
DO HIGHWAYS MATTER?

**EVIDENCE AND POLICY IMPLICATIONS OF
HIGHWAYS' INFLUENCE ON
METROPOLITAN DEVELOPMENT**

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ABSTRACT

Growing concerns about traffic congestion and rapid suburban expansion (also known as sprawl) have reignited interest in the ways in which highway spending affects metropolitan growth patterns. This discussion paper extracts the best evidence to date on how highway investments distribute growth and economic activity across metropolitan areas. The paper also offers ideas on how transportation financing and policies can better respond to the various costs and benefits of highway projects in a region.

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DO HIGHWAYS MATTER? EVIDENCE AND POLICY IMPLICATIONS OF HIGHWAYS' INFLUENCE ON METROPOLITAN DEVELOPMENT

I. INTRODUCTION

Highways and urban growth. The two seem inextricably linked, and certainly in popular and scholarly debate much attention is given to the way that highways shape urban development. But the link between road building and metropolitan growth is extraordinarily complex and common assumptions on both sides of the political spectrum are often overly simplistic. Some claim that the problems of central cities can be confidently attributed to suburban highway programs while others deny that any such link exists. A balanced policy perspective most certainly lies in the middle. More importantly, a balanced policy perspective requires an understanding of theory and evidence that, while often complex, points in a consistent direction.

This paper critically reviews the evidence on how highways are linked to metropolitan development and makes policy recommendations that suggest the need to rethink the way we finance and program highways in this country.

The analysis proceeds in four steps:

First, we summarize the policy research context for this debate;

Second, we summarize recent theory and empirical evidence on how highways influence urban growth. An up-to-date assessment of this question is the linchpin of any policy analysis that seeks to link federal highway programs to problems that are by-products of metropolitan growth patterns;

Third, we reformulate some of the policy questions that are popular in this area, emphasizing that questions of economic efficiency, the geography of urban development, and the institutional structure of regional transportation agencies have been overlooked too often;

Fourth, we develop policy recommendations based on our assessment of theory and evidence, and on the need to give increased attention efficiency, geography, and political institutions.

Overall, we conclude that changes in metropolitan location patterns are induced by highways, and these changes are not, on net, costless. A rational highway investment plan should account for the effects on location that highways induce. Land price, population or employment growth benefits that appear in one part of a metropolitan area may come at the expense of even larger costs elsewhere. The difficulty is that the way in which we make and finance our highway investment decisions does not induce rational consideration of all these effects.

We recommend an increased role for representative regional decision-making bodies with both the vision and the authority to balance the competing transportation demands of various metro area constituencies. Such bodies would ideally design policy so as to maximize the regional, rather than local, advantages that transportation policies offer. Although traditionally advisory and research organizations, metropolitan planning organizations (MPOs) are well positioned to fulfill the regional role that is necessary in highway governance and finance. Yet to do that, MPOs must complete the transition, started by earlier federal legislation, from advisory bodies to full highway financing, planning, and programming authorities. To be sure, such a transition faces political obstacles, but federal policy can be used to encourage and guide this policy change.

Overall, we conclude that federal highway policy should be oriented toward more efficiently funding and managing the nation's road infrastructure. In urban areas, that requires that the federal government, among other things, empower metropolitan authorities.

II. A BRIEF INTELLECTUAL HISTORY OF THE ARGUMENT ABOUT HIGHWAYS AND GROWTH

The debate on the link between highways and urban development has long focused on two policy problems: central city decline and suburban sprawl. Central cities often have larger per capita public expenditures and higher per capita tax burdens than suburban municipalities. The cause of such fiscal stress is complex (e.g., Ladd and Yinger, 1989; Bradbury, Downs, and Small, 1982; Peterson, 1981), but regardless of the cause, central city fiscal distress is typically exacerbated when upper-income residents and tax-generating firms flee to what are often lower-tax suburbs. To the extent that suburban highways facilitate this, they are implicated in the minds of many with the problem of central city fiscal distress. Related problems, such as the concentration of poor persons who are left behind in the flight to the suburbs, are also sometimes attributed to suburban highway building programs.

Changing the focus to outlying portions of metropolitan areas, there are heated debates about the costs, benefits, and even the definition of urban sprawl. Many in the policy and planning communities claim that far-flung suburban growth requires expensive extensions of utilities and public services, wastes often underused central city land and infrastructure, and brings traffic congestion and air quality problems from increased driving (e.g., Burchell, 1998; Real Estate Research Corporation, 1974.) These costs may fall disproportionately on those least able to avoid them (Persky & Wiewel, 1998). Others argue that suburban residential development is desired by persons who prefer low-density living on the metropolitan fringe so the concern about sprawl, more properly stated, is a concern that the costs of particular development patterns outweigh the benefits.

The concerns about central city decline and suburban sprawl are two sides of the same coin. Both concerns reflect the idea that metropolitan areas are excessively decentralized in ways that draw tax and economic resources out of the central city while requiring additional infrastructure investments, land, and driving (with attendant congestion and air quality impacts). The broad question of whether United States cities should be more or less centralized and related questions about the costs and benefits of urban sprawl are controversial (e.g. the exchange between Ewing, 1997 and Gordon and Richardson, 1997). We mention these issues not to suggest that American urban areas ought to be more centralized, but to emphasize the perceived links to highway policy. The question of how highway policy enters the debate thus becomes a question of whether highways contribute to the decentralization of urban areas and if so, whether that influence is, on net, beneficial or harmful.

Phrased differently, the key factual point is the “chicken and egg” question of whether suburban highways facilitate (or even cause) the decentralization of metropolitan areas, or whether outlying highways simply serve growth that would have otherwise occurred. This is not a new question by any means. Four decades ago, informed opinion was divided in ways that still characterize the current debate. On one side are those who believe that highways shape urban growth and decentralization, and on the other side are those who believe that the influence of highways is not large and that other factors are more responsible for the decentralization of urban areas.

In 1960, Daniel Patrick Moynihan, then a university professor (and later, as a United States Senator, a co-sponsor of major transportation legislation) argued that there was a link between, according to the title of his article, “New Roads and Urban Chaos.” Moynihan wrote, “Highways determine land use, which is another way of saying they settle the future of the areas in which they are built.” Moynihan saw the then-fledgling Interstate Highway System as a great engine of urban decentralization. In his words, “For good or ill, the location of the interstate arterials would, more than any other factor, determine how this [projected urban] growth would take place.” Elsewhere in the same article, Moynihan makes it clear that

he thinks the effect on urban areas would be negative. Without proper planning (which he complained was largely absent at the time) interstate highways would eviscerate downtowns, drawing persons, shopping, and employment to the suburbs while dividing and disrupting older urban neighborhoods (Moynihan, 1960, p. 19).

But there were other voices in the debate. John Meyer, a transportation scholar at Harvard University, wrote in 1968 that, "The financial problems of city governments are almost certainly more attributable to over-reliance on property taxes and, at least in some states, to inadequate urban representation in state legislatures than to urban transportation choices." (Meyer 1968, p. 52) In 1970, John Kain, also of Harvard University, wrote that, "... research indicates that the postwar pattern of residential development is as much, or possibly even more, a cause of rapid growth of car ownership as the converse." Arguing that the automobile is only one of several factors that contribute to metropolitan decentralization, Kain states, "Cheap credit, favorable mortgage loan terms, accumulations of savings, rapid family formation, the postwar baby boom, favorable tax treatment, a strong preference for home ownership, and the suburbanization of an ever larger number of jobs must all be regarded as important causes of the suburban boom." (Kain 1970, p. 77).

