The Economic Evaluation of Projects

Papers from a Curriculum Development Workshop

Edited by
David G. Davies
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The World Bank
Washington, D. C.
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Foreword

The chapters in this volume were first commissioned as papers for a curriculum development workshop on Economic Analysis of Projects organized by the Economic Development Institute of the World Bank. They are now being published for a wider distribution to World Bank staff and to others who are interested in updating the teaching and practice of economic analysis.

The quality of project evaluation is a matter of ongoing concern within the World Bank. Although the EDI and the World Bank operating departments have made pioneering efforts to refine project evaluation methodologies and to make them more practical and useful tools, recent studies of Bank project appraisals have shown that there remains considerable room for improvement.

The Bank has addressed this challenge by providing stronger incentives for sound economic analysis through management and review processes, better guidelines and instructions, and systematic staff training. Although EDI’s primary focus is on the dissemination of policy lessons, the Institute continues to support learning activities in project analysis and management in collaboration with partner training institutes in the developing world.

This book presents a simplified approach to project evaluation which the Bank is adopting, including how project evaluation should be modified to take into account current economic situations in most countries. The volume highlights issues that arise in applying this methodology and how to resolve them. The two chapters that discuss approaches to teaching economic analysis will be of interest to educators and trainers.

Vinod Thomas, Director
Economic Development Institute
Renewing Efforts in Project Evaluation: Workshop Summary

David G. Davies

The papers in this volume were contributions to EDI's Curriculum Development Workshop on the Economic Analysis of Projects, held in Washington, D.C. on October 8–9, 1992. The substance of the papers and the workshop's proceedings and conclusions have helped EDI in its curriculum development and publications efforts. They should be of considerable interest to practicing project economists, and are therefore being put into this form for wider distribution.

The workshop was prompted by a need to respond to a demand from World Bank staff and new member countries for training in project analysis. The workshop's objectives were to re-examine the content of the curriculum and to review the state of the art of teaching courses. Important considerations were (a) that EDI teaching and Bank practice be consistent and contribute to the establishment of standard practices and terminology that people who make investment decisions in member countries can understand easily, and (b) that EDI re-establish its leadership position in devising effective and efficient pedagogical designs for teaching the subject to professionals.

To achieve these objectives, EDI commissioned four papers by Arnold Harberger (Project Evaluation for the Next Decade and Notes on Some Issues in Social Project Evaluation), Glenn Jenkins (The Appraisal of Investment Projects: A Training Approach), and William Ward (The Role of EDI in Project Training for Developing-Country Managers). Because the two papers by Harberger were written as follow-up and companion pieces to a previous paper by the same author, the earlier paper, Reflections on Social Project Evaluation (Harberger 1985), is reprinted here. The workshop opening remarks by Robert Picciotto, director general of the Bank's Operations Evaluation Department, and the written comments on the workshop by Henry Bruton of Williams College were valuable products of the workshop, and are therefore included in this set of papers.

The papers and opening remarks provided a substantial basis for the workshop's discussions and were further enriched by contributions by, among others, John Besant-Jones, Henry Bruton, George Psacharopoulos, Joanne Salop, and Lyn Squire. While there was considerable debate, which is summarized below, a consensus emerged with respect to the substance of practical project evaluation. These conclusions are as follows:
The use of economic surplus as the sole measure in formal project evaluation means that a great burden is placed on separate analyses of the social and macroeconomic contexts of the project. Some implications are that

- Projects should be identified, evaluated, and considered only if they can be shown to contribute to a strategic plan or strategic vision. This substantially reduces the amount of resources required for evaluation and links the project to its larger macroeconomic setting.

- Part of a strategic plan or vision involves establishing incentive systems that will govern the kinds of projects that the private sector will invest in. These incentive systems will include fiscal incentives as well as incentives resulting from infrastructure investments and regulatory changes. Decisions are required about how the project will take these matters into account.

- As investment projects are invariably complemented by organizational changes, institutional development, and other activities, assurance is needed that these complementary activities take place and are appropriately timed.

- The recurrent costs to the government of the project should be evaluated independently in the context of budgetary management and planning.

Project evaluation should be simple and understandable. This should be accomplished by the following:

- Making growth (or preferably economic surplus) the sole measure used to evaluate projects. Projects whose objectives are, for example, to increase equity or employment, to reduce poverty, or to improve the environment are thus evaluated against their contributions or costs in terms of growth (or surplus).

- Using domestic prices at the domestic price level as the numeraire.

- Building the economic evaluation directly from the project's financial analysis, where possible.

Changes in the relative prices of factors of production and final products require much more attention in project evaluation than they are normally accorded. Price projections to get at changes in relative prices require at least as much, if not more, attention than the estimation of conversion factors or shadow prices.

Computer technologies have rendered formal risk analysis accessible to all. Monte Carlo simulations should be an important part of project evaluation, especially in connection with price projections. In many cases, point estimates of variables can now be replaced by probability distributions and we can state the probabilities of accepting a bad project or of rejecting a good one.

The Papers

The main points or arguments made in each of the papers are summarized in the following paragraphs.
Robert Picciotto, *Evaluation and the New Development Agenda*

Picciotto's opening remarks essentially respond to the papers written by Harberger and Jenkins. He was concerned with the narrowness of the analysis being proposed. While Picciotto agreed that all project economists should be skilled in economic analytical techniques as discussed in the Harberger papers, he believes they should also be well trained in the use of other analytical and conceptual tools needed to deal with the major elements in what Picciotto calls the "New Development Agenda." This agenda requires that individual projects be examined in the context of overall country and sector policies and as part of the array of investment projects under consideration. In effect, this means that all project operations should be assessed in terms of their policy content, social impact, environmental consequences, effect on public finances, and institutional soundness.

Arnold Harberger, *Reflections on Social Project Evaluation*

This is a reprint of an article previously published in the World Bank's *Pioneers in Development* series. In this article Harberger summarizes his basic approach to project evaluation. The main feature of this approach is its strict and austere adherence to the three basic postulates of applied welfare economics: (1) Competitive demand price measures the benefit of each marginal unit to the demander; (2) competitive supply price measures the opportunity cost of each marginal unit from the standpoint of the suppliers (factors of production); and (3) the difference between benefits and costs is a measure of the benefits or costs to society as a whole. Harberger specifically rejects the use of distributional weights in the analysis, which is advocated in a substantial part of the literature, largely because weights do not represent the way citizens feel about redistributional efforts channeled through the public sector and their use effectively negates postulate (3). He advocates, instead, the measurement of "basic needs externalities."

Arnold Harberger, *Project Evaluation for the Next Decade*

This paper reviews the conditions that prevailed during the 1960s that contributed to the flowering of project evaluation methodologies. These conditions included the introduction of greatly distorted prices as governments used quotas, and administered prices, licenses, and tariffs to channel or guide the future development of their countries. Hence the preoccupation of project evaluation with correcting financial prices to their "true" economic or shadow prices. Harberger then makes the point that projections of the market real exchange rate over the life of a project are at least as important as estimates of the current distortions in market prices.

The article provides a rather detailed, useful outline of the steps and processes of project evaluation. This is followed by a set of basic exercises on project timing, dealing with successor projects, comparing projects with different lives, problems of scale, when to replace old assets with new ones, separable components, and dealing with risk.
Arnold Harberger, *Notes on Some Issues in Social Project Evaluation*

This paper is explicitly intended to review and extend the discussions in both of the previous papers. He covers risk neutrality, portfolio risk and covariance, discount rates and the shadow price of funds, and projections of changes in relative prices. The latter topic is of particular interest given the author’s admonition in his previous paper to pay attention to prospective changes in relative prices over the lives of projects.

William Ward, *The Role of EDI in Project Training for Developing-Country Managers*

The author, who has extensive experience working with EDI and the Bank in general, specifically addresses the question of what EDI should now be doing in project evaluation. He raises a number of issues that need to be addressed in answering this question, namely: (a) EDI tends to offer single, generic courses that are not suitable for all the various roles that course participants play; (b) EDI is not sufficiently concerned with the organization and procedures of systems that might use project evaluation; (c) EDI has neglected the technical analysis of projects in favor of financial and economic analyses; (d) EDI pays insufficient attention to important market failures as opposed to government failures; (e) EDI has not integrated project analysis with policy analysis sufficiently. For example, an objective of project evaluation is to compensate for price distortions while an important objective of policy analysis is to eliminate them in the first instance; (f) EDI has yet to integrate new thinking on the role of government into project evaluation practice; (g) current Bank practice does not provide a model for training in project evaluation; and (h) many of the generic training materials EDI has developed will not satisfy specific national needs, with the implication that EDI might consider training case writers.

Glenn P. Jenkins, *The Appraisal of Investment Projects: A Training Approach*

Jenkins’s paper describes the course offered at Harvard University on project evaluation in some detail. Specifically, the course subscribes to the methodology of project evaluation prescribed by Harberger. The author provides a general discussion of the relationship between financial and economic appraisal and the rationale for his choice of numeraire (domestic prices and domestic price levels). He then goes on to describe an intensive eight-week course in project evaluation intended to produce professionals who can actually do the job. The course is characterized by a heavy use of staff, computers, and computerized case studies. The economics of project evaluation is closely integrated with practical case work. An important feature of the course is the considerable amount of time spent on risk analysis using Monte Carlo simulations.

Henry Bruton, *On Training in Project Evaluation*

Bruton’s paper is a commentary on the proceedings of the workshop. His comments are discussed in the following section.
The Workshop’s Discussions

Picciotto’s remarks, which advocated training project economists in a broad range of areas consistent with the considerations of the “New Development Agenda,” inspired the most important debate of the workshop. While Harberger and Jenkins accepted the importance of the considerations presented by Picciotto, they argued that keeping the basics of project analysis as simple as possible and not burdening it with a need to incorporate objectives other than output into the analysis was extremely important. They believed that project analysts should learn to do these basic techniques well and be able to communicate results effectively to those who make investment decisions. The techniques of project economic analysis, they continued, were not a normal part of the tool bag of economists and could be acquired only with special training. In any case, the economic analysis of projects is a specialty that engineers and accountants could learn as well as economists. Moreover, Harberger and Jenkins argued, given the need for a large number of trained project analysts, one could not expect all of them to have the broad knowledge and skills needed to make final decisions on projects. Both Harberger and Jenkins regard project evaluators as resembling accountants, who systematically go about estimating economic surpluses or losses on projects unadulterated by other considerations.

Thus, one side of the debate argued for broad training based on the wide scope of knowledge and analytical skills needed to make investment decisions, while the other argued for giving top priority to the mastery of narrowly defined techniques of project analysis to assure that this was done extremely well. Essentially, Harberger and Jenkins fear that a broad curriculum would be at the expense of project analysis.

Implicitly, Harberger and Jenkins assume that there has to be a division of labor. Project analysts do a narrow technical job and provide their results to others who have different skills that they bring to bear on final decisionmaking. Perhaps based on experience, Bruton, Picciotto, and Squire, by contrast, fear that narrowly trained project analysts would not perform well and recommend a broader curriculum. They do not envisage that the division of labor implied in the Harberger and Jenkins model can actually be realized.

Bruton’s paper, On Training in Project Evaluation, summarizes the views that he expressed at the workshop and assesses the workshop proceedings. It also tries to find a middle ground in the debate about the scope of the curriculum. According to Bruton, the differences expressed in the debate ultimately reflect differences about the sources of economic growth and development, which is why he believes that agreement is so difficult. The narrower curriculum implicitly accepts the notions prevalent in the 1960s that growth is attributable to capital accumulation, but that attempts at rapid accumulation lead to distortions in factor prices and the exchange rate. In the belief that these distortions lowered the level of investment and affected its allocation, the old school specifically designed the techniques of project analysis to help project decisionmaking by estimating the social opportunity costs of productive factors (their shadow prices), and thereby eliminate the effects that distortions might otherwise have had on decisions.

The broader view, as expressed by Bruton, is that capital formation is not the basic source of productivity growth and that a wide range of other matters should be taken into account when making decisions about investments in projects. According to Bruton, the concept of a project is actually rather ambiguous when all that is important (as discussed by Picciotto) is taken into account. Moreover, he believes that the techniques of project
analysis are not reliable, for example, while they require projecting the values of all components in a project, their record is dismal.

Besant-Jones presented data bearing on this matter. He compared Bank projections of a number of key prices with the actual prices recorded. The differences were substantial and, what is more, seemed to be inevitable. The main lesson is that even without taking a wider range of considerations into account, there will be room for considerable disagreement on the acceptability of a project.

Squire, who at the time of the workshop was the chief economist in the Bank's Europe, Middle East, and North Africa regional office, remarked that in his region, projects were considered for financing only after Bank staff had shown how they would help the country achieve its macroeconomic and sector policy objectives and how they would take into account the matters discussed by Bruton, Picciotto, and Ward. Squire pointed out, however, that the Bank's current organization did not assure that procedures were uniform and common standards were applied with respect to project analysis. Salop confirmed Squire's view.

Even given these problems, Bruton nevertheless regards the narrow view of project analysis proposed by Harberger and Jenkins as a critical development tool, and views the project as the heart of the development process. However, he would begin any course with a module that puts project evaluation in the context of the country's development and its major problems. He would then put students through a Harberger/Jenkins type of project analysis. They would estimate net present values "neat," without taking equity, poverty alleviation, and other external economies and diseconomies into account. They would perform sensitivity analyses with respect to the critical variables. A decision to accept or reject the project would be based on the "neat" calculation and the sensitivity analysis.

The next step would be to consider the project in the context of the initial module, which was concerned with the country's overall economy and problems and the government's policies. An answer would be sought to the questions of how the project fits the economy and society at the present time, what institutions are relevant to the project, and what the general macroeconomic effects of the project are. A decision should then be made on the project's acceptability.

Workshop Consensus

The workshop participants unanimously agreed on the appropriate techniques for the economic evaluation of projects as spelled out in the three papers by Harberger. The methodology is particularly valuable not only because of its clarity and meaning, but because it provides results in terms that decisionmakers, many of whom are not economists, can understand, and because students can master it relatively easily. The participants also agreed that the economic conditions that project analysts should focus on in the 1990s relate to the movement of relative prices of productive factors and commodities. Errors in price projections are far more likely than distortions to result in mistakes about projects. (The observations by Besant-Jones and Bruton should be noted in this context.)

A number of valuable points that have direct relevance to what should be taught emerged in the discussion of Harberger's papers. One of these was that the financial analysis of a project should be given primacy where appropriate. Perhaps the most
Renewing Efforts in Project Evaluation

important points, however, were made in Bruton's paper relating to the need to evaluate projects in their macroeconomic contexts. Bruton's proposed curriculum seemed to represent a satisfactory compromise between the opposing arguments on the breadth of the curriculum. The papers and arguments by Picciotto and Ward support Bruton's curriculum, and are themselves upheld by Squire.

In terms of pedagogy, the participants generally agreed on the following additional points with respect to teaching the narrower aspects of project evaluation:

- The center of learning should be the computer laboratory, not the lecture hall.
- Students should be taught to use a computer in the context of using a spreadsheet, preferably LOTUS 1-2-3 because of its widespread use.
- Students should learn to use Monte Carlo simulation software for risk analysis instead of RiskMaster 2.0 as used at Harvard.
- Some form of recognition for successful completion of the course is useful, if not necessary, for the success of the teaching program.

A Brief History of Project Evaluation in the Bank and EDI

During the late 1960s and early 1970s, under the presidency of Robert McNamara, the World Bank became the pre-eminent international institution for financing development projects. At the same time, and to support the Bank, EDI became a virtual trade school for project evaluation. Within its own ranks, the Bank required the use of project evaluation methodologies through the formal technical specifications that it placed on project appraisal operations and published in its Operations Manual. Its personnel policies gave priority to hiring economists with a specialization in microeconomics. To establish the methodology as a basis for investment decisionmaking among the Bank's member countries, EDI trained large numbers of government officials in project evaluation. In addition to improving overall investment decisionmaking by the governments of member countries, the Bank expected that EDI's training efforts would result in improved communications and cooperation among government project planners and Bank staff responsible for project operations.

Project evaluation has been promoted in the Bank and EDI because it requires the systematic collection of relevant data and information on possible investments. It helps governments to avoid wasting resources at the microeconomic level and to distinguish between projects that are clearly beneficial from a social perspective and those whose benefits are doubtful. It was also expected to improve communications between a government's central planners and sectoral or project planners on the one hand, and between governments and international financial institutions on the other hand.

A number of publications reflect the contributions of Bank and EDI staff and consultants to the development of project evaluation methodologies and to training.¹ Most

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¹ Much of the literature in the Bank and elsewhere at this time was prompted by reasoning that today seems simplistic: doubt was cast on the practical effectiveness of the predominant development paradigm that made a country's rate of growth dependent on its savings and investment rates. If countries could not save and invest sufficiently from their own resources, they might borrow the savings of other countries and invest them to enhance their own rates of growth, including their savings rates. This reasoning saw investment projects as the major source of growth, and international lending and aid institutions, such as the World Bank, as the major sources of other countries' savings. Naturally, planning was required to assure that aid did not
noteworthy are the works of Tinbergen and Harberger, who both taught EDI courses. Tinbergen was a resident teacher in EDI when he wrote the *Design of Development* (Tinbergen 1958). For three decades, Harberger has continuously served as an EDI teacher and writer and Bank consultant. His most important written contributions include an essay on applied welfare economics (Harberger 1971) and a discussion of project evaluation (Harberger 1972). Bank staff members Squire and van der Tak (1975) advanced the methodology of project evaluation by showing how income distributional weights could be taken into account. Gittinger (1982) wrote his classic and extensively used textbook, *Economic Analysis of Agricultural Projects*, and Helmers (1979) authored *Project Planning and Income Distribution* while they were EDI staff members.

However, the Bank and EDI did not sustain the burst of intellectual and training efforts on project evaluation in the late 1960s and early 1970s. From the mid-1970s onward, while remaining primarily a project lending institution, the Bank became preoccupied with refitting itself intellectually and operationally to deal with problems of macroeconomic and sector management. To effect these changes, both the Bank and EDI underwent major reorganizations during the mid-1980s. The Bank retired a large number of technical project staff and increased the number of macroeconomists. In the process, it lost some of its substantial capabilities in project operations. EDI was reorganized and restaffed to handle economic policy and management problems, and after 1984 project evaluation courses had a low priority and were seldom offered. It was assumed that other institutions would pick up EDI's training efforts.

By the early 1990s, the Bank began to suspect that its project operations required renewed attention. This led to two studies, one (World Bank 1991) on the quality of the economic analysis used to justify projects (the Joanne Salop Report) and the other (World Bank 1992) on the overall quality of the Bank's project operations (the Wapenhans Report). The former was prompted by evaluations of Bank operations by its own Operations Evaluation Department, which found that assumptions justifying projects tended to be overoptimistic, and by criticism of project evaluation in the Bank by Little and Mirrlees (1990), who found that actual project evaluation departs from the theoretical ideal. This study found that:

- There is an enormous gap between the existing guidelines and current practice;
- The economic evaluation of projects in the Bank tends to be overoptimistic and to neglect downside risks—a tendency it shares with the Bank's macroeconomic forecasts;
- Project economic issues have been pigeonholed into a very narrow concern with the calculation of economic rates of return, as opposed to a more fundamental concern with the economics of project design and strategy and their consistency with the broad macroeconomic and sectoral strategy.

enable governments to invest in projects that wasted resources. This model, known as the Harrod/Domar model, was central to economists' thinking at the time. The much richer and more influential dual economy model of Lewis (1954) and others implies a Harrod/Domar model. The capital-output ratio that emerges from this model figured prominently in the formulation of development plans. A reduction in the ratio was an objective of cost-benefit analysis and project evaluation.
The second study, the Wapenhans Report, was more far-reaching. While endorsing the findings on project economics in the Salop Report, it found that problems in the Bank's project portfolio were largely embedded in the Bank's culture. Undue pressure on staff to get projects to the board led to a lack of attention to local participation in project identification, design, and, ultimately, in project implementation. Inadequate attention was paid to project supervision and to portfolio management at the country level.

In addition to these studies, which required a re-examination of project evaluation, an enormous demand emerged for project evaluation training, not only by the Bank's newer members, such as China and the countries of Eastern Europe and the former U.S.S.R., but by more long-standing members in the Middle East and South Asia.

Training programs in project analysis are offered by Harvard's Institute for International Development (HIID) and at The University of Bradford in the United Kingdom. EDI currently supports training in project analysis and implementation in collaboration with its training partners in the developing world, especially in transition economies.

EDI, however, had reasons to hesitate before embarking on renewed training efforts in project evaluation. The economic and policy environments of developing countries and the thinking about them had changed dramatically during the 1980s. The implications of these changes for the substance and practice of project evaluation were unclear. Furthermore, surveys and evaluations showed that with some noteworthy exceptions, prior efforts by EDI and others to establish project evaluation in governments through training had not been as successful as anticipated. Indeed, both the Salop and Wapenhans reports revealed problems within the Bank in this respect. What were the reasons for this lack of progress? Finally, what do the new electronic technologies imply for the practice and teaching of project analysis?

The papers in this volume attempt to come to grips with these questions and to provide guidance in making a renewed effort in project evaluation training.

References


Evaluation and the New Development Agenda

Robert Picciotto

Human welfare is the ultimate objective of development. It is, therefore, appropriate to base the evaluation of development operations on welfare economics and to have Arnold C. Harberger, a pioneer of this proud tradition, provide intellectual leadership to this workshop. We are also fortunate to have as participants Professors Glenn Jenkins, Henry Bruton, and Anthony Bottomley.

Equally, I wish to express appreciation to Joanne Salop, Lyn Squire, and the other Bank professionals who have joined the workshop. I look forward to an insightful and spirited debate. I can think of no professional topic of greater priority or relevance than the one on our agenda or of a better group to deal with it.

The main theme of my remarks is that the new development agenda mandates this group to bring a variety of fresh perspectives to bear on the economic evaluation of development operations.

In architecture, form follows function—and so it is in the development business. The role of the project economist, that is, the function of economic evaluation of investment projects, has changed since Little-Mirrlees and Squire and van der Tak dug the foundations of current project evaluation methodologies. The spare elegance of their models is reminiscent of Bauhaus architecture.

But we live today in a postmodern environment characterized by diversified development objectives, multifaceted operations, and new technologies. The time has come to reflect these requirements in the architecture of the economic evaluation curriculum.

Accordingly, as this workshop proceeds, it will have to be responsive to today’s operational needs and to the actual dilemmas faced by our developing member countries.

We count on the participants from academia to tap into the most recent advances of the social sciences. Regional staff will be called on to clarify the needs implicit in current country assistance strategies. EDI’s representatives will have to find ways to make these contributions accessible to development professionals within and outside the Bank. In sum, this workshop faces a conceptual as well as a pedagogical challenge.
Evaluation and Portfolio Quality

From an institutional perspective, the stakes are considerable. As a financial institution and as a development think tank, the Bank has been doing rather well. But as the leading development lender, it has not been performing as well as it should have. Enhanced appraisal practices are essential to help improve the Bank's lending record.

Since the Operations Evaluation Department (OED) has been tracking the estimated results of Bank operations, the failure trend has been increasing. Whereas 15 percent of completed projects approved in the mid-1970s did not perform satisfactorily, more than 30 percent of those approved in the mid-1980s were rated unsatisfactory at completion.

Nor can we expect an early reversal of the trend: The rate of problematic operations under implementation doubled between 1981 and 1991.

Improved evaluation is equally important for our borrowers. Although it is harder and harder to generalize about developing countries, they have on average done rather poorly in managing their domestic and borrowed resources. While average per capita growth of gross domestic product (GDP) in developing countries fluctuated within a 2.6 percent range from the mid-1960s to the mid-1970s, it has been stuck below 2 percent in most years since 1986 and even turned negative in 1990 and 1991. Lessons learned through evaluation should help improve the design of economic management.

Need for a New Approach

Never since its introduction as an essential tool of development financing has cost-benefit analysis been viewed with such indifference by academics and practitioners alike.

What lies behind this dismal state of affairs? The development paradigm that ascribed a central role to planning and public investment has been discredited. Accordingly, the focus of development economics has shifted from investment planning to policy, that is, to redefining the role of the state, adjusting economic management, and reducing public expenditures.

The consequent demise of national agencies concerned with planning (without a commensurate increase in the professional capacity and influence of evaluation units within finance ministries or audit administrations) has had an unintended consequence: a pervasive neglect of quality assurance with respect to public investment—just at a time when accountable and transparent decisionmaking with respect to public expenditures has emerged as an essential factor of structural reform and effective governance.

In parallel, overall country policy—rather than the discrete investment project—has become the central organizing principle of development assistance. The shift has been especially pronounced in the World Bank, which, over and above its project financing role, has been called on to exercise intellectual leadership within the development community; to set country performance standards for donors in conjunction with the International Monetary Fund; and to take a special role in the financing of adjustment.

In this context, it is not surprising that Bank economists have concentrated their creative energy on macroeconomic and sectoral policy issues.
Measuring Performance

The choice of appropriate evaluation methodologies is more than a matter of conceptual
elegance. According to Tom Peters, "What gets measured, gets done." And W. Edwards
Deming, the guru of manufacturing quality, has issued dire warnings about the
unintended consequences of accounting conventions in the corporate world.

Crossing over to development, similar warnings have come from the OED,
environmental groups, and grassroots nongovernmental organizations. Their concerns
have evoked a deep resonance in the development community. The rapid spread of such
concepts as sustainability, participation, and capacity building reflects a deep unease
with the paradigm of traditional investment analysis. Is this unease justified?

Evaluation and the Development Agenda

Development is readily defined as equitable and sustainable economic growth. But
environmentalists have challenged available measures of growth; equity is far from an
unambiguous concept; and sustainability has at least three dimensions: financial,
institutional, and environmental. Furthermore, operations are increasingly used as
vehicles for broadly based policy reform and capacity building.

New objective functions animate development operations. Therefore, the tests needed
for screening programs and projects must reflect these concerns or risk irrelevance. Yet
attempts to cram sophisticated adjustments into rate-of-return calculations have proven
short-lived.

Development operations are widely expected to serve poverty reduction, private
sector development, and environmental protection through improved economic
governance and a variety of programs emphasizing human resource development, public
sector reform, efficient infrastructure creation, and effective natural resource
management. We must sharpen the tools of economic evaluation to deal with these
emerging priorities.

Methodological Issues

Thus economic evaluation must, first and foremost, assess the effect of the operation on
economic growth. But given the new development agenda, analysts must assess every
operation in terms of: its policy reform content; social impact; environmental
consequences; financial justification (including its impact on public finances); and
institutional soundness.

Of course, not all projects can be expected to meet all these objectives simultaneously,
so tradeoffs may be involved. Are there practical ways of translating a gain in one
category into a loss for the other? How can economic evaluation deal with multiple
objective functions?

A similar dilemma arises at the project design stage. All too often, excessive
complexity in project design leads to implementation gridlock and to project failure. So
there is a growing tension between the ambition of the development agenda (associated
with a multiplicity of objectives, each championed by one or more stakeholders within
and outside the developing country concerned) and implementability considerations,
that is, the desirability of keeping project designs within the constraints of domestic capacities. What are the implications for economic evaluation?

Country Focus

One implication of this conundrum is that it may not be feasible to examine the efficiency and responsiveness of a single operation without examining the other components of the development program. This means that, beyond the individual project, economic evaluation must concentrate on the investment portfolio. In other words, the country has become a "privileged unit of account" in evaluation.

There are, of course, limits to a country-based approach:

- Growing interdependence among countries may bring a global dimension to bear on economic, social, and environmental evaluation.
- The recognition of a crucial role for private enterprise has highlighted the firm as a unit of account.
- The increasing sensitivity to social factors may bring a local, if not a household, or individual, dimension to economic evaluation, namely, in such respects as resettlement and employment effects.

Participatory Development

The advent of participatory development is an attempt to respond to this new order by adjusting the design process for development operations. According to this increasingly influential conception of the development process, the preoccupation with a single measure of the net present value of a given project is less relevant than the transparent consideration of alternative schemes by stakeholders.

In such a context of bounded rationality, effective guides to "second-best" solutions can be more useful than cumbersome optimization models animated by a single objective function.

The expanded menu of objectives included in the development agenda explains why it has been necessary to diversify the instruments of development assistance beyond the investment project. Structural and sectoral adjustment operations, sector investment and financial intermediation operations, and a wide variety of institutional development, technical assistance, and advisory services have been added to the standard tool kit of the Bank. All of these instruments are subject to evaluation. How can evaluation methodology deal with each of these instruments?

Sectoral Focus

Sectoral diversification must also be a consideration. The share of social sector projects is increasing. The nature of financial sector projects is changing. Privatization, public sector management, and technology development are now frequent. Freestanding environmental projects have emerged, and many if not most development operations are subject to environmental impact assessments. What does cost-benefit analysis have to offer for the evaluation of each of these projects?
Are the rates of return assessed in one sector comparable to those in another sector? Are the methodologies applicable to an irrigation project applicable to a health project? What kind of cost-effectiveness tests are useful for social projects? Is it appropriate to use willingness to pay as the main determinant of benefits streams in utility projects? Are externalities suitably taken into account in traditional rate-of-return methodologies, say for agriculture settlement projects? How should nonrenewable resources be handled in the evaluation process?

Factoring Out External Factors

The factoring out of exogenous variables—global and national—is an important issue for project evaluation. For such investigations to be of practical use, however, they must be geared toward improving the engineering of development programs and projects so that they can withstand the intense stresses imposed on them by the macroeconomic and the global environment. Any serious review of evaluation methodologies should address this concern. In turn, what implications do risk and uncertainty have for project design and economic evaluation?

A Multidisciplinary Venture

In conclusion, cost-benefit analysis is solidly anchored in theory. It provides a useful discipline for development project design and evaluation. But, to be relevant to the new development agenda, the framework needs enrichment by the full range of economic inquiry as well as by financial analysis and the other social sciences.

As projects become more policy laden, it will be important to assess the effectiveness of policy reform. As development instruments become more diversified, it will be imperative to trace the linkages between macro policy and microeconomics. As social and environmental projects become more numerous, resource economics must be brought to bear.

Improved design of institutions requires evaluation of operations from a public choice perspective. Agency theory and transaction cost economics may have to be tapped for the analysis of public sector projects. Infrastructure and environmental projects may have to be analyzed from the perspective of institutional economics.

More often than not, projects work is a struggle with the dilemmas inherent in the financing of (and the access to) public goods, a fertile area of recent economic inquiry.

In sum, there is no denying that development practitioners must rediscover the rigorous and conceptually elegant standard cost-benefit methodology again and again. It constitutes the basics of the profession. It is not a question of abandoning cost-benefit analysis. Rather, it is a question of applying cost-benefit analysis to cost-benefit analysis and being prepared to use other analytical tools and the insights of other disciplines to ensure improved development effect of policy and project interventions.

The world of development has changed. More than ever, its practitioners today must be well versed in the basics of cost-benefit analysis. But they must understand its limitations as well as its potential. They must be equipped with a diversified set of analytical and conceptual instruments to deal with a variety of decisionmaking situations in an agile and credible fashion. To remain relevant, the EDI curriculum should construct this tool kit. This is the challenge before this workshop.
On Training in Project Evaluation

Henry Bruton

This report summarizes the main themes of the conference and adds various comments on the themes that seem to me relevant to the training programs in the Economic Development Institute (EDI).

The conference began with a strong statement by Robert Picciotto to the effect that project evaluation must take place in the context of the “New Development Agenda.” This requires that any project be looked at from many perspectives. Cash flows are, of course, important, but so are numerous other aspects of projects. Conceptual elegance is not the objective; rather, the aim must be to find directly usable tools that catch bad projects at the appraisal stage. The primary objective is the creation of equitable, sustainable growth, and this requires attention to policy reform, the social and environmental impacts of a project, and the effect on the institutions of the society. In particular, we must focus on poverty alleviation and employment. This is obviously a very wide view of project evaluation itself and of its purpose.

Equally strongly, Arnold Harberger has urged a much narrower view. The main theme here is that we should seek to establish a common, widely used technique that enables us to effectively address specific, identified things. Primary, if not exclusive, attention focuses on the effect of a project on output. We need to recognize that we cannot put prices on everything, cannot take everything into account, but we can do some things very well. In taking these actions, we should make clear exactly what we have done, what our assumptions are, how reasonable our dates are and so forth. Then we will be supplying a product that the policymaker can factor into decisionmaking with confidence, even though all questions are not answered. It was noted that in the old days, the EDI taught a culture—it must now teach how to do things.

The difference between these two approaches rests on contrasting ideas about how development takes place, and indeed about the definition of development. The narrower view seems to rest on the Arthur Lewis dual-economy model, which in turn had links with the growth model of R. F. Harrod. In the Lewis model all investment was to take place in the “modern” sector. The physical capital and technology that was to be created was the same as that in rich countries. This meant assuming that the capital output ratio in the developing countries was fixed. The Harrod model told us that the rate of growth of output is given by the saving rate over the capital output ratio. With the latter fixed, the higher the saving rate, the higher the rate of growth of output. This in turn meant that
it was crucial to allocate the new capital in such a way that the maximum growth would be realized with a particular rate of saving. So project evaluation was born, and development became essentially a matter of getting a high rate of investment and the correct allocation of new capital. Factor prices did not matter because technology dominated, and the high rate of output growth would solve poverty and employment problems. These objectives would not need any independent attention.

In the 1960s economists realized that the strategy to achieve a high rate of capital accumulation had led to a range of policies that severely distorted factor prices and the exchange rate. Such distortion penalized both the level of investment and its allocation. Project evaluation then was directed at correcting these distortions by introducing shadow prices, and the focus was on the estimation of shadow prices. To get private investment allocated correctly, the policy package was simple: eliminate the distortions—get prices right. Development then was achieved during a situation in which all prices were right and the rate of investment high. Project evaluation, once all prices were right, would be largely concerned with projecting future prices of output, factors, intermediate goods, and foreign exchange. The narrow view of project evaluation remains strategic as a development tool, and the project is the heart of the development process.

