are straightforward. In order to achieve production efficiency, all production decisions in the industrial sector should be based upon the same prices, whether the goods are used as inputs or as outputs. The correct accounting price for a particular intermediate good is the price at which, as a result of present-value maximization, the good is neither in excess supply nor in excess demand. This is one of the basic principles of welfare economics, and is perfectly relevant here. The principle provides the relationships that determine the prices for all goods that are not consumed — i.e. for capital goods, and goods like steel, industrial electricity, goods transportation, and so on. (In cases where there are economies of scale, matters are more complicated in the usual ways : we shall not discuss these issues in this Appendix.)

We now introduce a multiplicity of consumer goods into the model. In the text of the Manual, this case is dealt with by saying that the government should take appropriate measures to tax the various consumer goods to the correct extent, and that if this is not done some estimate of the correct extent may have to be made. Granted particular tax policies (that is, in the context of completely public production, pricing policies for public enterprises), consumer demand will be determined, and will have to be supplied. The rule used above, that allowable supply will have to be equal to allowed demand, applies : the accounting price for a commodity will have to be set at such a level that the excess of its production over its use in production is just sufficient to satisfy consumer demand. However, it is instructive to see also what kind of principles should govern the setting of the consumer prices.

The analysis is more transparent if we make plenty of simplifying assumptions. Let us suppose that tax possibilities are independent of

the allocation of the labour force between the two sectors, and express them by the constraint

$$\varnothing(A) \leq \overline{\varnothing} \tag{42}$$

where A is the vector of commodities taken from the non-industrial sector. We assume that more of one commodity can be taken only if less of another is taken. Similarly, there may be many possible consumption budgets for the industrial wage earner. Which the wage earners choose will depend upon the prices they are charged : if we know what we want them to consume, we can set the market prices so that they do so. The constraint on real wages can be expressed in the form

$$\Theta(c) \geq \overline{\Theta}, \tag{43}$$

where c, the consumption of the average industrial worker, is now a vector, with one component for each commodity consumed.

In the expression for the production frontier,

$$F(X_1, L_1 ; X_2, L_2 ; \ldots) = 0, \tag{44}$$

X_1, X_2 etc. must now be interpreted as vectors, giving the levels of net production of the various kinds of consumers goods (allowing, in the calculation of net production, for the use made of foreign trade opportunities). Thus F_X will have to denote the vector of derivatives of F with respect to the various commodity levels. The ratios of the different components of the vector F_X will be the marginal rates of substitution between production of the various kinds of consumer good. As before, $X + A = cL + G$, with G now a vector too.

We introduce a Lagrange multiplier p for the constraint (44), as before ; we now also introduce Lagrange multipliers (or dual variables) λ and μ for the constraints (42) and (43). If the production vector X, the industrial employment L, and the vector of transfers from the non-industrial sector A, are chosen optimally, we shall have

$$U_L - pF_X.c - pF_L = 0 \tag{45}$$

$$U_c - LpF_X + \lambda\Theta_c = 0 \tag{46}$$

$$U_A + pF_X - \mu\varnothing_A = 0. \tag{47}$$

In equation (45), it should be noted that $pF_X.c$ is the inner product of the two vectors, showing the consumption budget of the worker, evaluated in terms of the accounting prices of the different commodities. So long as the two constraints (42) and (43) are binding, the dual variables λ and μ will be positive (except at the moment when the constraints just cease to be binding).

Equation (45) is written so as to resemble, as much as possible, the previous equation relating the shadow wage rate and the accounting rate of interest. This is fair, since it is essentially the same equation, the only change now required being the substitution of the value of the consumer budget at accounting prices for the previous c, which was just the quantity of the single consumer good consumed.

It is the other two sets of equations that are the interesting ones, since they tell us the optimal choice of c and of A. They do this because the numbers λ and μ are independent of the particular commodity considered. In conjunction with the constraints (42) and (43), these equations would in principle allow our imaginary government to determine the

optimum tax levels, and pricing policies. If wages are constrained simply by the need to provide a certain minimum level of utility, we can write $\Theta = U$ [in constraint (43]. Then $\Theta_c = U_c$; and equations (46) tell us that the marginal utilities of industrial workers should be proportional to the accounting prices — i.e. that tax rates should be *uniform*. This is, however, a very special case, both because the homogeneity of the labour force assumed is clearly unrealistic, and because other considerations, such as the effects of consumption on productivity, influence the wage constraints besides the utility derived from it.