In 1993, Peter Mieszkowski and Edwin S. Mills returned to a similar theme in summarizing the research evidence on the determinants of suburbanization. They asked whether metropolitan areas decentralize as part of a natural evolution that is a response to technological changes and market forces, or whether suburbanization is driven by a flight from the blight of central cities. This is not precisely the same as debating whether highways cause urban decentralization because highway infrastructure could facilitate either evolutionary decentralization or a flight from downtown blight. Yet Mieszkowski and Mills' distinction is informative because the opponents of suburban highways usually couch their argument in terms of the fiscal and social ills that are part of what Mieszkowski and Mills classify as flight from blight. In the maddening habit of social scientists, Mieszkowski and Mills (1993, p. 144) claim that both the "natural evolution" and the "flight from blight" explanation of suburbanization are important.

In many ways we are still where the debate started some forty years ago. The link between highways and metropolitan development is complex, and different persons draw different conclusions from often-similar evidence. In this paper, we argue that there is a way out of this policy morass - but two questions must be answered. First, what can objectively be said about the influence of highway infrastructure on metropolitan development? Second, if highways do influence urban growth and vitality, and thus are part of what Moynihan (1970, pp. 8-9) called the federal government's hidden urban policy, what reforms are suggested by both theory and evidence? We turn first to the factual question of the link between highways and metropolitan growth.

III. HIGHWAYS AND METROPOLITAN GROWTH

A. Theory

Economic theory suggests that highway improvements will have effects on urban growth by changing both intra- and inter-metropolitan accessibility. Much of the theoretical apparatus for examining the intrametropolitan effect of transportation investments is rooted in “monocentric” models of urban land use. In these models, jobs are assumed to be concentrated in a single central business district (CBD), and persons live in residential communities that surround the CBD. Land values drop with distance from the CBD to reflect the increased cost of commuting from distant locations into the jobs in the city center. (For summaries of monocentric urban location models, see, e.g., Alonso, 1964 or Fujita, 1989.) New highways that link the outlying residential areas to the CBD lower the cost of commuting into the employment concentration in the center of the city. This increases land values in the suburban fringe while reducing the “accessibility premium” that central locations had previously enjoyed. The urban area will grow geographically as commuters can live farther from work without increasing their travel budgets. Densities will fall as the premium for the densely developed locations near the CBD is reduced. In short, in monocentric models, transportation improvements are associated with decentralization and deconcentration of the population of the urban area. (For a more detailed discussion of these results, see, e.g., Fujita, 1989.)

While this broad interpretation of the link between transportation and urban development is accepted at its simplest level within much of the urban literature, there are considerable complications that the monocentric model does not address. The most obvious difficulty is that modern metropolitan areas are far from monocentric. While the assumption that jobs are located only in a central business district might be a reasonable depiction of early eighteenth century American cities¹, both anecdotal and scholarly evidence have clearly documented that modern cities are now characterized by multiple employment centers (e.g. Garreau, 1991; Small and Giuliano, 1991). This immediately leads to the need to explain not only residential location, but also how firms choose to locate within metropolitan areas and how firm location is influenced by transportation accessibility.

Like households, firms that value the use of a particular transportation mode will have incentives to cluster near access points to that system. For example, the Interstate Highway System offers low transportation cost for moving goods and passengers over long distances (so-called “line haul” benefits) and interchanges in that system are thus valuable locations that will command high land prices and foster dense job development (Hoover 1975). This is consistent with the evolution of urban employment locations, which were originally concentrated near points of access to waterway transportation, then increasingly at rail junctions near the fringes of central cities and finally have clustered around highway interchanges on the edges of metropolitan areas (Jackson 1985; Cronon 1991; Garreau 1991).

Clustering to gain transportation access is a special case of a more general phenomenon that helps explain the geographic concentration of firms within and across metropolitan areas. The existence of “agglomeration economies” implies that firms are more efficient when they locate in close proximity to each other. Some of these benefits are transportation-related. Firms that produce for regional or national markets may cluster near points of access to the inter-metropolitan transportation system. Retail businesses may share a customer base that values the convenience of shopping in a small

¹ See, for example, Jackson’s (1985) descriptions of the “walking city”; Pred (1966) includes some fascinating maps of job locations and journeys to work in New York during the first half of the 19th century.

geographic area. Firms may also cluster if they produce for each other: the growing prevalence of “just-in-time” inventory techniques provides incentives for suppliers and their buyers to locate together (Doeringer & Terkla 1995). Geographically concentrated firms may also provide each other with industry-specific information about markets, production processes or suppliers that translates into higher productivity and profits. Quigley (1998) contains a recent review of the literature on these agglomeration economies.

Further complicating the relationship between highway investments and metropolitan development patterns is the fact that transportation costs may play an important role in determining the overall level of regional growth, as well as its intra-metropolitan distribution. Often, those in favor of transportation improvements argue that they will improve the productivity of an entire region. A new highway system can theoretically provide a large enough boost to a region’s economic development that the central city will grow in spite of increased pressure for decentralization created by the same highway.

Transportation infrastructure can provide a region with a potentially important advantage in the inter-regional competition for firms and economic development. Regions that are far from sources of raw materials can nonetheless attract development if their transportation systems allow delivery of these inputs at low cost. Examples from American history underline this point. In the nineteenth century, the development of canals and railroads provided significant advantages to the locations they served, allowing city businesses to simultaneously locate near their markets while keeping raw material transportation costs acceptably low. The rapid growth of New York in the first half of the nineteenth century and Chicago in the second half would not have been possible without the development of canals (for New York) and railroads (for both cities) -and the benefits of these transportation systems may be quite widespread. The completion of the Erie Canal, for example, contributed powerfully to the growth of Albany, Buffalo and Rochester - all located at junctions along its length. At the same time, the development of this transportation network helped New York to rise relative to its primary competitor, Philadelphia, which tried unsuccessfully to construct a series of canals connecting the Schuylkill to the Ohio River basin during the early part of the nineteenth century. Similarly, the interstate highway system allows produce to be rapidly transported from fertile regions to markets. Thus a key benefit of an interregional transportation network is its ability to foster the relative growth of those places that are accessible to the network.

However, in spite of this history, the interaction of transportation and regional development is complex. By limiting the geographic area that can be served from any particular point in space, transport cost provides the impetus for the development of small-scale industries that serve the local market. For these firms (and their employees), transport cost reductions may lead to a loss of customers as larger firms in other regions are able to penetrate the local market. In the theoretical models of Krugman (1993) and Walz (1996), reductions in transportation costs lead to growth in developed regions but decline in regions whose industries operate at less than efficient scale.

The bottom line is that there is no single bottom line. For some industries (especially high cost producers in small markets) transportation cost reductions will eliminate the barriers that protect them from outside competition, eroding their markets. For others (especially industries that already operate efficiently at a relatively large scale), improved access opens up new markets and allows costs to be reduced.

Of course, as touched upon above, the distinction between inter- and intra-regional transportation networks is applicable only in theory. In practice, the very same highway investments that reduce long-distance transportation costs may

also be used for intra-urban transportation. The building of the interstate highway system reduced the cost of transporting goods from region to region while simultaneously altering the geography of accessibility within metropolitan areas. The complex nature of highway systems means that theory alone cannot untangle the effects of a particular investment. We must turn to empirical evidence to assess how the conflicting theoretical effects actually play out.