The broad view, in contrast, emphasizes “welfare.” Development is not simply more output but includes a wide range of other components of welfare that must be taken into account as investment takes place. When matters of distribution, health, environment, poverty, food security, values and culture, and so forth are given weight, the project takes on a much more ambiguous form, and evaluation becomes more a matter of the way the project fits into the general policy package than as an independent unit to be analyzed separately. Evidently this is a much less precise notion than is the narrow view.

This wider view also recognizes that capital formation is not the basic source of growth of output. Rather, one must give equal, if not more, attention to productivity growth. The evidence shows that productivity growth accounts for as much or more of the growth of output than does capital. It is, however, obvious that unless productivity growth continues regularly, the rate of return on capital will fall, and private investment will be weak. Thus capital formation and projects no longer are the heart of growth. Despite the vast literature on productivity growth, it is fair to say that economists do not understand its real source. In particular, we cannot say which investments lead to regular productivity growth of the kind needed in developing countries, nor can we say what prices are “right” to induce the search and learning that produces the productivity growth.

Perhaps the primary aspect of this wider approach is that it involves a great deal of searching and learning, of trial and error, and of recognizing the huge complexity of even a simple economy.

Much of the discussion at the conference seemed to reflect these different points of view. I emphasize that the differences seem to rest on various views of development because it is this fact that makes resolution of the disputes so difficult. I now want to explore these differences, as they emerged at the conference, in a bit more detail.

The Narrow View

The idea of having a rather formal, widely used technique of project evaluation that yields an answer that is understood is an important objective. Even for those who are
willing to accept this narrow view, there are many sources of disagreement. The most appropriate treatment of risk is open to many questions. There are many doubts about the estimation and use of shadow prices; the choice of the discount rate is both fundamental and subject to many disputes—including whether it should be positive. There are disputes about what criterion to use in determining which projects to reject or accept. All these questions arise even if the sole objective is increased output.

Fundamental to all investment projects is, of course, the projection of all components relevant to the project. John Besant-Jones presented data that compared Bank projections of a number of key prices with actual prices, and the differences were generally large. Such differences seem to be inevitable. In some cases it seems possible to say that a current price is not sustainable and to agree on the direction that it will change. In general, however, projections are going to be wrong, in many cases drastically wrong. Calculations of expected values do not really resolve this difficulty because expected values are not likely to equal actual values. Indeed, participants at the conference seemed to agree that to project more than five or so years into the future was unwise. Since many public investment projects are intended to last well beyond five years, it is not clear how to meet this particular problem. Thus in this narrow view different projections and various ideas of how to project are sure to be a source of disagreement.

Therefore, it does not seem likely, even in the context of this limited view of project evaluation, that there will be a widespread acceptance of a particular package. At the same time there is an important issue here, and I want to come back to it later.

The More General View of Project Evaluation

The fact that the narrow view is open to many difficulties does not mean that the more general view is “right,” and simple. Obviously it is not, and this larger view has as many or more problems that must be addressed. To accept the view that matters of poverty relief, employment, environment, deep social values, and so forth should be explicitly considered creates the need to assign such objectives some sort of measure or weight, and no one knows exactly how to do this—even conceptually. Many projects that the Bank supports now appear to have no present values or internal rates of return calculated. This seems to be due, in large part, to the fact that many projects are concerned with those aspects of the economy and society that simply do not lend themselves to these sorts of calculations. One may conclude that on these kinds of projects the Bank has determined that it can make decisions on a project’s appropriateness without explicit calculations of conventional measures. If such an assumption is valid for some projects, why is it not valid for all of them? Perhaps all projects should be treated in this way. This seems to me to be incorrect, but there is an important message here, one which I will explore in a moment.

The basic question, of course, is: How does the bank decide on projects for which no net present value (NPV) or internal rate of return (IRR) is calculated? Lyn Squire made a number of important points on this issue. Analysts focus on the rationale of the project, of how it fits in with the general strategy of the Bank and of the country. How does it affect the macroeconomic balance of the country? Does the idea of the project make sense in general, given the state of the country at the moment? Another important question is: Why is the private sector not already doing the project? If these questions all are answered in a way that suggests the project looks hopeful, then attention shifts to more
specific matters, such as discount rates, cost recovery, effect on balance of payments, and sensitivity to exchange and conversion rates. It seemed clear that these latter calculations were deemed less important than were the more general issues noted previously. Clearly, in this approach the traditional model of project evaluation does not really enter into the story. As nearly as I could ascertain, the "failure rate" of projects approved in this manner was no greater than that of those following the more traditional approach.

Such an approach puts great emphasis on general knowledge of how the economy works, of the current state of the economy and the government, of critical bottlenecks in the country, and so on. This kind of knowledge is very real and difficult to assign numerical value. Someone noted that it costs one hundred or more times as much to educate a person at the college level than at the elementary level. This piece of information can be used in an illuminating way in deciding where to put the education dollar.

Computers

Before turning to some pedagogical and curriculum issues, I want to say something about computers. Let me emphasize that I know virtually nothing about computers and am generally inclined to the view that the world would be better off without them. We have them, however, and the question is how to use them in the most productive way. I have only two observations. Richard Lucking emphasized that the computer was a teaching instrument, a way to help students more completely understand exactly what they were doing during project evaluations. For students unfamiliar with computers, thinking of them in this way is difficult and demands careful teaching. Baher El-Hifnawi reported that Harvard once had one computer for each student, but then cut back to one computer per two students. The reason was that if the students had their own computers, they would spend much too much time on them, and not enough time on other aspects of the course.

Both of these points are surely important, and we must find a way to exploit the computer without the courses becoming a course in computers rather than in project evaluation. I suggest that it is not easy, and it is important.

Some Proposals

Given this interpretation of the conference, what makes sense for the EDI to try to do as it places increasing emphasis on training in project evaluation within the Bank and in various countries? Following are some general ideas that do not exactly add up to a formal proposal but may contain ingredients of a more complete outline:

1. There should be an opening session of, say, one morning, or one day that puts the project evaluation exercise in the context of the entire development objective. This should be done in a careful, systematic way and should recognize the extent of disagreement in the profession, the range of objectives, the state of knowledge and ignorance, and some thoughts on how our views have changed since the 1950s. I put great weight on doing this as objectively as possible.

This discussion would identify the main problems of the country at the present time. These might be employment, poverty, inequality, and the environment, but they might
be something more nebulous, such as entrepreneurial shortages, lack of response of the private sector to price or profit incentives, and corruption. These should be specifically identified. In this context, it would be possible to talk about the origin of projects, an important topic not frequently discussed.

2. Then the group could work through one form of the narrow version of project evaluation. The obvious one to use is that of Harberger, the most convincing (in my view) one available. The group could use only output as the objective, that is, nothing on poverty, environment, or other problems. It should be fairly easy to introduce some kind of sensitivity analysis into this: What happens if the cost of foreign exchange is 5% less or 5% more than it is? What happens if the discount rate is moved around a bit? The class should spell out assumptions made at every step and specifically state the rationale for making them. Much of the class discussion would center on why these assumptions, not others, were made. A few hypothetical examples should be used at the outset, but students should be put in touch with "real" projects early. My view is that participants in such a course should do their own projecting, choose discount rates, and so forth rather than assume that some other office does that. To depend on someone else for the projections, lets the project evaluator off the hook too easily—given the problems listed above. Once an NPV is obtained, the assumptions specified, and the sensitivity work done, the class will make a decision to accept or reject it.

When projects do not lend themselves to this sort of treatment, the class should recognize this explicitly. It may, however, be possible to gather data that are relevant to the issue of such a project, for example, education costs, as mentioned above. It would be unfortunate, in my view, to teach that it is possible to calculate the NPV of a project aimed at reducing, for example, infant mortality even though everyone agrees it is advantageous to reduce infant mortality.

3. The class would then study this result and its justification in the context of the material covered in the first session. The basic question would be one noted earlier: How well does the project fit the economy and society at the present time?

(Let me illustrate this latter point with an example from one of Al Harberger's comments. He mentioned that a group of economists from Cambridge had asked him to support their proposal of a $30 billion aid package for Russia. No information was available on what the money was to be used for or how the total was determined. He refused to lend his support to the proposal. He was surely right to refuse. Then Al said if the group had listed some projects, things would be different. For example, we all know that telephones are a necessity in a modern society, and a major aid program to provide telephones in Russia could well be accepted. This may be, but I would doubt it. Given the present disarray of the Russian economy, I doubt that telephones would break many bottlenecks or would fit in with the economy. I would believe this, even if the NPV of a telephone project was positive.)

To do this part of the exercise well requires a lot of intuition. There are people in developing countries who have a lot of intuition. We need to find a way to exploit this source of information. This is difficult. People with good intuition are hard to find, hard to get information from, but they are there. Part of the exercise at this point might include a discussion of who would have information about a project's effect and how to get them to tell what they know. Certainly this source of information should be recognized.

After this is done, the class should review its decision to reject or accept. If it changes, a complete statement of why should be spelled out.
It may be noted explicitly that this approach does not involve putting weights or numerical values on the environment, poverty relief, and so forth and then including them in the calculation of NPV. Rather, the NPV is calculated "neat," and then the decision that emerges is studied in a larger, more inclusive context. It is studied no less rigorously or formally, but in a different way. The class would use data but not in the explicit way done in the conventional project evaluation form.

One might also consider the difficulties arising from the fact that most projects are expected to last longer than it makes sense to project their prices, costs, and so on. How can that be taken into account? I think the main policy implication of this situation is to recognize the advantages of considerable flexibility. The least-cost method may not be the least cost if it results in an inflexible, unadaptable piece of physical or human capital. Indeed, in an era when technology is changing rapidly, flexibility and adaptability are a high-priority objective.

4. Participants frequently mentioned "institutions" at the conference. This is a difficult notion to define. In a course with participants from different countries, it is often effective to ask them to identify specific institutions in their country that seem relevant to appropriateness of a project. It is important to try to make the student be very specific. Only then does an emphasis on institutions have a great deal of empirical content and policy relevance.

5. The last part could be a study of the general macroeconomic effects of the project.

6. The final result should be a specific decision to reject or accept. It does not seem useful for the project evaluator to say to the minister or policymaker, "Here are the economic aspects of the project, now you decide." Project evaluators know more than ministers are ever likely to know—and may be more objective as well. They should be willing to accept the responsibility. It will help make them more careful.

Pedagogy

Everyone seemed to agree that the classes should be formally conducted. Participants should have graded tests, graded homework, and get a final grade. It should be made clear at the outset that it is possible to fail. The basis for this emphasis is that participants must be motivated—and motivated strongly—to go all out to learn the material.

I agree completely with all this, but I do want to turn it around a bit. I want to convince the participant that the material is important, vitally important, it really matters. Make this clear on the first day. Then the discussion of how to do the job makes more sense and (I would hope) provides the real motivation. The testing then would be justified by the need to ensure that the participants understood the material, really and truly understood it. The tests would not be simply to see who failed and who passed, but to be sure that everyone passed and understood . . . and they understood because they recognized that such understanding was of great relevance to their country.
Reflections on Social Project Evaluation

Arnold Harberger

I approach with considerable humility the task of organizing and expressing these reflections because I do not consider my work in the field of project evaluation to be characterized by great originality. What I have strived for over the years is better expressed by the word “professionalism.”

This statement applies at two levels. First, there is the level of that largely unsung host of people serving in budget bureaus, planning authorities, and all types of ministries and agencies (among them the World Bank itself) all over the globe, who strive selflessly to see to it, insofar as they can, that projects not meeting adequate standards are rejected, while those in the social interest are accepted. These honorable people (for I exclude the many who demean project evaluation by using it as a device for “justifying” whatever projects their clients or superiors want) must literally number in the thousands. They, in my view, form a nascent profession. To me, the task of helping them develop this profession lies more in distilling the knowledge, wisdom, and common sense that are already part of our heritage than in extending the frontiers of knowledge in any deep sense. Moreover, I have always thought that in doing so one should respect the goal of simplicity as much as possible—seeking principles and rules that can be readily communicated to and understood by this heroic (and hopefully growing) band of practitioners, most of whom belong to professions other than economics.

This brings me to the second level at which the word “professionalism” is relevant. The economics profession has been with us for a long time. The insights and wisdom it has accumulated over more than two centuries are probably the most important source from which to derive the principles and rules to guide the new profession of social project evaluation. This is the star that I have tried to follow as I have dealt over the years with project evaluation: to distill from the huge corpus of economic science the concepts that were particularly relevant for the new profession, and to function as a professional myself (rather than as a scientist) in studying different areas of application.

This same spirit motivates the present paper. In the course of it I will surely have to disagree with other professional colleagues who have dedicated their time and efforts to work in the same vineyard. But even here the spirit of the disagreement is better described by “Who has found the simplest and most convenient distillation of our profession’s accumulated tradition?” rather than by “Who has invented what?” or even, on a given point, by “Who is right and who is wrong?”
Three Basic Postulates of Applied Welfare Economics

The grand tradition of applied welfare economics, going back at least to 1844 and the days of J. A. Dupuit (1952), can be interpreted as being based on three simple postulates:

1. Competitive demand price measures the benefit of each marginal unit to the demander.
2. Competitive supply price (or marginal cost) measures the opportunity cost of each marginal unit from the standpoint of the suppliers (factors of production).
3. In attempting to measure the benefits and costs to a society (or group) as a whole, one must take the difference between benefits (+) and costs (−).

On the basis of these postulates, we can derive the classical principles of economic policy analysis. Among these are (1) the measure (a triangle between demand and supply curves) of the so-called welfare or efficiency cost of a tax; (2) the traditional demonstration of why the exercise of monopoly power is not in the social interest; (3) the case for the so-called optimum tariff or export tax, which shows how a nation (although not the world as a whole) can benefit from exploiting its monopoly power, if any, over products it imports and its monopoly power, if any, over products it exports; (4) the generalized expression for the welfare or efficiency cost of taxation in a general-equilibrium setting with many commodities, developed independently by many authors but perhaps most elegantly by Hotelling (1983); (5) various rules for optimal taxation, of which the so-called Ramsey rule (1927) is among the most famous; and (6) the so-called Lerner theorem (1936) showing the equivalence of a uniform import tax with a uniform export tax under conditions of balanced trade.

These examples are impressive because of the power of the ideas involved and their significant place in the accepted corpus of economic policy analysis. But truly they are only the tip of the iceberg. The tradition of what is called consumer surplus analysis has had many distinguished representatives, among whom Alfred Marshall (1890) and A. C. Pigou (1932) stand out as giants.

The three basic postulates have sometimes been criticized as not yielding in every circumstance “true” measures of how the utility of individuals changes when some policy is introduced or some other disturbance occurs. But as a basis for the actual analysis of real-world policies and projects, the postulates have not been seriously challenged, let alone surpassed.

Some authors have worried about cases of multiple equilibria, others about examples in which the postulates need not always yield the same measure if a sequence of policies is imposed in a different order (the so-called integrability condition). But I do not know of even a single case where the presence of multiple equilibria has been identified as a factor in an important real-world policy problem. And as for the integrability condition, my favorite analogy is that we all know that the distance between two cities will vary with the route we take. But most road maps, geography books, and airlines present only a single number for distance. The logical answer in the case of intercity distance is sometimes “as the crow flies,” sometimes “the shortest available route.” The corresponding answer in applied welfare economics (when the sequencing of policy steps is an issue) is to choose the most plausible or likely sequence or, if there is none, to
assume that all the policies are imposed together (in technical jargon, to assume "a radial expansion of the vector of distortions" from the relevant starting point to the end result).

From my own standpoint, I have always thought of the three basic postulates as exactly that—simple postulates on which economists have constructed a system of measurement (traditional applied welfare economics). All economists know that national income and gross national product are inaccurate measures of national welfare. Yet most studies rely on them. In spite of their defects, they have performed reasonably well in most contexts. What can be said of the three basic postulates is that they are considerably more subtle and more refined than the rules on which national income accounting is based—they would not, for example, make the mistake of implying that welfare falls when mothers voluntarily leave the labor force to take care of their homes and families. In every case that I know of where the three postulates lead to results different from those derived by the rules of national income accounting, the postulates (as in the above example) win hands down. For the real-world problems they have been used to solve, they have proven more adequate than anything else we have. They are thus the natural sources from which to draw the principles to guide the budding profession of social project evaluation.

On Distortions and Externalities

Using the three basic postulates makes it easy to understand the sense in which the grand tradition of economics has always looked on an undistorted and fully competitive economy as an optimum. If demand price as seen by demanders in each market is equal to supply price as seen by suppliers, and competition prevails, marginal social benefits as measured by postulate 1 will always be equal to marginal social costs as measured by postulate 2. This happy state no longer prevails when distortions or externalities are present.

Distortions can take on many forms, of which the simplest to analyze are taxes and subsidies. When these are present, marginal social benefit as measured by the price paid by demanders differs from marginal social cost. If we represent the excess of demand price over supply price in an activity by \( D_i \) and the change in the level of that activity by \( AX_i \) the introduction of a new policy or project will produce net benefits or net costs, through its effects on other markets, according to whether the expression \( \Sigma_i D_i \Delta X_i \) is positive or negative.

I have always thought of \( D_i \) as standing for "distortion," with the term construed broadly. That is to say, the above expression is valid generally—not only for taxes and subsidies but also for the distortions present in more complicated public policies and for those stemming from monopoly and monopsony situations. Externalities that vary with the level of an activity, such as traffic congestion with the volume of traffic or smoke pollution with the volume of a factory's output, can also be treated as distortions (\( D_i \)) within the same simple formula.

All this is important because, as will be seen below, these distortions are precisely why (within the framework of the three postulates) we have to build a system of social project evaluation that is different from the simpler economics of a distortion-free world. In particular, the pervasive presence of important distortions is the main reason it was necessary—or at least exceedingly useful—to construct these concepts.
On Social Opportunity Costs in a Market Setting

As pointed out previously the postulates would assert that in the absence of any distortions in the economy, the social opportunity costs of marketed goods and services would equal their market prices. When new demand for a good or service is generated (say, by a new project), there are only two sources from which to satisfy that demand: increased total supply and the crowding out (displacement) of other demanders. Postulate 2 tells us that the increased supply should be evaluated at the supply price, while postulate 1 tells us that the displaced demand should be evaluated at the demand price. In the presence of a distortion, say, a tax, these two prices are different and the social opportunity cost becomes (at least in simple cases) a weighted average of them. Another way of expressing this is that demand price \( P_d \) is equal to supply price \( P_s \) plus the distortion \( D_i \). If the social opportunity cost of one unit of the good or service is a weighted average, \( f_1 P_d + f_2 P_s \), this can be expressed as \( (f_1 + f_2) P_s \to f_1 D_i \). But \( f_1 \) is simply the measure of the amount of displaced demand, so the above formula boils down to saying that the social opportunity cost of a unit can be expressed in the form \( P_s + D_i \Delta X_i \).

The above is the most rudimentary example of a general rule. Other cases are more complicated but come down to the same thing. A simple capital market example contains two taxes, a capital income tax, \( t_c \), and a personal income tax, \( t_p \). There are thus three rates of return: \( p \), the gross of tax return to investment; \( i \) \((= p - t_c)\), the market rate of interest; and \( r \) \((= i - t_p)\), the after-tax return received by savers. In this market, funds raised by a project come in part from displaced investment, which by postulate 1 has an opportunity cost of \( p \), and in part from newly stimulated saving, which by postulate 2 has an opportunity cost of \( r \). The social opportunity cost of capital can then be expressed as \( f_1 p + f_2 r \). But this is also equal to \( f_1(i + t_c) + f_2(i - t_p) \), so given that \( f_1 + f_2 = 1 \), it is equal to \( i + f_1 t_c - f_2 t_p \)—that is, it is a market rate of interest adjusted for distortions by the \( \Sigma_i D_i \Delta X_i \) principle.

No matter how many sectors we add, the fact remains that it is substantially equivalent in such cases to look at social opportunity cost as a measure that is a weighted average of the demand prices \( p^d_i \) of those sectors whose demand was displaced by the entry of new demand, and of supply prices \( p^s_i \) of those sectors whose supply was stimulated, and as a measure that is a market price (like \( p_s \) in the first case or \( i \) in the second) adjusted by a factor based on the application of the \( \Sigma_i D_i \Delta X_i \) principle. Here \( \Delta X_i \) represents precisely the same displacements of demand and stimuli to supply incorporated in the weights of the weighted average. Perhaps the most elegant case is the representation of the social opportunity cost of foreign exchange in terms of a weighted average of a host of individual terms, which reflect the different tariff treatment of many categories of imports and the various taxes and subsidies applying to different categories of exports. For a dollar's worth (the dollar being the main foreign exchange unit for most small countries) of imports of good \( j \) the demand price (postulate 1) is \( E_m + T_j \), and for a dollar's worth of exports of good \( k \) the supply price would be \( E_m + S_k \). Here \( E_m \) is the market exchange rate for the dollar, and \( S_k \) the subsidy per dollar of exports of \( k \). If there are many categories, we have weights of \( f_j \) and \( f_k \) reflecting the fractions of a dollar newly demanded (say, by a project) that are brought about through displacing imports of \( j \) or by stimulating an increment in exports of \( k \). The end result of this exercise is the following expression for the social opportunity cost of foreign exchange:
\[ \sum_j f_j (E_m + T_j) + \sum_k f_k (E_m + S_k). \]

This is a weighted average of the demand prices (postulate 1) of many classes of imports and of the supply prices (postulate 2) of many classes of exports. But since \( \sum_j f_j + \sum_k f_k = 1 \), the expression above can equally well be written as

\[ E_m + \sum_j f_j T_j + \sum_k f_k S_k. \]

This takes the form of a market rate of exchange adjusted by the \( \Sigma_i D_i \Delta X_i \) principle.

In all the above cases the weighted average of demand prices for displaced demand and of supply prices for newly stimulated supply (based on a quite intuitive application of postulates 1 and 2) is equivalent to the representation of social opportunity cost as a market price, duly adjusted by the same weighted average of the relevant distortions (based on the \( \Sigma_i D_i \Delta X_i \) principle, a less direct but more subtle application of postulates 1 and 2).

This leads us to see that the standard weighted-average measures of social opportunity cost can be regarded as attempts to follow an approach that (though subtle and correct) asks us to look at the effects of a given action on all the distorted activities of the economy, and to assemble the adjustments for distortions into convenient “packages.” For the weighted-average measure, the elements in the package are the supplies and demands in the various component parts of the given broad market. Thus, for the social opportunity cost of foreign exchange, the weighted-average measure includes the supplies of all the various export categories and the demands for all the various import categories, while for the social opportunity cost of capital it would include the demands for all the various investment categories and the supplies of savings from different sources (presumably with different marginal tax rates, hence different supply prices of their savings). Of course, in all these cases, we can lump several categories together if they have the same, or closely similar, distortions.

But there may be times when the relevant package includes elements above and beyond those in the weighted average. In deciding on the relevant package, one must recall that in determining social opportunity cost we are attempting to trace what happens when new demand enters a market. Weighted-average methods trace out those consequences just on the constituent parts of that market—displacing imports and stimulating exports, for example. These displacing and stimulating effects work through the real exchange rate, and one must recognize that there may be other consequences. I have suggested, for example, that if a rise in the real exchange rate ends up displacing some imports of petroleum, one side effect would be reduced receipts from gasoline taxes. I have also suggested that if there was a tax on bricks, and if the introduction of new demand into the capital market displaces construction, there would similarly be a side effect in the form of reduced receipts of that tax. When these effects are relatively minor, the principle of simplicity suggests ignoring them. But when they are significant, they should be taken into account. Most important, perhaps, from the standpoint of the present paper, is the clear conclusion that weighted-average measures of social opportunity cost are not in themselves the correct solution. In a market situation they will always be a component of the correct solution, but they may at times need to be supplemented in important respects. All of this, of course, follows directly from the three basic postulates that have guided applied welfare economics from its beginnings.
Some Additional Observations

Let me set the stage by pointing out an important characteristic of a well-functioning capital market or foreign exchange market. Particularly in the latter case, one can almost guarantee that the reaction will be the same: The real exchange rate will go up by the same amount, and the same set of displacements of imports and stimuli to exports will occur—regardless of who is the buyer of a given amount of foreign exchange. In the case of foreign exchange in well-organized markets, the names of the buyers and the purposes for which they buy are not even known by the market, most purchases being made by financial institutions or other intermediaries. The market simply “feels” the pressure of an added demand, and a set of market-determined reactions ensues.

Some people dispute the above proposition by saying that it does not take into account how the foreign exchange will be used, and that when this use is considered, the social opportunity cost of foreign exchange will vary from case to case according to the attributes of the use. I believe that this line of reasoning misses the whole point of the concept of the social opportunity cost of, say, foreign exchange. The main reason for assembling certain $\Sigma D_i \Delta X_i$ in packages is that these packages turn up with great frequency. When this is so, one can calculate the package solution just once and save lots of time and effort.

This, I believe, is what we accomplish when calculating the social opportunity cost of foreign exchange. To my mind, the social opportunity cost of foreign exchange (in a market setting) has no relation to its use. To put it graphically, if an enterprise or individual in country A enters the market, buys dollars, and then suffers a fire in which the dollars burn up, what is the loss to the country? This loss is measured by the forces of import displacement and export stimulus and is the same regardless of who was the buyer or what intentions he might have had about the use of the now-lost dollars. Here is a perfect example of how social opportunity cost can be separated from use. Of course, one cannot neglect the use of foreign exchange in social project evaluations. But here, by the very nature of the case, a different pattern of effects ($\Sigma D_i \Delta X_i$) in distorted markets will take place in almost every operation. Foreign exchange spent on highly taxed imports ($D_i$ positive and large) will produce an important benefit, which should be attributed as a benefit of the project. If spent on subsidized imports ($D_i$ negative), it will produce a cost. Application of the three basic postulates requires that these benefits and costs be taken into account in the analysis of each project. But this does not annul the usefulness of the package represented by the social opportunity cost of foreign exchange. Quite the contrary, when a project buys foreign exchange, the package is a cost, and the analyst need examine only the $D_i \Delta X_i$ that are involved in spending it. Similarly, when foreign exchange that has been earned is sold in the market, the package is a benefit and the analyst need examine only the $D_i \Delta X_i$ that occurred as a consequence of the particular activities by which it was earned.

The social opportunity cost of capital basically shares the same attribute. Again, when money is drawn from a reasonably well-functioning capital market, people rarely know for what purpose. But the withdrawal of funds tightens the market and produces a package of responses that is likely to be very similar, regardless of who was doing the withdrawing. There is a difference between the foreign exchange market and the capital market, however. In the former, the price paid (say, for a dollar of foreign exchange) is essentially the same for every buyer, and so are the market reverberations that produce
the difference between the social opportunity cost of foreign exchange and its essentially uniform (among buyers) market price. In contrast, the rates of interest paid by different classes of borrowers vary substantially, but the market reverberations that follow from the withdrawal of funds from the capital market are likely to be virtually the same, regardless of who withdrew them. To put it simply, the lender learns who the borrower is and charges him a supply price; but the market, which then reacts to the greater scarcity of funds, does not know who the borrower is. Its reaction is governed only by the fact that funds are tighter.

Thus the reverberations \((\Sigma_i D_i \Delta X_i)\) may cause the social opportunity cost of capital to be 4 percentage points above the market price, but the market price might be 8 percent for the government, 10 percent for a good industrial borrower, and 12 percent for a normal commercial borrower. In this case, the social opportunity cost of funds would be 12 percent for the government, 14 percent for the industrialist, and 16 percent for the commercial borrower.\(^1\) Most actual social project evaluations deal with public sector projects, for which the government rate is appropriate. In some developing countries, however, there have been serious analyses of the social costs and benefits of projects planned by the private sector, and in such cases the appropriate procedure is to adjust a private (real) cost of borrowing (10 percent in the industrial case above) by a premium that takes into account the reverberations \((\Sigma_i D_i \Delta X_i)\) from the borrowing.

Furthermore, the time should come when students of the development process take seriously the idea of making extensive postevaluations of both public and private investments. When this happens, it will also be appropriate, in principle, to consider the social cost of capital to be different for broad classes of private borrowers. As in the case of foreign exchange, there is going to be an entirely different set of reverberations \((\Sigma_i D_i \Delta X_i)\) stemming from the way the money is spent. These have nothing to do with the market for capital funds and should appropriately be taken into account in analyzing the outlays of each project.

The Social Opportunity Cost of Labor

The application of the three basic postulates to the calculation of the social opportunity cost of labor is vastly more complicated than the applications in the preceding section. There are typically huge variations in the wages of labor according to occupation and skill. Even within these categories in many countries there are substantial regional variations in wages. One must also deal with the fact that individuals can and do move among occupations, regions, and jobs and that they have demonstrably different supply prices in at least some of these cases.

\textit{The Important Role of Supply Price}

To continue with the three basic postulates, the starting point for measuring the social opportunity cost of labor must surely be postulate 2. This has powerful implications. If a worker is willing to work at different jobs but demands more pay for some of them than

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\(^1\) These rates should in principle be defined net of the actuarial component of default risk, which is not part of the social cost of borrowed funds. But in fact rates do differ by these amounts, and more in many cases, even after correction for the actuarial component.
for others, he does not have a single opportunity cost of labor; instead, he has as many (private) opportunity costs as he has asking prices. But for any one job, only one opportunity cost is relevant—his supply price for that job.

Obviously, it is folly to think of conducting real-world social project evaluations by finding out the supply prices of all the workers hired. The key lies in the presumption that, in the absence of clear evidence to the contrary, the project is paying market wages for each job, in each skill, and in each occupation. This in turn leads to the presumption that for most workers the wage represents or approximates their supply price, determined mainly by what they could get for an equivalent job in the same market. Some workers may be willing to take their jobs for less than the market wage and may thus be earning economic rents. But if all (or in practical cases nearly all) the workers on a project are earning economic rents, that project simply cannot be paying market wages—it must be paying above-market wages, a case I will take up later.

This clearly implies that analysts must treat the social opportunity cost of labor as an essentially microeconomic phenomenon, at least in social project evaluation, although possibly not in cases of major macroeconomic adjustments. The prevailing market wage, although different among types and categories of labor, must reflect the market clearing supply price of labor under postulate 2.

Yet this supply price is far from being the social opportunity cost of labor. To get to social opportunity cost, we must follow a path directly analogous to the ones pursued in the case of foreign exchange and capital. We begin with a somewhat semantic point. When a worker states his asking price (what he expects to be paid), he typically recognizes that he will have to pay income tax out of the proceeds. In this respect the market wage, $w_m$, is similar to the market interest rate, $i$, presented above in analyzing the social opportunity cost of capital. The true supply price of labor, $w_s$, must be defined net of taxes (at least in applied welfare economics) because it is only out of net income that workers presumably gain their welfare and satisfaction. If we take the market wage $w_m$ as the base, we must recognize that there is a distortion $t_p$ (personal taxes), lying between $w_m$ and the true supply price of labor, $w_s$, just as a similar distortion lies between $i$ and $r$ in the case of the social opportunity cost of capital. 2

The easiest way to think of the social opportunity cost of labor in a given area, occupation, industry, or other category is to start with the market wage and make a series of adjustments. All the labor of each type earns its relevant market wage. The first adjustment is to recognize that taxes, $t_p$, are being paid on those wages; this represents a positive external effect of the form $Di \Delta X_i$. But now we must turn to the ultimate sources from which that labor was drawn. Some may have been drawn from other regions, some from other industries within the same region, some from competing firms within the industry. In addition, there will be some who newly joined the labor force, and at least in

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2. I hope readers will forgive my using the term "supply price" sometimes in a gross-of-tax sense and at other times in a net sense. To use "asking price" as a technical term is, I believe, stretching it too far, but when it does not seem stilted or possibly confusing, I have used it. In other contexts I have stuck with "supply price." I trust that in such cases it will be evident from the context whether I am referring to the market wage, $w_m$, or the net-of-tax wage, $w_s$. 
times of less than full employment there may be some net reduction in the number of unemployed.

For all but one of the above sources there will be some sort of external effect of the form $D_i \Delta X_i$. All three of the first groups will have ceased to pay income taxes in their former place. These lost taxes represent a negative external effect of the project. They may just cancel the positive effect of taxes paid by the workers on the project, but this should not be presumed. Wages may have been higher or lower in the source than in the destination; in countries organized on a federal basis, taxes may also differ from region to region. When it comes to displacing labor from other industries, we must consider taxes that may be levied on the products of those industries. These taxes, too, are part of the marginal product of the factors of production in those industries, for the marginal product of the factors must be valued at the prices paid by the ultimate demanders of those products (postulate 1), but their loss may be partially offset if other factors end up substituting for the labor that was in net terms drawn away. Labor drawn from the ranks of the unemployed is likely to produce an external benefit. In cases where unemployment compensation is being paid, any net reduction in the number who would probably be unemployed in the absence of the project means a corresponding saving of public funds, presumably to the benefit of the citizenry at large. This saving is an obvious external benefit. It is to be expected (and indeed has been demonstrated many times) that the presence of unemployment compensation causes the asking price of the unemployed to be higher. Where there is no unemployment compensation, the absorption of the unemployed creates a benefit in the form of economic rent (consumer surplus) that reflects the excess of the wage received over the true supply price of the unemployed (which is unlikely to be zero, as was so often assumed in the early development literature).

The vicissitudes of measuring the social opportunity cost of labor are vast, as indeed are those associated with foreign exchange and capital. In practice, the actual measurement is always immensely cruder than the underlying concept. I have tried to show that even though the task is more complex and differentiated for labor than for the other two, the three basic postulates lead to essentially the same general solution to the problem of measuring social opportunity cost. Whether hiring labor, borrowing capital, or buying foreign exchange, we must first determine (estimate, guess, or assume) the pattern of the ultimate sources of supply. That pattern will inevitably entail some sourcing from new supply and other sourcing from displacement of other demand. In simple cases one can merely assign the net supply price as the opportunity cost of new supply and the gross demand price as that of displaced demand. In more complicated cases, which the labor market exemplifies, the more subtle approach of working with a market price corrected by distortions is indicated. In the case of labor we start with the market wage and correct it for all relevant externalities: taxes forgone in the various sources, unemployment compensation saved, and consumer surplus gained by newly hired workers. We also need to remember to introduce a credit for income taxes paid by labor at the destination. In this respect the procedure differs slightly from that of foreign exchange and capital, where all distortions were to be treated in the explicit analysis of the benefits of each project. The reason is that within a labor market category (region, occupation, or some other), which we define by the fact that roughly a single market wage applies, the relevant tax rate, $t_p$, will not vary from project to project, and simplicity calls for incorporating the adjustment directly into the cost of labor.
The Social Opportunity Cost of Labor with a Protected Sector

A final complication to the labor story is the frequent existence of what I call "protected sectors." Others have spoken of duality in the labor market, of traditional versus modern sectors, and so on. I like the term "protected sector" because it directly connotes a wage above what would be a free-market equilibrium level. It also connotes that some element (such as minimum wages, union bargains, or "political insurance" by multinational companies) must be at work to create the differential. In addition, the protected-sector concept, more readily than its alternatives, opens the door to the idea of not just two but quite a number of protected sectors, ordered hierarchically according to the wages they pay for equivalent work.

