Improving Funding and Management of Surface Transportation Infrastructure

Veronique de Rugy and Tracy Miller

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President Trump and others have argued that the United States faces a crisis in infrastructure, including transportation infrastructure, that needs to be addressed. Although the crisis rhetoric exaggerates the seriousness of the problem, in some parts of the United States, roads, highways, bridges, airports, and water and sewer systems do need upgrades or better maintenance.[1] US transportation infrastructure, in particular, falls short in a number of ways, including inadequate maintenance of highways, bridges, and public transportation.

Although spending on infrastructure does not, in itself, stimulate the economy, infrastructure investments can contribute to economic growth, since infrastructure is part of the economy's capital stock. Investments in infrastructure can also benefit the economy by alleviating the problems that poor infrastructure causes. For example, inadequate transportation infrastructure leads to traffic congestion, which causes commuters to waste millions of hours stuck in traffic. Reducing traffic congestion would enable people to commute farther in a given amount of time, increasing employment opportunities for some workers and leisure time for others. Decreased congestion would also reduce the time vehicles spend idling or traveling slowly, decreasing fuel consumption and air pollution from auto emissions. The extent to which infrastructure investment contributes to growth, however, depends on the net benefits of the projects chosen.

This paper focuses on how to manage and pay for investment in, and maintenance of, transportation infrastructure in a way that maximizes the net benefits from its use and contributes to economic growth. In this regard, we conclude that federal spending is not the best approach. Instead, a better path to making

1. The fraction of structurally deficient bridges declined by 37 percent between 2000 and 2015, according to the US Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2016*, 2016. Similarly, according to the Department of Transportation, *2015 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance*, December 16, 2016, 80.3 percent of the federal-aid highways were in "acceptable" condition in 2012, the most recent year covered in the report.

needed infrastructure improvements is to *reduce* the role of the federal government (including the funding and management of projects) and to increase reliance on state and local governments, user fees, and private firms.

We begin our assessment with a discussion of the role played by the federal government and how it contributes to problems with transportation infrastructure. The first section discusses how politics has driven priorities so that the projects with the highest net benefits do not necessarily get funding. It also discusses growing problems with congestion, as well as the unequal and inefficient geographic distribution of highway and transit funding. The next section discusses strategies for improving the funding and management of transportation infrastructure, including greater use of tolls and mileage-based user fees (MBUFs), privatization, and expanded roles for state and local governments. It also discusses the likely effects of autonomous vehicles on congestion and the demand for mass transit. The final section summarizes recommended changes in federal policy and institutions.

PROBLEMS WITH FEDERAL FUNDING AND MANAGEMENT

There are many problems with the way transportation is funded in the United States, and these problems are often exacerbated by the federal government. Although state governments decide which projects will receive federal Highway Trust Fund money, the federal government decides by formula how money from the fund is divided among states and how it is divided among highways, public transportation, and a variety of other uses.

Choosing Priorities

When government, whatever the level, chooses priorities, it usually does not decide among projects by comparing benefits to costs.[2] Instead, decisions are made based on politics and pressure from interest groups. Also, in government, the incentives for good management are very weak. Lawmakers make decisions

2. Although some federally funded transportation infrastructure programs, such as the TIGER (Transportation Investment Generating Economic Recovery) grant program, require a benefit-cost analysis, evidence suggests that the results of those analyses have not been decisive in determining whether a project receives funding. See Anthony C. Homan, Teresa M. Adams, and Alex J. Marach, "A Statistical Analysis of the Role of Benefit-Cost Analysis in Awarding TIGER Grants," *Public Works Management and Policy* 19, no. 1 (2014): 37–50, cited in Robert Krol, "Political Incentives and Transportation Funding" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, 2015).

regarding the use of other people's money rather than their own, which means that their exposure to the risk of a bad decision is fairly limited. The lack of incentives for good management and high cost for each taxpayer to monitor closely how each dollar is spent mean there is little to no reward for spending taxpayers' money wisely or providing a service effectively or efficiently. As a result, public provision of infrastructure is "characterized by growing budget deficits, travel delays, and physical deterioration."[3]

