

Chapter 15

Macroeconomic Benefits of Highway Investment

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Introduction

The economic benefits of transportation infrastructure investment have traditionally been measured at the project level, relying on concepts and measurement techniques drawn from benefit-cost analysis. In recent years, however, there has been growing interest in measuring the overall contribution of transportation investments in general to the economy, by measuring such effects at the macroeconomic level. Extensive research conducted during the past decade has attempted to identify and measure the relationship between the amount of transportation infrastructure and aggregate economic activity.

While not addressed in this chapter, it is important to note that there are also external disbenefits of infrastructure investments that should be considered in any comprehensive benefit cost analysis. The impacts of highway and transit investments on air quality are discussed in Chapter 19.

Sources of Macroeconomic Benefits

Traditional benefit-cost analysis tools such as the Highway Economic Requirements System (HERS) used in this report focus on reductions in vehicle operating costs, the economic value of savings in travel time experienced by facility users, and benefits from the increased use of highways that are induced by these facility improvements. (See Chapter 7 and Appendix A.) User benefits include time and cost savings in both personal and business travel, as well as savings that result from faster and less costly movement of freight by trucks. Conventional benefit measures also include reductions in costs to public agencies for road maintenance and the economic value of reductions in property damages and injury costs resulting from less frequent accidents. More recent tools such as HERS may also include any changes in the economic costs of environmental impacts (such as air pollution or noise) caused by highway vehicles in their analysis.

The effects of highway investments on aggregate economic activity arise from the complex workings of a market economy. Economic players translate the increased supply of highway capital (and the resulting reductions in transportation costs) into reductions in firms' cost of production and distribution. Firms may also respond to the resulting increase in the level of service the highway system provides by changing their use of other inputs or altering their production processes in ways that further reduce their production and distribution costs. Furthermore, producer cost savings may be reflected in lower market prices and higher output levels for the wide range of products and services that depend on transportation infrastructure.

Macroeconomic measures of highway investment benefits for the production sector capture the total savings in firms' production and distribution costs that result directly from an increased supply of highway capital. One major advantage of measuring highway investment benefits from an economy-wide perspective is that it may be possible to capture the total benefits from a continuing program of highway investments by all levels of government, without requiring detailed evaluation of individual projects. Carefully conducted macroeconomic benefit studies offer a useful approach for estimating the aggregate value of an overall program of highway investments, thus providing an important source of evidence on the total economic return these investments generate.

Investments in highway capital may also generate important macroeconomic benefits in addition to direct savings in transportation cost. Increases in the highway capital stock may also improve the productivity of labor or increase the return on private capital investment, thus increasing the amount of goods and services that can be produced using the resources that are available to the economy. By increasing the productivity of labor and private capital, highway investment could allow overall economic activity to grow more rapidly than demographic and technological progress alone would allow. If increases in the value of the Nation's highway

capital stock raise the productivity of private inputs, the aggregate or macroeconomic returns to investments in highways may exceed those that would be captured using conventional measures of highway user and related benefits, perhaps by a significant margin.

Macroeconomic and User Benefit Measures

Despite similar objectives, macroeconomic measures of investment benefits are likely to differ somewhat from the highway user benefit measures that are the focus of benefit-cost evaluations (such as HERS). One of the key differences between the two approaches is that macroeconomic measures reflect market outcomes at the regional or national level, while microeconomic approaches may include valuations of benefits that do not result from market activity. For example, project-level economic evaluation recognizes certain highway user benefits that will not be captured by measures based on national income or output measures, since national income accounting does not include the value of time spent in unpaid household activities. Thus, the economic value of time savings in personal travel will be omitted from macroeconomic benefit measures, causing them to underestimate benefits from highway investments. The value of reducing highway fatalities, as reflected in the willingness to pay for reductions in life-threatening risk, is also omitted from such macroeconomic analyses.

