ROUNDTABLE DISCUSSION
Critical Issues in Infrastructure in Developing Countries

The panelists for this roundtable discussion were Bruno Philippi, president of Chilever S.A.; Karen R. Polenske, professor of regional political economy and planning, Department of Urban Studies and Planning, Massachusetts Institute of Technology; Everett J. Santos, director, Department of Investments and Infrastructure, International Finance Corporation; and Clifford Winston, senior fellow at the Brookings Institution. Karen Polenske's paper is based on an earlier study by Polenske and Nicolas O. Rockler. The moderator was Gregory Ingram, editor of World Development Report 1994, which will focus on infrastructure.

Bruno Philippi

In the broadest sense, infrastructure can be defined as the resources necessary for the creation and operation of a given organization. In developing countries infrastructure has primarily been associated with public works and services. Responsibility for the implementation and management of these investments has been reserved almost exclusively for the state, which in turn has allocated substantial financial and human resources to state-owned companies or to centralized bureaucratic organizations entrusted with the development and operation of a given sector of the economy.

This preference implies the postponement of investments in infrastructure for human capital development in such sectors as education, health care, and housing, which are essential for real and sustained growth. The focus on public works is attributable to the lobbying power of state-owned companies and government officials. Construction projects and purchases of equipment often generate immediate political rewards and influence economic activity in a way...
that investments in health care and education do not. The results of the latter
investments become visible only after a period that exceeds the typical electoral
timetable.

This preference for the short term is frequently reinforced by subcontractors
or end-users in the private sector who take advantage of subsidized infrastruc-
ture and services to artificially improve their competitive advantage. In addition,
strong labor unions in state-owned enterprises push for increased benefits and
privileges, evoking nationalist sentiments to disguise their real interests. Finally,
the lack of transparency in contract bidding frequently permits officials to award
contracts on the basis of personal or political influence rather than according to
social or economic criteria.

The concept that the "strategic" importance of infrastructure investments
justifies public funding effectively excludes the private sector. Arbitrary and
restrictive legal norms, price and tariff controls, the huge costs involved, and the
absence of a transparent, stable regulatory framework also hinder participation
by the private sector, which has typically been limited to investment in less
capital-intensive activities. In these areas private interests may gain access to
healthy profit margins regulated according to intricate accounting criteria formu-
lated by specially created "tariff commissions."

To solve these problems requires a completely different approach. What is
needed is an institutional structure that can guarantee the efficient allocation of
resources and shift the responsibility for the nation's development to the private
sector. This outcome implies a competitive environment in which the market
and prices play central roles. Clear, nondiscriminatory, stable, and effective
regulations are required for natural monopolies. Deep capital markets that are
well integrated into the international financial community are also essential. The
recipe appears to be simple, but in fact implementation requires explicit long-
term objectives, as well as strong political will and determination. Unfor-
unately, these ingredients are often scarce or absent.

Chile's experience with energy infrastructure is a good example of how the
state can harness natural market forces and develop the necessary regulatory
structure. In the late 1970s, 90 percent of Chile's electricity-generating capacity
and 80 percent of its electric power distribution network were government
controlled. These activities were concentrated in two large, vertically integrated
state-owned companies the administration of which was oriented more toward
technical than toward economic considerations. Moreover, there was a signifi-
cant political bias in industry-related decisions—a reflection of efforts aimed
at short-term income redistribution based on economic conditions, in a confu-
sion of objectives and instruments. Prices of electricity were distorted by sub-
sidies that, coupled with limitations on access to and use of energy resources,
barred the entry of new competitors, whether state or private. Financing for
new projects was obtained through direct fiscal contributions backed by gov-
ernment guarantees that were available without cost solely to state-owned
firms. Because the state lacked an organizational structure capable of effectively
supervising the operations, firms generally acquired a certain degree of management independence. Thus the state approved development plans that, for the most part, called for new investments aimed at ensuring steady work for the firms’ engineering and construction departments. These development plans did not necessarily support Chile’s long-term national interests. All too often, expensive technology was commissioned and environmental issues were ignored.

