

REPORT NO. 50

PUBLIC INVESTMENT CRITERIA: FINANCIAL
AND ECONOMIC INTERNAL RATES OF RETURN

by

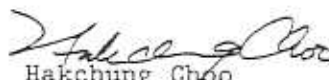
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A B S T R A C T

Profits are an essential signalling mechanism for guiding investment decisions. However, private or financial profitability, while important in investment decisions by firms, may not be a good signalling mechanism from the viewpoint of the contributions of a project to the national economy. It is good only if expenditures closely measure economic costs and receipts closely measure economic benefits. The essence of economic analysis of projects is that actual receipts may not equal economic benefits and actual expenditures may not equal economic costs.

The reasons for the above are fourfold. First, project boundary in financial and economic profitability is likely to be different. Second, market prices may underestimate economic benefits in cases where consumers' surplus is significant. Third, a project may have influences that work outside the market rather than through it resulting in externalities. Fourth, on account of distortions in the policy environment, prices that obtain in the market are not necessarily the ones that should be used in economic analysis.

However, economic analysis presupposes that in many cases actual receipts and expenditures can be suitably adjusted so that differences between them, which are analogous to ordinary profits, will properly reflect economic profitability. Two main types of adjustments must be made to financial calculations to reflect economic concepts: (i) include (exclude) some costs and benefits which have been excluded from (included in) the financial analysis; and (ii) revalue some inputs and outputs if their market and economic prices differ. Since investment projects require streams of inputs and produce streams of outputs over time, discounted cash flow analysis is required to estimate profitability. This analysis leads to the use of the concepts of financial (FIRR) and economic (EIRR) internal rates of return associated with financial and economic profitability, respectively. Taking the approach of starting with financial profitability and incorporating the four points of departure of economic from financial analysis, the paper provides an integrated framework of relating financial with economic profitability. It will focus on the relationship, if any, between FIRR and EIRR.

Economic profitability is shown to consist of three main components: (a) financial profitability expressed in economic prices; (b) profitability in economic prices associated with differences in project boundary; and (c) profitability in economic prices linked to external economies and diseconomies. Item (b) would include consumers' surplus related to final consumption of project output.

Given that financial analysis is often the starting point for economic analysis and economic prices are primarily used to account for distortions in the policy environment, it is inevitable that differences between FIRR and EIRR are used to draw inferences about net transfer payments that are implied by the prices for a project's inputs and outputs. A major contribution of this paper is that it indicates why extreme caution should be exercised in drawing these inferences which are

valid only when issues of project boundary (b) and externalities (c) are absent. In their absence and when domestic competitive conditions prevail, the case for economic analysis is not compelling.

In terms of the evolution of the literature on economic or cost-benefit analysis, while (b) and (c) were the main grounds on which economic analysis was justified at the earlier stages, issues relating to economic pricing (a) received considerable attention in the late 1960s and 1970s. A fundamental point of departure of economic from financial analysis is in the valuation of costs and benefits. While market prices are used in financial analysis, economic prices reflecting national opportunity costs are used in economic analysis. Market prices differ from economic prices owing to market-failure which can be natural or artificial. Failures which occur naturally in the absence of government intervention are called natural market failure while those caused by inoptimal government intervention are termed artificial market failures. It is assumed in this paper that economic or accounting prices are used to provide a partial correction for the distortions that are caused by artificial market failure.

The major rationale for public sector intervention arises because of differences in project boundary between economic and financial analysis and the existence of externalities. Under these conditions, the paper indicates that very little can be said at a general level about the relationship between FIRR and EIRR. What the paper does indicate is that by adopting a stage wise procedure of introducing each departure of economic from financial analysis in a sequential manner, some insights can be gained about the impact of the policy environment and pricing of public utilities on the determination of the FIRR and EIRR estimates.

While economic analysis presupposes the identification, quantification and valuation of costs and benefits, there are certain sectors like social infrastructure where the above may not be possible. This is compounded by the fact that markets for goods and services for these sectors may not exist raising the problem of pricing of public utilities. The paper briefly discusses the problems arising for projects with these characteristics.

In some social sectors where markets for the outputs of projects do not exist, public utilities design pricing rules on the basis of various criteria, e.g. full cost pricing including capital cost. In this case the FIRR, by definition, will be equal to or greater than the real cost of capital to the public utility. It is important to note that even if an 'EIRR' is estimated based on financial profitability adjusted for price distortions, the fact that FIRR is equivalent to the real cost of capital to the public utility cannot be used to assess whether the 'EIRR' is equal to the opportunity cost of capital to the economy. The difficulty arises on two counts. First, it is not possible to assess how adjustment to financial profitability by conversion factors will affect economic profitability. Second, the opportunity cost of capital to the economy may be greater than the real cost of capital to the public utility. Thus financial viability cannot be used a priori to assess economic viability even in the limited case under consideration.

The main purpose of this paper is to develop an integrated framework of analysis to examine the points of departure of economic from financial analysis of projects. This framework is sufficiently general to encompass the characteristics of various sectors of an economy. Differences in project boundary, externalities and policy distortions together provide the *raison-d'être* for economic analysis. Once this is recognized, the transition from financial to economic analysis is clear cut as indicated in the following important conclusions drawn from the paper. First, only in cases where there are no externalities, project boundaries are similar between financial and economic analysis, and competitive internal markets exist can FIRR be used as a proxy for EIRR. Second, when issues of project boundary and externalities become important, public intervention is likely. Consequently, the weight of project boundary and externalities in determining the EIRR becomes critical. Low FIRRs and high EIRRs are likely in projects with significant externalities. However, a comparison of FIRR and 'EIRR' based on financial profitability adjusted for price distortions and differences in project boundary may, in this case, provide some clues of relating financial price to willingness to pay. Third, in cases where issues of project boundary and externalities are known to be important but quantification and valuation of all benefits and costs are not possible, the project analyst will have little option but to estimate an FIRR and indicate qualitatively that net benefits associated with differences in project boundary and externalities are likely to be positive. Fourth, the statement that whenever an FIRR can be calculated an EIRR can also be calculated is in general not correct. Even if an 'EIRR' associated with financial profitability adjusted for policy introduced distortions can be estimated, it may be meaningless as a proxy for economic viability if issues linked to project boundary and externalities are important. Fifth, the statement that the FIRR is a lower bound estimate for EIRR has no basis when issues of economic pricing, project boundary and externalities are important. Sixth, FIRR should not be used as a proxy for assessing economic viability even when full cost recovery including capital cost has been used to establish the pricing principle for the public utility undertaking the investment project under consideration.

TABLE OF CONTENTS

	Page No.
I. INTRODUCTION	1
II. FINANCIAL PROFITABILITY, PROJECT BOUNDARY AND FINANCIAL INTERNAL RATE OF RETURN .	2
III. ECONOMIC ANALYSIS AND PROJECT BOUNDARY	4
IV. EXTERNALITIES	9
V. ECONOMIC PRICING	10
VI. FINANCIAL VERSUS ECONOMIC PROFITABILITY	14
VII. FINANCIAL AND ECONOMIC INTERNAL RATES OF RETURN: MEASURES OF PROJECT VIABILITY	17
VIII. CONCLUSION	20

I. INTRODUCTION

1. In public investment decision making, considerations of both financial and economic profitability are important. While economic profitability indicates the true worth of a project to the entire economy, financial profitability provides a measure of whether the enterprise can operate the project in a commercially viable manner. With growing fiscal deficits in many developing countries, financial viability is becoming increasingly important in public investment. To the extent possible, public investment should alleviate rather than aggravate government budgetary deficits. On these considerations, both economic and financial profitability are desirable in public investment projects.

