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THE ECONOMICS OF MALARIA CONTROL

Jeffrey S. Hammer

Ideally, in devising and assessing policies to control disease, the rules and reasoning of economics should be combined with comprehensive epidemiological information to arrive at the best decisions. Simple economic concepts can be of great practical assistance to policymakers in disease control. This article describes the economic principles to be applied and the kind of information needed to make informed choices about the options for controlling malaria. In this context, the article surveys the research on the costs that malaria imposes on people and economies, discusses how to assess the costs and effects of interventions used to combat the problem, and identifies the conceptual difficulties and gaps in information that must be bridged before the marriage of the two disciplines can be effectively consummated.

Malaria strikes an estimated 100 million or more people in the developing world each year, killing 1 to 2 million of them. It is one of the biggest killers of children in Sub-Saharan Africa, where 80 percent of the cases and an estimated 90 percent of the parasite infections occur. A mosquito-borne disease, malaria has many diverse forms. The methods suitable for its control are correspondingly diverse.

At the end of World War II eradication of malaria was considered attainable; in 1955 the World Health Assembly made worldwide eradication the goal of its control programs. The effectiveness of DDT in mosquito control and of drug therapies such as chloroquine made such optimism tenable. Already malaria had been reduced in some areas—although how much of the reduction was attributable to control and how much to economic development and the loss of mosquito breeding grounds to human settlements is unclear. In any

case, the initial optimism had to give way to the growing realization that continued surveillance and control efforts, essential to maintaining and building on the earlier successes, were extremely hard to sustain—as attested by resurgence of the disease in many places where progress had been made. More recent tactics have aimed to control rather than to eradicate the disease.

In many places around the globe, the problem has actually worsened. The malaria parasite has progressively developed resistance to chloroquine, the principal drug for combating the disease. The need to replace chloroquine, a cheap and effective treatment for all forms of malaria, with more expensive and more dangerous drugs has dealt a heavy blow to control efforts. Meanwhile, the mosquitoes have been developing resistance to the main insecticides used for their control. And, at the same time, the deadliest of the four strains of the malaria parasite that cause disease in humans (*Plasmodium falciparum*) has been growing relative to the others (*P. ovale*, *P. malariae*, and *P. vivax*). Little wonder that a recent report (Oaks and others 1991) from the Institute of Medicine of the U.S. National Academy of Sciences begins: “The outlook for malaria control is grim.” As one eminent malariologist (Bradley 1991) has described it, the historical development of thinking about malaria can be characterized by decade: the 1950s was the decade of eradication in its attack phase, the 1960s was that of eradication in its consolidation phase, the 1970s saw a resurgence of the disease, and the 1980s was a decade of chaos—though Bradley does allow the 1990s to be the decade of hope.

Current hopes are centered on the possibility of developing a vaccine. Whether such a vaccine can maintain its viability and long-term effectiveness in the face of the parasite’s capacity for developing resistance remains conjectural. In the meantime, policymakers still need to make choices on the basis of the existing knowledge about malaria control.

Integrating Economics with Epidemiology

The potential for integrating economic and epidemiological reasoning in the formulation of policy for malaria control is great and largely untapped. Whereas the epidemiology of the disease is necessary to define the bounds of the possible, the bread and butter of economics is the making of choices among the different possibilities—either in describing how people (as consumers or as producers of goods and services) actually make choices or in prescribing how governments should make them.

The Ideal: Policymaking with Complete Information

Ideally, decisionmakers applying economic reasoning to the policy choices entailed in controlling malaria would have at their disposal precise information of the following kind. For each available policy instrument (such as building clinics

or organizing spraying teams), they would know what effect different levels of use of the instrument would have on the outcome—preferably measured in some common unit of account, like money. For the same instruments, they would then know how much it would cost, in the same unit of measurement, to operate this activity at different levels (the number of clinics or teams). The rule for the decision is then easy: expand the use of each policy instrument as long as the benefits received from the expansion outweigh the costs. These benefits and costs from the expansion may be termed the marginal benefits and costs. At some point, the marginal benefits and costs will be about equal, and this balance defines the right level for the instrument. Stopping short of that level leaves some benefits (net of their costs) unexploited. Going too far entails costs that are too high relative to the benefits received. If the activity involved is discrete—that is, if it is an all-or-nothing proposition or an investment that entails a particular package of inputs—then this rule translates into: Do it if and only if the benefits outweigh the costs. Most cost-benefit analyses are done on such discrete packages of inputs and outputs. In the ideal world, the information concerning each of these components would be available and used according to these principles to evaluate the available policies.

It follows that a central criterion in selecting among alternative strategies is that choices should be based not on the size of the problem, but on the effects that policies have on the outcome. That malaria affects so many people in the world is not on its own sufficient to make it an important priority for policy: what matters is whether something can be done about it. The appendix to this article gives a numerical illustration of this point. (One exception needs to be noted to the argument that it is the marginal effect, not absolute burden, that matters in setting priorities. The criterion does not apply when the instrument in question is pure research, say, on new drugs. Here the project's success is speculative in terms both of costs and outcome, and one might as well go for the larger targets. The burden of the disease defines at least the upper bound of the project's value.)

At the different levels in the hierarchy of decisions to be made, the sets of problems to be solved may look quite different from one another. At the highest level of government, the value of resources put into health must be assessed against those allocated to other sectors; within the health sector, a ministry may need to assess the problem of malaria versus other diseases; within a malaria control program, a manager faces the choice of dividing resources between alternative control methods such as vector (mosquito) control and case management (the treatment of the disease once contracted). In the ideal world of adequate epidemiological information and common units of account just described, the procedure for making choices among different strategies should be equally applicable to all these types of decisions. In practice applying the procedure is not so simple.

The Reality: Conceptual Difficulties and Incomplete Information

The two principal components of the analytical procedure described above—defining the policy and defining the relationships among policy instru-

ments, objectives, and costs—are, in the real world, bedevilled by problems, both conceptual and practical.

DEFINING THE POLICY OPTIONS. Defining the available policy instrument—that is, determining what is actually under the control of the policymaker—is not as easy as it may seem. Epidemiological research typically identifies risk factors associated with the disease. These risk factors are not, themselves, necessarily under the control of the decisionmaker. Take, for example, vector capacity—the number of infected bites a person receives in a given period of time, which itself is a function of the relative populations of mosquitoes and people, the feeding habits of the mosquito, and the personal measures people take to protect themselves. The effect of vector capacity on the incidence of disease may be identified. But neither vector capacity nor any of its components are directly controllable by governments. When, for example, a government decides to spray houses for mosquitoes, it may specify the number or proportion of houses to be sprayed, which merely helps determine the death rate of mosquitoes. Strictly speaking, the only aspect of policy implementation it directly controls is the hiring and instruction of workers. Unless it has an administrative or monitoring capacity that few organizations possess, the government cannot control whether those workers spray houses successfully. Each of these links helps to determine the actual functional relationship of the policy to the outcome. In drug therapy, the technical effectiveness of a drug may be identified, but the degree to which it affects the disease depends on how many people show up for treatment and how well they comply with prescriptions. The relevant policy instrument here is more likely to be information, education, communication, active detection of malarial infection, or the pricing of government health services, than simply the choice of drugs.

Vector control operations usually entail well-defined investments that are almost always made by the public, rather than the private, sector. Such operations are easily put into the framework described above. Identifying the government's role and policy levers for case management is more complex, however, because these differ according to the structure of different health care systems. The policy instruments effective in a system in which most health care is provided within the family or by the private sector through traditional healers, private doctors and nurses, or pharmacists will differ from those suitable when all services are provided in public primary health facilities or malaria clinics. The instruments in the former might be taxes or subsidies for different drugs, or campaigns to inform private providers or the public; for the latter, facility protocols could directly control the types and dosages of drugs used. Evaluating the benefits of providing free drug therapy, for example, would require knowing what substitutes are available for treatment sought outside the public sector; as a service, drug therapy is a nontraded good (internationally) and *net* additional people treated depends on the extent of substitution from the private sector (or nongovernmental organizations). The policy may look

very different if substitution is high—less a health intervention and more a transfer from taxpayers to clinic users. A policy that merely switches the treatment venue from private to public clinics may not treat any more people. But this is a progressive policy if the average taxpayer is better off than the average clinic user. In many places in Africa, however, taxes are based on agricultural exports and are therefore frequently regressive, whereas clinics may be disproportionately available in urban areas and used by the relatively wealthy.

FUNCTIONAL RELATIONSHIPS BETWEEN INSTRUMENTS AND OUTCOMES. The conceptual problem involved in evaluating an instrument in terms of expected results is the difficulty of defining an outcome that can be compared to the cost of inputs. Because of basic problems associated with placing a monetary value on lives saved, outcomes—especially if some are in terms of mortality and others in morbidity—are difficult to compare. If results can be fully valued in monetary units, cost-benefit analysis can be applied, and investments in health can be directly compared to those for, say, road building. Short of this, intermediate outputs can be defined and compared across projects. In health, lives saved is a popular measure of outcomes, as is “discounted quality-adjusted life years.”¹ That measure is used, for example, in a forthcoming World Bank study of disease control priorities in developing countries (Jamison and others forthcoming).

Once a unit of output is defined, one needs to know what is achieved by each dollar spent or program pursued. Complete information on this score is hard to come by for three reasons. First, although a policy may be directed toward one specific aim, its effects may be felt in other areas. Vector control aimed at malaria could well affect the transmission of other diseases or contribute to environmental degradation. Changes in water management practices to control mosquitoes can affect agriculture. More accurate diagnostic techniques for detecting malaria also improve the information useful for the treatment of other diseases. These external effects, for good or ill, should be part of the evaluation.

Second, the effectiveness of a policy depends on the extent to which it is used. The degree of use can increase or reduce the cost of each life saved. If a new clinic is to be built, the costs of the investment may be spread over a large number of potential users and so will decline over some range. Alternatively, the effectiveness of an information campaign (on, say, personal protection) may fall as more and more is spent to educate hard-to-reach people.

The appendix gives five examples of this point and a sense of how it affects policy decisions. A full analysis would require information on the complete relationship among different levels of the use of a policy instrument and its effect on the disease. The key point is that it is necessary to know the marginal benefit of an activity at each level of use to compare to its marginal cost. The crucial contribution of epidemiology clearly is to identify the link between risk factor and incidence of disease. But epidemiology does not necessarily reveal the other link, between the risk factors and policy variables—taxes, subsidies, govern-

ment hiring, and organization rules. The role of organizational structures, either local or national, can be essential in gauging the effectiveness of a policy.

The Current State of Knowledge

Research into the economics of malaria falls into two categories: those studies that document the economic burden of the disease and those that examine the cost-effectiveness of interventions.

The Economic Costs of Malaria

The costs of malaria include the impact of the disease on the economy and economic development, on the local community, on the household, and on the individual. Precise estimates of the mortality and morbidity of malaria are often hard to come by; unsurprisingly, estimates of malaria's economic effect are correspondingly vague. The costs that malaria imposes are borne through increased mortality and through high morbidity rates. The impact of mortality varies with the age distribution of deaths, which in turn vary by ecological zones. In Africa and other regions where malaria is highly endemic and malaria deaths occur primarily among infants and young children, the effect of mortality is different, and will be perceived differently, than it is in areas of low to moderate endemicity where malaria deaths occur among the primary breadwinners or caretakers as well. Substantial secondary effects are attributable to adult deaths as surviving family members adjust to the loss of those with primary responsibility for the well-being of others. Increased infant mortality accompanies the loss of mothers; distress sales of assets to cover lost incomes of principal earners also increase. Arguably, the loss of an adult imposes greater emotional loss on survivors than the loss of infants, especially when infant mortality is generally high. (See Over and others 1992 for discussion of the consequences of adult deaths as a result of disease.)

Information on increases in morbidity is harder to obtain than data on mortality. Much of the research has concentrated on measuring the effects of bouts of illness in reducing productivity and, thus, output of workers. This research has been reviewed in Barlow and Grobar (1986). Research on the physical effects of the disease can be found in Conly (1975), Malik (1966), Russell and Menon (1942), and Van Dine (1916). Days of disability per case of malaria estimated in these studies range from five to twenty. Bhombore, Worth, and Nanjundiah (1952) estimate that families with malaria cleared only 40 percent as much land for crops as similar families without malaria. Conly (1975) traces a variety of adjustments in Paraguayan farm families afflicted with malaria, including increases in labor input by healthy family members per unit of output as well as reallocations of land and hired labor. The reallocations of land entailed substituting relatively low-value crops, whose crop season was not af-

fectured by interruptions in cultivation due to malaria outbreaks, for higher-value crops that need more continuous cultivation. De Castro (1985) finds that such reallocations may also include an increase in the work load of healthy family members. This increase may be seen as an ameliorative factor in that it reduces the net effect of the disease, but it may also be seen as simply spreading the costs of the disease to others besides those who are ill.

The effect on reduced productivity is still a matter of controversy. Direct measures of physical ability have been made by Brohult and others (1981), who find no effect on productivity at all; however, a common convention in the literature is to assume that seven days of work are lost for each bout of malaria whenever this parameter is needed to assess a program but is not independently estimated (see studies by Niazi 1969, Quo 1959, San Pedro 1967, and Sinton 1935/36). When this parameter is independently estimated, it varies between five and fifteen days. A further issue, raised by Wernsdorfer and Wernsdorfer (1988), is the undermining of the effectiveness of investment in education. In areas where malaria is highly endemic, adults normally have acquired sufficient immunity to make the symptoms less severe, but schoolchildren are severely affected; repeated bouts of the disease can affect not only their attendance at school but also their ability to learn. Judging the degree of impairment caused by illness is difficult, and one can only speculate as to the cost.

Other studies emphasize direct financial benefits from activities made possible by eradication or control of malaria (see the survey of these by Wernsdorfer and Wernsdorfer 1988). For example, companies incur costs either when they bring workers who have no immunity to the disease into areas infested with malaria mosquitoes or when they forgo opportunities in the area to protect these workers from exposure. Griffith, Ramana, and Mashaal (1971) show the benefits, in the form of increased profits, that accrue from bringing miners who are not immune into areas where malaria has been eradicated. Forgone profits are the measure of the cost of the disease. Sinton (1935/36) documents many cases in India where the presence of malaria prevented an expansion into new territories, with substantial losses in forgone earnings. (These include as much as 60 percent of land in Bengal remaining idle and commercial ventures such as sugar estates in Assam being abandoned.) Demographic changes since then, however, have probably made it much harder to repeat such expansion in the subcontinent.

Valuing output from opening new lands leads to the broader question of how the *threat* of malaria affects peoples' behavior, a point stressed by Rosenfield, Golladay, and Davidson (1984). People have a range of options available to lessen the effect of illness or risk of infection, but these options have costs that are hard to assess. An example mentioned earlier is that farmers might plant relatively low-value crops—rootcrops, for instance—which are less sensitive to interruption of cultivation, if the possibility of illness makes interruption likely. The difference in the value of output between crops is rarely counted in these studies.

The tendency in cost estimation to confine attention to days lost from work or output forgone is oddly narrow. In welfare terms, the appropriate measure would be "willingness to pay" to avoid the disease altogether. This is sometimes referred to as the "equivalent variation," or the amount that would need to be paid by a healthy person to feel as well off as when ill. An alternative measure could be the "willingness to accept," or the "compensating variation," which is the amount that needs to be paid to someone who is ill in order to return the afflicted person to the same level of well-being as he or she enjoyed before the onset of the disease. In contexts of price changes, these two measures should be quite close. In the context of measuring the burden of disease, the latter could be quite a bit larger than the former, since it does not depend on current ability to pay, which sets a limit on what could be paid (Hanemann 1991). In other words, the amount one would need to bribe someone to risk getting a potentially deadly disease may be much higher than the amount that person would be willing (or able) to pay to avoid that risk. Either of these measures would necessarily be larger than lost productivity alone, since they would include the subjective valuation of the discomfort and the fear of severe consequences—death—from the disease itself, as well as more easily measured losses.

The disadvantage of using a theoretically correct concept is that measurement requires a concerted research effort. A lower bound for how much people would be willing to pay can be inferred by calculating the total costs that people *do* pay to obtain treatment. The total costs borne by families and individuals include payment for treatment, time and transport costs in seeking treatment, time costs for family members who look after the patient, and the time and monetary costs of preventive action. The sum of these costs is only a lower bound because those who seek treatment reveal by their actions that they prefer to bear these costs rather than suffer the disease.

The true costs of the disease exceed the costs of seeking treatment for two reasons. First, there is pain and suffering before treatment is sought. Second, there are people who have decided that the costs of seeking treatment are too high relative to letting the disease run its course. For people in remote areas (who must pay very high transport costs to get treatment) or for those afflicted at peak agricultural seasons (when implicit wages are high, both for the person falling ill, or, in the case of children especially, for those needed to care for the person), these costs can be high. In addition, people who are uninformed about the potential benefits of treatment may suffer with the disease even when they would pay the costs of transport and treatment if they had better information.

In a careful study of Thailand, Kaewsonthi (1989) has attempted, among other things, to measure the costs borne by patients in seeking care. These costs amounted to \$20 per positive case, or nine times the average daily wage.² This estimate is for people coming to the malaria clinic and therefore does not include those who have handled the disease in other ways. The study includes costs entailed in seeking local treatment before travel to the clinic, which can be substantial. The degree of underestimation of the cost to sufferers is prob-

ably quite high. Time lost before and after seeking treatment can be considerable and varies with the quality (primarily speed) of service provided.

The situation is summed up by Andreano and Helminiak (1988, p. 35), who state that “despite the many studies and the excellent work by Barlow and Conly, which represent methodological advances in the study of tropical diseases, we remain woefully ignorant of the social and economic effect of malaria in those countries of the world where it is prevalent.” They also emphasize that findings in many of these studies cannot be easily generalized from one area to another.

The Cost-Effectiveness of Interventions

Research has made some progress in estimating the burden of the disease, but estimates of the effect of policy instruments are less satisfactory. Because it is so difficult to conduct a complete cost-benefit analysis by the standards outlined earlier, cost-effectiveness ratios are frequently substituted. These are simply the ratio of the costs of an intervention divided by a given outcome, usually lives saved, cases prevented, or life years saved (sometimes corrected for quality or with discounting of future years). The idea is that these numbers can be compared and then choices made among alternative policies. But these ratios must be used with care and are sometimes misleading, as illustrated in the appendix to this article. Doubilet, Weinstein, and McNeil (1986) provide a number of grounds for caution, as does example 4 in the appendix. Nonetheless, cost-effectiveness ratios are the most widely used analytic technique and often the only game in town.

From the review paper by Barlow and Grobar (1986) mentioned earlier and the Nepal study by Mills (1987), the costs per year of lives saved and cost-benefit ratios can be calculated for malaria control efforts in several countries. These results are presented in tables 1 and 2. Included in table 1 are calculations of the cost per discounted quality-adjusted life years saved by the program. These calculations were made on the basis of the information, presented in the various studies, on costs per case averted or death prevented.

The most striking feature of these numbers is their variability. Indeed, the differences among the studies are so marked that it would be hard to make any generalizations about them at all. The costs per case prevented ranged from \$1.30 to \$260 (in 1987 dollars) and the benefit-cost ratios from 2.4 to 146; that is, the monetary benefits are between 2.4 and 146 times as high as the costs. The higher benefit-cost figures make malaria control seem of utmost importance. The lower figures bring it into competition with many other government programs or the costs of taxes to pay for them. Most of the explanation of the wide range of variation is not very illuminating. Differences in data quality, in assumptions used in the analysis (for instance, in ways mortality is estimated), in the definition of the relevant costs, in the length of time studied, in the discount rate applied, and in the coverage and purpose of the original intervention all account for much of this variation. As one example, in the

Table 1. Cost-Effectiveness of Malaria Control
(1987 U.S. dollars)

<i>Study</i>	<i>Country</i>	<i>Intervention</i>	<i>Cost per case prevented</i>	<i>Cost per death averted</i>	<i>Cost per discounted quality-adjusted life year saved</i>
Barlow (1968)	Sri Lanka	Insecticide	—	78	3
Cohn (1973)	India	Insecticide	2	—	7
Gandahasada and others (1984)	Indonesia	Insecticide	83–102	—	275–6,180
Hedman and others (1979)	Liberia	Vector control; drug therapy	14	—	143
Kaewsonthi (1989); Kaewsonthi and Harding (1984)	Thailand	Vector control; drug therapy	27–74	—	90–760
Mills (1987)	Nepal	Vector control; drug therapy	1–172	3–255	—
Molineaux and Gramiccia (1980)	Nigeria	Vector control; drug therapy	259	—	1,500–2,650
Ortiz (1968)	Paraguay	Insecticides	60	—	71
Walsh and Warren (1979)	Developing countries	Vector control	—	990	34

—Not available.

Note: Figures are rounded to the nearest dollar.

Sources: Barlow and Grobar (1986); Mills (1987); authors' calculations.

Table 2. Benefit-Cost Ratios in Malaria Control

<i>Study</i>	<i>Country</i>	<i>Intervention</i>	<i>Benefit-cost ratio</i>
Barlow (1968)	Sri Lanka	Insecticide	146.0
Griffith, Ramana, and Mashaal (1971)	Thailand	Chemoprophylaxis	6.5
Khan (1966)	Pakistan	Eradication program	4.9
Livandas and Athanassatos (1963)	Greece	Eradication program	17.3
Niazi (1969)	Iraq	Eradication program	6.0
Ortiz (1968)	Paraguay	Insecticide	3.6
San Pedro (1967)	Philippines	Eradication program	2.4
Democratic Republic of Sudan (1975)	Sudan	Control program	4.6

Source: Barlow and Grobar (1986).

Garki Project study (Molineaux and Gramiccia 1980), which generated the figure of \$260 per case averted per year, the costs of the extensive research and monitoring exercise that accompanied the intervention are included in the program costs.

Similarly, some of the studies included administrative costs, while others used only the cost of materials. Some costs were calculated on the basis of small pilot projects (Gandahasada and others 1984 in Indonesia) and others on the basis of national efforts (Barlow 1968 for Sri Lanka). The costs per quality-adjusted life years are sensitive to assumptions concerning case fatality rates for those countries with data only on cases averted per year.³ Differences in research methods of these sorts would make it difficult to find a reliable cost figure even if it were unambiguously defined and common to all of the studies.

That the return to investments differs in different locations and circumstances should not be surprising. There are at least four systematic reasons for the wide variations in the cost-effectiveness numbers presented in the tables. Each points to an area of ignorance that limits the relevance of the calculations to policy. These are: (a) differences among areas in their ecological, epidemiological, and social characteristics; (b) wide variations over time of the incidence and severity of malaria within a particular area; (c) variations in the organizational structures of control programs; and (d) differences in the intensity with which the interventions are applied.

STRATIFICATION. The variability in the epidemiology among regions determines much of the effectiveness of control programs, with the degree of endemicity being the most important variable. Also of importance are characteristics specific to a region, such as the traits and habits of the mosquito population, the openness of the area to migration of vulnerable populations, and the degree of parasite resistance to chloroquine. For any particular policy analysis, the local conditions must be assessed. Little information is widely generalizable.

TEMPORAL VARIABILITY. Depending on the degree of endemicity, the prevalence of malaria can vary substantially within the same region over time. Calculations of the cost-effectiveness of control efforts will similarly vary (inversely with the prevalence rate); the usefulness of cost calculations that use a single base year as a comparison for a program are therefore limited. Policy options must be evaluated on the basis of their expected value averaged over the distribution of prevalence occurring at different times for the area. This is particularly important if costs include a fixed component—for example, the administrative costs for control organizations—that must stay in place regardless of the prevalence in any one year.

ORGANIZATIONAL STRUCTURE. Control programs vary from highly structured, single-purpose, vertical programs to “integrated” health services where all disease conditions are the responsibility of the local health authority. As a matter

for policy design, joint costs between the provision of health care generally and malaria control programs in the integrated schemes must be assessed. This assessment can help in deciding to what extent malaria control operations should be operated independent of the local health center. Mills (1987) finds that the higher the volume of cases, the more similar the costs of integrated and free-standing programs are likely to be. In areas in which case load is low, integrated programs can have substantial cost savings as personnel shift their attentions to other health care needs.

RETURNS TO SCALE. As discussed in the description of the ideal world, costs and effectiveness vary substantially with the level of activity of the intervention. Certain costs of intervention programs, such as facilities and staff salaries, are relatively fixed. Others, such as costs of materials (drugs), are variable and proportional to outputs. And still others, such as costs of spraying when more dispersed populations are covered, rise more than proportionately with output. Because none of the studies cited gives more than an estimate of costs at a given point, these estimates are difficult to incorporate into a thorough analysis.

Because there are good reasons to expect diminishing returns to most single activities for controlling malaria, effective policies are likely to entail a package of instruments. Costs for mosquito control activities rise as densities of mosquitoes and of people decrease. Costs for case management operations rise as it becomes necessary to move from passive case detection methods to more costly public awareness campaigns, such as information, education, and communication (IEC) campaigns, or even to active case detection. Barlow and Grobar (1986) suggest that the great uncertainty surrounding cost estimates argues that a combination of policies should be used to control parasitic diseases—in the same way that financial managers use a portfolio of investment instruments rather than investing everything in a single instrument that could fail. The argument could be made for malaria, at least, that a combination of policies would be desirable, even with accurate information, because of the diminishing returns to any one instrument.

Specific Interventions: What Do We Need to Know?

One inference that can be drawn from the preceding argument is that the effects of particular interventions need to be assessed in specific contexts and are not likely to generalize much from one context to another. Further, when considering the use of *public* funds to control the disease, the appropriate measure for effectiveness of a policy must be the increase of the use of a control instrument and the lives saved by it over and above what a private market would provide without government help. For some antimalarial operations, such as mosquito control, the service provided is a pure public good—if the public did not provide it, it would not get done at all. For other activities, such

as drug therapy for people who show up at clinics, public provision may only substitute for private. If private provision is inadequate—due, perhaps, to imperfect information for consumers of the value of treatment—public intervention may be called for. Whether the intervention should be treatment or a public information campaign needs to be assessed. The functioning and performance of private markets should be examined when public interventions are proposed.

In vector control operations, spraying inside homes, or residual spraying, will continue to be the principal tool in most areas. Theoretical justification for this comes from the effects of the various techniques on the variables determining vectorial capacity. Residual spraying has a strong immediate effect on vectorial capacity and hence works directly on the mortality rate, whereas the other techniques—land management, larvacides, or drainage—work primarily through decreasing vector density over time (Rishikesh, Dubitiskij, and Moreau 1988; Molineaux 1988). This immediate advantage is not sufficient to infer the superiority of residual spraying, but costs do not differ so much as to overturn that conclusion. The degree to which spraying can be effectively used, however, varies substantially with the endemicity of the disease, and the costs can differ substantially at different levels of use. To what extent spraying is effective needs to be decided locally. Other techniques of vector control, such as outdoor spraying of specific mosquito breeding grounds or drainage of swamps, can be effective in very specific settings but are subject to distinct limits on the extent of their use.

For case management, drug therapy will continue to be the principal antimalaria tool. The material cost of drugs is easy to assess. The full costs of drug therapy as a public policy, however, depend on the efforts (either by the individual or the health care system) to get the patient to seek treatment. These will vary from place to place, as will the rate at which costs of active case detection or public awareness campaigns rise with greater coverage of the population. Public information campaigns could also improve the way people use the drugs—the mosquitoes' resistance to chloroquine, for instance, has been exacerbated because many people stop taking the drug before the full cycle has been completed. But there is little information available on how much such a campaign would cost or how effective it might be.

Personal protection methods, such as using bed nets or curtailing evening activities, could be influenced by informing the public—but again, there is little information on how effective this educational effort would be. The same might be said of subsidies on the sale of bed nets. An assessment of the costs and the benefits would require guessing how responsive to price the demand for bed nets might be.

Surveillance can reduce costs and improve the functioning of control operations. For example, in areas where malaria is a recurrent but not perfectly predictable problem, the value of vector control varies substantially. Surveillance activities have some fixed costs that are independent of the prevalence rate—the cost of a parasitology laboratory or of the entomological service—but can save

the cost of spraying when the prevalence rate does not justify the operation. The value of surveillance for this purpose can be described theoretically (see Kaewsonthi 1989; Harding 1984; Hammer 1992), but it has not been quantified.

The challenge of drug resistance points to another gap to be bridged by cooperation between economics and epidemiology. Little has been done in the way of combining analyses of the dynamics of the disease and the value of interventions. Drugs can induce resistance as well as cure the disease. If the relationship between current drug use and the development of resistance in the parasite were known, such future effects might be taken into account in designing policies concerning pricing, regulation, and information campaigns. Vector resistance to insecticides tells the same story. Once again, however, merely tracking the pattern of resistance development is not sufficient for policy analysis: the rate of the spread of the resistant strain must be tied to variables that are under the policymaker's control.

