Public Infrastructure Policy And Economic Development

By William F. Fox and Tim R. Smith

Construction of public infrastructure in the United States has slowed considerably in the past 25 years. In 1987, new infrastructure spending represented just 1.7 percent of gross national product, down from 2.3 percent in 1964. Since most spending for public infrastructure occurs at state and local levels, many state and local policymakers are concerned the economic health of their regions will depend on building new infrastructure.

There is little doubt roads, water and sewerage systems, electricity, telecommunications, railroads, and airports generally support economic activity. Yet the degree to which such public infrastructure stimulates economic development in specific locations is less clear. Projects to improve infrastructure may spur development in some places but not in others. Moreover, building new infrastructure may not always be the best way to enhance infrastructure. Improving the services delivered by existing facilities can often enhance infrastructure at a lower cost than building new facilities.

This article discusses the relationship between public infrastructure policy and economic development. The article concludes that infrastructure cannot be expected to stimulate the economies of all communities, but most communities can benefit from exploring new ways to deliver infrastructure services. The first section of the article briefly describes the slowdown in state and local spending on infrastructure. The second section discusses how the linkage between public infrastructure and economic development depends on the individual location in question. The third section discusses some options available to state and local officials who wish to deliver infrastructure services more efficiently.

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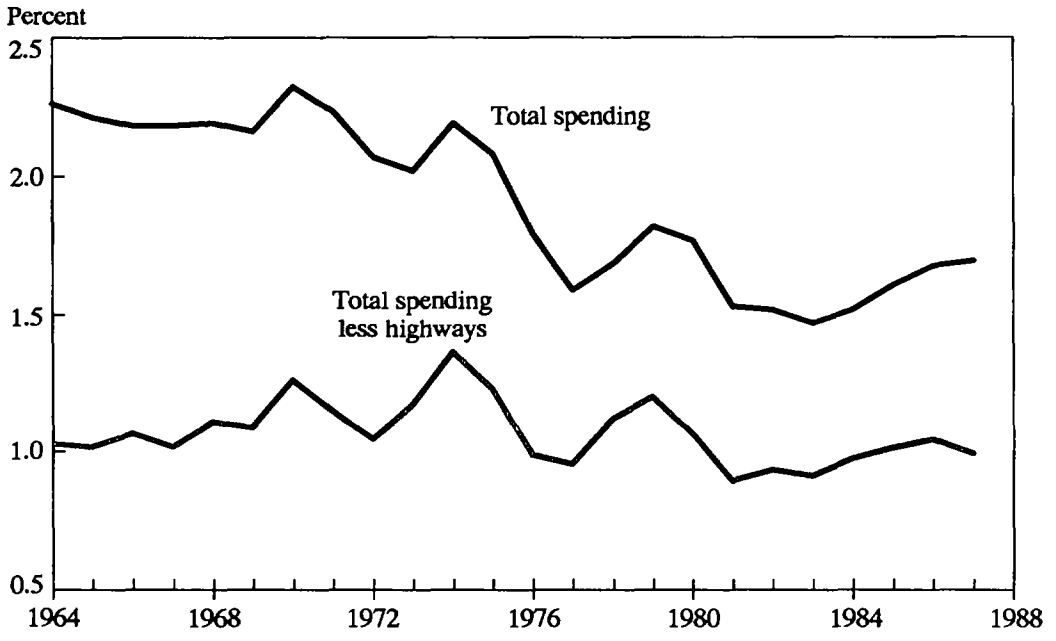
I. Trends in Public Infrastructure

Public infrastructure is defined as the physical capital investments—for example, roads, water and sewerage systems, electric power

Chart 1

Infrastructure Spending by State and Local Governments, 1964-87

(Percent of GNP)



Note: Spending includes all categories of capital expenditures by state and local governments, except for education and gas, electric, and transit utilities.