2. When economic and financial profitability of a project under consideration differ, it would be necessary to determine the reasons for the difference. The purpose of this paper is to examine the points of departure of economic from financial profitability with a view to analyzing the reasons for the differences. The differences which will be highlighted relate to definition of project boundary, valuation of benefits, externalities and pricing. This analysis will enable an assessment of the role of policy reform in narrowing differences between them. Further, it will indicate the conditions under which financial profitability can be considered a valid starting point for assessing economic profitability. These will highlight the issues involved in relating the two measures of project viability. The fundamental point that emerges is the importance of ascertaining the reasons why economic analysis becomes necessary in establishing any relationship between financial and economic profitability.

3. The main purpose of the paper is to develop an integrated economic framework which is sufficiently general to encompass the characteristics of various sectors of an economy. These characteristics could differ on account of identification, quantification and valuation of cost and benefit streams. Conclusions based on the characteristics of certain sectors have resulted in generalizations in the relationship between economic and financial profitability which are not universally applicable. The integrated framework that emerges from this paper will clarify many of these issues by highlighting the need to take a comprehensive view of economic analysis rather than focussing on any one individual aspect. The relevance of this paper will be mainly for sectors for which both economic and financial viability needs to be determined in public investment decision making.

4. The paper is divided into three distinct but interrelated parts. It begins by examining the meaning of profitability from the point of view of an entity or firm facing market demand and supply conditions. The next part of the paper deals with analyzing the interpretation of profitability from the economy's viewpoint. Sections III to V indicate the main issues in the economic analysis. The third part of the paper contained in Sections VI and VII use the building blocks developed in the first two parts of the paper to show the relationship between economic and financial profitability. It is shown that on grounds of both identification and valuation of costs and benefits, economic and financial profitability of

an investment project can differ significantly. Consequently, it is difficult to establish any relationship between these two concepts of profitability. While profitability on both considerations is desirable for project viability, no conclusions can be generally drawn about economic profitability from ascertaining financial profitability and vice versa.

II. FINANCIAL PROFITABILITY, PROJECT BOUNDARY AND FINANCIAL INTERNAL RATE OF RETURN

5. A project entity whether it is in the public or private sector is faced with market prices. Market prices are relevant for the entity or firm in determining costs for establishing and operating the project and the receipts from the sale of its outputs or services. Profits based on these market prices are an essential signalling mechanism for guiding investment decisions by a firm or public utility. Financial profitability is of concern in this context.

6. Every project uses up resources or inputs and produces outputs. These inputs or costs and outputs or benefits to the firm must be identified and valued. The identification of costs and benefits streams or identification of project boundary depends on the definition of project objectives. In this paper, it is assumed that the firm's objective is to maximize profits. With this objective in mind, the decision that has to be taken is whether to accept or reject a proposed investment project. All costs and benefits which influence financial profits to the firm from the project will be included in the project boundary.

7. For every year, all expenditure on goods and services for the project including capital expenditure and all expected receipts are included in the cash flow for estimating profits. Borrowing and lending and interest payments are normally excluded from the concept of cash flow when this is used for the purpose of assessing the profitability of new investment. Thus, only cash flow for non-financial operations or return to all resources are relevant for assessing project viability.^{1/}

^{1/} In estimating the financial profitability it is necessary to identify the money profit accruing to the project-operating entity. To determine the money profit, consider a project which produces a commodity (i) using domestically produced inputs (j), imported inputs (m) and primary factors of production (f). Let a_{ji} , a_{mi} and a_{fi} indicate the direct amounts of domestically produced, imported and primary factor inputs used per unit of output i. Assume that p_i^d , p_m^d , p_j^d and p_f^d represent relative domestic or market prices for outputs, imported inputs, domestically produced inputs and primary factors of production respectively. Let q_i represent project output. Money or financial profitability (Π^t) in year t is given by

$$\Pi^t = [p_i^d - \sum_j a_{ji} p_j^d - \sum_m a_{mi} p_m^d - \sum_f a_{fi} p_f^d] q_i \quad (1)$$

It should be noted that while p_i^d , p_j^d , p_m^d , p_f^d incorporate relative price changes at every point of time they do not include nominal price changes.

8. Since the streams of expenditures and receipts occur over relatively long periods of time, they cannot be compared directly for determining the project's profitability. A discounted cash flow analysis is used to account for the time dimension.^{2/} A system of discounting is used to determine the net present value of the stream of costs and benefits of the project. The discount factor will be based on the real market rate of interest or financial cost of capital to the firm or public utility. Alternatively, the financial internal rate of return (FIRR) which is defined as the discount rate that makes the net present value of the project equal to zero can be used. Project financial viability can be expressed in two alternative ways: (i) net present value of the stream of benefits and costs is greater than or equal to zero; and (ii) the FIRR is greater than or equal to the financial cost of capital to the firm or public utility.

9. It should be noted that in identifying the cost stream used in defining money or financial profit, only the cash flows for non-financial operations are included. Thus, in assessing profitability of new investment, only resource flows relevant for the firm or public utility are included; borrowing, lending and interest payments are excluded. Therefore, the FIRR derived on these assumptions is called the FIRR to all resources. It is the return from the standpoint of equity and loan participants or the FIRR before financing. In contrast, the FIRR to equity only is referred to as the FIRR after financing. In this paper, only the FIRR to all resources or the FIRR before financing is relevant.

10. The definition of FIRR raises an important issue about relating public utility pricing to FIRR. If pricing is determined on the basis of full-cost recovery including capital cost of the investment project under consideration, then by definition, the FIRR will be equal to or greater than the real financial cost of capital relevant to the public utility or firm. This happens because of the equivalence of the general profitability and the rate of return to capital criteria.^{3/}

^{2/} Assuming that the project life is from year 0 to T, the net present value is given by

$$\sum_{t=0}^T \frac{\Pi^t}{(1 + i_f)^t} \geq 0 \quad (2)$$

where i_f is the real market rate of interest or financial cost of capital relevant for the firm. The project will be accepted if the net present value exceeds or is equal to zero, and is rejected if this value is negative. The rate of interest which makes the net present value zero is defined as the financial internal rate of return (FIRR). An alternative way of expressing profitability is

$$\text{FIRR} \geq i_f \quad (3)$$

^{3/} Ali, I. Foreign Exchange and Fiscal Impact of a Project: A Methodological Framework for Estimation, Economics and Development Resource Center Report Series No. 49, February 1990.

11. Anticipating the discussion to follow, the more salient issues raised in this section are recapitulated for contrasting financial with economic profitability. It indicates that having identified the receipts and expenditures, these should be expressed in market prices. From the point of view of the firm, receipts equal benefits and expenditures equal costs. Two points emerge from this discussion. First, in identifying costs and benefits, the firm has to take account of only those effects which have a direct bearing on its profits. It must also take into account costs which are excluded from the project but which will be incurred by the firm or public utility to realize the additional revenue. Despite this, as will be shown, a firm focusses its attention on a rather limited range of effects in the project boundary relevant to it. Second, the firm faces specific demand and supply conditions or prices which may not represent the prices for the economy as a whole.

III. ECONOMIC ANALYSIS AND PROJECT BOUNDARY

12. Economic development subsumes two objectives: (i) increase total national income which is the growth objective; and (ii) improve distribution of national income which is the equity objective. Projects should be assessed in relation to their net contribution to both of these objectives. In this paper it is assumed that projects are targeted to the growth objective and other instruments are available to achieve the equity objective. On considerations of matching instruments with targets, the focus of economic analysis of projects in this paper will be on an assessment of project worth in terms of contributions to growth. The contributions to growth will be ensured through improved resource allocation resulting from choosing projects which augment efficiency of resource use. This paper concentrates on the use of economic analysis of projects as an instrument to improve efficiency of resource allocation and thereby promote growth.