What we have sought to show here is that a clear significance can be given to the notion of the optimum pricing and tax policies of the government. But even if these are not followed, the more basic rule, that accounting prices should bring about a balance between supply and demand, should be followed, unless it is actually possible for public sector producers to ration their product, in which case considerations of the kind just outlined should influence the choice of the extent of the ration. Crudely put, the principle is to minimize the cost to the economy of providing consumption in the two sectors, due account being taken, if appropriate, of the effects on utility of the possibilities contemplated. So long as the pF_X terms are large in comparison to marginal utilities — i.e. so long as the constraints keeping consumption high are of great importance — these utility considerations can well be neglected.

9. The introduction of the private sector into the industrial half of our model raises many more problems, and we shall not be able to go very far into any of them. The significance of the private ownership of production opportunities is, first, that the government's influence on production decisions may be lessened ; secondly, that it may not be possible by the use of taxes and other controls to set consumer prices at the desired level, while to obtain the fullest effect of taxes it may be necessary to impose them on the purchases of producers rather than upon the purchases of consumers ; and, thirdly, that the extent of private production may affect the commitment to consumption in the economy through its effect on the incomes of the investors.

Let us first neglect the possible effects upon consumption of investment in the private sector. We can think of the public sector as trading with the rest of the economy and with foreign countries. If, as is usual (but not universal), the government has fairly complete control over foreign trade, and can choose, and administer effectively, tariffs of virtually any level, we can regard all foreign trade as being channelled through the public sector. The amounts of the various commodities supplied by the public sector to the rest of the economy, or demanded from the rest of the economy, naturally influence the behaviour of the rest of the economy : they affect the utility of those dependent upon the private sector, and the possibilities of raising tax revenue from that sector. Another way of putting this, is to say that utility and tax possibilities are affected by the terms on which goods and services are traded with the private sector. These effects may, and usually will, include effects arising from changes in the production decisions of the private sector. Nevertheless, the investment rules for the public sector take the same form as those used above. Accounting prices will exist, and the same relationship will obtain between

the shadow wage rate and accounting rates of interest. In particular, the marginal costs and marginal revenues of foreign trade should be equal to the accounting prices. For any commodities traded at constant prices, this is enough to determine the accounting prices. In general, however, and in particular when the commodity in question is not traded at all, the accounting price has to be determined by means of the kinds of relationships we discussed in the last section. They are now more complicated, since the effects of changing the supply of a commodity to the private sector, involve changes in production as well as changes in consumption.

In the case of any particular economy, there is no question that a model of the economy could be developed that would allow some kind of estimation of these further relationships that are required to determine the accounting prices. But it is clearly a task of some complexity. The more influence government has on the production decisions of the private sector, the easier it becomes to estimate these relationships, since the consumption effects predominate. In the extreme, we have the analysis of the last section, where only theories of real wage determination, and of tax possibilities, and a specification of the objective function, were required. For, when production decisions are made optimally, the small changes in them resulting from small price changes are negligible. Increased government control may be achieved both by direct influence on production decisions, particularly investment decisions, and by shifting the point at which taxes are applied, from transactions between public and private producers, to transactions between consumers and producers.

It should be particularly noted that the basic equality of accounting prices and the marginal costs and revenues of foreign trading, which is derived from the desirability of production efficiency within the public sector (including foreign trade), has been argued *without assuming that the private sector production decisions are being made optimally*. Even although tariffs may be used for revenue purposes, it is nevertheless desirable that these tariffs should be neglected when present value calculations are being made. This proposition played a central part in the exposition of the text. It presupposes that public production decisions need not be allowed to affect the terms on which the private sector trades as influenced by tariffs, taxes, rations, etc. (These tariffs, etc. need not themselves be optimal, for they affect the trade between the public sector and the private sector, not the trade within the public sector itself.) Thus we exclude the possibility that certain arbitrary quotas might be fixed on foreign trade independently of public sector production decisions — for that would remove the freedom of the public sector to determine its own imports and exports on the basis of the optimal decision rules.