On the other hand, politics plays a major role in choosing what transportation infrastructure investments are undertaken. This is particularly true for discretionary programs, such as the New Starts program, which provides grants for new transit projects in selected metropolitan areas. As part of the New Starts program, urban areas compete for mass transit capital grants from the federal government on the basis of their willingness to provide matching funds and their ability to demonstrate an urgent need for an expansion of transit facilities. Congressional districts with representatives on the House Transportation and Infrastructure Committee also tend to receive more transit funding.[4]

Even when benefit-cost analysis does play a role in government decision-making, many projects with negative net benefits gain approval. For infrastructure projects, government agencies usually underestimate costs and overestimate benefits.[5] We are all too familiar with horror stories about cost overruns of projects like Boston's Big Dig or the US Capitol Visitor Center.[6] Additionally, the data show that government agencies' reports are biased toward overestimating net benefits of a particular project and investment, suggesting that analysts are responding to incentives to approve projects that are supported by politically powerful groups.[7] The tendency to overestimate traffic prevails also among private firms that are competing for government contracts to design, build, and operate toll highways.[8]

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3. Clifford Winston, "On the Performance of the U.S. Transportation System: Caution Ahead," *Journal of Economic Literature* 51, no. 3 (2013): 773–824.
4. Randal O'Toole and Michelangelo Landgrave, "Rails and Reauthorization: The Inequity of Federal Transit Funding" (Policy Analysis No. 772, Cato Institute, Washington, DC, April 21, 2015).
5. Bent Flyvbjerg, Matte Skamris Holm, and Søren Buhl, "Underestimating Costs in Public Works Projects: Error or Lie?," *Journal of the American Planning Association* 68, no. 3 (2002): 279–95.
6. Chris Edwards and Nicole Kaeding, "Federal Government Cost Overruns," *Downsizing the Federal Government*, September 1, 2015.
7. Flyvbjerg et al., "Underestimating Costs in Public Works Projects."
8. Robert Bain, "Error and Optimism Bias in Tollroad Traffic Forecasts," Transportation 36, no. 5 (2009): 469–82, cited in Krol, "Political Incentives and Transportation Funding."

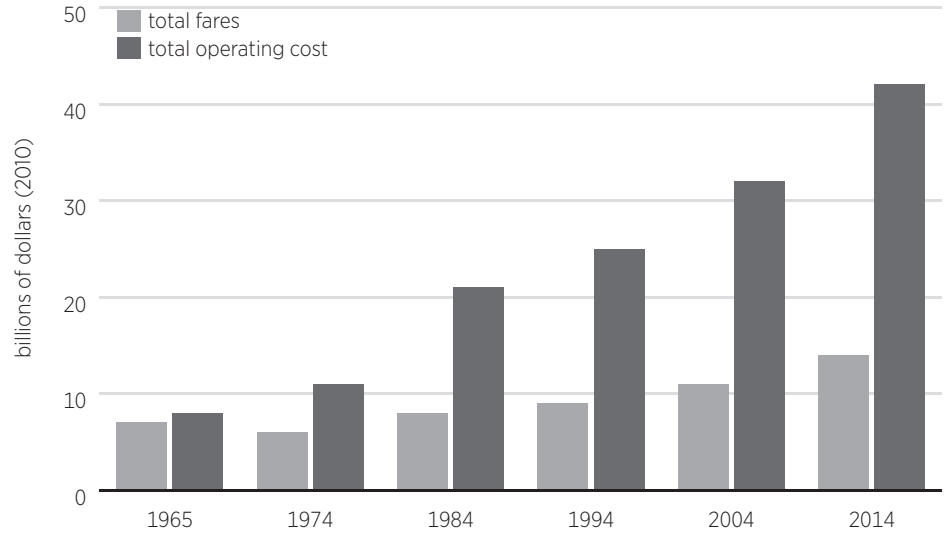
Highways. Approving projects where costs exceed benefits not only results in the funding of unworthy projects, but it also may keep other projects with positive net benefits from being funded. In such prioritization decisions, highway construction competes with highway maintenance, and highways compete with mass transit, for limited government budgets.