13. The similarity between economic and financial analysis which is described in Section II is that both assess the profitability of investment. However, there is a significant difference in the perspective from which profitability is assessed because of differences in objectives: while money profit accruing to the firm or project entity is maximized in financial analysis, contributions to growth is maximized in economic analysis. Three aspects are highlighted. For analytical convenience, each aspect is considered in separate sections. First, a sharp distinction must be drawn between project outputs and project benefits. While outputs are the measurable products of a project, benefits represent a project's final effects. In this section it will be shown that a consideration of this set of issues could lead to significant differences in the definition of project boundary between economic and financial analysis. Second, prices in the market may not be a good guide to opportunity cost which is the relevant concept in designing policies for growth. Some aspects of economic pricing are discussed in Section V. Third, some benefits and costs arising from a project's operations do not appear as inputs or outputs of a firm. Also these benefits and costs do not vary with both inputs and outputs and hence cannot be accounted for by revaluing such inputs and outputs. Any such costs or benefits have to

be separately added for every year of operation in which they occur. The issue of externalities pertaining to the above is raised in Section IV.

14. The definition of project boundary depends on the identification of project benefits. Also, the identification of costs must take into account project benefits. All costs which have to be incurred to realize the benefits attributed to a project must be taken into account, irrespective of whether they are included in the project or not. Alternatively, the correct identification of costs requires a clear definition of project boundary which must include all the facilities required for realizing project benefits.

15. The first step in the identification of benefit is the use of the "with and without" principle in identifying the net output of a project.^{4/} Net output is defined as the additional goods and services that become available to the economy as a result of a project. If the goods and services physically produced by a project add to the supply in the economy than without the project, this additionality of supply is regarded as the net output of the project. In this case, the net output of the project is its actual additional physical output. On the other hand, if the goods and services produced by the project do not add to the supply in the economy, but instead substitute for an alternative source of supply, leaving total output constant, then the net output of the project is reflected by the resources released from the alternative source of supply. In this case, from the economy's point of view, the net benefits of the project are not the output of the project, since this output would be available in the without project situation. The net benefits of the project are the newly available resources that would be released by the discontinuation of the old, displaced activity.

16. Having identified project benefits in terms of actual physical output and/or resource cost savings, the effects on the economy would need to be assessed. The case of additionality of supply to the economy is considered first. There could be several categories of net output which could consist of: consumer goods for domestic consumption, intermediate producer goods and/or foreign exchange. In the case of consumer goods for domestic consumption, the benefit to the economy would be given by the willingness to pay (WTP) for the net output.^{5/} The consumer WTP per unit of net output will not exceed its market price when competitive market conditions prevail: (i) there is no rationing; (ii) no consumer can influence market price; and (iii) net output of the project is not large enough to change the market price.

17. In the case of an intermediate producer good, the benefit is measured by calculating the net profit the producer realizes on the

^{4/} United Nations Industrial Development Organization (UNIDO), Guidelines for Project Evaluation, New York, 1972.

^{5/} The consumers' willingness to pay can be defined as an area concept or as a line concept. In this paper when WTP is related to additional supply from a project, the area concept is used. When WTP per unit of output is used, the reference is to the line concept.

purchased input. The per unit net profit for the intermediate producer good is estimated by calculating the residual after deducting the costs of all inputs other than the intermediate producer good from the sales value of the producers' output resulting from the use of one unit of the intermediate producer good. If output of intermediate goods are sold to perfectly competitive producers, the willingness to pay for such goods would be reflected by the per unit net profit. Where this is not the case, it is strictly necessary to estimate the increased production of final output that will accrue, and to value it at consumers' willingness to pay. If price is greater than the marginal cost for final output, consumers' willingness to pay is greater than market value of inputs.

18. When net output consists of export or import competing items, the final effect on the economy is felt in terms of foreign exchange earnings or savings. In this case, the relevant net output of the project is foreign exchange to the extent that exports are increased or imports decreased.

19. The case when project output substitutes for an alternative source of supply is taken up next. The net benefits of the project consisting of resources released by discontinuation of displaced activities will have to be valued. These will be valued in terms of the opportunity cost to the economy. The determination of opportunity cost of resources released is done on the basis of estimating economic cost of inputs taken up below.

20. The discussion in the preceding paragraphs which draws a sharp distinction between project outputs and project benefits implies that a fundamental difference between economic and financial analysis is the identification of project boundary. The project boundary in economic analysis is likely to be wider than in financial analysis. Consequently, the identification of project costs needs to be more comprehensive in economic compared to financial analysis.^{8/} Consider an electricity generation project which displaces older plants and also leads to additional supply of electricity from the utility. In the financial analysis, benefits will consist of reduced costs of production of without project output and revenue from additional supply. In the economic analysis, cognizance has to be taken of how the additional supply from the project is used. If it displaces kerosene use, then benefits to the economy will consist of resource cost savings. If in addition, there is a net increase in energy supply, the net increase will be valued at willingness to pay. Furthermore, if benefits are identified at a retail level for an electricity generation project, then all costs of transmission and distribution as well as costs incurred by the consumer must be added to the project costs in the identification of economic cost. In financial analysis, only costs directly associated with the investment that are undertaken directly by the entity are included.

^{8/} Ali, A., A Review of the Economic Analysis of Power Projects in Asia and Identification of Areas of Improvement, Economics and Development Resource Center Report Series No. 45, November 1989.