Finally, we bring in the consumption of private investors. So long as the government has no influence on the private production decision, this determinant of consumption, along with others, affects the value of goods made available to the private sector. But this raises no new points of principle : it merely complicated the application of principles already established. Making electricity available more cheaply may encourage production in sectors where investors consume a great deal, thus diminishing the savings available to the economy. To that extent the (accounting) demand price for electricity, which has to be calculated from the effects of making

more electricity available, is lower than it might have been : transfers to the public sector are diminished with little compensating increase in utility.

In the evaluation of a private sector project itself, the consumption of investors must of course be allowed for directly, making due allowance for the no doubt relatively low marginal utility of those who enjoy consumption from the profits of the enterprise.

It may be thought that a particular private sector project need have no different effect on aggregate consumption from a public sector project, since savings — which earns interest in any case — is simply diverted from one to the other. However, sanctioning a private sector project means putting certain profit opportunities into private hands, and it is generally observed that such opportunities yield much higher returns than are provided by government bonds : the total of profits is thus increased, and potential government income reduced. It is to be presumed therefore that consumption will be increased.

10. In this Section of the Appendix we make some further analysis of decisions under uncertainty, supplementary to the verbal treatment in Chapter XV. Since the principles can be illustrated in terms of a single commodity, we restrict ourselves to that case.

Let consumption in some year be X, a random variable. We have a very simple project which yields additional consumption Y, also a random variable. We ask what will be the certainty equivalent of this uncertain prospect, Y : the largest amount of consumption it would be worth giving up (with certainty) for the sake of this prospect. Denote the certainty equivalent by y, the expectation of aggregate consumption by X, and the expectation of the consumption provided by the project by Y.

The expected utility of aggregate consumption in the economy if the project is undertaken is $E\,[u\,(X + Y)]$. y is defined by the equation

$$E\,[u\,(X + y)] = E\,[u\,(X + Y)]. \tag{48}$$

If one ignored the riskiness of the project, one would use the expectation Y as an indicator of its worth, instead of the correct value y. We have to determine how good an approximation to y is Y, and to provide some better approximation.

Assume that the joint probability distribution of X and Y has moments at least up to the third order. Expanding u by Taylor's theorem around $\bar{X} + \bar{Y}$, we obtain from (48) :

$$E\,[(y - Y)\,u'\,(\bar{X} + \bar{Y}) +$$

$$(y - Y)\,(2X - 2\bar{X} + y + Y - 2\bar{Y})\,1/2\,u'\,(\bar{X} + \bar{Y}) + Z] = 0$$

where the remainder term, Z, will have an expectation negligible compared to the other terms. Thus, approximately,

$$y = \bar{Y} + 1/2q\,\frac{E\,[(y - Y)\;(2X - 2\bar{X} + y + Y - 2\bar{Y})]}{\bar{X} + \bar{Y}}$$

where $q = -\dfrac{(\bar{X} + \bar{Y})\,u''(\bar{X} + \bar{Y})}{u'(\bar{X} + \bar{Y})}$ which is a positive number if u is concave, and is the elasticity of marginal utility with respect to consumption. q is often taken to be between 1 and 3.

Since,

$$E[(y - Y)(2X - 2\bar{X} + y + Y - 2\bar{Y})]$$
$$= E[(y - \bar{Y})(2X - 2\bar{X} + y + Y - 2\bar{Y})] -$$
$$E[(Y - \bar{Y})(2X - 2\bar{X} + y + Y - 2\bar{Y})]$$
$$= (y - \bar{Y})^2 - 2\ \mathrm{Cov}\ (X, Y) - \mathrm{Var}\ (Y),$$

we have

$$y - \bar{Y} = -(1/2)q \frac{2\ \mathrm{Cov}\ (X, Y) + \mathrm{Var}\ (Y)}{\bar{X} + \bar{Y}} + (1/2)q \frac{(y - \bar{Y})^2}{\bar{X} + \bar{Y}}.$$