B. Empirical Evidence

Despite the ambiguity of some of the theoretical results, most models predict a link between improvements in transportation access and increases in land prices and development densities nearby. A fundamental empirical question, then, is whether transportation access influences land prices and development densities in the way that theory predicts. Some studies have examined whether land near highways sells for a higher price which reflects, at least in part, the value of the transportation access provided by the highway. Other studies have examined how highways influence population and employment growth patterns within urban areas. Both groups of studies are often intrametropolitan in their geographical focus. After reviewing the evidence on the influence of highways on land prices and growth patterns, we will turn to literature that suggests that the traditional view has overlooked the important possibility that highways influence the spatial distribution of urban growth. A focus on the way that highways influence the spatial distribution of urban growth helps illuminate policy issues related to highways and urban development.

1. Evidence on Land Prices and Highway Access

Giuliano (1989) reviewed the literature on land use and transportation and Huang (1994) reviewed the narrower literature on land prices and transportation infrastructure. Both agree that studies of land prices and highways yield results that vary depending on when the study was conducted. The early studies, from the 1950s and 1960s, usually showed large land price increases near major highway projects. The later studies, from the 1970s and (less often) the 1980s, typically showed smaller and often statistically insignificant land price effects from highway projects. The early studies typically examined the first limited access or interstate highway built in an urban area.² Giuliano (1989) and Huang (1994) both argue that the first link in a metropolitan highway system is likely to bring large improvements in transportation access and thus, based on the theory summarized above, large increases in land prices near the project. As more highways are built, and the metropolitan highway network matures, the incremental effect on accessibility from new or improved highways decreases, thus accounting for a smaller change in land prices due to any access premium.

Giuliano (1989, p. 151), interpreting this and other evidence on land use and transportation concludes, "Transport cost is a much less important factor (in locational decision-making) than location theory predicts." She bases that conclusion partly on the good metropolitan-wide accessibility provided by mature urban highway systems and partly on changes in production relations, economic structure, and metropolitan development that, in Giuliano's view, reduce the value of within-metropolitan area transportation access. While the character of the influence of transportation on land use changes as a highway system matures, we suggest that the view that transportation access is less important now than in the past is incomplete.

² In these early studies, land value increases near highways were usually compared with land value changes in other similar parcels distant from the project. This is not too different from the logic of later studies, although the statistical approach used to choose similar parcels far from highways in early studies was often less sophisticated than in later studies.

New evidence suggests that metropolitan highway projects still influence land use in the way that theory predicts. The important difference between the new evidence and earlier studies is that the geographic scale of the land use effect appears to be somewhat smaller. A new highway or improvement might importantly reduce travel times in the immediate vicinity of the project, even if the resulting changes in metropolitan-wide transportation accessibility are small. Hence, the land use effects of modern highway projects likely operate over a very fine geographic scale, rather close to the project.

Voith (1993), in a study of the determinants of house sales prices in Montgomery County, Pa. (a suburb of Philadelphia) from 1970 to 1988, found that homes in locations with lower highway travel time to the Philadelphia central business district had higher sales prices, other things being equal. The study further found that the value of highway access increased during the 1980s. Ryan (1997), in a study of office and industrial property rents in San Diego, found that better highway access, measured by distance from a property to the nearest freeway on-ramp, is consistently associated with higher office rents, controlling for other characteristics of the property. Both of these analyses used site-specific information that provides substantially more geographic detail than many earlier studies.

2. *Evidence on Highway Access and Intrametropolitan Population and Employment Growth*

Several recent studies have examined the determinants of population and employment changes in census tracts or similarly small geographic units within a metropolitan area. The advantage of these studies is their fine geographic scale.³ Much previous research examined the influence of highways on growth in central cities and suburban rings (e.g. Payne-Maxie, 1980), a level of detail substantially more coarse than the geographic scale used in the research described below. In New Jersey, Boarnet (1994a and 1994b) used municipalities. New Jersey municipalities are quite small, such that the geographic scale of municipalities in New Jersey is comparable to the scale of census tracts.⁴ The studies of tract or (for New Jersey) municipality data yield a consistent relationship between population and employment change and highway location. Highway access positively influences tract or municipal employment levels in the northern half of New Jersey (Boarnet 1994a and 1994b), Orange County, California (Boarnet, 1996; Geho, 1998), the Atlanta metropolitan area (Bollinger and Ihlanfeldt, 1997), South Carolina and parts of North Carolina and Georgia (Henry, et. al, 1997), and strictly within South Carolina (Singletary, et. al., 1995). These studies use data from both the 1970s (Boarnet, 1996) and the 1980s (Boarnet 1994a and 1994b; Bollinger and Ihlanfeldt, 1997; Geho, 1998; Henry, et. al., 1997; Singletary, et. al., 1995). Some of these studies restricted their attention to employment changes, but in the studies that also examined population (Boarnet 1994a; Bollinger and Ihlanfeldt, 1997; Geho, 1998; Henry, et. al., 1997), highways were also shown to be associated with larger levels of tract or municipal population growth.

These studies, combined with the recent evidence on highways and land prices, suggest that highway access is still an important determinant of fine-grained geographic variation in intrametropolitan growth patterns. This leads to another question: is growth near highways, in part, growth that otherwise would have gone elsewhere in the metropolitan area? Several studies hint at the existence of these intrametropolitan shifts.

³ As an example, the median census tract size in the Boarnet (1996) study of Orange County, California was less than one square mile. Census tracts are based in part on population, and so tract sizes are larger in less densely settled parts of a metropolitan area.

⁴ The median size of the New Jersey municipalities used in Boarnet (1994a and 1994b) was four square miles.

3. *Highways and the Spatial Character of Urban Development*

Stephanedes and Eagle, in a time series study of Minnesota counties, found a positive association between highway expenditures and employment in counties that are regional employment centers, and a negative association between highway expenditures and employment in what they classified as “next-to-urban” counties.⁵ They concluded that, “... while certain areas are likely to gain from improved roads, others are likely to lose and the statewide effect may not be significant.” (Stephanedes and Eagle 1987, p. 77)

Rephann and Isserman (1994) echoed Stephanedes and Eagle’s findings in a later study. Rephann and Isserman conducted a quasi-experimental study of employment, income growth, and population change in two groups of counties -- those with and without interstate highway improvements in the 1963 through 1975 time period. Rephann and Isserman found that counties with some prior urbanization (specifically, counties with cities of 25,000 persons or larger) appeared to benefit from interstate highway projects, but other more rural counties showed much smaller or, for some variables, no impact from the highway projects. Combined with Stephanedes and Eagle’s (1987) results, the research suggests that the land use effect of highways differs in ways that are related to the urban character of particular locations.

Two studies by Haughwout (1999a, 1999b) explore the effect of highway investments on the distribution of activities within urban areas. Haughwout (1999a) finds that increases in state highway stocks reduce house values in both the city and suburbs of large metropolitan areas. Since (by definition) the majority of an urban area’s housing units are located in its most densely developed areas, this means that new highways tend to reduce the accessibility premium that central locations enjoy. In Haughwout (1999b), state highway investments are shown to foster the decentralization of employment growth from dense to less dense counties

To interpret these findings, we draw on the concept of negative spillovers. For our purposes, a negative spillover is defined as a negative economic consequence experienced distant from a highway project. If highways enhance the economy of nearby areas, while at the same time reducing economic activity in distant places, we call the reduction in economic activity at distant locales a negative spillover. This implies that highway projects built in one jurisdiction might be associated with, in addition to any local benefits, reductions in economic activity that spill over, or extend beyond, the jurisdiction that contains the project.

