

# The Feasibility Study and Economical Impact on Highway Infrastructure

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## Abstract:

This research reviews the literature on the effects of highway infrastructure on economic outcomes to inform the current debate. The government has at times premised investment in highway infrastructure in part on the belief that it contributes to economic growth. However, the economic effects of highway infrastructure remain a matter of debate. We focus on highway infrastructure because it constitutes the largest share of federal spending on transportation infrastructure and because there exists a rich literature assessing the economic effects of highways. We start by highlighting connections between highways and the economy, noting the recent calls for reconsideration of national transportation policy. We then turn to an analysis of the quantitative literature tracing the effects of highway infrastructure on such economic outcomes as productivity, output, and employment. We conduct this analysis in two ways. First, we present a qualitative discussion of the literature. Second, we conduct a formal quantitative Meta analysis to discern more clearly why the literature has produced its current findings about infrastructure and the economy. After discussing these findings, we consider their implications for highway policy and for future research.

## Introduction:

Highway infrastructure can affect the economy in a number of ways, nearly all of them related to increasing mobility. It can enable producers to reach markets more cheaply, to increase the size of their market area, and to have a broader choice of input suppliers. It can increase the speed with which producers can reach markets or inputs, allowing them to hold lower inventories and carry out just in time production. Highway infrastructure can enable workers to choose among a wider array of employment opportunities and to live farther from their workplaces. It can enable consumers to have a more varied choice of goods, services, and prices. Not all highway infrastructures produce these outcomes in the same way. Some transportation infrastructure serves purely local needs, whereas other infrastructure enables connections to national and international markets. Besides the longer run effects, highway infrastructure also can boost economic activity through immediate construction activity that

results from new highway infrastructure investment. We focused the literature review on studies that used statistical methods to seek relationships between existing highway investment, highway capital, or some other measure of highways, and economic outcomes. We conducted this review two ways. First, we carried out a qualitative review describing key findings in the literature. Second, we conducted a formal Meta analysis using statistical methods to help us gain a better understanding of how study characteristics influenced study results. In our review, we concentrated on three broad classes of economic outcomes: changes in productivity, meaning the ability to produce greater levels of output than previously from a specific level of inputs; changes in economic output, measured as changes in total output, value added, or per capita measures of either; and changes in employment. Analysts have also considered a number of other economic and demographic outcomes, such as earnings growth and population shifts, and we discuss these outcomes as well where appropriate. We excluded the immediate employment and income effects of highway construction and maintenance.

### **Review of Literature:**

Studies of highway infrastructure at the national level tended to find high rates of return and strong productivity effects, at least in the initial building phase of the national highway system. One way this was manifested was through lower costs to industries, especially those that most heavily used the highway network. Likewise, some of the research at the state level found positive effects of highways, or broader measures of public capital, on a variety of economic outcomes. However, these effects tended to be lower than those of private capital investment when the two were compared. Although some research identified positive effects of infrastructure in one state on the economy of neighboring states, more identified zero or even negative effects. Taken together, this evidence is consistent with the idea that some highway infrastructure investment can lead to positive productivity or output outcomes. However, there is a possibility that such investment can have negative effects on neighboring states. Research at the sub state level confirms that the economic effects of highway infrastructure are far from straightforward. Highway infrastructure in a county can boost the economic performance of that county but can also cause economic declines in other counties. Such positive and negative effects can even be found within a county or metropolitan area and could result in a zero or even negative overall economic effect for a metropolitan area or a multicounty region. There are solid reasons why the effects of highway infrastructure vary. County characteristics, such as existing levels of income, have a strong influence on whether highway infrastructure will change economic outcomes. In addition, even among highways,

the type of highway matters. Finally, the value or quantity of highway infrastructure is only one factor to be considered when measuring the effects of highways on economic outcomes. Congestion which might not be solved by building more infrastructures but by managing highway use in an efficient way can have negative effects on economic performance. International research further confirms that quantity and value are not the only important variables and provides the intriguing finding that the condition of highway infrastructure can have large effects on economic outcomes.

