Externalities, Information Costs, and Social Benefit-Cost Analysis for Economic Development: An Example from Telecommunications

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Abstract

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The past two decades have seen a major change in the literature on social benefit-cost analysis for investment choice in developing countries. The earlier literature gave considerable prominence to externalities ("indirect effects") in investment choice. Recent professional work, however, has given much less attention to externalities in developing countries. This analytical shift is unfortunate, for in the context of a less-developed country, an investment project's indirect effects on income creation and income distribution may be very significant. By way of illustration, this paper considers the social benefit-cost analysis of telecommunications investment in less-developed countries.

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Introduction

The analytics of achieving a socially-optimal allocation of investment resources have been a continuing problem in the field of economic development. Early work in this field focused on externalities, and on the need to include in the analysis consideration of a project's "indirect" promotional effects.[1] Later research in what came to be called social benefit-cost analysis (SBCA) has added an emphasis on shadow prices, uncertainty and, increasingly, on income-distribution effects.[2] These diverse concerns of social benefit-cost analysis are of course complementary rather than competitive. In the conditions of a less-developed country (LDC) an investment project's "side effects" on income creation can be significant.[3] Similarly, an investment's indirect impact on income distribution may also be substantial. Accordingly, an analysis incorporating externalities is necessary to take these social benefits and costs into account. In practice, however, the more recent concerns of SBCA have sometimes been accompanied by diminished interest in externalities and the inter-activity effects in project selection.[4]

This paper presents a case study that illustrates the need to include externalities in considering both the efficiency and the equity consequences of investment choice. Our example analyzes the welfare effects of investment in telecommunication (primarily telephone)

expansion in developing countries.[5] Telephone expansion in LDC's is often viewed as having effects similar to increased availability of consumer durables like color television or air conditioning. Those products are primarily an added convenience for the upper classes, and their availability enlarges further the gulf between the standard of living of the upper classes and that of the vast majority of the population. But as we shall see, depending on how the additional telephone facilities are allocated, the consequences can in fact be very different. If the incremental facilities are allocated primarily to business users in the public and private sectors (rather than to private residential users), telephone expansion can have equalizing redistribution effects, as well as positive consequences for production and efficiency. The analysis that leads to these conclusions involves taking account of externalities and of some results from the economics of information.[6]

Our analysis of the welfare effects of telecommunications investment in LDC's is primarily conceptual. Elaboration of an analytical framework is essential to aid empirical work and field studies in this area. The overall perspective we will follow is that of social benefit-cost analysis. Thus we consider such standard questions as the effects of ex ante uncertainty on investment choice, and the impact of telecommunications expansion on the distribution of income in LDC's. Further, because telecommunications service is rarely supplied on purely commercial terms in these countries, market profitability gives little indication of the social returns to such investments. Accordingly, our analysis begins by considering the external economies that telecommunications generates.[7]

External Economies

One externality provided by telecommunications expansion in developing countries is straightforward, and has been widely noted. Telecommunications technology often entails declining average costs over a wide range. Hence, expanding the system leads to a fall in the social costs of supplying service to earlier subscribers. Another externality relates to the benefit rather than to the cost side, and has also been noted in the literature.[9] Consider a new telecommunications project that permits additional subscribers to be connected to the system. The benefits this specific project provides exceed the gains that accrue to the people who are now provided with equipment. A special property of telecommunications investments is that each subscriber's welfare rises with the number of other people who have access to the network, and with whom communications can therefore be made. This feature means that the benefits of telecommunications investment increase exponentially as expansion permits new participants to join the system.

This condition is especially pertinent in the context of the developing countries. In most LDC's, only a small fraction of the population are now subscribers; consequently, the possibilities for utilizing the system to communicate are severely limited.[10] Moreover, unlike the case in the more-developed countries where telephone density is much greater, telecommunications congestion for individual receivers in the LDC's is likely to be remote. Under these conditions, both on the cost and on the benefit sides telecommunications expansion leads to higher net gains than those which accrue to the people now provided with equipment. Further, these external

economies also apply intertemporally. That is, future (as well as earlier) subscribers benefit because of a current project which enlarges the system. This aspect of telecommunications investment also affects the time profile of a project's social rate of return. With plausible discount rates and rates of expansion for the system, a project's SBCA rate of return may even rise over time.

More importantly, in the context of an LDC, increased availability of telecommunications generates external economies that accrue to many other sectors. Once mentioned, these externalities are obvious. Many of them are indeed taken for granted in the economically-advanced countries, where telecommunications density is already high, and low-cost communication is pervasive. The externalities present in this case are in fact extremely important; for they involve the efficiency with which markets and administrative structures function. These effects are apparent if we consider what it is that modern telecommunications actually does. Telecommunications is of course a means of transmitting information. More specifically, modern telecommunications achieves two things: it reduces the time required to transmit information; and it reduces the cost of transporting information over space.[11] In both ways, telecommunications expansion facilitates the flow of information that is current, and hence useful for economic and administrative decisions.

Such conditions which lower the cost of acquiring information are of particular importance in the context of the less-developed countries. In the words of Harvey Leibenstein, these are often "obstructed, incomplete, and 'relatively dark' economic systems."[12] Or as Clifford Geertz, a social scientist with intensive field experience in LDC's, describes the situation:

" . . . information is poor, scarce, maldistributed, inefficiently communicated, and intensely valued."[13] As Geertz suggests, this situation is partly due to the inefficiency with which information is communicated using premodern modes. In addition, other conditions also make for a situation in which the quantity and quality of available information are often deficient in LDC's. The distortions that characterize many LDC factor and product markets make these markets poor providers of information. Further, economic agents in the LDC's generally lack a large stock of knowledge about their economies that is available as a public good. Finally, instability and rapid structural change may render obsolete much earlier information that was available. All of these conditions lead to a situation in which uncertainty beclouds many economic and administrative decisions.