Source: U.S. Department of Commerce, Bureau of the Census, *Government Finances.*

plants, telecommunications facilities, railroads, and airports—traditionally provided by the public sector to private households and businesses.[1]

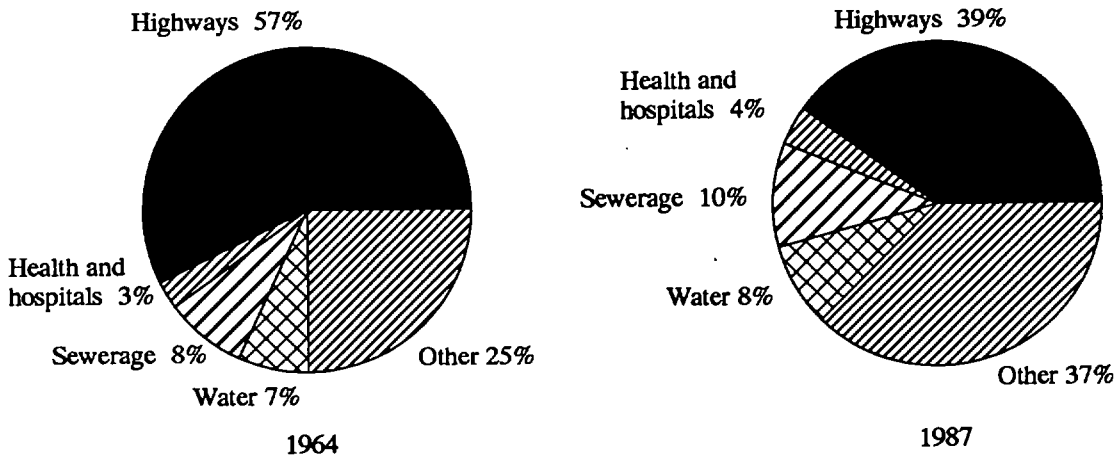
Spending on public infrastructure occurs mainly at the state and local level regardless of its funding source. For example, most of the federal funding for interstate highways is included as state and local spending on highways. The section, therefore, examines recent trends in public infrastructure by reviewing such spending by state and local governments.

The slowdown in public infrastructure investment

Spending by state and local governments on infrastructure has slowed considerably over the past quarter-century. Chart 1 indicates how infrastructure spending by state and local governments has declined in relation to overall economic activity in the United States from 1964 to 1987. Specifically, spending on public infrastructure declined from 2.3 percent of GNP in 1964 to 1.7 percent in 1987.[2]

The decline in infrastructure spending has been concentrated in one of infrastructure's most important categories—highways. Spending on highways represents the largest share of infrastructure spending and is generally thought to be an important stimulus to economic growth.[3] While most other major spending categories—health and hospitals, sewerage, and water—have maintained their share of total infrastructure spending, the share accounted for by highways

Chart 2
Infrastructure Spending
(Percent of total)



Note: Spending includes all categories of capital expenditures by state and local governments, except for education and gas, electric, and transit utilities.

Source: U.S. Department of Commerce, Bureau of the Census, *Government Finances.*

has declined from 57 percent in 1964 to 39 percent in 1987 (Chart 2).[4] The decline in highway spending largely reflects the completion of the interstate highway system. Spending on infrastructure other than highways has remained relatively constant at about 1 percent of GNP from 1964 to 1987 (Chart 1). The relatively constant spending on infrastructure other than highways does not mean concern about the linkages between infrastructure and economic development is unfounded. Those linkages are formed at the local level, where national average data may overlook the direction of infrastructure spending.

Infrastructure in individual states

The general slowdown in infrastructure investment is common to all states. Table 1 lists average annual spending on infrastructure as a percent of gross state product (GSP) in three periods from 1964 to 1986. In every state, average infrastructure spending was a smaller share of GSP in the 1982-86 period than in the 1964-72 period.