The last term is small compared to the first, which will in general give a satisfactory approximation to the difference between y and $\bar{Y}$. If the prospects for the project are independent of the prospects for the economy, Cov $(X, Y) = 0$, and we have approximately:

$$\frac{y - \bar{Y}}{\bar{Y}} = -\frac{q}{2} \frac{\bar{Y}}{\bar{X} + \bar{Y}} \frac{\mathrm{Var}\ (Y)}{\bar{Y}^2},$$

the formula referred to in Chapter XV. In general, the standard deviation of Y would not be more than a quarter of $\bar{Y}$: it would be extremely unusual to have Var $(Y) / \bar{Y}^2 > 1/10$. It would also be very unusual to have $\bar{Y} / (\bar{X} + \bar{Y}) > 1/10$. If the two fractions are both equal to 1/10, the proportional correction required is not more than 1.5 per cent of $\bar{Y}$ or 0.15 per cent of national consumption. This is very small (but no smaller than the gains from many carefully analysed projects).

If X and Y are not independent, the correction may be more important. In the extreme case, where X and Y are proportional, $[\mathrm{Cov}\ (X, Y)]^2 = \mathrm{Var}\ (X)\ \mathrm{Var}\ (Y)$, and, approximately,

$$\frac{y - \bar{Y}}{\bar{Y}} = -\frac{q}{2}\left[2 \frac{s_{X+Y}\, s_Y}{(\bar{X} + \bar{Y})\, \bar{Y}} - \frac{\bar{Y}}{\bar{X} + \bar{Y}} \left(\frac{s_Y}{\bar{Y}}\right)^2\right]$$

where s_{X+Y} and s_Y are the standard deviations of $(X + Y)$ and Y, respectively. It seems that even for quite distant years, s_{X+Y} $(\bar{X} + \bar{Y})$ would not usually be greater than 5 per cent. If s_Y $\bar{Y}$ is 30 per cent, this would give a correction of about $-.015q$: possibly as much as 5 per cent of $\bar{Y}$. Interdependence of this magnitude seems unlikely: but world recessions, and the effects of general mistakes of prediction in the economy, will usually affect many sectors simultaneously, so that some interdependence should be allowed for.

BIBLIOGRAPHY

PART I

The following books, among many which could be mentioned, may be found helpful as background reading for Part I. On the economic and social environment in developing countries and its implications for planners and policy-makers we suggest

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BAUER, P. T. and YAMEY, B. S., *The Economics of Underdeveloped Countries,* Cambridge University Press, 1957 ;

HABAKKUK, H. J., " The Historical Experience of the Basic Conditions of Economic Progress ", ed. L. H. Dupriez, *Economic Progress,* Louvain, 1955 ;

JOHNSON, H. G., " Planning and the Market in Economic Development ", *Pakistan Economic Journal,* June 1958, reprinted in *Money, Trade and Economic Growth,* George Allen and Unwin Ltd., London, 1962 ;

LEWIS, W. A., *Development Planning,* George Allen and Unwin Ltd., London, 1966.

The approach to economic policy underlying the method of project evaluation proposed in this Manual stresses the efficient use of a country's resources, given the opportunities open to it in world markets, and policy objectives concerning such matters as the distribution of consumption between different classes of income recipients and different periods. A different approach to policy-making in developing countries is proposed in

HIRSCHMAN, A. O., *The Strategy of Economic Development,* Yale University Press, New Haven, Conn., 1958.

A review of the use of cost-benefit analysis in developed countries is contained in :

PREST, A. R. and TURVEY, R., " Cost-Benefit Analysis : A Survey ", in *Economic Journal,* December 1965, reprinted in " Surveys of Economic Theory ", Vol. III, *Resource Allocation,* Macmillan, London, 1966.

There is also

MAASS, A., HUFSCHMIDT, M., DORFMAN, R., THOMAS, H. A., MARGLIN, S. A., and FAIR, G. M., *The Design of Water-Resource Systems : New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning,* Harvard University Press, Cambridge, Mass., 1962.