Integrating knowledge of the dynamic properties of the disease with economic analysis could be beneficial in more general ways. Depending on the degree of endemicity, policies can have effects over varying periods of time. The most dramatic effects may be expected in areas of low endemicity where eradication is a possibility. However, even in areas of high infestation, real, although more limited or temporary, gains may be possible. Short-run benefits that are eroded over time may still be worthwhile. The dependence on policy variables of the interrelated time-paths of vector density, immunity development, resistance development, and human disease has yet to be determined. Wiemer (1987) provides an application of optimal control techniques to a dynamic model for schistosomiasis in China, but this has not been replicated for other diseases.

Research

Much of the best recent work in the economics of malaria control has been operationally oriented, designed to answer specific questions concerning service delivery. When specific activities are proposed for a specific area, costs can be gauged relatively easily, because changes in scale are not at issue. Marginal benefits can also be appraised in terms of the local epidemiology and institutional and administrative conditions. Costing exercises in these cases can greatly improve allocation decisions by managers; the work done by Kaewsonthi (1989) in Thailand and by Mills (1987) in Nepal are examples of how useful such studies can be. These studies used careful costing procedures at local levels to clarify comparisons between techniques of vector control and between vector control and therapy, and to make practical recommendations for improvements. Mills, for example, was able to suggest that active case detection methods be reduced and the number of malaria clinics (or other treatment-based facilities) be increased—and that either of these activities looked better than spraying.

One of the few studies that has been sensitive to the issue of decreasing effectiveness was done by Ettl and others (1990). In this study, the increasing costs

of expanding clinic coverage in a district in Thailand are documented and presented in a form that makes clear the tradeoff between numbers of cases treated and the cost per case.

Recent work at the U.S. Centers for Disease Control (Sudre and others 1990) has focused on the choice of drug therapy in areas of chloroquine resistance and identifies the variables salient in this decision. Interestingly, the study finds one of the most important factors relevant to the choice of drugs to be the relative compliance with drug regimens—an indication that information and other measures to improve compliance should be explored.

Work in progress at the Centers for Disease Control has highlighted the problems of infant and child mortality in malaria-prone regions of Africa. One conclusion emerging from that work is that prenatal prophylaxis, early in pregnancy and especially for first pregnancies, can be effective in averting low birth weight and related infant mortality. From a policy perspective, this raises the issue of how to get women who have not felt sick from malaria for years, and who do not seek prenatal care in any case, to take preventive measures. Once again, questions about the cost-effectiveness of information campaigns loom large.

Many of the questions that need to be tackled in policy analysis for malaria have been addressed in other areas. On the regulation and control of drugs, a review by Foster (1990) shows the scope of cost savings and improved health outcomes that can come from more effective use of drugs in Sub-Saharan Africa. Misdiagnosis, errors in prescription, and failures in compliance appear as important issues, raising the problems of providing information to a decentralized and largely private market. A more theoretical approach is taken by Hammer (1992), who examines the relative merits of selling drugs over the counter rather than by prescription, balancing access and affordability with accuracy in drug use.

Policies to control malaria will have to include many activities that involve improving public awareness and modifying personal behavior. The costs and effectiveness of public information campaigns have been studied in a number of contexts not specifically related to malaria control. Existing studies on family planning and, in industrial countries, on behavioral changes in diet and lifestyles may be of use, but, given the very different contexts and issues, these may serve only as examples of what might be done.

Finally, dynamic models of epidemiology have been integrated with economic policy models for other parasitic diseases such as schistosomiasis (Wiemer 1987). The potential value of similar work on malaria is great.

Agenda for Research and Operations

The main thrust of my arguments has been that appropriate policies will often entail a mix of interventions, that this mix will vary from one quite small

region to another, that circumstances change (especially in regard to drug resistance), and that the information needed to assess the effectiveness of each intervention often does not exist. These considerations underline the need to develop local institutional capacity for generating policies suited to local needs. No single set of policies will be applicable globally, except for a general policy of strengthening institutions charged with the health of the public and encouraging the collection of more data. Policies can only be more precisely specified in the field.

Making intelligent choices among different strategies, learning from experience, and being able to change these strategies to suit the circumstances all require considerable expertise in epidemiology and in operationally oriented research, in economics among other disciplines. This expertise is needed to varying degrees at the local and national levels. Maintaining well-organized programs (whether specialized in malaria or not) with well-trained people is an important task, but by no means an easy one.

In Africa and other areas where malaria is highly endemic, the range of policy options specific to malaria is somewhat more limited than in areas where endemicity is lower. In these circumstances, the emphasis should be on improving health care delivery overall. The policies in question relate to the financing of health care, public investments, location of facilities, and campaigns aimed to inform the public and the providers about drugs, therapy options, and protective behavior.

It is safe to say that one general need is to improve routine collection of information. This, of course, will be of value beyond the application to malaria alone. The information needed is largely epidemiological, narrowly defined, but with an emphasis on those variables that policy can manipulate. The functional dependence of these risk factors on the policy options must be explored to be useful.

All the steps in the decision process outlined in our “ideal world” are surrounded by uncertainty. In each context, the information to be collected and the appropriate set of policies will be different. Research on one class of policy options may be applicable in a range of situations: information, education, and communication programs, or health education generally may have substantial value in improving drug compliance, in seeking prenatal care, in recognizing symptoms in cooperation with vector control operations, and in adopting personal protection measures. The costs and effectiveness of providing this information are not well known, however; neither are the effect of this information on behavior or the effect of behavior on incidence. Given the potential benefits, applied research in this particular area may yield substantial returns.

Appendix: Some Economic Concepts Relevant to Malaria Control

This appendix uses five examples to illustrate some fundamental economic concepts relevant to the points made about disease control in this article. The

first point is that the absolute magnitude of the burden of a disease is *not* a proper criterion for setting priorities in health. The second is that changes in costs that might be expected to occur at different levels of intensity of activity affect the optimal allocations of resources. The third is that this pattern of costs can imply that a mix of techniques may be appropriate in malaria control; the fourth, that average cost-effectiveness is also not a proper criterion for priority setting; and the fifth, that cost effectiveness ratios cannot be used to compare activities that are mutually exclusive, such as curative care options for a given disease.

Example 1: Disease burden and priority setting. Consider the following simple example. There are two diseases. Disease A kills 1,000 people a year and disease B kills 30 people a year. It so happens that it costs \$100 to save one person from disease A and \$50 to save that person from disease B. The ministry of health has \$10,000 for disease control. How should it be spent?

If priorities were set by ranking diseases by “importance,” that is, by mortality rates, disease A would win hands down because it kills more than 30 times as many people as disease B. If all resources were devoted to disease A, the ministry could save 100 lives ($\$10,000 \div 100$). If resources were devoted to each of the diseases in proportion to their mortality rates, disease A would receive \$9,700, B would get the rest, and 103 lives would be saved—6 from disease B using the \$300, and 97 from A. The ministry could have done even better, though, had it used the entire \$1,500 needed to eradicate the less “important” disease B and used the remaining \$8,500 on the more “important” disease. With that strategy, 115 lives would be saved—30 from B and 85 from A.

In this example, priorities set by considering the burden of the disease are exactly backwards. The disease with the lower total burden, not the more prevalent one, is the first priority. The point is that priorities depend on what can be done about a problem, not how big the problem is. Interventions should be ranked in order of the marginal effect, that is, the effect of one more unit of input—dollars, or hours, or patients seen. The interventions should be conducted in that order until the budget is exhausted (as in this case) or until the marginal effect of the first intervention is no longer greater than the (again) marginal cost of other uses of these funds. For example, if it were decided to spend no more than \$60 per life saved (either because that is how much saving lives from all other causes would cost or, more contentiously, because someone decided that was what lives are worth), then only disease B would be attacked because only B meets this criterion. Disease A would be ignored.

Example 2: Decreasing returns. In this case, costs of controlling disease B remain \$50 per life saved, but those of disease A vary in the following way. One hundred people can be saved at a cost of \$25 apiece, but the remaining 900 would cost \$100 apiece, as in the first example. This differential could occur because there are different techniques for dealing with the disease and the

cheaper technique is subject to some capacity limits. Alternatively, there could be only one technique that becomes less effective as use increases because it faces more difficult environments. For example, drug therapy may be cheap for those who present with symptoms but may be very expensive if active case detection is necessary to expand coverage to those who do not seek treatment.

With this cost structure and the same \$10,000 budget, what is the best thing to do? If disease A is a priority because of the burden-of-disease argument, 175 lives can be saved—100 at a cost of \$2,500 and 75 at a cost of \$7,500. But again, more lives could be saved if the criterion of what can be done, rather than which is the biggest problem, is used. On that criterion, the \$25 technique for disease A would be used, saving 100 lives for \$2,500. Next, attention would turn to disease B where 30 lives could be saved for \$1,500, and the remaining \$6,000 could be used for the more expensive technique for controlling A, thus saving 60 lives, for a total of 190 saved altogether. These 15 extra people are the same as those saved in the first example. If, instead of thinking in terms of a budget constraint, we were comparing marginal benefits with the marginal cost figure of \$60 as above, the first 100 people from A and the 30 people from B would be saved, leaving the remainder of the money to be used elsewhere in the health sector (or in the rest of the economy).

Figure 1. *Decreasing Returns: Lives Saved in Relation to Money Spent*

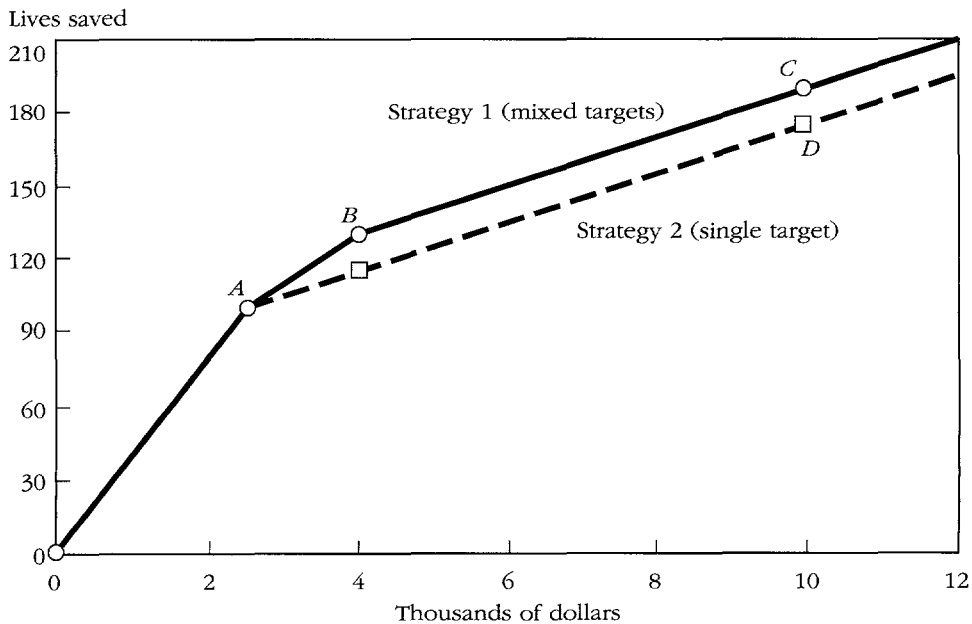


Figure 1 illustrates these points. The diagram shows the relation between money spent and lives saved following the different strategies. The path $OABC$ (strategy 1) represents the strategy of using the \$25 technique (from O to A) for disease A , followed by attention to disease B (A to B), and finishing with a return to the less effective technique for A (B to C). Had all resources gone to disease A , following the path OAD (strategy 2), the opportunity to reduce mortality caused by disease B would have been missed.

Example 3: More decreasing returns. In this example there is only one disease but two types of intervention. Let the cost structure for A in the second example refer to vector control (that is, the first 100 lives cost \$25 apiece and the additional lives cost \$100 apiece). This difference could be attributable to high returns to focal spraying, which is of limited applicability, and low returns to more widespread control operations. With passive case detection techniques, 200 people could be treated at a cost of \$10 apiece. If active detection services are required, the cost rises to \$33.33. With the same budget constraint of \$10,000, the optimal policy intervention is to treat the 200 people who come to the clinic (at a cost of \$2,000), do focal spraying, saving 100 lives (at a cost of \$2,500), and use active detection methods until the remaining budget of \$5,500 is exhausted, saving 165 more lives. Note that this strategy involves using a mixture of techniques because of the increasing costs (or, equivalently, decreasing returns) to the use of each type of intervention alone.

Example 4: Average versus marginal costs and benefits. This example illustrates the importance of obtaining the relevant information about the true effect of interventions “on the margin,” rather than on average. The example involves two techniques—vector control and drug therapy. Focal spraying is very effective—it costs \$10 a life and can save 200 lives. After that, the cost of spraying jumps to \$100 a life. Drug therapy costs \$40 a person. The country’s current program simply splits the budget in half, giving \$5,000 to vector control and the same to malaria clinics. It is saving 355 lives (200 from focal spraying costing \$2,000; 30 from the remaining \$3,000 from vector control); and 125 ($\$5,000 \div 40$) from therapy. An accountant comes along to appraise the program and discovers that the average cost of a life saved by vector control is only \$21.74 ($\$5,000 \div 230$) while drugs cost \$40 a life; the accountant therefore recommends expanding vector control operations at the expense of the clinics. This is exactly wrong. While the *average cost* of vector control operations is \$22, the *marginal cost* is \$100 because the country has already exhausted the limits of focal spraying (which substantially increased the calculation of average effectiveness) and is relying on the less effective techniques. The correct advice to give is to cut back vector control funds to \$2,000, which covers focal spraying, and use the remaining money for drugs. This strategy increases the number of lives saved to 400. The accountant’s advice would have reduced the number saved.

Example 5: Mutually exclusive options. One last example illustrates a general problem with applying cost-effectiveness analysis to choices between competing, mutually exclusive options.

Consider a situation in which two drugs are available to treat a particular disease. Drug 1 changes the probability of avoiding death from 0.2 to 0.3 and costs \$5 per treatment. Drug 2 changes the probability from 0.2 to 0.25 and costs \$2 per treatment. The cost per life saved by drug 1 is \$50 ($\$5 \div [0.3 - 0.2]$), while lives saved by drug 2 cost \$40 ($\$2 \div [0.25 - 0.2]$), making drug 2 more cost-effective.

Most people probably would opt for drug 1, though, provided they are willing to pay more than \$60 to save their life. For any imputed value of life greater than \$60, the value of the increased probability of recovery outweighs the extra cost of the drug. That is, at \$60, the net return to drug 1, $\$60 \times (0.3 - 0.2) - 5 = \1 , is equal to that of drug 2, $\$60 \times (0.25 - 0.2) - 2$, and is higher for any value greater than \$60. Cost-effectiveness ratios, while seeming to avoid the contentious issue of deciding on a monetary value of life, merely disguise an implicit valuation that may not reflect people's preferences. Mutual exclusivity characterizes all comparisons of alternative treatment options for a given disease, and this rules out cost effectiveness ratios in the analysis of curative care.

Notes

The author is on the staff of the Population and Human Resources Department of the World Bank. The article draws on work done for the Institute of Medicine study of malaria (Oaks and others 1991) and on Nájera, Liese, and Hammer (1992).

1. The number of years saved—in the case of mortality—by health intervention, weighted by a term capturing the degree of unpleasantness caused by the morbidity of a disease, and discounted to conditions in the future.

2. All dollar amounts are U.S. dollars, unless otherwise noted.

3. Following Lancaster (1990), a case fatality rate of 1 percent was assumed for India, 0.25 percent for Liberia and Nigeria, 3 percent for Paraguay, and from 0.2 percent to 1 percent for the rest of Asia, on the basis of the India figure and data from Malaysia.

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FEEDING LATIN AMERICA'S CHILDREN

Philip Musgrove

More than US \$1.6 billion is spent annually on 104 programs in nineteen Latin American and Caribbean countries to subsidize or provide food for people supposedly at risk of malnutrition. This amount constitutes only 0.2 percent of these countries' gross national product. If there is no double-counting, these programs reach more than 80 million people, or 21 percent of the population, at a cost of \$20 per beneficiary or \$4 per capita. Yet some 10 million children are malnourished, which suggests that the expenditures are poorly directed or ineffective. There is little hard evidence that these programs are preventing much malnutrition; even curative results are seldom measured. The effort is too small in some countries with great needs, while other countries have nearly eliminated malnutrition. Where coverage is high, programs—although generally targeted and with sensible criteria—do not always reach the neediest. They may also fail to provide enough food or to combine food with the health care and nutritional education necessary to attack all three root causes of malnutrition: poverty, disease, and ignorance. The evidence, limited mostly to program inputs rather than results, suggests that greater progress against undernourishment is possible even with current spending levels.

It is a commonplace that malnutrition is unacceptably widespread in Latin America and the Caribbean, particularly among preschool-age children (United Nations 1989); that economic growth alone would be very slow to eliminate it; that other means are available to reduce malnutrition more rapidly and surely; that among these means are targeted programs providing some combination of food, nutrient supplements, health care, and education to

vulnerable children and their families; and that such programs need not cost an enormous share of a country's resources. These conditions create a need to understand what efforts are under way in the region to reduce malnutrition through such programs, to determine what makes programs more or less effective or efficient, and to improve them where they appear inadequate and extend them where they appear to work as intended.

Answering these questions, which are at the heart of any effort to end malnutrition, is difficult primarily because of poor information. One problem is that information on the prevalence of malnutrition is incomplete and out of date. There are survey data for one country each for 1990 (Paraguay) and 1989 (Brazil) and for two for 1988 (El Salvador and Mexico). But some data are from as long ago as 1978, and those for several countries refer to 1981–82. Many small surveys refer to particular subpopulations, usually defined by geographic region, but it is impossible to tell how well they represent a country's population. And even national samples may be based on 2,000 or fewer children, so that estimates of the prevalence of wasting—low weight for height, the least common form of malnutrition—are derived from just a few dozen underweight children.

A second problem is that almost nothing is known about whether existing programs prevent children from becoming malnourished or restore malnourished children to normal nutritional status. Prevention is intrinsically hard to measure, but curative results are easy to detect; yet even this information is almost universally missing. As a result programs tend to be judged only by measures of input, such as how many people they enroll, how much food they distribute, or how much it costs to reach one beneficiary or to deliver a given amount of calories, protein, or other nutrients.

A third problem is that the typical program provides surprisingly little information even about its inputs, beneficiaries, and costs. Important data are often missing, incomplete, or open to suspicion. For example, an internal World Bank inventory of nutrition programs in 1990 found that program-level data on beneficiaries in Brazil do not correspond well to household-level responses to questions about enrollment or participation. Using measures of inputs to make inferences about outcomes can be misleading, particularly if inputs are poorly measured to start with.

To enlarge the information available on nutrition programs in Latin America, the World Bank produced a detailed inventory of supplementary feeding programs for mothers and children (and some other programs) under way in mid-1990, with as much detailed information as possible about implementation of programs with the highest coverage in each country (Musgrove 1991). Information was obtained on 104 programs in nineteen countries. This article summarizes the findings of that larger study. Because there are so many programs, tables show data for entire countries only; some program-level data are displayed graphically.

Nature, Size, and Consequences of Malnutrition

In an entire population “malnutrition” can include obesity and diet-related risks of cardiovascular disease, diabetes, or other health problems, but for young children, only two conditions matter. One is being too small according to some physical criterion, defined by a reference population of healthy, well-nourished children (Zerfas 1991; Carlson and Wardlaw 1990; Frisancho 1990). Because this condition is associated with inadequate intake or utilization of macronutrients, it is referred to as protein-calorie or protein-energy malnutrition. The other condition encompasses all the specific or micronutrient deficiencies, of which the most important are iron-deficiency anemia and inadequate intake of vitamin A and iodine.

Protein-calorie malnutrition is defined by low weight for age (underweight), low weight for height (wasting), or low height for age (stunting). Stunting indicates failure to grow normally over extended periods, and it is often considered a sign of *chronic* malnutrition, such as routine failure to eat enough. It can also result from repeated brief interruptions to growth caused by frequent episodes of illness. Wasting is often described as *acute* malnutrition, because it tends to result from actual loss of weight. A stunted child may have survived various episodes of wasting, with subsequent recovery of weight but not of normal height. Being underweight for age is a common consequence of stunting, but it can, of course, also result from wasting. Underweight is therefore sometimes used as a measure of *global* malnutrition reflecting unknown proportions of stunting and wasting.

Children who are malnourished during their early years were often born small or prematurely because their mothers were malnourished during pregnancy. If one measures a child’s age from conception rather than birth, then low birth weight at normal gestational age is a form of malnourishment. There is thus no clear separation of maternal and infant malnutrition, which justifies the practice of directing nutrition programs to pregnant women as well as to young children.

In the reference population of U.S. children adopted as a standard by the World Health Organization (WHO) and UNICEF (United Nations Children’s Fund), the distributions of all three anthropometric indicators are essentially normal. This means that there is no natural limit below which one can be sure a child is malnourished; any cutoff point is arbitrary. It is becoming standard practice to define *moderate* malnutrition by values lying between two and three standard deviations below the mean, and *severe* malnutrition by values more than three standard deviations below the mean, with both the mean and the deviation defined by the reference population.

Defining malnutrition relative to a point on a reference distribution has three important consequences. First, even in the reference population, 2.3 percent of children get identified as malnourished (whether they are or not); therefore, the prevalence of malnourishment should be estimated by the excess over

Table 1. Estimated Prevalence of Malnutrition among Children under 5 Years, by Country

Country ^a	Year	Type of malnutrition ^b			
		Global (number)	Global (percent)	Stunting (percent)	Wasting (percent)
Bolivia	1981	609,000	14.5	42.7	0.7
	1987 ^{c,d}	760,200	18.1	—	—
Brazil	1989 ^e	5,024,200	30.7	—	—
Chile	1986	35,000	2.5	9.6	0.5
Colombia	1977–80	684,700	16.7	22.4	4.6
	1986 ^f	487,900	11.9	22.7	1.0
Costa Rica	1982	24,000	6.0	7.8	2.0
	1987 ^{b,c}	10,800	2.7	6.4	—
Dominican Republic	1986 ^f	125,000	12.5	20.8	2.3
	1987 ^b	58,000	5.8	12.8	1.8
Ecuador	1986	264,000	16.5	34.0	1.7
El Salvador	1988	123,200	15.4	26.8	2.3
Guatemala	1987 ^f	502,500	33.5	57.9	0.4
Haiti	1978	342,000	37.4	39.6	8.9
Honduras	1987	164,800	20.6	33.9	1.9
Jamaica	1985 ^g	43,800	14.6	7.1	5.1
	1989 ^h	21,900	7.3	2.9	2.1
Mexico	1988 ⁱ	1,584,600	13.9	22.3	6.3
Panama	1980	47,100	15.7	22.0	6.4
	1980 ^c	47,400	15.8	25.1	6.1
Paraguay	1990 ^j	25,200	4.2	20.3	0.4
Peru	1984	428,800	13.4	37.8	0.9
Uruguay	1987	20,500	7.4	15.9	—
Venezuela	1981–82	275,400	10.2	6.4	1.3

— Not available.

Note: Except as indicated, prevalence is calculated using the reference median minus two standard deviations, or according to the World Health Organization (WHO) definitions of less than 80 percent of the reference median for global malnutrition (weight for age) and wasting (weight for height) and less than 90 percent of the reference median for stunting (height for age). These two definitions coincide approximately for the 0–5-year age group; estimates based on the Gomez definition (less than 75 percent of the reference median) would be lower.

a. Data for Argentina are not included because no recent national estimates were available.

b. Data from WHO (1989), except as indicated; same data reported in Carlson and Wardlaw (1990).

c. Data from PAHO (1990), vol. 1, tables 86–88; sample sizes and age ranges not indicated.

d. Data refer to children brought to health service centers; not a representative sample.

e. Data from INAN (1990); malnutrition defined as less than 75 percent of reference median (Gomez definition).

f. Children aged 6–36 months or 4–36 months, rather than 0–60 months. Estimate of number of malnourished children assumes the same prevalence for the entire population under 5 years of age.

g. Jamaica Ministry of Health (1985).

h. Statistical Institute of Jamaica (1991).

i. World Bank staff estimates.

j. Institute for Research Development/Westinghouse (1991).

Source: Musgrove (1991).

this share. Second, if children in the reference population who look malnourished are considered “small but normal” rather than unhealthy, small-but-normal children can similarly be present in any other population. Thus, aside from the question of excess prevalence, there is a problem of identifying individuals. A child whose height or weight falls more than two standard deviations below the mean may not really be malnourished; if the prevalence of malnutrition in the population is low, this error becomes more likely. Conversely, a child not classified as malnourished may in fact have grown more slowly than is normal. These errors matter little when estimating prevalence in large groups—in part because they cancel each other out—but they complicate assessing how well a program is targeted. And third, the status of an individual child is better judged by growth through time than by current weight and height. Every child can be thought of as having a growth path, and failure to grow along that path is a surer sign of trouble than simply falling far below the mean.

The most recent country-level data on the prevalence of malnutrition in eighteen Latin American countries show that some 10–11 million preschool children in these countries are underweight for age (table 1). (There are no recent national data for Argentina.) Even more—perhaps 15 million—are moderately or severely stunted. Wasting is much less common, affecting perhaps 1–2 million children (no estimate is available for Brazil). Comparison across countries is hampered by differences in timing, definition, and accuracy of national estimates. Even so, there is no doubt that the bulk of malnutrition is found in a few countries with very large populations (Brazil and Mexico), with substantial concentrations of poverty (Bolivia, Guatemala, Haiti, and Peru), or both. Prevalence of low weight for age appears to exceed 30 percent in Brazil, Guatemala, and Haiti and to fall below 10 percent only in Chile, Costa Rica, Jamaica, Paraguay, and Uruguay. The prevalence of stunting is estimated to equal or exceed 40 percent in Bolivia, Guatemala, and Haiti, while the prevalence of wasting never surpasses 10 percent and often is less than 1 percent.

Causes of Malnutrition and Interventions to Reduce It

How to combat malnutrition depends on its causes, which fall into three broad classes: poverty, illness, and ignorance. For *poverty* to be the only cause of malnutrition, it is not enough for the two phenomena to be closely associated. It is also necessary that increases in income be translated into increases in food consumption and reductions in the prevalence of malnutrition; removing the cause should remove the effect. The close association of poverty and malnutrition (World Bank 1979; Gray 1982) has sometimes led to the erroneous conclusion that illness and ignorance are minor contributors and that the only intervention necessary is to give poor families more money. This conclusion ignores a second finding of these same studies, which is a very low tendency to spend additional income on food, particularly on calories.

The evidence that responsiveness of food intake to income changes is very low has in turn been challenged on two fronts. Elasticities are estimated to be much larger among the poor than for the population as a whole (Musgrove 1985; Musgrove 1989, table 22; Senauer 1990), so that poverty appears as an important cause of malnutrition. And since nutritional state does not depend on food consumption alone, higher income can mean better nutrition because of its contribution to the other determinants of nutritional status, such as health and education (Schiff and Valdés 1990). In any case, whether attacking poverty in general is the best way to improve nutrition also depends on how quickly poverty can be reduced.

Illness contributes directly to malnutrition in three important ways. A sick child may eat too little or fail to eat a balanced diet. Illness can lead to loss of nutrients, particularly during diarrhea, or interfere with nutrient absorption. And parasites such as helminths compete with the host for the nutrients in food, causing iron-deficiency anemia through loss of blood. By some estimates sickness is the most important cause of malnutrition and the factor that does the most to explain why some poor children are malnourished and others—even siblings—are not (Shrimpton 1984). Illness is more likely to lead to malnutrition among the poor than among those who are better off, because poor children are likelier to have marginal nutrient reserves at the start of an illness and because poor families can less easily buy food or medical care to promote a child's recovery.

Of the three general causes of malnutrition, *ignorance* is the most difficult to measure and the most subject to emotional interpretation. To say that children are malnourished because their parents do not know how to care for them sounds like blaming the victims for the problem. It is not true that the poor are malnourished simply because they are ignorant about what they should eat and so spend their limited incomes on the wrong foods. But there are three important ways that more specific kinds of ignorance contribute to malnutrition. The first is that people may know nothing about micronutrients, especially vitamins, so they fail to eat even the cheap and readily available sources. The second is ignorance about disease and its causes and consequences. Valuing good health is not enough; neither is depending solely on one's immune system. Third, people are often specifically ignorant about how to care for very young children: they may undervalue breastfeeding, or believe that food and even water should be withheld from a sick child, or simply not recognize that growing children need to eat more, in relation to their weight, than adults.