In many cases, the antidote for uncertainty is additional information. The situation described above is exacerbated, however, because much of the information that does exist in the LDC's is not widely available. Once information has been produced, its marginal social cost is zero. But to be used, information must be transmitted. And in countries with premodern communications facilities, the costs of transporting information over time and over space are relatively high. Unless the demand for information (on the part of present users and potential new users) is totally inelastic with respect to price, the high costs of transmitting information in LDC's limit its use. Furthermore, high transmission costs probably reduce both the quantity and the quality of the information that is produced in developing countries. This is because an inverse relation generally exists between the cost of transmitting information and the information that an economy produces. Premodern

transmittal facilities reduce both the number and the range of potential users of information. Smaller markets provide lower returns to investing in the production of useful information. These conditions affect both the quantity and the quality (timeliness, reliability, completeness) of the information generated. The prevalence of this situation in which high transmission costs reduce the information available varies within individual LDC's. The problem is probably most serious in the cases of rural-to-urban and rural-to-rural communications. However, the situation also exists in interurban (and to a lesser extent, in intraurban) contexts.

More generally, the amount of information used in economic and administrative decision-making should satisfy the standard marginal conditions. Consequently, by lowering information costs, telecommunications expansion makes it rational for economic agents to acquire additional intelligence that is pertinent to their decisions. Such additions are especially important for decision-makers in the special context of the LDC's. As Geertz has described the situation: "the primary problem facing . . . participants . . . is not balancing options, but finding out what they are."[14] Further, lower communications costs lead to the acquisition of additional information not only about the mean values of prices nad of other economic phenomena, but also about their probability distribution. Hence the new information permits the transformation of uncertainty into risk.[15] As a result, probabilistic techniques can be applied (if only implicitly), and the scope for more rational decision-making is extended.

In some instances, more information may make decision-makers aware of contingencies of which they had previously been ignorant. Coming in conjunction with their earlier information, this new intelligence may sometimes increase decision-makers' uncertainty. But in any case, additional

intelligence enables people to act on the basis of more complete and more accurate information. And because what you don't know can hurt you, even in instances of increased uncertainty, additional information permits more rational decisions. The economic benefits of the changes described above are of course likely to be greater to the extent that incremental telephone facilities are allocated primarily to business and government users rather than to private residential subscribers.

Still another externality stems from a special feature of telecommunications' role in transmitting new information. New information may be either compelmentary or competitive with the information that economic agents already possess. What is special here is that in either case, new information generally increases the demand for communications. These are needed to transfer messages regardless of whether the new information supplanted or enhanced earlier knowledge.[16] Additionally, the demand for telecommunications may increase in order to implement decisions which are now rational on the basis of the newly-available information. This complementary-competitive feature helps explain why even experienced forecasters have tended persistently to underestimate the growth of demand for telecommunications in developing countries.[17]

Increased availability of moder telecommunications can also lead to benefits in improved organizational performance.[18] As noted, modern telecommunications lowers the costs of transmitting and receiving messages. Consequently, telecommunications expansion increases the likelihood that intra-organizational information flows will not be prematurely blocked. That is, information whose content and analysis can affect the organization's productivity is more likely to continue flowing until it reaches all the people who can use it productively. These considerations apply both to message which originate from within the

organization and to news which comes from the organization's external environment. Note further that the need to avoid premature information blockages is especially great in the LDC's. In the economically more-advanced countries, decision-makers may sometimes suffer from "information overload." But our earlier discussion of the conditions making for information scarcity and pervasive uncertainty in LDC's suggests that the situation facing decision-makers in these countries is likely to be very different. In the LDC's, decision-makers are often still on the increasing-returns segment of the function that relates additional information to higher productivity.

Organizational performance may also improve because of the impact of modern telecommunications on the time required for messages to flow. Not only is the number of messages available to managers increased, but they are also made more current. Consequently, the risks of taking decisions which are poor because they are based on obsolete information diminish. Further, the fall in the time costs of transmitting information may also enhance administrative performance in another way. In many situations, effective decision-making requires interactive communication with people--i.e., negotiation. The possibility for "on line" negotiation can of course greatly facilitate the decision-making process in instances where distance separates the participants. Finally, by reducing the costs of two-way information flows, telecommunications expansion also facilitates effective operation of larger organizations. Such changes are important in cases where economies-of-scale accrue to production technology, but net economic gains cannot be achieved if organizational effectiveness deteriorates markedly with larger size.[19]

The effects of telecommunications expansion in reducing the costs of information flows over time, over space, and within individual organizations are not limited to one class of organization. Thus increased availability of telecommunications can improve managerial performance in public-sector agencies as well as in private firms. Similarly, gains to more effective decision-making accrue both in interorganizational and in intraorganizational negotiations. And telecommunications' effects in facilitating the decision-making process are relevant both in centralized and in decentralized administrative structures.

Information Costs, Decision-Making, and Economic Development

The gains we have noted include much more than the time of the administrators involved. First, capital, labor and land are often strict complements to managers as inputs in production. Consequently, conditions which slow the pace at which decisions are made reduce the social returns of other resources. Similarly, sharp declines in social returns can occur when projects are delayed in reaching their rated capacity.[20] Conversely, conditions which enhance the speed and efficiency of the decision-making process also raise the productivity of complementary inputs.