On the other hand, macroeconomic approaches may capture some potentially significant benefits of highway investments that are omitted from the user benefit evaluation of highway improvements conducted by HERS. One of these is the improved reliability of transportation service that results when a highway investment reduces the variability of travel time for passenger trips or freight shipments between specific origins and destinations. Investments in highway infrastructure can reduce travel time variability by increasing the capacity of congested facilities, reducing the frequency of traffic accidents or other incidents that cause unexpected delays, or improving the “connectivity” of highway networks to provide alternative routes that allow travelers and freight vehicles to avoid delays. More reliable travel reduces the extra time that shippers must allow for to ensure that deliveries will be received on time even when delayed en route. Benefit measures that employ direct estimates of economy-wide savings in firms’ logistics and distribution expenses may be able to capture the reorganization benefits that stem from both faster and more reliable shipment times.

Another category of returns from highway investments that may not be adequately reflected in typical user benefit estimates is the gain in economic welfare from increased competition in markets where suppliers of a product previously exercised monopoly power. By lowering transportation costs and reducing the delivered prices of products, investments in highway infrastructure can expand firms’ geographic market areas, thus allowing them to introduce new sources of supply into more distant markets. The resulting savings in highway users’ travel time and other transportation costs will indirectly capture the value of reductions in the prices of products delivered to these more distant markets, as well as of the resulting increase in demand for them. However, if local producers were previously able to charge higher prices for these products due to the absence of alternative sources of supply, any further reduction in prices caused by the increased competition that lower-cost transportation permits represents an additional benefit that may not be fully reflected in user benefits measures. Macroeconomic approaches may again offer the potential to capture this additional benefit, but the specific measures used must be carefully constructed in order to appropriately estimate it.

Research on Macroeconomic Benefits

Early studies of benefits resulting from transportation infrastructure investments used measures derived from national income and product accounts to estimate the aggregate benefits generated by investments in highways. While some of these studies estimated very large returns to highway investment, the specific

economic mechanisms that might have produced these benefits often remained unclear. More recent research has attempted to identify the mechanisms through which highway investment can influence macroeconomic measures such as aggregate firm or industry production costs or economy-wide productivity growth, and to develop empirical estimates of the magnitude and economic value of these effects. Some recent research has estimated significant macroeconomic effects of highway spending, which in turn imply very high economic rates of return on historical investments in the Nation's highway infrastructure.

The Federal Highway Administration (FHWA) has been a major sponsor of recent research on macroeconomic approaches to measuring highway investment benefits. This research is intended to improve measures of economic returns from historical and prospective future investments in highway infrastructure, as well as to improve the transportation community's understanding of the specific mechanisms through which infrastructure investments affect the overall performance of the Nation's economy. Some of the most highly regarded studies of the magnitude of highway investment benefits and the economic mechanisms that generate these macroeconomic benefits have been produced through this effort.

A 1996 study conducted by Nadiri and Mamuneas under FHWA sponsorship developed a sophisticated econometric model of the influence of highway capital investment on firms' productivity and costs, and applied this model at both the detailed industry and economy-wide levels to estimate significant economic returns from highway investment. A more recent (1999) FHWA-sponsored study by Nadiri expanded the previous model to include benefits from the reductions in product prices and increased consumption that result when lower production costs are passed through to consumers. Using this more comprehensive model of highway investment benefits, Nadiri concluded that economic returns to highway investment were very high (perhaps exceeding 50 percent) during the 1960s, but subsequently declined to approximately the average rate of return on private capital (16—17 percent) during the 1980s. Under FHWA sponsorship, Nadiri has also conducted a more recent analysis of benefits to the household sector of the economy from highway investments. A future project will attempt to link the analysis of the production and consumption sectors together in a general equilibrium framework.

The FHWA continues to support additional research on other macroeconomic or aggregate approaches to measuring benefits from highway investments, and to adapt its microeconomic analysis tools to incorporate non-traditional benefit concepts. For example, the addition of incident delay (valued at a premium over routine travel time) in the benefit calculations in HERS is an attempt to address some of the benefits of improvements in highway system reliability. (See Appendix A.) Another major research effort under FHWA sponsorship is attempting to develop a conceptually sound and empirically practical approach to estimating highway investment benefits by measuring savings in firms' logistics costs that result from additions to highway infrastructure. Finally, attempts may be made to link HERS outputs to models of regional economic development that use measures of highway conditions and performance as an input.