If there are three general causes of malnutrition, there are three corresponding interventions to combat it. One is to create or transfer income, in the form of money or goods such as foodstuffs. The second is to prevent or cure the illnesses that contribute to childhood malnutrition. This can include providing health care services, improving sanitation, and distributing micronutrient supplements. Because such supplements may be fortified foodstuffs, there obviously is no clear line between giving away food (basically an income transfer) and

giving away a particular nutrient (a health intervention). The third intervention is to change what people know or believe—to educate them about nutrition, child care, and health.

Consequences: Malnutrition and Human Capital

Malnutrition may cause no apparent problem because the body compensates for inadequate nutrient intake by growing more slowly or by reducing its physical activity. But compensation works only for low levels of deprivation, and even then an apparently successful compensation can be costly. A child who is anemic or calorie-deficient will be lethargic and will develop and learn more slowly, perhaps retaining a permanent deficit. Malnourished children are also subject to more frequent and more severe infections (Frisancho 1979, ch. 13; Tomkins and Watson 1989), which exacerbate the initial malnutrition, as well as interfering with their early learning and later with their schooling (Pollitt 1990). Malnutrition therefore leads to a waste of resources in both education and health, apart from the damage to children's development. Conversely, children who benefited from an effective program to protect their nutritional status may show the gains in schooling, health, and income many years afterward (Martorell 1991).

Because information on the prevalence of malnutrition is so sketchy and the consequences for health, learning, and productivity are often hard to quantify and are just beginning to be well understood (Behrman 1991), it is not possible to estimate the total economic damage caused by malnutrition in Latin America and the Caribbean. But it is increasingly clear that such damage exists, beyond the pain and suffering associated with more severe nutritional deficiencies, and that the damage is probably substantial, particularly when all the interactions among nutrition, health, and development are taken into account (Selowsky 1981).

Major Findings: A Summary

Some results of the study merit more extensive discussion, but it will be helpful first to summarize the principal findings that emerge from the review of detailed program information.

- There are now a very large number of food programs in Latin America and the Caribbean. Nonetheless, some countries still have few or no programs. Perhaps the most striking cases are Haiti, with a serious problem of childhood malnutrition but only one small maternal and child health program, and the Dominican Republic, which has only a small school feeding program covering 7 percent of the target age group.
- Food transfers per beneficiary vary enormously. Some are undoubtedly too small to have any effect on nutrition or even to alleviate poverty signifi-

cantly; others may be overgenerous. However, there does not seem to be any standard for the “right” size of transfer.

- The calorie-protein composition of food transfers varies much less than the total amounts. Most programs pay no attention to possible micronutrient deficiencies, but there is no systematic evidence that the composition is incorrect or that the wrong foods are being used. The criteria for selecting foods are generally sensible, at least within the limits set by dependence on foreign donations in many programs.
- Costs per beneficiary per year vary enormously, chiefly because of variation in the amount of food provided. Food costs and total costs are highly correlated: variation in total costs primarily arises not from differences in administrative costs, but from differences in what is spent on food.
- Costs per nutrient unit (calories or protein) bear surprisingly little relation to costs per beneficiary or to the number of beneficiaries. There is no evidence of economies of scale over the large range of program sizes considered.
- If no beneficiaries are double-counted, then coverage of the target population is often very high. When several programs are directed to the same age group or when the target population spills over the intended age limits, coverage can exceed 100 percent. In countries where many people participate in one or more programs, malnutrition is due not simply to a lack of coverage, but to some combination of poor targeting, insufficient food transfers, and failure to attack the other causes of malnutrition.
- Most programs include sensible targeting criteria, but too little is known about the population excluded from programs to tell whether targeting in fact works well. Simple failure to target is generally not the only, and perhaps not the principal, reason for poor effectiveness.
- Unrestricted subsidies are rare, except in school feeding programs, where they may be justified. As the number of programs has increased in the past decade, more have been targeted on maternal and child health.
- Although most maternal and child health programs—and some programs of other types—claim to provide complementary services (health care or health and nutrition education), there is little evidence that these services correspond to needs or are effective.
- Nearly all programs suffer from logistic inadequacies. Programs need adequate storage facilities, vehicles for transport, and systems of supervision to prevent spoilage and theft. Cost-effectiveness does not mean minimizing total cost, and it particularly does not mean minimizing nonfood costs.
- Most programs proclaim reasonable objectives, but only in such vague and qualitative ways that it is difficult to tell whether they are being met. Espousing a variety of goals also leads to treating progress toward any of them as an indication of program success.
- Most programs have never been evaluated, or at least their effect on the beneficiaries has never been measured. The programs that have been

evaluated show mixed and generally disappointing results, although a few evaluations are much more favorable.

Type and Number of Beneficiaries

Of the 104 programs, 54 are intended to cover infants aged 5 or younger, 31 involve pregnant or lactating women, 30 are for school children, 23 focus specifically on malnourished children, and 28 are addressed to entire families. In some cases food is regularly distributed to other classes of beneficiaries, such as the elderly or handicapped, or as a payment in kind to volunteers, day-care providers, or other collaborating personnel.

Except when a program is open to the public and does not identify its beneficiaries, it is easy to describe the intended beneficiaries. Much more difficult is finding out how many beneficiaries there really are. Some errors arise for conceptual reasons: individual beneficiaries may participate irregularly, so that the number of people benefiting at a given moment and the number benefiting over an interval are quite different. But often the difficulty of counting beneficiaries arises from a failure to keep accurate records, perhaps aided by political pressures to inflate the numbers.

On the input side of a program that involves giving away or subsidizing food, there are three fundamental quantitative variables: the number of beneficiaries, the amount of food distributed, and the expenditure on the program, all during some interval. There is much other important information, but it is generally qualitative—the mechanisms of beneficiary selection and food transfer, the nature of the food provided, and so on—or, if quantitative, it refers to other program inputs such as immunizations, micronutrient supplements, or educational interventions. From the three basic variables—people, food, and money—ratios for judging the adequacy of a program are commonly created. These ratios are the amount of food distributed per beneficiary, the unit cost of food, and the amount spent per beneficiary.

In principle, any of these ratios can be derived from the other two, since they are tautologically related—a program that spends a lot per kilogram of food will either spend a lot per beneficiary or give each beneficiary rather little food. Differences in cost per beneficiary between two programs can always be “explained” by differences in the amount of food a beneficiary gets or by how expensive that food is to obtain and distribute. Unfortunately, all three variables are subject to errors in measurement, and an erroneous value in just one variable leads to two erroneous ratios. For example, overcounting beneficiaries makes a program appear less costly per person than it really is and “explains” that result by a small food transfer per person.

The number of beneficiaries covered by the 104 programs varies greatly, from fewer than 1,000 individuals in one program in Bolivia to almost 28 million in the Brazilian school lunch program. The average is slightly under 1 million.

Eleven programs have more than 3 million beneficiaries, and 18 each have more than 1 million. At the other extreme are 53 programs with fewer than 100,000 beneficiaries each; these are almost all maternal and child health programs.

To estimate the total numbers of individual beneficiaries, individuals in families covered by some of the programs had to be categorized and counted. For those purposes it was assumed that 20 percent of the family individuals were mothers, 30 percent were children under 5 years, 30 percent were children of primary school age, and the remaining 20 percent were older children and adults. The total number of pregnant and lactating women could not be estimated because many programs do not report that information. With these adjustments, individual coverage, aggregated for each of the nineteen countries, reaches about 9.8 million adult women, 27.3 million preschool children, 51.9 million school-age children, and 10.3 million other beneficiaries (table 2). Ninety percent of these estimated 99 million beneficiaries are concentrated in six

Table 2. Total Number of Beneficiaries by Country and Type of Beneficiary (Redistributed)

Country	Women	Children under 5 years	Primary school children	Older children and other adults	Total number
Argentina	383,263	968,228	1,827,182	31,787	3,210,460
Bolivia	188,743	482,227	317,764	110,288	1,099,022
Brazil	4,670,713	13,957,298	33,142,040	5,936,408	57,706,459
Chile	116,316	1,342,208	461,041	1,910	1,921,475
Colombia	465,106	1,197,966	1,559,477	50,079	3,272,628
Costa Rica	11,527	64,554	386,135	—	462,216
Dominican Republic	—	107,095	70,000	—	177,095
Ecuador	28,050	172,955	795,939	—	996,944
El Salvador	41,398	110,820	224,804	—	377,022
Guatemala	14,137	254,292	1,239,520	—	1,507,949
Haiti	8,630	16,946	—	—	25,576
Honduras	32,256	140,000	548,578	16,129	736,963
Jamaica	40,000	169,620	95,000	80,000	384,620
Mexico	1,931,149	5,037,724	5,941,721	1,945,149	14,855,743
Panama	—	—	58,860	—	58,860
Paraguay	18,365	21,565	82,500	—	122,430
Peru	1,712,065	2,704,801	2,478,194	1,452,130	8,347,190
Uruguay	7,122	139,564	367,266	406,516	920,468
Venezuela	110,266	448,185	2,323,685	240,400	3,122,536
Total	9,779,106	27,336,048	51,919,706	10,270,796	99,305,656

— Not available.

Note: Beneficiaries covered as families were redistributed as follows: 20 percent to women (mothers), 30 percent to children under 5 years, 30 percent to primary school children, and 20 percent to older children and other adults.

Source: Musgrove (1991).

Table 3. Numbers of Programs and Beneficiaries by Country and Mode of Food Distribution

Country	Take-home		Direct feeding		Food subsidies	
	Programs	Beneficiaries	Programs	Beneficiaries	Programs	Beneficiaries
Argentina	1	990,521	3	2,219,939	n.a.	n.a.
Bolivia	8	333,006	9	366,016	1	400,000
Brazil	3	16,031,162	1	27,993,257	3	13,682,041
Chile	1	1,354,404	6	567,091	n.a.	n.a.
Colombia	1	29,117	3	2,385,028	2	858,483
Costa Rica	3	58,858	2	403,358	n.a.	n.a.
Dominican Republic	1	89,095	1	88,000	n.a.	n.a.
Ecuador	1	66,045	6	920,899	1	10,000
El Salvador	1	152,218	1	224,804	n.a.	n.a.
Guatemala	3	268,429	1	1,239,520	n.a.	n.a.
Haiti	1	25,576	n.a.	n.a.	n.a.	n.a.
Honduras	2	107,520	2	629,443	n.a.	n.a.
Jamaica	1	4,620	1	80,000	n.a.	n.a.
Mexico	3	610,633	n.a.	n.a.	7	14,245,110
Panama	n.a.	n.a.	1	58,860	n.a.	n.a.
Paraguay	1	21,565	2	100,865	n.a.	n.a.
Peru	3	527,435	4	4,554,895	2	3,264,860
Uruguay	6	638,242	3	263,880	1	18,346
Venezuela	3	168,266	5	2,954,270	n.a.	n.a.
Total	43	21,476,712	51	45,050,125	17	32,478,840

n.a. Not applicable.

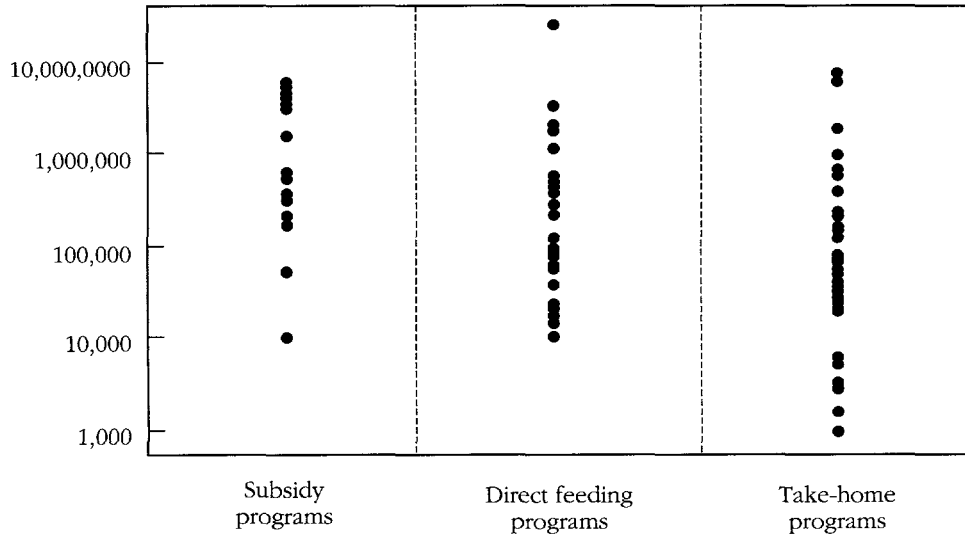
Source: Musgrove (1991).

countries: Brazil (58 million), Mexico (almost 15 million), Peru (more than 8 million), and Argentina, Colombia, and Venezuela (more than 3 million each).

Looking at this beneficiary count by country and by type of program—take-home food distribution, direct feeding (including school feeding), or subsidy—shows essentially equal numbers of take-home and direct feeding programs (table 3). Direct feeding programs, however, cover almost twice as many beneficiaries on average—a little under a million people versus half a million for the take-home programs. Subsidy programs are the largest, on average, with nearly 2 million estimated beneficiaries. The size ranges overlap considerably, with the greatest variation found among the take-home programs (figure 1).

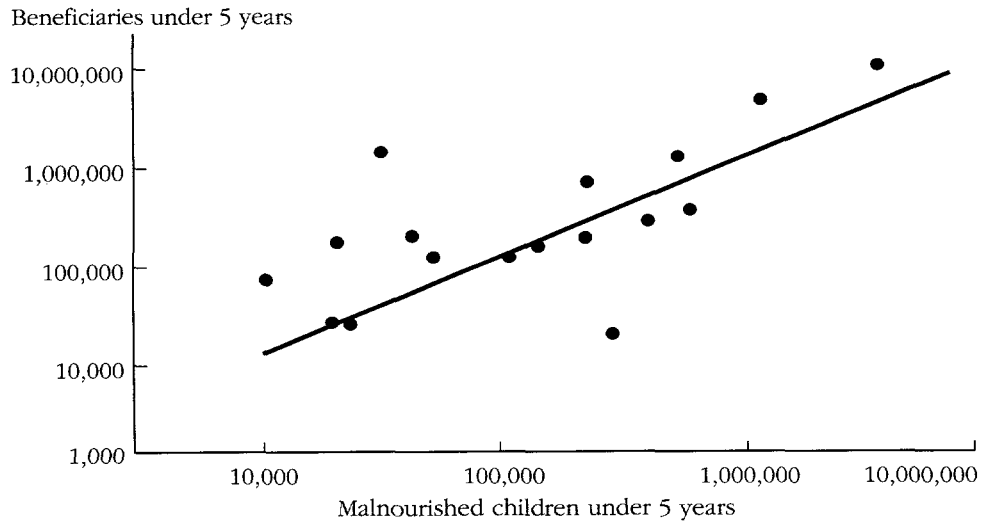
Comparing the program totals for preschool children in each country (Argentina and Panama are excluded for lack of data) to the numbers of malnourished children (from table 1) shows a rough proportionality, but a malnourished child's chance of participating in some kind of program still differs enormously according to country (figure 2). Part of this variation arises, of course, because maternal and child health programs are directed not only at

Figure 1. *Number of Beneficiaries by Type of Program*
(logarithmic scale)



Source: Musgrove (1991).

Figure 2. *Number of Malnourished Children and Beneficiaries under 5 Years in Seventeen Latin American Countries*
(logarithmic scale)



Note: Data for Argentina and Panama were not available.

Source: Musgrove (1991).

children who are malnourished, but also at children at risk. If the group at risk were adequately covered by programs that effectively prevented malnourishment, there would be more beneficiaries than malnourished children. What is clear is that enrolling large numbers of beneficiaries can still leave many children suffering from malnutrition.

Information on beneficiaries as a percentage of the target population by country and by type of beneficiary is fairly complete for age groups (table 4); much less is known about coverage according to other criteria, such as poverty or the presence of specific risks of malnutrition. Coverage of children varies widely among countries: from 1.9 percent in Haiti to 96 percent in Chile for children under 5 years of age (the average is 50 percent) and from 7 percent in the Dominican Republic to more than 100 percent in Brazil and Uruguay for school-age children (the average is 80 percent). (Coverage above 100 percent reflects two kinds of double-counting: the same child may participate in more than one program, and the primary enrollment rate can exceed 100 percent because repetition keeps some children in school beyond the normal age limit.)

The proportion of the total population covered also varies widely, with one person in every seven receiving some kind of benefit from a food or nutrition program in ten countries (Bolivia, Brazil, Chile, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Peru, and Venezuela). Finally, under the generous assumption that all programs are limited to the poor, or at least concentrated on them, 55 percent of the estimated poor population of eleven countries is reached by some kind of program, with coverage ranging from 5.8 percent in Haiti to 88 percent in Brazil and Uruguay. The higher the coverage, of course, the less plausible is the assumption of perfect targeting.

These estimates suggest three conclusions. First, malnutrition does not persist solely because the programs directed against it are too few and too small. Second, the relatively high coverage is far from universal; in some countries only a small share of a target population appears to participate, and fewer than half of schoolchildren benefit in seven of the countries studied. Third, "coverage" is just head-counting unless more is known about the characteristics of beneficiaries and what a program does for them.

How adequate is this coverage, relative to the magnitude of malnutrition in each country? And how large and how adequate is the expenditure on food and nutrition programs? Before trying to answer these questions, it will help to look at what food the programs actually provide and how much the programs actually cost.

Food Distributed and Program Costs

All the data refer to food "delivered," that is, brought to the point where beneficiaries can eat it. Delivered amounts may not represent additional consumption by the intended beneficiary, however, for three possible reasons.

Table 4. Program Coverage as a Percentage of the Total Population, by Country and Type of Beneficiary

Country	Population under 5			Primary school population			Total population			Poor population		
	Total	Covered		Total	Covered		Total	Covered		Total	Covered	
	(millions)	Millions	Percent	(millions)	Millions	Percent	(millions)	Millions	Percent	(millions)	Millions	Percent
Argentina	3.2	0.968	30.3	3.2	1.827	57.1	31.9	3.211	10.1	—	—	—
Bolivia	1.2	0.482	40.2	1.2	0.318	26.5	7.1	1.099	15.5	—	—	—
Brazil	18.7	13.957	74.6	27.0	33.142	122.8 ^a	147.3	57.706	39.2	31.8	27.900 ^b	87.7
Chile	1.4	1.342	95.9	2.6	0.461	17.7	13.0	1.921	14.8	4.9	1.308	26.7
Colombia	4.1	1.198	29.2	3.3	1.559	47.2	32.3	3.199	9.9	—	—	—
Costa Rica	0.4	0.065	16.3	0.4	0.386	96.5	2.7	0.462	17.1	—	—	—
Dominican Republic	1.0	0.107	10.7	0.1	0.070	7.0	7.0	0.177	2.5	—	—	—
Ecuador	1.6	0.173	10.8	1.6	0.796	49.8	10.3	0.997	9.7	4.4	0.997	22.7
El Salvador	0.8	0.111	13.9	0.8	0.225	28.1	5.1	0.377	7.4	2.7	0.377	14.0
Guatemala	1.5	0.254	16.9	1.5	1.240	82.7	8.9	1.508	16.9	2.4	1.508	62.8
Haiti	0.9	0.017	1.9	0.9	—	—	6.4	0.026	0.4	4.4	0.260	5.9
Honduras	0.8	0.140	17.5	0.8	0.549	68.6	5.0	0.737	14.7	3.6	0.737	20.5
Jamaica	0.3	0.170	56.7	0.3	0.095	31.7	2.4	0.385	16.0	1.0	0.085	8.5
Mexico	11.4	5.038	44.2	11.4	5.942	52.1	84.6	14.856	17.6	—	—	—
Panama	0.3	—	—	0.3	0.059	19.7	2.4	0.059	2.5	0.6	0.059	9.8
Paraguay	0.6	0.022	3.7	0.6	0.083	13.8	4.2	0.122	2.9	1.4	0.122	8.7
Peru	3.2	2.705	84.5	3.2	2.478	77.4	21.2	8.347	39.4	—	—	—
Uruguay	0.3	0.140	46.5	0.3	0.367	122.3 ^a	3.1	0.920	29.7	0.6	0.532	88.7
Venezuela	2.7	0.448	16.6	4.6	2.324	50.5	19.2	3.123	16.3	11.3	2.994	26.5
Total	54.4	27.337	50.3	65.0	51.921	79.9	414.1	99.232	24.0	69.1	36.879	53.4 ^c

— Not available.

a. Coverage can exceed 100 percent, reflecting participation in more than one program and/or children who remain in school beyond the normal age limit (5–9).

b. Assuming one-half of all subsidy beneficiaries and one-fourth of all school lunch beneficiaries are poor.

c. Percentage of the estimated population under the poverty line in the countries with data on poverty; the real value of the poverty line may vary among countries.

Source: Musgrove (1991).

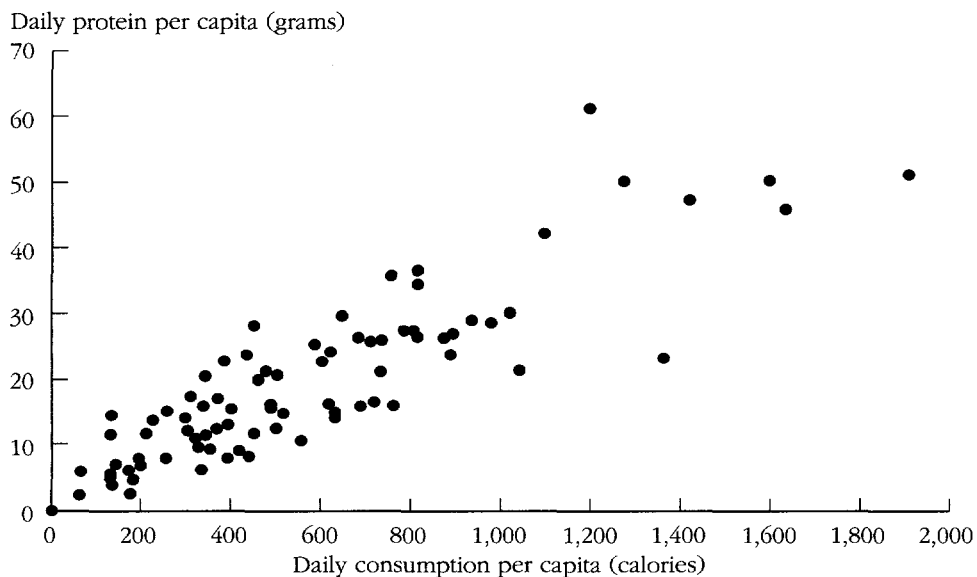
First, the food may be wasted and therefore not be eaten by anyone. Second, the food may be consumed by someone other than the person for whom it was intended. By definition, this problem can arise with take-home programs but not with programs that directly feed the beneficiary. For that reason take-home programs commonly include some effort to persuade the family not to share the food, and in some cases they provide food designed to be palatable only to the intended recipient. Third, even if the beneficiary eats all the food provided, wasting none and sharing none, total intake may increase by much less than the transfer. The family may compensate by feeding that member less of other foods, so as to be “fair” to the other members. This is most likely to occur when the beneficiary is a small child who receives meals away from home.

Data on the daily supply of calories and protein per individual beneficiary show planned rations ranging from 75 to 1,936 calories and from 2.5 to 50.8 grams of protein, with a mean of 616 calories and 20.6 grams of protein. Because many programs operate for less than a full year, annualized figures are lower (494 calories and 16.3 grams of protein). Displaying this information for all kinds of programs together (figure 3) demonstrates how much programs vary in the amount of food provided and in the protein-calorie balance, which shows considerable dispersion around a trend of approximately 30 calories per gram of protein. Actual supplies (not shown in figure 3) tend to fall below those planned—generally, the greater the planned supply, the larger the shortfall. Unexpectedly, the actual supply shows less dispersion in the ratio of calories to protein; calories supplied fall short of planned amounts more often than protein supplied does, despite the higher cost of protein-rich foods.

Programs to combat malnutrition should be judged by the cost of obtaining some nutrition-related result or some other outcome, such as improved health or learning. In the absence of information on outcomes, data on costs are usually related to the number of beneficiaries and the volume or nutritional value of food distributed. Estimates of program costs per beneficiary are subject to errors in either the numerator or the denominator; beyond that, they are poor proxies for program efficiency because high spending per beneficiary may be associated with low cost per case of malnutrition prevented or cured.

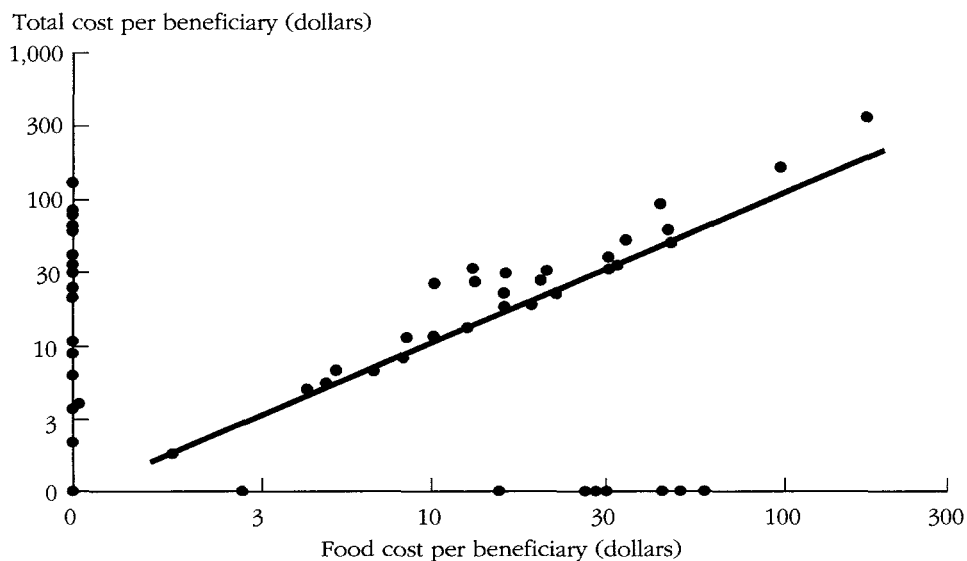
A comparison of beneficiary numbers and costs per beneficiary shows no apparent relation, in particular no evidence of economies of scale across programs. At very small size, high unit costs might be expected because of some minimum administrative expenditure, but the evidence is that all the programs studied are large enough for their costs to be unaffected by size or else that errors in the data hide any relation. Estimates of food cost and total cost per beneficiary show clearly that food costs are an almost constant share of total costs and that the variation that does occur is independent of cost per beneficiary (figure 4; for the many programs that provided only one of these estimates, the observations are presented along the corresponding axis of the figure). If the cost per calorie transferred were constant, then the caloric content of the ration and the food cost per beneficiary would be proportional. A

Figure 3. *Planned Daily Supply of Calories and Protein per Individual Beneficiary for All Programs*



Source: Musgrove (1991).

Figure 4. *Food Cost and Total Cost per Beneficiary per Year (logarithmic scale)*



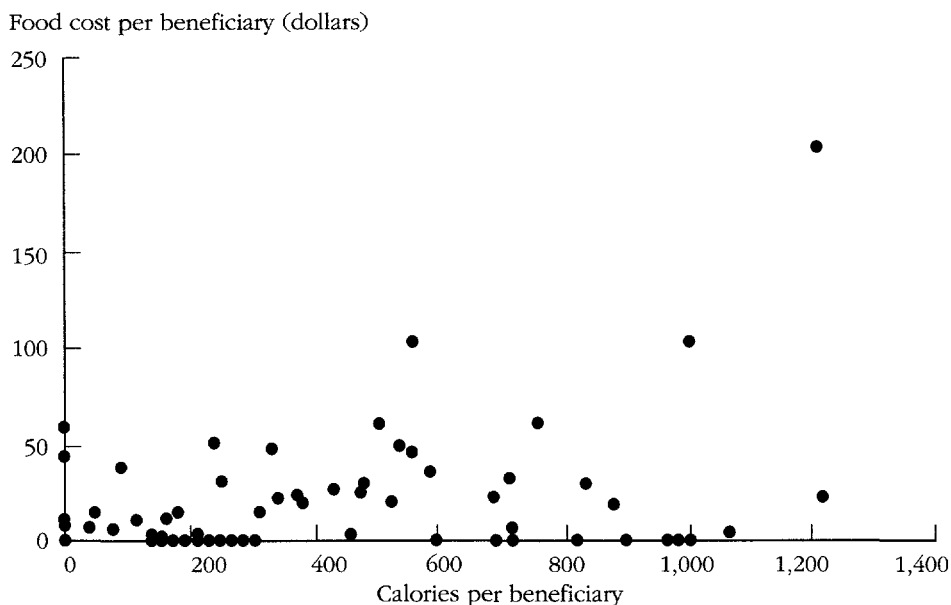
Source: Musgrove (1991).

comparison of the data shows only a rough proportionality (figure 5). More food per beneficiary means more cost, but the cost per calorie is far from uniform, in part because of variation in the composition of the ration.