Even more importantly, as Albert Hirschman has emphasized, the capacity to take (and implement) decisions is itself a key input to the development process.[21] Because of this promotional role, more effective decision-making in the public and private sectors can have a far-reaching impact on a country's economic development. Lower-cost information flows and faster communications are obviously not sufficient conditions for a generalized improvement in organizational performance. But it would be surprising if the

increased availability of telecommunications did not generate this externality in at least some firms and government agencies. And as this discussion suggests, the effects here encompass both allocative and X-efficiency. Further, by providing increased information, telecommunications expansion may be a partial substitute for increased entrepreneurship in developing countries. Improved information flows can raise the effectiveness of a country's existing stock of entrepreneurial talent.

By lowering communications costs, telecommunications expansion may also improve the efficiency with which LDC product and factor markets operate. A standard result of search theory is that as the cost of search falls, the amount of search which is privately and socially optimal rises.[22] Hence, as the expansion of modern telecommunications expansion lowers the cost of receiving new information, the quantity and quality of information demanded are likely to increase. A growth in information flows, in turn, can be expected to promote increased arbitrage and enhance market efficiency. These are socially desirable developments, for well-functioning markets themselves generate useful information concerning prices, quantities, and qualities of goods. Again, there is no necessary private-sector bias here. The information that more efficient markets produce can aid decision-makers in the public as well as in the private sector.

The impact of increased information on the functioning of markets are more far-reaching than might initially be assumed. Research in the economics of information has noted that the very existence of markets in many activities cannot be taken for granted.[23] That is, markets--with their pervasive resource-allocational and promotional effects--are of themselves a special institution whose emergence depends, inter alia, on relative prices. Two

conditions are among the key determinants of whether or not markets emerge in specific activities: the costs of acquiring information and the costs of negotiating transactions.[24] These are precisely the costs that modern telecommunications technology reduces. Hence, it seems clear that telecommunications expansion aids the spread of markets. Note, moreover, that two distinct cost phenomena are invoved. Lower costs for acquiring information reduce the fixed-cost hurdle that must be overcome if a market for a given product or input is to emerge at all.[25] In addition, better communications and lower transactions costs reduce the variable costs of market participation and operation. The latter condition, in turn, facilitates the incorporation of more participants--both geographically and over a larger range of activities with diverse opportunity costs. Consequently prices are likely to become informationally more efficient, reducing quasi-rents and resource misallocation.

Our discussion of this subject has thus far been in <u>a priori</u> terms. Empirical verification of these hypotheses requires a consideration of economic history, for the changes we have discussed are by their nature structural and medium-term in nature. One historical study available has considered the impact of the transatlantic telegraph on international financial markets during the nineteenth century.[26] The advent of improved communications did in fact lead to a narrowing in price variance and increased market efficiency. Similarly, in the United States during the nineteenth century, the rapid spread of telegraphy was due largely to business demand.[27] Important conditions underlying this demand were "certainty in the transmission of intelligence," and the "enormous benefits of instantaneous communications." And a major source of demand for telegraphic messages was the transmission of information concerning prices.

changes reduced the uncertainties that surround economic decision-making in the nineteenth-century United States. The fall in the cost of transmitting information concerning prices also facilitated arbitrage between markets. Market size was enlarged by the linking of economic agents who had previously been isolated. Consequently, price differentials within markets diminished, and the economy's capacity to respond to new conditions increased. These effects of telecommunications expansion come as no surprise after our earlier discussion concerning the impact of a fall in the cost of transmitting information over space and over time.

Further Discussion

In contemporary less-developed countries, the emergence of markets and their improved functioning are likely to have important welfare effects. A reduction in the dispersion of actual prices as well as in the uncertainty concerning expected prices can be expected to promote higher output levels.[28] Moreover, with the larger output evoked by greater ex ante certainty concerning prices, both consumers and producers benefit. Such non-zero-sum-game effects, in which one party's gain is not another party's loss, are rarely available in developing countries. They are at a special premium in the economic development process, which is often highly conflictive.

The gains generated by improved market efficiency may be greatest in LDC agriculture. That sector's development has in recent years been accorded a high priority in many LDC's. But for historical reasons, the domestic agricultural sector in many developing countries has suffered from an especially inadequte stock of telecommunications facilities. As a

result, information flows and market efficiency in domestic agriculture have also been poor, to the point where the pace of rural development may often have suffered. Under these conditions, investments in urban-rural and rural-rural telecommunications can increase the capacity of the domestic agricultural sector to achieve national development objectives. Similarly, the availability of more (and more timely) information can be expected to improve the functioning of factor and product markets in the urban sector of many LDC's. The scarcity of publicly-accessible telecommunications and information flows have sometimes exacerbated imperfect market conditions in the industrial sector.[29]

By reducing transmission costs, telecommunications expansion has multiple effects on the availability of information in the LDC's. As noted above, greater flows of information that is current and relevant for production, investment, and trading decisions enhances the efficiency of markets. But a two-step process is also at work. For markets (when they exist) are themselves an important mechanism for providing price signals and other information that can aid in the mobilization and rational allocation of resources. Also, as we saw earlier, lower transmission costs enlarge the market for information and thus increase the incentives to produce more information in LDC's. And as the size of the market increases, optimal scale and specialization will be more closely approached in the activities that provide diverse information services. These shifts are likely to generate an increase both in the quantity and in the quality of the information that is produced in developing countries.

A sharp reduction in the cost of transmitting information is not a panacea for all of the problems facing LDC's. For instance, an increased

flow of information and the destruction of earlier informational monopolies will not mitigate market distortions that stem from other sources. Similarly, lower transmission costs will not loosen intraorganizational infromational blocks that derive from other causes. For example, opportunistic behavior may lead individuals or sub-units purposely to impede the flow of information within their organizations.[30] And government decision-making will not impede in cases where its previous performance stemmed from a lack of "political will" rather than from the poor quality of its information and administrative processes. In such cases, increased information flows and a reduction in transactions costs are a necessary, but not a sufficient, condition for better results.