Many of the chapters in this Volume discuss investment decisions in general, and are relevant to industrial investment decisions also.

Chapter I

This Chapter mostly retraces the ground covered in Volume I of the Manual of Industrial Project Analysis in Developing Countries, and the relevant bibliography can be found there. A shorter survey of the use of discounted cash-flow methods in investment decisions can be found in

HIRSHLEIFER, J., de HAVEN, J. C., and MILLIMAN, J. W., *Water Supply : Economics, Technology, and Policy,* University of Chicago Press, Ill., 1960, Chapter VII.

Chapter II

Some works on the economic environment with which policy-makers in developing countries are confronted have already been suggested. Particularly suitable as background reading for this Chapter are

BHAGWATI, J., *The Economics of Underdeveloped Countries,* Part 2, World University Library, Geneva 1966 ;

LEWIS, W. A., *Development Planning,* Chapter II, George Allen and Unwin, Ltd., London, 1966.

On ' welfare economics ', namely that branch of the subject which seeks amongst other things to answer the question posed in Section 1, ' What assumptions do we need to make about the real world, if the theory that actual costs measure social cost is to be true ? ', we suggest

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ARROW, K. J., and SCITOVSKY, T. (eds), *Readings in Welfare Economics,* (forthcoming), Part III ;

de V. GRAAFF, J., " On Optimum Tariff Structures ", *Review of Economic Studies,* 1949, reprinted in Arrow and Scitovsky, *op. cit.,* Part VI ;

MISHAN, E. J., *Welfare Economics,* Random House, 1964, Chapter 2, " Reflections on Recent Developments in the Theory of External Effects ".

The chapter in Baumol gives some idea of the sort of reasoning used by ' welfare economists ' without recourse to difficult mathematics. Part III of the *Readings in Welfare Economics* contains a number of classic papers discussing the reasons why social and private costs and benefits should diverge. Amongst these we specially recommend

SCITOVSKY, T., " Two Concepts of External Economics " originally printed in the *Journal of Political Economy,* April 1954 ; and

YOUNG, A. A., " Increasing Returns and Economic Progress ", originally printed in the *Economic Journal,* December 1928.

Graaff's paper is a statement of the case for taxes on the import and/or export of commodities over whose prices a country exerts some monopoly power. Some use is made of mathematics, and the argument may be difficult to follow for someone not well versed in economic theory. The chapter in Mishan discusses recent contributions to the theory of external effects. The reasoning is often abstract, but makes almost no use of mathematics.

Chapters III and IV

The distinction between the objectives (the subject of Chapter III) and the constraints (the subject of Chapter IV) which should be taken into account by those in charge of project selection in developing countries, is somewhat arbitrary, and other authors have not always made the same division between these categories as this Manual. Amongst these authors we recommend

CHENERY, H. B., " Comparative Advantage and Development Policy ", *American Economic Review,* March 1961 ; reprinted in *Surveys of Economic Theory,* Vol. II, " Growth and Development ", Macmillan, London, 1965 ;

ECKSTEIN, O., " Investment Criteria for Economic Development and the Theory of Intertemporal Welfare Economics ", *Quarterly Journal of Economics,* February 1957 ;

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GALENSON, W., and LEIBENSTEIN, H., " Investment Criteria, Productivity, and Economic Development " in, *Quarterly Journal of Economics,* August 1955 ;

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Chapters I and II of Marglin's book discuss the implications of several different policy objectives for project selection. Chapter I focuses in particular on the distribution of consumption amongst different income groups and regions ; Chapter II on its intertemporal distribution. The paper of Galenson and Leibenstein was one of the earliest attempts to work out the implications for investment criteria of putting a premium on projects' generation of reinvestible savings. Eckstein (1957) contains a critique of the arguments of Galenson and Leibenstein. Eckstein (1961) contains a survey of the different objectives relevant to project selection, with special stress on

the relationship between the interest rate as a measure of the value of output at different points in time and planners' time preference. Chenery has a brief discussion of these objectives in the context of development policy, focussing in particular on possible conflicts between growth and making the best of the opportunities open to a country in world markets. (Of the works which we have just cited, only Eckstein (1957) makes more than a minimal use of mathematical reasoning.)