Another phenomenon in conjunction with protected sectors is that of quasi-voluntary unemployment. Consider that there is a given protected-sector wage ($w_p$) and a free-market wage ($w_f$). The protected sector cannot hire all who want to work there, for to do so would mean bidding the market wage up all the way to $w_p$, in which case the dichotomy between the two sectors would cease to exist. With a protected sector of moderate size (compared with the size of the relevant labor market), the normal labor market structure is one in which a significant number of people having supply prices between $w_f$ and $w_p$ were not lucky enough to be employed at $w_p$ but have no interest in working at $w_f$. These are the quasi-voluntary unemployed. In such a situation an expansion in the number of jobs in the protected sector will draw workers in part from the free-market sector and in part from the quasi-voluntary unemployed. The average supply price, and hence private opportunity cost (postulate 2), of those who fill the protected-sector jobs will accordingly be above the free-market wage. Quasi-voluntary unemployment is thus an institutionally induced phenomenon, which curiously entails an opportunity cost of the unemployed that is above rather than below the free-market wage.

If the setting of the protected sector is the urban labor market, and if there is ready migration from rural areas, it is likely that the presence of the protected sector will induce rural-urban migration. This has the effect of driving down the free-market wage and swelling the ranks of the quasi-voluntary unemployed. It is really a case of migration-induced unemployment, as noted early by Lewis (1954) and analyzed in some depth by Harris and Todaro (1970), by myself (Harberger 1971), and by others.

Migration-fed unemployment is the result of the phenomenon of rent seeking, which in turn is easily rationalized in terms of postulates 1 to 3. Wages offered at the destination are above those required to induce migrants to move. The normal workings of an open labor market would entail a fall in wages as increased supplies of workers make themselves available. That is to say, the wage rate itself would serve the function of equilibrating the labor market and in doing so would stem the flow of migration. When wages are maintained at protected levels and are prevented from adjusting, labor market equilibrium is nonetheless brought about in some other way. In the case of migration-fed unemployment, the unemployment rate itself brings it about. One starts with a supply

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3. The protected-nonprotected distinction does not refer, for example, to high-skilled as opposed to low-skilled jobs or to experienced as opposed to inexperienced workers. It refers to workers of identical characteristics and abilities receiving different rewards in essentially identical jobs in two sectors of the same labor market.
price of migration (a wage at destination that would just barely induce the migrant to move). Initially, the wage at destination is above this supply price, and the migration occurs. But as unemployment at the destination mounts, the supply price of migration increases. That is, in the presence of greater unemployment, the same destination wage becomes less attractive, and the incentive to migrate declines. With enough unemployment the tide of migration is stemmed; unemployment at the destination, however, remains high as a continuing equilibrium phenomenon as long as the wage paid at the destination remains above the supply price of migration that would prevail in the absence of unemployment.

I like this particular way of viewing the adjustment process via migration-fed unemployment because it is framed directly in terms of supply prices and demand prices. The demand price is the fixed wage at the destination; the supply price is the wage that would just barely induce (or compensate) migration. As unemployment mounts, this supply price rises, and the adjustment becomes complete when this supply price equals the fixed destination wage.

This demonstrates very simply the usual result: that under conditions of migration-fed unemployment the social opportunity cost of labor will end up being equal to the fixed destination wage. Raising the latter would only increase unemployment until the supply price of migration again equaled the wage. Not only do we reach this result simply, but once again we see the power of the three postulates. The answer is a profound expression of postulate 2. If demand price exceeds supply price and is not allowed to adjust, then something else (here unemployment) will develop so as to bring supply price up to demand price.

Social Opportunity Cost in Nonmarket Situations

Except in the preceding section, I have dealt with a world of market prices—prices that may be distorted by taxes, tariffs, or subsidies, but nonetheless prices that clear the market. Now I turn to cases where this is no longer true—cases of licenses, quotas, arbitrary rationing, and the like. To begin with foreign exchange, consider a country with a fixed exchange rate system that uses licensing rather than monetary policy as the principal mechanism of adjustment. That is to say, export proceeds must be turned over to the exchange authority, which then doles them out among the many applicants. If there is enough foreign exchange to fill all applications at the going exchange rate, the licensing system is redundant and the problem reverts to the cases discussed earlier. But if—as has actually been the case in many countries for long periods—there are far fewer dollars available than are desired, a problem of allocation appears, which the licensing authorities somehow resolve. Characteristically in such cases, the demands for some “essential” imports will be fully met, others not so fully, others partially, and some (the prohibited list) not at all. It is plausible to assume that the tariff structure probably already recognizes this hierarchy, with perhaps zero duties on “essentials,” moderate duties on the next group, and progressively higher ones on the remaining two.

What do the three postulates tell us here? Only for the first group would demand price and supply price be equal to market price. For the other groups the demand price would be above the supply price even if all the desired dollars were made available. Because dollars are not made available, there must be some unsatisfied demanders willing to pay prices well above the world market price plus the tariff. If such demanders
are given incremental dollars, their demand prices should be treated as a measure of the benefit (postulate 1).

The easiest case to deal with is one having an open market for the domestic resale of the licensed items. In this case the appropriate demand price is the one prevailing in that market. The social opportunity cost of foreign exchange will be a weighted average of the market prices of the various categories of imports. The problem is that the weights here are not derived from the structure of demand and supply and from the normal elasticity of response of different items within that structure to changes in the degree of ease or pressure in the foreign exchange market. Instead, the weights stem from the policy decisions of the licensing authorities, which—particularly with respect to items not in the "essential" category—tend to change with great frequency; items "serve sentences" on the prohibited list only until enough political pressure takes them off. In a case where imported goods can be freely resold in the local market, it would be easy to estimate the social opportunity cost of foreign exchange if there is a stable, consistent, and predictable licensing policy. I know of no case, however, where these conditions have been met. If policy is governed by sufficient rationality to do all these things well, it seems highly likely that the authorities would then take the next logical step of following monetary and exchange rate policies that would render the licensing system superfluous.

When there is no open market (either legal or parallel) for the licensed items, the problem becomes one of estimating their value to the users. The principle of measuring the social opportunity cost of foreign exchange remains the same: When the licensing authority gives foreign exchange to a new project, it must come at the expense of other demanders. The opportunity cost is then the value (demand price) that those other demanders would place on the amounts of which they are being deprived. This is obviously impossible even to try to determine, so the estimation of the social opportunity cost of foreign exchange becomes a crude process indeed. The only solid base to work from in this case is that we know that any licensed import is worth at least the world price plus the prevailing tariff to all license applicants, because that is what they will have to pay even if they get the license.

On the side of the social opportunity cost of capital, interest rate ceilings of various kinds are probably the most frequent source of deviation from a market solution. The critical element in these situations is that banks and other financial institutions are sometimes faced with a demand for credit that far exceeds the available funds—especially since the same demanders get in line at many banks. Characteristically, service charges, minimum compensating balances, and other devices appear. They may be powerful enough to produce a market solution—that is, one that involves no arbitrary rationing. In this case one would have to determine the actual total payments by the users of credit in order to estimate their demand price according to postulate 1, but no other serious complications emerge.

Frequently, however, the equivalent of a market solution is not worked out, and banks and other financial institutions are left with a substantial range of discretion. This opens the door to bribery and corruption, which indeed frequently occur. But there are more subtle ways, generally fully or nearly within the law, of doling out credit in these circumstances. For example, when a borrower hires a banker's relative at a good salary, his subsequent loan applications may more readily be approved. Thousands of ruses of this type exist, and given the controlled interest rate, the banker can fairly argue that his choice among alternative solvent borrowers has cost his stockholders nothing. The net
result is that credit is rationed in inefficient ways, and the marginal productivity of capital overall is lower.

To determine the influence of this situation on the social opportunity cost of capital, one must inquire what happens when financial institutions are left with lower lending capacity because some savings have been diverted to finance a new project. No clear answer exists for this case, but the most reasonable assumption is that given the ability of financial institutions to ration funds, their basic behavior patterns will not change significantly. Thus we can say, roughly at least, that in these rationing situations the social opportunity cost of the diverted funds will be greater than the controlled interest rate, and less (because of the inefficiency factor noted above) than the typical gross-of-tax productivity of capital (p in the simplest case) that would prevail in an open capital market.

The above examples show how one can attempt to cope with what I have called nonmarket situations in the measurement of social opportunity cost, using the three basic postulates as a guide.

The Social Rate of Discount

The social rate of discount has been at the center of controversy for many decades. Early debates raged over whether to use the marginal productivity of capital, the market interest rate (usually the government bond rate), or the marginal rate of time preference. These concepts correspond broadly to \( p, i, \) and \( r, \) as presented earlier. The recent discussion has been less simplistic. The major contending views, at least as I see them, all recognize that both \( p \) and \( r, \) when they are different from \( i, \) reflect distortions, and all recognize that when properly taken into account, this fact leads to situations in which social project evaluations yield different results from private ones. In my opinion, the major contending views all are basically compatible with the three basic postulates. The squabbles are not between saints and sinners, but rather among factions within the same church. Their resolution, in consequence, turns on issues of efficiency, relevance, convenience, robustness, communicability, and the like, rather than fundamental error or heresy.

Three approaches to the social discount rate will be treated; they bear a curious sort of triangular relationship to one another. For example, two of them are based on the convention that marginal funds come from the capital market, while the third adopts the alternative convention that they come from fiscal sources. In a different pairing, two of them use weighted averages of \( p \) and \( r \) as the discount rate; the third uses \( r \) alone.

Consider, first, the dichotomy between the view that the funds for public sector projects come from fiscal sources and the alternative view that they come from the capital market. The proponents of fiscal sourcing (Eckstein 1957; Eckstein and Krutilla 1958; Haveman, 1972) argue that most government funds come from fiscal sources and that most of the increment in government funding over time has been, and almost inevitably is, mainly on the fiscal side. In this they are correct. They then proceed to postulate a set of weights, \( f_1 \) and \( f_2, \) reflecting the fractions of an increment of fiscal revenues that come at the expense, respectively, of investment and consumption. Their final formula, a social discount rate equal to \( f_1p + f_2r, \) is identical in form to the one we derived earlier. The only difference is that the weights \( f_1 \) and \( f_2 \) here derive from a hypothetical fiscal experiment rather than a hypothetical capital-market experiment.
As noted earlier, in a functioning capital market we have reason to expect that the reactions to market pressure or ease will on the whole remain quite similar from one case to the next. In particular, we can be sure that just about everywhere the elasticity of investment with respect to market pressure substantially exceeds that of saving. In contrast, experience all over the world suggests that each tax change is very different from the last. The weights \( f_1 \) and \( f_2 \) may bound all over the map, depending on whether one is imposing value added taxes, tightening income tax loopholes, lowering high or prohibitive tariffs to gain more revenue, and so on. To me, it would be perfectly sensible to have a fiscal weighted-average measure of social opportunity cost if, say, the value added tax was the only or principal tax and if changes in the fiscal situation of the governments were met by changing its rates. In that world, I, too, would be a proponent of this position.

But the world we observe shows a whole panoply of fiscal adjustments with little or no predictability about what the next one will be like. I find it impossible to conjure up even a semirealistic mental experiment in which a specified fraction of fiscal revenues typically comes at the expense of consumption, with its complement coming at the expense of investment. In contrast, it is natural for these fractions to be relatively stable for dollars drawn from the capital market. Because of the relative stability of the weighting structure, this argues in favor of the convention that the marginal source is the capital market.

Of course, a stable weighting structure would not mean much if the idea of the capital market as the marginal source of funds did not make sense. But in fact, on a day-to-day, month-to-month, and even year-end-to-year-end basis, the capital market is in most countries the marginal source of funds. Most government budgets, even on the day they are first presented, contemplate the borrowing of some funds. In addition, as actual events produce deficits greater than planned, governments almost always turn to the capital market for the difference. When the future smiles and deficits are smaller than expected, the extra money is in effect returned to the capital market. In sum, the capital market is the marginal source when funds are short and the depository for marginal funds when they are abundant.

Another advantage of adopting the convention of treating the capital market as the source of funds at the margin is that one can readily adapt it to incorporate capital funds from abroad. the weighted average would now be \( f_1 p + f_2 r + f_3 MC_f \), where \( f_1 + f_2 + f_3 = 1 \) and where \( MC_f \) is the estimated marginal cost of foreign funds. One should employ here the marginal cost of foreign funds because of the presumption that the supply curve of such funds is not infinitely elastic. With an upward sloping curve, the marginal cost of funds will exceed the average cost. This is an obvious consideration in calculating the social opportunity cost of capital.

Thus the arguments for building the calculation of the social opportunity cost of capital on a capital-market sourcing model are that (1) the weights are relatively stable, (2) the capital market is the de facto marginal source and destination of funds in the short and middle run, and (3) the calculation is readily adaptable to incorporating sourcing from the world capital market.

4. The textbook formula is \( MC = AC(1+(1/\varepsilon)) \), where \( AC \) is average cost and \( \varepsilon \) is the price elasticity of the average cost curve—in this case the upward rising supply curve (of foreign funds) facing the country in question.
Having elected to hold with a capital-market sourcing convention, let us consider the relative merits of using the social opportunity cost of capital \((f_1p + f_2r)\), on the one hand, or the marginal rate of time preference \((r)\), on the other, as the discount rate in social cost-benefit analysis.

The best starting point is to realize that modern defenders of the use of \(r\) as the rate of discount (Dasgupta, Marglin, and Sen 1972; Feldstein 1972; Squire and van der Tak 1972) do not neglect the existence of the distortions taken into account in the discount rate by proponents of the weighted-average approach (Baumol 1968; Bruce 1985; Sandmo 1976; Sandmo and Dreze 1971; Sjaastad and Wisecarver 1977). Instead of being reflected in the discount rate, these same distortions show up in the “shadow price of investable funds” in the case where \(r\) is used for discounting. The procedure is as follows. Assume that one dollar is extracted from the capital market. A fraction \(f_1\) of this comes from displaced investment, which in turn would have generated future income at the rate of \(p\) per year. The complementary fraction \(f_2\) comes from newly stimulated saving, the supply price of which is \(r\) per year. There is therefore an annual opportunity cost of \(f_1p + f_2r\) for each year in the future as a consequence of withdrawing one dollar this year from the market. This future flow of opportunity costs, discounted back to the present at the rate \(r\), has a present value of \((f_1p + f_2r)/r\). This is the shadow price of investable funds for those who use \(r\) as the discount rate.

If \(p = 12\) percent and \(r = 4\) percent, with \(f_1 = 0.75\) and \(f_2 = 0.25\), we would have a weighted-average opportunity cost of capital of \((0.75)(12\%) + (0.25)(4\%) = 10\%\). This is what the weighted-average advocates would use for discounting. In doing so, their investment criterion would be that the discounted value of benefits should exceed the discounted value of costs.

In contrast, the advocates of discounting by the marginal rate of time preference \((r)\) would use 4 percent as the discount rate, but would require that the present value of benefits be more than 2.5 times the capital costs of the project. The factor 2.5 is exactly \((f_1p + f_2r)/r\); discounted at 4 percent, this is the present value of what is given up for every dollar withdrawn from the capital market.

If the two sets of criteria (10 percent discount rate requiring that benefits exceed costs, and 4 percent discount rate requiring that benefits exceed 2.5 times costs) were properly implemented, I do not believe there would be many serious contradictions in their implications for longer-term investment projects. However, I have never had any doubt about preferring the first approach. Three grounds for this preference are: communicability of the procedure, implications with respect to current expenditures, and implications for handling situations with different rates of time preference for various groups.

With respect to the first, I have always believed that the most basic function of project evaluation was to shoot down the worst projects. Unfortunately, most of the worst projects have strong supporters, usually within and outside government. To my mind, the project evaluation team weakens its position if it adopts a criterion that requires benefits to be, say, 2.5 times costs.\(^5\) It is hard to beat down a project with the argument that its benefits are only twice its costs, and that this is not enough!

\(^5\) To be sure, within the context of the methodology, the factor 2.5 is necessary to adequately reflect the present value of the future costs entailed in borrowing. Once this factor is used as a shadow price to multiply capital costs, the correct rule is that benefits should simply exceed costs,
With respect to the second point, I have always been greatly impressed by a powerful argument raised by Sjaastad and Wisecarver (1977) in a paper that merits the most serious attention. Once the capital market is accepted as the marginal source of funds, it should be recognized as such not only for capital outlays, but also for current spending. Most particularly, any money saved through greater efficiency in the police force or in the schools can be used to pay off debt; used in this way, it will (in our numerical example) produce a benefit equal to $2.5$ times its nominal amount. The logic of the case presses one ineluctably to the conclusion that for current outlays as well, the critical ratio of benefits to costs should be $2.5$. In short, the factor \( \frac{f_1 p + f_2 r}{r} \) represents the social value of one dollar of liquid funds, either taken from or placed in the capital market. Any funds sourced in the capital market will have a shadow price of $2.5$ per dollar, in our numerical example. Also since the capital market is being taken as the marginal source of funds (as in truth it really is, in most cases), the $2.5$ factor should apply to all cash costs across the board. Cutting out any cash outlays—either current or capital—would likewise permit achievement of benefits at the ratio of $2.5$ to $1$. A powerful and persuasive argument, to which I have yet to see a convincing rebuttal!

The third reason for preferring the weighted-average discount rate to the marginal rate of time preference is my own (in the sense of my not having encountered it in other writings or discussions). To my mind, the weighted-average discount rate moves naturally from the simple \( f_1 p + f_2 r \) to the more disaggregated \( \sum f_j + \sum r_k \). In each case the \( p_j \) are the demand prices of displaced investments and the \( r_k \) are the supply prices of newly stimulated savings. A project undertaken today must be able to repay the cost of its assets and to cover these demand and supply prices; otherwise it has not paid its way. There is nothing in the weighted-average approach that insists there be only one \( r \), and the existence of any number of different \( r_k \) presents no conceptual difficulty or embarrassment.

Contrast this with the use of \( r \) as the discount rate. Its justification stems from the standard treatment of intertemporal consumption decisions in economic theory—the rate of return to the saver, after all taxes, is the rate that he uses in deciding on his savings. The weighted-average approach builds on this also, but the time preference advocates turn this into the cornerstone of their discounting procedure, on the ground that it is by using \( r \), not \( p \) or \( i \), that consumers make their intertemporal choices. Here is where I encounter difficulties in passing from a case in which there is a single \( r \) (a single uniform tax rate separating \( i \) and \( r \) for all consumers) to one in which there are two or more \( r_k \) for different groups (for example, two or more marginal tax rates). If \( r \) is used as the discount rate because it is the fundamental guidepost for consumers as they make their intertemporal consumption decisions, then when various consumer groups use different rates, it would seem that each group’s benefits should be discounted at its own rate.

To my knowledge, none of the advocates of using \( r \) as the discount rate has broached this problem—I merely say it is a problem that flows naturally from the conceptual basis of the time preference approach. The underlying problem is that when there are different rates of discount for various groups, postulate 3 needs tighter specification. Suppose

so adjusted. But nonprofessionals will still wonder about projects being rejected simply because the present value of their benefits is only $1.5$ or $2$ times actual capital outlays, and powerful forces behind bad projects would surely use such circumstances to convince the public and the relevant authorities that the projects were in fact quite good.
groups A and B have different \( r_k \)'s, and suppose there are two projects (say, parks), each of which gives to one of the groups a certain path of in-kind benefits through time. Let these benefit paths be identical for the two groups. If we simply subtract one benefit profile from the other, year by year, the difference is zero each year. But if we discount future benefits back to the present, the group with the lower discount rate (presumably the wealthier of the two) will have a higher present value of benefits. Also, if we accumulate the benefits forward to some future time, measured as of that point in time, the group with the higher discount rate will have the higher present value of benefits. So by subtracting the benefits of A from the benefits of B year by year, we perceive no difference; by discounting to the present, we find group A with greater benefits; by accumulating to the future we find group B with greater benefits. (There seems to be no good reason to treat costs differently in the two cases, as they are supposed to follow identical time paths.) All this runs counter to the standard proposition of capital theory and project evaluation that the ranking of projects should not depend on the point in time to which benefits and costs are discounted or accumulated; it matters only that the projects be evaluated as of the same point in time. This proposition is always true if a single rate is used for discounting and accumulating—even when that rate varies from one year to the next. But it obviously is not true with rates applying to groups of economic agents.

Actually, those who propose using time preference discount rates always work with a single rate, which avoids the ambiguity just referred to. I concur and suggest that in social project evaluation, postulate 3 should apply within the year, canceling costs against benefits as they occur, and that a single discount rate (possibly varying from year to year) should be used to carry net benefits or costs from one time period to the next. To my mind, the weighted-average social opportunity cost of capital \( Z = \frac{\sum_j p_j \eta_j + \sum_k f_k r_k}{\sum_j p_j + \sum_k f_k} \) is ideally suited to this role. For the reasons already expounded, a time preference rate is not.

Concepts versus Numbers

Practitioners whose main experience is in the field, together with others who function daily in the world of affairs, may wonder at the level of precision that has characterized most of the discussion so far: demand prices, supply prices, distortions, and weights based on elasticities that are impossible to observe directly and virtually impossible to estimate exhaustively (that is, it is impossible to estimate all the items necessary to construct a system of elasticity-based weights). We have weights that depend on saving and investment behavior, for which econometric explanation is still a matter of controversy even in advanced countries. We have weights that depend on the responsiveness of individual classes of exports and imports to the tightening and easing

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6. I am assuming that there are different groups with different values of \( r_k \). The weighted-average social opportunity cost has a precise meaning—the amount needed to compensate all losers when money is drawn from the capital market. Using as the discount rate a weighted average of just the \( r_k \)'s will do the trick in a mechanical sense—that is, it will eliminate the ambiguity of working with separate \( r_k \)'s—but no clear concept lies behind such a weighted average covering only marginal rates of time preference.
of general pressure on the exchange market, items that to my knowledge have not been estimated at all. 7

What then do people actually do? In point of fact, most of the time they use extremely crude estimates based on readily available data. The simplest measure of the social opportunity cost of foreign exchange is the market exchange rate augmented by the so-called force of tariff—the ratio of actual tariff receipts to the c.i.f. value of imports. This measure (1) neglects the export side altogether, (2) makes no attempt to distinguish between import categories that are especially sensitive and those that are especially insensitive to changes in the real exchange rate, and (3) completely ignores the possibility that important distortions (such as petroleum and gasoline taxes) that do not fall directly on trade may nonetheless have a measurable effect on the social opportunity cost of foreign exchange.

The great benefit of having a conceptual framework is not only that it helps us think through problems in a clear way. It also tells us how to try to improve on estimates and measures that are extremely crude and approximate. Starting with a force-of-tariff first approximation, the steps we must take are those suggested by points 1-3 above. First, we must ask whether exports belong in the weighted average. If the exchange policy is one of simply doling out by licenses whatever foreign exchange comes in, it may well be that no export adjustment should be made. But if market forces determine the real exchange rate to a substantial degree, then one should try to infer how elastic is the response to exchange rate pressure of different categories of exports, and to determine what distortions (such as taxes and subsidies) are relevant for each major category. At the very least, a broad “average distortion” for all exports taken together (for example, the ratio of export taxes or subsidies to their total f.o.b. value) can be estimated and introduced along with the force of tariff to produce a weighted-average estimate (including exports) of the social opportunity cost of foreign exchange.

Second, to break down imports into categories that have different relative sensitivities to changes in the real exchange rate, the practical procedure is to start, with simply a value-weighted average of all tariffs. (If exports are not in the picture this actually yields the force-of-tariff ratio.) Then one classifies the categories into those that are judged to be, say, very sensitive, somewhat sensitive, average, somewhat insensitive, or very insensitive to changes in the real exchange rate. Having done so, one adjusts the weights accordingly—doubling or tripling, say, the weight attached to the very sensitive group and perhaps cutting by one-half or two-thirds the weight attached to the most insensitive

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7. In deriving the relevant weights in the foreign exchange case, the origin of the pressure is conceived of as additional purchases of foreign exchange in the market. These purchases raise the real exchange rate either because of the flexibility of the nominal rate or because of the natural workings of the adjustment process under a fixed exchange rate. If the real exchange rate is denominated by \( e \), the derivatives that are relevant for constructing the weights \( f_t \) and \( f_k \) are \( M_t / \delta e \) and \( \delta x_k / \delta e \). For example, \( f_1 \) would be equal to \( -(M_1 / \delta e) - (M_1 / \delta e) / (\delta x_1 / \delta e) \) and \( f_k \) would be \( \delta x_k / \delta e \) divided by the same denominator. \( M_1 / \delta e \) is typically negative when \( e \) is defined, as it is here, as the local-currency price of, say, the dollar.) In short, we are asking how each item in the foreign exchange market responds to the general pressure of a tightening of the real exchange rate. This is not the same thing as how each item responds to a change in its own price or to an increase in pressure in just its own market.
group. Any category subject to a quota that is unlikely to change but likely to be continually effective would receive a zero weight, because these imports, even though they may be quite important, are neither displaced when the real exchange rate tightens, nor do they expand when it eases. A similar treatment can then be applied to exports. Obviously, throughout the process of adjusting weights, take care not to alter their sum.

The third step of adjusting the social opportunity cost of foreign exchange for internal distortions is relatively easy. If, say, the country produces no petroleum, then the petroleum and gasoline taxes imposed internally function in the same way as tariff surcharges—one simply combines them with the tariff to get a picture of the total government revenue generated by each dollar of petroleum imports. In case there is domestic production of a good (such as alcoholic beverages) that is subject to excise tax, an increase in the real exchange rate will give rise to some substitution toward the domestic product, hence the government's loss in excise taxes will be some fraction of what one would predict on the basis of the reduction in imports.

The basic conceptual framework also guides us as we struggle to come up with empirical estimates of the social opportunity cost of capital. The fact that the concepts are framed in real terms suggests beginning with direct, rather than indirect, measures of the real return to capital. Rates of total return, including real capital gains, in financial markets (especially stock markets) are notoriously volatile and subject to the vagaries of transitory swings in expectations. Much more steady and reliable are measures of the national or sectoral rate of return, based on estimates of the real capital stock (usually built up via a perpetual-inventory process) together with data on the real returns accruing each year to the capital factor. Considerations of differential taxation suggest distinguishing where possible between predominantly corporate and predominantly noncorporate sectors, and singling out those with special tax treatment, such as housing, mining (at times), and agriculture (frequently).

The underlying concept is one in which the government draws its marginal funds from the capital market. In most countries, this probably means that there is no systematic mechanism by which one government project derives part of its funds by displacing other investments throughout the public sector. One project may indeed displace another—even in its entirety—but such displacement is likely to be unique for each project, not systematic and similar for all classes of public projects.

Consequently, when we try to estimate \( p \), the marginal productivity of displaced investment, we probably should try to measure what I call the social rate of return to private sector capital. We can look at the case where government project A in fact displaces government project B then as a combination of two modules: one in which project A is undertaken and is financed by resort to the capital market; the other in which project B is canceled and its funds returned to the capital market.

Some countries have only rudimentary capital markets, often pretty much limited to the banking system itself. In such cases, government's resort to the capital market usually means that a roughly equivalent amount of credit is crowded out of the private sector. Therefore the first approximation of the marginal productivity of displaced investment should be the real social rate of return to capital by those segments of the private sector that are the typical recipients of bank credit. Where monetary policy does not permit government borrowing from the banking system to crowd out enough investment, the typical result is that part or all of the government's borrowing gets reflected in inflation. It is then likely that a significant part of the government's outlays will in the end come at
the expense of consumption. Inflation processes are exceedingly complex, however, with institutional arrangements (such as indexing) varying widely among countries. In an inflationary environment, therefore, analysts should probably treat the weights such as $f_1$ and $f_k$ as a problem to be solved separately for each country.

With respect to the labor market—perhaps the most vexing case of all—the underlying concepts are essential guideposts to those who undertake the difficult task of empirical estimation. From the very outset, the concepts tell us to seek the ultimate pattern of sourcing from which an increment to labor demand is filled—and not to take too seriously the provenance of the particular workers hired by a new project. They may be lured away from other employers; they may quit a job because the project is near their home or otherwise appealing; or they may be picked up by the project during a temporary spell of unemployment. This direct sourcing pattern may be next to meaningless: If they left another job, the likelihood is they will be replaced; if they were unemployed, they would probably soon have found some other job.

At the other extreme, the concepts warn us away from a demographic-historical approach that considers the ultimate sources of new labor supply to be natural increase, migration into the region, and changes in the rate of labor force participation. The problem with this approach is that most of such changes would have taken place regardless of the presence or the absence of any particular project. What we are seeking is the chain of causation by which the presence of a particular project draws labor (directly and indirectly) from where it would have been (in equilibrium) in the absence of the project. In short, we must think about sourcing in economic rather than demographic-historical terms.

To think in economic terms means to think about markets—in this case the market for the particular type and class of labor involved. One must determine whether the market is a national or a regional one and, if the latter, to what degree migration will likely meet increments of demand. One must try to identify the structure of the market and the characteristics of its supply and demand. For highly specialized and highly skilled jobs, the likelihood is that the bulk of any new demand will be met by bidding workers away from other employers. For relatively unskilled, undifferentiated tasks, the existing pool of those who hold such jobs has little significance—new taxi drivers, hotel maids, or grocery clerks can come from anywhere.

By fortunate coincidence, dealing with the social opportunity cost of labor is simplified by the fact that most labor market distortions (such as payroll taxes and income taxes) are relatively modest in size (at least compared with many tariffs and with some taxes on the income from capital) and also rather widespread through the labor force. Perhaps the biggest distortions in developing countries are those between the most highly protected sectors (typically multinationals) and the rest of the economy. But this creates relatively little difficulty because we can be sure that the other sectors do not obtain any net labor from the most protected ones. If a worker leaves a highly protected sector, a long list of candidates is always waiting to replace him. The highly protected sector's wage enters the calculation of social opportunity cost only when the new jobs being created are actually in that sector. In such a case the protected-sector wage enters as the upper limit to the supply price of the quasi-voluntary unemployed.

Similarly, although the problem of determining empirically the social opportunity cost of the unemployed in a cyclical setting poses challenging conundrums to the analyst,
Reflections on Social Project Evaluation

it is of relatively minor importance in real-world project evaluations.\(^8\) The reason is that, most of the time, project evaluations are forward-looking operations. The project being evaluated may not even start until two or three years later, and its economic life may then stretch for ten or twenty or even fifty years. Whether or not cyclical unemployment is currently observed, the best prediction for future years is that the situation will be "normal" or "average." As far as I can see, the issue of the social opportunity cost of labor in a setting of cyclical unemployment comes up largely with respect to programs (perhaps of temporary job creation) specifically designed to deal with the unemployment situation. In this context, there will be a relatively rapid absorption of the unemployed, with a duration roughly commensurate to the recession under way. The typical longer-term investment project simply does not fit into this context.

With respect to chronic unemployment, the two varieties discussed were: quasi-voluntary unemployment linked to the presence of protected sectors, and migration-fed unemployment. Neither of these, in my view, presents conceptual or measurement problems of a serious nature.

Distributional Weights and Basic Needs

At the outset I want to re-emphasize that all three basic postulates form the roots of the grand tradition of applied welfare economics; all three are needed to produce the series of classic results recounted at the beginning of this paper; all three have been employed by a long lineage of great economists. Nonetheless, it is the third postulate that comes into question most often and has raised doubts among some thoughtful people—economists and noneconomists alike. The purpose of this section is to address such doubts and to discuss some of the issues surrounding them.

Let me begin at the end. The great economists who have employed the three postulates have been neither naive nor crass. From their writings one can readily discern that they do not believe that the postulates and their implications are all that count. Each society has its own values, and each has many important objectives apart from economic efficiency. No one, to my knowledge, has argued that the three postulates should overthrow society's values or should supplant important noneconomic objectives. But the three postulates do provide a disciplined, coherent framework for thinking through the economic aspects of a wide range of problems. The appropriate analogy is with accounting—another example of a complex structure of analysis and consequences that rests ultimately on a few fundamental postulates. Accounting tells how to calculate net profit and net worth (wealth). It does not attempt to do the absurd by saying that profits and wealth should never be compromised or sacrificed for other objectives. Accountants know and recognize this. So do economists when it comes to considering the consequences and implications of the three basic postulates in comparison with other objectives.

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8. The principal problem here is to determine what supply price of labor to use. Labor supply, particularly of adult males, is known to be extremely inelastic in most countries, yet in repeated surveys the unemployed state their supply price close to the going wage for their age-education-experience category in their own labor market; that is, the stated supply price takes on the attribute of the expected demand price in the market. The question is: To what extent should we accept such statements of supply price at face value, thus attributing little gain in utility to the unemployed person when he or she finds a job?
One must be careful here, however. Traditional accounting, although far from revealing the meaning of life, is important enough in many different contexts to be taken seriously. Also part of accountants' role is to call the attention of others to the relevance and usefulness of their discipline. So, it seems to me, it is (or should be) with applied welfare economics. It is significant and relevant for many matters of interest to society. It gives a disciplined and structured response to important questions. It embodies some of society's values, but not all. And in many, even most, cases its results are not incompatible with society's other values. In my view, part of the role of economists is to present the answers given by applied welfare economics to the problems at hand, as the particular contribution of the economics profession to society's decisionmaking process. If economists do not present what economics as a discipline has to contribute, who else will?

