



Remarks by Governor Edward M. Gramlich

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Infrastructure and Economic Development

I am glad to be here today to talk about the role of infrastructure investment in economic development. As some of you may know, this is a subject that I studied before joining the Board. Ten years ago a cottage industry arose in the economics profession investigating the role of public infrastructure investment in the productivity slowdown of the 1970s and 1980s. In 1994, I wrote an article summarizing what had been learned up to that point. I felt that the evidence then was quite unclear--the many econometric uncertainties made it very hard to attribute the productivity slowdown to a shortage of infrastructure investment.

That was then, this is now. The question has been turned on its head since 1995 when productivity began a dramatic climb. Although public investment in infrastructure has picked up somewhat, the bulk of the recent increase in the nation's capital stock has come from soaring private investment. Does that mean that private infrastructure investment is sufficient? Or is there still a role for public infrastructure investment in boosting the long-run growth of the economy? And, as a corollary, what are the factors that should guide government policy as it relates to infrastructure investment? These are some of the broad issues I would like to discuss today.

As a definitional matter, infrastructure investment, or capital, consists of large capital-intensive projects, often publicly owned or regulated, that provide the backbone of the distribution system for the economy. Highways, airports, harbors, utility distribution systems, railways, water and sewer systems, and communications networks are examples of projects that would be considered infrastructure investment.

Historically, it seems clear that infrastructure investment has been crucial to the process of economic development in America. In our nation's earliest days, construction of canals and turnpikes, followed by construction of railroads in the first half of the nineteenth century, greatly increased the prospects for trade and development. Large-scale investment in electricity and telephone networks near the turn of the last century facilitated the development of a broad spectrum of innovations that, after a time, significantly improved the productivity of America's workers.

From this overall picture, it seems that infrastructure is important to growth. But how important is it empirically, and how much can changes in infrastructure investment explain changes in productivity growth? As I mentioned, these questions received a lot of attention in the economics profession about ten years ago. Back then, the burning question was whether the slowdown in productivity growth experienced in the United States after 1973 could be attributed to a decline in public infrastructure investment. In particular, the stock of highways and streets per person had leveled off after growing steadily between 1950 and

1973. A natural question was whether the decline in spending on roads caused the decline in productivity.

Figuring out exactly what forces affect productivity, and actually measuring effects, turn out to be very difficult. One particularly difficult issue is a favorite of economists--the distinction between marginal and average. According to research by John Fernald of the Federal Reserve Bank of Chicago, public investment in highways contributed about 1 percentage point more to productivity growth before 1973 than after. The building of the interstate highway system allowed for greatly increased trade. It also made profitable continued investments and innovation in the automobile industry, and it eventually allowed for the development of efficient and effective supply-chain management techniques that have greatly enhanced productivity over the years. But Fernald's evidence also suggests that once the network of highways was in place, the productivity payoff from further road building was considerably smaller.

Today, we are faced with explaining a different phenomenon--the recent pickup in productivity growth. A key question is the extent to which the recent productivity surge can be linked to infrastructure spending. Research by Steve Oliner and Dan Sichel, two economists at the Board, indicates that to a significant degree the current productivity boom can be explained by developments in information technology. How much these improvements are associated with infrastructure spending is hard to say. Although the tremendous increase in computing speed, and the tremendous reduction in the price of computing, yielded direct benefits to users, the benefits of the computer revolution were vastly enhanced by the advent of the Internet. In a sense, the Internet can be thought of as the infrastructure of the computer revolution. Like other networks, the Internet significantly raised the productivity of each and every computer. The more Internet users there are, the more valuable each Internet connection and the more valuable the information that can be disseminated over the Internet. Thus, it seems clear that the synergies between innovations in computing and innovations in communications have yielded great benefits. And like the interstate highway system, the effects of the Internet on productivity growth are likely to wane over time-- although it seems that we have a long way to go before these particular marginal benefits taper off.

One interesting question is: How much did public infrastructure spending contribute to this latest productivity boost? Clearly, the government had much to do with the development of the Internet. In the mid- to late 1960s, the Advanced Research Projects Agency at the Department of Defense, generally known by its acronym, ARPA, created a small network, ARPANET, to promote the computer-to-computer sharing of information among researchers in the United States. This network was the forerunner of what would eventually become the Internet.

The National Science Foundation expanded ARPANET to universities and research centers before turning it over to private providers in the mid-1990s. Without the early government subsidization of basic research on computer-to-computer communication, it is not clear that the Internet would be as advanced as it is today.

In contrast to the fully public interstate highway system, infrastructure projects often feature a mixture of public and private elements, as does the Internet. The building of the canals was sometimes financed by private investors, sometimes with public funds. The building of the railroads was financed entirely by private companies, although the federal government

heavily subsidized railroads through land grants.