To correct these difficulties, new legislation enacted in 1982 established an explicit regulatory framework for the electric power industry. Prices were freed in segments in which the market was functional (that is, for large clients), and marginal cost pricing was established where natural monopolies existed. An important component of this program called for splitting state-owned monopolies into separate companies to generate and distribute power. The necessary conditions for use of common transmission lines were created. Long-term planning was undertaken for large projects, and a system of rights and responsibilities for distribution firms was clearly established. In addition, an effective regulatory and normative role for the state was defined with the creation of the National Energy Commission, a body that is independent from production, construction, and marketing decisions. In a relatively short period of time this new institutional framework improved efficiency and led to changes in the administration of state-owned companies. The achievement of technical and financial success made it possible to attract private investors. At present, 88 percent of the electricity-generating capacity is held by private firms, and about 98 percent of electric distribution facilities is privately owned. Furthermore, the companies have undertaken to finance and build the infrastructure for Chile’s electrical expansion program (which will cost about $400 million a year) without state guarantees or contributions.

Perhaps the most interesting aspect of this experience is the confirmation that an institutional framework in which the state limits its regulatory role to the dictates of the market system is congruent with long-term private investment. Private sector participation contributes to the consolidation and stabilization of strong, competitive capital markets, which in turn provide access to substantial local resources. The experience with a marginal-cost-pricing criterion for electricity has been used in designing similar systems for other services, such as water, sewerage systems, and telecommunications. The evidence derived from more than ten years of operational experience in Chile under this new model has inspired similar transformations throughout the region.

Just a few years ago all this seemed quite impossible. The lesson is simple: if we reduce the size of the state and establish clear, stable, nondiscriminatory rules within a framework of competition and economic freedom, perhaps the critical issues in infrastructure in developing countries can be more easily resolved. Thus the state will be in a position to focus its development activities on enhancement of human capital, which is undoubtedly the only effective means of overcoming poverty once and for all.

Roundtable Discussion
Investment in public infrastructure has long been integral to planning for national and regional economic development. Economists—even those disposed to minimizing government intervention in markets—have generally accepted the need for some form of participation by the public sector, either as owner or as regulator, in providing infrastructure, largely because monopoly profits and increasing returns are likely to be present. A new argument favoring public expenditure on infrastructure is that the generation of infrastructure services stimulates increases in private sector productivity, which have long been deemed essential for fostering and maintaining economic growth. We review here the main issues that need to be analyzed in determining the relationship between the provision of public infrastructure and productivity.

The literature on the relationship between regional economic performance and public infrastructure expenditures is inconclusive. U.S. analysts who have found a positive relationship include Garcia-Mila and McGuire (1987), Aschauer (1989, 1990), Munnell (1990a, 1990b, 1992), Nadiri and Mamuneas (1991), Lynde and Richmond (1992), and Morrison and Schwartz (1992). Snickars (1989), Johansson (1991), and Berndt and Hansson (1992) obtained similar findings for Sweden. Other analysts, notably Aaron (1990), Winston (1991), Duffy-Deno and Eberts (1991), and Holtz-Eakin (1992), contend that the data and methods applied in the “pro-infrastructure” analyses are flawed and that after correcting for the defects, only a very small role, if any, can be attributed to infrastructure in enhancing private productivity. Furthermore, Aaron (1990) and Easterly and Rebelo (1993) call into question the direction of causality and the nature of the linkages. Munnell (1990b) and Nadiri and Mamuneas (1991) find that public infrastructure is a substitute for private capital, while Eberts (1986) and Berndt and Hansson (1992) argue that it is complementary. That competent researchers draw opposite conclusions is a fair indication that the opportunities for research on this topic are far from exhausted. Little is known about the important physical and financial linkages of infrastructure with the rest of the economy (Israel 1992).

A review of the empirical research shows that in different places and at different times the productivity effects of public investment range from negative to positive and from small to large and that causality can work in either direction. At present, theory provides little guidance regarding the possible outcomes, particularly as development progresses and both public and private capital stocks increase in size and breadth.