The approach just described is modest, in the sense that it makes no excessive claims for the postulates and does not try to graft onto them other objectives that might expand their scope. A significant strand of literature, however, follows a different line, specifically with respect to the distribution of benefits and costs. This literature explores the use, within applied welfare economics, of distributional weights. Use of such weights entails multiplying the net gains or net losses of particular groups by specific factors—higher for groups whose welfare is deemed more meritorious, lower for those whose welfare is less prized (presumably by society as a whole). In principle, welfare weights could be classified according to any criteria—ethnic or national origin (Malaysians and Chinese in Malaysia), educational or class background (untouchables in India), type of economic activity (independent farmers and farm laborers in many countries), and so on. But most of the literature has focused on discussing income or wealth as the criterion and has typically assumed that the welfare weights are a declining function of the criterion variable.

Several authors have rigorously applied such declining weights, particularly to deal with the problem of the optimal choice of an income tax schedule (Atkinson 1970; Atkinson and Stiglitz 1976, 1980; Diamond and Mirrlees 1970; Dixit and Sandmo 1977; Mirrlees 1971, 1979). A few attempts have been made to incorporate distributional weights in actual project evaluations. Most of these have been flawed by the application of the weights to the changes in income of the various groups, rather than to the changes in surplus (net benefit or cost). All the logic of distributional weights leads to the use of change in consumer and producer surplus as the base to which to apply the distributional weight. An increase in labor along an infinitely elastic supply curve, for example, implies no increase in welfare to the suppliers; hence there is no relevant base to which to apply the group's distributional weight.

After giving considerable thought to the problem, over almost a decade, I have come to the conclusion that systems of distributional weights do not adequately represent the way citizens feel about redistribution efforts channeled through the public sector. Instead, I believe that a system of "basic needs externalities" reflects people's values and beliefs much better than distributional weights (Harberger 1984). Basic needs externalities are based on the idea that citizens and taxpayers look for specific and concrete results when public funds are channeled into helping others. They want to see the recipients turn out to be better educated, better cared for medically, better fed, and better housed. In short, citizens and taxpayers are not interested in having their money used simply to gratify the recipients; they want to see it used to advance the welfare of
the recipients as they (the donors) perceive that welfare. This helps explain why the most universally popular government transfer programs have entailed transfers in kind rather than in cash, as in the case of universal free primary education and free or heavily subsidized medical care for the indigent. It also explains why public support has been weak for programs in which transfers in kind can be converted into cash with relative ease. Subsidized food, or the food stamps with which to acquire it, can be resold; subsidized housing, with space judged to be "adequate," may quickly become overcrowded by an inundation of "cousins." In such cases the recipients are maximizing their own welfare by transforming their in-kind transfer into cash, but the donors are unhappy because their purpose (improving the welfare of recipients as the donors perceive it) has not been served.

This and much other behavior, as well as many other opinions and attitudes on the part of citizens and taxpayers, can be rationalized in terms of basic needs externalities. Citizens, the argument goes, are concerned enough to have their money spent to ensure better education, medical care, nutrition, and housing for the less fortunate members of society. But donors are not interested in seeing their money go toward financing more elegant dowries for brides, more elaborate funeral ceremonies for grandparents, or more frequent return trips of workers to their native villages. Even if these are the things the recipients prefer, they give rise to no external benefit as perceived by the donor, hence donors (taxpayers) do not want to see their money used directly or filtered indirectly to pay for such items.

Elsewhere I have suggested ways of getting crude quantifications of the basic needs externality for such needs as education, medical care, and nutrition (Harberger 1984). These quantifications are justified by the existence of a basic needs externality, but they are also influenced by a modified version of the least-cost principle. The least-cost principle tells us not to accept any project (or other action) if a cheaper way of achieving the same or equivalent benefits can be found. This dictum needs to be modified, at least for basic needs externalities, because in most countries an almost infinite number of situations exist in which equivalent benefits from basic needs externalities might be found. The modified least-cost principle, then, states that the costs society is willing to incur to meet a basic need should vary inversely with the intensity or urgency of that need. For example, we would typically be willing to incur a greater cost to bring a given group from 85 to 90 percent of some nutritional or health standard, than to bring a similar group from 95 to 100 percent of that standard. Similarly, poor countries can attempt to subsidize only the earlier stages of education for broad groups of the population; the higher the level, the more selective the criteria must be.

In line with this modification principle, the project authority could set, for each basic need, a cutoff level above which no basic needs externality is deemed to exist. Moreover, since the externality in the end turns out to be a justification for society to pay some or all of the bill, it is important that the income or standard of living of the recipient households enter into defining the cutoff level. For most developing countries, for example, it does not make sense for society to subsidize the diets of the top 50 or 60 percent of the population. Cutoff levels for the attribution of any basic needs externality would presumably vary with the type of need. They might be set at the 75th percentile of the income distribution for primary education, at the 40th for secondary education, and at the 25th for higher education. For basic medical care, they might be at the 60th percentile, while for housing only at the 20th. For society to attribute a basic needs
externality, in the terms in which we are speaking, it must be willing and able to bear part or all of the cost.

In addition to establishing a cutoff point for each externality, the modified least-cost principle would define a maximum externality (as a percentage of the normal cost of providing the service in question) that society is willing to attribute, even in urgent cases. The reason is similar to the one that motivated the original version of the least-cost principle. If we attribute a maximum externality of 100 percent of normal costs in cases of very low nutrition levels, we can be sure that, as a result, society will pay double the normal cost at least some of the time to meet the need in question. The logic of cost-benefit analysis is simple and ineluctable. If the normal cost of meeting a given (say, nutritional) need is 10 per unit, and if we attribute a 100 percent externality to meeting that basic need, in two plausible extreme cases that externality would cause the acceptance of a project that would otherwise be rejected. At one extreme is the case in which there are no benefits of the usual type—the externality is the only benefit. In such a case the project would be accepted if its costs were less than or equal to the usual 10 per unit. At the other extreme is the case in which the usual type of benefit is equal to 10 per unit; here the existence of the externality will render a project acceptable if costs range up to 20 per unit. In both cases society ends up paying a cost of up to 10 per unit as the "price" for meeting the basic need in question.

Could not cheaper ways of meeting this or an equivalent basic need be found? Almost certainly so, and the surest way to bring about a search is to disallow the attribution of externalities as large as 100 percent in the first place. When we attribute a given externality as a benefit, we say in effect that it is worthwhile to incur a corresponding amount of costs in order to produce that benefit. Without a systematic process of searching for alternative, cheaper ways of obtaining given amounts of benefits, the attribution of an externality is an invitation to incur up to that amount of extra costs so as to achieve the external effect.

The modified least-cost principle embodies the idea that society is willing to accept the risk of inefficiency in the most urgent cases, such as famine, starvation, and pestilence. But the willingness to accept this risk declines as the basic need becomes less urgent, until—at the cutoff point—society simply refuses to attribute any externality and thereby refuses to invite the conscious acceptance of extra or higher costs.

The practical implementation of the schema just described can be made very simple. The budget bureau, the finance or planning ministry, the project evaluation office, or even the national cabinet would decide that for, say, the lowest percentile of households it would assign a basic needs externality of 30 percent of the normal cost of additional nutrients. This percentage would decline to zero at the 40th percentile of households (the cutoff point). Thirty percent, in this case the maximum allowable externality, is also the maximum amount of excess cost that the procedure would permit. Society would be accepting some inefficiency (by standard criteria) for meeting basic needs. But this acceptance would be tempered by placing explicit and conscious limits on the extra costs to be incurred on this account.

Although the use of distributional weights by definition entails the rejection of postulate 3, the attribution of basic needs externalities is fully compatible with it. The positive externality involved in improving the education, health, nutrition, and housing of the disadvantaged takes its place alongside other externalities, such as air and water pollution and traffic congestion. All these, like basic needs externalities, have the
attributes of public goods (or public "bads"), but all can easily fit as positive or negative distortions into the framework of $\Sigma_i D_i \Delta X_i$.

Once this is recognized, it helps solve what many people consider a troublesome conundrum. As shown above, when the relevant group has an infinitely elastic supply of labor, no distributional weight benefit can be attributed, even when the employment of low-income workers expands dramatically at the given supply price. This bothers many people, who firmly believe there should be a social gain. The answer is clear: The people who are troubled by the no-benefit result do not think in terms of distributional weights. Their intuition, it seems to me, runs more along the lines of basic needs externalities. A rise in employment—even along an infinitely elastic curve, and either through increases in numbers employed or in hours worked per person—will increase the cash income of the affected families. These added funds, in turn, will almost certainly be spent in meeting at least some additional basic needs. When we value these increments of welfare as externalities using $\Sigma_i D_i \Delta X_i$, we find that the added employment did indeed bring a social benefit. The basic needs approach thus solves the conundrum.

Epilogue

I have tried in the preceding pages to outline an approach to social project evaluation that is conceptually sound, simple, and deeply rooted in the grand tradition of economic science. This approach depicts what economic science has to say or to offer in the area of cost-benefit analysis as society struggles with the many difficult choices it faces.

In the process I have recognized several times that it is an austere analytical structure that emerges when we build on the three basic postulates. No more than the accountant's rules does that structure reveal the fundamental purpose and meaning of life or the ultimate values that a particular society ought to treasure or to seek.

These things are the source of vast amounts of misunderstanding and confusion. Neither economics as a science in general nor the three basic postulates in particular tell us that individuals and societies should seek to maximize their incomes. Economics postulates that individuals and families seek to maximize their own welfare (as they perceive it), including the various ways—such as basic needs externalities—in which the welfare of others impinges on their own. This welfare-seeking behavior by each individual economic unit forms the foundation stone of the three basic postulates. These, in turn, give rise to an analytical structure that extends to society as a whole a procedure for weighing social benefits against costs, one that is compatible with welfare seeking at the level of the individual unit.

The resulting structure is austere. It does not answer all questions. It does not incorporate all society's values. It does, however, incorporate the value of economic efficiency in the sense of trying to maximize perceived welfare—not income. One important question for doubters to ask themselves is: How many of society's other goals and values are really antagonistic to economic efficiency? I, and the whole tradition of economic science, see relatively little problem of incompatibility. But there may be some incompatibility nonetheless, as when a society chooses to favor certain groups (such as disadvantaged minorities) in ways that may not fit neatly as basic needs externalities under the three postulates.

Even in such cases economic science can help us reach an answer. For at the very core of economics is the notion that when we are striving after two or more good ends, but
reality tells us that we cannot have more of all of them, we should be prepared to
sacrifice something of one to get more of another. This is the most fundamental of
economic principles. It tells us that in the presence of multiple social goals we should first
strive to seek compatibility between those goals and economic efficiency; but if there
remains some incompatibility, we should be prepared to make at least a minimal sacrifice
of economic goals to gain advances toward other important ends.

But I still remain a defender and champion of the three postulates and of the
traditions of economic science that they represent. So far, I have mainly used the same
terms as the philosophical doubters. In their discussions, the other values that vie with
economic efficiency are somehow deemed almost always to be good values, with high
ethical and moral connotations. Almost always they are values that carry us to a world
that is somehow better than the one we reach using the three basic postulates.

What I see, however, and what I believe was seen by most representatives of the great
tradition of applied welfare economics in the past, is a world in which good and evil exist
side by side, and pervasively. The noneconomic goals pursued in the real world are not
all based on the high principles of ethics and philosophy. Many, far too many, reflect the
darker side of human nature.

One important noneconomic goal in most countries—at the very least it is a goal to
which the three postulates have been able to contribute only little—is national defense.
This is a perfect example of what I mean, for under the label of national defense we have
seen things that run the full gamut from the most honorable to the most vile. Those who
struggle nobly against aggression and oppression argue their cause in terms of the value
of national defense. Those who perpetrate these very acts of aggression argue their own
cause by using the same vocabulary.

Almost by its very nature, social project evaluation is enmeshed in the structure and
processes of government. Most often it is public sector projects being analyzed—the
analysis done by one public agency, the approval of another required, and the
implementation done by a third.

When we speak then of noneconomic goals, let us not forget the many projects that
have been carried out just to satisfy the caprice or whim of some powerful figure or clan.
Let us not forget the corruption that pervades the decisionmaking and contracting
process in many parts of the world. Furthermore, even when these elements are not
present, let us not forget how project choice gets intertwined with the political process
almost everywhere: How the granting and withholding of projects are used to reward
political supporters and to punish enemies, and how in electoral situations governments
tend to distribute projects with the purpose of winning over constituencies that may be
doubtful or wavering.

All kinds of objectives compete with the three postulates, and I have no doubt that, in
the final analysis, the less than noble motives enter with greater frequency and
importance than the lofty ones. Viewed in this light, the three basic postulates provide a
way of insulating the methodology of social project evaluation from the banal, crass,
even vile pressures just alluded to. They lead to the sort of professionalism discussed in
the introduction to this essay. Just like the principles of accounting, the methodology
based on the three postulates enables one group of project evaluators to review or
"audit" the world of another. The methodology itself should always lead to the same
answers; the only serious problems lie in estimating and quantifying future costs and
benefits. This aspect is what makes it possible to think of a "professionalized" discipline
of social project evaluation in spite of the many human failings that characterize the environment of making and executing project decisions. I believe, too, that the development of a rigorous professionalized discipline provides the best hope for improving actual performance and gradually overcoming the institutional weaknesses and personal temptations that have blemished records from the past.

References


Project Evaluation for the Next Decade

Arnold Harberger

As the Economic Development Institute (EDI) strives, once again, to give greater weight to project evaluation among its many activities, it is only appropriate to take a fresh look at the subject to identify those aspects likely to be most relevant and important in the years immediately ahead.

In my view, a lot has happened since the field of project evaluation first came to full flower in the 1960s. Most importantly, the world has changed dramatically, both in terms of the types of policies pursued and in terms of the way in which economic policymakers tend to define their tasks.

At the time of the blooming of project evaluation as a field (or subdiscipline) of economics, the most common attitude of developing countries was that they had to plan, guide, and direct their economies. Development planning was the watchword; input-output matrices provided the data needed for wise, long-run decisionmaking; tariffs, quotas, prohibitions, license requirements, multiple processes of authorization and approval—all these were the tools by which the authorities sought to channel, guide, and direct development of their countries.

The consequence of this type of attitude and this sort of approach to the development process was a situation in which it was common for market prices to be greatly distorted. That was a world in which an import tariff of 40 or 50 percent was thought of as low, while tariffs of 80 and 100 and even 200 percent were common. On top of tariffs, countries maintained long lists of prohibited imports—lists that, much to the consternation of project evaluators, they were constantly changing. Moreover, access to the foreign exchange market was typically not free and gave rise to parallel gray and black markets, with exchange premiums that sometimes were expressed in multiples rather than percentages.

Capital markets, too, were full of distortions. Rarely were banks free to compete among themselves to attract deposits by paying depositors a competitive rate of interest. Instead, interest on demand deposits was often prohibited by law or at the very least kept close to zero, while interest on time and savings deposits was also held far below what would be its competitive level. In countries with significant inflation the interest rates received by depositors were almost invariably negative in real terms, sometimes to the point of virtual confiscation.

Moreover, with or without inflation present, there were also huge implicit subsidies to certain classes of borrowers. Sometimes the central bank itself gave subsidized credits.
sometimes it was other public sector banks, (for example, development banks), and sometimes it was the commercial banks themselves (operating under legislative mandates or under directives from the government or the central bank).

Then there was the tax system. With few exceptions the system of corporation income taxation was modeled after those of the industrial countries, and gave rise, in principle, to a situation in which the marginal product of capital was higher in the corporate than in the noncorporate sector. But this broad tendency was often obscured by so-called tax incentives, which gave preferential treatments of various kinds to favored classes of investment. In a number of countries, the accumulation of tax incentives over the years created a mare's nest of "special treatments," causing huge distortions in the way capital was allocated among industries, sectors, regions, and specific uses. In the process, it virtually wiped out the revenue-generating capacity of the corporate income tax.

Other mechanisms besides import protection, subsidized credit, and tax incentives were used to stimulate production or use of particular products, so one clearly had product market distortions side by side with trade distortions and capital-market distortions. All these were quite well understood and reflected in the mainstream literature on project evaluation in the 1960s and early 1970s.

The project evaluation literature that appeared during this period was a natural outgrowth and, in a sense, a reflection of the policy environment just described. With distortions so rampant in the main markets of the economy, actual market prices were rather far from reflecting what standard competitive economics says they should reflect: the true economic cost of the good or service in question. This leads naturally to an attempt to quantify what these true costs really are. Thus the profession arrived at what were variously called the shadow prices, the economic costs, or the social opportunity costs of foreign exchange, of capital, sometimes of main commodities like oil, and of labor (about which more will come later).

To give an idea of how these social opportunity costs came into play, consider a foreign exchange market with three classes of imports (\(M_1\) with 100 percent tariff, \(M_2\) with 50 percent tariff, and \(M_3\) with zero tariff) and three classes of exports (\(X_1\) with a 30 percent subsidy, \(X_2\) with a 10 percent tax, and \(X_3\) with no special treatment). The consensus solution in the literature of the time was that the social opportunity cost of foreign exchange would be the relevant weighted average of the effective individual social opportunity costs applicable to each "source" of foreign exchange. Thus if it was deemed that an added dollar of demand for foreign exchange would be "sourced" 30 percent at the expense of \(M_1\), 20 percent at the expense of \(M_2\), 10 percent at the expense of \(M_3\) and that the rest would come from newly generated exports—20 percent from \(\Delta X_1\), and 10 percent each from \(\Delta X_2\) and \(\Delta X_3\)—this would yield a social opportunity cost of foreign exchange of 14.5 pesos per dollar, as compared with a market exchange rate here assumed to be 10 pesos per dollar. The calculation follows:
Without going into detail about the conceptual foundation and the practical estimation or assignment of the weights, there is a clearly huge difference between the measured social opportunity cost of 14.5 pesos and the market exchange rate of 10 pesos per dollar.

Let us now shift gears and, using the same weighting structure, apply a set of trade restrictions that comes closer to the targets that countries are setting for themselves in the 1990s.

Here we get a weighted-average social opportunity cost of foreign exchange that is quite close to the market exchange rate of 10 pesos.

The main point of this example is that the adjustment needed to account for distortions in the sourcing of foreign exchange is much smaller (in a typical developing country) today than it was twenty or thirty years ago. I believe these matters must still be treated in a course aimed at the next decade, but the fraction of time devoted to them should be much smaller than before.

To buttress this point, consider the issue of expected changes in the real economic cost of foreign exchange over time. Recall that a typical investment project will have an expected life of twenty years or more, and that we must project the profile of costs and
benefits of such a project over its lifetime. There is little doubt in my mind that the expected time path of market real exchange rates is worth at least as much attention as the distortions that separate the social opportunity cost of foreign exchange from the market exchange rate. Yet many courses in social project evaluation devote no attention to this topic. Here is an indication of the volatility of the real exchange rate for a number of countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>1970s</th>
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<tbody>
<tr>
<td></td>
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<td>Lowest</td>
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<td>United States</td>
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<tr>
<td>Zaire</td>
<td>72</td>
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</table>

Basic Principles of Project Evaluation

1. The Profile of a Project \((F_t = B_t - C_t)\)
   a. Cash flow as a simple example and model.
   b. What to do when there are noncash benefits and costs.
   c. Dealing with taxes and subsidies when measuring natural economic benefits and costs.
   d. Introduction to the least cost principle: Do not attribute a benefit that is greater than the least alternative cost of achieving the same or similar benefit.

1. Perhaps the most common and egregious error in standard project evaluation over the years has been the failure to deal with prospective changes in relative prices. This error is reflected in reports that delineate in great detail the path of investment outlays over the gestation period and then blithely project the "typical year" of operation, once the project gets going. There are surely numerous cases in which the consequence of this error is mild, but they cannot be known in advance without facing the problem of changing relative prices. The most critical items of changing relative prices are in cases where the present price is out of line with the long-run expected equilibrium prices.
2. **Expressing the Profile in Real Terms**

a. The basic processes of the economy are real processes.

b. Economic analysis may help us predict inflation one or two years ahead, but it is totally useless for ten or twenty years ahead. Factors like the strength and responsibility of future governments are the critical determinants.

c. Economic analysis can help us project the real economy over a ten- or twenty-year horizon—certainly more so than projecting the general price level.

d. Projecting the economy "in real terms" includes projecting the course of relative prices. It simply makes no sense to project "at 1990 prices" keeping each and every price at its 1990 level. The right way to project the economy is to project the course of individual prices, \( p_j \), relative to the general price level, \( \bar{p}_a \). This price level should be quite general and give due weight to nontradables. Good candidates are the consumer price index (CPI) and the gross domestic product (GDP) deflator.

e. Examples of commodities whose prices are currently "out of line" with their long-run equilibrium levels—grains after the "Russian wheat deal" in 1974, sugar reaching 40¢ and 50¢ a pound in world markets (three occasions in the 1970s and 1980s), copper falling below the marginal operating cost of most mines (early 1980s). How to project a time path by which they will once again reach "normal" levels.

f. Projecting the "normal" time path of relative prices. The trend of any given relative price reflects a battle between (hopefully) rising real wages on the one hand and technical advances specific to that commodity (or service) on the other. Things like haircuts and taxi rides have little room for technical advance, hence they are observed to rise in real terms (so long as the labor market yields rising real wages). Items like television sets and computers have enjoyed technical advances strong enough to more than offset rising real wages, hence they have a downward trend in their respective relative prices.

g. Projecting the time path of real wages. Real wages for a given class of labor tend to reflect the overall average rate of technical advance in the economy, modified by supply and demand forces specific to the labor market in question. The premiums for different skills basically tend to reflect the return on various kinds of human capital investment, but these in turn are only loosely connected to market interest rates and to the "capital market" as such. Hence the skill premiums can change significantly over time.

h. Projecting the time path of the real exchange rate. The real exchange rate is best thought of as the "real price of the real dollar." If the nominal exchange rate is \( E \), then \( (E/\bar{p}_a) \) is the real price of the nominal dollar. If we can find or generate a world price index, ideally one that concentrates on tradable goods (call it \( \bar{p}_x \)), we can get to the real exchange rate \( (E \bar{p}_x/\bar{p}_a) \). We can track this through time and analyze its movements to help us project its likely future course.
3. Finding a Real Interest Rate for Discounting

a. There are two important messages here: (1) the relevant interest rate for discounting real flows must be a real discount rate, and (2) just as the real prices of other goods and services can and do vary over time, so too we must allow for the possibility of a real discount rate varying over time.

b. It makes most sense to try to estimate the normal, real equilibrium rate of return on capital for the economy in question and use that as the basis for deriving the relevant real rate of discount. The real discount rate is probably best based on estimated patterns of sourcing in the capital market, but for most poor countries I would be prepared to simplify and use the real, gross-of-tax, measured rate of return to capital in the market-based portion of the economy. (More on this subject will come later.)

c. We must make allowances for cases where the current situation is one of abnormal stringency (or glut) in the capital market. In such cases the real discount rate should start out higher (or lower) than the normal rate, and approach the normal rate over time as the circumstances giving rise to the abnormal situation pass away or are surmounted.

d. Another class of cases that one might have to deal with for some countries is that in which, because of deficient policies or external events, the observed real rate of return on capital has been low for a considerable period of time. If the policies have been dramatically reformed or the external causes of low returns have disappeared, there may be reason to set the forward-looking "expected normal real return on capital" at a level significantly higher than the recent observed level.

e. The best way to incorporate a changing rate of discount is to consider the discount factor for any year \( t \) to be \( \frac{1}{(1+r_i)} \). That is, to discount \( F_1 \) back to year zero, we take \( F_1/(1+r_1) \); to discount \( F_2 \) we take \( F_2/(1+r_1)(1+r_2) \); for \( F_3 \) we take \( F_3/(1+r_1)(1+r_2)(1+r_3) \) and so on. Here \( r_1 \) is the discount rate linking year zero to year one, \( r_2 \) the one linking year one to year two and so on.

f. It is very treacherous to work back from observed nominal interest rates in financial markets, and to try to derive real discount rates for future flows on this basis, for various reasons:

   (i) Financial interest rates can be tremendously volatile. There are countries in which correcting such rates for the ongoing inflation yielded negative real rates for significant periods. Yet in some of the same countries in different periods the same procedure produced real rates of 2, 3, even 4 percent per month.

   (ii) Financial interest rates do not incorporate the "standard" capital market distortions, such as property taxes and corporate income taxes. Nor is it easy to "correct" them for this deficiency.

   (iii) Financial interest rates are often subject to formal and informal controls, which are distortions in their own right, but not as easy to take into account as tax rates.

g. For most developing countries, a measure of return to capital in the private sector is the best starting point. In the denominator one has the total real return accruing, say, to private sector capital. In the denominator one has the private sector capital stock, built up from gross investment data using the
perpetual inventory method, with assumed depreciation rates. Ideally, separate calculations are done for buildings, machinery and equipment, and inventories. If the data are drawn from the national accounts, the numerator (return to capital) will likely include the returns accruing to land, while the perpetual inventory method (which accumulates gross real investment) yields an estimate only of reproducible capital. Thus one must either separately estimate the return to land and take it out of the numerator, or separately estimate the real value of land for each year and insert it into the denominator. Another problem that arises using national accounts and similar (for example, business census) data is that the income of unincorporated enterprises commingles the labor income of the owners (and their family members) with the return to capital of the firm. When this is the case, one must resort to some system of dividing the global unincorporated enterprise income into these two parts.

4. Types of Project Profile

a. The project profile should in principle summarize all the relevant information about the project. That is, it should capture all the relevant benefits and costs.

b. This means that taking a different "point of view" usually means having a different profile. At least three points of view can be distinguished for a standard commercial project:

(i) Owner's point of view. This follows a straight cash flow approach. Cash coming in is a plus; cash going out is a minus. Receipt of a loan is therefore a plus; both interest and amortization of the loan are minuses. Depreciation of physical assets is not taken year by year but is reflected in the difference between the cash outflow for asset acquisition and the cash inflow from disposing of the asset at the end of its useful life within the project.

(ii) Banker's point of view. The banker looks at a project before he decides whether to lend money for it. As he analyzes the project, he does not know how much of the financing will be debt or how much will be equity capital. Hence he looks at the full capital outlay as the investment and the full return to capital (not saying which part goes as interest and which as return to equity) as the reward. The banker's point of view thus merges or consolidates the accounts of those who provide debt capital and those who provide equity. The banker's point of view is nonetheless a private one. It does not consider taxes generated by a project to be benefits or make any other adjustments (for example, for externalities or social opportunity costs) that would be incorporated in an economic (social) analysis.

(iii) Economic (social) point of view. This point of view counts as benefits all that the banker counts, but in addition adjusts for taxes, subsidies, and other types of external effects. The use of social opportunity costs (for example, for foreign exchange) is simply a way of dealing with such effects for situations that occur repeatedly. Thus, the act of buying foreign exchange causes displacement of "existing" imports and the
expansion of exports. Tariff revenue is lost on imports that are displaced, as is the extra money spent as subsidized exports expand. Since these effects occur essentially whenever anybody enters the market to buy foreign exchange, we calculate their impact once and for all and reflect that effect by simply using the social opportunity cost of foreign exchange as the cost to attach to any net purchase, or the benefit to attach to any net sale of foreign exchange by the project in any given period.

These uses of social opportunity cost are invariably connected with the "sourcing" of the item in question. If the foreign exchange is spent on a tariffed item, the amount of the tariff should appropriately be counted as a benefit in the derivation of the project profit from the economic point of view. An example will probably help. A project needs imports of $1 million of equipment. It buys the dollars in the open market at 10 pesos and in addition pays a 20 percent tariff. Total private cost: 12 million pesos. This would be the cost from either the owner's or the banker's point of view. However, from the economic (social) point of view the cost would be 10.7 million pesos (assuming the social opportunity cost of foreign exchanges is 10.7 pesos per dollar, as in the example presented earlier). This can be represented as the private cost of 12 million pesos, less the 2 million of import tariffs paid by the project (a cost to its operators but a benefit to the treasury), plus 700,000 pesos of difference between the SOC and the market price of foreign exchange, \((10.7-10.0) \times 1\text{ million}\).

The economic analysis of a project would treat in an analogous fashion the indirect taxes paid on a taxed input (for example, cement). In principle, the negative externalities of air and water pollution stemming from the project's emissions and effluents should be counted as additional external costs in passing from the profile of a project from, say, the banker's point of view to the corresponding profile calculated from the economic point of view.

Additional "social benefits or costs." Other considerations are sometimes brought into the picture to evaluate government projects. There may be a desire to weigh the benefits and costs perceived by one group more heavily than those perceived by others. Sometimes the meeting of specific "basic needs" is given greater credit than that which is implicit in a market-price analysis. Sometimes the employment of the otherwise unemployed is deemed to signal an extra benefit, not already counted in the calculus.

I know such considerations do in fact motivate policymakers in many places. I know, too, that economic analysis alone will not tell us when and whether to assign such a benefit or cost. Furthermore, a realistic assessment of the considerations that actually motivate the authorities will reveal that they are not always high-minded and noble. They often amount to little more than rewarding one's (political) friends and punishing one's enemies. Moreover, even when the motivation is pure, the quantification and calculation of the benefit or cost to assess is almost invariably arbitrary.

My suggestion at this stage of the game is to be ready to quantify such benefits and costs but to label them explicitly as "project subsidies" and
"project taxes." Thus if I consider that 10 percent of the wages bill of a particular project is a positive externality because of improved nutrition of those workers' children, I would count the full wages bill as a cost and introduce two other entries. In the social evaluation I would add a benefit equal to 10 percent of the wages bill and call it a child nutrition benefit. In the financial analysis of the project I would add a corresponding item labeled "project subsidy to child nutrition."

This procedure keeps the concepts straight, gets implicit subsidies more out into the open, and immediately reveals when a project ends up passing the critical test only because of these ascribed social benefits, or ends up failing the test because of similarly ascribed social costs.

5. Working with the Project Profile (internal rate of return, net present value, and so forth)

a. Calculation of the internal rate of return (IRR): The project profile can be evaluated at different discount rates. Each rate will yield its own net present value (NPV) calculated to a given point in time. As long as the project has a normal profile (with periods of net outlay first, followed by periods of net benefits), there will be only one rate that generates an NPV of zero. That rate is the project's internal rate of return. Its great merit is that it is an attribute of the profile as such; to calculate it one does not have to know the relevant opportunity cost of capital (discount rate).

b. Internal rate of return is not a criterion.

Simple counterexample:
Project A: You lend me $1; I pay you $2 one year hence.
Project B: You lend me $1,000; I pay you $1,250 one year hence.
In the U.S. capital market context, B is clearly preferable to A, yet A has an IRR of 100 percent, B of only 25 percent.

Suppose the opportunity cost is 10 percent. Then project A, evaluated as of the endpoint, has NPV = 90¢. But project B, evaluated at the same point in time, has NPV = $150. This is why we prefer B. If the relevant discount rate were 30 percent, B would not be interesting. Its NPV would be negative.

In this example A and B must be seen as strict alternatives. Otherwise, we don't have to choose between them; we can do both. But it is not artificial for A and B to be strict alternatives, and for one to cost much more than the other—for example, a high dam or a low dam at a given site; a gravel road or a concrete road connecting two towns. One should think of the IRR as a useful descriptive statistic, nothing more than that. It is definitely not a criterion. (Sometimes, indeed, there are multiple IRR, but this is not common in real-world projects. This never happens with profiles of "normal" shape.)

c. Net present value is the relevant criterion as long as the discount rate reflects true opportunity cost.

If you can earn 10 percent on your money in a bank, you could do better by investing in a project whose NPV, calculated using 10 percent as the discount rate, is greater than zero. NPV is, in fact, a measure of the profit you make compared with keeping your money in the bank, earning 10 percent.
d. If the relevant opportunity cost of funds is expected to vary through time, NPV is still the correct measure. But now NPV must be calculated at a discount rate that varies through time, as discussed above under (3e).

e. The benefit/cost ratio is even less a criterion than IRR.

<table>
<thead>
<tr>
<th>Project</th>
<th>All Benefits</th>
<th>Capital Costs</th>
<th>Current Costs</th>
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</thead>
<tbody>
<tr>
<td>Project A</td>
<td>1,000</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>Project B</td>
<td>1,000</td>
<td>500</td>
<td>250</td>
</tr>
</tbody>
</table>

If benefit-cost ratio is defined as \( \frac{PVB}{(PVC_1 + PVC_2)} \)
we find project B > project A.

If benefit-cost ratio is defined as \( \frac{(PVB - PVC_2)}{PVC_1} \)
we find project A > project B.

Both these procedures are used in actual cost-benefit analyses.

The NPV criterion gets the same answer when it compares total benefits with total costs as when it compares net current benefits with capital costs, that is:

\[
PVB - (PVC_1 + PVC_2) = (PVB - PVC_2) - PVC_1
\]

The difference is fundamental. Net present value is fundamentally an additive concept. It works in both cases because of the commutative law of addition.

The benefit/cost ratio in a sense founders because it cannot deal with a fundamentally additive concept.

6. Basic Exercise 1: The Timing of a Project

One of the most basic cases of one project being an alternative to the other occurs when it is essentially the same project but is executed at different times.

To deal with the problem of timing, we must realize that to compare projects with different timing we must discount (or accumulate) their net present value to the same year. It can be year 0, 1, 2, or \( k \), but it must be the same year for all projects being compared.

One can think of starting the project at many different possible times. For each possible starting date we select the "best" design for the project, done at that particular date. We get a profile for that project (in principle) and for the "best" design for each alternative starting date. Then we compare the net present values of these projects, taking present value to a common date. The one with maximum NPV is the one with the optimal starting date.

The above procedure would be tedious and require lots of information about what project benefits and costs would look like for different starting dates. Hence it is not
likely to be done with the proper care. We should seek shortcuts for the analysis of timing.

But one thing remains clear, even from the above quick sketch. If we have a curve showing how $\text{NPV}_j$ (net present value of the project started at time $j$, with NPV measured to time zero), we want to choose $j$ to be the time for which that function is at its maximum.