Notwithstanding these limitations, the social gains that can follow from lower informational and transactions costs should also not be minimized. Some of the externalities we have noted are indeed sufficiently widespread that they qualify as public goods. This certainly applies to improved functioning of product and of factor markets. And enhanced performance of administrative organizations is also a public good. In addition, Richard Posner has noted that many of the special institutional arrangements prevalent in underdeveloped countries stem from the pervasive uncertainty and the high transactions costs that characterize those societies.[31] This observation suggests that a fall in information costs may help facilitate some of the institutional changes that facilitate long-term economic development. More generally, the social gains we have discussed are part of what Charles P. Kindlegerger epitomized as "transformation": a society's capacity to adjust quickly and respond effectively to new problems and opportunities.[32] That capacity is a public good <u>par excellence</u>.

The effects of telecommunications expansion in promoting these externalities and public goods must be taken into account if investment allocations are decided on the basis of social benefits and costs. However, at the same time as it provides external economies in production and increases an economy's capacity for transformation, an investment project also affects inequality and the distribution of income. Social benefit-cost analysis urges the necessity of considering such effects, and we discuss them in the next section.

Effects on Inequality and the Distribution of Income

Telecommunications investment raises two separate distributional issues: the impact on the distribution of income, and the impact on equality in the access to information and communications. As regards equality of access, few generalizations can be advanced; for much depends on how the new facilities are allocated. In addition, one must be clear about the alternative situation to which one is (perhaps implicitly) comparing the equality of access that prevails following telecommunications expansion. Under premodern conditions, access to information and communications in LDC's is usually highly unequal. Hence there is no basis for assuming that the previous distribution was in any sense equitable or socially optimal. In such a context, the opening of new communications modes usually permits people outside of the upper classes to gain access to what had earlier been the exclusive preserve of groups who possess private communications networks. Thus telecommunications expansion may in fact permit more equal access to information and communication.

Social benefit-cost analysis has also emphasized the need for explicit incorporation of income-distribution considerations in investment evaluation.[33] The SBCA literature focuses on two distinct distributional issues. The first involves the interpersonal distribution of income. It proposes the use of

distributional weights to favor projects that benefit an LDC's poorer people. The second concern deals with the intertemporal distribution of income. That perspective urges procedures that would give a high priority to investments which generate a future flow of investible resources to the country's government. This condition is assumed to permit higher capital formation and socially more optimal rates of income growth.

A standard text on SBCA offers the following comments concerning the sectoral effects of applying this income-distributional approach in LDC's.[34]

> It is not possible to draw more precise conclusions about the sectoral allocation of investment that would result from the systematic use of such weights [reflecting interpersonal and intertemporal distribution of income]; but generalizations of the following kind can be made: projects that make heavy demand on scarce public funds (such as most infrastructure projects) will be justified only if they charge high prices or other user charges (thereby replenishing the government's coffers), or if they benefit the poor either through employment or price reductions. . . ."

Applied in the context of the LDC's, this approach has clear implications concerning the impact of telecommunications investments on the intertemporal distribution of income. In LDC's, telecommunications service is usually provided by the government or by a state economic corporation. Because of relative transactions and metering costs, user charges are more easily levied for telecommunications than for many other infrastructure services. Consequently, from the viewpoint of generating a continuing flow of investment resources for the government, telecommunications investments appear relatively

attractive. (More realistically, these conditions may mean that the projects in telecommunications do not impose as large a drain on government resources as do projects in many other infrastructure sectors.) The focus on user charges raises immediate questions concerning pricing policy. But within an SBCA perspective, socially-optimal pricing and investment policies are in any case interdependent.[35] Intelligent allocation decisions are aided if questions concerning pricing and operating policies are faced explicitly at the outset.

The impact of telecommunications investment on the interpersonal distribution of income is more complex. The quotation just cited mentions two major channels through which investment allocations may lead to a more equal distribution of income: employment creation, and (relative) price reductions that favor the poor. Telecommunications investment has both of these effects. First, the improved functioning of markets implies a reduction in the monopoly power that penalizes low-income people in many developing countries.[36] In addition, depending on the sectors to which the new facilities are allocated, telecommunications expansion may also generate other equalizing price effects. As is well-known, poor people in the LDC's spend a relatively large share of their incomes on food. What is relevant here is that increased availability of telecommunications promotes rural development.[37] In particular, telecommunications expansion is likely to accelerate the rate at which new, more-productive techniques are diffused among agricultural producers.[38] Even if these farm operators are mainly middle- and upper-income people, the expansion of telecommunications facilitates may benefit an LDC's poorer people. This is because the diffusion of more-productive technology lowers the relative price of food, with its large weight in low-income budgets. Another process engendered by telecommunications expansion can reinforce this outcome. Agriculture marketing in the LDC's is often relatively inefficient and imperfectly competitive. The opening of new communications

communications channel, however, facilitates the spead of more efficient and more competitive networks for the marketing of agricultural products. And a reduction in the costs and distortions present in the distribution system will also lower the relative price of food.

Telecommunications expansion may also increase equality of access to other goods (see below). In particular, telecommunications investment can make available to low-income people certain goods that upper-income people in the LDC's take for granted, but which, with premodern transmission modes, are too costly for the poor. Allocation policies that emphasize public telephone facilities can have important welfare effects in the LDC's. A survey of the use that villages made of public pay-telephones installed in rural Costa Rica presents some interesting results in this context.[39] The survey showed that by far the major reason for which calls were made was "personal" -- to maintain contact with family and friends who had emigrated from their native villages. Such personal communications may increase the efficiency of migration, production, and marketing decisions, and thus have economic effects too. But the wider availability of modern telecommunications also facilitates the continuation of ties among people whose poverty would otherwise have precluded maintaining social links over long distances. Social benefit-cost analysts may not be able to obtain prices for valuing the maintenance of personal and social ties. Nevertheless, the private (and social) value of such links in contemporary LDC's may be great. These countries are often characterized by rapid rural-to-urban migration and social fragmentation.