Three critical issues will affect further research into the relationship between investments in public infrastructure and changes in productivity. These issues, which largely concern analysts in industrial economies but have applications for developing countries as well, include:

- The development of clearly stated theoretical expectations concerning the economic impact of public investment, particularly within a regional frame-
work, as an aid to development planning that will lead to the design and testing of improved models for gauging the productivity of public investment

- The improvement of data used in empirical research, particularly regarding infrastructure service lives, depreciation, and the role of maintenance and repair activity in the growth of net capital stock
- The changing institutional arrangements that affect public investment; examples are property rights and, especially, the current emphasis on privatization.

Theoretical Developments

Because of the paucity of data on the stock of public capital, most analysts treat infrastructure as a homogenous good, largely ignoring its technological characteristics, service life, and spatial economic context. Infrastructure, however, is not homogenous, and we can reasonably expect that its provision will generate a range of outcomes with respect to economic development. For developed countries analysts need to restate the disparate theoretical treatments on this subject in a cohesive fashion, as was done by Youngson (1967) for developing countries. In both cases we must be prepared to abandon the notion that investment in infrastructure represents intrinsic development potential.

Early research by the European Economic Community (EEC) and others (EEC 1982; Lee 1982; Mera 1984) directly introduced a public goods or stock-of-infrastructure variable into the production function of a city or firm. The EEC analysts sidestep the issue of the exact role of infrastructure, stressing the “complementarity between regional economic growth and infrastructure” (EEC 1982, p. 32). They use a regional-development-potential approach, differentiating mobile from nonmobile inputs (Azad and Jacobs 1986).

In developed economies, and increasingly in developing economies, a significant proportion of public infrastructure investment goes toward replacement of obsolete facilities or expansion of existing capacity in order to alleviate bottlenecks (Currea and Polenske 1985; Gakenheimer 1989). Such investment in response to a supply shortfall has a significantly different effect on economic development from that of new investment: as Batten (1989) notes, new investment is plagued by large uncertainties about the level of demand for infrastructure services, with sizable risks of over- or underprovision. Expectations of productivity gains also depend on factors other than demand, such as the type of infrastructure, the degree of congestion (whether nodal or systemwide), the rate of growth of demand, the state of technology, and the rate of technological change. These factors may have a significant influence on productivity and need to be incorporated into a theoretical framework of analysis.

Analysts studying productivity generally use either an aggregate production function or a cost function. In the production-function approach output is a function of factor inputs; most analysts use public capital, private capital, and labor as the basic input measures. The estimated coefficients of the logarithmic
transformation indicate factor productivities, with a constant term representing total factor productivity. Because the value of capital services is difficult to estimate, the value of capital stocks is used as a proxy, with the explicit assumption that this value is proportional to the flow of services.

In the cost-function approach the cost of aggregate output is a function of factor-input prices and quantities, output quantities, and the level of technology. Capital stocks are used as a proxy for the capital services input, and labor input is measured as the number of employees (with the cost given by the wage bill), as in the aggregate production function. Gross product measures are used for output measurement. Some researchers include other inputs, such as energy. Morrison and Schwartz (1992) argue that this approach is preferable because it permits the endogenous determination of infrastructure quantities conditioned by variations in costs of other factors and scale effects.

I would argue that the structure of the models tested thus far is too aggregate for analytic benefit and should be extended to include—at the least—land, types of labor input, and regional data. To my knowledge, no attempts have been made to include land (developed versus undeveloped) in the model formulation, although many investments in transport and certain other sectors are clearly intended to raise the productivity of land in the short run, as well as that of other factors over a longer time horizon. I would also like to see some differentiation of the types of labor inputs affected by investment, as suggested by Snickars (1989). At a minimum, analysts should distinguish between skilled and unskilled labor as a useful means of gauging the distributional impacts of public investment.

Finally, more analyses need to be conducted at the regional level within countries. It is difficult to determine the effects of productivity from international comparisons because of the myriad of institutional arrangements for financing, forms of ownership, and regulation, as well as the simple currency and value conversions that have to be made. A detailed regional analysis of a sufficiently large country offers the variation needed to develop more conclusive outcomes from the model estimates.