Now, the typical project probably starts out as “not yet ripe” for the picking. Much of the time, the project will have a negative NPV if done right away. Common sense, as well as our analysis, counsels us to wait and see if NPV turns positive at some later date. So we, the technical people, tell the politicians and administrators and the interested parties that they should wait. We probably even show them that NPV is negative and convince them they must wait for that reason. So they wait, perhaps several years. Finally a year comes when the NPV finally turns positive. Now the pressure gets really severe. Unless we believe that the maximum NPV for the project is at or near zero, we should counsel everybody to keep on waiting. Even though $\text{NPV}_j$ is now positive, it is probably not at its maximum.

I feel certain that, as a general rule, projects are “timed” too early, precisely for the reason implicit in the above scenario: People want to do the project as soon as it will pay off—maybe even sooner. (The great bane of project evaluation is interested parties who enjoy most of the project’s benefits while paying only a fraction of the cost. From their narrow point of view benefits are always greater than cost—that is, the part of cost that they pay. They cannot imagine that the project is not good for the whole society, just as it is so clearly and obviously good for them. Think of the farmers in the region of an irrigation project. They get nearly all the benefits and may not pay even 2 percent of the cost borne by the public treasury.)

It is critical to instill in the minds of participants in project evaluation courses that there is a very strong presumption against building projects at the first point in time when their $\text{NPV}_j$ turns positive.

7. Basic Exercise 2: A Special Case of Timing
There is a neat special case when (a) project benefits, $B_t$, are an increasing function of time and (b) when the benefit of a given year, $t$, is the same regardless of when (prior to $t$) the project began. This pair of assumptions is pretty accurate for road projects. Since traffic seems “everywhere and always” to increase with time, and since the benefits of a road project are closely and positively associated with the traffic on the road, it is overwhelmingly likely that the time path of benefits will be upward. Also, with a bit less certainty, the traffic carried by a given road today would not be much different if the road had been built (or upgraded to its present specifications) five or ten years earlier.

In this special case, and with capital costs of the road or road improvement being constant through time, the timing rule is to build when the first year’s benefit first exceeds the forgone interest.

The idea is that each year of waiting allows society to enjoy a yield equal to the opportunity cost of capital ($r$) times $K^*$, the amount of funds involved. Therefore, as long as $B_{t+1}$ is less than $rK$, it pays to wait. As soon as $B_{t+1}$ is greater than $rK$, it pays to build.
Note that this theorem deals with the first-year benefits only. Obviously if the first-year benefits are bigger than $rK$, and if benefits grow through time, every year's benefits will be bigger than $rK$. It is easy to show that this rule gives us a maximum of $NPV_J$; hence it does not fall into the trap pointed out at the end of point (6).

We can modify this simplest special case to take into account capital costs that change through time, and to be less rigid about $B_t$ always increasing through time. When capital costs change through time, that is, $K_{t+1} \neq K_t$, it is reasonable to suppose that the movement is unidirectional—either up or down—over a period of years. In this case the rule becomes “Build when $B_{t+1}$ first exceeds $rK_t - (K_{t+1} - K_t)$” instead of “Build when $B_{t+1}$ first exceeds $rK$.” If capital costs are growing, this modified rule leads to building the project earlier. If capital costs are falling, it leads to further postponement (in order to take better advantage of the falling costs).

The important aspect about the annual benefit stream $B_t$ is that it should be rising in the neighborhood of the optimal date. If later on it starts to fall, this does not modify the optimal date at all.

What it does do is give rise to the possibility that even constructing at the optimal date given by the relevant rule, $NPV_J$ is still negative, even at that optimal date. Thus if we think it plausible that $B_t$ although not rising, will turn down later on, we follow the formula to get the optimum time of construction in the regular way. Then, however, we must perform an added check of calculating the net present value of the entire project to make sure it is positive.

8. *A Digression in Successor Projects and Opportunity Cost*

What happens when you compare alternative projects having different economic lives? Is it "unfair" to make the short-lived project compete with a longer-lived one?

More generally, what about the terminal dates of any and all projects? Might it not be appropriate to consider not just project A but a sequence including A and its successors, A', A", and so forth?

There is one important and very basic message here. Normally we expect successor projects, and any other projects whose identity is unknown, to have a marginal productivity of capital that is equal to the relevant opportunity cost of capital.

This message derives almost from the definition of opportunity cost. If the opportunity cost of capital is 10 percent, we should do all independent projects that yield more than 10 percent. The only time we should leave undone a project with yield higher than 10 percent should be when that project has been beaten out by a better alternative. In that case it is obviously not an independent project.

If, on the other hand, we have vast numbers of projects with yields higher than 10 percent that we cannot do for lack of funds, this practically tells us that the relevant opportunity cost is higher than 10 percent. It may be that we have simply misestimated the opportunity cost and that it should be raised straightforwardly to 12 or 15 percent.

In some situations, there may be a transitory stringency of funds because of special fiscal problems, bad crops, or even the simple fact that a large project is making huge budgetary demands and so little money is left over for other projects, even good ones.

In such cases it is appropriate for the relevant discount rate to be raised above 10 percent for the present period and for as long into the future as the special stringency
of funds will prevail. If this adjustment is appropriately done, it should be possible to approve all independent projects that meet the \( \text{NPV} > 0 \) test at the revised set of opportunity cost rates.

Returning now to successor projects, the normal presumption is that these as yet unknown projects, taking place 10 or 20 years hence, will be yielding benefits at the standard opportunity cost rate. If this is so, NPV will be approximately zero and we can duly neglect them. Even more so when we realize that to incorporate \( A' \) (beginning, say, in 10 years' time) and \( A'' \) (beginning 20 years from now), we would appropriately have to discount their NPVs back to the same time we are using as the reference point for \( A \).

The preceding discussion gives a clue as to when we should think seriously about successor projects. This occurs when the successor project promises not to be a marginal project but a supramarginal one. The natural scenario for this is a road project. When the old road reaches the end of its economic life, its demise can give rise to an opportunity for a new successor project that is supramarginal in the sense of having an IRR well above the opportunity cost rate and consequently, a significantly positive NPV, measured using the opportunity cost rate for discounting.

When this happens, it is appropriate to include the successor project or projects along with the specific new one being started. That is, we should treat \((A + A')\) or \((A + A' + A'')\) as the profile to be analyzed, instead of \( A \) above.


Suppose \( A \) (an asphalt road) has an economic life of 15 years, while \( C \) (a concrete road) lasts 30 years. This is a simple case to deal with, assuming that \( A \)'s successor project also has a life of 15 years, for then one compares NPV\(_0\) of \( C \) with the sum of NPV\(_0\) (\( A \)) and NPV\(_0\) (\( A' \)). Each alternative being compared runs out in year 30, so we have no need to introduce any alternatives after that. We are open at year 30 to choose \( C' \) (the successor to \( C \)) or \( A'' \) (the successor to \( A + A' \)), regardless of which option we took up to year 30.

The problem comes when \( A \) has a life of 15 years while \( C \) lasts 25 years. Now, in order to make the sequences come out exactly even, we would have to go 75 years in the future. And it could get a lot worse—if \( A \)'s life were 17 years and \( C \)'s 29 years, we would have to wait 493 years before the two sequences ended at exactly the same time.

It is obviously nonsense even to think in such terms, but if we are to avoid thinking that way, we need some device to help us. It is convenient here to think in terms of trying to be as fair as possible to each of the two alternatives.

If we simply compare NPV\(_0\) (\( A \)) with NPV\(_0\) (\( C \)), we are implicitly assigning a net present value of zero to \( A \)'s successor project. This is being unfair to \( A \) and biasing the choice in favor of \( C \) if we assume both \( A \) and \( C \) have significant positive NPVs.

Alternatively, if we compare \( C \) with \( A + A' \), making no adjustment, we are biasing the result in favor of \( A + A' \) by implicitly assigning an NPV of zero to project \( C' \).

The trick is to create an artificial project, \( A_i \), which has NPV \( \neq 0 \) and terminates at the same time as \( C \). Suppose \( C \) has NPV\(_0\) = 250 while \( A \) has NPV\(_0\) = 200. Suppose, too, that Project \( A' \) runs from year 16 to 30 and has NPV\(_{15} = 200 \). Let the discount rate be such that NPV\(_0\) (\( A' \)) = 100. Thus, in the unfair comparison favoring \( C \), \( C \) would win out because 250 > 200. In the unfair comparison favoring \( A \) (taking the full NPV of
A + A' and comparing it with that of C) the sequence A + A' would win because (200 + 100) > 250.

To mediate this impasse, we suggest calculating the internal rate of return of A' and dividing its benefit profile into $B_F$ (benefit stream up to year 30) plus $B_G$ (benefit stream after year 30). We know that the present value of costs equals the present value of benefits when $\rho$, the IRR of A', is used for discounting. Hence the present value of costs of A' is equal to $PV_{B_F}(\rho) + PV_{B_G}(\rho)$ we can therefore assign a sum equal to $PV_{B_F}(\rho)$ as the present value of the cost of producing the benefit stream $B_F$. Together this cost and benefit stream make up the artificial project $A'_F$. It has a positive net present value when $r$ (the opportunity cost discount rate) is used, but so too does $A'_G$, which is the part of the profile of A' we have left out. We have not been fundamentally unfair either to (A + A') or to B in adopting this device for splitting the costs and benefits of A'.

The above is not a profound theorem, but rather a "trick" to help surmount an otherwise troublesome problem. As a child, I and surely millions of children around the world, was fascinated by the box in which Mother's Oats cereal came. The box had a picture of a mother holding a box with a picture of a mother, who in turn was holding a box with a picture of a mother and so on. I remember getting out a magnifying glass to see how many mothers I could discern on that label. A trivial and fruitless enterprise, a waste of time, perhaps also misplaced childhood imaginings! Whatever the case, it is similar to the project evaluation problem when two supramarginal alternatives of unequal lives have to be compared. Our trick is directed at helping analysts surmount their fascination and get on with the serious labors they have before them.

10. Basic Exercise 4: The Problem of Scale
The analysis up to this point carries, both explicitly and implicitly, the message that the guiding principle of project evaluation is the maximization of net present value, using the relevant opportunity cost of capital as the rate of discount. Most scenarios and examples in the end boil down to being applications of this general principle. The point of the exercises is not to change the principle but to show people how to apply it, to give them an intuition concerning what sorts of problems (conceptual and practical) may arise, and to lead them to new ways of thinking about different applications.

The problem of scale is a case in point. Here many alternatives are possible, but (practically by definition) they are ordered in terms of their capital cost, from smallscale up to largescale.

This characteristic gives rise to the possibility of comparing increments of cost to increments of benefit as one moves from the design for a smaller-scale operation to the design for a larger-scale one. Indeed, one can think of a profile built up from increments, with the incremental cost coming first, followed by years of operation in which incremental benefits are produced.

Working with such a profile of increments, we can derive its net present value, using any desired interest rate, and obviously also its internal rate of return. Using these concepts, we can find some interesting and useful results with respect to scale.

a. If the relevant discount rate is 10 percent, there is obviously no point in choosing a scale that has $\text{IRR} = 10$ percent, for at such an IRR, NPV will be zero.
If we maximize NPV using a 10 percent interest rate, the resulting scale of project should have an IRR > 10 percent.

b. But while IRR > 10 percent at the optimal scale, MIRR (the marginal or incremental IRR) will tend to be equal to 10 percent. Think of proceeding from the smallest scale by increments. If the first step has incremental benefits > cost, using 10 percent, then we should take that step. But also its MIRR will be > 10 percent. We should continue to do this through successive steps as long as the incremental NPV is positive. All such successive steps will have MIRR > 10 percent. Where does this process stop? Naturally, where the next step will have a negative incremental NPV, and hence an MIRR < 10 percent. Basic conclusion: Optimizing the scale of a project typically means expanding scale until the marginal internal rate of return is equal to the opportunity cost of capital. This maximizes the NPV of the whole project in using opportunity cost as the discount rate.

c. This juxtaposition of NPV, IRR, and MIRR is a unique attribute of the problem of scale. If 10 percent is the discount rate, we go to the scale for which MIRR < 10 percent. That is also the scale for which NPV(10 percent) is at its maximum. So long as NPV(10 percent) is positive, the IRR at that scale will be greater than 10 percent.

If 12 percent is now the discount rate, we go to the scale for which MIRR is 12 percent. That is also the scale for which NPV(12 percent) is at its maximum. Again, typically IRR will be greater than 12 percent at this point.

d. If the relations involved can be approximated by continuous curves, then for each discount rate below a critical level there will be two scales of the project for which that discount rate is the IRR. This is necessary because if the maximum NPV(12 percent) is at S12, then there must be some S12 scale less than S12, where NPV is zero (and rising with scale) and S12 another larger than S12, where NPV is zero (and falling with scale). There will, however, be just one discount rate (call it h) for which NPV = 0 at S(h). That is the highest discount rate under which this project could survive as acceptable. But its scale S(h) is not the right scale at which to build the project. With each reduction of the discount rate below h, the optimal scale changes (presumably increases) as successive increments to scale that did not pass the test at higher discount rates will come to be acceptable as the discount rate is lowered.

11. Basic Exercise 5: Interrelated Projects
As in economics in general, we distinguish in project evaluation the relationships of substitution, complementarity, and independence. They are defined for the sides of benefits and costs as follows. Projects I and II are complementary on the benefit side if

\[ PVB_{(I+II)} > PVB_I + PVB_{II}. \]

This says that the benefits of doing the two projects “together” are greater than the sum of the separate benefits that would accrue from each one done separately. Similarly, projects I and II are substitutes on the benefit side if:

\[ PVB_{(I+II)} < PVB_I + PVB_{II}. \]

In this case “something is lost” by doing the two projects “together.”
Finally, projects I and II are independent on the benefit side if
\[ \text{PVB}(I+II) = \text{PVB}_I + \text{PVB}_II. \]
Here it simply does not matter, as far as benefits are concerned, whether the projects are done "together" or separately.

I put quotation marks around the word "together" because it does not mean they have to be done simultaneously. They may not even be located near each other. The idea of "together" means that both projects are simultaneously present (on the scene) when (most of) their benefits are being generated.

Corresponding to the three definitions above, we have:

**Complements on the Cost Side**
\[ \text{PVC}(I+II) < \text{PVC}_I + \text{PVC}_II \]

**Substitutes on the Cost Side**
\[ \text{PVC}(I+II) > \text{PVC}_I + \text{PVC}_II \]

**Independent Projects on the Cost Side**
\[ \text{PVC}(I+II) = \text{PVC}_I + \text{PVC}_II. \]

Note that the inequalities on the cost side go in the opposite direction from those on the benefit side. This reflects that complementarity means there are advantages in doing the two together—this happens when one gets greater benefits by doing them together, or lower cost. Similarly, substitute projects reflect either smaller benefits from doing them together, or greater costs. Recalling that the ultimate objective is net present value is another way to see why the definitional inequalities are in the opposite direction, for \( \text{NPV} = \text{PVB} - \text{PVC} \).

12. Examples of Interrelated Projects

**Substitutes on the Benefit Side**
\[ \begin{align*}
I &= \text{a power dam} \\
II &= \text{an irrigation dam} \\
(I+II) &= \text{a combined power-irrigation dam}
\end{align*} \]

Many people think the two uses of the dam are complementary. This is true on the cost side but not on the benefit side. The simplest way to see this is to recognize that if the dam is only for power, the electricity agency will be able to release water in a pattern that is totally optimal from the standpoint of energy operations. Likewise, if the dam is only for irrigation, the agricultural ministry will release water in the pattern that is optimal for agriculture. When we try to use the dam for both purposes, it would be pure serendipity if both "managers" would want exactly the same time pattern of releases.

In reality this will never occur. The electricity authority will want to use the water at times of daily and seasonal peak demand. The agricultural ministry will want to use the water in the particular weeks when the crops need it most. If the project is a joint power-irrigation project, therefore, one or both of the "managers" must take less than he would ideally like. This is what guarantees
\[ \text{PVB}(I+II) < \text{PVB}(I) + \text{PVB}(II). \]

The same sort of story applies with all kinds of multipurpose projects. Both the power use and the irrigation use think of the water as something to be used. In the course of a season the dam might go from full to empty, or nearly so. These uses are therefore in conflict with the goals of a flood control objective, which would want to keep the dam empty most of the time to cope with an unexpected flood, or with a
recreational objective, where the goal would typically be to keep the water level more or less constant to make good use of beaches, boat docks, and moorings.

In general, one can expect that most multipurpose projects will be substitutes on the benefit side.

**Complements on the Benefit Side**

These tend to be projects such as:

- I = an airport project
- II = a highway project improving access to the airport
- I+II = simply having I and II “together”

These are projects whose benefits are larger with larger traffic volume. The presence of one of the projects adds to the traffic flow that the other can expect, and hence adds to its benefits. In most pairs of projects of this type, the presence of the one adds to the benefits of the other.

One famous but somewhat different example is the textbook case of an orchard and an apiary. Here the flowers of the orchard feed the bees, while the bees' activity pollinates the orchard. In this case the presence of each project augments the productivity of the other.

**Complements on the Cost Side**

Obvious cases are:

- I = a dam
- II = a highway project that can utilize the dam for crossing the river and thus obviate the need to build a bridge
- I = a logging or mining project
- II = a port project that, when done together with I, reduces the transport costs from I.

**Substitutes on the Cost Side**

Here the most obvious way one project can make another more costly is by augmenting the transport costs of the second project. Any projects that involve large land assembly with little or no traffic “through” the assembled land have this characteristic. Thus, the large lakes created by dam projects render impossible (or much more costly) any highway project that would have run where the lake now is.

They also render more costly other types of projects whose natural lines of supply of inputs or shipping of products would have taken a direct route “through” what is now the lake.

Large metropolitan airports are like the lakes created by dams in that they too represent new obstacles that traffic now has to by-pass usually in more expensive way.

13. Basic Exercise 6: When to Replace an Old Asset with a New One

This is a problem that every family and every business, from the smallest to the largest, has to face on a rather regular basis. The full generality of the problem can be seen by considering a tiny enterprise that operates with just one truck.

One can assess the replacement option by calculating the NPV of the trade. This is

\[ \text{NPV}_T = \text{PV}_{\text{BN}} - \text{PV}_{BO} + S_0 - P_N \]

Another important challenge is that of taking properly into account the probability distribution of market prices and other important variables. The probability distributions of the relative prices of most raw materials and raw foodstuffs are highly
skewed, so their means are well above their most commonly observed values. Yet most project evaluations simply use the commonly observed values as the “expected value.”

There are also probabilistic interactions among sets of prices (for example, the grains), and among prices and quantities in different markets. Analysts can take these into account using Monte Carlo techniques, but their use has been generally rudimentary.

The above only sketches some of the challenges that still are present even if we assume society is neutral with respect to risk. Certainly these challenges are adequate to keep us busy for at least a decade or two!

But if that were the case for alternatives as close to each other as 3.1Y and 3.3Y, it follows that society would have little interest in, say, doubling its income—something we know is far from the truth.

The prudent conclusion to draw from the above sketch and from similar reasoning carried out at greater length is that it is not at all implausible to assume that society’s marginal utility of wealth is approximately constant over the probabilistic range of outcomes associated with even a very large project.

14. Dealing with “Risk” in the Next Decade

Some may believe that the assumption of risk neutrality simply assumes away the problem. It gives a result that seems to make the analyst’s life easy, and thus looks like a lazy man’s way out. Such a notion is far from the truth. The fact is that the art and science of project evaluation are far from extracting the full meat out of the simple assumption of risk neutrality.

As indicated above, risk neutrality implies looking only at the expected value of the outcome for each project. The bad news is that this is something that few if any project evaluations have so far succeeded in doing. Mostly, people work with vague notions of “most likely values” of the prices, quantities, incomes, wage rates, interest rates, and so on that enter into project evaluations. These may correspond to the median or the mode of a probability distribution of outcomes, but not the expected value. For example, I know of no evaluation of a dam that incorporated the huge potential cost of the dam’s eventually breaking. Admittedly, such a cost would enter the expected NPV with a low probability, but the product of cost x probability might still be a quite significant evaluation. We do not even know how to define society’s portfolio. We wouldn’t know how to begin measuring what a project like a dam or a road did to the total variance of outcomes of society’s portfolio. We have not the slightest idea how “society” judges the riskiness of the portfolio that we have not been able even to define.

The good news is that we can go a long way without ever having to confront the above conundrums. The key is to assume that society is neutral with respect to risk. So long as we can work with that assumption, we need only ask about each project: What is the expected value of the net benefits that it will generate?

It is rather easy to build a case that society should be treated as a neutral with respect to risk, as far as social project evaluation is concerned. The main concept in the analysis of risk preference and aversion is a function describing the utility attaching to each level of wealth. A function in which the marginal utility of wealth declines as wealth increases displays risk aversion, and with increasing marginal utility of wealth
shows risk preference. A function that is a straight line over a certain range shows risk neutrality over that range.

Now try to draw an analogy to the above for society. Society's wealth is probably 2 or 3 or 4 times national income in most countries. Hardly any project is larger than 10 percent of national income. A large, risky project might have the outcome that society's wealth is 3.1 times $Y$ with 50 percent probability and 3.3 times $Y$ with the other 50 percent probability. The social valuation of that package is not likely to differ much from the social valuation of a wealth of 3.2 times $Y$ for sure. In order to get the result that society really values the risky option much less than the sure option, you would need to have a sharply declining marginal utility of wealth.

15. Some Reflections on Allowing for Risk in Project Analysis

There are two quite different definitions of risk in the literature of finance and economics. One of these, default risk, is what we see in risk premiums on low grade bonds; its function is simply to allow for the probability that the expected payments will simply not be made. The second definition of risk is portfolio risk; it concerns the variability of outcomes to which a given portfolio is subject.

When economists talk about risk aversion or risk preference or risk neutrality, they are speaking of the attitudes of individuals toward the risk they see (or bear) on their actual or potential portfolios. Most of the literature assumes that most market participants are risk averse. The market itself seems to reflect risk aversion in the way it prices many, though not all, assets.

It is not easy today to infer how risk is being evaluated in the market because it is not true that risk is inherent in a particular asset. That was the old-fashioned and easy way of viewing risk. An asset's riskiness was simply measured by its coefficient of variation (standard deviation + mean) of income, appropriately measured. High-variance assets were risky, and low-variance ones were nonrisky.

The modern approach now looks at the entire portfolio—if a portfolio consists of assets that are cyclically sensitive, one does not try to reduce risk by adding a new asset with low variance. Rather, one looks to find a new asset whose performance is countercyclical. If such an asset can be found, high variance in it might well be a very positive attribute, for it can then more powerfully offset the cyclical riskiness of the existing portfolio.

The modern approach to risk was a big help to financial managers and advisers, but it is of no help to those who engage in social project

$$NPV_K = PVBN/O PN > 0.$$  

These inequalities tell a very clear story. If we are to keep the two assets, each must justify itself as the marginal asset. If one of them cannot, there is a better alternative than having both assets simultaneously on hand.

16. The Principle of Separable Components

The preceding exercise leads into one of the most important propositions in applied capital theory—the principle of separable components. This principle simply extends the lesson of the preceding exercise to any number of separable components. It states that for the best package of components, each and every separable component must
justify its presence in the package, as if it were the marginal component. If it cannot justify its presence in this way, the NPV of the package will be increased by simply not including that particular component.

This principle goes to the core of project design. Should a dam be 90 meters high or 100 meters? The last 10 meters are a separable component (in the design stage) and must justify their incremental cost with a corresponding incremental benefit. Should an irrigation project serve 2,000 hectares or 2,500? The last 500 are a separable component and should justify their incremental cost with at least a matching incremental benefit. Should the canals of the irrigation project be lined? Should a highway be 6 meters wide, or 7? Should another highway have four lanes or six? Should a port have 2,000 meters of mooring space or only 1,500?

There is simply no end to the questions, generally aimed at the design stage of a project, whose answers entail an application of the principle of separable components.

\[
\text{Where PVBN = present value of benefits of new asset} \\
\text{PVBO = present value of benefits of old asset} \\
\text{SVO = sale value of old asset} \\
\text{P = price of new asset,}
\]

the calculation is straightforward to the point of being tedious.

But this way of looking at the problem is not the only way, nor typically even the most appropriate way. Typically, we must also consider the option of keeping the old asset while buying the new. The present value of this option can be described by

\[
\text{NPVK = PVBO+N - PVBO - PN.}
\]

Here PVBO+N = present value of benefits of “old plus new” assets together. If the option of having both assets together is the best option, then NPVK must be greater than NPVT and must itself be positive.

Calculating out the differences, we find

\[
\text{NPVK - NPVT = PVBO/N} - \text{SVO} > 0 \\
\text{NPVK = PVBO/N - PVBN - SVO > 0.}
\]

It is appropriate to define

\[
\text{PVBO/N = PVBO+N - PVBN} \\
\text{PVBN/O = PVBO+N - PVBO}
\]

PVBO/N is the present value of the benefits from the old asset, given the new. It is calculated by assuming the new asset will surely be there, and asking how much the old asset adds in the presence of the new.

PVBN/O is the present value of the benefits from the new asset, given the old. In its calculation we treat the old asset as being there, and ask how much the new one will add to the presence of the old.

Armed with these concepts we find that:

\[
\text{NPVK - NPVT = PVBO/N} - \text{SVO} > 0
\]
Notes on Some Issues in Social Project Evaluation

Arnold Harberger

In "Project Evaluation for the Next Decade," I put forward the idea that we, in our applications of social project evaluation, are well advised to treat society as neutral with respect to risk. I base this recommendation both on things we are pretty close to "knowing"—which tell us that neutrality is probably a rather good approximation—and on other things that I wonder if we can ever really "know" but that we would have to know in order to apply an assumption, say, of risk aversion.

First, let us turn to what we more or less know. The economic analysis of an agent or an entity facing risky alternatives can be framed in terms of that agent’s or entity’s utility-of-wealth function, which expresses utility as a function of wealth. Where this function is a straight line, risk neutrality prevails; where it is concave upward, we have risk preference; where it is concave downward, we have risk aversion. In what follows, I will assume that most people tend to be risk averse (demonstrated by their willingness to buy insurance of all kinds), although one must realize that risk aversion is far from universal (namely, Monte Carlo, Las Vegas, Atlantic City, and the hundreds of national and state lotteries that do vast amounts of business every day, not to mention highly speculative stocks).

The second step in the analysis of risk is to define the alternatives. Consider an individual homeowner whose wealth is equal to twice his annual income (Y), all of it invested in his house (H). Suppose that he can insure his house against destruction by paying a premium equal to .03Y. We can then describe his options as being the following. If he does not buy insurance, he has H plus Y with probability .99, and zero plus Y with probability .01. If he does buy insurance he has H plus .97Y with certainty. Note that in this case the insurance is not a “fair” gamble—he pays a premium of .03Y to insure against a loss whose expected value is .02Y [ probability of loss (.01) x amount of loss (2Y)]. Thus the homeowner will buy insurance only if, faced with this choice, he is risk averse.

Most homeowners do in fact insure their homes against catastrophic loss. Let us go through “their” calculation. If they pay the premium, they lose MUw, the marginal utility of wealth, times .03Y. If they do not pay the premium, their expected utility loss is the average utility of wealth (U/2Y) times the probable loss (.02Y). Thus if one’s ratio of the marginal utility of wealth to its average utility is less than 2/3, the solution is to buy insurance; if one’s ratio is greater than 2/3, the solution is to self-insure.
Now consider the case of a TV set ($T$) that cost $0.04Y$ when new. The homeowner who has bought the house insurance is now offered insurance against theft or calamity at a premium equal to 15 percent of the value of the set. Assume, too, that the actual probability of loss is 10 percent, reflecting the same relation of premium to expected loss as we had in the house insurance case. What are the choices he faces? If he does not buy TV set insurance, he has $H$ plus $T$ plus $0.97Y$ with probability $0.9$, together with $H$ plus $0.97Y$ with probability $0.1$. If he does buy insurance, he has $H$ plus $T$ plus $0.97Y - 0.006Y$ with certainty.

The utility calculus in this case runs as follows. If he buys insurance, his expected utility is $U(H + T + 0.97Y - 0.006Y)$. If he does not buy insurance, his expected utility is $0.9U(H + T + 0.97Y) + 0.1U(H + 0.97Y)$. Here we have to compare the marginal utility of wealth times $0.006Y$ with $0.1$ times the difference between the utility of wealth “with” the TV set and the utility of wealth “without” the TV set. Call this difference the “incremental utility of wealth” times the value of the TV set. The “incremental utility of wealth” is the slope of a chord connecting two points on the utility function—one of them with and one of them without the TV set. The question is whether the marginal utility of wealth is greater or less than $2/3$ of the “incremental utility of wealth,” where the incremental utility of wealth is measured over a span equal to approximately $0.04Y$, or $0.02W$.

My point is that few households would choose to insure against the loss of a TV set, given the choice as stated. The reason is that there is little difference, over so small a range, between the “marginal” and the “incremental” utilities of wealth. Put another way, if we assume that these households have a constant marginal utility of wealth, we won’t make much of a mistake with reference to the TV insurance problem, but we probably would make a significant mistake with reference to the house insurance problem.

The next step is to assert that for every case of social project evaluation that I can think of, the problem of risk analysis lies much closer to the TV insurance case than to the house insurance case. As I write this, news broadcast are still full of the aftermath of Hurricane Andrew, with losses estimated at $20$ or $30$ billion. How does this compare with “society’s wealth” in the United States? With gross domestic product (GDP) in excess of $5$ trillion, and using a ratio of $3$ or $4$ between national wealth and national output, we have national wealth in the range of $15$ to $20$ trillion. Hurricane Andrew’s losses are equal to somewhere between $0.001$ and $0.002$ of total national wealth. To the extent they are covered by the taxpayers, the cost entails far less than $1$ percent of the wealth of each of us. How can we worry about curvature in society’s utility function for wealth over such a small range? Any curve can be approximated as a series of linear segments. If we take a hypothetical utility of wealth curve for society and break it up into, say, $20$ linear segments, we will get a close approximation to the total curve. Now we come to my final point: my assertion that the risk issues surrounding each and every project I know of, and each and every relevant package of projects I know of, do not carry us off the last—the $20$th—such linear segment.

Therefore, we are on quite solid ground in saying that a linear approximation to society’s “utility-of-wealth” function is really a close approximation for the sorts of variations involved in the risk analysis of individual projects or relevant packages of projects. Accordingly, the assumption that society is neutral with respect to risk is valid, to an equally close approximation.
Portfolio Risk and Covariance

The problem of defining "society's portfolio" seems to be almost insurmountable. It is reasonably hard work to come up with estimates of society's overall real wealth. The methods we use for this do not distinguish among the narrow categories of wealth required to talk seriously about portfolio risk and the covariance of alternative outcomes of a particular project with the corresponding values (movements) of society's portfolio.

The most widely used methodology for establishing society's wealth consists of building up a time series of capital stock, using the perpetual inventory method. This is based on national accounts data on investment, broken down into categories like residential construction, nonresidential construction, machinery and equipment, and inventories. Rarely are these categories broken down by individual industry or by region; yet this is the type of breakdown one would need to make a good guess as to whether a particular new project has a positive, zero, or negative covariance with "society's portfolio."

My reaction to this difficulty is a strong "Why chase this particular rainbow?" Why should we spend vast amounts of professional time and resources on a quest that has so little promise? Especially so in light of the fact that the main point of the previous section remains valid—that is, the assumption of risk neutrality yields a close approximation to the truth in any case.

For readers unfamiliar with how covariance enters into the analysis of portfolio risk, table 5-1 presents a very rudimentary example. It shows five alternative "states of nature"—Depression, Recession, Normal, Prosperity, and Boom. Row 1 shows the probability associated with each state, while row 2 gives the value that the old portfolio is expected to have under each of these states. Now the investor is looking at two assets that he might add to the old portfolio. I assume that each asset (A and B) costs the same amount and has the same expected yield in real terms. The differences between A and B lie in the "timing" of their outcomes—not in the sense of calendar time but in the sense of the contingencies under which certain results appear. Thus asset A has a strong positive covariance with the existing portfolio, while asset B has an equally strong negative covariance. Rows 5 and 8 show the expected set of outcomes when we add assets A and B, respectively, to the old portfolio.

The bottom line of the covariance/portfolio analysis is given in rows 3, 6, and 9. Here the various outcomes are translated into utility units, employing the utility function shown at the bottom of the table. This reveals a significant difference between assets A and B when taken in conjunction with the old portfolio and the degree of risk aversion implied by the utility function. Thus while both A and B add an expected value of 100 to the portfolio, A adds only 91 in terms of utility units, while B adds 100.8, measured in the same terms.

The example of table 5-1 shows how risk considerations can lead to a significant difference in the valuation of two alternative assets in the portfolio/utility-of-wealth context. How would we likely change this example if A and B were two projects being evaluated from the social point of view? In the first place, the size of the projects would be smaller. So, too, would the extent of variation in portfolio value as one moved from state to state. Furthermore, in all likelihood the "true" utility function would drop less sharply in marginal utility as one proceeded through successive levels of wealth. Also, the variance of project outcomes would in all likelihood be far less.
correlation (positive and negative) between project outcomes and those associated with this old portfolio would be far less than perfect.

Table 5-1. Asset Valuation under Different Risk Assumptions

<table>
<thead>
<tr>
<th>State</th>
<th>Depression</th>
<th>Recession</th>
<th>Normal</th>
<th>Prosperity</th>
<th>Boom</th>
<th>Expected Value</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Probability</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>1,000.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>2. Old portfolio</td>
<td>800.0</td>
<td>900.0</td>
<td>1,000.0</td>
<td>1,100.0</td>
<td>1,200.0</td>
<td>1,000.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>3. Utility</td>
<td>(Old portfolio)</td>
<td>790.0</td>
<td>897.0</td>
<td>1,000.0</td>
<td>1,099.0</td>
<td>1,194.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>4. Asset A</td>
<td>0.0</td>
<td>50.0</td>
<td>100.0</td>
<td>150.0</td>
<td>200.0</td>
<td>100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>5. Old portfolio + A</td>
<td>800.0</td>
<td>950.0</td>
<td>1,100.0</td>
<td>1,250.0</td>
<td>1,400.0</td>
<td>1,100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>6. Utility</td>
<td>(Old portfolio + A)</td>
<td>790.0</td>
<td>949.0</td>
<td>1,099.0</td>
<td>1,240.0</td>
<td>1,372.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>7. Asset B</td>
<td>200.0</td>
<td>150.0</td>
<td>100.0</td>
<td>50.0</td>
<td>0.0</td>
<td>100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>8. Old portfolio + B</td>
<td>1,000.0</td>
<td>1,050.0</td>
<td>1,100.0</td>
<td>1,150.0</td>
<td>1,200.0</td>
<td>1,100.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>9. Utility</td>
<td>1,000.0</td>
<td>1,050.0</td>
<td>1,099.0</td>
<td>1,147.0</td>
<td>1,194.0</td>
<td>1,100.0</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

n.a.: Not applicable.