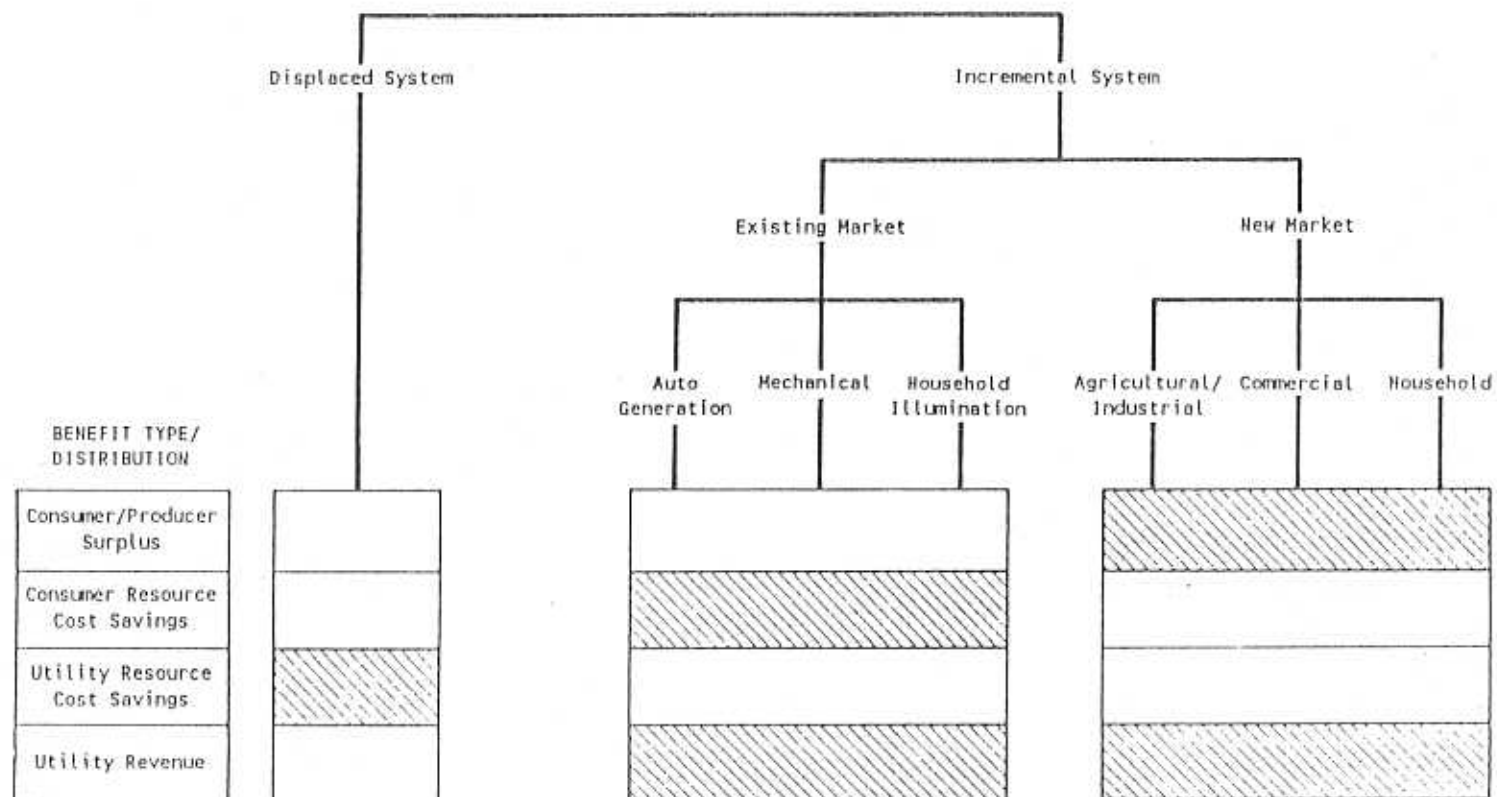
21. The example of the electricity generation project is useful to highlight the differences in the identification of project benefits between economic and financial analysis. Differences in the definition of project boundaries will necessarily follow. Benefits accruing to consumers and benefits accruing to a power utility are summed up in Figure 1 which identifies benefits by producer and consumer categories. The resource cost savings and willingness to pay concepts relevant for benefit accruing to the power utility, existing and new markets depend crucially on the use of the "with and without" principle and the concept of net output. The characteristics of the power sector will determine the net output of a proposed investment. The net output will consist of resource cost savings accruing to the power utility and additionality of electricity supply. The additionality of electrical energy supply will accrue to existing or new markets or both. The benefit in existing markets will consist of resource cost savings. In the new market it will consist of willingness to pay associated with induced demand. Thus, while resource cost savings are associated with the displaced system and the existing market, consumers' and producer's surplus are associated with the new market. Consumer's surplus accrues to final users like households. Producer's surplus accrues to intermediate input users of electricity like the agricultural, industrial and commercial sectors. In financial analysis only utility resource cost saving and utility revenue in Figure 1 will be included in project benefits. In addition to these, economic analysis will incorporate consumer/producer surplus and consumer resource cost savings in the identification of benefits. Since costs are defined as those required to make the benefit stream available, the costs in economic and financial analysis will differ accordingly. Consequently, with project boundary being defined by the project's benefits, project boundary in the present example will substantially differ in economic and financial analysis.

22. The first step in estimating economic costs is to correctly identify the relevant input to the project. The relevant input is related to the benefit accruing to the economy from the project. Costs of a project consist of its net input which is defined as the goods and services withdrawn from the rest of the economy that would not have been withdrawn in the absence of the project.^{2/} The following two possibilities are relevant. First, the use of various physical inputs for a project may result in a decline in the total availability of those inputs exactly equal to their consumption by the project. Here, net input of the project consists of actual physical inputs. Second, in response to input demand by the project, their supply may be correspondingly increased in the rest of the economy. Now net input consists of goods and services whose availability to the rest of the economy is reduced because they are used up in producing inputs for the project.

23. The main conclusion that emerges is that in every case, an attempt must be made to identify the goods and services that suffer a net decline in availability because of the project. For example, money payment made by a project operating entity for wages is by definition a financial cost. It will be an economic cost only to the extent that the

^{2/} UNIDO, *op.cit.*

Figure 1
PROJECT BENEFIT



use of labor in the project implies some sacrifice in the rest of the economy with respect to output. This issue will be taken up again in Section V.

24. The discussion in this section has highlighted the issue of project boundary which is likely to be significantly different between financial and economic analysis. In terms of an example, suppose a commodity goes through four stages: production, wholesale, retail and consumption. Consider an investment project for production of a commodity to be undertaken by a firm which confines itself to production activities only. In financial analysis, only costs and revenues (benefits) to project output will be relevant. In economic analysis, benefits to the consumer will represent economic benefits. Economic costs will include production, wholesale, retail and consumption costs. ^{B/}

IV. EXTERNALITIES

25. Sometimes the existence or operation of a project results in a net gain to the economy, but not a direct gain to those who acquire the project output. This gain will not be reflected in the willingness to pay for the output. These are called external economies or diseconomies. These occur when an economic activity influences "third parties" apart from the producer and consumer. The result of these externalities is that some production or consumption impacts will not be internalized in the financial price paid for a commodity. An example of an external economy is that of a project which lowers production costs for other producers owing to their ability to use a project by-product free of charge. Pollution caused by a project would be an example of an external diseconomy. While this constitutes a net loss to the economy, such an external diseconomy does not impact on direct users of the project and

^{B/} Compared to private or financial profitability of

$$\Pi^F = \sum_i p_i^t q_i^t - \left[\sum_j a_{ji} p_j^t + \sum_m a_{mi} p_m^t + \sum_r a_{ri} p_r^t \right] q_i^t \quad (1)$$

the counterpart in terms of economic profitability incorporating the issue of project boundary only (Π_E) is given by

$$\Pi_E = \sum_i WTP_i^t q_i^t - \left[\sum_j (a_{ji} + \lambda_{ji}) p_j^t + \sum_m (a_{mi} + \lambda_{mi}) p_m^t + \sum_r (a_{ri} + \lambda_{ri}) p_r^t \right] q_i^t \quad (4)$$

Where λ_{ji} , λ_{mi} , λ_{ri} represent the inputs per unit associated with changing project boundary to make the output available to the final consumer

$$\text{and } WTP_i^t \geq p_i^t$$

A comparison of equations (1) and (4) reveals the impact of differences in project boundaries on economic and financial profitability. It should be noted that in case net output consists of resource cost savings, instead of additional supply, this characteristic of project output would be captured by WTP_i .

therefore are not reflected as a reduction in the willingness to pay for the project's output.

26. The benefits and costs resulting from externalities in the project's operations frequently do not vary with both inputs and outputs of the project. Therefore, they cannot be accounted for by revaluing such inputs and outputs. Any such benefits and costs associated with externalities will have to be separately added or subtracted for every year of operation in which they occur. The identification, quantification and valuation of these costs and benefits associated with externalities raise complex issues. The problem of valuation is compounded by its relation to optimal government intervention which is made necessary by the existence of externalities.

27. While the case for incorporating external economies or diseconomies in the economic analysis is strong because of the need to account for all the effects of a project, it is very difficult to quantify many externalities.^{9/} For this reason, they are often ignored. This is one of the serious limitations of economic analysis.^{10/} While externalities could be viewed as influencing project boundary, they have been separately treated because of the special characteristics in terms of identification, quantification and valuation.

V. ECONOMIC PRICING

28. In addition to the identification of benefits, their valuation is important in measurement. A fundamental point of departure of economic from financial analysis is in the valuation of costs and benefits. While market prices are used in financial analysis, economic prices reflecting national opportunity costs are used in economic analysis. Market prices differ from economic prices owing to market failure which can be natural or artificial. Under certain conditions, free markets will automatically lead to the achievement of economic efficiency. When markets depart from these conditions in the absence of government intervention, natural market

^{9/} Cornes, R. and T. Sandler, The Theory of Externalities, Public Goods and Club Goods, Cambridge University Press, New York, 1986.