On the substitutability of savings into foreign exchange there is a discussion in Chapter V of

LITTLE, I.M.D., and CLIFFORD, J. M., *International Aid*, George Allen and Unwin Ltd., London, and Aldine Publishing Company, Chicago, 5., 1966.

On the balance of payments and economic policy, a brief survey of the relevant literature can be found in

JOHNSON, H. G., "The Balance of Payments", *Pakistan Economic Journal*, June 1958, reprinted in *Money, Trade, and Economic Growth*, George Allen and Unwin Ltd., London, 1962.

Chapter V

There is a vast literature on economic planning, from which we shall cite, on the relationship between projects and plans,

LEWIS, W. A., *Development Planning*, George Allen and Unwin Ltd, 1966, Chapter IV; and

TINBERGEN, J., *The Design of Development*, Johns Hopkins Press, Baltimore, 1958, Chapter II.

Chapter VI

The theory of the use of commercial policy to serve the ends discussed in this Chapter and its relative merits compared with taxes and subsidies, is surveyed in

BHAGWATI, J., *The Theory and Practice of Commercial Policy: Departures from Unified Exchange Rates*, International Finance Section, Department of Economics, Princeton University, N.J., 1968.

Some use is made of geometry in this booklet, which also contains a useful bibliography.

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All these papers make some use of simple mathematics, mainly algebra, and that of Power is illustrated with a discussion of some statistical evidence concerning Pakistan.

There is a survey of taxes, other than tariffs, in

JOHANSEN, L., *Public Economics*, North-Holland Publishing Company, Amsterdam, 1965, Chapter 7.

This survey makes use of simple calculus, and assumes some prior knowledge of basic economic theory.

PART II

Chapter VII

An early article in which it was suggested that market prices should be adjusted to derive social values in project selection is that of

CHENERY, H. B., "The Application of Investment Criteria", *Quarterly Journal of Economics*, February 1953.

The adjustments which he proposed involve corrections for taxes, subsidies, tariffs, imperfections of competition, and the surplus supply of resources such as labour.

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LITTLE, I.M.D., "Public Sector Project Evaluation in Relation to Indian Development", a Delhi School of Economics lecture of 1965, in Bhuleshkar, A.V. (ed.), *Indian Economic Thought and Development. Essays in memory of Hawaharlal Nehru,* Bombay, 1968.

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The implication of the shortage of savings for project selection is discussed in

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a paper largely concerned with the implications of the shortage of foreign exchange for project selection; and

MARGLIN, S.A., *Public Investment Criteria,* George Allen and Unwin Ltd., London, 1967.

Chapter VIII

There is an earlier estimation, by one of the present authors, of the shadow price of labour in terms of its consumption, using different assumptions to those adopted in this Manual. This can be found in

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Chapter IX

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These problems are illustrated in the case of a number of Indian industries in Part I. A theoretical treatment of some of them is given in Part II. Both parts make use of mathematical reasoning, that in Part II being at a fairly advanced level.

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Chapter XII

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Chapter XV

On the problem of decision-taking in conditions of uncertainty we suggest,

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which is a simple discussion of decisions under uncertainty, written for the general reader.

There is also,

ARROW, K.J., *Aspects of the Theory of Risk Bearing,* Helsinki, 1966.

This is quite a difficult book, giving an abstract account of the theory of economic behavior under uncertainty. It is probably accessible only to readers with a substantial background in economics and/or probability theory.

MAASS, A., HUFSCHMIDT, M., DORFMAN, R., THOMAS, H.A. MARGLIN, S.A. and FAIR, G.M., *Design of Water-Resource Systems : New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning,* Harvard University Press, Cambridge, Mass., 1962, discusses some of the problems at an intermediate level.

Chapter XVI

On the role of external effects in economic theory we suggest two works already cited at the end of Chapter II,

ARROW, K. J. and SCITOVSKY, T., (ed) *Readings in Welfare Economics* (forthcoming), Part III ; and

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