Utility Function for Table 5-1

<table>
<thead>
<tr>
<th>Wealth</th>
<th>Utility</th>
<th>ΔU</th>
<th>Wealth</th>
<th>Utility</th>
<th>ΔU</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>790</td>
<td>n.a.</td>
<td>1,100</td>
<td>1,099</td>
<td>49</td>
</tr>
<tr>
<td>850</td>
<td>844</td>
<td>54</td>
<td>1,150</td>
<td>1,147</td>
<td>48</td>
</tr>
<tr>
<td>900</td>
<td>897</td>
<td>53</td>
<td>1,200</td>
<td>1,194</td>
<td>47</td>
</tr>
<tr>
<td>950</td>
<td>949</td>
<td>52</td>
<td>1,250</td>
<td>1,240</td>
<td>46</td>
</tr>
<tr>
<td>1,000</td>
<td>1,000</td>
<td>51</td>
<td>1,300</td>
<td>1,285</td>
<td>45</td>
</tr>
<tr>
<td>1,050</td>
<td>1,050</td>
<td>50</td>
<td>1,350</td>
<td>1,329</td>
<td>44</td>
</tr>
<tr>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>1,400</td>
<td>1,372</td>
<td>43</td>
</tr>
</tbody>
</table>

n.a.: Not applicable.

Table 5-2 makes only two changes to the picture shown in table 5-1. First, the size of the new project (be it A' or B') is reduced from 100 to 20; that is, from 10 percent of initial wealth to 2 percent of initial wealth. Second, instead of the outcome ranging from zero to twice the expected value, we have the outcome ranging from 50 percent to 150 percent of the expected value. Asset A' still has a perfect positive correlation with the old portfolio, asset B' a perfect negative correlation. The utility function is still the same; in table 5-2 it is simply set out to read like an income tax table, to permit easy interpolation.

The change between the two tables is quite dramatic. Whereas the incremental expected utility from asset A was 91, and that from asset B was 100.8, we now have a utility increase of 19.94 from asset A' and 20.30 from asset B'. The difference falls from 9.8 all the way to 0.36—a much greater fall than one might expect just from reducing the
investment to $1/5$ its former size and from cutting the coefficient of variation of the outcomes in half.

One can also consider, using the data of table 5-2, how a project, $C'$, whose outcome had no cyclical sensitivity would compare with $A'$ or $B'$. If $C'$ has an outcome of 20 regardless of the state of the economy, the combination “old portfolio plus $C'$” would have an expected utility of 1,017.60. Note that this is exactly 20 greater than the expected utility of the old portfolio, 997.60. That is, in assessing the incremental benefit due to $C'$, we get exactly the same answer, regardless of whether we work with expected income or expected utility. In assessing that because of $A'$, the expected utility measure differs from the expected income measure by $3/10$ of 1 percent (19.94 versus 20.00). Finally for $B'$ the difference between these two measures is 1.5 percent (20.30 versus 20.00).

Now think of $A'$, $B'$, and $C'$ as projects, and of the utility function. The project cost of 20 represents 2 percent of national wealth. The cyclical swing of national wealth between “recession” and “prosperity” is equal to 20 percent of average wealth; the swing between “depression” and “boom” is 40 percent of national wealth. The probability of recession is 20 percent; that of depression is 10 percent. In all these respects the scenario appears to overstate the volatility of “states of nature” that we see in most real-world economies. Conclusion: Even in extreme examples we do not make much of a mistake by working with the simple and “utilitarian” assumption that society is neutral with respect to risk. This is what allows us to calculate an expected income, expected benefit, expected cost, and so forth in calculating the net present values of our projects.

On Discount Rates and Shadow Prices of Funds

This section reviews and extends the treatment given to this subject in “Reflections on Social Project Evaluation” (Harberger 1985; pp. 169–75). I focus here explicitly on the discount rate to be used in social project evaluation. We deal with a distorted capital market in which we have a marginal productivity of capital, $p$ (assumed = 12 percent), a marginal rate of time preference, $r$ (assumed = 4 percent), and a market interest rate, $i$ (assumed = 6 percent). We assume that when someone or some entity enters the capital market with a new demand for funds, these funds are “sourced” from displaced investment (entailing a social cost of $p$ per year) and from newly stimulated savings (with a supply price, hence social cost, of $r$ percent per year). Thus we get a social opportunity cost of capital equal to $\omega_s (= f_1p + f_2r)$, a weighted average of $p$ and $r$, with the weights representing the fractions of sourcing from the two alternative sources. In our numerical examples we will assume $f_1 = .75$ and $f_2 = .25$, yielding $\omega_s = 10$ percent.

Some economists have argued for the use of $r$ as the discount rate on the ground that $r$ is the rate that individuals use in making their choices between present and future consumption. The use of such a low rate would seem to open the door to a whole flood of projects, but in fact it does not. These economists recognize the distortions existing in the economy, $p$ and $i$ differing mainly because of corporation and property taxes, $i$ and $r$ differing mainly because of personal income taxes. They recognize, in particular, that drawing 1,000 of funds from the economy entails (under our numerical assumptions) forgoing a perpetual stream of 90 per year ($= 750$ of displaced investment times its productivity rate of 12 percent) of productivity from forgone investment, and also requiring a payment of 10 per year ($= 250$ of newly stimulated savings times a supply price of 4 percent) of compensation to the new savers (required to elicit their choice to
Table 5-2. Asset Valuation under Different Risk Assumptions and Project Size

<table>
<thead>
<tr>
<th>State</th>
<th>Depression</th>
<th>Recession</th>
<th>Normal</th>
<th>Prosperity</th>
<th>Boom</th>
<th>Expected Value</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Probability</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>2. Old portfolio</td>
<td>800.0</td>
<td>900.0</td>
<td>1,000.0</td>
<td>1,100.0</td>
<td>1,200.0</td>
<td>1,000.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>3. Utility (Old portfolio)</td>
<td>790.0</td>
<td>897.0</td>
<td>1,000.0</td>
<td>1,099.0</td>
<td>1,194.0</td>
<td>n.a.</td>
<td>997.60</td>
</tr>
<tr>
<td>4. Asset A</td>
<td>10.0</td>
<td>15.0</td>
<td>20.0</td>
<td>25.0</td>
<td>30.0</td>
<td>20.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>5. Old portfolio + A</td>
<td>810.0</td>
<td>915.0</td>
<td>1,020.0</td>
<td>1,125.0</td>
<td>1,230.0</td>
<td>1,020.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>6. Utility (Old portfolio + A)</td>
<td>8,001.4</td>
<td>912.9</td>
<td>1,020.0</td>
<td>1,123.5</td>
<td>1,222.2</td>
<td>n.a.</td>
<td>1,017.54</td>
</tr>
<tr>
<td>7. Asset B</td>
<td>30.0</td>
<td>25.0</td>
<td>20.0</td>
<td>15.0</td>
<td>10.0</td>
<td>20.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>8. Old portfolio + B</td>
<td>830.0</td>
<td>925.0</td>
<td>1,020.0</td>
<td>1,115.0</td>
<td>1,210.0</td>
<td>1,020.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>9. Utility</td>
<td>821.2</td>
<td>923.5</td>
<td>1,020.0</td>
<td>1,113.7</td>
<td>1,203.4</td>
<td>n.a.</td>
<td>1,017.90</td>
</tr>
</tbody>
</table>

n.a.: Not applicable.

Utility Function for Table 5-2

<table>
<thead>
<tr>
<th>Wealth</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 - 49</td>
<td>790 + 1.08 (W-800)</td>
</tr>
<tr>
<td>850 - 99</td>
<td>844 + 1.06 (W-850)</td>
</tr>
<tr>
<td>900 - 49</td>
<td>879 + 1.04 (W-900)</td>
</tr>
<tr>
<td>950 - 99</td>
<td>949 + 1.02 (W-950)</td>
</tr>
<tr>
<td>1,000 - 49</td>
<td>1,000 + 1.00 (W-1,000)</td>
</tr>
<tr>
<td>1,050 - 99</td>
<td>1,050 + 0.98 (W-1,050)</td>
</tr>
<tr>
<td>1,100 - 149</td>
<td>1,099 + 0.96 (W-1,100)</td>
</tr>
<tr>
<td>1,150 - 199</td>
<td>1,147 + 0.94 (W-1,150)</td>
</tr>
<tr>
<td>1,200 - 249</td>
<td>1,194 + 0.92 (W-1,200)</td>
</tr>
</tbody>
</table>

save more). Thus we have a total flow of 100 per year, into the indefinite future, which is the "cost" of raising 1,000 in the capital market today. Those who use  \( r \) as the discount rate then proceed to discount this 100 per year flow at the rate  \( r \) (here 4 percent) to obtain a present value of 2,500. From this operation comes a "shadow price of investible funds" of 2.5 (\( = \frac{\omega_s}{r} \)).

So we have a dichotomy between those who would use  \( r \) as the discount rate and those who would use \( \omega_s = f_1p + f_2r \). The first group is impelled to use a shadow price of investible funds equal to (\( \frac{\omega_s}{r} \)), while the second group uses a shadow price of 1.0 (that is, makes no adjustment to the normal measure of capital outlays).

In my previous paper "Reflections," I mention three reasons for preferring the combination (\( \omega_s, 1.0 \)) over the alternative combination [\( r, (\omega_s/r) \)]; communicability of the procedure, implications with respect to current expenditures, and implications for handling situations with different time preference for various groups. Here I will
Some Issues in Social Project Evaluation

concentrate on the second reason and refer readers back to "Reflections" for observations on the first and third.

It is but a simple step, following the numerical example presented above, to assume that the 1,000 of borrowed funds was being used to pay for the salaries of nurses or policemen or tax collectors or teachers. If the shadow cost of the 1,000 is 2,500 when it is used to pay for electric generating capacity, that shadow cost must also be 2,500 when it is used to pay for the current expenses of government. Or, consider the quite realistic case of a government that is always borrowing (debt increasing every year as the economy grows). Any reduction of 1,000 in current expenses—be it in nurses’ or teachers’ salaries, or in garbage or tax collection—will naturally lead to 1,000 less of borrowing than would otherwise be the case, resulting in a saving of future costs having a present value of 2,500. (This rather roundabout way of stating things is my response to those who say that “governments don’t typically borrow to cover current expenses.” This may sometimes be true, but still any autonomous reduction in current outlays will have its effect in reduced borrowing during the period in question.)

I am not arguing that the use of a 4 percent discount rate and a shadow price of investible funds of 2.5 entails some fundamental flaw of logic or analysis. But I am arguing that the label “shadow price of investible funds” is misplaced. It should be the “shadow price of public funds,” not just investible funds. Once this is recognized, one sees its powerful implication: Each and every current outlay should produce benefits equal to 2.5 times its costs! (See Sjaastad and Wisecarver 1976.)

For myself, I prefer the much less shocking implications of using ωs as the discount rate and 1.0 as the shadow price of public funds (for both capital and current outlays).

Using Measures of Social Opportunity Cost

This topic is a general one, with applications to various types of social opportunity cost, but it is probably most relevant and also easiest to visualize in the case of foreign exchange. Using Em to represent the market exchange rate (expressed in real terms) and Es to represent the social rate, we have the following formula for Es:

\[ E_s = \sum_{i} f_i E_m (1 + t_i) + \sum_{j} f_j E_m (1 + z_j). \]

Here \( E_m (1 + t_i) \) is the internal demand price of a dollar’s worth of imports of type \( i \), \( t_i \) being the tariff rate. (The dollar is used here to represent foreign currency—consider that we are a peso or rupee country.) Likewise \( E_m (1 + z_j) \) is the internal supply price (marginal resource cost) of a dollar’s worth of exports of type \( j \); \( z_j \) being the subsidy rate applying to exports of type \( j \). Clearly, \( f_i \) and \( f_j \) are weights giving the probable “sourcing” of a new demand for foreign exchange from these various sources. (See tables in chapter 4 of this volume, “Project Evaluation for the Next Decade,” for examples.) These weights must necessarily add up to one. Hence one can equally well express the social opportunity cost of foreign exchange as

\[ E_s = E_m + \sum_{i} f_i E_m t_i + \sum_{j} f_j E_m z_j. \]

This is an important lesson. The social exchange rate can be looked upon as (a) a weighted average of internal demand prices of import goods and internal supply prices of export goods or, equivalently, as (b) the market exchange rate (always in real terms)
plus a weighted average of the distortions $E_{m1i}$ and $E_{m2j}$ affecting the different types and classes of imports and exports.

It is extremely important to realize that the social opportunity cost concept is simply a way of systematically taking distortions into account for particular purposes. It represents an application of the general proposition that, after making the "private" evaluation of a project or policy, one should then correct for existing distortions by applying a general correction $\sum_i D_i \Delta Q_i$ where $D_i$ is the distortion affecting the $i^{th}$ activity and $\Delta Q_i$ is the change in the level of that activity stemming from the project or policy in question.

The reason why we use the concept of social opportunity cost is based on the repetitiveness of the operations in question. The foreign exchange market does not know whether today's new demand for $5,000 will finance a pleasure trip, an insurance premium, a computer, a lace tablecloth, or a shipment of children's toys. All the "market" senses is an extra demand. Its reaction will be the same, the "sourcing" of the extra dollars will be the same, regardless of who comes in to buy the dollars or how the dollars are finally going to be used.

One way to sense that this is the social opportunity cost of foreign exchange is to imagine a scenario in which somebody in a peso country goes out and actually buys $5,000 in the foreign exchange market. Then a fire occurs and the cash is burned up. We know that the private loss is $5,000, but what is society's loss? To replace the foreign exchange (which, in our terms, must be regarded as a real asset), the country will have to export more and/or import less. On the reduction in imports, potential tariff revenue will be lost; on the expansion of exports, any subsidies that have to be paid will add to society's cost, while any taxes that are generated will reduce that cost.

Return now to a normal case, where the $5,000 is not burned up but is spent on some import good. The act of buying the foreign exchange is what defines the social opportunity cost. Any distortions involved in the act of spending it have to be taken into account separately. Thus if the $5,000 is spent on something with a 30 percent tariff, this produces a credit (in the social calculus) of $1,500; if the $5,000 is spent on something with a 5 percent tariff, this credit is only $250. Whatever the case, the story of what happens when the $5,000 is spent has nothing to do with the social opportunity cost of foreign exchange. It gives rise to a completely separate entry in the social evaluation of a project.

The key word, in many senses, that defines social opportunity cost is sourcing. The message of this section is that sourcing and using foreign exchange are different operations, and the SOC of foreign exchange applies only to the former.

All the above refers to the case in which the project is going into the market to buy foreign exchange, which it then uses to purchase goods or services. There is also the opposite case of a project that, say, produces an export good and sells the resulting foreign exchange on the market. Here one just puts the previously described process into reverse. What was the social opportunity cost of the foreign exchange bought by the project in the earlier example now becomes the social benefit of the foreign exchange sold by the project. It is to the sale of foreign exchange that the weighted-average $E_s$ applies, and in this case it is a benefit, not a cost. By the same token, the tax or subsidy treatment of the specific items that are exported by the project must be dealt with separately; each separate $D_i \Delta Q_i$ should then be counted as one of the "external" costs or benefits of the project.
Projecting Changes in Relative Prices

In "Project Evaluation for the Next Decade," I point out that there may be bigger room for error in projecting market prices (relative to the general price level) than in estimating the appropriate relationship between social opportunity costs and their corresponding market prices. This naturally brings up the question of how to determine when allowances should be made (in project evaluations) for expected future price changes.

Perhaps the first point to make is that the task of projecting the future time paths of various important relative prices entering into project evaluations is not a task for the individual project analyst. There is thus some reason to wonder whether this is subject matter to be "taught" in regular project evaluation courses. What definitely should be taught is that project evaluators should be alert to the dangers of assuming that relative prices will simply remain constant into the indefinite future. They should seek out information on prospective changes and should incorporate such changes in their evaluations of particular projects.

In the best of all worlds, there would be central bodies to whom project analysts could turn in getting the required information. It is my understanding that the World Bank has a unit whose task it is to assess likely future trends in the prices of the principal commodities involved in world trade. It would be extremely helpful if this unit could take as part of its task the production of publications that could be used almost as "manuals" by project evaluators all over the world. Such a unit might also develop (alone or in collaboration with the International Monetary Fund) a general index of the "world price level of traded goods," which evaluators use as the standard deflator of the world prices of specific commodities (and could also use as the external price level in the standard measurement of each country's real exchange rate).

Even if the World Bank or some other organization undertakes the task of providing guidelines on relative price changes of internationally traded goods, there still remains a significant role for the central project evaluation authorities in individual countries. Not only should they make their own studies of the particular products that are most important in their country, but also they have major macroeconomic tasks, such as projecting the short- and longer-term future movements of the real exchange rate, the social opportunity cost of capital, the overall average level of real wages, and any likely trends of the wages of particular categories of workers relative to the overall average level.

Let us examine a few extreme cases. Today the consensus is that Argentina's real exchange rate (measured in pesos per dollar) is too low. The American press recently reported that Buenos Aires was the most expensive city in the Western Hemisphere for traveling businessmen. Even Argentina's official representatives recognize that today's real exchange rate is not tenable in the long run. (Their hope is that internal production costs will decline in real terms, so as to render a devaluation of the nominal peso unnecessary.)

In the early 1980s a spate of currency overvaluation occurred in a set of countries (Argentina, Chile, Mexico, Uruguay, plus others) that were the recipients of vast inflows of foreign capital. These inflows made the dollar extremely cheap (to local buyers) in real terms. But it could easily be verified that the rate of capital inflow was too high to be sustainable. The obvious conclusion was that the long-term real value of the dollar was significantly higher than the prevailing market value then.
These are real cases in which the evidence favoring a future rise in the real exchange rate was extremely strong. All four of the listed nations soon became the victims of the international debt crisis. Huge demands were made on them, mainly by the international banks that were their creditors, and their economies were put through wrenching adjustments. In the process their currency underwent huge, real devaluations. In each of the mentioned cases, the monthly series on real exchange rates has a peak that is more than twice the preceding trough. Moreover, this great swing took place within a relatively short time after the debt crisis struck.

Just as it was clear that the prevailing real exchange rate was below its long-run norm when the flood of capital was coming in, so too in the height of the adjustment that followed the debt crisis it reached points that were well above the norm. It is important for readers to realize that I am not asserting that these were points of disequilibrium—it is better to think of them as points of equilibrium characterizing transitory circumstances. When the capital flow was large, the supply curve of foreign exchange could be thought of as shifting far to the right. This was transitory because the countries in question were moving quickly toward their maximum debt/GDP ratios. The existence of prudent limits to the debt ratio can hardly be denied, but continued borrowing at the pace of 1980 or 1981, depending on the country, would soon carry it beyond such a limit.

In reaction to the debt crisis the countries squeezed credit to the extreme as they strove to meet the demands for payment. In the process GDP fell by an average of more than 10 percent in the four countries; imports were cut by more than half; unemployment soared. All these came as the result of shifting the countries’ stance from one of receiving a massive inflow of capital to one of having to generate a huge trade surplus. The real exchange rate had to be high in such circumstances in order to deter imports and stimulate exports. But the short-run “equilibrium” of that moment was different from the longer-run equilibrium that would come later, if for no other reason than the difference of supply response between the short run and the long run. When the debt crisis struck, the great bulk of the adjustment was borne by imports. Later, in response to the higher real exchange rate, exports (particularly nontraditional exports) grew significantly.

It should now be clear why the real exchange rate was low (but in equilibrium, given a huge capital inflow) in the early stage and high (but in equilibrium, given the demands of creditors) at a later stage, and why the longer-run equilibrium reflecting a “normal” postdebt-crisis situation would produce a real exchange rate that was in between, but quite distant from either of these extremes. Hence a project analyst working at the time of the big inflow should properly assume that the real exchange rate would increase from its then-prevailing level, while an analyst working at the time of the debt crisis should with equal assurance project a decline in the real exchange rate (RER).

Other circumstances in which a change in RER should be projected include cases where a country’s principal export good is experiencing an unsustainably high or an unsustainably low international price. In these cases there would be two price trajectories to trace—one for the principal export product as such, the other for the real exchange rate. Examples include coffee in 1977 (its world price tripled between 1975 and 1977), sugar in 1974 and 1980, tin in 1978–79, rubber in 1980, cocoa in 1977–78.

In any of these cases one has to study the situation to make sure that the new price does not reflect a permanent change in the prevailing supply/demand situation—something that is generally quite feasible to do. (Sugar reached 40–50 cents a pound in
1974 and 1980. At those prices there is hardly an arable hectare on earth where sugar, as cane or beets, cannot be profitably grown.)

The social opportunity cost of capital should be connected to the measured productivity of capital in the economy, but in periods of clear stringency in supply of funds in relation to demand, the near-term rates of discount should rise above the longer-term rate. For several years Chile used a variable real rate that started at 20 percent for the first year, then went to 18 percent for the second, 16 percent for the third, and so on, down to 12 percent for the fifth year and beyond. This is an exemplary way to deal with a near-term stringency of funds that is not expected to be permanent.

The course of real wages will largely be determined by the growth rate of GDP per worker, so a country projecting a 6 percent growth rate of real GDP will have a much different outlook for real wages than one which projects GDP growth at 3 percent per year. GDP growth is the principal factor to consider when projecting the growth of the general level of real wages, but we must also look at the situation of different segments of the labor market. When developing countries pass through a stage of rapid modernization, liberalization of capital and financial markets, and so forth, significant labor market premiums typically arise for the particular skills associated with financial analysis and the management of financial institutions. At the same time, modernization does not exert pressing demands on the unskilled labor force, so it is common for the unskilled wage rate to lag well behind the average rise of real wages during modernization periods.

The preceding notes reflect the level at which I would attempt to communicate some of the issues surrounding the projection of relative prices, in a course of relatively short duration, devoted to the general topic of social project evaluation. They do not go far enough to be the guidelines for those who will actually do the projections of relative price trajectories. But they certainly are adequate for sensitizing participants to the need to build changing relative prices into their projection procedures. They also indicate some of the main types of situations in which this need is most likely to arise.

References


The Role of EDI in Project Training for Developing-Country Managers

William Ward

The Economic Development Institute (EDI) should take a “worldwide systems” view of its role in project training in which it looks at national, regional, and Washington-based activities in terms of helping developing-country organizations create policies, operating procedures, and skills suited to development thinking and the development problems they will encounter in the 1990s. Pursuant to this, it should address the following issues:

1. *Project analysis training often does not focus on the right kinds of projects.* Project training provided for government officials in developing countries tends to be oriented toward planning and appraising projects (generally, larger ones) funded by bilateral and multilateral donors. The donors do their own appraisal; thus national agency staff needs to provide a liaison function, without necessarily being able to do these kinds of appraisals. Central and line agencies also need training directed toward projects that are locally planned, appraised, and funded. At least the national training programs should focus on providing this type of training. Moreover, the bulk of this training should be targeted toward the standard operating procedures (SOP) of the organizations doing the project work. (See point 2, below.) Thus the kinds of project skills taught should correspond to the functions of the various officials. This issue will be the focus of further discussions on the venue of training.

2. *Policy and procedures (management) consultancy often should precede project analysis training.* National agencies should have in place organizations, policies, and procedures (guidelines, manuals, and so forth) around which to develop project training. Before countries can develop the right types of training programs, they need management consultancy to help put into place the appropriate organizations, policies, and procedures. Time will often be better spent in the early stages by assisting in the development of these parts of the system as a first step. Is this kind of needs assessment/management consultancy an appropriate role for the EDI?

3. *We need to do a better job in dealing with issues other than financial and economic analysis.* Project courses and materials have focused on financial and economic appraisal of projects because these are easiest to teach in a short course format. Major weaknesses continue, however, in other areas of project planning and appraisal. For example, developing countries continue to have great difficulty finding the specialized subsector expertise needed to conduct technical analysis of industrial project proposals. Finding
some mechanism for putting technical, marketing, and operation and maintenance expertise into project planning continues to plague project trainers. This involves recruitment and retention practices, as well as training. What role do the Bank and the EDI have here?

4. *We need to rebalance the focus within economic analysis.* Project economic analysis has, since the publication of the *Manual of Industrial Project Analysis in Developing Countries* by Little and Mirrlees in 1968, focused on government failure and corrections for price distortions in the analysis. Much less attention has been paid in the past twenty years to the issues of identifying and valuing the effects of projects directed toward dealing with market failures, classic public and quasi-public goods, externalities, and so on. Issues such as estimation of willingness to pay for public utility outputs (that is, the consumers’ surplus issue) and valuation of quasi-public goods and externalities have taken a back seat to issues that include the estimation of conversion factors and accounting prices. It is primarily in industry and agriculture where the price distortions issue has warped investment decisions. Yet most of us have spent undue amounts of time in the past twenty years addressing these issues in all sectors. The EDI’s role in developing materials on water supply has been beneficial in breaking this trend. Can we muster the resources to continue filling such voids?

5. *We need to better integrate project analysis and policy analysis as well as the related training.* Economists now widely agree that we will not likely be able to make enough project investments in any sector in the 1990s to make up for bad policies affecting the sector. Thus in most countries the focus has shifted to getting policies and prices right rather than to correcting for price distortions while going forward with a government-directed investment program. The donors have moved on to implementing this approach in their programs without gaining an understanding of these issues by most government officials who are being asked to implement the new approach. On the one hand, we are teaching project courses based on an old government-interventionist, accounting-price model while, on the other hand, pushing programs that involve policy reform. Among other things, the content of the policy workshops needs to be brought into the project training programs. In addition, the nature of project analysis training must reflect the changing policy environment within which projects are planned. Do we need to do a better job of linking the policy workshops and the project training program?

6. *We need to integrate recent changes in development theory into project analysis and related training.* World Development Report 1991 reflected a changing approach to development. Compared with the 1960s and 1970s, market failure justifications for public sector intervention have narrowed greatly. These were narrowed further by the suggestion that government failure arising from inappropriate public sector interventions frequently causes more problems than simply tolerating the inefficiencies posed by many categories of acknowledged market failure. We need to do much more in all the project courses to reflect the changing views on which sets of government activities are now deemed appropriate and supportable by the international donor community. We also need to do more to develop appraisal and training materials that integrate this new approach into project appraisal practice, both inside and outside the Bank. At this juncture, the Bank has not accomplished this integration even for its own methods of project appraisal. This is partly because few people in the Bank are paying much attention to continuing to improve project appraisal practices (see point 7, below). Can the EDI take a leadership role in improving appraisal practices beyond those currently being applied in the Bank?
7. Bank practice cannot be the ultimate model for project analysis training in the EDI. Since 1980, project analysis work in the Bank has become increasingly perfunctory. In operational terms, lower-level staff are involved in project appraisal; fewer resources are committed to appraisal; basic models are seldom being developed for creating overall benefit streams; and less oversight is given to the appraisal process. On the methodology side, the Bank is doing less work on development and refinement of methods for project analysis (with the possible exception of environmental impact analysis). The Bank’s operational experience is becoming less of a source of practice and materials for project analysis, per se.

8. It will take special efforts to make Washington-developed training materials relevant to national programs. Certain training materials used in the national programs will need special attention, especially those related to procedures. Generic materials developed in Washington will not meet the targeted needs, although there will be a need for some generic materials. In addition, case materials will continue to be problematic because of the scarcity of case-writing skills. Many national programs have no staff with case-writing capability. Can the EDI provide a corps of case writers to work with national planners to help them develop appropriate case materials?

The Evolution of Project Training in the EDI

From the mid-1960s to the early 1980s, the EDI was a direct provider of project training for officials from developing countries. (The term “project training” is used here to denote training in the areas of project identification, preparation, appraisal, supervision, monitoring, and evaluation.) Training was conducted in three forums: (1) Washington at the EDI, (2) regional programs at various multinational institutions (for example, for Middle Eastern officials at the Arab Planning Institute in Kuwait), and (3) national programs in developing countries. In addition, the EDI assisted universities and other institutions in both developed and developing countries to prepare materials and curricula for project training within their graduate degree programs (for example, Shiraz University, the University of Pittsburgh, Michigan State University, Bradford University, and the University of the Philippines).

EDI project training drew on the Bank’s operational experience, and new course development depended heavily on the Bank’s operational staff. It conducted training-needs identification in conjunction with operational staff, who also had an important role in determining course content and selecting training materials. The typical pattern was to put a large initial trench of EDI and Bank resources into developing a course for presentation in Washington, before using the new curriculum and materials overseas in national and regional project training programs. The bulk of the materials now available in the EDI for project training was developed in conjunction with Washington-based courses and revised in repeated Washington and overseas presentations.

The Washington forum provided the developing and testing grounds for many of the courses that in the early 1990s continue to be conducted in revised form overseas. The EDI presented some project courses in Washington only once (for example, the 1977 General Projects Course); others were repeated several times there (for example, the Industrial Projects Courses). Because the EDI tended to allocate more resources to the Washington courses, those most often repeated there had and continue to have a larger,
better developed body of training materials available (see *EDI Catalogue of Training Materials*).

By the mid-1970s a stated objective of the EDI was to work toward transferring the project training capacity to regional and national institutions in the developing countries. By 1982 the institute had given primary responsibility for conducting project training over to these institutions.

EDI’s staff worked in the late 1970s to identify suitable regional and national institutions to which to transfer this capacity. Almost no perfect-match institutions were found. In the developing countries at that time, training institutions trained government officials in administration, national development planning, and various other subjects and skill areas; however, there were few national or regional institutions with a focus or capability in project training. In many cases, the EDI had to exert some degree of influence to get the institutions to take on project training as an area of work.

Various institutions were tried at different stages in the process, including administrative staff colleges, such as the one at Lahore; colleges, academies, and universities, such as the University of the Philippines at Los Banos and the Pakistan Academy for Rural Development; regional management institutes, such as the Eastern and Southern Africa Management Institute (ESAMI), training departments of development banks, including the Private Development Corporation of the Philippines (PDCP). In each case, course directors and lecturers had to be identified and trained to carry out the project training task and new career paths had to be built. In addition, the institutions required assistance in developing the training curricula and materials.

**Differences between Project Courses in Washington and Overseas**

**Staff levels and training venue.** Early in the process of transferring the capacity to national institutions, it became apparent that important differences existed between Washington-based and national and regional training programs. First of all, the Washington programs typically drew higher-level, faster-track officials, most of whom shortly became managers—not only managers of the project’s function itself, but often in a very short time policymakers and senior managers. The national programs, in contrast, trained a few (primarily midlevel) managers in the early presentations and then focused largely on training the more pedestrian staff of the projects’ agencies. This pattern was consistent with the real-world interface between training and compensation that existed then and has continued in most public institutions in developing countries: Because of low salaries in many of the subject institutions, overseas training has always been considered as partly staff development and partly compensation, with the more attractive overseas venues used to compensate higher-level staff for the financial sacrifices associated with remaining in the public service.

**Content of Washington programs.** The Washington project courses stemmed largely from Bank projects and procedures. They taught the lessons from a fairly wide range of larger projects, and they taught procedures that had been fairly well developed by Bank practitioners for the organization’s needs and projects. The Washington courses were very good training for those government officials who worked on Bank loans or had other liaisons with it. For the most part, the cases and procedures developed in Washington were revised and taught in the national and regional programs—although
there were and continue to be many examples of materials developed specifically for and from the overseas courses.

*Project work in national agencies.* Most of the larger projects in developing countries tend to get picked up for funding by the bilateral and multilateral donors. The donors have their own planning and appraisal procedures, and donor staff or consultants prepare and conduct the appraisals. The national line and central agency staff conserve resources by not duplicating this work. Rather, the theory is that national staff provide the link between the national development plan and the donor agency financing plans for the national investment program. Project planning and appraisal skills directed toward more than the requirements for this liaison function for the larger projects may well represent wasted resources.

*Local projects and national training programs.* What often has not been adequate in the national programs is development of training and materials oriented toward planning and appraisal of the smaller and more numerous projects funded outside the international donor framework. Most of these projects could benefit from improvements in planning and appraisal; the smaller projects normally found in the national programs cannot, however, support the cost of the kind of appraisals conducted for the larger projects funded by donors. Developing countries need appraisal methods suited to the types of projects and appraisers found in their agencies. Thus far, their training materials and programs have lagged behind those developed for planning and appraising the larger projects.

*Project organizations and project planning and appraisal.* In the performance-based training model discussed later in the Appendix, project training in at least the national programs would correspond to the organizational structures, planning and appraisal procedures, techniques, and manual statements that apply to the working environment of the officials in the countries' organizations. In most cases, the national training programs developed thus far have not given due consideration to the context of this operational environment. In the face of these failures, many countries have not “bought into” project analysis procedures and skills for officials planning local projects, and consequently have left the application of project appraisal techniques to the donors, since the donors will do their own analyses anyway.

*National, regional, and Washington programs.* The audiences and needs of the three venues are different. The audience of the national programs had and largely continues to have at least two characteristics not well served by the materials and approaches developed in Washington: (a) Most of the officials being trained in the national programs are low- and mid-level technicians, many of whom have not studied project analysis even in abstract form and lack even the low-level skills associated with acceptable project planning; and (b) in many cases, the officials are still planning and appraising projects in the absence of national equivalents of operational directives, operational manual statements, or central projects notes (that is, SOPs). The audience of the Washington programs tends to be higher-level professionals and managers who need to focus more on policy and management issues. The regional programs tend to fall in between, with a mix of audience ranging from staff similar to those of the national programs to the higher-level staff attracted by the Washington programs.
Venue, Curricula, and Materials

Training venue, curricula, and materials should tie in with the objectives of the training activity. The model discussed in the Appendix presents one "appropriate" approach to relating categories of objectives to categories of venue. It is important also to relate training materials development to objectives and venue.