### **Meta Analysis:**

The studies we reviewed used a variety of methods, analyzed different types of infrastructure, covered different time periods, focused on different geographic areas, and investigated different types of economic outcomes. To find out how the variation in study design affected the results, we conducted a formal meta-analysis. In such an analysis, results from a broad range of studies are analyzed statistically against the characteristics of those studies. The Meta analysis cannot answer definitively whether highway infrastructure has positive effects on the economy. Rather, it can explain the general tendencies present in the set of papers analyzed. If the papers were representative of the broader literature, the Meta analysis would also indicate what researchers in general would tend to find. The Meta analysis indicated that research that analyzed the relationship between infrastructure and productivity tended to find a positive and statistically significant result. Statistical significance means that there is only a low probability that this relationship occurred by chance. Secondly, research that analyzed the relationship between infrastructure and output tended also to find a positive and statistically significant result. These results extended to highway infrastructure, specifically. We found that highway infrastructure had the same effect on productivity and output as broader measures of public investment and that this effect was positive and significant. It appears that highway investment and broader public investment had different effects on employment and population, but we were unable to test this for the technical reason that certain variables in our data set were too highly correlated to allow us to calculate results. Finally, we also found that papers that analyzed national level data were more likely than studies that analyzed state level or sub state level data to find a positive and significant relationship between infrastructure and economic outcomes. We believe that this reflects the findings of much of the analysis at the state level and below that highway infrastructure has a tendency to reallocate economic activity and not just to increase it. Furthermore, national level studies may be more likely to capture geographically distant spillovers that could be

quite important but might not be found in a study concentrating on more constrained geographic areas.

### **Feasibility study:**

A feasibility study is a study undertaken to investigate alternative options for a highway project, to find out whether the project should be carried out, and which option is the most viable. A feasibility study is sometimes carried out in two stages, namely the corridor stage and the alignment stage. For example when bypassing a town, two different corridors might have to be investigated and evaluated. In most cases, however, the feasibility study can be narrowed down to studying the viability of alignments within one corridor. The feasibility study is also used to determine the viability of reconstructing and rehabilitating an old road. The study should take account of social factors, and economic and ecological considerations. Feasibility studies may also be carried out to compare different road projects serving different populations as a means of ranking them in order of priority.

### **Corridor Investigation:**

The corridor investigation starts with gathering and reviewing existing data on aerial photographs, existing traffic counts, site reconnaissance, initial field surveys of settlements and other developments, terrain assessment, analysis of road building materials availability, wildlife migration patterns and other environmental aspects. Following the determination of the corridors, a preliminary environmental impact assessment is to be carried out for each corridor in order to select the most feasible one. The environmental impact assessment carried out at this stage should generally not be detailed, but adequate for making an informed decision. The level of detail depends on the scale and magnitude of the project and will not be described in detail in this guideline. Informal discussions may be held with inhabitants of the study area to determine if there are any features that are not obviously visible which should influence the choice of the corridor. It is also important to give the local community an opportunity to express their opinion on the choice of corridor.

### **Alignment Investigation:**

The first stage in the alignment investigation involves data collection. Data collection at this stage will be more detailed than at the corridor selection stage, and a complete 'walk over' the alignments is required to ensure that no significant details are left out. In instances where adequate mapping is unavailable, the recommended corridor will be mapped out on a reasonable scale to allow all ground features to be depicted. Consultation will be more

extensive at this stage than at the corridor stage. Various alignments are studied taking account of socio political, ecological and economic impacts as well as engineering considerations in order to arrive at the pros and cons of each alignment and propose the best alignments for a detailed EIA. Sometimes there is only one relevant alignment, for example when rehabilitating an existing road. The assessment of alternative standards will then be the main objective of the study. Mitigation is defined as the implementation of practical measures to reduce adverse impacts on the environment, or enhance the beneficial aspects of an action. Mitigating measures will also be as drawn up for inclusion in the final EIA and in the plan at the detailed planning stage. If the existing road is going to be decommissioned, the assessment must cover different options, for instance removing the tarmac for nature to take over gradually or handing the road over to the local communities for continued use.

### **Construction:**

Impacts related to construction, operation and maintenance should be clearly defined such that all parties to the contract are aware of their respective responsibilities. Mitigating measures should be incorporated in the tender and in contract documents for implementation during the construction. The type of each mitigating measure and when it is to be implemented during construction should be stated for both adverse and beneficial impacts. The highways Department should organize a committee involving community leaders and other local authorities for the duration of the project in order to effectively communicate locally and with highways Department representatives. An Environmental Code of Conduct should be included in any contract covering the following themes as a minimum:

- The erection of camp site offices must be carried out in accordance with permission given, and the campsite rehabilitated on completion of the works.
- Respect for people's properties and local customs.
- Information to workers and the local community about the risk of spreading sexually transmitted diseases.
- Permission for the establishment of borrows pits and their rehabilitation after use.

### **Operation and Maintenance:**

The effectiveness of mitigating measures implemented during the construction requires monitoring and evaluation during the operation and maintenance of a highway project. Those impacts that can be assessed during the twelve month maintenance period should be evaluated so that any shortcomings resulting from the improper execution of recommended measures can be corrected. An evaluation report should be produced assessing the effectiveness of these measures and, if necessary, recommending correcting measures. Monitoring is the responsibility of the highway Authorities.



### Qualitative and Quantitative Reviews:

Research has identified positive effects of highway infrastructure on economic outcomes, in particular productivity and output. However, studies often do not take the next step of calculating whether the benefits stemming from the infrastructure outweigh the costs of building it.