To assess the overall adequacy of program effort by country, table 5 pulls together data on country population and gross national product (GNP), estimates of the prevalence of malnutrition, and cost data and beneficiary numbers for the eighty-three programs for which cost estimates are available. More than one-fifth of a total population of 414 million in the nineteen countries appear as beneficiaries, so if programs were well targeted and transferred enough food and other services to make a difference, the coverage attained should be sufficient to reduce malnutrition to very low levels. Of course, the share of the population benefiting is far from uniform: it reaches more than one-third in Brazil but falls below one-tenth in the Dominican Republic, Ecuador, El Salvador, Haiti, Panama, and Paraguay.

The total cost of these programs exceeds \$1.6 billion, which is just under \$20 per beneficiary, or about \$4 per capita.¹ Costs per beneficiary of \$10 or less are found only in Guatemala, Mexico, and Venezuela. Relatively high expenditures occur in Chile, Costa Rica, Jamaica, and Peru. On average, expenditures on these programs represent one-fifth of 1 percent of GNP, which is not a trivial sum but is still far from being an unbearable burden. If these expen-

Figure 5. *Number of Calories and Food Cost per Beneficiary for All Programs*



Source: Musgrove (1991).

Table 5. Program Cost and Actual and Potential Coverage by Country

Country	Total population (millions)	Population covered		Program cost			GNP ^a (millions of dollars)	GNP spent on programs (percent)	Potential beneficiaries ^b	
		Millions	Percent	Total (millions of dollars)	Per beneficiary (dollars)	Per capita (dollars)			Millions	Ratio to number of malnourished children
Argentina ^c	31.9	0.3	0.8	8.9	35.02	0.28	53,070	0.02	0.26	—
Bolivia	7.1	1.0	14.7	22.0	21.07	3.09	4,520	0.49	0.63	0.8
Brazil	147.3	53.7	36.5	907.5	16.90	6.16	319,150	0.28	25.93	5.2
Chile	13.0	1.8	14.0	86.9	47.76	6.69	25,250	0.34	2.48	71.0
Colombia	32.3	3.2	9.9	44.4	13.87	1.37	39,410	0.11	1.27	1.85
Costa Rica	2.7	0.4	15.0	18.0	43.93	6.67	5,220	0.35	0.51	21.3–47.7
Dominican Republic	7.0	0.2	2.5	4.9	28.82	0.70	6,650	0.07	0.14	1.1–2.4
Ecuador	10.3	1.0	9.6	32.6	32.92	3.16	10,380	0.31	0.93	3.5
El Salvador	5.1	0.4	7.4	11.9	31.29	2.33	5,860	0.20	0.34	2.8
Guatemala	8.9	1.5	16.9	11.4	7.54	1.28	8,150	0.14	0.33	0.7
Haiti ^c	6.4	0.0	0.4	0.7	27.69	0.11	2,370	0.03	0.02	0.1
Honduras	5.0	0.7	14.8	22.7	30.72	4.55	4,320	0.53	0.65	3.9
Jamaica	2.4	0.4	16.0	18.8	49.55	7.66	3,880	0.49	0.54	12.3
Mexico	84.6	9.9	11.7	102.6	10.33	1.21	200,730	0.05	2.93	1.8
Panama ^c	2.4	0.1	2.5	0.1	0.86	0.02	4,550	0.00	0.00	0.0
Paraguay	4.2	0.1	2.9	2.5	20.50	0.59	4,130	0.06	0.07	4.0
Peru	21.2	4.8	22.5	274.0	57.45	12.93	28,610	0.96	7.83	18.3
Uruguay	3.1	0.8	25.0	22.4	28.71	7.22	7,170	0.31	0.64	31.2
Venezuela	19.2	3.1	18.8	38.1	12.20	1.98	48,830	0.09	1.09	3.9
Total	414.1	83.4	20.9	1,630.4	19.62	3.9	782,250	0.21	46.59	4.5 ^d

— Not available.

Note: Program cost and beneficiary data cover eighty-three programs, including nearly all the largest ones, for which costs estimates, either in total or for food alone, are available.

a. Data from World Bank (1991), referring to 1989

b. Assuming a cost of \$35 per beneficiary.

c. Data from only one program.

d. Excluding Argentina.

Source: Musgrove (1991).

ditures were concentrated on the nutritionally neediest one-tenth of the population, that would mean a transfer on the order of \$40 per beneficiary per year.

Comparing the number of "potential" beneficiaries to the number of malnourished children provides some notion of how well the programs in a country are responding to its nutrition problems (last two columns of table 5). To estimate the number of potential beneficiaries that could be covered for the same total cost, total program expenditure is divided by a constant cost of \$35 per beneficiary per year. This \$35 unit cost is equal to that of a large, relatively successful maternal and child health program in Chile, the Programa Nacional de Alimentación Complementaria, or National Supplementary Food Program (Castañeda 1985; Torche 1985). It is also comparable to unit expenditure in several of the countries studied, including some of the poorer countries such as Ecuador and Honduras, which suggests that it is affordable. At that unit cost the \$1.6 billion spent on these programs could adequately cover 47 million beneficiaries, or about 56 percent of present total coverage and 12 percent of total population.

Forty-seven million beneficiaries is only a little more than the current coverage, but it is nearly five times the number of malnourished children in eighteen of these countries (data for Argentina are unavailable, see last column of table 5). Of course, programs should not be limited to children who are already malnourished. For every malnourished child, several others are at risk of being malnourished and should be covered if a program is to have any preventive effect; mothers of children who are malnourished or at risk should also be covered to protect their own health and to ensure greater benefit to their children. If the resources now being spent were concentrated on currently malnourished children and on about four other needy beneficiaries for each such child, it seems plausible that malnutrition could be largely eliminated from the region.

In fact, malnutrition has not been eliminated: some 10 million children in the countries studied are malnourished. One reason is that the relation of potential beneficiaries to actual needs varies enormously among countries. At one extreme is Chile, where malnutrition has been reduced so far that current spending could cover seventy times as many beneficiaries as there are malnourished children in the country. At the other extreme are countries where current spending simply would not be enough. This is the case in Bolivia and Guatemala, which could only provide for some three-fourths of children in immediate need. Colombia, the Dominican Republic, and Mexico spend enough to reach all potential beneficiaries who are currently malnourished but almost surely not enough to cover all the population at risk.

Ineffective use of resources within countries is the other reason why the substantial level of expenditure reported here has not succeeded in eliminating malnutrition. This is a consequence of diluting resources over too many beneficiaries, spending resources on food transfers with little or no health or educational component, directing resources to adults and families who may be poor but who are often not at risk of malnutrition, and wasting some part even

of resources that are well targeted. Brazil provides an example: its expenditure of nearly \$1 billion could, at \$35 per beneficiary, cover 26 million people, or 5.2 times the number estimated to be malnourished. Yet the prevalence of malnutrition in the country is estimated at 30.7 percent, almost as high as in much poorer countries such as Guatemala and Haiti.

Program Effectiveness

The information on programs does not describe their outcomes, so it does not provide answers about what works and what does not. Such answers can come only from evaluation, and much is already known from a variety of programs in various countries (Anderson and others 1981; Beaton and Ghassemi 1982; Feachem 1983; Mora, King, and Teller 1990; Musgrove 1989) and from the specific experience of the World Bank in promoting and financing nutrition projects or nutrition components of projects (Berg 1987).

To prevent or cure protein-calorie malnutrition, programs need to satisfy a short list of crucial requirements:

- Programs need to target the population according to the *risks* of malnutrition, not necessarily waiting for nutritional damage to occur, and to be more concerned with errors of exclusion than of inclusion.
- Programs must be *stable* through time, because the status and needs of beneficiaries vary over time, and a program that cannot deliver food or services when needed is of no use. Programs should offset—not exacerbate—the instability in the lives of their beneficiaries.
- Programs should be able to *detect* problems or possible sources of problems—growth faltering, illness, pregnancy, failure in school—quickly, and then *respond* to them rapidly.
- Programs need to respond with the right *mixture* of interventions, from food distribution to health care and education, to head off malnutrition or correct it once it begins, with relatively small transfers of food and with no lasting damage to the child.

Programs that meet these requirements still do not guarantee results. To know whether a program works, there is no substitute for measuring its impact on the intended beneficiaries (Sahn, Lockwood, and Scrimshaw 1984). As noted, most of the programs reviewed here have never been evaluated. One reason for this neglect is that evaluations take money and time—to anticipate and avoid methodological problems, to take account of possible long-term effects, and to track individual beneficiaries rather than just looking at changes in totals or averages.

Evaluation is resisted for two other reasons as well, one humanitarian, the other bureaucratic. If a program distributes food to people who are mostly poor, often hungry, and occasionally malnourished, it seems obvious that it must do some good—and churlish or unethical to question its benefits. But

while the direction of the program's effect may be correct, its magnitude may be inconsequential. Or the program may be ineffective because it supplies only one of the needed interventions, not recognizing the potential value of micro-nutrient supplements, education, or health efforts. The bureaucratic obstacle is one of attitude: in many implementing agencies, operating a program is considered a task to be performed rather than a result to be accomplished. These agencies are seldom required to show results and may be satisfied only to push food through a clogged, bent, and leaky pipeline.

But more surprising and distressing than the paucity of evaluation is the finding of several evaluations that programs have had little or no effect on malnutrition. Three factors deserve particular attention. One is the failure to measure any preventive benefits, even though these may figure among the program's objectives. Another is that rations are often too small to make much difference, unless they are exclusively provided to the needy beneficiary and accompanied by other appropriate interventions. Finally, failure may easily result from the simple irregularity of operation that plagues many programs. Overall, however, the main problem is not scarcity of resources; enough is being spent to reduce malnutrition substantially.

Notes

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1. Dollars (\$) are U.S. dollars throughout.

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THE DEMAND FOR WATER IN RURAL AREAS: DETERMINANTS AND POLICY IMPLICATIONS

The World Bank Water Demand Research Team

Improving the adequacy and quality of water supplies is a priority for rural development in developing countries. So far, the strategies of governments and international donors for tackling the problem have been supply-driven; the fundamental importance of demand in the selection of appropriate policies has been virtually ignored. The realization that effective policy and planning must take into account what the rural clients want and are prepared to pay for was the impetus for the World Bank's multicountry study of households' demand for improved water services.

This article summarizes the findings of the 1987–90 investigation of determinants of rural demand in selected regions of Latin America, Africa, and South Asia. The research team used both direct (contingent valuation) surveys and indirect (revealed preference) methods to estimate households' willingness to pay for different levels and types of improvement. The methodology produced some illuminating insights into how to decide what level of service is appropriate for a particular community and how the improved services should be paid for. The team identified four broad categories of village situations, with appropriate policies ranging from the provision of house connections at full cost at one extreme, to no improvement in traditional supplies at the other extreme.

Millions of people in developing countries face daily problems in obtaining water for domestic purposes. Recognizing the harm to health, economic productivity, and quality of life that can result from inadequate water supplies, international donors and the governments of developing countries have mounted numerous efforts to correct the problem.

The international community affirmed its commitment to improving water supplies by declaring the 1980s the United Nations' International Drinking Water Supply and Sanitation Decade; that commitment was reaffirmed at the 1990 New Delhi Global Conference on Safe Water and Sanitation.

Most of the initiatives emanating from this commitment have tackled the problem according to a formula described here as the "first standard" paradigm. The formula is based on a dual premise: that government must subsidize rural water supplies because many rural households are too poor to pay for improved water systems, but that, to achieve equity, those government funds must be spread thinly because public resources are also limited. This policy message was summarized in the declaration of the New Delhi Conference as "some for all rather than more for some."

Inevitably, the international donor community has not been unanimous in adopting this conception of the problem. Its "welfare state" implications have not been universally welcomed by many individuals in the World Bank and other donor organizations, who proffer an alternative, "second standard" paradigm. They contend that people can and will pay at least 3 to 5 percent of their income for improved water services.

Two observations motivated the investigation reported in this article: (a) both approaches concentrate on supply to the neglect of demand; and (b) neither has successfully solved the problem—the empirical evidence is that many of the water systems established according to these paradigms are either not functioning at all or not being used.

The research program was grounded on the recognition that policy and planning should be built on a better understanding of what improvements in their water services people really want and are willing to pay for. The research team therefore set out to investigate the determinants of household demand for improved water services—including relevant socioeconomic and demographic characteristics of the household as well as characteristics of existing and new water supplies, such as price, distance, quality, and reliability. The team believed that such information was vital to judicious decisions, both technical—such as the choice of appropriate technology or level of service—and financial—such as the monthly tariffs and connection fees to be charged for private house connections.

The Research Program

The studies sponsored by the World Bank to investigate these issues were carried out in Latin America (Brazil), Africa (Nigeria and Zimbabwe), and South Asia (Pakistan and India).¹ Each country study was led by researchers from a national institute or university, working in close collaboration with a team of World Bank staff and consultants. In three of the five studies various sites in several regions of the country were investigated. Sites in Brazil included

a relatively well-off, water-abundant area in the southeastern state of Parana and a poor, dry area in the northeastern state of Ceara. In Pakistan three areas in the Punjab were selected: one had easily accessible, high-quality groundwater; another had easily accessible but brackish groundwater; the third was in an arid zone where groundwater was relatively deep and inaccessible. In India (Kerala State) one area had abundant, good quality groundwater, one area had abundant but saline groundwater, and one area suffered from water scarcity.

At the outset, the research team developed a common design, or “indicative protocol.” The design was subsequently modified in some countries to take account of circumstances peculiar to a study area, but it did provide a conceptual framework and underlying logic that tied the different studies together. The common point of departure was the recognition that the issue central to planning policy for rural water supply in developing countries is to find out why households opt for an improved water source rather than the current supply. This focus on choice of water source is quite different from the focus in industrial countries, where it can be assumed that everyone will choose to use an improved source (for instance, a private house connection) if it is provided.

The researchers used both indirect (revealed preference) and direct (contingent valuation) methods to study how households made their choices about water sources. The indirect approach used discrete choice econometric techniques to model households’ decisions and to derive estimates of welfare change from the actual choices that households made. The direct approach involved asking people who did not have an “improved” water source whether they would use a new source if it were provided under specified conditions, and how much they would be willing to pay for access to different kinds of improved water systems, such as a public tap or a private house connection. Such questions were often difficult to formulate, and devising them taught the team a lot about how to conduct contingent valuation surveys in developing countries (World Bank Water Demand Research Team, forthcoming). For example, it was hard to convey the notion of what was meant by the *maximum* an individual would be willing to pay. A respondent in Haiti asked an enumerator, “What do you mean the maximum I would be willing to pay? You mean when someone has a gun to my head?”

Our indicative protocol identified two categories of villages for study. In type A villages, households had already had the option of connecting to a piped water system; some had connected, others had not. In these villages we used an indirect approach to assess the determinants of households’ decisions. Sometimes respondents in type A villages were also asked contingent valuation questions about their willingness to pay for various improvements in service and their response to different tariffs. In type B villages, improved water systems were not yet available, though in some cases they soon would be. Households in these villages were asked a series of hypothetical questions about whether they would choose to use an improved system if it were offered at a

specified price (and connection fee). Econometric techniques were then used to analyze what determined their responses.²

The research design enabled us to compare the estimates of household demand for improved water services obtained by the indirect method with those elicited by the direct method. One of our methodological inferences is that because the results yielded by both techniques tell essentially the same story, we can be confident of the validity and robustness of our conclusions. (For methodological implications of the design, conduct, and analysis of the studies, see World Bank Water Demand Research Team, forthcoming.)

Opportunities arose in the course of the project to study some of the same research questions in other countries; results from three of these supplemental studies are included in this article. In southern Haiti and the Newala District of Tanzania, contingent valuation surveys were conducted in type B villages to determine households' willingness to pay for improved water services. In Kenya a study of water source choices was carried out in a type A village (Ukunda), but no contingent valuation questions were asked.

Determinants of Household Demand for Improved Water Service

Three sets of characteristics jointly influence a household's willingness to use, or to pay for, an improved water supply:

- The socioeconomic and demographic characteristics of the household, including education of family members; occupation; size and composition of family; and measures of income, expenditures, and assets.
- The characteristics of the existing or traditional source of water versus those of the improved water supply, including the cost (both financial and in time required to collect water), the quality, and the reliability of the supply.
- Households' attitudes toward government policy in the water supply sector and their sense of entitlement to government services.

The response of a household to a new, improved water supply is not, we emphasize, due to any one set of determinants alone, but to their joint effect. It is this "jointness" that is modeled in the multivariate analysis. The multivariate analysis of water use in Ukunda, Kenya, for example, illustrates how a family there decides to purchase water from a kiosk rather than buy water delivered to its door by vendors, or draw water from a well (Mu, Whittington, and Briscoe 1990). Richer, better educated families with more women are more likely to use a kiosk. Kiosks are used more when the alternative water sources (wells or vendors) are more expensive, farther away, and provide lower quality water; they are used less as the price of water at the kiosk and the distance to the kiosk increase and as the taste of water from the kiosk declines. (These results are based on an analysis of actual household choices, not their responses to contingent valuation questions.)

Socioeconomic and Demographic Characteristics

This section summarizes the results of the research in terms of the first set of determinants delineated above, namely the socioeconomic and demographic characteristics that influence whether and how much households are willing to pay for improved water supplies.

MEASURES OF INCOME AND ASSETS. The first standard policy paradigm holds that rural households can pay very little or nothing for improved water services; the second standard paradigm assumes that they will readily pay 3 to 5 percent of their income. How well do these rules of thumb describe the demand of rural households for improved water services? Very poorly, the study shows.

Our empirical results show that willingness to pay for improved water services does not depend solely on income, but equally on the characteristics of both the existing and the improved supplies. Often, income is not even the principal determinant; the percentage of income that a household is willing to pay may vary widely. The following examples illustrate the point.

- In Chihota District of Zimbabwe, where existing water sources are relatively accessible, villagers are prepared to pay less than 0.5 percent of their income for access to an improved well.
- In Parana State in southern Brazil many households will pay virtually nothing for public taps, but will pay 2 percent of their income for yard taps.
- In southern Haiti households are willing to pay only about 1 percent of their income for public taps and about 2 percent for a private connection.
- In Ukunda, Kenya, households were already paying water vendors and kiosks about 9 percent of their income.
- In Anambra State in Nigeria many households pay water vendors 10 percent of their income in the dry season.

When the income elasticities of demand for access to improved water services could be computed (this was not possible in all of the studies because of the difficulty of collecting income data), they were uniformly low—0.15 in Brazil, 0.14 in India, 0.07 in Zimbabwe, and 0.06 in Kenya. These results suggest that a 10 percent increase in household income would result in roughly a 1 percent increase in the probability that a household would choose to use the improved water system. Overall, the findings suggest that household income, although often important, is not the overriding determinant of demand for improved services.

EDUCATION. One might expect that, as levels of education increase among household members, those households would be more aware of the health benefits of improved water supplies and would thus be more likely to use improved services if they were available. If improved services were not available, one would expect that such households would be willing to pay more to obtain them

than would households with lower educational levels. And because better educated households might, for a variety of reasons, have higher opportunity costs for time spent collecting water from a source outside the house, they might well be willing to pay more for improved service than would other households.

Our empirical results generally confirm that better educated households are willing to pay more for improved water supplies. The contingent valuation studies conducted in the sweetwater zone in the Punjab show that a household whose most educated member had five more years of school than a comparable household without such an educated member, was on average willing to pay about 25 percent more for a private house connection. In Nigeria five more years of education increased a household's willingness to pay for both public taps and private connections by about 50 percent. In Brazil a family in which the head of household had one to four years of education was 7 percent more likely to connect to a piped distribution system than was a family in which the head of household had no education. A family in which the head of household had completed primary education was 20 percent more likely to be connected to the system than was a family in which the head of household was uneducated. In Kerala, India, households that included adults who had finished primary school were 6 percent more likely to connect to a piped distribution system than were households in which no adult had finished primary school. Finishing middle school increased the probability of connecting by an additional 13 percent. Subsequent increases in educational level had smaller effects: finishing secondary school increased the probability of connecting by an additional 5 percent; finishing college increased the probability by another 4 percent.

GENDER. To test how the gender of the respondent influenced the household's willingness to pay for improved water services, four of the contingent valuation studies were designed to interview both male and female respondents. Because women almost universally bear the burden of collecting water, sociologists who study household water use hypothesize that women would attach more importance to improved supplies than would men and that women would therefore be willing to pay more for such improvements. But in many cultures women do not have equal control over or access to the household's cash resources. When asked how much the household would be willing to pay for an improved water supply, a woman might be reluctant or unable to commit the household to a substantial financial obligation, even though in her opinion the improved water supply would be worth the expense. In fact, therefore, it was by no means clear how gender would influence the respondent's indicated willingness to pay for improved supplies.

In all four of the contingent valuation studies that tested for this effect, the gender of the respondent proved to be a statistically significant determinant. In Tanzania and Haiti female respondents were willing to pay more for access to public taps than were male respondents, but in Nigeria and India they were not willing to pay as much. In Nigeria women were only willing to pay about

50 percent as much as men for both public taps and private connections. In other words, the gender of the respondent appears to be an important influence in households' expressed willingness to pay for improved services, but the direction of that influence depends on the specific cultural context.

OCCUPATION. The effect of occupation on households' willingness to pay for improved service was mixed. Farming families in Haiti were willing to pay less than nonfarm families for access to a public tap. In Brazil respondents employed in the formal sector were willing to pay about 15 percent more than those employed in the informal sector. In India civil servants were more likely to be connected to the water distribution system than households where no one worked for the government. In Pakistan and Nigeria our survey found no difference between farm and nonfarm households in demand for improved water services.

FAMILY SIZE AND COMPOSITION. Surprisingly, the multivariate models rarely show any significant effect of family size and composition on households' willingness to pay for or to use improved services. This was true for variables such as household size, proportion of adult women in the family, proportion of children in the family, age of respondent, religion, and work experience outside the community (for instance, whether a member of the household was working abroad).³

Characteristics of Existing Versus Improved Water Supplies

It is the *difference* between what people have now and what they expect to receive that affects their demand. Yet the standard policy paradigms ignore the fact that households' willingness to pay for an improved water supply depends as much on the characteristics of existing alternatives as on the characteristics of the improved water supply. Our research assessed the effects of differing costs, quality, reliability of supply, and level of service on households' demand for improved services.

COST. Basic consumer demand theory (and common sense) suggest that households would pay more for an improved supply when costs in time and money of obtaining water from existing sources are higher than if such costs were low. Our studies found strong, consistent support for a substantial influence.

- In the arid zone in the Punjab, households living near a perennial stream would pay only one-third as much for a private house connection as villagers living farther away from reliable traditional sources.
- In Haiti households' willingness to pay for a private connection increased about 40 percent if their existing water source was an additional kilometer away.
- In Kenya a 10 percent increase in the price of water from a vendor or in the time required to collect water from a community well would increase

by 2 percent the probability that a household would purchase water from a kiosk.

- In villages in both the brackish and the sweetwater zones in the Punjab, almost all households had installed a private handpump in their house or compound. Many had also installed an electric pump to draw groundwater into an overhead storage tank, which provided water for indoor plumbing facilities. Such households had effectively replicated the water services available from connection to a public system. Not surprisingly, now that they had essentially solved their water problem, these households were prepared to pay much less for connection to a public system than were households that had not already made such investments.
- In Brazil households living in water-abundant areas were, other factors aside, willing to pay 22 percent less for a private connection than households living in a dry area.

“Other factors aside” is an important qualification in all of these findings. It is not universally true that people living in water-abundant areas are willing to pay less than people without readily available alternatives, because people in water-abundant areas may have higher educational levels or higher income levels (or both), which would increase their willingness to pay. For example, people in the relatively wealthy, water-abundant region of southeastern Brazil are much more willing to pay for improved water than people in the very poor, dry areas of southern Tanzania.

Economic theory correspondingly suggests that the more an improved water source costs in capital, recurrent monetary costs, and time, the less likely a household would be to choose it. This expectation is likewise confirmed in all of our research studies. The elasticity of demand for improved sources with respect to the monthly tariff—that is, the percentage change in the probability of using the improved source as a result of a 1 percent change in the monthly tariff—is often surprisingly large for both public taps (–0.7 in Zimbabwe and –0.4 in Kenya), and private connections (–1.5 in India, –0.7 in Brazil, and –0.7 in Pakistan). Our data for Pakistan and India allow us to calculate the elasticity of demand for improved sources with respect to one-time connection costs (and fees): –0.3 in India and –0.2 in the sweetwater and –0.1 in the brackish water areas of the Punjab. These results consistently indicate that households respond to *both* monthly tariffs and one-time connection fees in the manner suggested by economic theory, and that these effects are often sizable.

PERCEIVED QUALITY. Our empirical results support the expectation that a household would be more willing to pay for an improved source when the perceived quality of the existing or an alternative water source is poor. In some cases this effect was sizable. For example, in Kerala households living in areas with saline groundwater were 30 percent more likely to use an improved water source than were households in areas with good-quality groundwater.

In the brackish water zone in the Punjab, the water obtained from private handpumps was saline and often unsuitable for drinking. In villages that lacked a piped water system, 62 percent of households had installed electric motors on their wells to draw improved quality water from deeper levels and to enjoy the convenience of having plumbing facilities in their houses. In the sweetwater zone, the comparable figure was only 30 percent.

In other locations the quality of the alternative supplies was a statistically significant determinant of households' willingness to pay for improved supplies, but the effect was not substantial. In Haiti, for example, households that rated the quality of their existing water source "poor" were willing to pay about 10 percent more for a private connection than were those that rated the quality "satisfactory" or "good." The effect was also small in Kenya.

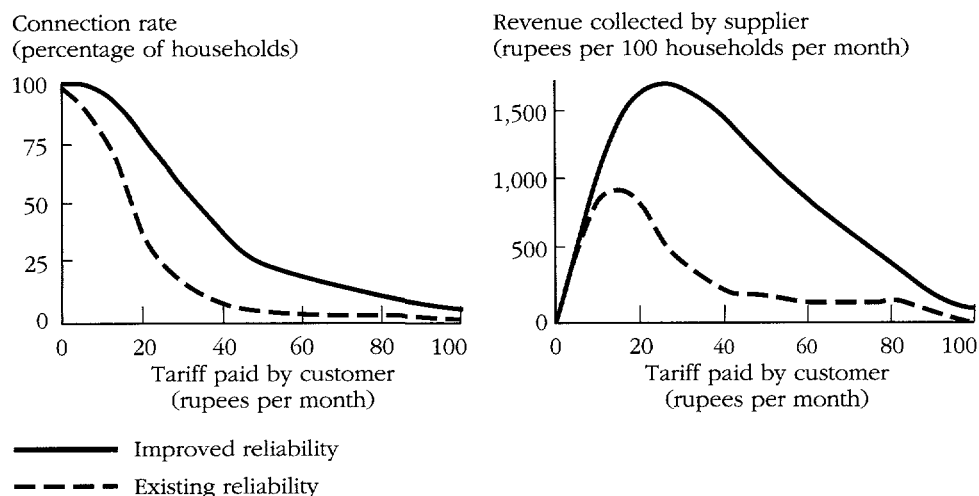
RELIABILITY. Reliability is crucial: households are typically willing to pay much more if the water from an improved source is reliable. In two of the study areas, India and Pakistan, the existing government-operated systems supplied water sporadically, usually for only a few hours each day and some days not at all. This unreliability causes considerable dissatisfaction. For example, only 17 percent of the Indian households already connected to the piped distribution system reported that they were satisfied with the system. (By contrast, 62 percent of those who were not connected said that they were satisfied with their water supply.)

In both India and Pakistan, households in villages where supplied water systems were already available were asked how much they would be willing to pay for more reliable service. The responses of households living in the brackish water area of the Punjab are illustrated in figure 1. Tariffs, the number of households connected to the system, and revenues could all be increased substantially if more reliable service were offered.

In simple terms increased reliability also means people can be less preoccupied with obtaining water and attend to other concerns. During the course of our study in Newala, Tanzania, we drove into a village about noon one day and found a queue of perhaps ten women waiting at a public tap. Because we had just come from talking to the head of the pumping station some kilometers away, we knew that no water had been delivered to this village in several weeks, so we stopped to ask the women why they were waiting at a dry public tap. They told us that they had heard a rumor that water was coming that day and had been waiting at the tap since early in the morning. But because the traditional water source was several hours away, they had to decide soon whether to wait longer or begin the trek to the traditional source. They were actually grateful that we could tell them definitively that no water would be coming that day.