More intuitively, we might say that highway projects affect the geographic location of economic activity by advantaging some places while causing firms and persons to shift their location choices away from other places. If, as the studies of Stephanedes and Eagle (1987) and Rephann and Isserman (1994) suggest, relatively urbanized counties benefit more from highway projects, it is not unreasonable to suspect that some of that benefit comes at the expense of less urbanized counties. Haughwout’s studies (1999a, 1999b) suggest that the fringes of urban areas benefit at the expense of the center. Other evidence on spillovers comes from the extensive literature on production function studies of public infrastructure.

⁵ More formally, Stephanedes and Eagle (1997) examined whether highway expenditures “Granger cause” county employment changes. This is a statistical technique that examines whether highway expenditures are statistically associated with later employment changes, rather than employment changes being associated with later highway expenditures. Stephanedes and Eagle (1987) found evidence that highway expenditures “Granger caused” employment changes in the regional employment centers.

Production function studies look for links between private sector economic output or productivity and the stock of public infrastructure.⁶ Most studies in this literature use data from U.S. states or time series data for the entire United States. (See, e.g., the summaries in Gramlich, 1994 or Boarnet, 1997.) The evidence suggests that when studies correct for important statistical difficulties, there is little or no link between public infrastructure (or, for those studies that examine it, highway infrastructure) and economic output or productivity. Yet the level of geographic detail -- states or nations -- is coarse compared to the land price and intrametropolitan growth studies discussed above. To get more fine geographic detail, Boarnet (1998) fit a production function on data for California counties from 1969 through 1988.

When explicitly testing for negative cross-county spillovers from street and highway infrastructure, Boarnet (1998) found that street and highway stocks are associated both with output increases in the same county and output decreases in other, similarly urbanized counties. This is consistent with the evidence from Stephanedes and Eagle (1987) and Rephann and Isserman (1994) that the effect of highways varies across geography.

In sum, the evidence suggests that highways influence land prices, population, and employment changes near the project, and that the land use effects are likely at the expense of losses elsewhere. Yet the question that we started with was subtly different -- do highways contribute to suburban growth at the expense of central cities? The evidence that highways influence land use, especially near a project, suggests that highways can be an important factor in shaping and channeling the growth of urban areas. But that is different from saying highways cause or even contribute to urban decentralization.

Much of the debate on highways and suburbanization has asked to what extent highways lead to the decentralization of urban areas, or, conversely, whether United States urban areas would be more centralized had the Interstate Highway program not been so ambitiously funded. The evidence on this question suggests, as Mieszkowski and Mills (1993) concluded, that transportation access is only one of several factors that led to the decentralization of United States metropolitan areas. (For similar evidence and conclusions, see also Giuliano and Small, 1993.) Believing that highways are the sole or even the most important cause of suburbanization ignores important evidence that suburbanization is driven by a broad range of influences.

Yet given that metropolitan areas are decentralizing for reasons that might be unrelated to transportation, highways certainly have the potential to influence the geographic character of that decentralization. The evidence discussed above, especially the census tract population and employment studies, suggests that highways can be conduits for decentralization, helping to channel urban growth in some places rather than others. Furthermore, the evidence on negative spillovers suggests that locations that gain due to highway access do so in part at the expense of other locations. Highway projects confer economic advantages on some places and the relative pattern of comparative advantage can be expected to, and appears to, influence the location of economic activity and growth within and across metropolitan areas.⁷ Highways are,

⁶ Street and highway capital is approximately a third of the public infrastructure owned by states and the federal government in the United States (Gramlich, 1994), and some studies examine highway infrastructure as distinct from all infrastructure. The results hardly vary depending on whether the study examined all public capital or only street and highway infrastructure.

⁷ The limited spatial scale of many modern highway projects, which is suggested by rather consistent recent empirical evidence, leads us to conclude that many of the spatial impacts of highways will be within metropolitan areas. This is part of the motivation for our later focus on policy initiatives within metropolitan areas.

as Moynihan claimed years ago, part of the federal government's "hidden" urban policy. Highway construction is more than concrete and cars -- it also influences the ways metropolitan areas grow. This has implications for policy but to understand those implications, one must focus on several often overlooked issues related to highways and metropolitan development.

IV. NEGLECTED POLICY ISSUES

As mentioned, the evidence suggests that metropolitan highway investments can (and do) act as conduits for growth, influencing where new firm and household growth occurs within a metropolitan area. In broad terms, this pattern is likely to favor suburban places over central cities. An important question is what effect such a redistribution of economic activity will have on social welfare.

Highway investments, like other public programs, are justified on economic efficiency grounds only if they improve social welfare, which itself is comprised of the well-being of the individuals who make up society. This implies that highway investments should pass a benefit-cost test -- those investments should generate more social benefits than costs, and ideally (for social welfare maximization) the investments should generate a larger surplus of benefits minus costs than alternative uses of the money. Thus both the benefits and costs of highway projects need to be accurately measured, which is a complex task. We focus mostly on measuring how highways influence individual well being (highway benefits), because that is often more confusing and thus a more likely source of serious errors than measuring project costs.⁸

Transportation economists have traditionally argued that public assessment of the benefits of highway programs should be restricted to road user benefits -- the value of travel time savings, safety improvements, and other reductions in the cost of travel (e.g. Forkenbrock and Foster, 1990; Mohring, 1976). The argument is that other benefits, such as reductions in consumer prices that result from cheaper transport costs or increases in land value that result from improved accessibility, are simply transfers of road user benefits to other persons. Thus to count both road user and transfer benefits would “double count” benefits (Mohring, 1961, 1976, 1993, Mohring and Harwitz, 1962).⁹ That point is well taken, but the transfer benefits, even if they flow directly from road user benefits, are often highly visible and some discussion of the transfer benefits is important, if for no other reason than that such benefits are often drawn into the policy debate. Even more importantly, ignoring transfer benefits obscures some of the more important and obvious location-specific impacts of highway programs. Those location-specific impacts, including some of the economic and land use impacts summarized in Section III, are often part of the political debate about particular highway projects, and the location-specific impacts are also a key source of inefficiencies in highway finance.

⁸ We do not mean to imply that measuring highway costs is easy. Both accurately projecting dollar value highway costs and assessing how those relate to the opportunity cost of the resources can be difficult. Yet both are technical problems which, however difficult, have been often discussed (e.g. Gramlich, 1991), and we see little need to add to that discussion. Measuring external costs of highway projects can be more complex, but with the exception of links to metropolitan development, external costs are not discussed here as that would complicate matters without much changing the thrust of our argument.

⁹ Jara-Diaz (1987) notes that, in cases of imperfect competition, road user benefits might not exactly equal the social benefits of transportation projects. While this raises the prospect of a potentially important shortcoming in the traditional maxim to focus only on road user benefits, we still believe the focus on road user benefits is technically sound, even if short-sighted for the reasons mentioned above. The analytical errors that can result if one counts both road user and transfer benefits can be large (see the discussion in Boarnet, 1997 or Forkenbrock and Foster, 1990), and we suspect that any errors created by focusing only on road user benefits in cases of imperfect competition would be smaller. Overall we conclude that, in an ageographic sense, a focus on only road user benefits is usually acceptable. The difficulty with using only road user benefits to evaluate projects is that it obscures the geographic shifts, discussed below, that are important sources of inefficiency in the current system of highway finance. Of course, one could argue that the geographic shifts discussed below the result of a form of imperfect competition. We prefer not to use that language and to focus on geographic rather than market structure effects, as the former leads more clearly to policy implications that relate to metropolitan growth patterns.