Data Requirements

Recently analysts have conducted research using estimates of U.S. capital stock for the past twenty to thirty years prepared by the Bureau of Economic Analysis. For the most part the estimated regional capital stocks are obtained by distributing national estimates in proportion to another factor, such as cumulative gross investment, over a time interval. The analysts estimate national net capital stocks using the perpetual inventory method (U.S. Bureau of Labor Statistics 1979), in which gross investment is adjusted by some depreciation rate.

Unfortunately, analysts often do not reestimate or maintain these depreciation rates, which are generally taken from service lives used for taxation purposes. Furthermore, virtually nothing is empirically known about depreciation.
rates for public infrastructure except that such investments are generally long-lived (their design life is often used to develop a discard function). Apart from all the other problems evident in the development of capital stock figures, analysts' failure to apply true rates of depreciation estimated for different regions is likely to bias critically all the results obtained thus far and may explain, at least partially, contradictory or unexplained results. This is especially true for regions that have undergone development at different times and under the influence of different technologies.

Blades (1990) points out that empirically estimated depreciation rates have changed significantly over time and in an uneven fashion for different industries. It is also clear from Frenken (1992) that depreciation rates based on observed rather than estimated stocks differ greatly from one another. One reason for such variation may be expenditures on maintenance and repair, the rate of which may vary as the fiscal behavior of a region is differentially affected by long-run secular growth rates and short-run cyclical pressures. This all seems to point to the need for analysts to assemble new measures of depreciation of public infrastructure that include the net effect of such factors.

**Institutional Changes**

During the past decade dramatic changes have occurred in the institutional arrangements for financing, managing, and maintaining infrastructure; the most prominent example is privatization (Roth 1987; Gomez-Ibanez and Meyer 1992). Analysts are exploring the “bundle of property rights” (the rights to own, develop, transfer, manage, inherit, and so on) that is being transformed.

In some countries the public sector plays a major role, while in others the private sector is becoming increasingly involved. In Colombia and some other Latin American countries (Doebele, Grimes, and Linn 1979), betterment levies have been used with relative success for many years to help finance infrastructure. Officials recover the costs of infrastructure by assessing the relative benefits to each plot generated by an infrastructure investment and then charging in relation to the assessment. In Hong Kong the leasehold system allows the government to recapture the surplus land value created by infrastructure investments and social service expenditures (Alterman 1982). In the case of Nigeria Lee and Anas (1992) propose several policies for responding to current infrastructure deficiencies, including reform of regulations, participation by the private sector, and alternative pricing policies to account for capacity limitations and congestion. A major research area for the future will be the investigation of the advantages and disadvantages of alternative methods of providing infrastructure: public, private, and public-private partnerships.

**Conclusion**

Insufficient attention has been given in past studies to the theoretical structure of the relationship between productivity and infrastructure investment. Land, dif-
ferentiation of labor by skill, and regional data have been especially neglected. Data on capital stocks and depreciation rates for private and public capital need to be obtained and improved. Finally, analysts need to take account of the transitions that are occurring in property rights; these institutional changes will affect the relationship between productivity and infrastructure investment, but we do not know exactly how.

Analysts recognize that different forms of property rights may affect the productivity of a firm, but they are still experimenting with ways of investigating the relationship in depth. Researchers who examine these alternative institutional structures undoubtedly will have to use both quantitative and qualitative analytical tools and work closely with policymakers in order to understand the complexity and richness of emerging institutional arrangements. Because many of the organizational forms are new, time-series data will not be available, and even cross-sectional data will be scarce. I therefore foresee the increased use of case studies until more data appear.

Everett J. Santos

It is no exaggeration to say that enterprises in infrastructure sectors are among the worst-run industries in the world. Government management in these sectors has left developing countries with distorted patterns of demand, inefficient operations, and severely eroded asset bases.