Considering first the competition between highway maintenance and highway construction, the allocation of money may not be consistent with the net benefits of each. Between these choices, the federal government gives priority to capital spending. A relatively small share of federal Highway Trust Fund spending is used for operation and maintenance (O&M) of highways and roads.[9] Once the infrastructure is built, most maintenance costs are borne by state and local governments.[10] Sarantis Kalyvitis and Eugenia Vella show that state and local spending on infrastructure has a positive effect on private productivity and that the greater the O&M share of spending, the larger the increase in productivity. This implies that O&M (usually funded by state and local governments) is more productive than capital spending (usually funded by the federal government).[11] Other research suggests that investment in new highway capacity has been excessive but that investment in durability has been insufficient.[12]

Public transit. Investment in public transportation has been similarly misallocated. Fixed-guideway transit systems can cover their costs only if they run frequently and have high ridership, a combination that depends on population density.[13] Very few US cities have sufficient population density for transit systems to even come close to paying for themselves through fares. This is particularly true for rail transit.[14] The only transit system in the United States that currently

9. Congressional Budget Office, *Trends in Public Spending on Transportation and Water Infrastructure*, 1956 to 2004, 2007.
10. Sarantis Kalyvitis and Eugenia Vella, "Public Capital Maintenance, Decentralization, and US Productivity Growth," *Public Finance Quarterly* 39, no. 6 (2011): 784–809.
11. Ibid.
12. In a study covering 1983 to 2003, Gilles Duranton and Matthew A. Turner find that investment in highways has been excessive. See Duranton and Turner, "Urban Growth and Transportation," *Review of Economic Studies* 79, no. 4 (2012): 1407–40. Another study finds large net benefits from investment in increased highway durability. See Kenneth A. Small, Clifford Winston, and Carol A. Evans, *Road Work: A New Highway Pricing and Investment Policy* (Washington, DC: Brookings Institution, 1989).
13. Erick Guerra and Robert Cervero, "Cost of a Ride: The Effects of Densities on Fixed-Guideway Transit Ridership and Capital Costs," *Journal of the American Planning Association* 77, no. 3 (2011): 267–90.
14. Randall O'Toole, "Reason #8 to Stop Subsidizing Transit: It Only Moves People," *Antiplanner*, May 5, 2017.

FIGURE 1. PUBLIC TRANSIT INDUSTRY OPERATING REVENUES AND EXPENSES, 1965–2014



Source: Authors' calculations. Fare and cost data are from John Neff and Matthew Dickens, *2016 Public Transportation Fact Book* (Washington, DC: American Public Transit Association, 2017). GDP deflator is from Organisation for Economic Co-operation and Development, "Main Economic Indicators: Complete Database," accessed February 15, 2017.

generates enough benefits to cover its costs is the Bay Area Rapid Transit system in San Francisco.[15]

The federal government has not made good decisions about how much to invest in public transit compared with highways. Most recent investments in public transit systems have not generated enough benefits to cover their costs. Nevertheless, the federal government has continued to invest billions of dollars in building new rail transit systems or in expanding existing ones. The share of federal Highway Trust Fund money going to transit now exceeds the share of the population that commutes to work on transit buses or trains. In spite of this investment, the percentage of the population using transit is lower than it was in 1990.[16] The percentage of operating costs covered by fares has also declined, and it has been declining since 1965, when fares covered more than 90 percent of operating costs (see figure 1).

15. Clifford Winston and Vikram Maheshri, "On the Social Desirability of Urban Rail Transit Systems," *Journal of Urban Economics* 62, no. 2 (2007): 362–82.
16. American Public Transportation Association, "Ridership Report," accessed February 1, 2017, http://www.apta.com/resources/statistics/Pages/ridershipreport.aspx.