At first glance, it may appear that redistributions of activities from one place to another are zero-sum: the winners (possibly often suburbanites and their governments) gain exactly as much as the losers lose. If this is true, then evaluations of the social welfare effects of highway investments will be based on distributional considerations. Equity may be an argument in the social welfare function, and we may choose to avoid policies that transfer welfare from city to suburban residents on the grounds that they are inequitable. However, such judgements are inherently subjective and prior to resorting to what will surely be contentious grounds for policy making, it is worthwhile to determine whether a redistribution of activity from city to suburb is indeed zero-sum.

It turns out that there are substantial and growing reasons to believe that the spatial distribution of activity is an important determinant of total growth. In a series of papers, Voith (1992, 1993, 1998) has uncovered evidence of strong and increasing connections between city and suburban growth. Other authors have confirmed this general finding, and Brooks and Summers (1997) show that the direction of causality in the relationship runs from central city to suburb. That is, when the city's growth is robust, the entire region is more prosperous than it would be without strong city growth. This leads to the possibility that highways, by influencing the spatial character of metropolitan development, influence growth and social welfare in ways that are not readily apparent.

The literature on the productivity benefits of agglomeration (e.g. Ciccone and Hall, 1996; Ihlanfeldt, 1995) implies that the spatial concentration of producers leads to higher productivity and higher incomes to owners of land, labor and capital. For any particular firm, the incentive to locate in a dense agglomeration of activities will presumably decline with transportation cost; improved accessibility reduces the value of central locations, since employees and inputs may be drawn from a greater distance. The firm considers only its private costs and benefits, and ignores the effects of its decision on other businesses. A decentralizing firm loses the benefits of agglomeration, but this is only part of the cost to society since other firms lose the benefit of proximity to the moving firm. That is, a firm's location decision process ignores the fact that its presence in a dense agglomeration is beneficial to other firms. If agglomeration effects are important, then transportation improvements may lead to excessive job decentralization from society's point of view. The potential for reduced agglomeration benefits is an important, but rarely discussed, social cost of improvements in highway infrastructure. Haughwout's (1999b) finding that state highway investments reduce the relative density of a state's core counties, for example, suggests that state highway investments may indirectly undermine economic growth.

An analogous case may be made for household locations. Sociologists and, more recently, economists have found evidence that the characteristics of an individual's neighbors can affect a person's well-being (Wilson 1987; Case and Katz 1991, Cutler and Glaeser 1997). In these studies, an individual's residence in a racially segregated or extremely poor neighborhood is associated with a variety of unhappy social and economic effects. If high-skill individuals consider only their own welfare and not the potentially beneficial effects that their presence in an integrated urban neighborhood can have, then their decision to move to an ethnically or economically homogenous suburb may have negative social effects. Again, improvements in transportation that foster the segregation of income groups and races may generate social costs that must be accounted for when evaluating the investment.

Finally, the distance of employees from their jobs may have social effects as well. Of much interest among planners is the effect of automobile commutes on congestion, the environment and energy use. At least the first two of these are classic unpriced negative externalities, but the evidence suggests that decentralization has contributed little to increased commute times (Gordon and Richardson, 1994; Gordon, Richardson, and Jun, 1991). Labor economists, meanwhile, have emphasized

“spatial mismatch” - the idea that low skill job creation within metropolitan areas tends to take place far from the residences of low-skill workers, making it difficult for employees to reach them (Ihlanfeldt 1997). To the extent that improvements in the highway system induce relocations that worsen these problems, they generate social costs that ought to be considered as part of the decision process.

Taken together, these factors suggest that changes in metropolitan location patterns induced by highways are not, on net, costless and that a rational highway investment plan should account for the effects on location that highways induce. Land price, population or employment growth benefits that appear in one part of a metropolitan area may come at the expense of even larger costs elsewhere. The difficulty, as we discuss in the next section, is that the way in which we make and finance our highway investment decisions does not induce rational consideration of all these effects.

V. POLICY IMPLICATIONS

A. Highway Finance and Economic Efficiency

Given the discussion in the previous section, there are two economic efficiency issues that must be addressed -- the *cross-subsidies* that are endemic across different localities in the current system of highway finance, and the potential for *negative spatial externalities* from highways that are most often built in suburban portions of metropolitan areas. Consider first the problem of cross-subsidies.

There are many reasons to conclude that highways are often paid with funds that come from outside of the area that will benefit from the project. The evidence summarized in Section III suggests that modern highway projects typically bring localized benefits, often for only a part of a metropolitan area or region. Further, the evidence implies that much of the economic impact of highways is to shift activity across the landscape, suggesting that some local benefits are, in part, at the expense of other places that might lose economic activity as a result of a highway project. Add to this the fact that many highway projects are financed in large part by state and federal funding, and the highway system takes on the appearance of a patchwork of local benefits purchased with state and federal money. If local decisions and preferences dominate, this raises the potential that localities will argue for a project that might produce benefits in excess of the local funds expended, but that might also produce benefits which fall short of the total cost once state and federal funds are included.

Ideally, the area that benefits from a project would pay the cost, since that would encourage a more complete consideration of costs and benefits. As things currently stand, local governments can often export a large share of the cost of projects to states and the federal government, in effect buying local gains with money that comes from other cities, regions, and states. This can lead to a systematic bias toward too much highway construction -- too much in the sense that projects which do not produce social benefits that exceed social costs nevertheless get built.

As an example of this problem, consider a rail transit analogy. Donald Pickrell, of the United States Department of Transportation's Volpe Research Center, published the results of an analysis of cost and ridership forecasts for eight rail transit systems built during the 1970s and 1980s. Pickrell (1992) reports that initial travel demand estimates for seven of the eight systems exceeded actual travel in the early years of system operation. Pickrell (1992) further documents that actual construction costs exceeded estimated costs in seven of the eight systems. Operating costs similarly exceeded forecasts for most of the systems. Overall, in the eight cities examined, rail transit system project analysis displayed a strong trend toward an overly optimistic assessment of system benefits, while underestimating costs.¹⁰ Pickrell (1992) concludes that a primary reason for this poor project analysis is that the systems he examined were built with large shares of state and federal funds. In short, localities did not bear the full cost of their own faulty analysis and were able to export the cost of analytical "mistakes" to other regions. The lesson is not so much an indictment of rail transit planning as an example of the potential inefficiency in financing local benefits with state and federal money. We are not aware of similar studies for highway projects, but the geographic mismatch between often localized highway benefits and large state and federal funding

¹⁰ Pickrell (1992) analyzed the accuracy of forecasts that "... were available to decision makers at the time they chose among alternative projects." These forecasts were often from planning phases rather than preliminary engineering phases of a project and some persons have contended that an analysis of the accuracy of forecasts should give more weight to later, more detailed, estimates. Yet for our purposes the early estimates (because they are often influential in both rail transit and highway project decisions) are more important, and examining the accuracy of those early forecasts can give insight into the efficiency of the infrastructure spending and allocation process.

responsibility creates the potential for poor assessment of highway projects in a manner analogous to what Pickrell (1992) describes for rail transit.

There are two broad solutions to this problem. Policy-makers can either require careful benefit-cost analyses of all projects, or funding shares can be changed to bring local incentives more in line with social goals. While either would be desirable, we suggest that reforming highway finance has more promise.

Benefit-cost analysis has been advocated for highway projects for years. In 1977, the American Association of State Highway and Transportation Officials published a guide on conducting benefit-cost analysis for highway and other transportation projects (AASHTO, 1977). Other textbooks, research reports, and publications discuss the importance of analyzing highway projects using benefit-cost techniques (Friedlander, 1963; Mohring, 1976; Weisbrod and Weisbrod, 1997). Yet, as long as localities are able to purchase local benefits with state and federal funds, local governments have incentives to overstate highway project benefits and understate costs, in a fashion similar to what Pickrell (1992) documents for the rail transit projects he examined.