Access to infrastructure in developing countries is heavily biased toward urban residents. Although typically 95 percent of the urban population has access to safe drinking water, in rural areas the coverage is only 25 percent. In half the countries for which data are available 70 percent or more of urban households are connected to electricity, but in the other half the overall connection rate is 36 percent or less. Maintenance is overdue on between 60 and 70 percent of the roads in developing countries. Some 15 to 30 percent of the water and electricity produced is wasted or stolen before it reaches customers.

The critical issues in developing countries therefore relate to how management in infrastructure sectors can be made accountable. This requires much more than auctioning a few public assets and opening bids for selected contracts. If better management in infrastructure is to be sustained by private sector involvement, two major changes must be encouraged: the macroeconomic framework for infrastructure management must be reformed to promote businesslike operations and investment planning, and competitive markets for infrastructure services must be fostered and strengthened.

The Macroeconomic Framework

Governments cannot afford to stand back and presume that after a century or more of public sector management private investors will be attracted to infra-

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structure operations without radical changes in the sector. In addition to strong political support, private investment requires a stable macroeconomic environment and an appropriate legal and regulatory framework. Efficient capital markets must be established to ensure security, convertibility, and transferability. Governments need to create what we have come to call an enabling environment.

Good macroeconomic management mitigates both project risk and country risk (see World Bank 1991). Moreover, it typically also means tight controls on public sector deficits, the reduction or elimination of subsidies to state enterprises, stable and convertible currencies, and credible efforts to reduce the burden of national debt. All these actions improve the business climate and enhance the attractiveness of infrastructure sectors to domestic and foreign investors.

In many countries the legal framework must be amended to permit private sector provision of infrastructure and to clarify the business code affecting such matters as contract enforcement, mortgages, and bankruptcy. Land tenure rights, which are often cloudy in developing countries, must be addressed, since infrastructure facilities usually require clear rights at least to site occupancy and perhaps to ownership of large acreage. Many infrastructure projects will involve foreign investors, and special attention may have to be paid to the need to relax limits on foreign investment or on the movement of foreign personnel. Because experience with privatization offers several regulatory models, the formulation of an appropriate framework should no longer be a time-consuming effort.

Competition is increasingly being looked at to ensure that infrastructure sectors deliver efficient, reliable, and low-cost basic services. New regulatory mechanisms in infrastructure sectors generally seek to use competition and contestability to the greatest extent as a substitute for overt government regulation. Inefficient and inequitable economic behavior can be held in check by competitive operating contracts that are periodically rebid; open competition for contracts and a transparent award process based on merit; and free entry and exit for infrastructure firms.

Infrastructure firms need to be able to operate in a market-responsive atmosphere in order to maintain efficiency. Two issues are of concern here.

First, infrastructure agencies have often historically been used to deliver subsidies to certain groups. The deficits of public utilities figure all too large in public budgets, and in some countries infrastructure deficits have been a source of macroeconomic instability. If private interests are to move into providing infrastructure, infrastructure sectors must be put on a sound financial footing. This entails not only eliminating subsidies and increasing tariffs to cover costs and provide an adequate return but also protecting the tariff-setting mechanism from political backsliding and from the temptation to withhold needed tariff increases for the sake of political interests. Among the systems available to provide this insurance is the well-known RPM — X formula, under which utilities have some freedom to raise tariffs at their own discretion, and for a limited number of years, at a rate equal to the consumer inflation rate (retail price
index) minus a small amount \(X\) that varies according to the extent of productivity improvements that are needed.

Countries that are encouraging private initiatives in infrastructure are seeking a large one-time gain in efficiency that can be sustained over the long run. But—the second issue—the efficiency gains often translate into a loss of jobs and other economic hardships. Maintenance of political support for private sector infrastructure operations often hinges not simply on efficiency and performance but also on the effective functioning of a social safety net to finance the retraining and redeployment of displaced workers. Financing the safety net may be part of the bid price paid by firms, or the government may agree to launch a program of employment reform and retraining prior to privatization, or the burden may be shared. In some cases privatized firms expanded so rapidly that they employed more people after privatization than before.