LEVEL OF SERVICE. Most of the studies examined households' demand for each of two levels of improved water service: public taps in the community, and

Figure 1. *How Reliability of Supply Affects Willingness to Pay for Piped Water: Punjab, Pakistan*



private house connections (or yard taps). In almost all cases people were willing to pay far more for private connections than for access to a public tap: in Nigeria 100 percent; in the arid zone of the Punjab, 130 percent. In Brazil and India, too, households were unenthusiastic about public taps but willing to pay for private connections. Only in Haiti could the difference be considered moderate (the preference was about 25 percent higher for private connections than for a public tap). Sometimes “improved” public water sources were even perceived to be a disadvantage. In Ukunda, Kenya, some households were alarmed when our researchers began field work because it was rumored that we might install handpumps on their open public wells. Villagers were concerned that the handpumps would break down and that they would no longer be able to obtain water from these wells.

Attitudes toward Government Provision of Water Services

The study conducted in Anambra State, Nigeria, uncovered a conundrum (Whittington, Okorafor, and others 1990). Households were already spending a lot of money in the dry season purchasing water from tanker truck vendors and neighbors—an average of about \$6 per month in the dry season.⁴ Most households were spending 6–10 percent of their income annually buying water from vendors. Yet when asked how much they were willing to pay per month for access to a public tap or a private connection to a piped distribution system, they indicated amounts significantly less than they were already paying

vendors. For example, 30 percent of those surveyed were already paying vendors or neighbors about \$7 per month in the dry season, but only 2 percent said that they would be willing to pay \$7 per month for a private connection.

One reason for this seeming inconsistency was that many respondents felt that they were entitled to free or subsidized water and that it was the government's responsibility to provide their village with a new water system. Respondents who preferred to "wait for the government to help" were willing to pay 30 percent less than similar individuals who had a less sanguine view of the government's abilities. This issue—the effect of households' sense of entitlement to improved services on their indicated willingness to pay—arose in other studies as well. In newly independent Zimbabwe, for example, the government had made promises to rural people during the war of liberation. As a result, the vast majority of rural households now consider provision of clean water to be a fundamental government responsibility (Robinson 1988).

In countries with longer histories of independence and more experience with broken promises, people were often deeply cynical about the government's ability to deliver free water service of reasonable quality. These doubts were manifested in many ways. In one study site in Kerala, households were asked whether they would connect to a piped system that they were told was to be commissioned. Many respondents pointed out that pipes had actually been laid as part of an "emergency drought relief scheme" more than ten years previously but had never been operational. When informed of the authorities' commitment to commission a new water scheme, they told the enumerators that the only thing that was coming was an election, not water.

In the Punjab, households who lived in villages that already had piped water systems were extremely skeptical when asked about their willingness to pay for a more reliable system and bid less for such a system than households who lived in villages that had not had a bad experience.

In Tanzania "free water" had been a major promise of the new government upon independence, but after three decades of experience, more than half of the households surveyed in Newala District now felt that the government should *not* be responsible for providing free water. Households that had given up on the promises of free water were willing to pay 20 percent more than those who still believed it was the government's responsibility. Indeed, in the 1950s and 1960s under the British administration the operation and maintenance expenses of the old water system in the Newala District (the Makonde scheme) had been financed by a system of kiosks that sold water to individuals by the bucket. Typically each village had one kiosk, which was staffed by an attendant who sat inside and controlled the tap. This system of paying for water by the bucket was abolished in 1969. Since then water has been provided free but is highly unreliable, partly because of a shortage of operating funds. The abandoned kiosks still found in the center of most villages serve as a vivid reminder of how the old cost recovery system used to work. Many older people volunteered the opinion that the old system of paying for water by the

bucket worked better than the current system, and they wished they could have it back again.

Despite their skepticism about government promises, many respondents still felt that they were entitled to free or subsidized water. Some contended that they already paid taxes that should be used to pay for improved water services and that there was no need to pay more. Others knew of nearby towns or communities where improved water services were provided at subsidized prices and felt that it would not be fair for their village to pay more than was being charged elsewhere. Finally, some households simply felt that it was worth the gamble to wait longer to see if government delivery materialized (or improved), rather than to pay realistic prices for water now.

Where respondents' answers to contingent valuation questions were influenced by their sense of entitlement to free government service, the questions evidently failed to elicit the "true" economic value of water to the household. But the findings reveal something equally important for policy: that the sense of entitlement and equity of many households may be a significant obstacle to charging realistic prices for water. We do not mean, however, to suggest that attitudes are fixed and inviolate. Indeed, our findings indicate that in many countries citizens are now wrestling with the question of the proper role for government in the rural water sector and that public opinion is changing.

Policy Implications: Four Types of Villages

The study addresses two questions that are critical in guiding policy for the rural water sector: What sorts of improved services, if any, should be provided in a particular village or region, and how should these improved services be paid for? The study revealed some consistencies in the ways villagers choose their water sources and in the amounts they are willing to pay for improvements. These consistencies suggest a simple classification scheme that may help policymakers answer those questions.

The classification is not meant to imply that communities can always be fit into neat, rigid categories. Nor is it meant to be used *ex ante* to enable planners to categorize villages and prescribe appropriate policies. Rather, the typology is intended to stimulate more careful thinking about the choice of appropriate policies.

Type I: High Willingness to Pay for Private Connections; Low Willingness to Pay for Public Taps

Type I villages are those in which most households' willingness to pay for reliable private connections is high relative to the costs of supply, and willingness to pay for public taps is low. Many more communities fall within this category than is commonly assumed. In one village in Nigeria, we received an

unusual indication that the demand for private connections was high. Upon arriving we paid a visit to the local chief to ask his permission to interview selected households. We explained that we wanted to know how much people were willing to pay for private water connections. The chief indicated that the community was desperate for a new water system and that the survey was not necessary. He proposed to write us a check immediately for a substantial portion of the capital costs if we would sign a contract guaranteeing that the improved water system would be installed. He proceeded to pull out a check book from a European bank and was visibly disappointed when we explained that we simply wanted to conduct research and could not accept his check.

In our study, type I villages include those in Kerala, the irrigated areas of the Punjab, and both northeastern and southeastern Brazil. In general, most of the large rural communities in Southeast Asia, South Asia, Central and Latin America, and North Africa probably fall in this category. In these communities a large proportion of rural people want and are willing to pay substantial amounts for private connections; there is little reason they should not have them. Often, poor government policies are to blame for the failure to meet this demand. In both of the South Asia studies, the policy problems centered around the poor reliability of the existing piped distribution system.

The situation in the irrigated areas of the Punjab illustrates the problem. Here, government-financed water systems have been designed to accommodate an estimated water use of 40 liters a day per person, and private connections are not metered. This estimate is much too low when the marginal price of water to the household is zero, partly because humans are not the only users of water from the piped system. Many households in the villages we studied own animals that live in the family compounds. Water buffalos in particular need large amounts of water to stay cool. Traditionally they were taken to ponds outside the villages to cool off and drink—a time-consuming activity. When a piped system is installed in a village, most people find it more convenient simply to hose down their water buffalos in the street outside their houses.

In addition to watering animals, households find many other uses for water when it is available at zero marginal cost. This high demand for water in a hot, arid climate, coupled with the low capacity of the system, means that water must be rationed by curtailing service.

Thus the water utility and the community are caught in a kind of “low-level equilibrium trap” (Singh and others 1992). Because water connections are not metered, people demand more water than the system can provide. To ration supplies, the water authority reduces the number of hours of service. Because the systems are unreliable, people are not willing to pay much for the service. Because households are not willing to pay, the water authority cannot charge realistic prices and does not collect sufficient revenues to manage the system properly, and reliability deteriorates further.

The way out of this trap is to install meters and charge higher prices for water. This will enable the water authority to collect the higher revenues required

to improve service and move to a “high-level equilibrium.” The key point to recognize is that household demand for water is affected by the price charged. If the marginal price to the household is very low (or zero), a household will use water for too many low-value purposes—particularly in arid areas.

The situation in Kerala provides a different example of a low-level equilibrium trap in type I villages (Singh and others 1992). Here the Indian government follows the “some for all, rather than more for some” rule. To obtain central government funding, local water authorities must provide distribution systems that offer only public taps; no private connections are allowed. Fortunately the operators of such systems are inventive and responsive to local demands: after systems are commissioned, private, metered connections are permitted.

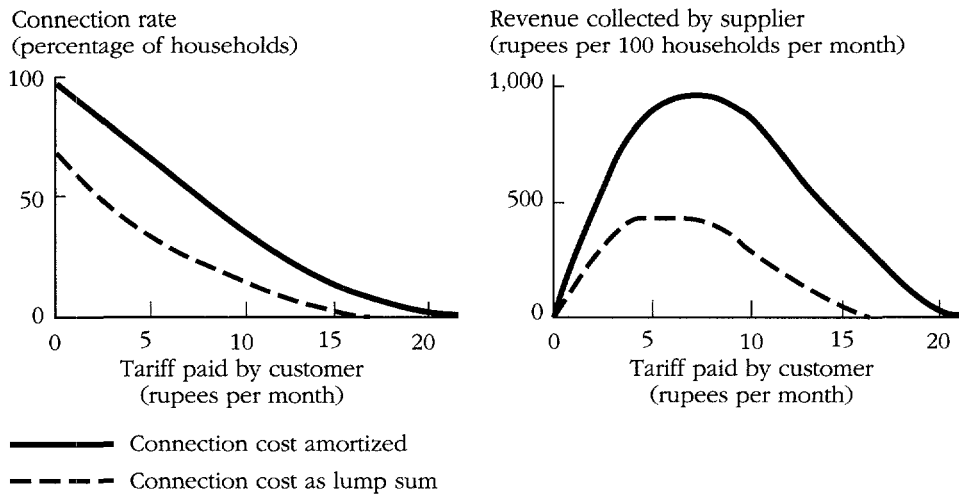
The result is totally perverse. Tariffs are much lower than people are willing to pay, and the number of connections is much smaller than would have been possible if higher tariffs were charged. The revenues collected by the water authorities are only a small fraction of the potential, and the system is so unreliable that households almost never use the public taps.

As in Pakistan, the way to break out of this trap is to abandon the supply-driven policy of “some for all” and replace it with a demand-driven philosophy that recognizes that many people want a higher level of service, and that they are prepared to pay a lot for it. Households’ welfare gains in changing from the current policy (low tariffs with few private connections) to a new policy (higher tariffs and more private connections) can be huge. Our results (Singh and others 1992) for Kerala suggest that this policy change would increase the number of families benefiting from house connections by a factor of ten, increase the consumer surplus by a factor of five, and increase the water authority’s revenues by a factor of eight.

In Brazil, by contrast, government policy is appropriately designed to encourage households to connect to the water distribution system. The principal problem is that, despite households’ high willingness to pay for water, the water systems are subsidized. Water is very cheap, but no funds are available to expand and improve the system. Here the policy implications are simple and direct: increase tariffs and use the increased revenues to improve system efficiency and reliability.

Two additional key issues affect policy for many type I communities. First, in many places the real cost of credit to households is very high; in such circumstances initial connection costs and fees can be a serious barrier to connecting to a piped distribution system. Households stand to obtain large welfare gains if the water authority has access to lower-cost funds, finances the connection costs, and recovers them through higher monthly water charges. This policy is routinely followed in Latin America, with much success. Figure 2 shows that if such a policy were followed in Kerala, both the number of households connected to the system and the revenues collected could be approximately doubled.

Figure 2. *How Spreading Connection Costs over Time Affects Willingness to Pay for Piped Water: Kerala, India*



Second, in type I communities the needs of the poor can be met by providing free water at public taps without jeopardizing the financial health of the water authority. Providing free water from public taps will not materially affect the number of households connecting to the system or the revenues that can be collected by the water authority. (This would be true whether the private connections were metered or not.) The question of how availability of free public taps might affect the demand for private connections (or yard taps) was explicitly investigated in Brazil and India. In Brazil we found that the presence of free public taps did not dampen the demand for yard taps at all. In Kerala households that could choose between a free public tap and a metered private connection almost never chose the free tap (only about 2 percent of the time in areas where water was scarce or saline; never in water-abundant areas). In the irrigated areas of the Punjab, interest in free public taps was so low that it was decided not even to ask households about their willingness to pay for them.

Type II: A Few Will Pay the Full Costs of Private Connections; the Majority Will Pay the Full Costs of Public Taps

Households in type II communities are willing to pay for improved water services, but they vary substantially in what they are prepared to pay for different levels of service. Only a minority will pay the full costs of a private connection, but the majority will generally pay the full costs for access to water

from public taps. The villages in Anambra State, Nigeria, and many of the better-off communities elsewhere in Africa and the poorer communities in Asia and Latin America would appear to fit into this category.

The mechanism used to charge for water is a key issue in type II communities. In contrast to type I communities, the provision of free public taps may significantly reduce the demand for private connections. And because the majority of the population will rely on public taps, some charge must be levied for water from the public taps for the water system to be financially viable.

At any given price for private connections, a decrease in the price of water from public taps will reduce the number of households that opt for a private connection. Similarly, for a given price for public tap water, an increase in the price of private connections will increase the number of households that choose to use the public taps. The tariff structure for a system of public taps and a limited number of private connections must be carefully designed so that households have the right incentives to choose appropriate levels of service.

Opportunities abound for policy errors in type II villages. A classic example is the common policy of providing unmetered private connections to a few households, charging them a fixed monthly fee. In type II villages this is a sure recipe for system failure. If a water authority provides unmetered private connections to a few, these households can then provide water at essentially zero marginal cost to unconnected households. This presents the connected households with a strong financial incentive to sell water to unconnected households. One common arrangement is for connected households to charge unconnected households a fixed monthly fee for unlimited access to water from their tap—an arrangement that will undercut virtually any per-bucket price charged for water at public taps. Soon all households in a community may enjoy essentially a zero marginal price for water, and too much water will be demanded. Supply will be rationed by reduced reliability, the quality of service will decline for everyone, and cost recovery will become impossible—the “low-level equilibrium trap” in yet another guise.

A more appropriate policy is to establish a system of public kiosks that charge for water by the bucket. Prices should be set to cover the full costs of the system. Households should have the option of obtaining a private metered connection if they will pay the full costs of supply. If the water authority operates the public kiosks, the prices there should cover the costs of staff and operating expenses. The price charged to connected households should not be designed to discourage private sales: if private connections are metered, the water authority will receive its revenues regardless, and households can buy and sell water among themselves at their convenience. An alternative is to privatize the kiosks, in effect making little distinction between connections for private use and connections for resale.

The key to the success of both public and private kiosk systems in type II villages is to ensure that any household that desires a private, metered connection can always obtain one if it is willing to pay the full costs.⁵ Providing this

option is important for several reasons. The first is practical. In most type II villages there is a group of influential people who will want and press for private connections or yard taps. If such connections are not officially sanctioned, many of these people will obtain them illegally anyway, and the water authority will not collect any revenues from households that would otherwise be among its best customers.

Second, rural areas of developing countries are not static economic entities. Many type II communities are in the process of evolving into type I communities. Water supply policies should be structured to assist, not hinder, this transition. Water systems should be designed so that evolution from primarily public taps to primarily private connections can occur conveniently and efficiently. Third, so that households already connected to the system cannot take advantage of their position, all households should have the option of a private connection to the distribution system if they are willing to pay the full costs of supply (Lovei and Whittington 1991). The universal option of connecting provides a powerful deterrent to monopoly pricing by connected households or privately owned kiosks.

Type III: Households Are Willing to Pay for Improved Service, But Improvement Is Very Costly

From a demand perspective, type III communities are similar to type II communities: in both cases a relatively high proportion of the population is willing to pay a considerable amount for water from public taps. The difference is on the cost side. In type II villages sufficient revenues can be collected from households to pay for the full costs of the public taps. In type III villages the costs of the improved water system are higher than the beneficiaries are willing to pay. Costs may be high because of aridity, low population densities, or lack of other infrastructure (for instance, electricity). In such cases improved systems cannot be built and operated without subsidies. Type III villages are often found in arid areas. Examples in our research include villages in Newala District, Tanzania, and Rawalpindi, Pakistan (a nonirrigated area in the Punjab).

In type III communities many households typically spend a great deal of time and energy collecting water from traditional sources and, unless improved sources are provided, will continue to do so. Households that collect water from distant, polluted, unreliable sources are almost always willing to pay a substantial portion of their income to avoid hauling water over long distances. In the Tanzania study members of most households were walking five to six hours a day to collect small amounts of water from traditional sources or unreliable public taps. Households on average were willing to pay about 6 to 8 percent of their cash income for reliable service from public taps in their village. But 6 to 8 percent of a household's income in this poverty-stricken region is not very much money in absolute terms—nothing like enough to pay the full costs of supply.

Household contributions could cover about 50 percent of the operation and maintenance costs. Virtually no one was willing to pay the full costs of a private connection.

In the poor type III communities in the dry Rawalpindi District, the situation was somewhat more complex. Here a few families were willing to pay considerable amounts for private connections, and the costs of providing a private connection were not substantially greater than providing access to a public tap (on a per household basis). Most households, however, could not pay the full costs of either level of service.

Devising an appropriate policy for type III villages is not simple. The dominant level of service must be public taps; as in type II communities, cost recovery mechanisms that allow households to pay by the bucket have important advantages over schemes that require households to pay a fixed monthly fee. Yet the few households that are willing to pay the full costs of a private connection should be allowed that option. Metering of all private connections is essential, and the tariff structure must be carefully coordinated with that used by the kiosk system. As in type II communities the tariff structure and other water regulations should be designed, not to discourage connected households from selling water to neighbors, but to discourage them from profiting unduly from their connections.

On the financing side, neither the "full cost recovery" policy recommended for type I and II communities nor the supply-driven, "basic needs" policy that provides free service is suitable for type III communities. An appropriate policy response would recognize, first, that the sum of the outside resources available to such communities from both internal and external sources is insufficient to meet the long list of their needs and, second, that households' needs will be best met if they are able to allocate their limited resources to the projects they consider most important. The point here is not that such communities should not receive transfers from others, but that these transfers should be designed so that they do not distort the community's choice process. In other words, outside agencies and donors should not take it upon themselves to decide which projects (such as water) are of highest priority for communities: if subsidized development funds are available, communities should themselves allocate such funds to the needs they deem most important. In type III villages household demand for improved water services is high, and given a choice, many communities would in fact decide to spend development funds on improved water services. The essential points are that, even where subsidies are used for water supply, any rural water program must be demand-driven and that a considerable portion of the resources must be mobilized from the beneficiaries.

Type IV: Low Willingness to Pay for Improved Water Service

In type IV villages most households are unwilling to pay for improved water services. Communities in central Zimbabwe are examples of villages in this category. In these villages it is not feasible to recover the costs of either public

taps or private connections. But the problem is quite different from the high benefit, high cost situation in type III communities. In Zimbabwe the fundamental problem is that people would pay very little for improved services *both* in absolute terms and as a proportion of income.

In these areas there simply are no financially viable options for improving rural water supply at this time. Providing improved supplies is not likely to induce substantial changes in economic activity or dynamic multiplier effects, as it would in type III communities. The challenge is how to respond to this dilemma. The dominant response of many donors and governments in the past has been to step in and subsidize. But the resulting supply-driven programs have been a dismal failure. Many systems provided under such programs have fallen into disrepair, and no one in those communities cares much about making them operational.

In our view, the appropriate policy response in such situations is to recognize that the people of the community are in the best position to decide how available subsidies should be used. Improved water services are not a high priority in type IV communities. They have other, more pressing needs for roads, schools, and clinics. If subsidies became available, households would typically choose to spend them on something other than improved water services. The conclusion, unpalatable as it may be to some, would be to defer improvements in water supply until they are wanted and to concentrate the available resources on higher-priority needs.

Toward a New Paradigm

The challenge in formulating rural water supply policies is simple to state: devise institutional arrangements that are effective in providing people with the services that they want and for which they are willing to pay. This study does not address the critical institutional questions (which relate to the respective roles of public agencies, the private sector, nongovernment organizations, and the users themselves), but it does shed light on the levels of service and the financing arrangements that will emerge from a demand-driven approach.

Selection of the type of service to be provided, and the associated tariffs to be charged, is a two-step process. The first step involves collecting data on demand so that a menu of level of service and financing options can be devised that is both feasible and sensible in the particular setting. The second step involves households choosing a particular level of service (at a prescribed tariff). It is important to emphasize that, wherever possible, households must be given choices (between, say, a house connection and a public tap) and that such choices should remain open over time (so that, for example, a household that initially chooses to use a public tap can later upgrade to a house connection).

In this context, how are planners to collect information on demand, and how can they know what combinations of level of service and financing arrangements might be appropriate in a particular area?

Finding the Indicators

In general, detailed household surveys of the type conducted under our research program are necessary for defining the menu of feasible and sensible options from which households can choose. Rigorous procedures for sampling villages in regions, and households in villages, will enable planners to study fewer villages and interview fewer households and generalize their findings with more confidence. Still, in most countries a substantial effort to collect data will be required to categorize villages along the lines suggested above and to adapt policies to fit local realities.

There is, however, an exception to our general call for expanded data collection. A great deal can often be learned about local water conditions from surveys of water-vending activities, which are much easier and faster to carry out than are large-scale contingent valuation surveys of households' willingness to pay. Where water vending is prevalent, demand for improved water services almost certainly is high. Communities with substantial water-vending activities are thus not type IV villages.

If the majority of households in a community are buying water from private vendors, then it is not likely to be a type III village either. If most households can afford water from vendors, they should generally be able to pay for the full costs of private connections, even in arid areas with high costs of supply.

The extent of water-vending activities can sometimes also be used to distinguish between type I and type II villages. If most households buy water from vendors *throughout the year*, this probably indicates a type I village; if water vending is prevalent but tends to be *seasonal*, then demand for vended water is likely to be lower, an indication of a type II village. In these type II villages, households seek alternatives to purchasing water from vendors because the price of vended water is so high. A substantial minority—or even a majority—will buy some water from vendors but may also collect some water from traditional sources; other households collect all their water from traditional sources. In the rainy season most households stop buying from vendors and collect rainwater and water from traditional sources (as in Anambra State, Nigeria).

The absence of water vending can be an important indicator for water resource planners, but it must be interpreted carefully. Prolific water vending is but one indication of high willingness to pay. If households have already invested substantial amounts of capital in improving their private water supply, they may have little need for water from private vendors. For example, in the irrigated areas of the Punjab, almost all households have installed private handpumps; in southeastern Brazil most households have invested in private wells. In the Newala District of Tanzania, one third of the households in our sample had gone to the considerable expense of building rainwater collection tanks. Although such capital investments indicate a high demand for water, they may also dramatically improve households' water supply and thus reduce willingness to pay for further improvements in the short run.

Another indicator of high willingness to pay for water is a large amount of time spent collecting water. In this case households are making substantial efforts to obtain water, but, unlike the situation where households have made capital investments, collection costs can be *immediately* reduced by installing an improved water system. Willingness to pay for improved water is very likely to be high, and thus villages without vending, but where members of households are walking long distances to collect water, are not type IV villages.

If there is no water vending and no evidence that households have invested in private capital improvements or spend substantial effort collecting water, then such villages are likely to be type IV communities. The absence of water vending itself is not sufficient to identify type IV communities, but if such communities are candidates for improved water supplies, it should give water resource planners pause. If the benefits of improved water services are great, why hasn't the private sector found this market? The answer may be that household demand for improved services is not as great as assumed.

Formulating Policy

If planners and donors are willing to spend the time and resources necessary to understand local water demand and supply better, the outlines of a new formula for rural water supply policies can be discerned. In this new paradigm the appropriate policies would be different in each of the four different types of communities.

Type I communities offer exciting possibilities. Here most people want, and are willing to pay the full costs of, reliable water service delivered through private, metered connections (or yard taps). In such communities the objective should be to abandon the low-level equilibrium trap—the cycle of poor service, low willingness to pay, little revenue, and low reliability—in favor of a high-level equilibrium—private connections, high willingness to pay, and high reliability. Although water would be available free from public taps, this strategy would substantially increase the proportion of the population using private connections, the welfare gains to households, and the revenues to the water authority: everyone wins.

Type II communities also offer opportunities for achieving both improved water services and full cost recovery. In such villages the dominant service level would be public taps, although households would always have the option of a metered private connection if they were willing to pay the full costs of service. In these communities the greatest challenge is to devise systems for collecting revenue that are sensitive to people's preferences about when they want to buy water and how they want to pay for it. Kiosks appear to be an attractive option, because many households want more flexibility and control over their expenditures on water than is available from a cost recovery system based on fixed monthly fees that must be paid throughout the year. In most type II com-

munities unmetered private connections will result in poor service and prevent full cost recovery.

In type III communities the benefits of improved water services are high—people will pay a significant proportion of their income for improvement—but the costs of supply are even higher. In such communities improving water services is a priority, and households would typically choose to use available subsidies for the purpose. The appropriate service level for most households would be public taps, but the water authority should permit any households that are prepared to pay the full costs of a private, metered connection to have one. As in type II communities, unmetered private connections will create problems for the water authority and the community and should be avoided.

Finally, in type IV communities people are unwilling to pay for any type of improved water service. In such places any available subsidies could be better used to provide other community services—and for the time being, the appropriate rural water supply policy is simply to do nothing.

Notes

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1. Publications resulting from the work of this research program are listed in the bibliography; some but not all of these publications are cited in the text.

2. Multivariate models were estimated with the data from both types of villages. Data from the type A villages were used to estimate probit and logit models of households' decisions to use the improved system (see, for example, Briscoe and others 1990; Altaf, Jamal, and Whittington 1992; Altaf and others 1991; and Singh and others forthcoming). Data from the type B villages were used to estimate ordinary least squares, ordered probit, multinomial logit, and tobit models of the determinants of households' responses to contingent valuation questions (see, for example, Whittington and others 1989; Whittington and others 1990; Altaf, Jamal, and Whittington 1992; Whittington and others 1992). In specific instances other models were also estimated (for example, switching regressions in India, and duration models in Pakistan).

3. These results may be partially explained by the fact that, conceptually, family size enters the household's utility function in two places: in the benefits derived from the improved source and in the costs of obtaining water from the existing source. The larger the household, the more water it needs in total (although perhaps the less it needs per person). This would imply that a household's benefits (or willingness to pay) for a piped connection would increase as family size increases. On the other hand, in most rural communities it is women and children who fetch water from sources outside the home, and the larger the number of women and children in a household, the more time (labor) the household unit has to collect water. The value of labor to a household probably goes down as the supply of labor goes up—and thus the value of a private connection decreases. Our models are unable to distinguish between these two effects.

4. Dollars (\$) are U.S. dollars throughout.

5. The purchase price of a water meter in many places in developing countries is on the order of \$35–\$40. Installation costs vary but are roughly equivalent to the purchase price of the meter. The full costs of using meters, however, must include reading and repairing the meters and the use of more complex billing and financial systems.

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STUDENT LOANS: AN EFFECTIVE INSTRUMENT FOR COST RECOVERY IN HIGHER EDUCATION?

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Governments and universities have trouble reconciling the goal of keeping higher education widely accessible with the need to retrieve some of its costs from students. Student loans offer a plausible solution to the problem. But loan programs turn out in practice to have been a disappointing instrument of cost recovery: analysis of twenty-three programs found that students repay only a small portion of the value of the original loan. Subsidies, high default rates, and high administrative costs have eroded the value of repayments. Sometimes loan programs have proved as expensive as outright grants.

This article argues that most loan programs could be reformed to improve financial effectiveness—through targeting, charging positive real interest rates, designing repayment plans to take account of the likely pattern of graduate earnings, and ensuring that the oversight institutions can and will collect. Or governments could explore alternative devices for cost recovery, such as a graduate tax. This approach levies a higher income tax rate on beneficiaries of government-subsidized higher education and thus preserves the idea, implicit in loan programs, of paying for education with future earnings. As part of an effective tax system, a graduate tax could bring in significantly more revenue than traditional loan programs.

In the past thirty years, the most fundamental change in higher education policies throughout the world has been the attempt to democratize access. Rapidly expanding primary and secondary school enrollments, increased demands for skilled labor, and the growing perception of higher education as

a path to individual prosperity fueled pressures to expand higher education opportunities. In developing countries in particular, the effect has been dramatic: higher education enrollments increased substantially in developing countries at all income levels. But government resources allocated to higher education did not keep pace with the expansion. In many instances, particularly during the 1980s, real resources actually contracted as many developing countries adopted structural adjustment programs that led to declining government budgets, which forced drastic reductions in government support for higher education. Table 1 reports public expenditures per student in 1975, 1980, and 1988 for countries for which data are available for all three years. Between 1975 and 1988, public funding per student dropped in countries of all income categories; in all but the high-income countries, the decline was substantial.