The current system of highway finance provides large pools of money to states and localities for highway programs. In federal fiscal year 1996, federal transportation grants to state and local governments were 34% of all federal grants, excluding grants for health (mostly Medicaid) and income support. Of the transportation grants, over two-thirds were for the federal aid highway system. Both proportions have remained roughly constant since the mid-1980s (United States Office of Management and Budget, 1997, Table 9-2, p. 196). The implication is that highway money is a large pool of the federal funding available to states and cities, and that local governments will behave in ways consistent with obtaining that money. If highway projects are required to pass a benefit-cost test, the risk is that local governments will be tempted to tilt the analysis in ways that helps them garner more funds.

In short, better benefit-cost analysis of highway projects, while important and desirable, faces an uphill battle as long as local governments have incentives to influence the analysis to obtain projects built in part with state and federal funds. Instead of attempting to cajole local governments into ignoring their own interests for the greater regional, state, or national good, we discuss in the next section how highway finance might be reformed to require that projects be financed by the area of benefit. A policy that requires such a geographic correspondence between areas of benefit and areas of funding responsibility can help reduce the regional cross-subsidies inherent in the current system. In a simple world, requiring that highways be financed by a mix of intergovernmental funds that exactly reflects how project benefits accrue across different jurisdictions would go a long way toward ensuring more economically efficient highway policies. Yet there is a complication that makes highway policy not so simple.

Highways bring spatial externalities. Spatial externalities exist when the geographic pattern of activities affects households or firms in ways that are not fully mediated even by well functioning, otherwise competitive markets. As discussed above, suburban highway projects might weaken agglomeration benefits in central cities, isolate poor residents in ways that are socially undesirable, and possibly worsen air quality or (although the evidence here is weaker) traffic congestion problems.¹¹ Because all of these are external to any one local jurisdiction, a policy of matching local benefits and

¹¹ The evidence on air quality and spatial externalities is also thin. Does suburban highway construction worsen air quality problems? There is little conclusive evidence here, but one possible link is provided by emerging evidence on induced travel. Recent studies (Hansen and Huang, 1997; Noland, 1999) suggest that highway construction leads to overall increases in vehicle miles of travel. If that leads to, on

local costs would still not incorporate the external costs of highway building. Even if local governments paid the full dollar value cost of local highway benefits, the external effects of highway construction described above could lead to, on net, a highway program that is too large from the broader perspective of an entire metropolitan area or region.

Overall, we conclude that highway finance should be guided by a principal that local benefits should be purchased with local funds, combined with attention to the often negative within-region external costs of highway projects.¹² Yet for decades United States highway finance has been based on the opposite principal; funds are provided largely by states and the federal government, and external effects (when discussed at all) are typically assumed to be the positive external benefits associated with enhancing the performance of a network. Highway finance in the United States is still predicated on the idea that the system confers broad national and regional benefits, while the evidence summarized in Section III suggests a pattern of local benefits. Highway finance should change to be more consistent with this evidence. The change would have two pieces -- matching local benefits and local funding responsibilities, and incorporating spatial externalities into the decision-making process.

1. Matching the Benefitting Geographic Area with Highway Funding Responsibility

This step requires an assessment of what locations benefit from highway projects. This is difficult because the evidence on the geographic variation in benefits from highways is aggregate and is difficult to apply to a specific project. Lacking better information, one might proxy the geographic area of project benefits by the geographic lengths of trips served by a project. Transportation planning software can be used to infer, at least for commuting trips, the distribution of trip lengths served by a particular project, and projects that serve longer trip lengths might be judged to have benefits that accrue over larger areas. One would also want to adjust this to reflect the value of freight shipments that use a particular highway, and the distribution of origins and destinations of that freight. Such information exists both for freight and commuting, and transportation planners should begin to examine how to better use that information to estimate how highway project benefits are distributed across different geographic areas. Focusing more on long-term research, there is also a need to refine our knowledge of spillovers to better link those effects to specific projects and to better identify areas of loss and gain.

Yet even without clear project-specific information on spillover benefits, it is possible to develop some rules of thumb to guide highway finance. The evidence in Section III suggests that as the highway system in the United States has matured, highway benefits have become increasingly local. To catch up with this change, highway finance should also become increasingly local. The state and federal role in highway finance is a legacy of an earlier era when highway investments likely generated broad national benefits. Some of that funding responsibility ought to be shifted to local governments, not, as has been suggested, in ways that simply return gasoline tax revenues to the collecting jurisdictions, but

net, lower air quality, the fact that air quality is a regional issue implies that local jurisdictions will not fully appreciate and act on the air quality impacts of highway construction decisions.

¹² Traditionally, highway finance has focused on positive cross-regional externalities. Because a highway project in one location can enhance the performance of the overall network, areas distant from the project can benefit nevertheless. This is the more traditional formulation of how highway benefits spill over to distant regions, and it is one of the motivations for the large federal funding shares used to construct the Interstate Highway System. For a discussion of these positive spillovers in the context of, e.g., all public infrastructure, see Munnell (1992). We focus here on negative cross-region externalities because the evidence suggests that cross-state positive spillovers from highway capital are somewhat unimportant (Holtz-Eakin and Schwartz, 1995), and that within-state negative spillovers can be potentially as important as positive spillovers (Boarnet, 1998).

in the much more specific sense that local governments will bear lead financial responsibility for highway projects that bring predominantly local benefits. Conversely, projects with large state or national importance should be funded by proportionately large state and federal shares. For additional discussion of this idea, see Boarnet (1997, 1999).

2. *Incorporating Spatial Externalities into the Decision-Making Process*

The second step in highway finance reform should incorporate within-region spatial externalities in the decision-making process. Yet there is little solid evidence that can be used to quantify how a specific highway project might weaken central city agglomeration economies, isolate poverty populations, or worsen air quality, even if the theoretical link (especially for agglomeration and concentrated poverty) is highly plausible. For that reason, we suggest that the best start toward incorporating spatial externalities is to ensure that those issues are at least aired. Local, state, and federal practice should increasingly require a discussion of possible external effects, even if the magnitude of harm cannot be quantified. For now, the best approach to the external costs of agglomeration, social isolation of central cities, and other externalities associated with urban development patterns might be to put those issues, almost always ignored, on the agenda for public discussion. This bears more on process and governance than on funding arrangements. Highway finance reform is certainly important, but changing governance and political procedures to better address within-region external costs is also vital. We discuss those issues below.

B. Governance, Highways, and Economic Efficiency

The possibility of within-metropolitan area external costs and the localized nature of many highway benefits suggests that the regional level is the best one for highway financing, programming, and planning. In the wake of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), regional transportation planning bodies have grown in importance and are often well positioned to internalize the spatial externalities of highway-building discussed above.

Large metropolitan areas have long recognized that transportation investments are very likely to have consequences that do not respect jurisdictional boundaries. This realization has resulted in the establishment of both regional public transit authorities and metropolitan planning organizations (MPOs) for the purposes of planning road improvements. In both ISTEA and TEA 21 (the Transportation Equity Act for the 21st Century, enacted in 1998), metropolitan areas with populations over 50,000 are required to plan transportation investments on a regional basis. These federal acts aimed to give MPOs powers that would put them on a more equal footing with state DOTs, including authority over prioritizing highway (and other transportation) projects within each region. MPOs are instructed to use a list of criteria to evaluate projects, including controlling many of the region-wide externalities discussed above, like air pollution, energy consumption and the relationship between transportation and land use.