**Strengthening Infrastructure Markets**

To achieve lasting improvements in the management of infrastructure sectors, the marketplace for infrastructure services must be strengthened. The United Kingdom regulates its power sector through a small oversight agency and a competitive industry structure that exposes managers in the power sector to the discipline of market competition. In Argentina most of the electricity produced is traded in a spot market that determines the pass-through prices to consumers. Competition is an effective regulator in power, telecommunications, transport, and many other activities that were once monopolies. Contestability has extended the effective use of competition for regulating infrastructure monopolies through regulatory structures such as build-own-operate and build-own-transfer contracts that allow for periodic rebidding of operating licenses and operating concessions.

According to the World Bank estimates presented here, infrastructure investments in developing countries in the 1990s are projected to amount to more than $200 billion a year, about half of which will be invested in electric power. ("Power" in the table excludes investment in basic energy supply and transport associated with power generation.)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Projected annual investment (billions of dollars, 1993 prices)</th>
</tr>
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<tbody>
<tr>
<td>Power</td>
<td>100</td>
</tr>
<tr>
<td>Water and sewerage</td>
<td>60–70</td>
</tr>
<tr>
<td>Highway rehabilitation</td>
<td>15–20</td>
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<tr>
<td>Telecommunications</td>
<td>25–30</td>
</tr>
<tr>
<td>Total</td>
<td>200–220</td>
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</table>

At this rate infrastructure investments will account for between a quarter and a third of all fixed investments in developing countries (an estimated $700 billion–$750 billion a year). By comparison, current international aid for infrastructure is about $15 billion a year.
Private infrastructure projects offer unique opportunities for developing domestic capital markets because they tend to require long-term financing. Infrastructure projects are suitable for developing long-term options because they are activities with steadily growing demand that is fairly insensitive to price fluctuations. Such projects constitute relatively low-risk investments that can attract institutional and other investors who are seeking steady long-term income. The lack of stable long-term investments in many countries has undoubtedly hampered the broadening of securities markets. Ironically, absence of mature capital markets is often cited to justify government intervention in infrastructure services in some countries.

Infrastructure sectors also have important indirect effects on capital markets because they underlie the overall profitability and efficiency of the economy. Transport systems, water and power, communications services, and sanitation and waste disposal are essential in all economic and social activities. The productivity of infrastructure services is directly reflected in the productivity of industrial and commercial activities. Conversely, failures have important economic consequences. In the Philippines, for example, power blackouts, which are in effect for six to twelve hours a day, cost an estimated $800 million a year in lost production. This loss suggests the vulnerability of investors' returns when infrastructure is inadequate or unreliable.

Because of the importance of market efficiency in achieving efficient infrastructure, both the World Bank and the International Finance Corporation (IFC) should move cautiously in financing private infrastructure projects. Both institutions are creatures born of market failure. Our ultimate goal should be our own redundancy. We should look forward to a time when many, and perhaps most, projects will go ahead in deregulated infrastructure sectors without the participation of multilateral institutions. Our first development priority must be the formation of efficient local capital markets so that the principle of “market first, IFC second, and Bank last” that our Boards have laid down is not frustrated by lack of depth in the markets.

Clifford Winston

Some of the controversy about the relationship between infrastructure investments and productivity and economic growth could be resolved by thinking about the sources of productivity gains from infrastructure. These sources would include, for example, all of a company's functions, such as distribution, inventory logistics, production, and location. One can also imagine a household's production function and consider the contribution that infrastructure makes to improving household efficiency. So, although there is some controversy about the magnitude of the impact that infrastructure has on productivity, it is going to have some effect.

My view is that the most important question is how to maximize the productivity from infrastructure investments at least cost, and this least cost is continu-
ally ignored in the debate. In my sector, transport, it is not ignored, but in the more visible public sector everyone talks about infrastructure investment without worrying about minimizing costs.

Let me mention two obvious areas in which costs need to be reduced. One area is what we call X-inefficiency. Every infrastructure project turns out to cost more than initial estimates. The magnitude of these costs is an open area of research, but 10 to 20 percent would be a reasonable starting point.