This discussion suggests a further point concerning interpersonal income-distribution effects. Telecommunications permits the transmission of interpersonal messages without physically transporting the individuals

involved.[40] Consequently, expanded investment in telecommunications may facilitate administrative and economic decentralization. Centralized management control requires good communications. But for this very reason, effective communications also permit functional and/or administrative decentralization. Better telecommunications on a national scale may thus make possible a pattern of development that is geographically more dispersed, and in which comparative advantage in diverse regions can be given greater scope. Such considerations apply both between regions and as regards urban conurbations that may be excessively congested from a social viewpoint.

These possibilities are attractive because part of the variance in the interpersonal distribution of income in LDC's reflects geographical disparities. Moreover, once such inequalities over space emerge, they show a strong tendency to persist. Hence, the availability of an investment that can help check the agglomeration of geographical inequalities may be especially welcome to LDC policymakers. Again, the effects are not limited to one type of organization. Telecommunications expansion facilitates decentralization both in public and in private-sector activities.

Finally, telecommunications expansion can also be expected to increase employment in LDC's. The high capital-labor coefficients typical in telecommunications projects mean that the number of people directly employed in a project is relatively small. But as noted earlier, under LDC conditions, greater availability of telecommunications is likely to improve the performance of product and factor markets. Output and investment, in turn, are likely to increase in response to new opportunities and diminished uncertainties. And in the conditions prevalent in the developing countries, higher output and capital formation usually generate higher employment.[41]

Further, improved information flows and decision-making processes may also stimulate additional supplies of capital. As is well-known, capital-market imperfections in the LDC's often separate potential savers from investors. Consequently, increased availability of information that opens new investment opportunities to individuals, corporations, and state entities are likely to raise rates of domestic saving and capital formation. The distributional implications of this discussion are straightforward. A major cause of the unequal distribution of income in the LDC's is the low income of the people who are either underemployed or unemployed. Hence the higher employment that comes with higher investment and output levels leads to a more equal interpersonal distribution of income.

Our discussion of distributional effects has focused on the employment, relative-price, and income consequences of telecommunications expansion. These effects on the distribution of income in LDC's are no less important for being indirect. In a SBCA perspective, these effects are pertinent even if they occur as "second-order" consequences; indeed, even if the individuals who benefit from telecommunications expansion do not themselves use the newly-installed equipment. This point is obvious in a discussion that necessarily includes externalities. I mention it only because some perspectives on telecommunications' income-distributional effects have identified the beneficiaries exclusively as the narrow stratum of people who are the subscribers to a new project's facilities.[42]

Uncertainty

The preceding discussion suggests that from an SBCA viewpoint, telecommunications expansion in developing countries has some attractive features. This conclusion is reinforced if, in accordance within the SBCA framework, we consider ex ante uncertainty concerning an investment's future benefits and costs.[43] Such an assessment is of particular importance for project selection in the developing countries because of the random shocks to which the LDC's are often subject.

These shocks stem from different sources: economic changes that originate from abroad; internal political or policy shifts; and/or unexpected weather conditions in economies whose production and consumption depend heavily on agriculture. Whatever their source, such random shocks can rarely be avoided. This instability, however, adds special uncertainty to the returns that can be expected from investments in developing countries. Furthermore, the difficulties which confront investment planners in the LDC's are aggravated because the ratio of pure uncertainty to risk is probably greater than in the economically-advanced countries. Consequently, standard decision techniques which utilize probability analysis for ex ante investment assessment are less helpful in the LDC's. In addition, the impact of uncertainty on ex post investment results in the developing countries is to some extent asymmetrical. The effects of unexpectedly favorable shifts in demand are limited by sectoral capacity constraints. Similarly, rigidities in domestic demand constrain the gains that might otherwise accrue from unexpectedly favorable supply shifts in specific markets. By contrast, the social losses inflicted by unexpectedly unfavorable changes in supply or in demand are not so easily bounded.

Such cases involve, for example, the port facilities built to serve an export boom which failed to materialize. Or if domestic income and demand do not grow at the pace originally anticipated, factories installed to supply the domestic market with specific products may operate with low utilization rates. By the same token, if the supply of imported intermediate goods should unexpectedly slacken, investments in the activities that use those inputs will show low ex post social rates of return. These examples point to two key features of the uncertainty problem for investment choice in developing countries. First, the instability that affects future benefits and costs may be either systemic or sectoral. Also, the problem is not instability per se; but rather instability combined with a high degree of specificity in interindustry supply and demand patterns. These conditions put a special premium on investments in activities whose output is relatively flexible and/or general in its use. What is relevant in the present context is that telecommunications offers special advantages on both scores.

Compared with many other investments in LDC's, telecommunications projects have a high degree of generality in the sectors they supply. Equipment is not highly specific to demand from individual client sectors. And if random shocks favor activity A at the expense of activity B, the country's telecommunications facilities may be almost as well-suited to supply A as B. This feature means that the social returns of telecommunications projects are relatively insensitive to random shocks. Although such projects have high fixed costs, these costs are not sunk in any particular activity.[44] Should unexpected contingencies arise, the assets are salvageable in other lines. Because much of the equipment installed to

provide service for one activity may ex post transmit messages for very different activities, the losses imposed by sectoral uncertainty are mitigated in the case of telecommunications investments.