Maintaining the quality of and ensuring needy students' access to higher education, while at the same time containing fiscal expenditures require that institutions either become more cost efficient or bring in more external funds. The students—the direct beneficiaries of higher education—are the most obvious source of additional funds. Furthermore, recovering at least part of the costs of higher education from students can be justified on efficiency and equity grounds (Psacharopoulos, Tan, and Jimenez 1986; Jimenez 1987). To summarize these arguments: cost recovery is believed to lead to a more efficient use of public and private resources, to make educational systems that tend to attract elites more equitable, and to provide revenues to improve educational opportunities and quality.

Table 1. Public Expenditure per Student for Higher Education, by Income Level and Region

Category	Number of countries	Expenditure (1987 US dollars)			Ratio of 1988 expenditure to 1975 expenditure
		1975	1980	1988	
<i>Country income group^a</i>					
Low	8	2,436	1,925	1,182	0.49
Lower-middle	6	4,872	3,289	1,973	0.40
Upper-middle	4	2,175	1,773	1,258	0.58
High	16	7,811	8,205	6,769	0.87
<i>Region^b</i>					
Africa	8	6,805	4,630	2,566	0.38
Asia	6	1,078	818	605	0.56

a. As defined in *World Development Report 1991* (World Bank 1991) low-income countries are those with a GNP per capita of \$580 or less in 1989; lower middle-income, \$581–\$2,334; upper-middle-income, \$2,335–\$5,999; and high-income, \$6,000 or more.

b. Because reliable data were available for only a few countries in Latin America and the Middle East, those regions are not analyzed separately.

Source: Authors' calculations from UNESCO data.

But recovering costs from students is often politically difficult and raises the problem of how to preserve educational opportunities for students who cannot afford to pay. A solution adopted by many countries is loans that defer payment for higher education until students graduate and begin to earn. Woodhall (1983, 1987a, 1987b, and 1991) has done extensive theoretical and comparative work on student loans and their potential role in developing countries. Johnstone (1986) has surveyed student support mechanisms in industrial countries. More theoretical discussions have been developed by Mingat, Tan, and Hoque (1985) and Psacharopoulos and Woodhall (1985). Recent work has focused on alternative loan formats, especially income-related repayment structures commonly known as income-contingent loans (Barnes and Barr 1988; Barr 1989; Woodhall 1989).

In addition to mobilizing private resources for higher education, government establishment of, or support for, student loan programs is economically justified on the basis of imperfections in capital markets. Private banks will not usually accept an intangible asset, such as human capital, as collateral on a loan. In addition, investments in human capital are inherently risky, because some students do not complete their studies, while others do not find employment after graduation. This is a risk to individual students but not to lenders making many student loans. It provides a rationale for payments by students based on future earnings, as will be argued subsequently. These risks are compounded because student loans often have medium- to long-term repayment periods, while many countries, particularly those with inflationary economies, do not have long-term debt markets. Finally, student loans are often unattractive to banks because their small individual size makes them costly to administer.

These considerations may be sufficient reason for governments to guarantee loans, as many do. However, they do not explain why governments commonly subsidize loans by offering students credit at below-market interest rates, particularly if government is trying to shift some of the costs of higher education to the students. Such subsidies have tended to benefit not the poor, but the relatively well off and politically powerful.

Although most studies have been optimistic about the effectiveness of student loans as a cost recovery instrument, few have actually examined the financial implications of loan programs. This article examines those effects, identifies some fundamental flaws in existing programs that impede their effectiveness in recovering costs, and discusses some possibilities for reform.

Existing Student Loan Programs

More than fifty countries have used various forms of student loan programs. The present study has identified twenty programs in Latin America and the Caribbean, eight in Asia, four in the Middle East and Northern Africa, seven

Table 2. Student Loan Programs

Country	Repayment mechanism ^a	Administering institution	Expenses covered ^b	Average loan value (US\$)	Year program begun	Students with loans (percent)	Data year
<i>Latin America and Caribbean</i>							
Argentina							
INCE	Loan	Autonomous body	Living	—	—	—	—
Barbados							
SRLF	Loan	Autonomous body	Tuition, living	11,000	1976	12	1989
Bolivia							
CIDEP	Loan	—	Living	—	—	1	1987
Brazil							
CEF	Loan	Commercial banks	Tuition	400	1974	10	1987
Chile	Graduated	Universities	Tuition	—	1981	21	1987
Colombia							
ICETEX	Loan	Autonomous body	Tuition, living	280	1953	9	1987
Costa Rica							
CONAPE	Loan	Commercial banks	Tuition, living	—	1977	6	1987
Dominican Republic							
FCE	Loan	Autonomous body	Living	—	—	—	—
Ecuador							
IECE	Loan	Autonomous body	Living	—	—	1	1987
El Salvador							
Educredito	Loan	Autonomous body	—	—	—	—	—
Honduras							
Educredito	Loan	Autonomous body	Tuition, living	2,700	1976	1	1991
Jamaica							
SLB	Loan	Autonomous body	Tuition, living	405	1970	20	1985
Mexico	Loan	Commercial banks	—	—	—	—	—
Nicaragua							
Educredito	Loan	Autonomous body	—	—	—	—	—
Panama							
IFARHU	Loan	Autonomous body	—	—	1966	6	—
Peru							
INABEC	Loan	Autonomous body	—	—	—	—	—
Trinidad							
SRLF	Loan	Autonomous body	Tuition, living	—	1972	—	—
Venezuela							
Educredito	Loan	Other	Tuition, living	400	1967	1	1991
FGMA	Loan	Universities	Tuition, living	2,200	1975	1	1991
BANAP	Loan	Commercial banks	Tuition, living	700	—	1	1991
<i>Asia</i>							
China	Loan	Universities	Tuition, living	—	1987	30	1989
India	Loan	Other	Tuition, living	85	1963	1	1989
Indonesia ^c	Loan	Universities; commercial banks	Tuition, living	550	1982	3	1986
Korea, Rep. of	Loan	Commercial banks	Tuition, living	—	1975	—	—
Malaysia	Loan	Commercial banks	Living	1,300	1985	—	—
Philippines	Loan	—	Tuition	—	1976	1	—
Pakistan	Loan	Commercial banks	Tuition, living	—	1974	—	—
Sri Lanka	Loan	Commercial banks	—	—	1964	—	—

Table 2. (continued)

Country	Repayment mechanism ^a	Administering institution	Expenses covered ^b	Average loan value (US\$)	Year program begun	Students with loans (percent)	Data year
<i>Middle East and North Africa</i>							
Egypt	Loan	Autonomous body	—	—	—	5	1980
		Commercial banks	—	—	—	2	1980
Israel ^c	Loan	Commercial banks	Tuition, living	—	—	12	1983
Jordan	Loan	—	—	—	—	—	—
Morocco	Loan	Commercial banks	Tuition	—	—	<1	1990
<i>Sub-Saharan Africa</i>							
Burundi ^c	—	—	—	—	—	—	—
Ghana	Income-contingent	Government	Living	200	1989	68	1990
Kenya	Loan	Commercial banks	Living	845	1973	100	1990
Nigeria	Loan	Autonomous body	Tuition	—	—	—	—
Rwanda	—	—	—	—	—	—	—
Malawi	Loan	—	Living	80	1988	50	1989
Tanzania ^c	Loan	—	Living	—	—	—	—
<i>Industrial countries</i>							
Australia	Income-contingent	Government	Tuition	1,750	1989	81	1990
Canada							
(Quebec)	Loan	Commercial banks	Tuition, living	2,800	1963	59	1990
Denmark	Loan	Commercial banks	Living	3,700	1975	—	1985
Finland	Loan	—	Living	2,200	1986	—	1987
France	Loan	Government	Living	—	—	1	—
Germany	Loan	—	Living	1,500	1974	30	1987
Hong Kong	Loan	Government	Tuition, living	1,050	1969	26	1989
Netherlands	Loan	—	Living	200	—	—	1989
Norway	Loan	Autonomous body	Living	4,000	—	80	1986
Japan	Loan	Autonomous body	Tuition, living	2,500	—	19	1987
Singapore	Loan	Government; commercial banks	Tuition, living	—	—	39	1990
Sweden	Income-contingent	Autonomous body	Living	5,828	—	—	—
United Kingdom	Loan	Autonomous body	Living	745	1990	28	1991
United States	Loan	Commercial banks	Tuition, living	2,176	1964	28	1987

— Not available.

a. "Loan" means mortgage-type loan; "graduated" means a mortgage-type loan that is repaid in graduated nominal payments; "income-contingent" means a loan in which a proportion of the borrower's annual income is used to repay the loan.

b. When only living expenses are covered, tuition is fully subsidized.

c. Programs in Burundi, Indonesia, Israel, and Tanzania have been abandoned.

in Sub-Saharan Africa, and fourteen in industrial countries (see table 2). The large number of loan programs in Latin America and the Caribbean is noteworthy. Colombia first implemented student loans in 1953 to assist graduate students studying overseas (Woodhall 1983), and loan programs (referred to locally as student credit programs) are now in place in most countries in the region. In addition to the programs listed in the table, Guatemala has a loan program with limited coverage and the Caribbean Development Bank operates a student loan program for eleven small countries (Carlson 1992). The great number of loan programs in the region contrasts with the paucity of such schemes in other developing countries, especially in the Middle East and Africa, where some loan plans have been abandoned in recent years.

With only four exceptions, these programs offer students credit in the form of a traditional mortgage-type loan. Repayment is made over a specified period, usually in fixed monthly payments whose level depends upon interest rates and the maximum length of the repayment period. In contrast to this regime of equal nominal payments, most universities in Chile allow graduated nominal payments; borrowers from Chile's Catholic University repay in equal real (rather than nominal) installments, thus ensuring that early payments are not excessively large in real terms in relation to later payments.

A third type of repayment mechanism, used in Australia, Ghana, and Sweden, is an income-contingent loan in which a fixed proportion of a graduate's annual income is used to repay the loan. Income-contingent loans are expected to be more favorable than mortgage-type loans to low-income students. Because the future value of a degree is not known with certainty, the risk of borrowing for education is greatest for poor students whose future earnings potential may be lower than that of wealthier students. In addition, the poor are more risk averse than the well-to-do (Reuterberg and Svernsen 1990; Barr 1989). The fixed repayments of mortgage-type loans commit the debtor to repaying an open-ended proportion of his or her income, and may, therefore, deter borrowing among the very groups that the loans are intended to reach. Income-contingent loans provide for effective recovery of costs at minimum risk to the borrower. Because monthly repayments are linked to the graduate's income, income contingency limits debt burden in a given period and is therefore beneficial to lower-wage earners. These earners also benefit more from any subsidies built into the loans because they repay their loans more slowly than high-wage earners. One problem with income-contingent repayments is that, like any income-based tax, they may discourage earnings. Fixed loan repayment programs, which are akin to lump-sum taxes, do not discourage earnings.

Loan programs are usually administered by autonomous public lending institutions through revolving funds, which, once capitalized, are expected to finance themselves through repayments from earlier loans. This is rarely the outcome, however, because, as will be shown, loans are generally heavily subsidized and result in losses for the lending agency. The advantage of public lending institutions is that they can target loans to particular groups in line

with government policy. Autonomous public lenders exist throughout Latin America, in Europe, and in Egypt and Nigeria, but institutional strength varies tremendously.

A second common administrative arrangement is the use of commercial banks, both publicly and privately owned. Some manage entire programs, while others act simply as collection agents. Banks tend to manage student loan programs more efficiently than do autonomous bodies. In fact, there are three good reasons to rely on the private sector to run student loan programs: the government does not have to make initial capital outlays; private sector efficiencies may reduce the costs of a loan program; and government does not have to create a potentially costly administrative apparatus to operate the program. When commercial banks are the lenders, governments usually guarantee the loans, fully or in part. In the United States, for example, private banks disburse and collect money from students, while the government guarantees and subsidizes the loans. In some countries, private banks have begun student loan programs without any government guarantees or subsidies. Lending, however, is usually limited to creditworthy borrowers (not poorer students) and to students in fields such as medicine or finance that promise high private returns to the investment. A program in Morocco, for example, supports private institutions that offer training in fields that lead to high-salaried employment. A program in Indonesia finances high tuition fees for elite business programs. Such programs signal universities to expand their programs in fields relevant to the labor market.

A third administrative approach, in place in Ghana and Australia, uses existing government revenue collection systems to recover loans. In Ghana borrowers repay through the social security system; their initial contributions to social security are actually used to repay their loans and the accumulation of retirement benefits is deferred until repayment is complete. In Australia borrowers repay through a graduated addition to their income tax rate of 2, 3, or 4 percent, depending on the borrower's income. In both countries, repayments are transferred to the budgets of the appropriate government bodies without creating new administrative structures. Although there may be little conceptual difference between a loan repaid through the taxation system and one repaid to a bank, repayment through the taxation system may be considerably more effective both in recovering funds and lowering administrative costs. In addition, if government structures are used, then the government usually needs to make the initial capital outlays for the program.

In most countries (particularly developing countries), tuition is free or set at nominal levels only; living costs, however, are high. Thus, numerous programs offer support for students' living expenses. Of the forty-three programs for which information is available, thirty-seven offered living expenses (for lodgings, food, and so on). Of these, nearly half (among them, European countries, Kenya, and Ghana) supported living expenses solely; the rest (including the United States, Colombia, Hong Kong, the Republic of Korea, and Japan), a

combination of tuition and living expenses. Only six countries (Australia, Brazil, Chile, Morocco, Nigeria, and the Philippines) offered support for tuition alone. The programs supporting combined tuition and living expenses often attempt to promote student choice between public and private institutions. A student can use support either to pay tuition at more expensive private schools or to cover living costs at a public university where the tuition is lower (as in Colombia and the United States).

The purpose of the loan program in any country depends on the particular policies and structure of its university system. Student living allowances often absorb a very high proportion of the higher education budget. In Africa, for example, where public university education is typically free, generous student support often accounts for more than half of public monies allocated to higher education. In theory, loan programs that finance living expenses can therefore free up government budgets to finance other educational inputs. Many African governments with large student support budgets have either recently implemented loan programs, such as in Ghana and Malawi, or are contemplating such programs.

Loans for tuition, alone or in combination with living expenses, have often been essential to the development of fee-charging private institutions of higher education. In Colombia and Brazil loans to students attending private institutions have permitted these institutions to expand, thus increasing the overall access to higher education while lowering budgetary demands on the government. Australia combined new tuition fees with an option to pay the whole amount as a loan through the tax system. In Chile, large tuition increases were combined with student support programs managed by universities.

Both the amount that students receive and the number of students receiving loans influence the amount of total lending. In industrialized countries average annual loans typically range between \$1,000 and \$5,000 a year; in developing countries loans are much smaller. With the exception of countries that use loans to finance overseas study, programs in developing countries usually lend less than \$500 per student. Those programs lending large amounts (Venezuela, Honduras, and Barbados) have extensive overseas programs. Barbados' lending is exceptionally high because the country does not have its own university and students rely almost exclusively on foreign training. Whereas between 20 and 80 percent of all students receive loans in industrialized countries, in developing countries coverage is almost always less than 10 percent of the student population. The exceptions are Kenya and Ghana, where all public university students receive loans for living expenses. High coverage usually indicates that loans replaced outright grants or the free provision of housing and food. Generally, in developing countries, the higher the coverage, the lower the average loan amount. When institutions lend to less than 1 percent of the student population, they are able to lend larger amounts; when coverage expands to 10 percent of the student population, the size of the average loan dwindles. The constraint on loan organizations in developing countries stems from their over-

whelming dependence on the government for financial support: when student repayments are relatively insignificant, total support in a given year is determined by government allocations.

The Financial Impact

The main purpose of a loan program, unlike a grant program, is to require students to share the costs of tuition or living expenses or both with the government through payments from their future earnings. The financial efficacy of any loan program depends centrally on the extent to which the loans are repaid. The relationship between amounts lent to students and amounts returned in repayments is an indicator of the program's efficiency in achieving cost recovery; this is defined as the *loan recovery ratio*.

Because most developing country loan programs provide assistance for student living expenses and not for tuition, even if loan recovery were complete the vast majority of loan programs would only reduce government financing burdens for living expenses, and the problem of diversifying the resource base of higher education institutions would not be resolved. That is because tuition fees at most public institutions of higher education, where present, cover only a small proportion of the full costs of the education that students receive. Therefore, the institutional *cost recovery ratio*—the average loan repayment in relation to unit costs—will be low, particularly in those countries where student loans cover living expenses only. Institutional cost recovery cannot be significant unless tuition fees reflect those costs and loans are used to pay tuition.

Loan Recovery

Recovering the costs of student loans depends on three issues: the amount of hidden interest subsidies on the loans; repayment losses due to default; and administrative costs. Student loans are subsidized if their interest rate is below the market rate. More precisely, even if loans are provided at market interest rates, for example, at rates comparable to those on consumer loans, they are still subsidized because loans for investment in education are inherently riskier than consumer loans. This subsidy is a hidden grant to students.

The authors have calculated the size of the hidden grant relative to the loan amount for twenty-three programs in twenty countries.¹ The calculations assume repayments are made in conformity with the formal conditions of the loan agreement. Thus, the amount and timing of scheduled repayment are compared to the amount of the loan disbursed. The real interest rate charged and the length of the repayment period influence the size of the subsidy. Table 3 lists the nominal interest rate charged, the real interest rate (the nominal rate adjusted for average inflation), and the length of the repayment period (excluding grace periods) for the twenty-three programs in the sample. In some in-

Table 3. Government Losses on Selected Student Loan Programs

(percentage of loan)

Country (1)	Nominal interest rate (2)	Real interest rate (3)	Repayment period (years) (4)	Loss due to hidden subsidy (5)	Loss due to subsidy and default (6)	Loss due to subsidy, default, and administrative costs (7)	Data year (8)
<i>Mortgage-type loans</i>							
Barbados	8.0	4.1	12	13	18	33	1988
Brazil ^a							
Pre-reform	15.0	-35.0 ^c	5	91	94	98	1983
Post-reform	318.0	-14.9	8	62	65	71	1989
Chile	varies	1.0	10	48	69	82	1989
Colombia ^a							
Pre-reform	11.0 ^b	10.6	8	73	76 ^d	87	1978
Post-reform	24.0	3.0 ^c	5	29	38 ^d	47	1985
Denmark	8.0 ^b	1.6	10	52	56	62	1986
Finland	6.5 ^b	-0.6	10	45	46	52	1986
Honduras	12.0	3.0	8	51	53	73	1991
Hong Kong	0.0	-6.3 ^c	5	43	43	47	1985
Indonesia	6.0	-2.3 ^c	10	57	61	71	1985
Jamaica ^a							
Pre-reform	6.0	-10.7	9	74	84 ^d	92	1987
Post-reform	12.0	-5.6	9	56	62 ^d	70	1988
Japan	0.0	-1.4	20	50	51	60	1987
Kenya	2.0	-6.9	10	70	94 ^d	103	1989
Norway	11.5 ^b	5.6	20	33	33	48	1986
Quebec	10.0 ^b	5.2	10	31	31	37	1989
Sweden ^a							
Pre-reform	4.3	-3.0	20	61	62	70	1988
United Kingdom	6.0	0.0	7	26	30	41	1989
United States							
GSL	8.0 ^b	3.8 ^c	10	29	41	53	1986
Venezuela							
FGMA	4.0	-23.0	20	93	98	108	1991
<i>Income-contingent loans</i>							
Australia	varies	0.0	17	48	52	57	1990
Sweden ^a							
Post-reform	varies	1.0	10	28	30	33	1990

Notes: The appendix contains a methodological note outlining the method used for calculating the hidden subsidy. A real opportunity cost of capital is used, according to the government rate of borrowing or estimates used by the World Bank. Loans are assumed to be paid out in equal installments over a four-year period, adjusted each year for inflation. Because of the unavailability of relevant data, the calculation for the Swedish income-contingent program is based on Australia's age earning profile information.

Column (1). "a" Denotes loan programs in four countries that underwent substantial reform. Data are given both for the pre- and post-reform programs.

Column (2). Nominal interest rate refers only to the rate during the repayment period. "b" refers to loans with different rates during the disbursement and grace period.

Column (3). Real interest rates use purchasing power parity formula, where inflation is based on the average of the 1980-88 period as reported in the World Bank's annual *World Development Report*, except in those instances where a five-year average of inflation was calculated from the data date. "c" denotes those programs with indexed interest rates.

Column (4). The repayment length is the maximum prescribed in the loan, not including grace periods. For the two income-contingent plans, the repayment length is that implied by the average income profile of a graduate. Inflation is assumed to be constant throughout the life of the loan.

Column (6). "d" denotes estimates based on the percentage of loans in arrears.

stances, repayment length is a function of the number of years over which borrowing occurs; four years of borrowing is assumed. The length of repayment on income-contingent loans is estimated by using an average income profile for university graduates. The hidden subsidy to the student is expressed as a percentage of the original loan; this is calculated as the ratio of the net present value of the student's repayment to the present value of the loan disbursement. (See the appendix, which explains the methodology used for measuring the hidden subsidy, as well as the subsequent calculations used to assess the financial implications of student loan programs.)

All of the loan programs in the sample are subsidized, with subsidies ranging from 13 percent of the loan amount in Barbados to 93 percent in Venezuela. In half of the programs examined, the subsidy exceeded 50 percent of the loan, indicating that less than half of the real loan value would be recovered if all students repaid on time. Even when real interest rates were positive—as in Barbados and Sweden—the loans were still subsidized because the interest charged was below market rates.

A concurrent study of loan programs in selected Latin American and Caribbean countries found broadly similar results for the two countries common to the two studies (Carlson 1992). Carlson calculated a “subsidization rate” based on the difference between the interest rates on student loans and those on commercial loans. His results yielded a subsidization rate of 33 percent in Colombia and 54 percent in Honduras, which do not significantly differ from the estimated hidden subsidy rate of 29 percent and 51 percent, respectively, in our calculations.

Because not all students meet their repayment obligations, the calculation of loan subsidies alone does not reflect the full costs of the loan program to the government. Experience with default has been mixed. In some instances, default and evasion add significantly to the cost of hidden subsidies. Nonrepayment of loans was as high as 81 percent in Kenya, for example, so that even with strict repayment terms, little revenue returned to the lender. In other countries, such as Sweden and Hong Kong, default was less of a problem. Default rates were lower in industrial countries, particularly smaller countries where borrowers were easy to track. It has yet to be demonstrated that default can be reduced in large developing countries without extensive administrative costs.

When default probabilities are factored into the lender's cost, measured losses from the loan program rise (table 3). In the original Jamaican program, in Chile, and in Kenya, defaults increased losses by ten, twenty-one, and twenty-four percentage points, respectively.

To establish the true cost of a deferred payment program, administrative costs must also be taken into account. Administrative costs include initial processing costs, maintenance costs, and collection costs. In developing countries the difficulty of tracking students can substantially increase administrative costs. The small average size of loans makes them proportionately more costly to process and maintain.

No detailed comparative study of administrative costs of loan programs has been conducted, and available data are mostly limited to industrial countries. Because of data limitations, the administrative costs of programs are usually evaluated using a measure of cost in relation to outstanding debt. The most efficiently run operations, in Sweden, Hong Kong, and Quebec, report administrative costs ranging between 0.5 and 1 percent of outstanding debt each year (Woodhall 1983; Woodhall 1990; Quebec Student Financial Assistance Program 1990). In Latin America the cost of loan management overall has been estimated at 12 to 23 percent of the value of the loan (Woodhall 1983). Annual reports from Latin American loan organizations confirm these estimates, and suggest that the loan recovery agencies are spending even more, as much as 30 percent in Honduras. World Bank data from Venezuela suggest that the overall administrative cost for the largest loan program varies between 13 and 16 percent of the loan value.

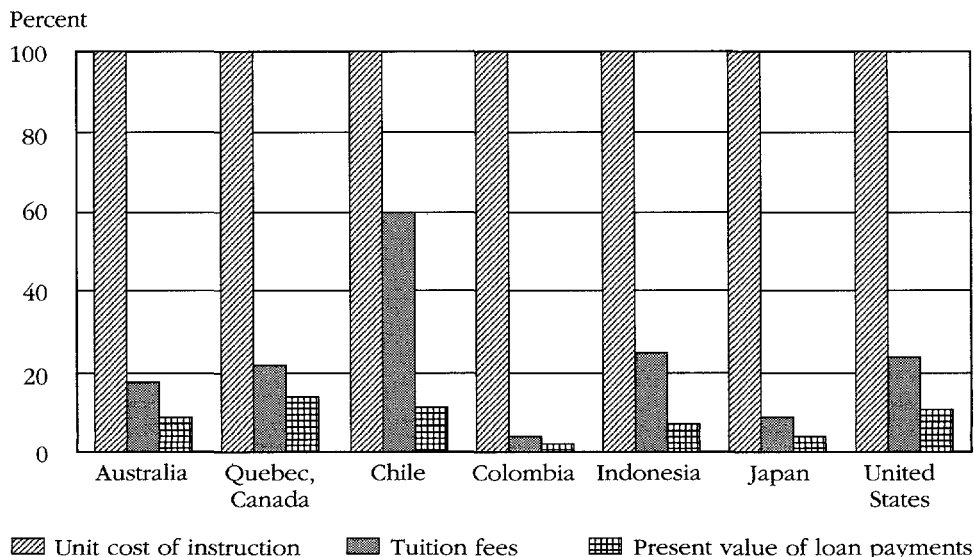
In calculating the net return of loan programs when administrative costs are unknown, we assume an annual cost of only 2 percent of outstanding debt each year. When discounted, this assumption implies an overall cost of approximately 10 percent of total loan value, which is likely to understate the actual administrative costs of a loan program. Loan programs that rely on commercial banks or use taxation departments for collection have been less costly to administer. In Brazil, according to World Bank data, operating costs for the commercial banks are approximately 10 percent of the total loan value (World Bank data). Administrative costs for collection through the tax system may be even smaller due to large economies of scale.

Given the low assumed value of administrative costs, the overall losses in table 3 are conservative estimates; the true net loss to government is likely to be greater. The most efficient programs are in Sweden and Barbados, which both recover 67 percent of the loans' value, while the programs in Venezuela and Kenya may actually cost more than would outright grants to students, depending, of course, on the cost of administering student grants. Carlson's (1992) study of loan recovery in selected programs in Latin America produced similar results (except for Chile). Taking account of loan repayments, default, and administrative costs, Carlson estimated the overall loan recovery rate at 34 percent for Brazil, 52 percent for both Chile and Colombia, 27 percent for Honduras, and 30 percent for Jamaica. The comparable loan recovery rates from the current study are 29 percent for Brazil, 18 percent for Chile, 53 percent for Colombia, 28 percent for Honduras, and 30 percent for Jamaica.

Cost Recovery

One of the central theoretical and practical rationales for loan programs is to broaden sources of funding for higher education. As noted, however, most loans are used not to finance tuition fees, but to limit government expenditures on student living expenses. Figure 1 illustrates the experience of seven countries

Figure 1. *Tuition Fees and Effective Cost Recovery from Loan Recipients at Public Universities in Relation to Instructional Cost*



Note: It is assumed that student loans equal the full cost of tuition.

in which loan programs explicitly support student payment of fees in public universities and thus are an instrument of cost recovery. The student contribution via direct fees and the present value equivalent of payments via student loans are shown as percentages of unit instructional costs. It is assumed that students receive a loan equivalent in size to tuition fees. In these seven countries, with some of the highest public sector cost recovery rates in the world, governments recover on a present value basis the equivalent of only between 2 percent (Colombia) and 14 percent (Quebec) of instructional costs from loan recipients.

The problem is perhaps most severe in Chile where tuition fees in formerly public institutions cover more of the unit instructional costs—60 percent—than they do anywhere else in the world (Schiefelbein 1990). Because of losses on loans, mostly due to nonpayment, the net cost recovery from students who receive loans is only 11 percent. Thus their efforts to diversify their revenue sources are undermined.

In Australia the government recovers, on average, 43 percent of the loan value if the student pays for tuition via an income-contingent loan. Students who pay their fees directly are given a 15 percent discount, in recognition of the hidden subsidy on the loan. This discount, however, is well below the loan subsidy, as calculated for average income earners. The effective cost recovery is only 9 percent of unit costs. (Since these calculations were made, the Aus-

tralian government increased the percentage of income that students must repay each year, thus reducing the subsidy.)

Overall, effective cost recovery is extremely low because tuition and other student fees generally do not represent significant portions of the costs of higher education and because loan recovery ratios are themselves low. If loans are to be used for cost recovery, significant fee levels must be established, and loan recovery rates must improve. To date, loans have operated only at the margins of cost recovery.