^{10/} At a conceptual level, external economies and diseconomies (X) could be incorporated in defining economic profitability in the following manner:

$$\Pi_{(B+X)}^{Ei} = \Pi_B^{Ei} + (\text{External Benefits} - \text{External Costs})^i \quad (5)$$

where Π_B^{Ei} is defined in equation (4). A comparison of equation (1) on financial profitability and (5) shows the impact of differences in project boundary between financial and economic analysis arising from differences in the perspective of the two types of analyses.

failure is said to exist.^{11/} Natural market failure can be caused by monopolistic elements, external economies, public goods and paradoxes and fallacies. For example, the "isolation paradox" where people may be agreeable to sign a contract which forces everyone to save more, though individually they may not agree to raise their own savings unilaterally given the savings of others is often cited as a case of natural market failure resulting in suboptimal savings.^{12/} The literature on cost-benefit analysis has been significantly influenced by this line of reasoning.^{13/} Natural market failure provides the rationale for two sets of roles of governments: (i) macroeconomic interventions designed to augment growth rates, stabilize prices and ensure external balance; and (ii) sector and market level interventions designed to correct for specific market failures. Artificial market failure is defined as (i) policy interventions which are designed to correct natural market failure but which are either inappropriate, insufficient or excessive; or (ii) policy interventions which disrupt an otherwise efficiently functioning market. In this paper, it is assumed that the economic or accounting prices that are used in the economic analysis of projects are designed to provide a partial correction for the distortions that are caused by artificial market failure.

29. While the existence of artificial market failure is used to provide the rationale for the use of economic pricing, the mechanics of its use depends on the adoption of a particular numeraire. If projects are to be judged in terms of their contribution to national economic efficiency, then the contributions must be measured by some common denominator, called a numeraire. Two kinds of numeraire have emerged as the most widely used: willingness to pay (WTP) (aggregate consumption) numeraire and the foreign exchange numeraire.^{14/}

30. The WTP numeraire values non-traded goods and services in terms of what society is willing to pay. It values traded goods and services in foreign exchange at border prices which are then converted into local currency to make them additive with the non-traded good values. In the WTP numeraire, the shadow exchange rate defined in terms of the willingness to pay for some basket of goods and services that incremental foreign exchange would enable to purchase, is a key parameter.

^{11/} Ward, W.A. and B.J. Deren, A Practitioner's Guide to Economic Analysis of Agricultural Projects, Economic Development Institute, World Bank (mimeo), 1988.

^{12/} Sen, A.K., On Optimizing the Rate of Saving, Economic Journal, September 1961,

^{13/} Little, I.M.D and J.A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, OECD, Paris 1968 and UNIDO Guidelines, op.cit.

^{14/} UNIDO, op.cit. and Little, I.M.D. and J. Mirrlees, Project Appraisal and Planning for Developing Countries, Basic Books, Inc., Publishers, New York, 1974.

31. The foreign exchange numeraire requires that non-traded goods be valued in terms of their indirect impact on foreign exchange. Traded goods are valued in terms of their direct effects on foreign exchange. Calculating the foreign exchange impacts of non-traded goods requires either tracing down the direct and indirect foreign exchange used in producing these goods, or it requires finding traded goods for which the non-traded goods are substitutes. Since all inputs and outputs of a project are ultimately converted into foreign exchange impacts, the relative value of the objective function will be unaffected by the exchange rate. Consequently, it is convenient to use the official exchange rate in the analysis when it is deemed desirable to convert between currencies.

32. Clearly, the foreign exchange numeraire is most appropriate in cases in which a majority of the project inputs and outputs are traded goods. Now the analyst will not have to convert non-traded goods into foreign exchange impacts. On the other hand, the WTP numeraire is most appropriate in cases involving largely non-traded goods. Then the issue of the correct calculation of the shadow exchange rate is not so critical to the analysis. Usually, both traded and non-traded goods and services will be involved in most projects. Therefore, a numeraire which is most appropriate will need to be selected. The major multilateral institutions have adopted the foreign exchange numeraire.^{15/}

33. Traded goods which are directly imported or exported or whose domestic sale (purchase) results in goods being exported (imported) by some firm or person are valued at cif/fob prices corrected for transport and distribution costs. For all non-traded goods, economic prices are derived by adjusting the market prices. Two broad adjustments can be identified. First, the impact of domestic distortions arising from market imperfections, government intervention and market failure is removed from the market price. Second, the impact of foreign trade distortions arising from government intervention like the imposition of tariffs and quotas is removed. This procedure for deriving the economic prices of non-traded goods ensures they are also expressed in border price equivalents to make them comparable with the traded goods. The derivation of economic prices from market prices is made through the use of conversion factors which can relate to either groups of commodities or specific commodities. Conversion factors are defined as the ratio of economic to market prices.

^{15/} The World Bank, Operational Manual Statement: Economic Analysis of Projects, No. 2.21, May 1980; Asian Development Bank, Guidelines for Economic Analysis of Projects, May 1983, August 1987.

34. The transition from market to economic pricing emerges by linking up the discussion on valuation using the foreign exchange numeraire with the financial or private profitability.^{16/} Some payments which appear in the cost stream of financial analysis do not appear in the cost stream of economic analysis. This happens because some payments like taxes and subsidies do not represent direct claims on a country's resource but merely reflect a transfer of control over resource allocation from one segment of the economy to another. Since these taxes and subsidies are transfer payments and do not constitute resource cost, they do not appear in the cost stream in economic analysis.

35. A comparison of the financial profitability and economic profitability adjusting for artificial market failure only is instructive to assess the impact of government introduced distortions. For example, an export promotion project could be financially profitable but

16/

Consider equation (6) which focuses attention on profit per unit of output Π_i^F at a point in time. A one-period analysis is used to highlight the differences in financial and economic profitability. The transition to a multi-period analysis is straightforward as will be shown in section VII.

$$\Pi_i^F = p_i^d - \sum_j a_{ji} p_j^d - \sum_m a_{mi} p_m^d - \sum_t a_{ti} p_t^d \quad (6)$$

Assume that project output is exported with a subsidy, a tariff is placed on imported inputs, a subsidy is given on domestically produced inputs and primary factor (wage) policy implies a tax on the use of primary factor (labor). These are reflected in the following:

$$p_i^d = (1 + S_i) p_i^w e \quad (7)$$

$$p_m^d = (1 + t_m) p_m^w e \quad (8)$$

$$p_j^d = (1 - S_j) MC_j \quad (9)$$

$$p_t^d = (1 + t_t) p_t \quad (10)$$

where S_i = export subsidy

p_i^w = world price of exports

e = official exchange rate

t_m = tariff on imported inputs

p_m^w = world price of imported inputs

S_j = subsidy on use of domestically produced intermediate inputs

MC_j = marginal cost of producing domestic intermediate inputs

t_t = tax on use of primary factors of production

p_t = opportunity cost of labor

The valuation of non-traded inputs will be done through the use of conversion factors β

$$\beta_j = \frac{MC_j}{p_j^d} = \frac{1}{1 - S_j} \quad (11)$$

$$\beta_t = \frac{p_t}{p_t^d} = \frac{1}{1 + t_t} \quad (12)$$

(Using the information contained in equations (6) to (12) and expressing all values in border equivalent prices will give economic profitability:

$$\Pi_{CF_i}^E = (p_i^w - \sum_m a_{mi} p_m^w) e - CF_i [\sum_j a_{ji} p_j^d \beta_j + \sum_t a_{ti} p_t^d \beta_t] \quad (13)$$

where $\Pi_{CF_i}^E$ provides the counterpart of private profitability expressed in border price equivalent to account for adjustments on existing policy distortions in the economy. CF_i defined as:

$$CF_i = \frac{p_i^w - \sum_m a_{mi} p_m^w}{p_i^w (1 + S_i) - \sum_m a_{mi} p_m^w (1 + t_m)} \quad (14)$$

is a project specific conversion factor applied to the non-traded goods to value them at border price equivalent and as can be seen from (14) is likely to be less than unity. An alternative expression for CF_i is:

$$\frac{1}{(1 + ERP_i)}$$

where ERP_i is the effective rate of protection for activity i .

economically not profitable because of the export subsidy and subsidies on the use of domestically produced intermediate inputs. A similar case could hold true for an import substituting project which is protected. An important result which emerges from this discussion is that when project boundary is confined to that of a firm or entity and profitability in terms of market and economic prices is compared, the impact of the policy environment facing a project can be assessed.