Before Congress passed the Urban Mass Transportation Act of 1964,[17] which promised capital grants from the federal government to public agencies operating transit systems, most transit systems were privately owned and self-supporting.[18] Since then, almost every major transit agency has been taken over by a city or a state-chartered public agency, and subsidies have increased as fare revenue has decreased relative to costs. Between 1965 and 2008, inflation-adjusted fares collected per transit trip declined by almost 24 percent, while operating costs rose by 125 percent.[19]

The failure of most transit agencies to provide cost-effective service does not necessarily mean cities should eliminate or drastically reduce transit service. Decisions about investments in transportation infrastructure and the net benefits of those investments cannot be separated from policies that affect urban development patterns, including zoning laws and tax subsidies for owner-occupied housing. Thus, the fact that few US rail transit systems can now collect enough fare revenue to cover their costs does not mean that rail transit or exclusive busways could not be viable in the long run in a number of US cities if the neighborhoods they served developed sufficient residential and job density. In fact, many urban planners, government officials, and policy analysts have argued in favor of denser, pedestrian-friendly transit-oriented development on a number of grounds, including that it would reduce obesity.[20] These arguments have resonated with voters in some areas, as exemplified by smart growth policies and initiatives to expand transit systems and promote transit-oriented development .

Evidence supports the assertion that proximity to transit increases property values; however, there is also evidence that, all things being equal, Americans are willing to pay more for houses in less dense suburban neighborhoods.[21] In addition, many residents of metropolitan areas, especially families with children, rely heavily on their automobiles and have good reasons for

17. Pub. L. No. 88-368 (1964).
18. Charles Lave, "The Private Challenge to Public Transportation: An Overview," in *Urban Transit: The Private Challenge to Public Transportation*, ed. Charles Lave (San Francisco: Pacific Institute for Public Policy Research, 1985), 22.
19. Randall O'Toole, "Fixing Transit: The Case for Privatization" (Policy Analysis No. 670, Cato Institute, Washington, DC, November 10, 2010).
20. See, for example, Peter Calthorpe, *Urbanism in the Age of Climate Change* (Washington, DC: Island Press, 2011).
21. Yunmi Park, Shih-Kai Huang, and Galen Newman, "A Statistical Meta-analysis of the Design Components of New Urbanism on Housing Prices," *Journal of Planning Literature* 31, no. 4 (2016): 435–51.

doing so.[22] Given these preferences, policies that emphasize transit and transit-oriented development throughout a metropolitan area usually result in highly congested roads and highways, reducing mobility for those who live or work in neighborhoods without good transit access or for those who would rather drive than use transit.[23] Increased density leads to increased traffic congestion, particularly if a large share of transportation spending goes to transit instead of highways.

Various policy changes could contribute to more efficient provision of transit services. With better management, which privatization might be able to provide, rail transit could be cost effective in a few densely populated cities. Overall, bus service is more likely to be cost effective than rail, and rapid bus service could provide efficient service between high-density residential areas and employment centers. Unfortunately, large subsidies from state and federal governments, with limited accountability to taxpayers or users, reduce public transit agencies' incentives to make choices (such as investing in bus rapid transit rather than rail) that would reduce costs while still attracting riders.

Congestion

Congestion is perhaps the most pressing problem for transportation policy in many urban areas. In 2014, congestion delays in the United States totaled billions of hours in the aggregate, with an estimated monetary cost of $160 billion in time and wasted fuel.[24] Congestion also reduces employment growth by raising shipping costs and decreasing the number of job opportunities within commuting distance of workers' homes.[25]

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22. Driving is usually faster and more convenient, reduces time outside in inclement weather, and facilitates trip chaining (combining multiple errands into one trip). More than 75 percent of jobs in each major metropolitan area are accessible by auto within one hour, but the typical job is accessible by transit within 90 minutes, and such transit is accessible to only 27 percent of metropolitan-area workers in the United States. See David Levinson, "Access across America" (Center for Transportation Studies Working Paper CTS 13-20, University of Minnesota, Minneapolis, 2013), cited in Winston, "On the Performance of the U.S. Transportation System"; Adie Tomer, "Where the Jobs Are: Employer Access to Labor by Transit" (Washington, DC: Brookings Institution, 2012).
23. Randall O'Toole, "Roadmap to Gridlock: The Failure of Long-Range Metropolitan Transportation Planning" (Policy Analysis No. 617, Cato Institute, Washington, DC, 2008).
24. David Schrank et al., *2015 Urban Mobility Scorecard* (College Station, TX: Texas A&M Transportation Institute and INRIX, 2015), cited in Robert Krol, "Tolling the Freeway: Congestion Pricing and the Economics of Managing Traffic" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2016).
25. Kent Hymel, "Does Traffic Congestion Reduce Employment Growth?," *Journal of Urban Economics* 65, no. 2 (2009): 127–35, cited in Krol, "Tolling the Freeway."