- The Meta analysis confirms that broad measures of public infrastructure have a positive and significant effect on economic outcomes, and that highways have such an effect on productivity and output specifically.
- Private capital investment tends to have larger effects on economic outcomes than public capital investment or highway investment, although the public investment can serve as a complement to the private investment.
- In the absence of a complete network, construction of transportation infrastructure can have large, positive effects on economic outcomes. As the network becomes more complete, effects of network expansion tend to diminish.
- These effects appear to be both direct with transportation infrastructure serving as an input in production processes and indirect with transportation infrastructure making other types of inputs more productive. Not just the quantity but the condition of infrastructure and its level of congestion may be important for inducing positive economic benefits.
- Transportation infrastructure has effects beyond the geographic area in which it is located. These can be positive or negative, and so the net economic effect could be positive, zero, or even negative. However, the Meta analysis results regarding national level studies versus those at the state-level and below suggest that geographically distant effects may be hard to measure when a study focuses only on smaller geographic areas.

Many transportation specialists agree that transportation policy is in need of fundamental change. At the same time, they hold a wide range of opinions about how to effect that change and craft future programs. We intend the findings from the literature review to suggest alternative ways to view key policy issues and inform public debates over the content of the next transportation legislation. Although the findings do not suggest specific programs that can be implemented, they may present underlying principles for the reform of policy and programs.

## Conclusion:

Highway infrastructure varies greatly in its economic effects, depending on a wide variety of system and geographic factors at the local and regional levels. Although highways on average appear to have positive economic effects, these effects can be highly context specific. Better targeting of highway investments could lead to better economic outcomes. The economic benefits and costs of highway investments can and often do spill over into jurisdictions different from those in which the infrastructure is located. Where benefits are dispersed or costs are concentrated, this can make it politically difficult to achieve support for projects that allocate differential benefits and costs over multiple political jurisdictions. We refer to these as projects of national significance, and we suggest that they are the most likely to be in the national interest and worthy of national funding. The review also suggests a number of avenues for future research. A great deal of statistical research on the economic consequences of highway infrastructure focuses on how highways have influenced productivity, output, or employment. A minority of that literature has then taken the next step of placing a value on those economic changes and comparing that value with the cost of the infrastructure. Taking that next step can make a valuable contribution to the policy debate and should be a priority of future highway research. Furthermore, research should be broadened from considering not just the value or quantity of highway infrastructure but also its condition. It is possible that long term economic changes such as increased globalization have affected relationships between transportation infrastructure and the economy. Finally, there was relatively less literature of the type we considered studies that used statistical methods to analyze existing infrastructure on public transit and intercity freight railway than on highway infrastructure, suggesting a further knowledge gap.

## References:

1. Chandra, Amitabh and E. Thompson. 2000. Does Public Infrastructure Affect Economic Activity? Evidence from the rural interstate highway system. *Regional Science and Urban Economics* 30(2000): 457-90
2. Chari, Amalavoyal. 2007. License Reform in India: Theory and Evidence. Mimeo, Yale.
3. Demurger, Sylvie. 2001. Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China. *Journal of Comparative Economics*. 29: 95-117.

4. Djankov, Simeon, Tim Ganser, Caralee McIlesh, Rita Ramalho and Andre Shleifer. 2008. The Effect of Corporate Taxes on Investment and Entrepreneurship. NBER Working Paper No. 13756. Cambridge, MA. Duao, Esther and Rohini Pande. Damsí. MIT Department of Economics, Mimeo.
5. Fernald, J.G. 1998. Roads to Prosperity? Assessing the Link between Public Capital and Productivity. AER 89:619-38.
6. Gulyani, Sumila. 2001. Effects of Poor transportation on Lean Production and Industrial Clustering: Evidence from the Indian Auto Industry. World Development 29(7): 1157-77
7. Holl, Adelheid. 2004. Manufacturing location and impacts of road transport infrastructure: empirical evidence from Spain. Regional Science and Urban Economics. 34: 341-63
8. Knittel, Christopher. 2002. Alternative Regulatory Methods and Firm Efficiency: Stochastic Frontier Evidence from the U.S. Electricity Industry. Review of Economics and Statistics 84(3).
9. Michaels, Guy. 2007. The Effect of Trade on the Demand for Skill Evidence from the Interstate Highway System. Mimeo, LSE
10. Munnell, A.H. 1980. Policy Watch: Infrastructure Investment and Economic Growth. Journal of Economic Perspectives 6(4): 189-98
11. Rephann, T.J. and A. Isserman. 1994. New Highways as Economic Development Tools: An evaluation using quasi-experimental matching methods Regional Science and Urban Economics 24, 723-51
12. Shirley, Chad and Cliord Winston. 2004. Firm Inventory Behavior and the returns from highway infrastructure investments. Journal of Urban Economics 55: 398-415