VI. FINANCIAL VERSUS ECONOMIC PROFITABILITY

36. The financial profitability of an investment project from the viewpoint of a firm is given by the difference between the value of earnings and the value of costs borne by it. Earnings are defined as the direct money earnings of the firm at market prices. Costs are taken as the direct money costs at market prices borne by the firm. The discussions in Sections III to V suggest that financial profitability is not a reasonable criterion by which public sector projects should be assessed for four major reasons. First, prices that obtain in the market are not necessarily the ones that should be used in economic analysis due to market failure. Second, a project may have influences that work outside the market rather than through it resulting in externalities. Third, market prices underestimate benefits in cases where consumers' surplus is significant. Fourth, project boundary in financial and economic profitability is likely to be different.

37. On account of all these reasons, a firm's receipts and expenditure are not an economy's benefits and costs. Thus financial and economic profits differ. While financial profits are an essential signalling mechanism in determining viability for the firm or entity, they may not be a good signalling mechanism for economic viability. The essence of economic analysis is that actual receipts may not equal economic benefits and actual expenditure may not equal economic costs. However, economic analysis presupposes that actual receipts and expenditures can be suitably adjusted so that the difference between them, which is analogous to financial profits, will properly reflect economic gain or loss. The paper has indicated different concepts of profits as reflected in differences in identification of costs and benefits and in their valuation.

38. At this stage it will be useful to compare financial with economic profitability which incorporates all four issues mentioned in para 36. Alternatively, the discussions in Sections III to V are integrated in one definition of economic profitability. The cases of

traded and non-traded goods outputs are considered separately.^{17/} Financial profitability contains three categories of items: value added in world prices, costs of non-traded items and transfer payments. All values are in domestic market prices. In contrast, economic profitability includes value added in world prices, economic costs of direct (project) and indirect items and the net of external benefits and costs all expressed in border price equivalent. Thus economic profitability incorporates adjustments for policy distortions, project boundary and externalities.

39. Clearly, financial and economic costs need not coincide. While the boundary in economic analysis is likely to be wider than in financial analysis due to indirect costs changing project boundary and external diseconomy adding to costs, the netting out of transfers and subsidies will act in the opposite direction. The use of opportunity cost captured by the conversion factor rather than market prices could either raise or lower economic price vis-a-vis market prices. Thus economic cost can be greater or lower than financial cost depending on the particular circumstance of a project. Similarly, economic benefits could also be greater or lower than financial benefits. In the case of an export subsidy, financial benefit will be greater than economic benefit.

40. Against this background, it would be instructive to consider the conditions under which definite conclusions can be drawn about the relationship between financial and economic profitability. Consider a case with no domestic distortions, no indirect costs and no externalities. Assume that foreign trade distortions make the conversion factor relevant for the project less than unity. Even in this highly simplified example, no conclusion can be drawn about the relationship between economic and financial profitability because the financial subsidy must be weighed against economic costs being lower than financial costs on account of the conversion factor being lower than unity.

^{17/} Taking up the example of an export good, equations (1), (7) and (8) give

$$\Pi_i^F = (p_i^w - \sum_m a_{mi} p_m^w) e - (\sum_j a_{ji} p_j^d + \sum_t a_{ti} p_t^d) + (Sp_i^w - \sum_m a_{mi} t_m p_m^w) \quad (15)$$

Where the third item in the right hand side represents net subsidy per unit of project output.

Using the information contained in equations (4), (5) and (13) we get

$$\begin{aligned} \Pi_i^E = & (p_i^w - \sum_m a_{mi} p_m^w) e - CF_i [\sum_j (a_{ji} + \lambda_{ji}) p_j^d \beta_j + \sum_t (a_{ti} + \lambda_{ti}) p_t^d \beta_t] \\ & + (\text{External Benefit} - \text{External Costs}) \end{aligned} \quad (16)$$

41. The case of a non-traded good output is considered next.^{18/} Normally, it is expected that willingness to pay would be greater than or equal to domestic price for the project output. As in the case of a traded good output, consider a situation with no domestic distortion, no indirect cost and no externalities. If the conversion factor is less than unity, no conclusions can be drawn about the relationship between economic and financial profitability about a non-traded goods output. The decrease in economic compared to financial cost resulting from adjustment by using the conversion factor could be outweighed by adjusting the willingness to pay in the economic analysis by using the conversion factor.

42. The integration of the description of financial and economic profitability leads to an apparent paradox. Since the projected financial analysis of a project is often made a starting point for identifying economic costs and benefits, it may be expected that financial and economic profitability will be related. However, as pointed out in the paper, two types of adjustment must be made to financial calculations to reflect economic concepts: (i) include (exclude) some costs and benefits which have been excluded from (included in) the financial analysis; and (ii) revalue some inputs and outputs if their shadow and market prices differ. In the process, project expenditures may differ from economic costs and benefits will not equal project receipts making economic analysis necessary. Thus, despite using financial analysis as the starting point for economic analysis, it is extremely difficult to draw any conclusions about the relationship between financial and economic profitability except under extremely simplified conditions when the need for economic analysis is not compelling.

43. An assumption underlying the paper so far is that benefits and costs can be identified, quantified and valued in the with and without project situations in both the financial and economic analysis. For all traded and some non-traded goods sectors, with the possible exception of externalities, this assumption is generally valid. An important result of this section is that when economic analysis becomes essential on account of considerations of definition of project boundary, willingness to pay, externalities and price distortions, no clear cut relationship can

^{18/} The counterpart of equation (16) is

$$\Pi_i^E = CF_i WTP_i - \sum_m a_{mi} p_m^w e - CF_i \left[\sum_j (a_{ji} + \lambda_{ji}) p_j^d \beta_j + \sum_t (a_{ti} + \lambda_{ti}) p_t^d \beta_t \right] + (\text{External Benefits} - \text{External Costs}) \quad (17)$$

Where CF_i is the conversion factor applied to all non-traded goods and

$WTP_i \geq \text{Min} [\text{Marginal Utility (productivity) of } i, \text{ financial cost of alternative source of supply}]$

Financial profitability in this case will be given by

$$\Pi_i^F = p_i^d - \sum_m a_{mi} p_m^w e - \left(\sum_j a_{ji} p_j^d + \sum_t a_{ti} p_t^d \right) - \sum_m a_{mi} t_m p_m^w \quad (18)$$

be established between economic and financial profitability even when all costs and benefits can be identified, quantified and valued.

44. In many social sector projects it is extremely difficult to identify, quantify and value benefits. In addition, there could be significant externalities and indirect costs, willingness to pay considerations could be important and pricing of project output could be difficult. While these circumstances make economic analysis essential, undertaking it in a meaningful manner may prove to be impractical. The framework developed in this paper for making a transition from financial to economic analysis in a stage wise manner incorporating one issue at a time, could be useful to assess the nature of economic analysis attempted by a project analyst. If financial analysis is possible and conversion factors are available, limited economic analysis adjusting for price distortions only, can be attempted to assess the impact of policy introduced distortions. The neglect of the difference in project boundary between financial and economic analysis, willingness to pay considerations, and externalities could well imply that the limited economic analysis is not meaningful. Further, as has already been shown, the estimation of financial profitability cannot be used to make any statement on economic profitability. In these cases involving social sectors, the analysis may have to be limited to financial profitability.

