

KEY TOPICS

How Levels of Transportation Investment Affect Economic Health

PRESENTATION

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Note: The full text of the resource paper prepared and circulated by Mr. Eberts in advance of the conference appears in the "Resource Papers" section of these proceedings.

My interest in the areas of economic development and transportation dates back to the early 1970s, when I was a graduate student at Northwestern University. One of my professors suggested that for my dissertation, I go around to all 256 communities in the Chicago metropolitan area and ask them about how much infrastructure they have and what condition it is in. Well, no one had ever done that before, and I quickly found out why.

After I got my degree, I got a National Science Foundation grant to put together capital stock measures for metropolitan areas around the country. In recent years, however, the emphasis has shifted to the macronational level. I am very pleased that with this conference and others, we are getting back to the state and local level, which is where so many important decisions are made.

The questions that I posed in my paper all relate to the state and local level. We might ask, for example, how transportation investment increases value by creating

new jobs, increasing personal income, improving environmental quality, enhancing quality of life, and perhaps even improving low-wage workers' access to jobs.

More specific questions at the national and state levels might address the effects of additional highway spending on economic development. At the local level, one might ask how a local freight facility, expansion of a regional airport, or an additional lane might boost the local economy.

Can we answer these questions very well? I would give us a fairly low score, especially for questions focused at the state and local level; on a scale of 1 to 10, I think we are around a 2 or a 3. We can do much better.

We don't have very good information, but we do know that broadly speaking, transportation investment makes a positive but small contribution to economic health. Many estimates find that the contribution of public investment to productivity is about a quarter of that which derives from private investment.

Most studies to date focus on the correlation between transportation infrastructure and economic activity over a long period of time. These analyses can be accomplished using a production function or a cost function.

Turning first to the production function, consider the following formula:

$$Q = f(K, L, M, G)$$

In this formula, Q represents output, measured as value-added. Output is a function of private capital (K), labor (L), materials (M), and government-provided infrastructure (G).

In contrast, the cost function formula looks like this:

$$C = b(Q, P_k, P_m, W, G)$$

In this formula, the cost (C) of producing a certain amount of output is a function of the amount of output (Q), the price for capital (P_k), the price for materials (P_m), the price for labor, expressed as the wage rate per hour (W), and government-provided infrastructure (G).

What's the difference between these functions? Production functions by themselves look at the technical relationship between outputs and inputs. Cost functions add in the demand for inputs through inclusion of the price variable. Thus, the cost function adds another dimension to the relationship.

But either way, we need to understand that this analysis occurs within the regional growth process. Thus it is important to anchor these relationships within some type of spatial context. However, most studies haven't yet done this, largely because the analysts don't have the detailed data necessary to make that spatial correspondence.

Once we have that regional process in mind, grounded again in some spatial context, we then can ask about transportation's effect. Transportation can play several roles. First, as a direct input it can affect output directly. Second, we can look at transportation's ability to help us produce more efficiently if we hold labor, materials, and all other inputs constant.

I would now like to walk through some of the shortcomings I perceive with the state of the practice as we currently know it:

- Most studies rely on capital stock estimates that are calculated using the perpetual inventory method that Barbara Fraumeni discussed earlier. The problem with this approach is that it does not recognize attributes. For example, the perpetual inventory method treats a dollar of highway investment in Montana the same as it does a dollar of highway investment in New Jersey, but we all know that this is not the case because of differences in terrain, climate, and construction costs.

- In a related matter, we have very little information with which to respond to more detailed questions about the contribution of specific attributes of a given highway segment to economic development. This is an especially serious problem because the highway system is so mature, meaning that most investment today entails changes

to these attributes rather than construction of major new segments.

- Most studies include commodity flows—that is, where goods are coming from and where they are going. When looking at a national study that focuses on a given industry, we can make some inferences knowing that certain industries are concentrated in certain parts of the country. But still, most studies bundle all highway infrastructure in the whole country within the production function. It is important that we begin to separate out infrastructure that does not pertain to the activity or industry on which we are focusing.