In general, it is more feasible to develop abstract materials outside the venue of use than to develop concrete materials away from the venue of use. The EDI's experience in the 1970s, for example, was that project analysis case studies tended to grow out of a particular trainer's need to demonstrate a concrete point (or the intersection between an abstract principle and a concrete lesson) in a session that he or she was directing. Seldom did usable cases derive from any other source than a trainer's need for the material for a particular session. (Typically, the cases then were picked up and used by other trainers after seeing the case taught two or more times.) A small number of lecturers in the EDI developed most of the materials of this type specifically for project courses being offered repeatedly, either in Washington or overseas. This basic observation holds, in particular, for the development and revision of case and exercise materials.

Training materials relating to general principles or to reviews of knowledge and experience inside and outside the Bank have been developed by a broad range of parties for use inside and outside the EDI. These have not necessarily been related to the specific in-class needs of trainers. The experience with materials prepared by consultants, for example, has tended to be much better in course note writing than in case writing. By extension, the range of uses (in terms of training venue) of the course notes has tended to be better than that for the cases—although we must recognize that the lack of good, specific cases has often led to usage of inappropriate cases in a wide range of venues.

The hypothesis arising from these observations is that it will likely be difficult to prepare skills-oriented training materials in Washington for use in national and regional project training programs unless two requirements are met: (1) Those who prepare the materials are the ones presenting the sessions in the overseas courses, and (2) the EDI allocates sufficient time and resources for these lecturers to identify, prepare, test, and revise the materials. This hypothesis must be tempered by an additional observation: Case preparation skills (perhaps like fiction writing skills) are scarce. Among all the lecturers in the EDI's history, probably less than 10 percent have proved willing and able to write usable case studies. Thus the preparation of usable case materials not only will pose the above two requirements, but also will require that adept case writers be identified and assigned overseas teaching responsibilities, coupled with the time and resources required to develop such materials.

Venue and "skills" orientation. The national programs have always needed more "skills" orientation (that is, oriented more toward procedures than policy) and more targeting than the university programs, the regional programs, or the Washington-based EDI programs. They continue to have a substantial in-country demand for country-specific and organization-specific skills in project planning, analysis, and management. Materials and curricula—especially for these programs—tend to be most appropriate if developed from local needs, cases, procedures, and conditions.
A Model for Relating Venue and Training Content

Established procedures and the performance-based training model. A major problem with the national training programs in many countries is that established and codified policies, procedures, and techniques do not exist (with differing degrees of exception, such as the Philippines and Pakistan. They seldom have official procedures (such as the Pakistan PC-1 form and related systems and the Philippine "Project Development Manual") on which to design a project training program based on the classical performance-based model. This is particularly the case in the countries most frequently thought of as having serious training needs (largely the poorest member countries, many of which are in Africa). Thus to meet the needs at the national level, in many if not most developing countries, may well require a substantial commitment of resources in the form of skilled and specialized manpower in organizational development and training in project institutions.

The procedures/training interface. Most of these countries need to establish national and organizational systems first before they can effectively put in place the type of training necessary. (This approach was effectively used, for example, in the Philippines in the early 1980s for a regional planning project of the United Nations Development Programme implemented by the Bank, under the leadership of former Bank division chief Ben Thoolen.) Thus one may argue that the "off-the-shelf" approach to curricula and materials is substantially less than satisfactory for those agencies that need organizational development the most. On this basis, one may question how a model using training materials developed in Washington and made available to national and regional training programs could help the countries and institutions needing the greatest assistance.

A training model. The Appendix to this report presents an approach to project training based on what might be called a "classical" model. It puts training into the broader contexts of (1) strategic planning and management, (2) organizational development to achieve the performance objectives stated in the strategic plan, and (3) training as just one subset within strategic planning and organizational development. This approach involves the trainer in the overall planning activities of the organization, and it involves senior management in the identification and definition of the training program. The model breaks the distinction between "staff" and "line" functions and attempts to bring training (organizational development) back into the line functions. The approach is in counterpoint to the typical pattern found in many organizations, where management typically delegates training to a "staff" functionary (who often further delegates to a consultant) and does not involve trainers in the "line" functions of the organization. This latter approach, although widely practiced, has proven repeatedly to be a model for organizational performance failure.

The proposed model has certain attributes that trainers should appreciate at the outset. First, training and management are parallel and intertwined. Training materials and curriculum preparation—in practice—must correlate with the development of organizational policies and procedures. The development of materials and curricula needs feedback from, and interaction with, managers to make the materials good; furthermore, management needs the interplay with the training function in order to develop good policies and, especially, procedures.

Second, training and organizational development are continuous and dynamic. Only in a static organization, in which most activities are routine, would training curricula and
materials stay the same for long. If the environment, objectives, or policies of the organization change, the training also needs to change. Thus trainers must be constantly involved with line managers and operational staff. The changing environment in developing countries posed by structural adjustment, for example, provides a case in point.

Policy seminars and dynamism in procedural functions. Policy-oriented training and education should be designed to prepare upper management to deal with nonroutine activities and to make policy. Procedures-oriented training should be developed in conjunction with and reflect the policies and procedures that evolve from strategic and tactical decisions made by upper management. If there is a need for policy training, then, by definition, there will also be a dynamic element to procedures and to the training that accompanies it. It is not rational to expect that project training curricula and materials will be static in the face of a perceived need to conduct policy-oriented seminars.

New policies, old procedures. The 1980s saw a dramatic change in the environment in which project work takes place. The materials arising from the various EDI policy seminars document this change quite well. The EDI spent the decade—no doubt correctly—attempting to help senior managers cope with that changing environment. In the process, it paid less attention to the interface between policies and the procedures needed to implement changed policy approaches. This is true across a broad spectrum of development management functions in developing countries—including macroeconomic management and program and project planning. Although the EDI was helping managers understand the changing environment, the “procedures” used by lower-level staff in the organizations reflected policies designed to deal with a paradigm that grew out of the “policy” issues of the 1960s and 1970s. It is time for the EDI to consider (1) helping convert the evolving policy changes into SOPs that will improve the performance of the organizations whose managers have been sensitized, and (2) training the middle and lower-level staff, who must now operationalize these performance-based changes in SOPs.

The Current State and Changing Requirements of Project Analysis

Project planning and analysis require a broad range of skills. These fall under the general headings normally assigned to “Aspects of Project Analysis”—namely, financial, economic, commercial, technical, organization and management, and so on. In the 1960s and 1970s, the EDI attempted to develop training materials and approaches to deal with all the aspects of project planning and appraisal. Staff assigned to project training included engineers, agriculturalists, financial analysts, and even management experts.

By the end of the 1970s, the project courses had settled down to focusing largely on financial and economic aspects of projects. The other skill areas were still thought to be important, but most lecturers tacitly had begun to admit that (1) not all those objectives could be met in one training program, and (2) certain of those aspects could not be transferred in the time available, even if the entire course were allocated to it (for example, market planning and analysis, organization and management, and technical analysis).

Most of the project analysis material and curricula currently available within the EDI focuses on financial and economic analysis, much of which was developed for
Role of EDI in Project Training

Theories of development practiced in the 1960s and 1970s gave a proactive role to government. The presumed success of central planning in the former U.S.S.R. and the belief that widespread "structural" problems in developing countries precluded the efficient functioning of markets led to prescriptions for large-scale government intervention and "directing" their economies. Projects were often deemed the cutting edge of this process.

The activist role of government in the 1960s and 1970s led to large-scale "distortions" in prices and incentives in many developing countries. The effect of these distortions on patterns of public and private investment led project economists to turn to dealing with these distortions in the analysis of public sector investments and publicly influenced private investments. This process came to a head in the late 1960s and early 1970s with the publication of two important, widely known books on project analysis by the Organization for Economic Cooperation and Development and the United Nations Industrial Development Organization. These books and their descendents caused cost-benefit analysts to shift their attention almost entirely from issues related to dealing with "market failure" in project analysis to dealing with "government failure." Infatuation with conversion factors and accounting prices was the outcome of this shift in focus of cost-benefit analysis.

In the 1980s the focus was on getting government out of economic activity rather than one of adjusting the project accounts for government's distorting effects. Instead of suggesting investing in projects that looked good after correcting for the distortions—the approach taken in the 1970s—analysts shifted to "sector" and "policy" operations designed to get rid of the distorting influences imposed by government. In the process, the pendulum may have temporarily swung too far, and—with encouragement from the Thatcher and Reagan administrations—it became popular in the Bank and other parts of the donor community to suggest that all government activity may be inappropriate.

By 1990 a more balanced approach had begun to re-emerge in the Bank and in some other parts of the donor community. The more balanced approach returned to an updated version of the "theory of market failure," in which government was given a role, but a more circumscribed one. World Development Report 1991 recognized this changed world and a new approach to development involving a facilitating role for government, rather than a proactive role.

This reorientation of development theory is already having an inexorable effect on project identification, planning, and appraisal. On the one hand, it is leading to implementation of new types of projects (for example, the India Technology Development Project) by those who are at the forefront of the emerging approach to development. On the other hand, it is causing analysts to apply the traditional approaches to project appraisal—those reflected in existing manuals and guidelines—in an increasingly perfunctory fashion, both in the World Bank and in agencies that still pretend to do cost-benefit analysis. The guidelines and training materials that form the
basis for "procedures" of project analysis are increasingly inappropriate to the
development theories and project practices of the 1990s.

Dealing with project-planning needs in the 1990s will require a major refocus of training materials and curriculum development:

1. Within the proposed worldwide delivery system we must find some way to provide the skills for other aspects of project planning besides financial and economic analysis so that the line agencies will have project planners skilled in these other areas.

2. Curricula and materials must be developed to assist government officials in identifying and planning the public interventions deemed appropriate in the new and evolving approach to development—for example, skills in identifying interventions to improve the environment for developing and internalizing technology.

3. A refocus of cost-benefit analysis on the identification and measurement of benefits arising from interventions in the market failure sectors is necessary and must lead to curricula and training materials directed toward developing the requisite skills.

4. In the next five years, training materials and curricula will be required to help establish this new project paradigm in the consciousness of central and line agency managers and professionals.

These changes will be particularly problematic. It takes ten years or more to get "new" thinking in the economics community to effect the policies and procedures of operating agencies in developing countries. First, the attitudes of top management must change. Then, policies must change. Finally, training of operational staff and the development of new procedures must proceed together.

We currently find ourselves running training activities designed to reorient the thinking of top managers to the "new" approaches to development. Bank operational units are, at the same time, trying to force changes in policies to accommodate the "new" thinking. But at the same time training programs and project-planning procedures still focus on "old" methods of public intervention in the economy.

In the 1990s, major new investments will be necessary in the development of "systems" for implementing what we learned in the 1980s about the role of the public sector and about the role and practice of project planning and implementation in economic development. Just as the Bank, through the EDI, took a leadership role in these areas from the 1950s onward, a similar leadership role will be essential in the 1990s.
Appendix: A Systems View of Human Capital Development for Project Planning Organizations in Developing Countries

The differences in training needs of various officials and in the strengths and weaknesses of different venues lead to identification of a model based on a worldwide systems approach to meeting the human capital needs of project planning and implementation organizations in developing countries. The model involves at least two sets of actors: (a) the individuals and institutions to whom the training and education are directed, and (b) the actors in the training and education delivery process (“training” implies here delivery of concrete skills, while “education” implies delivery of broader and perhaps more abstract knowledge).

Project Training Recipients

There are different uses and thus different needs for project training at various levels within project organizations and central organizations of developing-country governments. Staff members passing through the management progression need, at some time or another in their careers, an understanding of the training and educational content delivered at each position level they enter.

Generally, officials at higher levels (policymaking and management positions) need greater breadth of knowledge of the political and economic environment and the policy issues surrounding project planning. They require more knowledge of the external environment within which the organization operates. They also need to know something about the general principles that have been developed in the broader world to deal with the issues involving their organization.

Staff at lower-level operational positions in project organizations, in contrast, need greater depth of skills in the details of the organization’s work. The requirements for these positions tend to be (a) more internally focused and (b) more skill oriented than are the senior management and senior policy positions. The lower-level staff’s knowledge and skills are usually quite specific to the procedures and practices of their own organizations. Table 6-1 presents a schematic view of this distinction. This difference is sometimes referred to as the hierarchy of emphasis within the organizational structure on “policy” issues compared with “procedures” issues. Note in table 6-1 that the high-level officials do not necessarily have to be as knowledgeable about the details of internal procedures as do the midlevel managers and the senior professionals. However, the most senior officials should be much more informed about the environment in which the organization functions. This latter kind of knowledge often will require continuous experiences outside the organization, even outside the country.

In general, training tends to be increasingly specific, skills-oriented, and procedural when the training venue is closer to the job site. Many organizational development experts argue that it is best to address the needs of lower-level officials in organization-level training activities, those of midlevel officials in national training programs, and so forth. Senior managers and senior policy advisers need a much broader view of the external environment in which their organizations function; thus the policy-oriented seminars offered by the EDI for senior officials tend to fit well into this systems approach to training.
Table 6-1. External Knowledge Compared with Internal Skills Requirements of Officials in Project Planning Organizations

<table>
<thead>
<tr>
<th>Official</th>
<th>External knowledge (policy)</th>
<th>Internal skills (procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior management</td>
<td>★★★★★★</td>
<td>★★</td>
</tr>
<tr>
<td>Senior advisers</td>
<td>★★★★★★</td>
<td>★★</td>
</tr>
<tr>
<td>Upper middle management</td>
<td>★★★★★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>Middle management</td>
<td>★★★★★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>Senior professionals</td>
<td>★★</td>
<td>★★★★</td>
</tr>
<tr>
<td>Professionals</td>
<td>★</td>
<td>★★★★</td>
</tr>
<tr>
<td>Assistant level</td>
<td>*</td>
<td>★★★★</td>
</tr>
</tbody>
</table>

Project Training Delivery

As implied in the preceding subsection, project (as well as other forms of) training may take place close to the job, or at great distance. At the same time, the training may be oriented toward organizational procedures (that is, it may be very concrete), or it may focus on principles (it may be more abstract in approach). Table 6-2 schematically states the principle that the breadth of vision required by senior management may require that part of their education and training be done in programs in which they interact with a broad range of peers from other related environments. Lower-level staff are engaged in more “procedural” activities (see the following section and table 6-3). Generally, the lower the operational part of a project organization, the more procedural the training needs tend to be. At the lowest levels (that is, assistant level and professional level, in table 6-2), knowledge and skills in established procedures diminish because: (1) newer entrants to the organization tend to cluster at those levels, and (2) older staff with limited ability to master all skills required for the organization’s work also tend to remain at these levels.

Routine and Nonroutine Project Activities

Generally, the most senior managers in a project organization should deal almost wholly with nonroutine activities—tasks for which no established procedures are possible and thus carry the possibility of making policy with every decision. Standard models of organizational management suggest that the mix of routine and nonroutine activities should change toward more routine as one moves downward in the organizational hierarchy. Table 6-3 describes the suggested relationship between routine and nonroutine activities according to staff level within a project organization.

Generally, the more routine the activities performed, the greater the scope for developing established procedures, manual statements, guidelines, and classical training. The more nonroutine the activity mix, the greater the need for abstract thinking, knowledge of general principles and policies of the organization, and knowledge of the outside environment. Again, the EDI policy seminars generally help build the capability
Table 6-2. Training and Education Venues for Human Capital Requirements of Project Organizations

<table>
<thead>
<tr>
<th>Venue</th>
<th>External knowledge (policy)</th>
<th>Internal skills (procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>International institutions (for example, EDI, Harvard University)</td>
<td>***</td>
<td>*</td>
</tr>
<tr>
<td>Foreign regional institutions (for example, Arab Planning Institute, ESAMI, etc.)</td>
<td>***</td>
<td>*</td>
</tr>
<tr>
<td>National university</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Local or regional college</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Staff training college (for example, administrative staff college)</td>
<td>***</td>
<td>****</td>
</tr>
<tr>
<td>Sectoral training institute (for example, LPPI, bankers' staff training college, and so on)</td>
<td>***</td>
<td>****</td>
</tr>
<tr>
<td>Training department</td>
<td>**</td>
<td>********</td>
</tr>
<tr>
<td>On-job supervision</td>
<td>*</td>
<td>********</td>
</tr>
</tbody>
</table>

Table 6-3. Routine and Nonroutine Activities by Level in Project Organizations

<table>
<thead>
<tr>
<th>Official</th>
<th>Nonroutine activities (policy)</th>
<th>Routine activities (procedures)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior management</td>
<td>***</td>
<td>*</td>
</tr>
<tr>
<td>Senior advisers</td>
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<tr>
<td>Upper middle management</td>
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<tr>
<td>Middle management</td>
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<tr>
<td>Senior professionals</td>
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</tr>
<tr>
<td>Professionals</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Assistant level</td>
<td>*</td>
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</tr>
</tbody>
</table>

to deal with nonroutine activities, and to establish the policies for a framework of procedures.

The Procedures/Training Interface

Not all project organizations structure the work program in the manner outlined here. An almost-universal problem in these organizations is that a disproportionate share of both
the routine and the nonroutine work is borne by the staff above the senior professional level. An often-quoted rule of thumb is that 80 percent of all work—routine and nonroutine—gets done by the top 20 percent of the staff. In a common anecdote, the top staff do their own work during the day (predominantly nonroutine work) and do their staff's work at night (predominantly routine work). Most project organizations seriously need to put in place systems and skills that will allow their organizations to better use all their human resources.

To improve the percentage of the operational load carried by the lowest-level staff (assistant level and professional level in table 6-2) requires that planners develop "established procedures" and that organizational development activities (including training) closely correlate with the development of "standard operating procedures." It is important to understand that the development of training (in the present context, "project" training) for staff below the upper-middle-management level should go hand in hand with the development of SOPs. The standard model shows the SOPs being developed by upper-middle and middle management. The reality is that, in most cases, development of the SOPs and staff training should be a combined effort by trainers and senior/middle management.

While tables 6-1 to 6-3 of course paint the world with broad and simple brushes, they nevertheless are useful in analyzing the worldwide system for meeting the human capital needs of project planning and implementation organizations in developing countries.
The Appraisal of Investment Projects: A Training Approach

Glenn P. Jenkins

The ultimate outcome of a public or a private investment hinges on the financial, economic, managerial, and political parameters associated with the project. A financial or economic net present value (NPV) calculated on a few sets of input variables tells one little about the potential of a project if its managerial capability is weak and its political support is fickle. While any analysis has its limitations, a project evaluation that closely links the financial and economic analysis, and in turn identifies the distribution of benefits and costs over the various interest groups, will be far more likely to identify fatal flaws in a project's design than will an appraisal that segments the analysis and does not address the interdependencies of the components.

A primary outcome of a project appraisal is the identification of aspects of the project that could inflict great damage on its performance. With this information the next step is to see if the project can be redesigned (organizationally, financially, or physically) to make it more robust and resistant to external or internal shocks.

In order to carry out project evaluations in this way, it is our view that project analysts should be comfortable with the skills of financial analysis, welfare economics, the evaluation of alternative sources of project uncertainty, and estimation of the distribution of costs and benefits across interest groups.

The Relationship between Financial and Economic Analyses

The economic analysis of an investment project is an essential complement to its financial appraisal. When traditional financial analysis examines the feasibility of the total investment for a project, the appraisal is done from the point of view of the banker. Alternatively, if this project is a voluntary undertaking by its owners, analysts must consider the financial feasibility of the project from the owners' point of view.

These perspectives differ in the way they treat certain variables. For example, from an owner's point of view, a loan is a cash inflow and repayment of the loan and interest is a cash outflow; from the banker's point of view, neither of these items is present in the cash

The assistance of Vivien Goldman and Mostafa Baheer El-Hifnawi in the design and implementation of the programs discussed here is greatly appreciated. Without their ideas and dedication, the outcomes of these "projects" would be very different.
flow. A close comparison of the annual (or even monthly) cash flows from these two perspectives provides a means to analyze the way a particular set of financing arrangements distributes the risks of a project among its financial interests.

Traditionally, the financial internal rate of return (FIRR) and the NPV of the project are calculated from the cash flow statements developed from these financial perspectives. These summary criteria do not, however, accurately assess the sustainability of a project or its riskiness. Consider a project that has both a large FIRR and a large positive NPV but also has negative cash flows in the early years of its life. Such a project may go bankrupt long before it gets a chance to generate the large positive net cash flows expected in later years. Examination of the cash flow profile over the project’s lifetime will indicate the sustainability and financial riskiness of the project.

An economic analysis of a project evaluates its feasibility from the point of view of the whole country. A positive net present value indicates that the project will make a positive contribution to the economic growth of the country as compared with utilizing the funds for their alternative uses. This criterion, however, is reliable only if the project is financially sustainable. If the financial structure of the project is such that it cannot pay its financial costs, the potential net economic benefits have little probability of realization.

The economic values of both inputs and outputs differ from their financial values because of market distortions created by both the government and the private sector. Tariffs, export taxes and subsidies, excise and sales taxes, production subsidies, and quantitative restrictions are common distortions created by the government, while monopolies are a market phenomenon that can arise from either private or public sector actions. Some market distortions are created by the public nature of the good or service. The values of common public services such as clean water, transportation, road services, and electricity are based on the maximum amount people are willing to pay for the services. These values are often significantly greater than the financial prices people must pay for the services. It is such factors that create divergences between the financial and the economic prices for a project.

A consensus exists among accountants on the principles to use in undertaking a financial appraisal of a potential investment, with relatively minor disagreements on certain issues, such as the treatment of inflation. Also, financial analysts will usually agree on the cash flow and balance sheet requirements for a public or a private sector project to remain viable. Nevertheless, these accounting and financial principles are not a sufficient guide for undertaking an economic appraisal of an investment.

The measurement of economic benefits and costs is built on the information developed in the financial appraisal, but in addition, it extensively uses the economic principles developed in the field of applied welfare economics (Harberger 1979). The techniques of economic investment appraisal are predicated upon three basic principles of applied welfare economics: (a) the competitive demand price for a given unit of an item measures the value of that unit to the demander (that is, his willingness to pay); (b) the competitive supply price for a given unit of a good or service measures the value of that unit to the supplier; and (c) when evaluating the net benefits or costs of a given project in a period, the costs and benefits accruing to each relevant group (for example, a nation, tribe, profession, or an income class) should wherever possible be measured and identified with the recipient, but in the assessment of a project’s economic efficiency, all costs and benefits should be added up to determine the overall net economic benefit of the project.
At the present time, there is broad agreement in the field of applied investment appraisal as to how to use these principles to estimate the economic prices of inputs and outputs of projects. The alternative approaches do not differ significantly in their theoretical foundations and in the recommendations of approval or rejection (Ward, Deren, and D'Silva 1991, pp. 1-50). The choice among the different ways of expressing the results of the analysis, however, depends on how analysts use the economic analysis in the overall financial, economic, and social distributional assessment of a project.

Traditional approaches to appraising investment projects have tended to undertake the economic analysis in isolation from the financial analysis (Asian Development Bank 1987; Dasgupta, Marglin, and Sen 1972; Little and Mirrlees 1979, 1982). But the frequent collapse of development projects worldwide during the 1980s has forced project analysts to consider the sustainability of these investments. Furthermore, there continues to be a need to identify the groups in society that will benefit from a project and those that will bear the costs. Finally, in an environment of trade liberalization and economic policy reform, the economic distortions that financially subsidize a project become some of the main sources of its financial risk.

Many project bankruptcies in the real estate development sector in Malaysia in the 1980s arose from the government's cutback in subsidies to such projects. The reduction in the rate of trade protection in Indonesia and Argentina provides two examples in which the realignment of financial prices of inputs and outputs with their fundamental economic values caused a considerable decline in the financial profitability of some industrial projects. Unless the prospective economic and financial performances are compared on a period-by-period basis, it is difficult to assess a project's financial risk arising from the potential to either reduce or augment economic distortions.

The difference between the financial and the economic values of a good or service represents a benefit or a cost that accrues to someone other than the financial sponsors of the project. Additional taxes cause financial values to decline, while some level of government will benefit from the tax revenues. If the financial price of a service, such as water supply, is less than its economic value, this means that the consumers of water receive an increase in their real standard of living. A project that causes the price of a good or a service to fall, will create economic benefits that are greater than its financial revenues. This difference between the financial and the economic values will represent a distributional gain to the consumers of the output, and a somewhat smaller loss to the other producers of the good or service who are competing in the market with the project. In each case, one can define the distributional effect by the difference between a financial price and an economic value for the inputs or outputs of a project.

As international organizations start to stress cost recovery and the financial sustainability of projects, an important question for many public sector projects is the level of user charges that a project can levy on consumers while still maintaining demand. Analysts can determine this only by estimating the economic value of the benefits to the consumers as measured by their willingness to pay for the good or service. Again, a direct comparison of financial prices and economic values is essential before setting a financial charge that will enable the project to be financially sustainable.

To carry out an analysis of risk, distributional impact, and project sustainability, two conditions must hold. First, we must express the financial and economic analysis in the same units of account. This may be domestic currency at the domestic price level, domestic currency at the border price level, units of foreign exchange, or any other
monetary unit that is easy to measure and understand. When the financial analysis is
done in one unit of account and the economic analysis in another, the differences
between the financial and the economic values will have no meaning. Hence the elements
of risk and distribution become much more difficult to assess. Second, analysts should
compare the project's economic and financial profiles on a period-by-period basis and
not just summarize them in a single statistic, such as the net present value or the internal
rate of return. Neither of these conditions has been stressed by the traditional
methodologies of economic appraisal, but they are critical in the assessment of a project's
likelihood of survival, whether it be financially, economically, or politically.

The Choice of a Numeraire in the Economic Analysis of Projects

In theoretical developments of the economic analysis of projects, various authors have
used different numeraires to measure economic costs and benefits. Basically, they have
most frequently used three of them: (a) the willingness-to-pay numeraire expressed in
domestic currency at the domestic price level, (b) the willingness-to-pay numeraire
expressed in domestic currency at the border price level, and (c) a numeraire by which all
values of inputs and outputs are expressed in units of foreign exchange. Experts now
widely recognize that the choice of a numeraire in conducting an economic analysis in
isolation is largely a matter of convenience in measurement. (For an excellent discussion
of the theoretical and practical features of each of these numeraires, see Ward, Deren, and
D'Silva 1991, chapters 4-7.)

The financial analysis is generally done in domestic prices at the domestic price level
because these are both the "currency" and the "price level" in which the financial
sponsors of the project operate. The use of any other numeraire quickly diminishes the
level of understanding that the financial decisionmakers will derive from the results of
the financial analysis.

In the past, various "schools" of project analysts have recommended using the
numeraires mentioned above. In particular, analysts following the method of the United
Nations Industrial Development Organization or the approach developed by Arnold
Harberger (1982) use domestic prices at the domestic price level as the numeraire, while
those following the Little-Mirrlees approach use either domestic prices at the border
price level or units of foreign exchange as the numeraire.

Using units of foreign exchange as the numeraire has a considerable theoretical
weakness when valuing the nontradable goods where the level of consumption
(demand) is affected. In the shortcut approach to determine the economic value of a
project output in foreign exchange when the consumption of a nontradable is increased,
analysts employ the technique of trying to find the foreign exchange value of the
decline in consumption of a substitute tradable good. For example, they would measure
the value of additional electricity consumption by rural households by the foreign
exchange saved through the reduction in their consumption of kerosene previously used
for lighting. This approach leads to implausible results because, with the heat loss in the
generation of electricity, the economy might use several times as much kerosene to
generate the electricity as the savings in kerosene consumption by the households; yet
people are willing to pay many times more for electric lights than for kerosene lights.
This type of problem will be typical of the valuation of substitute nontradable goods and
services.
Because of this defect, it would seem prudent to use as a numeraire either domestic prices at the domestic price level or domestic prices at the border price level. The conversion of economic prices of inputs and outputs from one of these numeraires to the other is a trivial exercise. Clearly, if analysts want to undertake a modern risk and sustainability approach to project analysis, they should do both the financial and the economic analysis using the former numeraire. Employing either of them will have no effect on the use of the internal rate of return or the net present value as summary criteria statistics. At the same time, for those who wish to do a more complete analysis of risk, sustainability, and distributional assessment of a project, they need to express economic prices in domestic prices at the domestic price level so that the economic analysis can be easily linked to analysis of the project's financial feasibility.

Organization of Courses in Investment Appraisal

For the past eight years, Harvard University has offered an eight-week course titled the Program on Investment Appraisal and Management (PIAM). The course covers all the elements needed to complete a feasibility study of an investment project, including a financial, economic, risk, and distributional analysis. It is taught through lectures and having students do eleven small case studies, make presentations of their work, and complete a comprehensive analysis of an actual project from their countries.

Participants use a spreadsheet program (until now LOTUS 1-2-3) to complete their assignments, and they study microcomputers with the rest of the course. Each of the small case studies is designed to use progressively more sophisticated LOTUS commands. In addition, students conduct a Monte Carlo analysis of project variability with a LOTUS-based program (RiskMaster) developed by Sawakis Sawides of the Cyprus Development Bank.

The course is organized in three- or four-day cycles. Each module contains three or four morning lectures, plus a small case that participants receive on the first or second day. During the afternoons and evenings they spend approximately four hours a day in a computer laboratory to work on their case solutions.

Tutors, who continuously staff the computer laboratory, are completely familiar with the case and the substance of the course in addition to having the necessary computer skills. It is critical that the computer laboratory, not the lecture hall, becomes the center of learning. The lab is kept open, with at least two tutors, from 1 P.M. to 10 P.M. each day, including Sundays. On Saturdays it is open from 9 A.M. to 6 P.M.

The combination of microcomputer use and the learning process is complex and needs careful consideration. We have become aware of some aspects of this process. Although these ideas may not be much more than hypothesis, it might be useful to consider the following. First, for all participants the development of strong microcomputer skills employing a spreadsheet program is an important asset and a major element for bringing about change in the way they will work and deal with modernization in the future. Second, although there may be dozens of computers in a room, the focus of participants on their own computer screen nevertheless gives them a sense of seclusion so that they can concentrate and work efficiently in a pleasant, but crowded, environment. Third, it is essential to deal with participants' frustrations with their lack of knowledge in the use of a spreadsheet program quickly. One minute is as long as a participant should wait before a tutor or a colleague addresses his or her
problem. Fourth, portable computers should not be used in the first three or four weeks of a course. Participants who are shy about their rate of progress, or think they are coming into the program with a lower level of computer skills than others, will have a tendency to take the portable back to their hotel room to practice alone. Without the support of tutors and colleagues in the laboratory, these people will quickly fall far behind and are potential early dropouts. Initially, they will also spend too much time unproductively playing with the computer. Fifth, for demanding courses lasting more than three weeks, it is not a good idea to have a computer available to every participant all the time. This will create a large number of early "burn outs." People need to be required to take a break from the computer to read, think, and rest. If participants have constant access to a computer, they will tend to put in long hours in the first one or two weeks and become tired or even ill. Fatigue has a tremendous negative impact on their effectiveness in learning. Creating the need for definite "shifts" in the lab gives participants some sense of time organization, which they need. It also provides a solid justification for the lab manager to require them to save their work and leave, even when they are on the brink of "solving" their intractable problem.

The day after participants receive the case, the class briefly discusses it to ensure that everyone knows how to approach the problem and to introduce any new LOTUS commands that may be needed to solve the problem. About four days after receiving each case, participants are required to submit their solutions in the morning, and two participants are chosen to present their analyses. They are given about one hour's notice to prepare their presentations. All assignments are graded and returned to the students with a model solution to the case.

During the first three weeks of the course, instructors cover the financial analysis of projects while at the same time presenting the foundations of economic analysis in a series of one-hour morning lectures. Also during this time, the major cases are selected and groups are assembled by the project managers. The first assignment, to prepare an outline of their potential major case, is due the second day of the program. Interviews on the major case topics start on day three. A tutor is assigned to each major case to monitor progress and to assist if necessary.

The first three-week segment is completed with a quiz. Participants are informed the first day of the course that a quiz will be given in eighteen days. It is critical that the course commands the participants' attention and time from the first day of the program. People arrive from around the world with multiple agendas for their time; if they are given an opportunity to develop other plans or interests, it will be much harder, or impossible, to build a consensus on the intellectual goals intended by the program. Breaks can be given throughout the course, but not at the beginning.

Following the first three-week segment, the next week's module deals with the evaluation of the causes of project variability and with methods of contracting to reduce the variability of project outcomes. Also during this week, the class has largely completed the financial analysis of the major cases, and one of the shorter cases is completed.

The following three weeks cover the economic aspects of investment appraisal and the distributive analysis of projects. In addition, five short cases and the major case are being completed. Participants take a final quiz on Thursday of week seven and are then given four days (including a weekend) to finalize their major cases.

They submit all the major cases and make a series of presentations in the eighth week of the program. Each case and its presentation are evaluated by the audience of their
peers using a one-page evaluation form. The participants are in turn evaluated on the quality of the comments they make on their case evaluations.

Finishing the program with the presentation of major cases (which are completed by groups of three or four students) brings them back to the point of re-entry to their work. Many of the participants will be in a position to pass judgment on the projects that come for their approval. The evaluations they make (eight to ten cases) will give participants some experience in preparing their comments on proposals by using the knowledge they have acquired from the course.

This program is very intensive and labor intensive. The ratio of tutors to students is about one to ten, and each tutor works in excess of forty hours a week. They make every effort to prevent students from dropping out. Individuals who seem to be having trouble and may quit get help without having to ask for it. Often such potential dropouts are assigned a particular tutor who becomes their close associate throughout the remainder of the course. It becomes that tutor's responsibility to make sure the person keeps up with the work.

To reinforce their commitment to improving their work in this area, a very active alumni association exists. They distribute an alumni directory each year to previous program participants. This directory is widely used, and an extensive network has built up around the world. A detailed outline of the program is presented in Appendix A.