VII. FINANCIAL AND ECONOMIC INTERNAL RATES OF RETURN: MEASURES OF PROJECT VIABILITY

45. On grounds of analytical convenience, a static one period approach has been adopted through most of the paper to highlight the differences in financial and economic profitability. The generalization to a static multi-period framework is straightforward with profitability being estimated in terms of net discounted present value.^{19/} The internal rate of return is defined as the discount rate that would make the net present value of a stream of costs and benefits equal to zero.

$$\Pi^F = \sum_{t=0}^T \frac{\Pi^{Ft}}{(1 + i_F)^t} \quad (19)$$

$$\Pi^E = \sum_{t=0}^T \frac{\Pi^{Et}}{(1 + i_E)^t} \quad (20)$$

The above equations refer to total financial and total economic profitability, respectively. Π^E incorporates adjustments for existing policy distortions, changing project boundary and externalities.

Alternatively, it is the maximum interest rate that would be paid from the stream of net returns and still make the investment break even.^{20/}

46. Since the EIRR is defined in terms of real resource flows, the FIRR counterpart must also refer to all resources or the FIRR "before financing". This was the rationale for excluding borrowing and lending and interest on dividend payments from the concept of cash flow in assessing financial profitability of new investment in Section II. Thus the concept of FIRR used in this paper summarizes profitability of a firm from the standpoint of loan and equity participants. The EIRR analyzes real resource flows and thus summarizes the effect on everybody in the economy. Since the emphasis in both FIRR and EIRR estimates is on resource flows, all values are expressed in constant prices. Relative price changes will be incorporated but not changes in price levels. In this manner changes in opportunity cost of outputs and inputs will be explicitly incorporated thereby indicating real resource flows. Thus, the cut-off discount rates will also have to be in real terms. The financial (i_f) and economic (i_e) cost of capital are likely to differ with the former being defined in terms of real cost of capital to a firm while the latter is defined in terms of the opportunity cost of capital to the economy.

47. While the EIRR represents the return to the economy as a whole, the FIRR to all resources indicates the returns to loan and equity participants. The question that comes up is whether a comparison between the FIRR and EIRR is valid. To answer this question, it would be useful to recapitulate the discussion in Section VI. It is expressed simply as

$$\Pi^{Et} = \beta_f \Pi^{ft} + \beta_B \Pi^{Bt} + \beta_x \Pi^{xt} \quad 21/$$

where Π^{Et} = economic profitability in time t

Π^{ft} = financial profitability in time t

Π^{Bt} = profitability associated with benefits and consumers of end users at market prices time t

Π^{xt} = profitability associated with externalities expressed in market prices

β = conversion factors

It should be noted that for non-traded goods, Π^{Bt} will include consumers' surplus as benefits. This equation indicates that owing to differences

^{20/} Corresponding to (19) and (20) there exists a financial internal rate of return (FIRR) and an economic internal rate of return (EIRR):

$$\begin{array}{llll} \Pi^f \geq 0 & \text{implies} & \text{FIRR} \geq & i_f \\ \text{and } \Pi^e \geq 0 & \text{implies} & \text{EIRR} \geq & i_e \end{array}$$

^{21/} The β_i represent row vectors while the Π_i represent column vectors. Thus the conversion factors are applied to each individual input and output.

in project boundary, valuation of benefits, externalities and pricing, it would be extremely difficult to draw any conclusions about the relationship between FIRR and EIRR.

48. A comparison, however, is often made implicitly between FIRR and the 'EIRR' associated with $\beta_f \Pi^f$. Since β_f is closely related to the extent of policy introduced distortions, judgments are made about net transfer payments that are implied by the prices for the projects inputs and outputs through comparison of FIRR and 'EIRR'. Consider an example where $i_f = 8\%$, $i_e = 12\%$, FIRR = 20% and 'EIRR' = 10%. In this case, the project transfers income from other parts of the economy to the investors who profit from the project since the FIRR is greater than i_f . However, the economy is worse off with the project because the 'EIRR' is lower than i_e . The important result that emerges is that conclusions can be drawn about net transfer payments only when a comparison is made between FIRR and 'EIRR' associated with $\beta_f \Pi^f$ which is simply financial profitability adjusted by conversion factors associated with policy introduced distortions.

49. Extending the analysis, consider an example where an 'EIRR' is estimated based on the components $\beta_f \Pi^f$ and $\beta_g \Pi^g$. Suppose it is 14 per cent. What this means is that the consumers' surplus netted out for distribution and consumer's expenditures raises the EIRR from 10 to 14 per cent. The willingness to pay for additional output from the project becomes an important factor in determining the 'EIRR' and can be a useful input in determining the pricing rules of a public utility.

50. Assuming that externalities can be identified, quantified and valued, an EIRR associated with $\beta_f \Pi^f$, $\beta_g \Pi^g$ and $\beta_x \Pi^x$ is estimated. This is the 'true' EIRR of the project. Suppose it is 6 per cent. The project is economically not viable because of the external diseconomies associated with it. It is obvious that in this case the FIRR and EIRR cannot be compared to draw any conclusions about net transfer of resources.

51. In some social sectors, markets for the outputs of projects do not exist. Public utilities design pricing rules on the basis of various criteria, e.g. full cost pricing including capital cost. As already pointed out earlier, the FIRR, by definition, will be equal to or greater than the real cost of capital to the public utility or $\text{FIRR} \geq i_f$. It is important to note that even if an 'EIRR' is estimated based on financial profitability adjusted for price distortions, the fact that $\text{FIRR} = i_f$ cannot be used to assess whether the 'EIRR' is equal to the cut-off discount rate, i_e , on two counts. First, it is not possible to assess how adjustment to financial profitability by conversion factors will affect economic profitability. Adjustments on costs and benefits could work in opposite directions in influencing economic profitability. Second, i_e may be greater than i_f . Thus, financial viability cannot be used apriori to assess economic viability even in the limited case under consideration.

52. When the non-existence of markets is combined with difficulties in quantifying and valuing benefits, the analyst is confronted with a major problem. The FIRR estimate, in this case, is more a reflection of public utility pricing rules rather than an indicator of profitability. Difficulties in quantifying and valuing benefits may make it impractical

to estimate the EIRR. However, even in these cases, an attempt at establishing financial and economic viability should be made. Revisions of pricing rules related to cost recovery should lead to improvements in financial viability. If these are not possible, financial viability of the project may need to be ensured through subsidy injections whose long-run feasibility would need to be assessed.