Metropolitan planning organizations and state transportation departments have sought to reduce or eliminate congestion by some combination of expanding highways and expanding transit systems. Neither approach has been very effective.

If highways are expanded, or if transit service is improved so that people switch from driving to transit, the increased highway capacity soon fills with additional traffic.[26] New highway capacity increases throughput, but most transit expansions, especially those involving rail transit, have not had much effect on overall mobility. When new rail transit systems are built, many of their passengers are typically former bus riders.[27] Not many people switch from driving to rail transit.

Proponents of expanding highways argue that such expansions are funded by user fees and thus pay for themselves. But for the United States as whole, user fees do not cover all the costs of constructing and maintaining roads and highways. Vehicle taxes and tolls provide 72 percent of federal revenue spent on highways, 60 percent of state highway revenue, and only about 7 percent of revenue spent by local governments on roads and streets.[28] Local roads and streets continue to be heavily subsidized with general fund revenue, which comes from drivers and nondrivers alike.

In deciding whether to build new highways or add additional lanes, the key question is whether drivers are willing to pay enough to cover the cost. If they are, then expanding freeways could be cost effective. But Americans cannot assume that government transportation agencies will base their highway expansion decisions on benefit-cost comparisons. Even if agencies were willing to do so, they lack accurate information on benefits compared to costs. The fact that newly built lanes quickly fill with traffic may seem to demonstrate the value of the additional lanes, but it does not establish cost effectiveness if drivers are paying less than the marginal costs of adding and maintaining those lanes. Such underpayments may be the norm in many urban areas.

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26. Gilles Duranton and Matthew A. Turner, "The Fundamental Law of Road Congestion: Evidence from US Cities," *American Economic Review* 101, no. 6 (2011): 2616–52. See also Robert Cervero, "Road Expansion, Urban Growth, and Induced Travel: A Path Analysis," *Journal of the American Planning Association* 69, no. 2 (2003): 145–63. This research shows the existence of induced demand but finds smaller elasticities and notes that some cities, such as Houston (which steadily expanded and improved its freeway network), have made substantial progress in reducing congestion.
27. Nathaniel Baum-Snow and Matthew Kahn, "Effects of Urban Rail Transit Expansions: Evidence from Sixteen Cities, 1970–2000," in *Brookings-Wharton Papers in Urban Affairs* (Washington, DC: Brookings Institution Press, 2005), 147–206.
28. Pew Charitable Trusts, "Analysis Finds Shifting Trends in Highway Funding: User Fees Make Up Decreasing Share," Subsidyscope, November 25, 2009.

If highways have enough capacity to handle traffic without congestion for all but a few hours each day, the best response to excess demand might not be to use valuable urban land to add additional lanes. Instead, it might be more efficient to eliminate the excess demand by raising prices for highway use during the periods when demand exceeds supply. Recent improvements in technology have made it possible to implement such "congestion tolls" on highways and to require all drivers to pay those tolls electronically. Congestion tolls are now being used on express lanes on several highways in the United States, including State Route 91 in California and parts of the Capital Beltway around Washington, DC. By continuously monitoring traffic, highway agencies can adjust tolls so that traffic flows freely at all times. Other improvements in technology, such as adjustable lane technology and traffic signal control technology that responds to real-time traffic flow data, could also be used to reduce congestion.