In addition, the demand for telecommunications is relatively unaffected either by systemic shocks or by upward or downward movements within individual sectors. This because of a special feature in the relation between "news" and decision-making: many production, trading, and investment decisions require the transmission of information concerning new developments regardless of whether the new developments are favorable or unfavorable. It may be as economic to transfer fresh information concerning adverse market shifts as it is to send messages with favorable news.[45] Consequently, the impact of systemic instability and sectoral shocks on the demand for telecommunications (and on ex post returns) are also reduced in the case of this sector. Thus if we attempt to take into account the special problems that uncertainty poses for investment choice in developing countries, telecommunications also appears relatively attractive.

Some Negatives

Some socially negative effects may also be associated with telecommunications expansion in LDC's. The possibility of conveying messages more cheaply may increase the amount of false information transmitted, with socially pernicious effects. For example, some observers have suggested that radio and television have facilitated the transmission that mislead LDC peasants into thinking all is well in the city, and thus stimulate excessive rural-urban migration. As a result, aggregate social welfare may be reduced rather than increased.

This possibility of increased misinformation applies more to one-way communications media (like radio and television) than to the two-way media (like telephones) on which this paper has focused. Thus in the example given, telephone calls to (or from) potential migrants can dispel the false impressions that one-way media may have created. As this case indicates, the misinformation problem may sometimes be self-correcting. Opening new channels of communication facilitates a flow of additional information that can correct earlier inaccuracies. And, again, one must specify accurately the alternative situation with which one is comparing the supply of misinformation following the growth of modern telecommunications. Premodern communications channels convey false messages, too. In addition, it is difficult to see why the absolute sum of the supply and demand price elasticities should be higher for false than for true messages. Hence there seems to be no a priori basis for presuming that modern telecommunications reduce the ratio of true to false messages. Further, as noted earlier, telecommunications expansion generally involves the opening of additional (and comeptitive) channels of information. This feature may indeed increase the ratio of accurate to false information that is accepted.

Another potential cost of modern telecommunications must also be considered. Our discussion thus far has focused on the effects of telecommunications in lowering the relative price of information, with information treated as a composite good. We have abstracted from the fact that the introduction of modern transmissions networks also alters the relative price of different types of information. In reality, the relative price of information of the sort that permits easy imitation probably falls more than does the price of information that requires sustained thought and analysis.[46] As with any alteration in relative prices, these changes affect the opportunity

set, the mix of goods produced and consumed, and the techniques used to produce them. Since this internal relative-price shift occurs in the midst of a general decline in information costs, it seems unlikely that the net welfare change is negative.

By their nature, the effects noted in this section do not lend themselves to a conclusive treatment. My own assessment is that they do not outweigh the positive effects discussed earlier.

Conclusions

This paper has discussed some of the welfare consequences of telecommunications expansion in developing countries. Following the conceptual framework of social benefit-cost analysis, we have considered telecommunications investment in terms of ex ante uncertainty, income-distribution effects, and external economies.

Our discussion has focused on aspects of LDC's that are not always emphasized: their high information and transactions costs. In that context, the impact of modern communications technology in lowering the costs of transmitting information over time and over space is of special importance. By reducing transaction and information costs, telecommunications expansion can have far-reaching effects on economic development. In particular, lower transaction costs and reduced uncertainty can increase the efficiency both of markets and of administrative organizations. The prospect of improved performance in these two sets of institutions should not be taken lightly. They are the major mechanisms for resource mobilization and factor allocation in the development process. Consequently, the welfare effects of telecommunications expansion include publi-good aspects, notably in enhanced capacity to respond to new problems and opportunities. A fall in the costs of obtaining

accurate and timely knowledge is particularly important in the LDC's because uncertainty is often pervasive in these economies. And as noted earlier, both the quantity and the quality of the information produced in the LDC's has probably been reduced by the high cost of premodern modes of transmission.

Much of our discussion has involved the application of familiar concepts from the economics of information to a field where these ideas have not yet penetrated widely--the economics of development. The fact that the rapidly growing body of research in the economics of information has not yet had much impact in development economics reflects the often-remarked compartmentalization that has occurred within economics. As such, this experience highlights the need for intellectual arbitrage between sub-disciplines within economics. The need for such arbitrage is especially great in a field like development, which necessarily includes many sub-areas within its purview.

Finally, this paper also has implications for recent work in social benefit-cost analysis and investment choice in developing countires. One conclusion seems clear from our overall discussion. Primarily because of its externalities and inter-activity effects, within an SBCA framework the telecommunications sector seems a relatively attractive candidate for expansion in many LDC's. It may therefore come as a surprise to learn that public investment decisions in many LDC's have followed a very different pattern of resource allocation. In fact, telecommunications expansion seems to have proceeded at socially suboptimal rates in numerous developing counties.[47]

The reasons for this particular allocation pattern derive from the intellectual shift noted at the beginning of this paper. As the subject of social benefit-cost analysis for investment choice in LDC's has evolved in recent decades, formal and informal SBCA have moved away from the early emphasis on externalities. The case we have discussed suggests that this intellectual shift has important consequences for investment choice in developing countries. If investment allocations do not take cognizance of external economies they will obviously accord a low priority to projects whose income-creation and income-distribution effects accrue largely as externalities. The present case illustrates this result. In a perspective of SBCA sans externalities, telecommunications has typically been viewed as a consumer rather than a producer good, and one with unequalizing rather than equalizing distributional effects.[48]

There is no necessary reason for the newer concerns of social benefit-cost analysis to "crowd out" the older ones. Full SBCA, including externalities, is the technique that in principle should be used for investment choice in developing countries. Applying that technique may require further work to make the concept of externalities operational. The question of how full SBCA has been implemented by international agencies that are committed to its use is of obvious relevance in this context. But that question requires another paper.[49]

FOOTNOTES

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1. Paul N. Rosenstein-Rodan, "Problems of Industrialisation of East and Southeastern Europe," The Economic Journal 53 (June, 1943); Albert O. Hirschman, The Strategy of Economic Development (New Haven: Yale University Press, 1958), Chapters 5-6.