Although infrastructure spending slowed in all states, some states maintained higher average spending levels than other states over the entire period (Table 1). Alaska maintained the greatest emphasis on infrastructure with an average expenditure of 4.6 percent of GSP from 1964 to 1986. Indiana, on the other hand, emphasized

Table 1

Infrastructure Spending by State

(Average spending as a percent of gross state product)

	Overall period	Subperiods		
	1964-86	1964-72	1973-81	1982-86
U.S. total	1.8	2.2	1.8	1.6
Alabama	2.1	2.7	2.1	1.8
Alaska	4.6	7.9	4.2	4.3
Arizona	2.6	2.8	2.4	2.7
Arkansas	2.3	6.1	1.9	1.2
California	1.5	2.1	1.4	1.3
Colorado	2.1	2.4	2.1	2.0
Connecticut	1.4	2.1	1.3	1.2
Delaware	2.0	3.0	1.9	1.6
Florida	2.4	2.4	2.4	2.3
Georgia	2.0	2.3	2.2	1.8
Hawaii	2.9	4.2	3.1	2.3
Idaho	2.1	2.5	2.0	2.0
Illinois	1.6	1.7	1.6	1.5
Indiana	1.3	1.6	1.2	1.2
Iowa	2.0	2.4	2.0	1.9
Kansas	2.1	2.3	2.3	1.7
Kentucky	2.1	2.7	2.3	1.6
Louisiana	2.0	2.6	2.0	1.7
Maine	1.8	2.3	2.1	1.4
Maryland	2.5	2.6	2.8	2.2
Massachusetts	1.4	1.7	1.4	1.3
Michigan	1.4	1.7	1.5	1.2
Minnesota	2.3	2.7	2.4	2.0
Mississippi	2.3	3.5	2.5	1.6
Missouri	1.6	2.0	1.6	1.4
Montana	2.9	4.0	2.6	2.7
Nebraska	2.0	2.3	2.3	1.7
Nevada	2.7	3.3	2.7	2.6
New Hampshire	1.8	2.5	2.1	1.3
New Jersey	1.5	1.7	1.5	1.3
New Mexico	2.3	2.8	2.1	2.3
New York	1.9	2.3	1.9	1.6
North Carolina	1.5	1.9	1.7	1.2
North Dakota	2.4	3.2	2.5	2.1
Ohio	1.6	1.9	1.7	1.4
Oklahoma	1.7	2.2	1.7	1.6
Oregon	2.1	2.7	2.2	1.8
Pennsylvania	1.5	2.1	1.6	1.2
Rhode Island	1.6	2.2	1.5	1.4
South Carolina	1.7	2.2	1.7	1.4
South Dakota	3.0	3.4	2.8	3.1
Tennessee	2.1	2.7	2.2	1.7
Texas	1.7	2.2	1.7	1.6
Utah	2.4	2.8	2.2	2.4
Vermont	2.0	3.4	1.9	1.5
Virginia	1.9	2.5	2.1	1.4
Washington	2.4	2.9	2.3	2.2
West Virginia	2.5	3.2	2.7	1.8
Wisconsin	1.7	2.1	1.7	1.6
Wyoming	3.0	3.9	2.7	3.0

Notes: Spending includes all categories of capital expenditures by state and local governments, except education and gas, electric, and transit utilities. U.S. total for infrastructure spending is expressed as a percent of GNP.

Sources: U.S. Department of Commerce, Bureau of the Census, *Government Finances.*
U.S. Department of Commerce, Bureau of Economic Analysis.

infrastructure the least of all states over the entire period with an average expenditure of only 1.3 percent of GSP. States with the smallest average expenditure in the 1982-86 period were Arkansas, Connecticut, Indiana, Michigan, North Carolina, and Pennsylvania.[5]

The slowdown in infrastructure investment has raised questions about the impact on regional economic development. And the disparity in spending across states has raised questions about whether infrastructure shortfalls will limit some states' ability to attract economic activity. State and local policymakers, therefore, are asking if building new infrastructure will enhance the economic development prospects of their regions. An understanding of the linkages between infrastructure and economic development helps answer these questions.

II. Linking Infrastructure and Economic Development

Most analysts agree that infrastructure generally supports economic activity.[6] However, there is less agreement about whether infrastructure can be used as a tool to stimulate economic development in individual locations.[7] Understanding the linkage between infrastructure and economic development, therefore, might aid local policymakers in developing a better infrastructure policy for their community. For example, such understanding might help state policymakers determine which locations within their state will benefit most from additional expenditures on infrastructure.