The other obvious inefficiency involves appropriations for political, or porkbarrel, projects. West Virginia is the recipient of some of the best infrastructure projects in the United States, and I am sure it will be number one on the list to have a magnetic levitation train going through it. Wonder why? Political inefficiencies and X-inefficiency are easy to identify, but it is admittedly difficult to do anything about them.

Where can we make improvements? The two areas I want to emphasize are initial design and efficient use of the systems we have. The point regarding initial design is to get the investment right from the beginning. Let me give three examples.

In the United States highways have been designed to handle both cars and trucks. Cars need width—multiple lanes to offset congestion. They do little damage to the road; basically, they need an inch or two of pavement thickness. Trucks need depth of road—10 inches—but they need less capacity than cars do. What did we do? We built highways that can simultaneously handle both cars and trucks, with five lanes, 10 inches thick. That was a design flaw—diseconomies of scope in highway production. Developing countries that are considering building a major highway system might want to think about this experience.

A second design issue is the extent of the network. In the United States we build extensive networks. Everybody has to have access to an interstate highway system, everybody has to have access to a rail system, and so on. When we do not accurately forecast demand, we wind up with huge systems and excess capacity. Experience teaches that networks should be designed to be as small as possible.

Finally, engineering design must incorporate the correct economics. For example, because engineers did not efficiently trade off maintenance and capital costs when determining road thickness standards, certain roads were underbuilt.

It is important to make more efficient use of the systems we have. Once a transport system is in place, the price mechanism should be used to ensure that it functions efficiently. This means congestion pricing for vehicles and planes, to make efficient use of capacity, and axle-weight taxes for trucks, to make efficient use of durability. In addition to making the most efficient use of the system, efficient pricing postpones the need for new and potentially wasteful investments.

Floor Discussion

Gregory Ingram opened the floor discussion by asking to what extent better measures of output are needed. Is there truly a dearth of output measures or
performance indicators that can be applied, for example, when we begin to use private contractors for maintenance? Is research needed, or does the information exist and do we just need to apply it better?

Clifford Winston responded that the output measure on highways, particularly for trucks, is "loadings," or axle passages over the road. The difficulty is not in measuring loadings, although it may not be clear exactly how many loadings highways actually handle. The goal is to maximize loadings—the output—at least cost. Winston said that we should focus on actually measuring what we agree is the output, but in the United States that is somewhat controversial, and he was sure it was even harder elsewhere.

Karen Polenske repeated that in discussing the productivity of infrastructure it is important to widen the investigation to cover more institutional issues than have normally been included. Such things as changing family structures and work environments alter the meaning of "output" or whatever it is we are trying to measure. How are we looking at the different work environments in different countries? She agreed with Winston about finding different ways of pricing, but we could reprice everything and still have congestion and perhaps greater inequity as well. We must consider equity issues, and we must consider how new family structures affect our changing work environment, our journeys to work, and our leisure. That means coming up with output measures we have not really thought about. How do we incorporate them in our studies?

Ingram asked Bruno Philippi whether measurement was an issue in the power sector. Philippi responded that power was an easy sector in the sense that you can measure what is being sold. The product is price-specific and has certain characteristics, and as long as the public gets what it is paying for, measurement is not complicated.

Turning to a different issue, Ingram noted that in a variety of areas, including infrastructure, the World Bank has been promoting decentralization, or the devolution of responsibility for activities—usually from the central government to a state or a municipal government. The rationale has been that because in many respects infrastructure is inherently local, decentralization promotes more efficient selection of projects, on the basis of better information. In the areas of financing and regulation, however, the situation may be the reverse. Ingram asked Everett Santos about prospects for equity financing, rather than government financing, as countries move toward more decentralized provision of infrastructure.

Santos said that it was a question of whether the regulations applied to national or to local issues. Obviously, capital is a national issue: national legislation is required to promote capital markets by encouraging efficient infrastructure. In the power sector the regulatory framework must be broad enough to ensure minimal costing in the pricing of electricity. The national grid has to allow power plants to be built where they are needed, although local decisions will also be involved. Other decisions are purely local: water distribution networks, for example, and sewer systems. Government must recognize where it
wants to keep control at a national level and where it can allow local responsibility.