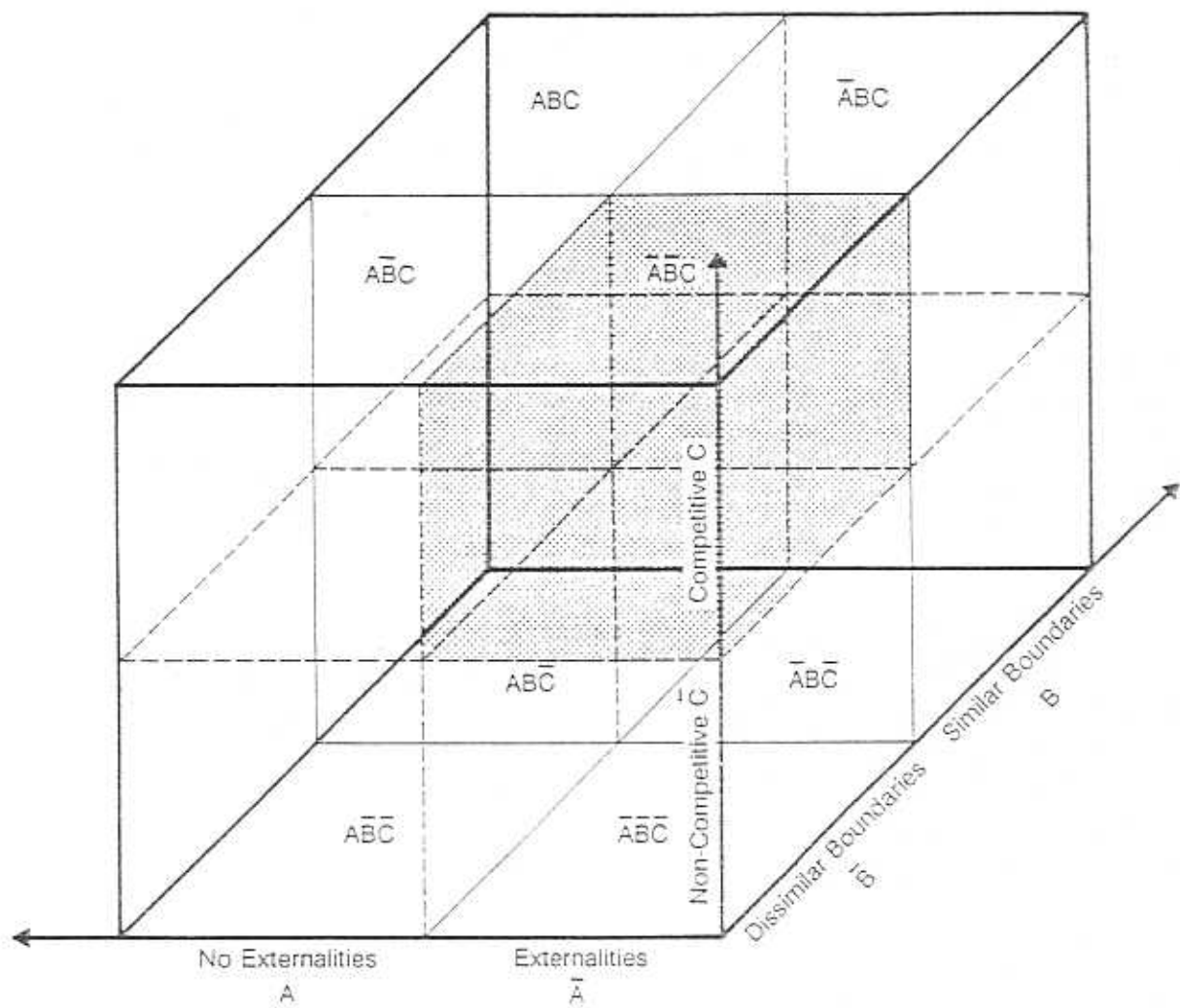
VIII. CONCLUSION

53. Individually, financial and economic profitability constitute necessary conditions for project viability. Together, they constitute the necessary and sufficient conditions for project viability. The paper indicates the points of departure of economic from financial profitability: project boundary, valuation of benefits, externalities and pricing. It does so by indicating that the projected financial statements of a project will often be a good starting point for identifying economic costs and benefits. Two types of adjustments must be made to financial calculations to reflect economic concepts: (i) include (exclude) some costs and benefits which have been excluded from (included in) the financial analysis; and (ii) revalue some inputs and outputs if their shadow and market prices differ.

54. The distinction between financial and economic profitability can be seen in Figure 2. The perpendicular axis in the matrix measures competitiveness. The further away from the origin the degree of competitiveness increases. In a competitive situation, financial or market and economic prices converge. The two horizontal axes measure (i) externalities and (ii) project boundaries. The degree of externalities decreases as one moves away from the origin. Similarly, differences in project boundaries between economic and financial analysis decrease as one moves away from the origin. C stands for competitive and \bar{C} non-competitive markets. B denotes similar and \bar{B} dissimilar project boundaries. A stands for no externalities and \bar{A} for externalities. The three axes bound the plane of financial-economic categorization. Consider four quadrants in the set of competitive market structure and four in the set of non-competitive market structure. The set with competitive market structure consists of ABC, $\bar{A}BC$, $A\bar{B}C$ and $\bar{A}\bar{B}C$. Financial and economic profitability will be identical only in ABC. The interesting result is that even when markets are competitive or no shadow pricing is required, the existence of externalities and/or differences in project boundaries will lead to dichotomies between economic and financial profitability. The second set consists of non-competitive markets and includes $AB\bar{C}$, $\bar{A}B\bar{C}$, $A\bar{B}\bar{C}$ and $\bar{A}\bar{B}\bar{C}$. Only in the case of $AB\bar{C}$ can the difference between financial and economic profitability be attributed to policy distortions only. The case of $\bar{A}\bar{B}\bar{C}$ is the most complex where the difference between economic and financial profitability will be highly significant and where it will be difficult to use financial profitability as a starting point for estimating economic profitability. It is likely to be applicable in some social sectors. Figure 2 summarizes the causes for likely differences in economic and financial profitability.

Figure 2

THREE-DIMENSIONAL MATRIX
FOR DISTINGUISHING ECONOMIC FROM FINANCIAL PROFITABILITY



55. While the existence of natural market failure provided the initial impetus to the evolution of the literature on cost-benefit or economic analysis, in the 1970s, the focus of attention changed to distortions which were policy introduced. This led to the advocacy for the use of shadow or accounting prices designed to provide partial corrections for distortions caused by market failure in the economic analysis of projects. Emphasis on this set of issues led to a preoccupation with shadow pricing in the 1980s. Combined with the fact that financial analysis is often the starting point for economic analysis, the emphasis on shadow pricing led some to believe that the FIRR and EIRR are closely related.

56. The main contribution of this paper is to develop an integrated economic framework which is sufficiently general to encompass the characteristics of various sectors of an economy. Differences in project boundary, externalities and policy distortions together provide the *raison-d'être* for economic analysis. Once this is recognized, the transition from financial to economic analysis is clear cut. With major policy reforms underway in many developing countries, the pricing issue in economic analysis is likely to decrease in importance. However, with the renewed emphasis on infrastructure projects to ensure growth with equity in the coming decade, issues related to project boundary and externalities are likely to resurface in importance in the economic analysis of public sector investment projects.

57. While the main relevance of the paper is for sectors for which both financial and economic viability need to be demonstrated in public investment decision making, the static one-period analysis can be easily adapted to examine issues in sectors like agriculture where farm budgets are used to indicate attractiveness to beneficiaries. Differences in financial and economic profitability can not only be determined but the reasons for them can also be assessed. In that sense, the framework of analysis developed in this paper can be used in a variety of situations where public investment decision making is required.

58. Some important conclusions can be drawn from this paper. First, only in cases where there are no externalities, project boundaries are similar between financial and economic analysis and competitive internal markets exist can FIRR be used as a proxy for EIRR. These are precisely the cases where there is no compelling reason for economic analysis. Second, when issues of project boundary and externalities become important, public intervention is likely. Consequently, the weight of project boundary and externalities in determining the EIRR becomes critical. Low FIRRs and high EIRRs are likely in projects with significant externalities. However, a comparison of FIRR and 'EIRR' based on financial profitability adjusted for price distortions and differences in project boundary may, in this case, provide some clues of relating financial price to willingness to pay. Third, in cases where issues of project boundary and externalities are known to be important but quantification and valuation of all benefits and costs are not possible, the project analyst will have little option but to estimate an FIRR and indicate qualitatively that net benefits associated with differences in project boundary and externalities are likely to be positive. Fourth, the statement that whenever an FIRR can be calculated an EIRR can also be

calculated is in general not correct. Even if an 'EIRR' associated with financial profitability adjusted for policy introduced distortions can be estimated, it may be meaningless as a proxy for economic viability if issues linked to project boundary and externalities are important. Fifth, the statement that the FIRR is a lower bound estimate for EIRR has no basis. Sixth, FIRR should not be used as a proxy for assessing economic viability even when full cost recovery including capital cost has been used to establish the pricing principle for the public utility undertaking the investment project under consideration.