What is economic development?

Economic development is a popular concept, but one which is often misunderstood. An area's level of development refers to its economic performance relative to the economic performance of other areas. This performance might be measured by per capita personal income, employment, or value added. Because development is a relative concept, a place is said to be highly developed if its per capita income, for example, is well above average.

A region's economic development is enhanced through economic growth. Growth alone, however, does not reflect a higher level of development. To achieve a higher level of development, a region must grow faster than the average region so its development position changes relative to other regions.

How fast a region can grow and develop depends on the presence of certain economic resources in the area. Economists do not agree on the exact recipe for economic development, but they do have a common list of potentially important ingredients for regional economic development: sufficient quantity and quality of labor, access to raw materials and markets, and the presence of adequate financial capital, land, and infrastructure.[8] Also instrumental in the recipe for economic development is the availability of technology to combine these ingredients and entrepreneurship to take risks under uncertainty.[9]

Infrastructure and economic development in three types of regions

A useful method to determine whether infrastructure will contribute to economic development is to consider the economic characteristics of the region in question. Based on an analysis by Hansen (1965), regions can be classified into three categories—intermediate, congested, and lagging—according to their current level of development and the presence of ingredients for further development.

Intermediate regions are positioned for further economic development because most ingredients for development are in place. Congested regions are less positioned for further development because additional growth may cause costly bottlenecks in transportation and production.

Lagging regions are not positioned for economic development because they lack many necessary development ingredients.

This framework should be viewed only as a rough guide for infrastructure policy because some locations may be difficult to classify. The economic development potential—and the classification—of a region can change rapidly due to circumstances beyond the control of state and local policymakers. For example, the oil price collapse in the mid-1980s quickly caused several congested or intermediate regions in the Southwest to become lagging regions. Moreover, the channels through which infrastructure influences economic development are common to all three types of regions, even though they are likely more effective in some regions than in others. For example, infrastructure construction provides jobs wherever it occurs, but the resulting increase in local incomes varies considerably from place to place.

Intermediate regions. Infrastructure investment has the greatest likelihood of significantly improving development prospects in intermediate regions. Intermediate regions may lack sufficient infrastructure but have the potential to grow and become more developed because other important development ingredients—a trained labor force, financial capital, and proximity to raw materials and markets—are in place. Furthermore, additional growth in intermediate regions can be expected to raise the level of development without generating congestion costs such as materials bottlenecks, heavy traffic, or air pollution that might offset the benefits of higher development. For these reasons, infrastructure can stimulate economic development more in these regions than in congested or lagging regions.

Infrastructure can contribute to regional economic development in intermediate regions in two ways. First, infrastructure—or the services it provides—enters directly into the production process of local business firms, making other production inputs more productive and permitting the firms to produce their intended output at lower cost. For example, additional electricity and water can be used directly by business firms' production processes. Roads can make workers more productive by reducing transportation time. And telecommunications can make workers more productive by facilitating interaction with customers. In addition to improving the productivity of existing firms, the presence of infrastructure may encourage new firms to move into an area.

The second way infrastructure contributes to regional economic development is through the impact of the initial public expenditure. When state and local governments spend money to construct infrastructure, they generate income in the local area. For example, when a highway is built, local incomes increase as residents are hired to build the road or as construction workers spend money in the area. The increase in personal income is largest if local workers and firms are employed and if the funding comes from federal grants rather than from local fees and taxes.[10]

Infrastructure policy in intermediate areas can be a key development tool because infrastructure can cause the area to grow and become more developed. Nevertheless, policymakers must still choose how to enhance infrastructure with the highest benefits relative to the budgetary costs. In Denver, for example, policymakers have chosen to build a new airport instead of continuing to refurbish and expand the old one. Because many other ingredients for development are in place in Denver, new transportation infrastructure might contribute to economic development both by making businesses more productive and by boosting income in the area during the project's construction.