2. See, e.g., I.M.D. Little and J. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, vol. II (Paris: OECD, 1968); UNIDO (P. Dasgupta, A.K, Sen, and S. Marglin), Guidelines for Project Evaluation (New York: United Nations, 1972): Arnold C. Harberger, Project Evaluation (Chicago 1973); S. Reutlinger, Techniques for Project Appraisal Under Uncertainty (Baltimore: Johns Hopkins University Press, 1970, third printing, 1976); L. Squire and H. van der Tak, Economic Analysis of Projects (Baltimore: Johns Hopkins University press, 1975, fourth printing, 1981) F.L.C.H. Helmers, Project Planning and Income Distribution (Rotterdam, 1979).

3. On this point, see Albert Hirschman's discussion in Chapter 5 of his Development Projects Observed (Washington: The Brookings Institution, 1967). The chapter is entitled "The Centrality of Side Effects."

4. This shift has also been noted by Janos Kornai in his critique of recent work in SBCA. See his "Appraisal of Project Appraisal" in Michael Boskin (ed.), Economics and Human Welfare: Essays in Honor of Tibor Scitovsky (New York: Academic Press, 1979), p. 86.

5. We focus on telephones rather than on other forms of telecommunications (e.g., radio or teleprinters) because telephone clearly dominates those alternatives for the uses considered in this paper (see below). For example, unlike the situation in teleprinters, telephone users need not be literate. This feature confers a substantial advantage in many developing countries. Further, in contrast with telephones permit interactive (rather than one-way) communication. The advantages in terms of the turn-around time for information used in decision-making, negotiation, and feedback processes are considerable.

6. The literature in that field has been surveyed in J. Hirschleifer and John G. Riley, "The Analytics of Uncertainty and Information: An Expository Survey," Journal of Economic Literature XVII (Dec., 1979).

7. This paper focuses on the domestic effects of telecommunications expansion in developing countries. The international consequences of telecommunications expansion raise a different set of issues. For a perspective on those issues, see Rita Cruise O'Brien and G.K. Helleiner, "The Political Economy of Information in a Changing International Economic Order," International Organization (Autumn, 1980).

8. Arthur Hazlewood, "Optimum Pricing as Applied to Telephone Service," Review of Economic Studes 18 (Sept., 1950), as reprinted in Ralph Turvey (ed.) Public Enterprise: Selected Readings (Hammondsworth, 1968), especially pp. 254-255 there, See also Lyn Squire, "Some Aspects of Optimal Pricing for Telecommunications," The Bell Journal of Economics and Management Science, (Autumn 1973), pp. 515-525.

9. The United States, Sweden, Switzerland, Canada, and New Zealand all have more than 50 telephones per 100 population. By contrast, LDC's generally have fewer than 5 telephones per 100 population. This information is from Robert J. Saunders,"Telecommunications in Developing Countries: Constraints on Development," in M. Jussawalla and D.M. Lamberton (eds.), Communication Economics and Development (New York: Pergamon Press, 1982), p. 190.

10. These two effects can be integrated in one concept. But for analytical purposes, it is useful to distinguish between the time costs and the other costs which are saved in transmitting information via modern telecommunications.

11. Harvey Leibenstein, "Entrepreneurship and Development," American Economic Review 58 (May 1968), p. 77.

12. Clifford Geertz, "The Bazaar Economy: Information and Search in Peasant Marketing," American Economic Review p. 29. Geertz indicates (loc. cit.) that he considers these features as general and prototypical of many less-developed economies (he describes these as economies which are neither "primitive" nor "industrial"). In addition, Geertz makes it clear that the conditions cited are not limited to bazaars or to peasant marketing.

13. Geertz, "The Bazaar Economy," p. 30.

14. I use these terms in the sense explicated by Frank H. Knight, Risk, Uncertainty, and Profit (Boston: Houghton Mifflin, 1921).

15. Thomas C. Schelling has noted aspects of this phenomenon, albeit in different terms. See his Micromotives and Macrobehavior (New York: Norton, 1978), p. 47. In a discussion of "telephoning" he observes: "One call leads to another. It may lead to a return call; or somebody learns something worth passing on; or a call initiates some business."

16. World Bank, Fourth Annual Review of Project Performance Audit Results (Washington, November, 1978), p. 43.

17. Harvey Leibenstein, General X-Efficiency Theory and Economic Development (New York: Oxford University Press, 1978), pp. 37-38, presents a general theoretical perspective that indicates the importance of the conditions discussed below.

18. After an earlier draft of this paper was written, I learned that some of the ideas presented in these paragraphs have also been discussed in Andrew P. Hardy, "The Role of the Telephone in Economic Development" Telecommunications Policy (Dec., 1980), p. 279, p. 283. See also B. Wellenius, "Telecommunications in Developing Countries," Telecommunications Policy (Sept. 1977).

19. R. C. Repetto, Time in India's Development Programmes (Cambridge, Mass., 1971), especially chapters 1-2.

20. Albert O. Hirschman, The Strategy of Economic Development, pp. 24-28 .

21. S. A. Lippman and J. J. McCall, "The Economics of Job Search" Economic Inquiry 14 (Sept. 1976) 347-368.

22. See, e.g., George Akerlof, "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," Quarterly Journal of Economics 84 (Aug., 1970); and Jack Hirschleifer, "Exchange Theory: The Missing Chapter," Western Economic Journal (June 1973).