Santos noted that before the U.S. federal highway system was constructed, there was much debate about whether the federal government was constitutionally entitled to build interstate highways. Federal highway construction was justified on the basis of national defense—federal highways would make it possible to move troops around the country—and so they were originally built to carry tanks. Illogical thinking went into such questions as how thick the pavement should be or how wide the lanes had to be. People do not argue against a federal highway system now, and they don’t remember that it was an issue.

Polenske elaborated on the subject of military involvement in U.S. infrastructure investments. In the 1960s she asked the U.S. Bureau of Transport how it decided on the size of highways and was told that the decisions were based on economic evaluations but that the Pentagon had the last word. Many of these decisions are motivated by political concerns, yet we have not factored political decisions into investment in infrastructure.

A participant from Japan asked to what extent politics can be separated from economics when it comes to infrastructure. For example, he said, the city of Kitakyushu is reclaiming land for a new airport. Fukuoka, an hour away from Kitakyushu, also wants a new airport because its present airport is too near the city center for comfort. It would probably be sensible to have a joint airport somewhere in the middle, a half-hour drive from either city. But the joint airport will not be built because the two cities are competing to be the principal city on Kyushu (Japan’s southernmost island). There is great pressure on Japan to improve domestic investment and reduce the trade surplus, and this pressure reinforces political rivalry in that part of Japan. The participant also pointed to Niigata prefecture, which he described as the least populated and least habitable part of Japan. Although Niigata is very high in altitude and is covered with 6 meters of snow in the winter, the area has excellent infrastructure because it is the home of a former prime minister.

In response to a question, Winston agreed that politics should not be separated from economics. Going a step further, he added that he would treat politics as endogenous to the system. When anyone proposes user charges to reduce congestion, for example, the usual response involves politics and issues of equity. Forget that the literature shows that congestion pricing, with the appropriate revenue distribution, would not be inequitable. Congestion pricing is no different from other externalities, but it raises its own questions. Which externalities are considered and which are not? Why is it that a country will get behind recycling and antipollution efforts but will not touch congestion? Are people nervous about externalities that involve civil liberties? We need a clear political understanding of why certain policies are pursued and others are not, and, armed with that understanding, we need to treat the reality of political restraint as something to be incorporated in the economic policy being recommended.
Winston conjectured that economists might be satisfied with reducing congestion to an efficient level but that noneconomists, when they deal with an externality, want to get rid of it altogether no matter what it takes to do so. The problem with congestion pricing is that politically feasible tolls would probably be too low. When people factor in what it would take to get rid of the externality—which would probably be high tolls—they decide they don't want to do it after all.

A participant from the World Bank observed that although most of the discussion had focused on infrastructure as a whole, Polenske had said that we ought not to treat infrastructure as a homogenous commodity. The questioner wanted to know which were the common elements across infrastructure, which were the least common, and how that might affect the policy discussion. Polenske responded that one could distinguish between development infrastructure, infrastructure that generates employment (to offset the effects of business cycles), and maintenance infrastructure. Development infrastructure can be subdivided according to its goals: basic needs, growth, disaster repair, and political enhancement. We tend to think that all infrastructure is developed for the same reason, said Polenske, but that is definitely not true. We need to look at these issues in more depth.

Ingram added that he thought the two common elements of infrastructure were its very high fixed costs and the need to serve all customers. Many aspects of infrastructure are not public but private goods. Power and water supplies are not public goods. If one person uses the electric power, another cannot. Roads are a mixed case. Infrastructure subsectors also differ dramatically in terms of what the user has to do. To use the highway system, individuals have to make significant capital investments—in the United States the investment in vehicles exceeds the investment in the highway system. The investment a household makes in telephones, however, is probably less than the investment the phone company makes for that household. With consumer appliances it is probably a draw. So there are some strong common elements, but there are also very strong differences.

References


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