Investing in such improvements is likely to be beneficial. Nevertheless, providing the improvements through government funding and management is not the best approach. In fact, government funding and management tend to hinder the very innovation they seek to promote by slowing the development of technology that could improve infrastructure services.[29]

Distribution of Highway Funds among the States

Congress has established formulas to determine the geographic distribution of highway funding and transit funding from the federal Highway Trust Fund.[30] As a result of these formulas, some state highway departments get more fuel tax revenue than their state residents pay, while other states get less.[31] A possible justification for this arrangement is that highways in some states attract a substantial proportion of out-of-state drivers, who may buy their fuel elsewhere. Nevertheless, there is no reason to think that the formula used for allocating funds between

29. Clifford Winston, "How the Private Sector Can Improve Public Transportation Infrastructure" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2014).
30. The formula for distribution of Highway Trust Fund revenues was established in 1956. At that time, all revenue was to be spent for highways. That is no longer the case because mass transit now receives a share of the revenue, and some has been earmarked for other purposes such as deficit reduction. Changes have also been made in the formula for allocating highway money to states, but changes in the shares the different states receive have been relatively small. See Ronald Johnson and Gary Libecap, "Political Processes and the Common Pool Problem: The Federal Highway Trust Fund," June 2000.
31. Ibid.

states is efficient or equitable.[32] During the period 1978–2008, states with the largest ratio of Highway Trust Fund money received to fuel taxes paid by residents had higher per capita incomes, were more rural, and had greater representation on the Senate Environment and Public Works Committee. They also had fewer lane miles and fewer vehicle miles traveled per capita than states that received less.[33] One study by the Federal Highway Administration finds that "capital spending would produce greater benefits relative to costs" if a greater share of highway funding were used to expand urban interstates, make major repairs to other urban highways, and repair bridges.[34]

The way federal transit funding is distributed also contributes to considerable inequity among cities. Although the Department of Transportation distributes a substantial share of transit funds according to a formula, billions of dollars are distributed in the form of discretionary grants. The New Starts capital grants program, for instance, rewards cities that build expensive projects, such as new rail transit lines. Cities that did not have rail transit before 1975 and built new lines after 1980 received an average of 80 cents per rider in federal capital funds per year between 1991 and 2013. But regions that used forms of transit other than rail received only 61 cents per rider, and those that had installed rail transit before 1975 received just 54 cents per rider.[35] Because of differences in ridership and the size and costs of rail and bus transit systems, the actual variation in subsidies per rider across cities is considerably larger than the difference in averages for cities in each group. For instance, as a result of building an expensive rail transit system, Salt Lake City has collected $2.17 in federal funds per transit rider over the 22-year period since 1991. That's significantly more than a city like Milwaukee, which has focused exclusively on buses and, as a result, has collected only 26 cents per rider over the same time period.[36]

Proponents of transit argue that it is vital to provide mobility to low-income residents. One recent study, however, finds that only 9.6 percent of workers with

32. Gabriel Roth reports that the amount of federal Highway Trust Fund money allocated to each state is based on geographical area, length of road network, and number of motor vehicles. See Roth, "Liberating the Roads: Reforming US Highway Policy" (Policy Analysis No. 538, Cato Institute, Washington, DC, March 17, 2005).
33. Pengyu Zhu and Jeffrey R. Brown, "Donor States and Donee States: Investigating Geographic Redistribution of the US Federal-Aid Highway Program 1974–2008," Transportation 40, no. 1 (2013): 203–27.
34. Congressional Budget Office, *Approaches to Making Federal Highway Spending More Productive*, February 2016.
35. O'Toole and Landgrave, "Rails and Reauthorization."
36. National Center for Policy Analysis, "Heavy and Light Rail Wasting Taxpayer Dollars," April 23, 2015.

incomes under $15,000 per year use public transit to commute to work.[37] For the reasons discussed, including the fact that far more jobs are accessible by auto than by transit, most low-income workers prefer to drive to work.[38]