- Current analyses also have a number of econometric problems associated with correlation and causation. Is infrastructure causing output, or is output driving additional demand for infrastructure?

- It is also important to capture network effects. Some studies are now trying to look at infrastructure in just one state and then layer that information onto data concerning infrastructure in the neighboring state. Certainly neighboring infrastructure has an impact. But does this type of layering really help refine the analysis?

- We also need to take a closer look at outputs versus outcomes. By outputs, I mean those services produced by transportation facilities, such as highways or rail. Outputs can be measured as traffic flows, reliability, or safety. By outcomes, I mean the effects of these outputs on the economy or environment. Outcomes are measured as the number of jobs created, changes in personal income, changes in gross domestic product, or air or noise pollution. If we look only at facility characteristics, such as lane miles, we're getting only part of the story. We need to understand how these outputs affect outcomes, such as reliability, safety, the economy, and the environment. And again, each of these depends on where a given facility is located.

- We need better ways to calculate the cost of providing transportation infrastructure. Although cost is embedded in the perpetual inventory method, cost is not explicitly considered anywhere else.

- Finally, it would be helpful to have a more comprehensive regional growth model, encompassing not just production and cost functions, but also the whole regional growth process. This links to the final proposal appearing at the end of my paper, which urges a working collaboration among agencies so that we can collectively maintain and improve the data that measure these various dimensions.

WORKING GROUP FINDINGS

Susan Binder of the Federal Highway Administration and William Black of Indiana University led the two groups assigned to the issue of investment levels' impact on economic health. The findings of these groups appear below.

Key Questions

- What are the full benefits and costs of transportation?
- Are there significant costs or benefits not being captured?
- Who bears the costs and enjoys the benefits?
- Can transportation address social issues such as sprawl and spatial mismatch of jobs?
- How should network effects be estimated (including creation of new networks and enhancements to existing systems)?
- What will this mean for jobs and income?
- Can transportation benefits be compared to other products of public investment? How can this information be used to guide investment decisions?
- How do we evaluate the performance of the transportation system and its individual components?
- How does transportation help our major industries?
- How can one link macro- and microanalyses? Can individual benefit-cost analyses be aggregated up to a macrolevel approach?
- What institutional forms and financing arrangements for delivering transportation will maximize net benefits?

Sufficiency of Data and Analytic Tools

- Consumer benefits are not adequately measured. In particular, it is difficult to isolate the benefits that accrue to nonusers.
- The data collected on functional or jurisdictional grounds often are inconsistent. They should be better aligned.
- We need better forecasts of economic conditions, both regionally and nationally.
- Measures of outcomes need to be expanded to include complementary public service investments.
- It can be difficult for analysts to obtain access to archived data (e.g., older metropolitan travel surveys).

- Existing measures of congestion do not adequately reflect delay on existing metropolitan or statewide networks.

- It would be helpful to see a segment-based measure of reliability.

- The National Passenger Transportation Survey provides good national data, but it is not currently flexible enough to support metropolitan planning and transportation modeling.

- With respect to vehicle stocks and travel patterns, it is difficult to distinguish business versus personal use.

- We lack good data on the value of privately owned capital to transportation service.

- With respect to behavioral choice models, these analytic tools could do a better job of showing the effect of pricing on consumer and producer behaviors.

- With respect to commodity flow models, we do not have a good understanding of imports or traffic on bridges. These kind of data would complete the local picture of freight movements and their importance to the economy.

- Regional forecasting models are not well developed and their usefulness is impaired by the fact that data are not available at the substate level.

Research Needs

- Development of comprehensive input data for measuring transportation infrastructure capital stocks;
- Development of expanded measures of transportation systems;
- Exploration of the correspondence between the economic benefits of highway investment and road user taxation;
- Assessment of transportation's role in encouraging development in economically depressed areas;
- Measurement of transportation outcomes and improvement of the efficiency of data collection;
- Synthesis of economic linkage case studies;
- Identification of the network effects of highway improvements;
- Linkage of commodity flow data to establishment-level data to measure transportation system utilization;
- Estimation of the impacts of network externalities; and
- Analysis of counties' and states' provision of highway services.