23. R. W. Clower (ed.), Monetary Theory (Harmondsworth, 1969), "Introduction" pp. 8-14. Similarly, but from a very different perspective, see Y. Ben-Porath, "The F-Connection: Families, Friends, and Firms and the Organization of Exchange," Population and Development Review 6 (March 1980).

24. Thus Albert Hirschman has noted that following the expansion of the long-distance telephone network in Ethiopia, a credit market for the coffee trade emerged in that country. See his Development Projects Observed, pp. 131-132.

25. K. D. Garbade and William L. Silber, "Technology, Communication, and the Performance of Financial Markets, 1840-1975" The Journal of Finance 33 (June, 1978), pp. 819-832.

26. On what follows in this paragraph, see R. B. DuBoff, "Business Demand and the Development of the Telegraph in the United States, 1844-1860," Business History Review (Winter 1980), pp. 461-477.

27. For a general discussion of the economic impact of information on market performance, see Michael Rothschild, "Models of Market Organization with Imperfect Information: A Survey," Journal of Political Economy 81 (Nov., 1973).

28. Nathaniel H. Leff, "Industrial Organization and Entrepreneurship in the Developing Countries: The Economic Groups," Economic Development and Cultural Change, (July, 1978).

29. See, e.g., Anthony Downs, Inside Bureaucracy (Boston, 1967) on such phenomena which lead to "control loss."

30. For a careful elaboration of this point, see Richard A. Posner, "A Theory of Primitive Society with Special Reference to Law," The Journal of Law and Economics XXIII (April, 1980).

31. Charles P. Kindleberger, Economic Development (New York, 1965), Chapter 10.

32. See, for example, Squire and Tak, Economic Analysis of Projects, 50 ff.

33. Squire and Tak, Economic Analysis of Projects, p. 75.

34. See, for example, W. G. Shepherd, "Residential Telephone Service in Britain," The Journal of Industrial Economics 14 (June, 1966). More generally, operating policies during a project's lifetime affect the magnitude of future benefits and costs. Consequently, (implicit) decisions concerning operating policies cannot in practice be avoided in ex ante social benefit-cost analysis. On this point, see I. Heggie, "Practical Problems of Implementing Accounting Prices: in I. M. D. Little and M. Scott (eds.), Using Shadow Prices (London, 1976).

35. On these effects see Nathaniel H. Leff, "'Monopoly Capitalism' and Public Policy in the Developing Countries," Kyklos (Autumn, 1979). Incomplete information flows are of course only one factor in the formation and persistence of such patterns of market power in the developing countries.

36. Emile McAnany (ed.), Communications: The Rural Third World (New York: Praeger, 1979).

37. Everett M. Rogers and Lynne Svenning, Modernization among Peasants: The Impact of Communication (New York, 1969). A two-step process may be involved here. Social interaction facilitated by the telephone may make farm operators aware of the existence and successful performance of more-productive agricultural techniques. The telephone may also be used to obtain information on how to gain access to the new techniques. However, other means of communications may be used to secure instruction in the use of the new techniques.

38. Robert J. Saunders and Jeremy Warford, "Telecommunications Pricing and Investment in Developing Countries" (Atlanta: Telecommunication Exposition, 1977), p. 2.

39. See also the results of a survey made on the reasons for long-distance bus travel in Nigeria. A major reason was the need to acquire or transmit information. This survey is reported in J. D. Howe, "Valuing Time Savings in Developing Countries," Journal of Transport Economics and Policy X (May, 1976), p. 117.

40. On what follows in this paragraph, see William R. Cline, "Distribution and Development: A Survey," Journal of Development Economics 1 (Dec., 1975) especially pp. 387-390. Cline demonstrates that even with capital-labor substitution, higher output is likely to generate higher employment in LDC conditions. In addition, higher output leads to accelerator pressures on capital formation. Concerning the impact of a larger capital stock on employment in the LDC's, see R. S. Eckaus, "The Factor Proportions Problem in Under-developed Areas," American Economic Review (Sept., 1955).

41. Despite its inaccuracy, the perspective cited in the text seems to have influenced allocation decisions within developing countries. Cf. the following statements by an experienced observer attempting to explain why national planning authorities in LDC's often given low priority to investment in telecommunications.

> Among the more serious reasons for the . . . low rate of investment . . . A perception that telecommunications investments, while profitable in a financial sense, confer direct benefits only upon a relatively narrow--and privileged--sector of the . . . community. . . ."

This is from Saunders, "Telecommunications in Developing Countries." Dr. Saunders heads the division within the World Bank which deals with telecommunications projects. His paper is preceded by a disclaimer stating that the paper does not necessarily reflect the views of the World Bank.

42. See, e.g., Reutlinger, Techniques for Project Appraisal Under Uncertainty.

43. On this distinction between "fixed" and "sunk" costs, see B. Klein and K. B. Leffler, "The Role of Market Forces in Assuring Contractual Performance," Journal of Political Economy (Aug., 1981), p. 619.

44. Thus, following the onset of the Great Depression in the United States, the number of telephone calls rose sharply. It was not until 1931 that the income effect led to a reduction in the total number of calls made. See John Brooks, Telephone (New York, 1976), pp. 187-188.

45. This was first pointed out to me by Raymond Vernon.

46. Evidence on this point is presented in Saunders, "Telecommunications in Developing Countries," pp. 191-192.

47. See, e.g., n. 41, above.

48. Nathaniel H. Leff, "The Use of Policy Science Tools in Public-Sector Management: Social Benefit-Cost Analysis in the World Bank" (mimeo, 1982).