STRATEGIES FOR IMPROVING FUNDING AND MANAGEMENT OF TRANSPORTATION INFRASTRUCTURE

Most of the problems described are, at least in part, because of the role of the federal government in funding surface transportation infrastructure, particularly highways and mass transit. In comparison, state and local governments have at least some incentive to build and manage transportation infrastructure efficiently, if only because they are directly accountable to the residents who use state and local roads. Evidence confirms that states and localities spend more efficiently for highways and roads and for mass transit than does the federal government.[39] For example, compared with the Federal Highway Administration or the Urban Mass Transportation Administration (now the Federal Transit Administration), states and localities spend a larger share of their transportation budgets on maintenance, which usually yields a higher rate of return than does investing in new highways or transit lines.[40]

At the same time, regrettably, politics also influences state and local spending, resulting in questionable decisions about priorities and inefficient management of transportation infrastructure. This influence is particularly strong when transportation infrastructure is funded with revenue from the general fund or with revenue earmarked from state sales or income taxes. In these cases, decisions about highway funding will depend on the political power of highway users vis-à-vis nonusers. If general sales tax revenue is used for highways, nondriving taxpayers effectively subsidize drivers because the nondrivers bear a substantial share of the financing burden. Fuel taxes at least require those who drive more to pay more for highways, although highway spending is not necessarily related to highway use. But costs are still not perfectly distributed to those who benefit most, since drivers of vehicles that use nonconventional fuels will not pay their fair share.

37. Winston, "On the Performance of the U.S. Transportation System."
38. Wendell Cox, "How Lower Income Citizens Commute," *New Geography*, February 8, 2012.
39. Kalyvitis and Vella, "Public Capital Maintenance, Decentralization, and US Productivity Growth."
40. A substantial share of federal mass transit spending takes the form of capital grants to build or expand transit systems. These new systems do not attract very many additional riders in spite of the billions invested. State and local governments are left to foot the bill for maintenance of older transit systems, whose construction in many cases was originally funded by federal capital grants.

Mileage-Based User Fees and Tolls

Technology has made it possible to use a revenue source other than fuel taxes—one even more closely tied to highway use—that is, MBUFs. Using a technology similar to GPS to record location, states or localities could charge each vehicle for miles driven. The amount of the charge could vary with congestion and with the weight per axle of the vehicle, which influences the amount of damage the vehicle causes to road surfaces. Revenue could then be allocated to each road based on how much traffic uses the road. Paying for interstate highways with MBUFs or tolls instead of fuel taxes would enable highways with substantial use by out-of-state drivers to get revenue in proportion to the number of drivers using them. Such use-based methods would be preferable to existing formulas for distributing revenue from federal fuel taxes.

A number of states, including Oregon, California, Minnesota, and Texas, have experimented with MBUFs. In addition, academics, think tanks, and a bipartisan commission have reached a broad consensus that MBUFs should replace fuel taxes as a funding mechanism.[41]

Although a transition to MBUFs could take 15–20 years, the federal government could contribute to a transition to direct user fees by permitting states to implement tolls on interstate highways. This additional funding is sorely needed. Many interstate highways are past their forecasted useful lives.[42] Reconstructing and modernizing these highways would relieve congestion. To make tolls politically viable, states could make improvements in advance of imposing the additional costs on users, first borrowing money to reconstruct the interstate highways and only afterward imposing tolls to pay back the costs of the upgraded infrastructure.

Funding road maintenance and construction with tolls could incentivize highway agencies to make decisions based on costs and benefits, as well as provide agencies with the information they need to make those decisions. In this way, analyses of possible toll amounts on existing highways would be useful in estimating whether a given project is viable—that is, whether the benefits of the new highway capacity would exceed its costs.[43]

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41. Denvil Duncan and John Graham, "Road User Fees Instead of Fuel Taxes: The Quest for Political Acceptability," *Public Administration Review* 73, no. 3 (2013): 415–26.
42. Robert Poole, "Interstate 2.0: Modernizing the Interstate Highway System via Toll Finance" (Policy Study 423, Reason Foundation, Los Angeles, CA, September 2013).
43. Road pricing and its relation to optimal investment in new capacity is discussed by Gines de Rus and Manuel Romero, "Private Financing of Roads and Optimal Pricing: Is It Possible to Get Both?," *Annals of Regional Science* 38, no. 3 (2004): 485–97.