Taxing Graduates

Traditional mortgage-type loans and income-contingent loans are not the only deferred payment options available. A more radical approach for recovering costs, which might be particularly relevant for those countries considering the introduction of a student loan program, is a tax on graduates.

The idea behind a graduate tax is straightforward. By subsidizing higher education, the government is in effect financing the creation of human capital. This produces a future stream of benefits that accrues mainly to graduates in the form of higher earnings. Because of its investment in the graduates' education, the government essentially acquires an equity share in the human capital created and is thus entitled to a dividend from the ensuing income benefits. In the case of a graduate tax, this dividend takes the form of a percentage tax on graduates' income over their working lives. The term graduate tax is somewhat misleading because the tax legitimately applies also to individuals who attend institutions of higher education but fail to graduate. The tax is a type of user fee, and therefore could accumulate for each year that the student attends a university. The graduate tax rate could also vary with income level, with low-income graduates exempted from the tax. Thus, the government assumes some of the risks of investing in human capital but spreads these risks over the student cohort; high-earning graduates will prove to have been good investments, graduates with low incomes or high unemployment, poor investments.

The graduate tax described here resembles the income-contingent loan program recently introduced in Australia (where it has been labeled a graduate tax). But despite the resemblance and the label, the two schemes are in fact quite different. In the Australian program income-related loan repayments are made through the income tax system, but this is done for administrative convenience only. In principle, other collection institutions could be used, though there are clear advantages in using the taxation system. The motivation behind both loan and equity finance schemes is, ultimately, cost recovery, with the beneficiaries of higher education forgoing part of the return on higher education. In the case of loans, the government and graduates have a creditor-borrower relationship, which terminates when the original loan has been repaid, as defined in the loan agreement. In the case of a graduate tax, the government can be considered to

have an equity holding, entitling the government to a share in the benefits of higher education, which are paid as a percentage of the graduates' income over their working lives.

How effective are graduate taxes in recovering the costs of higher education? In order to illustrate the impact of a graduate tax, the Australian loan program is simulated as if it were a graduate tax in which students are assessed 2 percent of their income per year.² The results are compared with a traditional loan repayment and an income-contingent loan program whose repayments are also set at 2 percent of income. The comparisons are based only on repayments and do not include likely losses to nonpayment and administrative costs. It is assumed that the graduate tax is collected for thirty years, rather than over the whole working life, that income-contingent loan repayments are made over seventeen years, and that mortgage loans are repaid over fifteen years. A discount rate of 5 percent is used, the loan amount is A\$2,500 over three years, the interest rate is equal to inflation, and the grace period before any of the payments start is two years.

The present value of loan repayments is A\$4,270 for the mortgage-type loan and A\$3,696 for the income-contingent loan. The difference stems principally from a shorter repayment period and higher initial payments for the mortgage-type loan. The lower present value on repayments on income-contingent loans may be offset in practice, however, by lower rates of default. But the present value of the graduate tax is A\$5,138, a sum significantly greater than either of the two loan formats. Whereas an income-contingent loan plan recovers only 9 percent of total costs of education (figure 1), a graduate tax would result in roughly full recovery of the equivalent loan, which covers some 20 percent of unit instructional costs, though this may not accrue to higher education. Within twenty years (assuming that the student cohort grows 3 percent a year), a 2 percent graduate tax would generate about 15 percent of the total university costs in Australia.

The chief justification for the graduate tax, or equity finance approach, is that it can generate more revenue than do loan programs. Since payment of a graduate tax is linked to future earnings and not educational costs, tax payments can in theory be extracted long after a loan would have been paid off. Moreover, as graduates age and their salaries increase, revenues from the graduate tax increase, even without a rate increase. Yet this gives rise to the criticism that graduate taxes are front-loaded; that is, the government pays out money immediately and receives the return much later when the stock of tax-paying graduates accumulates. (Mortgage loans are also front-loaded, but the repayment period is faster.) This criticism may be overstated, because, in principle, the government may borrow against these outlays just as it would if it ran a student loan program.

Moving Forward

This article has concentrated on the financial implications of loan programs, but issues of equity must also be considered. Despite the lack of empirical work

on how loans affect access to higher education in developing countries, it is clear that making students pay more of the costs of their education will discourage some individuals who otherwise would have pursued higher education. This does not necessarily hurt equity. Most higher education systems in developing countries are not very equitable to begin with; access tends to be skewed toward higher income groups, where children attend better primary and secondary schools and families can afford to have their children out of work for longer periods. Individuals in lower-income groups often lack meaningful access to educational opportunities, regardless of student loan programs. As currently designed, these programs bestow large subsidies on the wealthier groups. Increases in cost-recovery ratios will reduce access for lower-income groups but, by economizing on outlays for higher education, will also allow the government to improve access to primary and secondary education and to provide grants to the poorest. The central equity concern should be to design a deferred payment program that minimizes any reduction in access.

Loan programs can be expensive enterprises that do not easily satisfy the need for cost recovery. The following list of issues can serve as a guide in deciding whether to implement a deferred payment program.

First, a deferred payment program requires the participation of a credible collection institution with incentives to collect. In most instances commercial banks, a taxation department, or a social security agency will be the best choice. The likely default rate on a loan program can be assessed by examining the current tax evasion rate among graduates, the proportion of self-employed graduates, and the current rate of graduate unemployment. If default or evasion is likely to be greater than, say 25 percent, it would be inadvisable to implement a loan program; in such cases, a carefully targeted grant program is likely to be more cost-effective.

Second, interest rates on loans must be equal to or above the inflation rate in order to reduce subsidies. With tax or income-contingent collection, the rate assessed must be sufficient to ensure significant cash flows. Careful financial calculations must be conducted that account for the likely effect of inflation—particularly on the size of annual disbursements—and growth of the higher education system. From this information, one can assess whether the program will generate significant income for the higher education system.

Third, the relationship between necessary payments and the likely incomes of graduates should be examined to ensure that repayment never imposes an excessive burden on graduates. Just as a private bank examines repayment burdens in relation to an individual's earnings, student loan repayments should not exceed a certain (albeit unspecified) proportion of a graduate's likely income. Excessive burdens only result in higher default. Average income profiles of graduates are not sufficient for calculating repayment burdens. The income range according to profession and economic sector should be used in program design.

Fourth, targeting support to needier and more academically deserving students will be crucial to a program's efficiency. In developing countries, good

targeting requires access to information on need and ability. The universities themselves and other agencies that deal directly with the students often have access to this information.

Fifth, loan losses can only be justified if there are potential social gains that would not be reflected in a graduate's income. Subsidies can promote, indirectly, private institutional development and direct students into teaching, rural development work, or private sector entrepreneurship, by forgiving loans. If these are desirable goals, one can consider whether a student loan program is an efficient way of attaining them.

Appendix: Methodological Note for Calculating Subsidies on Mortgage-Type Loan Programs

Below are the assumptions used in the calculations for table 3.

1. Students receive the loan over a four-year disbursement period in real equal-value lump sums at the beginning of each year.
2. Administrative costs are evenly spread over the life of the loan.
3. The default rate is the percentage of loans that are not repaid, and is expressed as a probability for each year of repayment.
4. Grace periods have been rounded to the nearest year. No payments are made during grace periods.
5. Repayments are in equal nominal amounts in yearly installments, due at the beginning of each payment period.
6. Inflation is constant throughout the life of the loan.
7. The administrative cost of defaulted loans is equal to that of good loans.

Calculating the Student Subsidy

Let PV = present value; D = disbursement value; i = initial interest rate (during lending period); I = interest rate during repayment period; g = grace period in years; N = repayment length in years; n = year of repayment; r = opportunity cost of capital, from time of lending onward; L = disbursement length in years; and l = year of disbursement.

The amortization value is

$$A = D \sum_{l=1}^{l=L} (1+i)^{g+(l-1)}$$

The annual payment amount is

$$P = \frac{(A)(I)}{1 - (1+i)^{-N}}$$

The annual cash flow to the government is as follows: $-D$ for the four years of loan disbursements, 0 during the grace period, and P during the repayment period.

The present value of disbursements is

$$PV_{\text{disb}} = \sum_{l=1}^{l=L} \frac{D_l}{(1+r)^{l-1}}.$$

The present value of repayments is

$$PV_{\text{repay}} = P \sum_{n=1}^{n=N} \frac{1}{(1+r)^{g+L-1+n}}.$$

The subsidy to the student in currency units is $PV_{\text{disb}} - PV_{\text{repay}}$. As a percentage of the loan value, it is $(PV_{\text{disb}} - PV_{\text{repay}}) / PV_{\text{disb}}$.

Calculating the Loss to the Government, Including Default

The calculations are the same as above, except that payment amounts are reduced to account for the probability that they are not made. Thus, the annual payments are $P_{\text{def}} = P(1-d)$, where d is the probability of default in any year.

Calculating the Total Loss to the Government, Including Default and Administrative Costs

Each year of the cash stream is adjusted to reflect the cost of administering the loans, which is calculated as the annual percentage cost of servicing outstanding debt. Let od = outstanding debt on the loan; ac = administrative cost of servicing the loan, as a percentage of outstanding debt each year; t = year in the life of the loan; cf = cash flow calculated above, including the likelihood of default; and CF = adjusted cash flow, including the likelihood of default and administrative costs.

In each year, the cash flow is adjusted as follows:

$$CF_t = cf_t - [(od_t)(ac)].$$

and the present values and subsidies are calculated as they were for the student subsidy.

Notes

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for financing universities in developing countries, directed by Adrian Ziderman. Full results will appear in book form; a preliminary version is presented in Albrecht and Ziderman (1992).

1. Programs were evaluated using simulation models for mortgage-type loans (including tilted payment schemes), income-contingent loans, and graduate taxes. These models allow flexible repayment streams and costs and can project budgetary requirements. For information on their use, contact the authors.

2. Technically, a graduate tax should be charged only on the income enhanced by human capital investment in university education (that is, on income earned over the average received by those with university entry qualifications). For administrative efficiency a lower average rate, levied on all income is assumed, rather than a higher marginal rate only on the graduate earnings differential.

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ALTERNATIVE FORMS OF EXTERNAL FINANCE: A SURVEY

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For many developing countries, alternative forms of external finance—all forms of finance that are not guaranteed by or mediated through the public sector—have become increasingly important as traditional financing to the public sector has ebbed. Yet a survey of the literature reveals few recent analytical insights about alternative financing, which includes foreign direct investment, project lending, portfolio investment, closed-end equity funds, private nonguaranteed debt, licensing, joint ventures, quasi-equity contracts, and other forms of private, nonrecourse lending to private borrowers. The literature offers little solid guidance for distinguishing between alternative and traditional financing with respect to country risk, for establishing the most appropriate and efficient incentive structures and restrictions in the host country, or for identifying the optimal financing modes for international firms investing in developing countries. This gap in the analytical literature has important implications for policy formulation. It is not always clear whether a country is developing incentives and establishing safeguards (for ensuring adherence to project performance requirements) that are most effective in attracting alternative forms of finance.

Debt reduction is now the accepted solution for managing the external debt problems of many developing countries. This acceptance comes only after a decade of failed attempts to restore growth in debt-burdened countries by essentially forcing commercial banks to continue to lend new money. Most participants generally agree that commercial banks are not soon likely to step up their voluntary lending for balance of payments purposes to developing countries.

A consequence of limited new commercial bank lending is that governments will have to rely primarily on official creditors and multilateral institutions to help finance their economic growth. Another consequence is that net transfers from developing countries to commercial banks will remain positive for some years to come, thus intensifying the importance of forms of external finance other than “traditional financing,” or lending to or through the public sector. The term “alternative financing” here refers to all types of private, nonrecourse, external financing: foreign direct investment, project lending, portfolio investment, closed-end equity funds, private nonguaranteed debt, licensing, joint ventures, quasi-equity contracts, and other forms of private, nonrecourse lending to private borrowers. Among severely indebted middle-income countries, more than 40 percent of net resource flows in 1990 were from alternative financing sources, and this share is expected to rise.¹ Parallel trends exist for other groups of developing countries (World Bank 1992).

Alternative financing is likely to take on greater importance in developing countries for other reasons as well. As countries develop, they tend to rely more on alternative financing and less on traditional financing. Moreover, as developing countries open up their markets, privatize, and reform their economies, thereby transforming their economic systems and the role of the state, they will need a different form of financing than in the past. The opening up of these economies also means that local capital will become internationally mobile and exposed to competition from abroad, making the links between external and internal finance more vital and direct. With traditional financing these links are indirect because financing is mediated through the government. Other reasons for alternative financing’s growing appeal are its risk-sharing features, performance incentives, and links with goods and capital markets in industrial countries. And perhaps most important for developing countries, alternative financing often comes as a package of capital, technology, and know-how that can have pronounced spillover effects on growth.

As alternative financing becomes more important, so does knowing what determines flows of alternative financing, how these flows can be increased, how alternative financing can be put to best use for the host country, and what role is played by country risk factors—the probability of capital controls, expropriation, and other risks affecting the transfer of capital and its return. But because little analytical or empirical research has been done on alternative financing in recent years, answering these questions is difficult. (Most of the research goes back to the 1960s and 1970s; comprehensive surveys of this literature are provided by Lessard and Williamson 1985 and World Bank 1985.) Recent research on external financing has concentrated on public sector debt, largely because debt transfers dominated alternative financing transfers during the 1970s and early 1980s: the real value of lending grew by almost 10 percent a year during the 1970s, while the real value of alternative financing remained unchanged until the mid-1980s. Furthermore, much of the early literature dwelt on the underlying motivations for capital transfers (the “real” factors), and

little of it looked specifically at the effect and nature of country risk factors. Issues such as political stability and expropriation were discussed, but rarely were the discussions based on analytical models. And recent research on traditional financing has concentrated on sovereign risk—the risk of default and repudiation of claims—assuming, rather than explicitly modeling, the underlying motivations for capital transfers. In practice, both real and country risk factors influence alternative and traditional financing.

This survey of the literature concentrates on country risk factors related to alternative financing, domestic incentive schemes for attracting foreign financing, intermediation by multinational firms and banks, and the supply side of alternative financing. The survey is intended to help identify the factors that influence the flow of alternative financing and to provide the analytical—and empirically supported—underpinnings for policy work and for estimating the amounts of alternative financing likely to be available. It also seeks to identify major gaps in the research.

Some Key Aspects of Alternative Financing

To facilitate comparison of alternative and traditional financing and to establish a context for the literature survey, alternative financing is arranged into three categories: foreign direct investment (FDI), equity portfolio investment (including country funds), and private nonguaranteed debt (table 1). Because FDI represents by far the largest share of alternative financing, most of the analysis in this section relies on data for that category of investment.

Table 1. Alternative Financing to Developing Countries, 1989–91
(millions of dollars)

Type of financing	1989	1990	1991	1989–91
FDI (net flows)	23,343	25,445	33,546	82,334
Equity portfolio	3,409	3,737	7,299	14,445
Closed-end funds	2,123	2,831	943	5,897
ADRs ^a	0	138	4,902	5,040
Direct equity	1,286	768	1,454	3,508
Private	6,151	15,211	20,312	41,674
Loans	2,020	9,044	7,648	18,712
Bonds	3,544	5,295	10,134	18,973
CPs/CDs ^b	587	872	2,530	3,989
Total	32,903	44,393	61,157	138,453

a. American deposit receipts (issue of rights on equities in developing countries held by depository institutions in industrial countries).

b. Commercial paper and certificates of deposit.

Source: OECD data; World Bank (1992); Gooptu (1992).

Foreign Direct Investment

FDI consists of new equity, retained earnings, and intercompany loans. The relative contributions of these three components have varied substantially, but it is not clear what determines their distribution.² FDI flows to developing countries come almost exclusively from a small group of industrial countries: France, Germany, Japan, the United Kingdom, and the United States. To date there has been little FDI movement among developing countries.

There are common patterns as well as substantial differences among developing countries. FDI and debt flows to developing countries do not seem to occur together—one or the other has tended to predominate. In the 1930s debt-creating flows dominated; in the 1950s FDI flows did. The 1970s were again a period of large credit flows.

Stocks of FDI are, in general, lower than debt stocks in developing countries.³ In 1988 FDI stocks for all developing countries were equivalent to only about 11 percent of total debt claims.⁴ The average ratio of FDI stocks to gross national product (GNP) for all developing countries was 10 percent, while the ratio of debt to GNP was 83 percent. FDI's share of GNP was larger than debt's share for only a few developing countries. The standard deviation across countries of FDI's share of GNP is also much less (13 percent in 1988) than the standard deviation of debt's share of GNP (68 percent). The maximum share of FDI in GNP was 47 percent; the maximum share of debt was 450 percent. The coefficient of variation, however, was much larger for FDI as a share of GNP (1.35) than for debt as a share of GNP (0.82), indicating greater variation around the average share of FDI in GNP.

FDI stocks are far more concentrated among a few countries than are external debt stocks. Five countries—Brazil, China, Egypt, Malaysia, and Mexico—account for more than 63 percent of the total stock of FDI claims in developing countries, whereas the top five debtors—Argentina, Brazil, India, Indonesia, and Mexico—account for only 33 percent of total debt stocks. Countries with relatively high FDI claims share certain characteristics, such as a broad natural resource base and a large domestic market, but these similarities cannot easily be generalized because other countries with similar characteristics, such as India and Indonesia, do not have large FDI stocks.

A country's external debt tends to be positively related to its per capita income. This finding is contrary to the notion that foreign capital flows toward countries with low per capita incomes because of higher marginal rates of return—those countries would be expected to have higher debt stocks per capita as well (Gertler and Rogoff 1989). A similar positive relationship holds for per capita FDI and GNP. In fact, across countries FDI per capita tends to be even more sensitive to GNP per capita than does debt per capita. For example, in 1988 the elasticity of FDI per capita to GNP per capita was 1.5, while the elasticity of debt per capita to GNP per capita was only 0.84. Elasticities are comparable for other years, across regional groups of countries, and for individual

countries over time. The close correlation between debt and FDI levels and levels of income (growth) does not, of course, indicate the direction of causality: whether external capital leads to higher growth or whether higher growth attracts a larger amount of external capital (Caves 1982).

Countries that were not severely indebted relied relatively more on FDI as a source of external financing during 1976–81 than did the severely indebted middle-income countries. Countries with debt-servicing difficulties had significantly lower FDI-to-GNP ratios and significantly higher debt-to-GNP ratios than did countries without debt-servicing problems.

Countries have seldom explicitly defaulted on their external debt and FDI claims at the same time, a fact reflected in creditors' and investors' view of defaults on debt and FDI as manifestations of largely separable forms of sovereign risk. That several developing countries expropriated FDI in the 1960s and 1970s (Williams 1975) did not deter creditors from lending them large amounts of money. And in the 1980s, when many countries defaulted on their debt, only a few countries expropriated FDI.⁵

The cost of servicing FDI is in general higher than the cost of servicing debt. The average rate of return on FDI in developing countries during 1980–86 was 16.2 percent for investment originating in the United States (the only industrial country for which detailed data are available).⁶ In part because rates of return on FDI are, in general, positively related to growth rates in exports and gross domestic product (GDP) in the host country, differences among countries and country groupings were substantial. The 28.5 percent average rate of return in Asia was more than double the 12.2 percent average return in Latin America and in industrial countries. By comparison, the average cost of debt from commercial sources during the same period was 9.7 percent for developing countries, and the relationship between international interest rates and growth rates of exports and GDP in developing countries was insignificant or negative.

Equity Portfolio Investment

Foreign investments directly in the stock markets of developing countries have been small; larger investments have been made indirectly through the use of so-called country funds, mutual funds listed in individual countries that invest in the stock markets of developing countries (van Agtmael 1984; IFC various years). The total net asset value of country funds invested in developing countries in 1991 is estimated at \$6.8 billion. These investments, which were concentrated in a few developing countries (particularly the newly industrialized economies of Southeast Asia), represented about 1 percent of the estimated stock market capitalization of developing countries at the end of 1991 (\$643 billion, or 6 percent of the capitalization of stock markets in industrial countries; see IFC 1992). Other forms of equity flows have been through American deposit receipts (ADRs) and direct purchases.

Dollar rates of return on equities of developing countries tend to be high but volatile. The composite rate of return on these equities during 1984–91 was 17.2 percent, or 1.6 percentage points above the U.S. Standard and Poor's 500 equity markets (IFC 1992); volatility was higher than the index as well. Rates of return in developing countries tend to have a low correlation with the rates of return on equities in industrial countries (on the order of -0.3 to 0.4 ; see IFC 1992).

Private Nonguaranteed Debt

Information is harder to come by for other forms of alternative financing. Many developing countries do not keep data on nonguaranteed debt incurred by private companies. Data kept by creditor countries on funds raised by developing countries through bond issues and other capital market instruments often do not distinguish between public and private issues.

These forms of finance, which totaled an estimated \$12.7 billion for public and private issues in 1991, have increased in absolute and relative amounts, in part because developing countries have eased restrictions on private borrowing. (In contrast, gross medium- and long-term debt-creating flows to governments of developing countries that year totaled \$34 billion.)

On a stock basis, total private nonguaranteed debt claims are estimated at about \$77 billion, or 7 percent of the \$1,028 billion in public and publicly guaranteed claims of all developing countries in 1991.

Differences between Traditional and Alternative Financing

The statistics presented above show substantial differences between the amounts and distribution of traditional and alternative financing and the rates of return they earn in developing countries. They also show a relationship between the type of external financing and the country's economic performance. To the extent that alternative financing is similar to traditional financing, policy recommendations can build on the store of knowledge about traditional financing. To the extent that alternative financing differs from traditional financing, however, new tools for analysis, management, and forecasting are needed.

There are five primary differences between traditional financing and alternative financing (some differences overlap).

- *Private and public obligations.* The distinction between public or publicly guaranteed obligations (traditional financing) and private, nonrecourse obligations (alternative financing) is important because it has implications for the allocation of external resources, the internal and external transfers necessary to service claims, the sovereign risk involved, and the destination of capital, among others. Probably the most important of these implications is that public debt involves transfers within as well as outside the country (positive as well as negative), while private claims involve only transfers

outside the country. It is through internal transfers that the benefits and costs of public external financing are allocated, which is why this difference is so important.

- *Type of obligations and source of capital.* The two forms of finance differ at least three ways in type and source of capital. First, during the past several decades traditional financing has been provided almost exclusively as general obligation debt. General obligation debt is usually low cost and involves substantial control by the borrower, with little risk-sharing between lenders and borrowers and little incentive for lender involvement in selecting and monitoring projects. The debt also tends to come from a limited number of international commercial banks. The early 1980s dramatically demonstrated how risks could be concentrated within a small group of financial institutions and pose a serious threat to the international financial system. Second, traditional financing involves mainly transfers of capital, whereas alternative financing often involves transfers of capital combined with technology, know-how, and goods—factors that can greatly influence the expected rate of return for the investor and the country. Third, the amounts of different types of external finance can depend on which intermediary in the industrial countries controls the savings available for financing investment in developing countries. For example, FDI may depend on the amount of savings generated internally in multinational firms.
- *Purpose of capital transfer.* The final purpose of the capital transfer—project or expenditure financed—may differ because of the specific objective function used in evaluating the projects to be financed. Public investments can include projects, such as infrastructure and education, with high economic rates of return but low financial rates of return. Private investment will be directed to projects with high financial rates of return.
- *Links among those providing capital and among those receiving it.* The links among providers of capital are more explicitly defined for traditional financing than for alternative financing. For example, commercial banks participate in syndication agreements, which cover a large share of debt financing to sovereign borrowers; these agreements include clauses entitling each lender to an equal share of any payment received by any syndicate member. Such clauses create uniformity and a high degree of cohesiveness among lenders. Returns to claim-holders on projects financed by traditional means depend on aggregate fiscal revenues and not on the return of an individual project. Alternative financing claim-holders lack such cohesiveness. For example, they seldom treat failure to honor one claim as a default on other claims.
- *Links between projects and providers of capital.* With traditional financing the rate of return on a project bears virtually no relation to the interest or financing used. For alternative financing, however, the relationship is usually close or, as Lessard (1986b) puts it, foreign managerial penetration is

high. This relationship—or its absence—affects the incentive for the lender or investor to ensure that the project is a success.

Factors Determining Capital Flows

What determines the choice of traditional or alternative forms of finance? Capital moves across borders because it helps borrowers and lenders smooth or accelerate income and consumption over time, transfer risks, and increase permanent income (Lessard 1986a).

Smoothing income or consumption involves building up debt or reserves in response to *anticipated* movements in income over time (Cooper and Sachs 1985). Traditional financing makes this possible, and a good part of borrowing during the 1970s was probably motivated by this desire. Alternative financing was less often used for that purpose. In practice, however, much of the borrowing appears to have been procyclical rather than countercyclical, and little smoothing was accomplished.

The transfer of risks from developing countries to developed capital markets has only recently begun to receive attention as a key objective of capital flows. Traditional financing is ill-suited for insuring debtors and creditors against risk. Alternative financing, with its contingent payment obligations, appears to be better suited for reducing risk and thus avoiding some of the welfare and deadweight losses associated with fluctuating incomes and postponed investment decisions—investors tend to postpone investments in the face of increased uncertainty (Serven and Solimano 1991, 1992).

Primarily, however, developing countries have sought capital inflows to increase their permanent income (Fishlow 1991). Attracting capital requires that a country have investment opportunities that are judged profitable by world standards and that its total financing needs exceed domestic savings. The remainder of this article concentrates on this issue of profitable investment opportunities.

The Profitability of Investment

Four kinds of factors affect the profitability of investment opportunities in developing countries: real factors in the country receiving the capital, real factors arising from the interaction between the host country and the investor, government policies in host and source countries, and sovereign risk factors. Research has concentrated mostly on the ways the first and last factors affect traditional financing, while the other two have been relatively neglected.

Real Factors in the Host Country

For capital to flow across borders, the risk-adjusted real rate of return in the country receiving the capital must be higher than it is in the country providing

the capital.⁷ One reason for the higher rate of return could be differences in the factors determining the rate of return on capital; that is, the recipient country might have a more abundant labor supply, more natural resources, lower initial physical capital stock, or lower initial human capital stock than does the source country. In neoclassical theory, differences in these factor endowments are required to make an initial transfer of resources a sustainable strategy (sustainable in terms of satisfying some specific solvency constraint; see Jones and Kenen 1984; World Bank 1985, 1991b). This principle generally underlies lending by development agencies (see Lessard 1986a and 1989b).

Other areas of research also offer promise for explaining capital flows. The literature on endogenous growth examines the contribution to growth of factors other than physical capital—human capital, trade in intermediate goods (Grossman and Helpman 1990), and externalities associated with physical investments (Easterly and Wetzel 1989; Easterly and others 1992). But the implications for analysis of external capital flows have yet to be fully explored (see Spiegel 1990 and Arrau 1990 for some initial work). Of particular interest here is why capital, technology, and other factors do not always flow to their most productive use. The work on endogenous growth may challenge the hypothesis that, in the absence of barriers, capital will flow to countries with higher rates of return until rates of return are equalized. Spiegel's (1990) endogenous growth model demonstrates, for example, that a critical mass of foreign borrowing may be required to reap these higher rates of return.

DETERMINANTS OF INVESTMENTS. Many of the factors that determine the rate of return for foreign investors also determine the return for domestic private investors. Factors such as the macroeconomic environment, the credibility of exchange rate policies, the quality of fiscal policies, and the interaction between public and private investment can be as important for domestic investors as for foreign investors (Serven and Solimano 1992; Green and Villanueva 1990). Some factors may affect private domestic and foreign investment differently, however; these factors include exchange rate policies, transfer pricing rules, limitations on foreign investment in domestic firms or on repatriation of interest and dividends, and performance requirements such as domestic content specifications (IMF 1985; Lizondo 1990).

EXTERNAL AND DOMESTIC FINANCIAL INTERMEDIATION. The state of a country's financial system can have an important influence on external financing. Countries that have developed and liberalized their financial systems recently, such as Chile, the Republic of Korea, Mexico, and Turkey, have been able to attract increased flows of alternative financing. Recent flows of alternative financing in Southeast Asia have gone to investments in financial intermediation services, in response to the opening up of the domestic banking sector.

A few studies have formally investigated the links between the form of external finance and the institutional structure of the host country's financial sys-

tem. The studies have built on new research on the links between a country's real sector and its financial sector (Bernanke and Gertler 1989; Gertler 1988). Froot and Stein (1991) find that the form of external finance is affected by the structure of the domestic financial system.⁸ The severe capital flight experienced by some Latin American countries—a reverse manifestation of the links between net external capital flows and domestic financial systems—has often been attributed to the countries' relatively ill-developed domestic financial systems (Lessard and Williamson 1987).