Congested regions. Expanding infrastructure can improve development prospects in congested regions, but not as much as in intermediate regions. Congested regions are highly developed with all or most of the important development

ingredients in place. Although infrastructure investment may boost economic development in these regions, increased growth is likely to cause increases in population and congestion that offset the benefits from development. For example, heavier traffic in congested areas can lead to difficulty in transporting workers or materials, and air pollution can lead to more costly production methods. Hansen (1965) points to London, Paris, and the northeastern seaboard of the United States as examples of regions with significant congestion problems.

As in intermediate regions, infrastructure can contribute to economic development in congested regions by making firms more productive or by raising local incomes during construction. Many apparently congested urban places have continued to grow because new infrastructure investments, such as expanded subway systems, have offset some of their congestion problems. Nevertheless, remaining congestion tends to limit the development benefits of expanding infrastructure.

For expansion of infrastructure to be a successful development strategy, the expected benefits of the infrastructure must be large enough to outweigh the additional congestion costs caused by the new economic activity. Because congested regions grow mostly due to external influences, such as an increase in national demand for a product or service produced in the region, infrastructure policy is less likely to be used as an economic development tool than to accommodate the growth already occurring. In Boston, for example, a major highway construction project is being built to accommodate rapid growth from the 1980s. And in Seattle, policymakers currently faced with accelerating growth must decide whether recent improvements to its transit system will be adequate to sustain growth in the 1990s.

Lagging regions. Expanding infrastructure is not likely to improve the economic development prospects of lagging regions. Lagging regions are underdeveloped regions with few ingredients for development in place. These regions are likely to be rural areas with stagnant or declining industries. New infrastructure is less likely to boost economic development in lagging regions than in intermediate or congested regions because few other characteristics are present to attract new economic activity. Some lagging regions actually face disinvestment in infrastructure because their declining economies cannot afford to maintain the infrastructure already in place.

Infrastructure policy should generally not be used as an economic development tool in lagging areas. Building infrastructure probably cannot overcome an unskilled labor force, inadequate raw materials, or long distances to markets. Therefore, policymakers in lagging regions should focus their attention on delivering needed infrastructure services at lowest cost. Take, for example, lagging rural counties faced with deteriorating roads. Several such counties may be able to reduce the costs of road services and other public services by consolidating portions of their governments. Lagging regions also might benefit from policies that address the regions' lack of fundamental development ingredients. For example, improved education might make more skilled labor available.[11]

Investing in public infrastructure will stimulate economic development in some communities, but not in others. Building roads, for example, will support economic activity by moving people to jobs and products to consumers. But building more roads cannot guarantee economic development in all communities. The linkage between infrastructure and economic development clearly depends on the individual location in question. Intermediate communities are most likely to benefit from building infrastructure. Lagging communities, on the other hand, cannot expect to develop simply by building infrastructure without adding other development ingredients.

III. Guidelines for Providing Infrastructure Services

The three broad classes of regions described above may help policymakers tailor an infrastructure policy to the characteristics of their specific location. However, such an approach may still have uncertain effects. Thus, state and local policymakers in all locations must carefully decide how and where to spend economic development funds.

Whatever the development prospects, state and local governments can limit spending on new infrastructure by finding ways to enhance the delivery of services from existing infrastructure. Consumers and businesses are typically more concerned with the infrastructure services they receive than with the facilities themselves. In other words, consumers and businesses view public infrastructure as the electricity they use, not as the power plant that produces it. In intermediate regions and some congested regions, where building new infrastructure can improve development prospects, improving the delivery of infrastructure services may be cheaper than constructing new facilities. And in lagging regions, where new infrastructure is unlikely to spur development, improving the delivery of infrastructure services can relieve budget pressures. In short, state and local policymakers can stretch limited budgets by focusing on the services infrastructure provides rather than on the infrastructure facilities themselves.

This section discusses some alternatives available to state and local policymakers for shifting the emphasis of infrastructure policy from building new facilities to managing the services of existing facilities. Service-oriented policy alternatives include reducing the demand for services, making standards for service delivery more flexible, and improving infrastructure maintenance.[12]

Demand management

The demands placed on infrastructure can be managed so a lower capacity is necessary. One approach is to price services correctly. For example, prices can smooth extreme fluctuations in electricity demand. Some utilities raise prices for customers who use electricity during hours of peak demand. The Tennessee Valley Authority, on the other hand, offers lower prices during periods of peak electricity use to industrial customers who agree to possible service interruptions. With proper pricing, state and local governments can avoid increasing the infrastructure's capacity to accommodate periods of peak demand.