Courses Given In-Country

The Harvard Institute for International Development has also been involved with shorter courses in project appraisal conducted in-country. These three-week courses are more successful if combined with an advisory activity in which the participants evaluate a series of actual projects after completing the course. It is preferable if these courses are resident in nature so that the participants are taken completely away from their work. A syllabus of a typical course of this type appears in Appendix B.

In-country courses should begin by emphasizing the financial and risk analysis components of investment appraisal, with a few lectures and cases to make the participants aware of the importance of economic variables. The way to get people enthused about investment appraisal is to make sure they are given strong skills. With these skills the participants will be viewed by their peers as people who will be able to make changes in the way they do their work. The course participants will then have the capability and motivation to experiment with the analysis, which makes the introduction of the economic concepts and variables much easier.

During the subsequent month to six weeks, when students are working on actual cases, they should hold formal meetings twice a week to consider any economic adjustments that have to be made to the financial cash flows of the project.

References


Appendix A
Syllabus for
Program on Investment Appraisal and Management (PIAM)
June 22 – August 14, 1992

Monday, June 22
Morning Session

9:00 – 10:00 A.M. Course Opening Administration and Course Organization: Overview of Curriculum Major Cases Room 107, Pound Hall Ms. Vivien Goldman Dr. Glenn Jenkins Dr. Roy Kelly Mr. G. P. Shukla

10:00 – 10:30 A.M. Coffee Break

10:30 – 12:00 P.M. The Role of Project Evaluation Room 107, Pound Hall Dr. Glenn Jenkins

12:00 – 1:00 P.M. Lunch

Afternoon Session

1:00 - 2:30 P.M. Introduction to a Strategy for the Appraisal of Investment Projects Room 101, Pound Hall Dr. Glenn Jenkins

Readings: PIAM Manual, chapters 1 and 2

2:30 – 3:00 P.M. Coffee Break

3:00 – 5:00 P.M. Conceptual Framework for the Evaluation of Industrial Projects Room 107, Pound Hall Dr. Glenn Jenkins

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Instructor</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Tuesday, June 23</td>
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<tr>
<td>9:00 - 10:00 A.M.</td>
<td>Economic Principles</td>
<td>Dr. Roy Kelly</td>
<td>Room 107, Pound Hall</td>
</tr>
<tr>
<td>10:00 - 10:30 A.M.</td>
<td>Coffee Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:30 - 12:30 P.M.</td>
<td>Introduction to Microcomputers</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td>12:30 - 1:30 P.M.</td>
<td>Lunch</td>
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<tr>
<td>1:30 - 3:30 P.M.</td>
<td>Microcomputers: Spreadsheet Operations Group A</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Computer Laboratory 50 Church St., 4th Floor</td>
</tr>
<tr>
<td>3:45 - 5:45 P.M.</td>
<td>Microcomputers: Spreadsheet Operations Group B</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Computer Laboratory</td>
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<tr>
<td>Wednesday, June 24</td>
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<tr>
<td>9:00 - 10:00 A.M.</td>
<td>Economic Principles</td>
<td>Dr. Roy Kelly</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td>10:00 - 10:15 A.M.</td>
<td>Coffee Break</td>
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<tr>
<td>10:15 - 12:00 P.M.</td>
<td>Development of Financial Cash Flows</td>
<td>Dr. Glenn Jenkins</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td></td>
<td>Readings: *PIAM Manual, chapter 3, pp. 1-10; *Henderson and Maness, chapters 1 and 3</td>
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<tr>
<td>Distribution of Case 1</td>
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<tr>
<td>(Due Monday, June 29, 8:30 A.M.)</td>
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<tr>
<td>12:00 - 1:00 P.M.</td>
<td>Lunch</td>
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<tr>
<td>1:00 - 3:00 P.M.</td>
<td>Microcomputers Group B</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Computer Laboratory</td>
</tr>
<tr>
<td>3:30 - 5:30 P.M.</td>
<td>Microcomputers Group A</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Computer Laboratory</td>
</tr>
</tbody>
</table>
Thursday, June 25

9:00 – 10:00 A.M. Economic Principles Dr. Roy Kelly
Room 107, Pound Hall

10:00 – 10:15 A.M. Coffee Break

10:15 – 12:00 P.M. Operating Plan Dr. Glenn Jenkins
Room 107, Pound Hall

12:00 – 1:00 P.M. Lunch

1:00 – 3:00 P.M. Computerization of Financial Cash Flows Group A Mr. Baher El-Hifnawi
Computer Laboratory

3:30 – 5:30 P.M. Computerization of Financial Cash Flows Group B Mr. Baher El-Hifnawi
Computer Laboratory

Friday, June 26

9:00 – 10:00 A.M. Economic Principles Dr. Roy Kelly
Room 107, Pound Hall

10:00 – 10:15 A.M. Coffee Break

10:15 – 12:00 P.M. Investment Plan (continued) Dr. Glenn Jenkins
Measurement of Costs: Sunk or Incremental Room 107, Pound Hall

12:00 – 2:00 P.M. Lunch

2:00 – 4:00 P.M. Progress with Profits: The Development of Rural Banking Systems Mr. Richard Patten
Project Manager, HIID Bank Rakyat Indonesia
Rural Banking Project

Monday, June 29

9:00 – 10:00 A.M. Economic Principles Dr. Roy Kelly
Room 107, Pound Hall

10:00 – 10:15 A.M. Coffee Break
**Distribution of Case 2**
(Due Friday, July 3, 8:30 A.M.)

10:15 – 11:00 A.M. Presentation of Case 1
- **Group A**
  - Dr. Roy Kelly
  - Room 107, Pound Hall
- **Group B**
  - Mr. Baher El-Hifnawi
  - Room 108, Pound Hall

11:00 – 12:00 P.M. Analysis of Financial Profiles from Alternate Points of View
- Mr. G. P. Shukla
  - Room 107, Pound Hall

12:00 P.M. Lunch

**Tuesday, June 30**

9:00 – 10:00 A.M. Economic Principles
- Dr. Roy Kelly
  - Room 107, Pound Hall

10:00 – 10:15 A.M. Coffee Break

10:15 – 12:00 P.M. Discounting and Alternative Investment Criteria Net Present Value
- Mr. G. P. Shukla
  - Room 107, Pound Hall

Readings: PIAM Manual, chapter 4, pp. 1-10; Roemer and Stern, volume 1, chapter 2, pp. 24-32

12:00 – 12:30 P.M. Discussion of Progress on Case 2
- **Group A**
  - Tutors
  - Room 107, Pound Hall
- **Group B**
  - Tutors
  - Room 108, Pound Hall

12:30 P.M. Lunch

**Wednesday, July 1**

9:00 – 10:00 A.M. Economic Principles
- Dr. Roy Kelly
  - Room 107, Pound Hall
10:00 – 10:15 A.M.  Coffee Break

10:15 – 11:30 A.M.  Adjusting Projects for Different Lengths of Life  Dr. Glenn Jenkins  Room 107, Pound Hall

11:30 – 12:30 P.M.  Benefit-Cost Ratio, Payback Period  Dr. Glenn Jenkins  Room 107, Pound Hall


12:30 P.M.  Lunch

Thursday, July 2

9:00 – 10:00 A.M.  Economic Principles  Dr. Roy Kelly  Room 107, Pound Hall

10:00 – 10:15 A.M.  Coffee Break

10:15 – 12:00 P.M.  Internal Rate of Return  Dr. Glenn Jenkins  Room 107, Pound Hall

Readings, PIAM Manual, chapter 4, pp. 14–21

12:00 p.m.  Lunch

Friday, July 3

9:00 – 10:00 A.M.  Economic Principles  Dr. Roy Kelly  Room 107, Pound Hall

10:00 – 10:15 A.M.  Coffee Break

10:15 – 12:45 P.M.  Presentation of Case 2

Group A  Mr. Baher El-Hifnawi  Room 107, Pound Hall

Group B  Mr. G. P. Shukla  Room 108, Pound Hall
Distribution of Cases 3 and 4
(Due Tuesday, July 7, 8:30 A.M.)

12:45 – 2:00 P.M. Lunch

2:00 – 4:00 P.M. Lessons of the Reform Process in Latin America
                 Mr. Marcelo Selowski
                 Chief Economist
                 Latin American and Caribbean Desk
                 World Bank

Sunday, July 5

12:00 – 1:00 P.M. Discussion of Progress Cases 3 and 4
                   Tutors
                   Computer Lab

3:00 – 4:00 P.M. Discussion Session Repeated
                   Tutors
                   Computer Lab

Monday, July 6

9:00 – 10:00 A.M. Foundations of Risk and Uncertainty
                   Mr. Baher El-Hifnawi
                   Room 107, Pound Hall

10:00 – 10:30 A.M. Coffee Break

10:30 – 12:00 P.M. Choice of Scale and Choice of Project Timing
                   Dr. Shiv Kumar
                   Room 107, Pound Hall


12:00 P.M. Lunch

Tuesday, July 7

9:00 – 10:00 A.M. Foundations of Risk and Uncertainty
                   Mr. Baher El-Hifnawi
                   Room 107, Pound Hall

10:00 – 10:30 A.M. Coffee Break

10:30 – 11:30 A.M. Project Interdependencies
                   Dr. Shiv Kumar
                   Room 107, Pound Hall

Distribution of Cases 5 and 6
(Due Friday, July 10, 8:30 A.M.)

11:30 – 12:30 P.M.  Presentation of Cases 3 and 4

Group A  Mr. Joe Tham
          Room 107, Pound Hall

Group B  Mr. Baher El-Hifnawi
          Room 108, Pound Hall

12:30 – 2:00 P.M.  Lunch

2:00 – 4:30 P.M.  A Natural Resource Investment Project:
                  The Negotiation Process, Risk
                  Allocations, and Options for Contractual
                  Arrangements

Professor David Smith
Vice Dean
Harvard Law School
Room 107, Pound Hall

Wednesday, July 8

9:00 – 10:00 A.M.  Impact of Inflation on Investment Appraisal
                   Mr. G. P. Shukla
                   Room 107, Pound Hall

10:00 – 10:30 A.M.  Coffee Break

10:30 – 12:00 P.M.  Impact of Inflation on Investment Appraisal
                    (continued)
                    Mr. G. P. Shukla
                    Room 107, Pound Hall

Readings: PIAM Manual, chapter 6, pp. 1–7;
Harberger, Project Evaluation, chapter 2, pp. 42-48

12:00 – 12:30 P.M.  Discussion of Progress
                    Cases 5 and 6

Group A  Tutors
          Room 107, Pound Hall

Group B  Tutors
          Room 108, Pound Hall

12:30 – 2:00 P.M.  Lunch
<table>
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<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
<th>Room</th>
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<tr>
<td>2:00 – 4:00 P.M.</td>
<td>The Economics of Environmental Degradation</td>
<td>Theo Panayotou, Institute Fellow</td>
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<td>Thursday, July 9</td>
<td>9:00 – 10:00 A.M. Inflation: Examples of Impact</td>
<td>Mr. G. P. Shukla</td>
<td>Room 107, Pound Hall</td>
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<td>Readings: PIAM Manual, chapter 6, pp. 7-15</td>
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<td>10:00 – 10:15 A.M.</td>
<td>Coffee Break</td>
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<tr>
<td>10:15 – 12:00 P.M.</td>
<td>Discussion of Financial Analysis of Inflation: A Case Study</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Room 107, Pound Hall</td>
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<td>12:00 P.M.</td>
<td>Lunch</td>
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<tr>
<td>Friday, July 10</td>
<td>9:00 – 12:00 P.M. Review Session</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Room 107, Pound Hall</td>
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<td>10:00 A.M.</td>
<td>Group Picture</td>
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<tr>
<td>12:00 – 1:00 P.M.</td>
<td>Presentation of Cases 5 and 6</td>
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<tr>
<td>Group A</td>
<td>Mr. Joe Tham</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td>Group B</td>
<td>Mr. Baher El-Hifnawi</td>
<td>Room 108, Pound Hall</td>
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<td>1:00 P.M.</td>
<td>Lunch</td>
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<tr>
<td>Saturday, July 11</td>
<td>9:00 – 10:00 A.M. PIAM Quiz 1</td>
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<td>Room 107, Pound Hall</td>
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<tr>
<td>Monday, July 13</td>
<td>9:00 – 10:00 A.M. Introduction to Risk Analysis and Management</td>
<td>Dr. John Evans</td>
<td>Room 107, Pound Hall</td>
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<tr>
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<td>Readings: Brigham and others, “Risk Analysis and the Optimal Capital Budget”</td>
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</table>
10:00 - 10:30 A.M. Coffee Break

10:30 - 12:30 P.M. Introduction to Monte Carlo Analysis
Mr. Sawakis Sawides
Cyprus Development Bank
Room 107, Pound Hall

Readings: Sawides, "Risk Analysis in Project Appraisal"

12:30 - 2:30 P.M. Lunch

Computer Application of Risk Analysis Using RiskMaster
Room 107, Pound Hall

2:30 - 6:00 P.M. Group A
Mr. Baher El-Hifnawi
Computer Lab

6:30 - 10:00 P.M. Group B
Mr. Baher El-Hifnawi
Computer Lab

Tuesday, July 14

9:00 - 10:00 A.M. Illustration of Risk Analysis and Management: A Cement Additives Plant
Dr. John Evans
Room 107, Pound Hall

Readings: Glenday, "Monte Carlo Simulation Techniques in the Valuation of Truncated Distributions in the Context of Project Appraisal"

10:00 - 10:30 A.M. Coffee Break

10:30 - 12:00 P.M. Topic continued
Dr. John Evans
Room 107, Pound Hall

12:00 - 2:00 P.M. Lunch

2:00 - 6:00 P.M. Computer Application of Risk Analysis
Mr. Baher El-Hifnawi
Computer Lab
Distribution of Case 18
Group A

Major Cases
Group B

Wednesday, July 15

9:00 – 10:00 A.M. Review of Quiz 1 Room 107, Pound Hall
10:00 – 10:30 A.M. Coffee Break
10:30 – 12:00 P.M. Risk Bearing and Choice of Contract Form Dr. John Evans Room 107, Pound Hall

Readings: Blitzer, Lessard, and Paddock, "Risk Bearing and the Choice of Contract Forms for Oil Exploration and Development"

12:00 – 2:00 P.M. Lunch
2:00 – 6:00 P.M. Computer Applications of Risk Analysis Mr. Baher El Hifnawi Computer Lab

Distribution of Case 19
Group B

Major Cases
Group A

Thursday, July 16

9:00 – 10:00 A.M. Project Financing, Financial Contracts, and Risks Dr. John Evans Room 107, Pound Hall

Readings: Baldwin, Lessard, and Mason, "Budgetary Time Bombs: Controlling Government Loan Guarantees"

10:00 – 10:30 A.M. Coffee Break
10:30 - 12:30 P.M. Topic continued Dr. John Evans  
Room 107, Pound Hall

12:30 - 2:00 P.M. Lunch

2:00 - 6:00 P.M. Completion of Risk Cases Mr. Baher El-Hifnawi
  
Group A Computer Lab

6:30 - 10:30 P.M. Completion of Risk Cases Mr. Baher El-Hifnawi
  
Group B Computer Lab

**Friday, July 17**

9:00 - 10:00 A.M. Measurement of Costs and Benefits in Undistorted Markets Dr. Glenn Jenkins  
Room 107, Pound Hall

*Readings: PIAM Manual, chapters 7 and 8  

**Distribution of Case 9**  
(Due Wednesday, July 22, 8:30 A.M.)

10:00 - 10:15 A.M. Coffee Break

10:15 - 11:30 P.M. Topic continued Dr. Glenn Jenkins  
Room 107, Pound Hall

11:30 - 12:30 P.M. Presentation of Risk Analysis Cases Dr. John Evans  
Room 107, Pound Hall

Group B Mr. Sawakis Sawides  
Room 108, Pound Hall

12:30 - 2:00 P.M. Lunch

2:00 - 4:00 P.M. Marketing Analysis in Project Evaluation Mr. Sawakis Sawides  
Room 107, Pound Hall
Readings: Sawides, “Marketing Analysis in Project Evaluation”

Monday, July 20

9:00 – 10:00 A.M. Measurement of Benefits and Costs in Distorted Markets (Taxes and Subsidies) Dr. Roy Kelly Room 107, Pound Hall

Readings: PIAM Manual, chapter 9, pp. 1–14

10:00 – 10:15 A.M. Coffee Break

10:15 – 12:00 P.M. Measurement of Benefits and Costs in Distorted Markets (Taxes and Subsidies) Dr. Roy Kelly Room 107, Pound Hall

12:00 P.M. Lunch

Tuesday, July 21

9:00 – 10:00 A.M. Ceiling Prices and Rationing Dr. Roy Kelly Room 107, Pound Hall

Distribution and Discussion of Case 10, Part 1, in Class


10:00 – 10:15 A.M. Coffee Break

10:15 – 12:30 P.M. Monopoly and Measurement of Costs and Benefits Dr. Roy Kelly Room 107, Pound Hall

Discussion of Case 10, Part 2, in Class

Readings: PIAM Manual, chapter 9, pp. 20–25
12:30 - 2:00 P.M. Lunch

2:00 - 4:00 P.M. Review Session Room 107, Pound Hall
(Nontradable Goods)

Wednesday, July 22

9:00 - 10:00 A.M. Economic Prices for Traded Goods Room 107, Pound Hall
Dr. Roy Kelly
Readings: PIAM Manual,
chapter 10, pp. 1–10

Distribution of Case 11
(Due Monday, July 27, 8:30 A.M.)

10:00 - 10:15 A.M. Coffee Break

10:15 - 12:00 P.M. Presentation of Case 9

Group A
Dr. Roy Kelly
Room 107, Pound Hall

Group B
Mr. Joe Tham
Room 108, Pound Hall

12:00 - 2:00 P.M. Lunch

2:00 - 4:00 P.M. Performance Contracts: An Approach to Improving Public Enterprise Performance
Dr. Praja Trevedi Professor of Public Enterprise Indian Institute of Management

Thursday, July 23

9:00 - 10:00 A.M. Economic Prices for Traded Goods Room 107, Pound Hall
(continued)

10:00 - 10:15 A.M. Coffee Break

10:15 - 12:00 P.M. Topic continued

12:00 - 12:30 P.M. Discussion of Progress Case 11
Group A  
Group B  

12:30 P.M.  
Lunch  

**Friday, July 24**  

9:00 – 10:00 A.M.  
The Economic Price of Foreign Exchange  
Dr. Roy Kelly  
Room 107, Pound Hall  

10:00 – 10:15 A.M.  
Coffee Break  

10:15 – 12:00 P.M.  
The Economic Cost of Traded Goods and the Shadow Price of Foreign Exchange  
Dr. Roy Kelly  
Room 107, Pound Hall  

**Distribution of Case 12**  
(Due Wednesday, July 29, 8:30 A.M.)  

*Readings: PIAM Manual,*  
chapter 10, pp. 10–24  

12:00 P.M.  
Lunch  

**Monday, July 27**  

9:00 – 10:00 A.M.  
Estimation of Economic Prices with More Than One Distorted Market  
Dr. Roy Kelly  
Room 107, Pound Hall  

*Readings: PIAM Manual,*  
chapter 11, pp. 1–6.  

10:00 – 10:15 A.M.  
Coffee Break  

10:15 – 11:30 A.M.  
Topic continued  

11:30 – 12:30 P.M.  
Presentation of Case 11  

Group A  
Group B  

Dr. Roy Kelly  
Room 107, Pound Hall  
Mr. Baher El-Hifnawi  
Room 108, Pound Hall
12:30 – 1:30 P.M.  Lunch

1:30 – 3:30 P.M.  Project Finance  Mr. Adebayo Ogunlesi  
Vice President of Project Finance  
First Boston Corporation

**Tuesday, July 28**

9:00 – 10:00 A.M.  Estimation of Benefits of Impact in Complementary and Substitute Goods  
Dr. Roy Kelly  
Room 107, Pound Hall

*Readings: PIAM Manual, chapter 11, pp. 6-14*

10:00 – 10:15 A.M.  Coffee Break

10:15 – 12:00 P.M.  The Economic Opportunity Cost of Public Funds  
Dr. Glenn Jenkins  
Room 107, Pound Hall


12:00 P.M.  Lunch

**Wednesday, July 29**

9:00 – 10:00 A.M.  The Economic Opportunity Cost of Public Funds (continued)  
Dr. Glenn Jenkins,  
Room 107, Pound Hall

*Readings: Little and Mirrlees, “Project Appraisal and Planning Twenty Years On,” volume 1*

**Distribution of Case 13**  
(Due Monday, August 3, 8:30 A.M.)

10:00 – 10:15 A.M.  Coffee Break
10:15 – 11:30 A.M.  Topic continued

11:30 – 12:30 P.M.  Presentation of Case 12

Group A  Mr. G. P. Shukla
Room 107, Pound Hall

Group B  Mr. Baher El-Hifnawi
Room 108, Pound Hall

12:30 – 2:00 P.M.  Lunch

Thursday, July 30

9:00 – 10:00 A.M.  Distributive Analysis  Dr. Glenn Jenkins
Room 107, Pound Hall

10:00 – 10:15 A.M.  Coffee Break

10:15 – 12:00 P.M.  Distributive Analysis (continued)

Distribution and Discussion of Case 16

12:00 – 12:30 P.M.  Discussion of Progress Case 13

Group A  Tutors
Room 107

Group B  Tutors
Room 108

12:30 – 2:00 P.M.  Lunch

2:00 – 3:30 P.M.  Review Session
(Traded Goods and Foreign Exchange)

Friday, July 31

9:00 – 10:00 A.M.  Where is Professional Project Appraisal?  Arnold Harberger
Department of Economics,
University of Chicago and
University of California at Los Angeles
Readings: *PIAM Readings*, volume 1; Harberger, "Reflections on Social Project Evaluation"

10:00 – 10:15 A.M. Coffee Break

10:15 – 12:00 P.M. Topic continued

12:00 – 2:00 P.M. Lunch

4:00 – 6:00 P.M. Reception

Faculty Club
20 Quincy Street

Monday, August 3

9:00 – 10:00 A.M. Social-Distributive
Appraisal of Projects
Dr. Glenn Jenkins
Room 107, Pound Hall


10:00 – 10:15 A.M. Coffee Break

10:15 – 11:30 A.M. Topic continued

11:30 – 12:30 P.M. Presentation of Case 13

Group A
Mr. Baher El-Hifnawi
Room 107, Pound Hall

Group B
Mr. Joe Tham
Room 108, Pound Hall

12:30 – 2:00 P.M. Lunch

2:00 – 4:30 P.M. Review Session (optional) on Risk, Secondary Effects, and Cost of Capital
Room 107, Pound Hall

Tuesday, August 4

9:00 – 10:00 A.M. The Economic
Opportunity Cost of Rural Labor
Dr. Glenn Jenkins
Room 107, Pound Hall

**Distribution of Case 14**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
<th>Speaker</th>
<th>Location</th>
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<tbody>
<tr>
<td>10:00 – 10:15 A.M.</td>
<td>Coffee Break</td>
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<tr>
<td>10:15 – 12:00 P.M.</td>
<td>The Economic Opportunity Cost of Rural Labor (continued), including solution of Case 14</td>
<td>Dr. Glenn Jenkins</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td>12:00 P.M.</td>
<td>Lunch</td>
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**Wednesday, August 5**

<table>
<thead>
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<th>Time</th>
<th>Event Description</th>
<th>Speaker</th>
<th>Location</th>
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<tbody>
<tr>
<td>9:00 – 10:00 A.M.</td>
<td>The Economic Opportunity Cost of Urban Labor</td>
<td>Dr. Glenn Jenkins</td>
<td>Room 107, Pound Hall</td>
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<td><em>Readings: PIAM Manual, chapter 13, pp. 7-10</em></td>
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<tr>
<td>10:00 – 10:15 A.M.</td>
<td>Coffee Break</td>
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<tr>
<td>10:15 – 12:00 P.M.</td>
<td>The Social Opportunity Cost of Urban Labor</td>
<td>Dr. Glenn Jenkins</td>
<td>Room 107, Pound Hall</td>
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<tr>
<td>12:00 – 2:00 P.M.</td>
<td>Lunch</td>
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<tr>
<td>2:00 – 4:00 P.M.</td>
<td>Quiz Review Session</td>
<td>Rooms 107 and 108, Pound Hall</td>
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</table>
Thursday, August 6

2.00 - 4:00 P.M. Quiz 2 Room 107, Pound Hall

Friday, August 7

Preparation of Major Cases

Monday, August 10

Preparation of Major Cases

All Major Cases Due in Computer Lab at 10:00 P.M.

Tuesday, August 11

Morning Session

9:00 - 10:15 A.M. Major Case Presentations:
Case 1 Room 107, Pound Hall
Case 2 Room 108, Pound Hall

10:15 - 10:45 A.M. Coffee Break

10:45 - 12:00 P.M. Major Case Presentations:
Case 3 Room 107, Pound Hall
Case 4 Room 108, Pound Hall

12:00 - 1:30 P.M. Lunch

Afternoon Session

1:30 - 2:45 P.M. Major Case Presentations:
Case 5 Room 107, Pound Hall
Case 6 Room 108, Pound Hall

2:45 - 3:00 P.M. Coffee Break

3:00 - 4:15 P.M. Major Case Presentations:
Case 7 Room 107, Pound Hall
Case 8                  Room 108, Pound Hall

4:15 – 4:30 P.M.       Coffee Break

4:30 – 5:45 P.M.       Case 9                  Room 107, Pound Hall
                        Case 10                  Room 108, Pound Hall

Wednesday, August 12
Morning Session

9:00 – 10:15 A.M.      Major Case Presentations:
                        Case 11                  Room 107, Pound Hall
                        Case 12                  Room 108, Pound Hall

10:15 – 10:45 A.M.     Coffee Break

10:45 – 12:00 P.M.     Major Case Presentations:
                        Case 13                  Room 107, Pound Hall
                        Case 14                  Room 108, Pound Hall

12:00 P.M.             Lunch

Afternoon Session

1:30 – 2:45 P.M.       Major Case Presentations:
                        Case 15                  Room 107, Pound Hall
                        Case 16                  Room 108, Pound Hall

2:45 – 3:00 P.M.       Coffee Break

3:00 – 4:15 P.M.       Major Case Presentations:
                        Case 17                  Room 107, Pound Hall
                        Case 18                  Room 108, Pound Hall

4:15 – 4:30 P.M.       Coffee Break
4:30 – 5:45 P.M.  Major Case Presentations:

Case 19  Room 107, Pound Hall

Case 20  Room 108, Pound Hall

Thursday, August 13

6:00 P.M.  Certificate Presentation  Faculty Club
Reception and Dinner
Appendix B
Syllabus for
Project Appraisal and Risk Analysis Management
January 6 – 25, 1992

Week 1

Monday, January 6

09:00 – 12:00 P.M. Course Opening

12:00 – 13:45 P.M. Lunch

13:45 – 15:00 P.M. Components of Project Evaluation

Readings: PIAM: Jenkins and Harberger, Cost-Benefit Analysis of Investment
Decisions, chapters 1 and 2, pp. 2.1 – 2.5

15:00 – 15:30 P.M. Coffee Break

15:30 – 17:00 P.M. The Components of Cash Flow Analysis

Readings: Manual, chapter 2, pp. 2.5 – 2.16
chapter 3, pp. 3.1 – 3.6

Tuesday, January 7

08:30 – 10:00 A.M. Analysis of Cash Flows

Readings: Manual, chapter 3, pp 3.1 – 3.10;
Henderson and Maness, The Financial Analyst’s Deskbook, chapters 1 and 3

10:00 – 10:30 A.M. Coffee Break

10:30 – 12:00 P.M. Continuation of Topic

12:00 – 13:45 P.M. Lunch

13:45 P.M. – onward Distribution and Analysis of Case I
(Due Thursday, January 9, 8:30 A.M. in Computer Laboratory)
Analysis of Case I
Wednesday, January 8

08:30 - 10:00 A.M. Evaluation of Investment Projects from Alternative Points of View

Readings: Manual, chapter 3, pp. 3.10 – 3.20

10:00 - 10:30 A.M. Coffee Break

10:30 - 12:00 P.M. Discounting and Other Investment Criteria


12:00 - 13:45 P.M. Lunch

13:45 P.M. - onward Analysis of Case I
Financial Cash Flows (Computer Laboratory)

Thursday, January 9

08:30 - 10:00 A.M. Continuation of Discounting and Other Investment Criteria

Readings: Manual, chapter 4, pp. 4.13 – 4.19

10:00 - 10:30 A.M. Coffee Break

10:30 - 12:00 P.M. Presentation of Case I by Participants

12:00 - 13:45 P.M. Lunch

13:45 P.M. - onward Distribution and Analysis of Cases II A and II B
(Due Monday, January 13, 8:30 A.M., in Computer Laboratory)

Friday, January 10

08:30 - 10:00 A.M. Determination of Optimal Scale of Projects

Readings: Manual, chapter 5, pp. 5.1 – 5.4

10:00 - 10:30 A.M. Coffee Break
10:30 – 12:00 P.M. Determination of Optimal Timing of Projects and the Analysis of Separable Project Components

Readings: Manual, pp. 5.4 – 5.13

Distribution of Case III
(Due Tuesday, January 14, 8:30 A.M.)

12:00 – 14:30 P.M. Lunch

14:30 P.M. – onward Analysis of Case II
(Computer Laboratory)

Saturday, January 11

08:30 – 10:00 A.M. Analysis of Rehabilitation or Termination Situation

Readings:
The Case of the Limassol Juice Company

10:00 – 10:30 A.M. Coffee Break

10:30 – 11:30 A.M. Continuation of Topic

11:30 – 12:00 P.M. Discussion of Scale Aspect of Case III

12:00 – 13:45 P.M. Lunch

13:45 P.M. – onward Analysis of Cases II & III
(Computer Laboratory)

Week 2

Monday, January 13

08:30 – 10:00 A.M. Discussion of Time Aspect of Case III and Presentations of Cases II A and II B

10:00 – 10:30 A.M. Coffee Break

10:30 – 12:00 P.M. Completion of Case III
(Computer Laboratory)

12:00 – 13:45 P.M. Lunch
13:45 P.M.- onward Completion of Case III (Computer Laboratory)

Tuesday, January 14

08:30 – 10:00 A.M. Impact of Inflation on Investment Projects

Readings: Manual, chapter 6

10:00 – 10:30 A.M. Coffee Break

10:30 – 11:30 A.M. Impact of Inflation on Investment Projects (continued)

11:30 – 12:00 P.M. Presentation of Case III (5A and 5B)

12:00 – 13:45 P.M. Lunch

13:45 – 15:30 P.M. A Case Study of Inflation Impacts on Projects

15:30 P.M. – onward Distribution and Analysis of Comprehensive Cases (Computer Laboratory)

Wednesday, January 15

08:30 – 10:00 A.M. Statistical Foundations of Risk Analysis

10:00 – 10:30 A.M. Coffee Break

10:30 – 12:00 P.M. Completion of Comprehensive Cases

12:00 – 13:45 P.M. Lunch

13:45 P.M. – onward Completion of Comprehensive Cases

Thursday, January 16

08:30 – 10:00 A.M. Impact of Economic Factors on Project Feasibility: An Overview


10:00 – 10:30 A.M. Coffee Break
10:30 – 12:00 P.M.  Completion of Comprehensive Cases
12:00 – 13:45 P.M.  Lunch
13:45 P.M. – onward  Completion of Comprehensive Cases

Friday, January 17
08:30 – 10:00 A.M.  Completion of Comprehensive Cases
10:00 – 10:30 A.M.  Coffee Break
10:30 – 12:00 P.M.  Completion of Comprehensive Cases
12:00 – 14:30 P.M.  Lunch
14:30 – 16:00 P.M.  Presentation of Comprehensive Case I
16:00 – 17:30 P.M.  Presentation of Comprehensive Case II

Saturday, January 18
08:30 – 10:00 A.M.  Presentation of Comprehensive Case III
10:00 – 10:30 A.M.  Coffee Break
10:30 – 11:45 A.M.  Presentation of Comprehensive Case IV
11:45 – 13:00 P.M.  Presentation of Comprehensive Case V
13:00 – 14:30 P.M.  Lunch

FREE

Week 3

Monday, January 20
08:30 – 10:00 A.M.  Analytical Foundations of Risk Analysis
10:00 – 10:30 A.M.  Coffee Break
10:30 – 12:00 P.M.  Risk and Project Analysis: Introduction to Sensitivity and Risk Analysis
Readings: Sawakis Sawides, "Risk Analysis in Investment Appraisal"
Optional: Pouliquen, "Risk Analysis in Project Appraisal"

12:00 – 13:45 P.M. Lunch
13:45 P.M. – onward Introduction to RiskMaster

Tuesday, January 21

08:30 – 10:00 A.M. Principles of Contracting, Risk Sharing, and Risk Reduction


Optional:

10:00 – 10:30 A.M. Coffee Break
10:30 – 12:00 P.M. Continuation of Contracting, Risk Sharing, and Risk Reduction
12:00 – 13:30 P.M. Lunch
13:30 P.M. – onward Application of Risk Analysis to Comprehensive Cases
**Wednesday, January 22**

08:30 – 10:00 A.M.  
Project Financing


10:00 – 10:30 A.M.  
Coffee Break

10:30 – 12:00 P.M.  
Completion of Application of Risk Analysis to Comprehensive Cases

12:00 – 13:30 P.M.  
Lunch

13:30 P.M. – onward  
Completion of Application of Risk Analysis to Comprehensive Cases

**Thursday, January 23**

08:30 – 10:00 A.M.  
Quiz

10:00 – 10:30 A.M.  
Coffee Break

10:30 A.M. – onward  
Completion of Application of Risk Analysis to Comprehensive Cases

**Friday, January 24**

08:30 – 09:30 A.M.  
Presentation of Cases: Session I

09:30 – 10:30 A.M.  
Session II

10:30 – 10:45 A.M.  
Coffee Break

10:45 – 12:00 P.M.  
Session III

12:00 – 14:30 P.M.  
Lunch

14:30 – 16:30 P.M.  
Session IV

16:30 – 18:00 P.M.  
Session V
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