What about infrastructure investment in Mexico and other developing countries? The evidence from Mexico, as well as national and cross-country studies more generally, suggests that public capital formation in developing countries has had significant productivity and growth effects. Although the qualitative links are clear, there is less consensus about the exact magnitude of the effect, given that economic growth and infrastructure spending are simultaneously determined variables, and it is difficult to isolate the direction of causation. Studies have also found that whereas non-infrastructure public spending appears to crowd out private investment, public expenditures on infrastructure seem to encourage private investment.

Research also highlights a number of issues that might be especially relevant for developing countries. First, studies indicate that the public infrastructure in a number of such countries is of poor quality, and is used inefficiently. Second, it has been found that corruption can distort the entire decisionmaking process associated with government investment projects. The greater potential for bribery for this type of government spending may lead to an increased quantity of public infrastructure, but it may also partly account for its very poor quality. Finally, public infrastructure spending seems to bear a larger brunt of the fiscal retrenchment that developing economies often have to undertake in times of financial crises, raising questions about whether it's the wrong kind of spending that is cut. In light of these considerations, it is important to focus on government's role in investing, regulating, and maintaining a country's infrastructure--and the appropriate mix of public and private investment--in order to reap the full benefits of the public capital. That leads to my second question, which is probably the more interesting one: What factors determine appropriate government policy regarding infrastructure investment, and how do those factors play out in today's new economy? As mentioned earlier, government itself can provide infrastructure as it did in the case of the interstate highway system. Government can also influence private infrastructure investment--by direct subsidies, by regulation of prices, or by regulation of the rules of conduct in an industry.

The public policy issues revolve around the fact that infrastructure investment has large fixed costs relative to marginal costs, a phenomenon known as increasing returns to scale. When the fixed costs become so large that only one firm can feasibly operate, we call this a natural monopoly. Because of well-known pricing problems associated with monopolies, governments can step in and directly provide the infrastructure itself or can regulate the private providers.

Take the example of roadways. Construction of streets and highways involves huge fixed costs, and as long as the roadways are not congested, the incremental cost of having an additional car on the road is minimal. Collecting revenues from users may be costly, particularly in the case of city streets, so government has traditionally provided construction services, paying for them largely through taxation.

A similar case involves local telephone service. It is generally inefficient to have more than one set of telephone wires installed along every street. But having only one firm with a wire down a street would give that firm too much market power, risking excessive prices. Consequently, local telephone service is typically a private, but regulated, industry.

Having noted instances in which government involvement may be appropriate, it is easy to

overstate the value of government intervention. There are many instances in which government regulation, rather than improving efficiency and lowering prices, has actually had the opposite effect. Regulated industries can become entrenched monopolies and can waste valuable resources maintaining their monopoly power. Innovation can be suppressed, and without competition, the quality of services can suffer. The experience of deregulation has shown that competition can survive even in industries that exhibit some of the characteristics of natural monopolies. And competition unleashes entrepreneurial forces, leading to such innovations as the hub-and-spoke system following deregulation of the airline industry, the wide variety of new telephones and fax equipment arising out of telecommunications deregulation, and financial innovations to reduce risk after deregulation of the natural gas industry.

The economics of information technology are not dissimilar to the economics of older infrastructure industries. The large economies of scale in creating information--once information is created, it can be distributed virtually without cost--and the existence of positive network externalities--the larger a network, the more valuable it is--mean that the competitive process can easily lead to a fairly concentrated industry. But experience to date suggests that competition in information technology can be fierce, despite the industry's cost structure. For example, many firms are competing to provide telecommunications services. While the existence of multiple sets of fiber optic cables linking cities may not be efficient in and of itself, the benefits of added price competition may outweigh the costs of physical inefficiency.

One way to preserve competition and promote efficiency in the high-tech industry is through the setting of standards. In the network economy, having common standards increases the value of innovation, as more users can easily avail themselves of the new technology, and actually allows more firms to survive and compete. What the government's role needs to be in setting standards is an open question. While they could get together to determine standards, and often do, firms are naturally wary of being subject to anti-trust regulation. There is often a fine line between setting standards that promote competition and setting standards that provide an advantage for incumbent firms. Thus, government might have a role in setting or enforcing standards. On the other hand, having the government preempt the battle over the best technology by choosing standards may squelch innovation. A limited role for government may be best--but even then, it may be hard to define precisely that role.

The lesson to be learned by the United States, by Mexico, and indeed by all countries, is that the role of government in infrastructure investment may be more subtle than one might have thought. There may still be some industries in which government should actually invest physical capital. Government certainly should ensure that the existing public infrastructure is properly managed and maintained. But, in general, government's role should be to make industries as competitive as possible. In some cases, regulation of actual prices may be unavoidable; but in many cases, even if government needs to regulate, the regulation can be less intrusive, so as to maintain competition. The entrepreneurial forces unleashed by competitive markets can spur productivity growth much faster than direct measures taken by government.

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