Other links probably exist as well, as the extensive literature on financial flows among industrial countries suggests. The important points are that domestic capital in many developing countries is (or will become) internationally mobile and that international capital has become more mobile. This increased mobility imposes restrictions on domestic financial systems and makes certain types of external finance more attractive.

ECONOMIC AND FINANCIAL RATES OF RETURN. Unlike traditional financing, which is concerned only with economic rates of return, alternative financing requires that financial rates of return be high. Relying less on traditional financing and more on alternative financing may thus have a profound effect on development. The implications are especially important for the uses to which financing is put. Official lending should be directed to projects with high economic but low financial rates of return (education, health, environment, infrastructure). Alternative financing could then be used to finance projects with high financial and economic rates of return (say, in energy, manufacturing, and industry).

Real Factors Arising from Interactions between Debtors and Creditors

Interactions between recipient and provider may influence the rate of return on a project. For example, a multinational corporation may transfer some of its know-how to the country when it invests abroad. Such interactions may lead to gains in the efficiency of investment and raise its rate of return. The discussion here focuses on interactions through multinational corporations and the issues of managerial control and source of financing.

INTERACTION THROUGH MULTINATIONAL CORPORATIONS. Multinational corporations transfer technology and help diversify risks for their shareholders. The economics literature generally focuses on the first of these aspects, the finance literature on the second.

The *economics literature* tries to explain the decisions of multinationals—on where to source inputs, invest resources, and produce output—as well as what motivates intrasectoral, intrafirm, and intraindustry trade (Helpman and Krugman 1989; Graham and Krugman 1990, 1991). On the whole, the literature concludes that the determinants of total return and cross-border flows for

multinationals are economies of scale and scope, factor content of trade, benefits of vertical integration, market structure, locational advantages, and other dimensions that accompany the provision of alternative financing, such as intangible transfers between different plants. The literature is still weak in explaining why portfolio investments (without managerial control), exporting, leasing, joint ventures, or licensing cannot perform the same functions as FDI.

The economics literature also does not adequately explain why differences in factor endowment and market structure happen to coincide with legal boundaries between countries: the literature in essence tries to explain investment by multinationals in general, which is not necessarily *foreign* investment. The literature often identifies multiplant location with multicountry location, an identification that is valid only if sovereign boundaries determine locational advantage. Krugman (1991) argues that this literature is much more about geographic location of industries across regions (as, for instance, across regions within the United States) than about investments across sovereign boundaries. The answer that barriers to factor movements and market imperfections likely coincide with country limits does not explain why countries find it in their mutual interest to erect these barriers.⁹ Sovereignty—defined in the broadest sense as an inability to enter agreements that can be enforced by a legal authority—may itself be a logical explanation for erecting barriers and thus creating locational advantages, but sovereignty as a reason for, rather than a constraint on, foreign investment has received little research attention.

In general, the research in this area has probably influenced the behavior of multinational firms—showing them how to benefit from factor and market imperfections—more than it has influenced policies to promote alternative financing. This literature now needs to be translated into policy advice—on domestic market structure, regulation, and so on—that will help achieve investments that are advantageous to both multinational firms and the host country.

The *finance literature* has stressed the benefits of multinationals in terms of diversifying risks for shareholders. To the extent that shareholders cannot efficiently diversify their portfolios (growth stakes) in other companies or countries while multinational corporations can, foreign investments by multinationals can lead to risk diversification benefits for shareholders, especially if multinationals acquire or use nontraded goods that individuals cannot. For example, a multinational corporation could acquire human capital by buying up a company with high technological skills and using it productively.

Errunza and Senbet (1981) broaden this perspective on diversification by investigating monopoly rents associated with international operations as a result of market imperfections—product, factor, and financial—and international differences in taxation of multinationals. They demonstrate empirically a systematic positive relationship between current degree of international involvement and excess market value, even after adjusting for the benefits of risk diversification, which suggests the presence of these monopoly rents.

MANAGERIAL CONTROL AND CAPITAL STRUCTURE. Alternative financing fosters closer managerial control by the foreign investor than does traditional financing. When foreign investors are also the managers (majority or minority claim-holders), they are usually involved closely in selecting the project and evaluating sovereign risk. As managers of the project, they ensure access to capital and export markets. Such close control can have important implications for the amount of financing that can be sustained because it overcomes the important incentive-compatibility phenomenon—once funds are disbursed, a borrower's incentives to invest may be different than claimed beforehand (Aizenman and Borenzstein 1988; Claessens and Diwan 1990). For example, managers of a firm financed solely by equity will face different performance incentives than those of a firm financed solely by debt.

If the foreign investors are not the managers but are nonetheless directly concerned with project performance, the issue of managerial control arises. The capital structure of the firm then affects the incentive of the managers. Managerial control has received considerable attention in the literature of domestic corporate finance (see Dreyfuss and Knopf 1988 for an overview). The modern theory of the firm, which considers the complete set of contracts (labor, suppliers, and distributors) to constitute the firm, draws attention to the factors that efficiently monitor the performance of managers and to the discipline on managers conferred by the market for managerial services (Fama 1980; Jensen and Meckling 1976).

The research on the structure of capital in closed economies can offer some insight on the optimal financing or participation modes of an international firm if country risk is incorporated in the analysis. Neither the literature on corporate finance nor that on sovereign debt is directly applicable to an analysis of the capital structure of an international firm, however. The scope for principal-agent and moral hazard problems is even larger in an international context than in a domestic one, especially because international liability is poorly defined. Yet the single principal-agent model used in the literature on sovereign debt is not applicable because of the decentralized borrowing and repayment decisions entailed in, and the potential externalities generated by, private financing.

INTERNATIONAL LIABILITY. International laws on foreign claim-holders' liabilities are vague and ill-defined. The implicit nature of international liability influences both the investment and the financing decision. The private foreign financier will have an incentive to lay some costs off on the host society. Although the spread of more market-oriented economies has reduced the opportunities for foreign investors to exploit distortions in domestic markets, it has not prevented limited liability firms from adopting risky strategies that may have adverse consequences for the host country. In domestic firms another stakeholder (say, labor) may block this kind of behavior. There may be no similar counterweight for international investments.

Furthermore, the nature of international contracts allows a borrower to default selectively on claims incurred for one project and dilute the value of existing claims by incurring new obligations; with traditional financing the borrower cannot create different classes among its lenders.¹⁰ This distinction affects the amount that can be borrowed through alternative forms of external financing. The nature of international claims also makes the ranking of claims uncertain (particularly the relative seniority of debt and equity claims), further complicating the managerial control function of the capital structure of a firm.¹¹

With alternative financing, the rate of return on an investment is sensitive to the capital structure because of the absence of sharing clauses. Because conflicts can arise between different classes of claim-holders, profitable investments might not be undertaken in cases where the yield may be insufficient to service all outstanding claims in all events. Myers (1977) pioneered this line of reasoning, showing that the existence of preferred claims weakens the incentives of the shareholders of a firm to undertake good investment opportunities. Complete sharing clauses make the claim structure homogeneous, and conflicts about investment policies cannot arise among different classes of creditors. Conflicts between claim-holders and the host country can still occur, of course, because the country is, in a sense, the ultimate shareholder.

These issues have not been fully explored. John, Senbet, and Sundaram (1990) show that limited liability leads to globalization of benefits and localization of subsidies. Eun and Janakiraman (1990) show that the value of a firm with some international ownership depends on the share of foreign ownership and that foreign and domestic shareholders do not act together to maximize the value of the firm. Hodder and Senbet (1990a) show that, with integrated international financial markets, the agency costs of debt financing determine an optimal capital structure for multinational firms that is fundamentally different from the structure that would be predicted by the traditional literature on corporate capital structure.

What really needs to be investigated here, however, is either the endogenous derivation of the optimal liability structure without reference to existing financial contracts or the implications of existing (exogenous) financial contracts for international firms competing for capital. The first approach has the advantage of being able to work along the lines of the optimal contract theory in the principal-agent framework used to analyze corporate finance and sovereign debt. However, its interpretation in terms of existing instruments becomes difficult. The second approach is generally used to analyze domestic corporate finance and may more easily be adapted to an international context. The important point from a policy point of view is whether the market can adjust the capital structure of the firm in a way that leads to maximization of the value of the firm *and* to an investment level that is efficient from the perspective of the host country.

FINANCIAL INTERMEDIATION IN THE INDUSTRIAL WORLD. Closely related to issues of managerial control and capital structure is the availability of resources in the different sectors and institutions of source countries. Goldborough (1979), Oman (1984), IMF (1985), and World Bank (1985) analyze interactions between institutional arrangements in industrial countries and type of capital flows. The predominance of bank lending in the 1970s was associated with the large amounts of petrodollars recycled through the banking system to developing countries. It has since become clear that commercial banks do not have the institutional structure or comparative advantage to intermediate capital with long maturities. Conceivably, these capital transfers could have been intermediated first to multinational firms in the source countries, and these firms could then have added their technology and other skills before investing in developing countries. But the institutional structures and arrangements in both industrial and developing countries did not encourage that approach.

If financial intermediation is imperfect in industrial countries—if managerial control problems become too large—the availability of alternative financing for developing countries depends on the availability of capital at the relevant sectoral or institutional source. Institutional investors, such as pension or insurance funds, have been identified as important new sources of capital because they have long-term investment horizons and could learn to monitor and manage projects (Lessard and Williamson 1985). It is not clear, however, why direct investment by these investors is preferable to intermediation of their funds to multinational corporations, which would then invest in developing countries. Is it that intermediation, first to multinationals then to developing countries, increases the managerial control problem? Or can contracts between multinational corporations and the final lender be designed to exploit the informational and other advantages of multinationals while minimizing the managerial control problem?¹² In any case the international firm plays an important financial intermediation role that has not been adequately examined. Indeed, the link between available sources of finance and the structure of a developing country's external finance has in general received little attention. One of the few studies in this area is Husain and Choi (forthcoming). As a start it would be useful to look at how financial flows are intermediated on a worldwide scale, perhaps using a world accounting matrix, as discussed in McCarthy (1988).

EFFECTS ON BALANCE OF PAYMENTS. Multinational firms raise funds globally to finance fixed capital investments and other operations of their parent companies and affiliates abroad. The capital expenditure decisions of multinationals affect total capital formation in the developing countries where affiliates are located, and the corporations' financial decisions influence the external asset position of both source and host countries. The intercompany flow of funds between parent and affiliates is recorded in the balance of payments of source and host countries and is influenced by conditions in financial markets in industrial nations and by the degree of development of financial markets in de-

veloping countries. Taxation of international flows of capital, capital control policies in the source country, and incentives for foreign investment in the host country also affect the intercompany flow of funds.

The literature on financing and investment decisions of multinationals (Senbet 1979; Shapiro 1978) and on capital expenditures in various locations by multinational firms (Lipsey and Stevens 1988) does not account for the contribution of multinationals to the external asset position of countries. Various studies in the 1960s and 1970s examined foreign direct investment and the balance of payments of industrial countries, but they focused mainly on a program launched by the and United States in February 1965 to restrict capital outflows (Brimmer 1966; Kwack 1972; Prachowny 1972; Boatwright and Renton 1975).

Balance of payments components for the five industrial countries with the largest direct investment in developing countries (France, Germany, Japan, the United Kingdom, and the United States) have seldom been analyzed chronologically and linked to policies affecting capital outflows from industrial countries or incentives for foreign investment in developing countries. Lipsey (1987) analyzed the changing characteristics of U.S.-owned foreign operations and the growth of U.S. direct investment abroad after World War II. No comparable analysis has traced developments in balance of payments flows for other industrial countries with large FDI flows.

Government Policies

A third influence on the rate of return on foreign investment is government policies in the host and source countries. These policies include incentives, tax holidays, and differential tax structures—all measures that can alter the level of and return on foreign direct investment.

INCENTIVE SCHEMES. Most countries, both industrial and developing, have introduced at least some policy measures to boost expected profits for foreign investors (Guisinger 1986). The effect of specific subsidies or other incentives in developing countries is uncertain, however. The general investment climate and policies affecting specific sectors usually rank above special incentives in influencing the allocation decisions of foreign investors. Distortions in source countries, such as insurance on investments abroad, could also influence investors' decisions (Gubitiz 1991). Many studies suggest that investors largely ignore incentives, especially those that involve future benefits. Guisinger (1985) suggests that incentives play only a minor role in decisions on where to invest, with the attractiveness of the incentive scheme relative to those of other countries playing a more important role. The result is that countries sometimes compete in bidding wars that produce no change in a country's relative share of total capital flows while increasing benefits to investors (Wheeler and Mody 1990).

There is some largely anecdotal evidence that incentives involving sizable payments up front are effective in attracting foreign investment. But what the final economic benefits are for the host is unclear. Shapiro (1990), for instance, analyzes the case of the automobile industry in Brazil, which was established as a result of government intervention, and concludes that, in this case, the intervention was successful. Warr (1989), looking at whether export-processing zones attract foreign investment, finds that they do but that they yield uncertain economic benefits to the host country; the up-front costs can be substantial and the economic spillover effects appear minimal.

TAX TREATMENT. For industrial countries, differences or changes in tax structure explain only part of the flow of capital in recent years; for developing countries research results are mixed. Auerbach (1990), whose theoretical analysis focuses on developing countries, finds that tax structures can be important. Slemrod (1990) concludes that the influences of different tax regimes are not easy to quantify. Shah and Slemrod (1990) find that FDI flows to Mexico are sensitive to tax regimes in Mexico and the United States. Jun (1990) finds similar results for FDI to and from the United States; Froot (1990) for FDI from Japan; Froot and Stein (1990) for FDI from Japan to the United States; and Leechor and Mintz (1990) for FDI to Thailand.

Tax treatment may affect not only gross capital flows, but also decisions on investment, spending, and type of financing. Huizinga (1991a, 1991b, 1992) finds that international differences in tax treatment affect initial foreign investment incentives as well as later decisions on research and development spending and product innovation. Tax laws may also affect the type of cross-border flows—for example, decisions about the debt-equity ratio for individual firms in a country once the investment decision has been made (Huizinga 1990a; Er-runza and Senbet 1981). Hodder and Senbet (1990b), however, who derive the international analogy to Miller's (1977) debt and taxes equilibrium model, find that corporate tax policy plays a key role in determining the aggregate international debt-equity ratio but does not affect the decisions individual firms make about their debt-equity ratios.

Overall, then, the analysis of government policies for attracting foreign investment finds that they have only limited effect. This is especially the case where incentives can easily be withdrawn or reduced. Grieco (1985) reports, for example, that in many cases taxes on investments in natural resource projects increased by as much as 30 percentage points within a few years of the investment agreement, making the initial low tax rate a weak incentive to attract investment.

Country Risk Factors

The fourth factor influencing the level and pattern of international capital flows is country risk. Before transferring capital, lenders need assurances that

debtors will repay. Penalties are needed to forestall default, and good reputations need to be rewarded.

Eaton and Gersovitz (1981), who were the first to use an analytical model to explore sovereign risk for traditional financing, concentrated on the incentive for the borrower to retain access to international financial markets. Eaton, Gersovitz, and Stiglitz (1986) and Eaton (1990) survey the literature on the intertemporal costs of defaulting. Bulow and Rogoff (1989a, 1989b, 1989c) stress the importance of direct penalties, such as trade sanctions, that lenders can impose in cases of default.

The relative importance of each of the factors for determining capital flows to and transfers from sovereign borrowers is still largely unknown, however. This means that the exact nature of the implicit contract between lenders and borrowers is also unknown, which imposes severe limitations on formulating policy advice about the contractual forms that will achieve a first-best outcome.

Country risk has received less attention in the analytical and empirical literature for alternative financing. Lessard (1989a, 1989b) and Lessard and Williamson (1985) have identified several reasons why country risk in alternative financing differs from that in a public debt contract: internal transfers are absent; opportunistic default is defined differently (with foreign investment, default can be partial and the result of exogenous shocks, actions by the government, or a deliberate decision by the borrower); the types of project being financed may differ; the deadweight losses associated with default may differ, which makes the incentives to renegotiate different; and the amount of alternative financing has been less than that of traditional finance, possibly lowering the risk of default. The following discussion of country risk considers three issues: selective expropriation and reputation, assumption of private claims, and analytical modeling.

SELECTIVE EXPROPRIATION AND REPUTATION. Private foreign investors have almost no links to each other, whereas traditional lenders typically have strong links. A threat to stop lending would be more effective coming from traditional lenders than from private investors because private investors would find it difficult to coordinate their activities. But private investors are able to withhold technology and other inputs or restrict access to know-how developed in other countries.

The absence of links among private investors makes it easier for borrowers to default on individual claim-holders or projects and so tends to influence the nature of the penalties for default and the implicit contract between borrower and lender (Eaton and Gersovitz 1989). For example, borrowers are likely to default selectively on those projects where the penalties are smallest. Governments could evaluate the economic benefits and costs of defaulting on specific projects and make a decision about expropriation on an individual project.

Picht and Stuver (1991) suggest, however, that governments seldom expropriate selectively but rather expropriate across all sectors and industries. This behavior is irrational in an economic sense, because the costs and benefits of expropriation are not equal across sectors and industries. Unselective behavior tends to be based on ideology and to occur after elections or coups. That being the case, one might expect governments to behave the same way about debt obligations; yet joint defaults on both forms of finance seem to be rare. That leaves some scope for substitution between traditional financing and alternative financing. Anecdotal evidence (Eaton and Gersovitz 1984) also suggests that some governments have expropriated FDI selectively without impairing the country's access to other forms of external capital.

Expropriation occurs, however, along a continuum of policies that affect the return on investment. Creeping expropriation of the earnings of a foreign investment—through taxes, union activities, or domestic ownership requirements—is hard to detect, making it difficult to measure expropriation properly. Huizinga (1990c) investigated the effect of labor unions on foreign investment patterns, finding a potentially negative influence.

ASSUMPTION OF PRIVATE CLAIMS. Governments have frequently assumed the external liabilities of private borrowers who have defaulted. Many governments in Latin America did so in the early 1980s. Presumably, the social costs of default were large. Under certain circumstances, governments are justified in bailing out private debtors to prevent creditors from imposing penalties on the whole country.

This issue has received little analytical attention (Eaton 1987 is a rare exception). Unanswered are questions about the nature and importance of domestic property rights and contract enforcement, the role of government in screening and monitoring private borrowing, or the benefits of having an international organization for settling investment disputes and claims among private entities in different countries (to prevent foreign creditors from imposing such heavy costs that the government is forced to assume private claims).¹³ These issues have important implications. To increase private foreign investment where there are no implicit or explicit government guarantees will require proper enforcement of contracts, internationally and domestically. The experience of industrial countries with the enforcement of private cross-border contracts may offer useful guidance.

ANALYTICAL MODELING OF COUNTRY RISK. The influence of country risk on the level and pattern of alternative financing has been recognized since at least the early 1970s, when Vernon (1971) coined the phrase “the obsolescing bargain.” But little work in this area has been done using analytical models, which constitute the heart of the work on traditional finance and country risk. The modeling that has been done for alternative financing has investigated loss of reputation, loss of technology, and the credibility of tax holidays.

- *Loss of reputation.* Cole and English (1991) extend the Eaton and Gersovitz (1981) analysis of sovereign reputation to international equity contracts. Equity contracts involve different contractual repayments than do debt contracts. Although the welfare benefits of future access to international capital markets are identical to those of debt financing, default states are different for equity than for debt because the contractual repayments are different. Cole and English (forthcoming) extend their analysis to the case of two-sided sovereign default where two countries hold equity claims on each other as a way to share risk. The analysis shows that sovereignty prevents perfect risk sharing because of the possibility of default.
- *Loss of technology and know-how.* Eaton and Gersovitz (1984) examine the role of foreign technology in sustaining cross-border lending. They use a one-period model and assume that foreign technology is made available at the moment the return on foreign capital is paid, ensuring that the incentives of borrower and lender are compatible. They show that foreign technology can allow for a broader range of contracts. Because of the one-period model, however, Eaton and Gersovitz are unable to analyze the dynamic properties that arise in introducing technology in cross-border lending or to identify any time inconsistencies that may arise when foreign technology is made available before foreign capital is repaid.

Cohen and Michel (1991) show that neither a consumption-smoothing motive (the original argument of Eaton and Gersovitz 1981) nor direct physical sanctions (the Bulow and Rogoff 1989a argument) are necessary to sustain foreign financing, but that withholding future foreign technology can achieve an equilibrium that is dynamically consistent; neither of the two parties finds it in its interest to renege at any point in the future. Thomas and Worall (1990) also find an important role for future technology in sustaining capital flows. To the extent that developing countries inadequately protect intellectual property rights and to the extent that intellectual property is transferable and thus expropriable, foreign investment will be reduced or distorted. Only technology to be developed in the future can then serve as a deterrent to expropriation. Limiting the transfer of technology may have severe consequences for future growth in light of technology's spillover effects on development, which have been demonstrated by the endogenous growth literature.

- *Tax holidays.* Doyle and van Wijnbergen (1984) show that, after an initial tax holiday, tax rates are likely to rise to the level at which all the benefits of the investment accrue to the host country. Bond and Samuelson (1986) suggest that tax holidays, because of their reversibility, may need to be quite generous to attract foreign investment; otherwise, tax holidays may serve only as a signal of investment prospects, not as a monetary incentive. Huizinga (1990b) shows that tax holidays may be a way for a government to convey to foreign investors an otherwise unobservable index of its rate of time preference: a gradual diminishing of the tax holiday (an increase

in the tax rate) tells an investor that the government's rate of time preference is declining.

Additional analytical modeling is needed to identify the policies that host countries can adopt to stimulate foreign investment in ways that are efficient for the host country and credible to foreign investors. Research is needed to define what constitutes a mutually acceptable, dynamically consistent cross-border private contract in the presence of fixed costs, transfers of technology, and a sovereign enforcing the contracts. The characteristics of these private investment contracts should be derived in a sequential bargaining context; concepts developed in the literature on sovereign lending offer some direction here (Bulow and Rogoff 1989a; Fernandez and Rosenthal 1990). The rapidly expanding literature on credibility, commitments, and economic policies should also provide some valuable inputs (see Persson and Tabellini 1990 for an overview).

Three Specific Directions for New Research

Theoretical and empirical work is needed on international financing for developing countries in several important areas: the country risk aspects of alternative financing, incentives and restrictions, and optimal participation modes for international firms in developing countries. These issues also have important bearing on the policies of official creditors. The current literature offers little analytical support for identifying preferred forms of financial intermediation for official creditors or the types of support they could extend to private sector financing (such as cofinancing, guarantees, or privatization). Official creditors will have difficulty defining their roles in these areas without a clear understanding of the differences between traditional and alternative financing, the appropriate situations in which to use each form, and the implicit seniority status of these different claims.

Analytical and empirical studies of the differences in country risk between traditional and alternative financing are therefore needed to determine what institutional structures will ensure proper treatment of claims and what type and amount of alternative financing will be consistent with (explicit or implicit) enforcement of contracts. Research on investment incentives and restrictions in the host country should focus on their efficiency from the country's perspective and on their efficacy for attracting the desired volume and types of foreign capital. Important issues to consider are how to establish appropriate controls on ownership and capital, how to enforce and monitor private contracts, and how to design appropriate financial instruments. This information could in turn lead to the design of better policies on domestic regulation, taxes, accounting, institutional structure, and incentives.

Research on the optimal participation modes for international firms could focus on the optimal capital structure for multinational corporations seeking

financing from domestic and foreign capital markets, under the constraint of internationally mobile capital in the host country. The research could investigate how international firms should finance themselves and whether there have been shifts in the way they have been doing so, derive contracts for dealing with moral hazard and sovereign risk problems, and examine the intermediation role of multinational corporations and the restrictions a government should impose on private financing.

In a world of increased capital mobility and global capital shortage, research in these areas could help developing countries improve their policies and define the role of government in a manner consistent with the increased emphasis on development of the private sector. Many countries are heavily involved in domestic reforms, many of them aimed at attracting foreign finance. In particular, advice is needed for developing appropriate instruments and providing the necessary comfort to foreign investors that performance requirements at the project level will be met. Developing countries cannot afford simply to duplicate systems in place elsewhere, but need to take into account their specific situations.

Notes

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1. This group includes Argentina, Bolivia, Brazil, Chile, Congo, Costa Rica, Côte d'Ivoire, Ecuador, Egypt, Honduras, Hungary, Mexico, Morocco, Nicaragua, Peru, Philippines, Poland, Senegal, Uruguay, and Venezuela (World Bank 1991a, table A1.)

2. For example, during the 1980s transactions between parent and affiliate companies of multinational firms as a proportion of total FDI flows varied significantly. In addition these three components have at times moved in opposite directions. For example, for the United States total FDI flows ranged from a \$2.4 billion inflow in 1982 to a \$44.5 billion outflow in 1987, equity capital from a \$9.7 billion outflow in 1982 to a \$2.2 billion inflow in 1985, reinvested earnings from a \$1.4 billion outflow in 1982 to a \$35.7 billion outflow in 1987, and intercompany debt from a \$13.4 billion inflow in 1982 to a \$1.3 billion outflow in 1985.

3. Reliable numbers are difficult to obtain for FDI stocks, partly because of problems with data, but also because of the difficulty of calculating the market value of FDI. The method used here was to sum over time the net annual FDI flows (from the data bank of the Organization for Economic Cooperation and Development) from the earliest year data were available (generally 1965). These data were largely consistent with those reported by other sources (which may use the same method), such as the U.S. Department of Commerce and the International Monetary Fund. "Non-bona fide" developing countries, such as Netherland Antilles, which often merely serve as conduits for FDI to developed countries, are excluded. See also Pfeffermann and Madarassy (1989, 1991, 1992).

4. This article compares FDI to public external debt—debt outstanding and disbursed—although it argues later that this is not necessarily a sensible comparison from an economic point of view. The purpose here is just to indicate the absolute and relative magnitude of both measures and to point out some salient differences.

5. It can be argued that the value to the country of expropriating FDI claims declined in the 1980s because the costs (and corresponding opportunity value) of servicing the claims had fallen along with profitability. This argument can be only partly correct, however, because the opportunity costs of not expropriating must have risen in periods of shortage of foreign exchange. Possibly, links between the two types of defaults occur because of the domestic political system.

6. Calculated as the direct investment-related payments (dividend and interest plus reinvested earnings) as a percentage of the estimated stock of direct investment outstanding (obtained from U.S. Department of Commerce 1988).

7. The literature on sovereign lending, rather than explicitly arguing that the rate of return is higher in developing countries because of the development process or relative factor endowment, generally takes a higher rate as given. In contrast, work on alternative financing, especially FDI, often focuses on the reasons for the higher rate of return.

8. Froot and Stein focused on informational asymmetries and international capital flows. They conjecture that the increase in Japanese FDI in the United States in recent years may be associated with the appreciation of the yen, which increased the wealth of Japanese investors, as measured in dollars, and allowed them to overcome borrowing constraints arising from asymmetries in information between lenders and borrowers. Postulating that asymmetric information is more prevalent with FDI than with portfolio investment, Froot and Stein found that the appreciation of the yen during 1985–88 had a stronger effect on FDI flows (particularly those directed at real estate) than on portfolio investments. Thus, the form of external finance—FDI—depended on how well the financial system dealt with an asymmetry in information.

9. Restrictions on labor movement seem the most clearly drawn along sovereign lines but do not seem to offer a sufficient locational advantage to explain all foreign investment. Other factors do not need to differ along sovereign lines, except for tax differentials, which follow directly from sovereignty.

10. As in domestic corporate finance, the ability of a borrower to create multiple classes of claims and to make existing claim-holders junior to new ones diminishes the attractiveness of lending to that borrower and lowers the total supply of funds available. In the domestic context, contract clauses prevent the borrower from making these classifications.

11. The situation is analogous to that of the effectiveness of “me-first” and other priority rules in bankruptcy courts in domestic finance (Smith and Warner 1979). Contract restrictions used to limit conflicts among different classes of bondholders and between bondholders and stockholders are derived endogenously in the literature on corporate control. In domestic finance, restrictions are usually on dividend and financing policy and not on production or investment decisions. A seniority structure might possibly be derived endogenously in an international context as well.

12. Errunza and Moreau (1989) apply the argument for the benefits of an improved informational structure to debt-equity swaps, showing that, because multinationals are better informed about the investment project than banks, debt-for-equity swaps can have some benefits for all. See also Froot, Scharfstein, and Stein (1989).

13. One such organization is the International Center for Settlement of Investment Disputes, a part of the World Bank Group. It has had little work so far. Some developing countries have transferred the assessment of custom tariffs to foreign firms in response to corruption in customs collection (Eaton 1990). That is another example of reliance on a supranational judicial authority of sorts.

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