In principal, the statutorily important role of MPOs would seem to make them an ideal vehicle for maximizing the efficiency with which urban transportation investments are made. These bodies, with their presumed interest in benefits and costs in all parts of the region, can balance the net effect of projects on the region as a whole, offering an escape from both the too parochial perspective of local governments and the too expansive responsibilities of state DOTs. MPOs should be able to rationally plan and prioritize the allocation of available transportation investment funds, leading to intra-metropolitan investment efficiency. However, there are several reasons to be concerned about the ability of MPOs to act in this way:

First and foremost is the structure of the organizations themselves. MPOs are composed of representatives of local governments, and in many cases they follow a “one government / one vote” decision making rule. Since central cities tend to have significantly larger populations than individual suburban jurisdictions, this structure leads to an underrepresentation of central cities and certain other areas -- particularly unincorporated places. (Lewis 1998 contains an excellent review of and data on the structure of California MPOs.)

This organizational structure is very likely to lead to inefficiency in the allocation of transportation funding. If the benefits of new investments are localized while the costs are spread throughout the MPO’s jurisdiction, then each locality will want to obtain as many projects as possible. In these circumstances, overrepresentation of particular areas will lead to too much investment in those areas, and too little in areas with less political clout on the MPO board.¹³

The *second* problem involves the size of the investment pool to be allocated. In theory, the overall level of highway investment ought to be in the purview of the regional body, but in practice the total amount is given by state and federal decisions. Prior to ISTEA, MPOs tended to generate “wish lists” of projects that more than exhausted available funding. State DOTs were then able to pick and choose from these lists, giving them the real decision making power. However, under current law only those projects that have a reasonable prospect of being funded may be included in transportation improvement programs (TIPs). MPOs may thus be forced to forego including projects that, while of relatively low priority within the region, might still provide positive net benefits beyond the region. On the other hand, the existence of a pool of funding may be difficult to ignore, and projects that have negative net benefits within the region may get funded, particularly if MPO officials believe that a failure to spend all the funds made available to them will lead to reductions in funding (and influence) in the future.

The institutional structure of MPOs combines with the significant extra-regional funding of transportation projects to provide incentives for local areas to essentially compete to get projects into the TIP, with over-represented jurisdictions winning the competition more frequently than is optimal. As each locality seeks to maximize its own advantage, overall regional welfare can become a secondary consideration, if it is considered at all. It should be noted that while many votes on MPO boards are unanimous, this cannot be taken as reliable evidence that there is little or no competition for funds. First, the board relies heavily on reports and technical analyses authored by staffs who themselves are appointed by boards and can anticipate their reactions (Lewis 1998). In addition, unanimity on proposals that generally provide only localized benefits may be evidence of “log-rolling” politics, in which policy makers agree to support each other’s projects. Underrepresented areas could find themselves with relatively little influence to trade in this process, and emerge with concomitantly few projects. For example, on a per capita basis, a “one government/one vote” MPO structure would typically cause central city residents to be under-represented on a per capita basis. So even if central cities could form coalitions with other jurisdictions to get their projects into the TIP, it is possible that the resources flowing to the central city will still not be commensurate with that city’s population relative to the metropolitan area.

¹³ If land prices reflect the value of highway investments, then apportionment of MPO votes would ideally be made on the basis of land area. For example, a rule that one acre is one vote on the MPO board would lead to decisions made on the basis of their effect on the region’s aggregate value of land, a proxy for their effects on regional welfare. Such a scheme, while possible in theory, requires that the effects of highway investments be completely capitalized into land prices, that the electorate recognize the link between land price changes and highway projects, and that persons vote based on the intensity of their harm, so that small parcels with large benefits or costs would be appropriately weighted in any vote. While all are plausible to some extent, none seem likely in the complete sense needed for this scheme to yield an efficient outcome. For that reason, we do not recommend or further explore that voting arrangement here.

While the MPO structure is clearly an improvement over purely state and local planning, the actual institutional structure of MPOs and the divorce between their funding and their spending responsibility are likely to lead to inefficient outcomes. Improvements in MPO organizational structures would make them more closely approximate the distribution of transportation dollars' long term effects, which means making them more reflective of the underlying population distribution in the regions they represent (Lewis 1998). Overall, highway finance reform should focus on a geographic scale consistent with project benefits - often the MPO. This will require changes in both highway finance and MPO governance.

VI. POLICY RECOMMENDATIONS

The key policy idea to flow from this analysis is that efficient highway spending is most likely in a system where the geographic area that benefits from a project is also financially responsible for building the project.¹⁴ The current structure of United States highway finance creates geographic cross-subsidies that, while once justified based on the national importance of the Interstate Highway network, now often provide opportunities for inefficient allocation of highway resources. The initial step toward reform is to tie highway finance more closely to the areas that benefit.

The localized nature of many modern highway benefits suggests that metropolitan planning organizations often have the appropriate regional scale to internalize highway project effects while potentially balancing shifts of economic activity and externalities within the metropolitan area. One practical effect of matching financial responsibility to the area of benefit would be to empower MPOs to prioritize and finance highway projects. This requires reform of federal and state highway finance and of the institutional structure of many MPOs.

Dealing first with highway finance reform, a maxim that local benefits should be purchased with local funds requires that MPOs have revenue sources that they can use for transportation projects.¹⁵ Currently, MPOs program state and federal funds. Instead of simply expanding the role of MPOs as programmers of state and federal funds, MPOs should be empowered and required to raise local revenues for local highway projects. This would require that MPOs become true regional transportation infrastructure authorities -- something that is rare in United States politics, but which the evidence described above suggests is necessary for efficient allocation of highway resources. Local funds needed to pay for the local benefits of projects could come from many sources. Ideally, tightly targeted user fees would generate those funds, because that would make explicit to voters the link between taxes paid and transportation benefits provided by projects. The tighter and more explicit that link, the more likely the electorate is to carefully consider project costs and benefits.

Such a call for locally financed highway projects is consistent with the trends in some rapidly growing metropolitan areas. Taylor (1995) and Brown et al. (1999) have documented that gasoline tax revenues have failed to keep pace with both vehicle miles traveled and highway construction costs. Faced with a highway "fiscal squeeze," some rapidly growing suburban areas have already pursued ambitious programs of locally funded highway improvements. For example, Orange County, California has built over fifty miles of new highways and expanded capacity and improved interchanges on the existing network during the 1990s. This ambitious program of highway construction is largely locally financed through a combination of dedicated sales tax revenues, private investment, and largely toll-financed roads built by a special purpose public agency. The challenge now is to learn from experiments such as those in Orange County and to devise more

¹⁴ An alternative viewpoint, put forward by Winston and Shirley (1998), is that special interest politics effectively dooms any prospect for efficient provision of urban transportation services through the public sector and that the best option for reform is to privatize public services. To the extent that Winston and Shirley (1998) highlight and measure the social cost of inefficiencies in transportation policy, we see little conflict between their argument and ours. The primary focus of Winston and Shirley's work is urban mass transit, although they also argue for privatization of highways. We believe that road privatization is consistent with our call for greater local responsibility in highway finance, but that the role of government in highway finance is large enough and entrenched enough that public sector solutions, of the sort we advocate below, must be considered.