Another way local governments can use prices to manage demand is by pricing hazardous waste disposal, sewage treatment, and trash collection to accurately reflect the long-term costs of delivering the services. For example, prices—in the form of taxes—can be placed on the production or sale of materials that cause difficult disposal problems, such as plastic bags. Businesses will then identify production processes that will generate a lower need for disposal facilities.[13]

Flexible standards

Sometimes the infrastructure policy options of local governments are limited by restrictions placed on infrastructure facilities or services by higher levels of government. More flexible restrictions would allow local policymakers more latitude in developing infrastructure policy. These restrictions, often called standards, are meant to protect the environment or public safety. For example, federal and state governments often set limitations on the amount of pollutants that can remain in treated water. Government agencies also regulate construction of power generation facilities—especially nuclear reactors. These kinds of standards can be set to

protect the environment and population, but always with a recognition of the costs involved.

Standards set by federal and state governments frequently become mandates for local governments and thus determine the demand and cost for the services. However, such standards should be flexible enough to allow local governments to achieve the intended goals of the standards at lowest cost. For example, Los Angeles might attempt to meet federal air quality standards by building fewer highways and improving public transportation services. Denver might approach the same challenge by improving the delivery of gas and electric heat and banning wood-burning stoves.

The federal government also has set standards in the past without providing financing assistance to local governments. For example, the 1987 Clean Water Act will eliminate federal sewer grants by 1990, but the Environmental Protection Agency is imposing stricter standards for waste treatment. Where services are mandated, providing a means to finance the service could help local governments achieve the intended goals of standards. However, combining financing with standards does not guarantee the goals will be met.

Grant and loan programs for local governments often impose strict infrastructure standards local communities often find onerous. Local governments often forego federal grants rather than bear the additional costs imposed by standards. Again, grant and loan programs should be created with the maximum flexibility for identifying low-cost solutions for delivering services.

Maintenance

Maintenance of existing infrastructure should receive more attention. Maintenance often can extend the life of infrastructure and generally is a more cost-effective means for providing future services than building new infrastructure or undertaking major renovations. Pagano (1989) argues the "primary cause of the infrastructure decay" is not inadequate capital investment, but inadequate maintenance spending. Maintenance can preserve the everyday usefulness of certain types of infrastructure. For example, maintenance can help lower operating costs or raise the level of service on highways "roughed up" through normal use. In this case the maintenance could be combined with a demand management strategy that imposed the maintenance cost on the heaviest users through user fees.

Infrastructure maintenance is frequently ignored, despite its cost-effectiveness. Delaying maintenance is politically more expedient than raising taxes or foregoing other services. Also, many maintenance expenditures, with exceptions such as potholes, may not be immediately visible to the public. Political leaders, therefore, may tend to seek more observable spending patterns that involve building new facilities instead of maintaining old ones. Maintenance may even be discouraged by federal and state assistance programs that help finance construction and major renovations, but not maintenance.

Public information and intergovernmental assistance programs hold the potential to increase the attractiveness of maintenance as an infrastructure policy. As local populations become increasingly informed about the benefits of maintenance, they provide a built-in incentive for policymakers to pay more attention to maintenance. Moreover, intergovernmental assistance programs could encourage maintenance. Unfortunately, loan and grant programs frequently only finance major renovations or new projects, giving communities the incentive to forego maintenance until major repairs can be financed through an assistance program.

In summary, several options are available to state and local policymakers who want to reduce the need to build new infrastructure and enhance the delivery of services from existing infrastructure. Infrastructure policies of this kind cannot be expected to boost economic develop-

ment in many places, but if carefully carried out, they can ease budget pressures and help deliver infrastructure services more efficiently.

IV. Conclusions

Aging highways, outdated water supply systems, and overcrowded airports are casting doubts about the quality of the nation's infrastructure. State and local policymakers are focusing attention on this issue as the 1990s begin. Yet an even more pressing issue for state and local policymakers is whether expanding infrastructure in specific locations can bring renewed prosperity to ailing local economies or sustain growth in healthy local economies. While there is little doubt infrastructure is vital to economic growth, the economic benefits of building new infrastructure facilities are uncertain.

Given the uncertainty surrounding the use of public infrastructure as a development tool, policymakers should carefully identify the locations most likely to benefit from infrastructure expansion and explore new ways to deliver the services required by their regions. Intermediate-type regions, where other economic development ingredients are in place, will probably benefit most from enhanced infrastructure. But all regions, even lagging regions that stand little chance of raising their level of economic development, can find more effective ways to spend their limited development budgets.

Endnotes

1 This definition is consistent with one used by the National Council on Public Works Improvement (1986). Although investment in physical capital related to education and in human capital is not included in this article's definition of public infrastructure, these investments are part of a broader definition of infrastructure. See Smith, Drabenstott, and Gibson 1987 for an expanded discussion of the role of higher education in economic development. Private firms sometimes provide infrastructure investments, especially in electric power and telecommunications facilities, but the relative importance of private infrastructure investment varies across states.

2 Although gas, electric, and transit utilities are part of this article's definition of public infrastructure, they are omitted from the data presented in all tables and charts because these categories of public capital spending are highly volatile over time and vary considerably from state to state.

3 Aschauer (1989), for example, finds highways to be among the most important public capital investments in improving the productivity of private capital. Helms (1985) demonstrates a significant positive relationship between state highway expenditures and state personal income growth.

4 The "Other" category shown in Chart 2 increased from 25 percent in 1964 to 37 percent in 1987. This category includes spending on police and fire protection, parks and recreation, housing and community development, and sanitation other than sewerage.

5 Low infrastructure spending, however, does not necessarily mean a state has neglected its infrastructure needs. The greater emphasis on infrastructure spending in some states may simply reflect fundamental differences in population and geography. For example, states with greater land area generally spend more on building highways. Differences in land area, population, climate, existing infrastructure, and other important characteristics influence how states deliver the infrastructure services required by consumers and businesses.

6 Aschauer (1989) suggests the national economy is more productive when public infrastructure is available to private production. Garcia-Mila and McGuire (1987), Mera (1973), and Costa, Ellson, and Martin (1987) demonstrate significant positive effects of public infrastructure and economic activity using various measures of infrastructure and regional economic activity. Eberts (1988) reviews these studies and provides additional evidence of a positive relationship using estimates of public infrastructure in a sample of metropolitan areas. All of these regional studies use a production function framework. The measures of output and capital stock differ among studies, as do the regions

and industries examined.

[7] Studies showing public infrastructure is positively related to national or regional economic activity do not guarantee the same relationship exists for individual locations. Even the relationships between infrastructure and economic activity in metropolitan areas cannot be extended to other locations. Eberts (1988) finds substantial variation in the effects of public capital on output across his sample of 38 metropolitan areas.

[8] Hansen (1965) lists factors considered to be conducive to regional growth. Economic development ingredients can also be identified in studies of business location reviewed by Wasylenko (1985). Methodological differences among location studies lead to differences in the measured effects of individual factors. A survey conducted by Schmenner (1982) also identifies factors important to business location decisions.

[9] See Giese and Testa 1989 for a discission of the role of technology in regional development.

[10] The effect of infrastructure on economic development depends partly on how the infrastructure is financed. State and local governments have several alternatives, such as federal government assistance, taxes, user fees, or long-term debt, and the choice of financing method can change the user's cost of infrastructure services. See Fox 1988 for more discussion of infrastructure financing.

[11] For a discussion of the problems facing several lagging locations in a group of western states, see McCormick and Turque 1989.

[12] See Bell 1989 for means of effectively managing existing infrastructure as applied to Tennessee.

[13] An alternative to using prices to manage demand is using incentives. For example, to limit the waste disposal requirements of an area, local governments can pay businesses and consumers to recycle waste.

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