¹⁵ Note that this suggestion goes beyond, and is different from, policies that would simply devolve federal highway funds to the metropolitan areas where those funds are collected. Rebating gasoline tax funds directly to MPOs would likely look like a transportation block grant, and it is not at all clear that local MPOs would treat those funds like anything other than grants which should be exhausted. Efficiency under that system would hinge on the unlikely occurrence that federal (and state) gasoline taxes collected within a metropolitan area equal the funds needed to build the projects, and only the projects, that pass a social benefit-cost test.

systematic methods for efficiently splitting highway financial responsibilities across levels of government and funding mechanisms. A start is to shift lead funding responsibility for many projects (those with predominantly local benefits) to the MPO level.

Such a shift necessitates that MPO institutional and voting structures be reformed so that MPO governing bodies more directly reflect the populations they serve. Lewis (1998) notes that the policy of “one government/one vote,” while an understandable legacy of the reluctance of local governments to yield authority to regional agencies, often has the effect of disproportionately favoring suburban jurisdictions in MPO voting arrangements. If MPOs were to become more important taxing, financing, and programming bodies, their standard “one government/one vote” institutional structures would be increasingly likely to be viewed as inconsistent with the Fourteenth Amendment’s equal protection clause.¹⁶ It is also vital that MPOs reflect in some reasonably proportionate fashion the entire metropolitan area for issues of shifts in economic activity and intrametropolitan externalities to get more fully aired in political debates and technical analyses of highway projects.

In short, we suggest that MPOs complete the transition, started by ISTEA, from advisory bodies to full financing, planning, and programming authorities. The key element of reform, necessary to match local benefits with local costs, is that MPOs raise local revenues for local highway projects.

No suggestion for such reform can be advanced without mentioning the very substantial obstacles to such a regional authority in most United States metropolitan areas. Local jurisdictions guard their powers jealously and voters have traditionally been wary of moving government functions, especially taxing authority, to regional bodies. We suggest three ways that traditional opposition to regional authorities might be lessened:

The revenues for local highway projects should be raised through highway user fees. We suspect that much of the reluctance toward giving regional governments taxing authority has to do with a sense that regional bodies might be less accountable to voters than more local governments. Clear user fees can mitigate that concern by demonstrating a close link between the financing mechanism and the transportation services provided by the funds. Tolls are being used for an increasing number of new highway projects in the United States and appear to be one mechanism that can be used by regional and even private-sector authorities with, at least in some instances, little public opposition.

The role of the federal government in empowering MPOs is vital. Federal transportation legislation has already been used to enhance the role of MPOs, and it might usefully be employed toward that end again to overcome reluctance toward that goal at the local level. While Congress may be very reluctant to relinquish its power to provide localized benefits with federal highway dollars, evidence is mounting that economic growth in parts of metropolitan areas depends on the health of the region as a whole. If this conclusion becomes widely accepted, designing transportation governance to enhance regional growth should increasingly appeal to the enlightened self-interest of each individual jurisdiction (Voith 1993, Haughwout 1999a). *By taking advantage of the highway fiscal squeeze that exists in some rapidly growing urban areas, there*

¹⁶ Lewis (1998) provides a discussion of this and some explanation of why the courts have not invalidated current MPO voting arrangements based on Fourteenth Amendment criteria. In short, the judicial thinking as embodied in the case of *Education/Instruccion, Inc. et. al. v. Moore*, was that MPOs were largely advisory and research-oriented at the time the case was decided and did not exercise governmental powers or perform governmental functions. See Lewis (1998) for a discussion.

might be a political opening to create new highway financing mechanisms and to then attach those funds to regional authorities such as MPOs. Highway benefits that cross regions should continue to be financed by state and federal matching aid. In some instances that might entail substantial state and federal funds. But the evidence on the geographic span of modern highway benefits suggests that current state and federal matching rates are often too high. Again, the geographic span of a project's benefits should, ideally, inform the split of funding responsibilities across metropolitan, state, and federal authorities.

VII. CONCLUSION

We started this paper with an examination of how highway investments influence metropolitan development. The evidence pointed to two efficiency problems with current highway finance: (1) The current system of large state and federal subsidies does not lead to a correspondence between the geographic area of benefit and the geographic area of financial responsibility for many highway projects, and (2) There is little, if any, consideration of possible within-metropolitan area external costs from highway investment, especially when one focuses on the often neglected issues of central city agglomeration, the social isolation of the poor, and other incompletely understood but highly plausible sources of spatial externalities. The solution to both problems is to better link highway spending to highway costs. This requires both funding and MPO governance reforms.

Overall, we recommend a shift in the federal role from being a major source of highway revenues to encouraging, through the leverage that federal monies provide, states and metropolitan areas to empower MPOs or similar regional governments in transportation planning. Importantly, the focus of highway finance should shift from the state and federal level to metropolitan areas. This implies that future funding increases should more often be at the metropolitan than the state or national level. The federal role in highway transportation will be to preserve the vitality of the portions of the network that provide truly national benefits and provide assistance to poorer regions that might not be able to provide local funding for all of their highway projects. The federal government should continue to cooperate with state agencies and the newly empowered MPOs in setting standards, conducting research, and collecting and analyzing data. Importantly, federal leadership will be vital if any devolution of highway funding responsibility occurs in a manner consistent with the efficiency objectives outlined in this paper. This requires more than simply returning gasoline taxes to the jurisdictions in which they were collected. It requires regional responsibility to raise local revenues for local projects -- something that likely will not occur without federal encouragement and possibly requirements. Finally, the federal role in protecting the environment in the transportation planning process should remain, largely because the federal government has, in concert with a few states on particular issues, traditionally played a lead role in environmental issues. Given the decentralization of highway policy that we advocate here, the federal role as it pertains to the environment would be especially (but not solely) useful in funding pilot and other programs intended to encourage local experimentation with solutions to what are often external costs of highway programs.

At the metropolitan level, our reforms imply that MPOs will become true regional infrastructure agencies, with taxing authority to match the planning and programming function already resident in those governmental bodies. This will correct an important shortcoming in transportation planning. Currently, the financing of projects is divorced from project selection and planning. Too often, local governments have incentives to lobby for projects without being forced to consider the cost -- either the dollar value or the external costs. Combining the financing, planning, and project selection functions in one agency that is accountable to the population that predominantly benefits from highway projects is essential for encouraging more careful consideration of highway project benefits and costs.

One question remains: what would these reforms imply for the nature of metropolitan growth? Would metropolitan areas grow differently if our reforms were implemented? Despite the fact that an analysis of highways and metropolitan growth led us to our reform suggestions, we are reluctant to speculate in detail on the effect of our reforms on metropolitan development. Recall that urban decentralization is a result of many factors, and it is possible that even with a reformed highway finance and MPO governance system that United States urban areas will continue to decentralize. We

argue that our reforms should be pursued not because they will lead to some clearly identifiable urban form, but because a more efficient matching of highway project costs and benefits will lead to a more efficient allocation of highway investments. That allocation will likely include fewer highway projects, a relative shift in transportation resources from outlying areas toward central cities, and at least a continued examination of how investments in suburban highways affect central cities. Whether any resulting changes in urban form and metropolitan development patterns are large or small is beside the point.

Instead, the important policy point is that the investment in the United States highway system is huge, and the nation has a vital interest in managing, expanding, and maintaining that investment in an economically efficient manner. Federal policy is often at odds with that goal in ways that, among other things, likely lead to less than optimal urban growth patterns. The federal government should use its influence to take the lead in requiring that metropolitan governments pay for highway benefits that are strictly metropolitan in nature. The highway program has long been part of the federal government's hidden urban policy. The reforms suggested here would go a long way toward supporting the efficient allocation of highway resources and thus make the federal highway program one that better supports the vitality of metropolitan areas.

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