Tolls, if varied by time of day, could also provide signals to drivers about the relative scarcity of highway space. If drivers had to pay tolls high enough to cover the congestion costs they imposed on other drivers, they would have an incentive to reduce driving during peak periods by using mass transit, carpooling, telecommuting, or rescheduling their trips for times when the highways were less congested. People would also have a greater incentive to live closer to their workplaces, thus reducing residential sprawl.[44]

Tolls and MBUFs could also enhance the efficiency of transportation funding in rural areas. On rural roads and highways that rarely experienced congestion, it would be appropriate to set tolls at a level high enough to cover the cost of maintaining the road, including depreciation. If that were not possible because of insufficient demand, the existing road could be replaced with a lower-quality road that would cost less to maintain. If state governments continued to fund most rural highways, they might choose to subsidize lightly traveled roads. Even so, scarcity of resources would argue for giving lower priority to, and spending less on, lightly used roads, whether by leaving them unpaved or by maintaining a pavement quality well below that of more heavily traveled interstate highways.

Privatization and Public-Private Partnerships

Private firms can manage highways more efficiently than can governments.[45] One means of bringing this efficiency to infrastructure projects is the public-private partnership (PPP). Since the 1990s, PPPs have built several new highways and purchased some existing toll highways in the United States. Highway PPPs have typically combined some state investment of tax money with private financing, for which firms pay with toll revenue.[46]

Policies for privately managing highways through PPPs have many critics. Still, in assessing these critiques, it is instructive to compare the incentives for private firms with those for a state-owned enterprise.[47]

When the government (state or federal) funds and manages highways, a problem arises involving the incentives of the politicians and officials in charge. The state highway agency is supposed to manage highways to satisfy the interests

44. Clifford Winston, "How the Private Sector Can Improve Public Transportation Infrastructure."
45. Chris Edwards, "Options for Federal Privatization and Reform Lessons from Abroad" (Policy Analysis No. 794, Cato Institute, Washington, DC, June 28, 2016).
46. Bernard Feigenbaum, "Innovative Financing Tools Stretch Transportation Resources" (Testimony before the Senate Finance Committee, Reason Foundation, Los Angeles, July 23, 2015).
47. R. Richard Geddes, *The Road to Renewal: Private Investment in U.S. Transportation Infrastructure* (Washington, DC: AEI Press, 2011), 44.

of the voting public. However, individual voters do not have much incentive to be well informed about how efficiently the state highway department is managed. In contrast, other interest groups, including contractors, may stand to gain or lose much more from decisions about highways. These interest groups are likely to try to influence decisions about highways in their favor. As a result, the projects that get funded are not necessarily the ones that yield the greatest net benefits.[48]

Such perverse incentives may persist even in projects that allow some private role. For instance, some advocates of private participation in infrastructure projects believe private firms should provide the financing and project management, while the costs should be paid out of government revenue. Although this kind of arrangement might sometimes be more efficient than the status quo (i.e., full public ownership and management), as long as governments choose priorities and ultimately pay with tax revenue, the benefits of privatization will not be realized because the arrangement does not align incentives with net benefits.

Privatization can work better if firms earn their revenue through the prices they charge for services. If a highway can be financed by tolls or MBUFs, a private firm has an incentive to manage it in a way that serves the interests of highway users. Thus, a firm earning its revenue through tolls would have more reason than government agencies would to make sure the road was safe and well maintained, with limited congestion and low maintenance costs.

Although highways managed through PPPs remain public property, extended-term leases could give private firms a substantial interest in maintaining them. This interest would be even greater if the private firms owned the highways. Private ownership or extended leases would both motivate firms to maximize the market value of the highways they manage. Firms could best accomplish this by providing quality and quantity of highway capacity up to the point where the marginal revenue from increasing quality or capacity just covers the marginal cost.

This same difference between private and government incentives applies in the funding and management of transit. Privately operated transit agencies are rare in the United States but more common elsewhere.[49] Matthew Karlaftis, reviewing empirical studies, finds that most studies show lower costs, higher

48. Tracy C. Miller and Megan E. Hansen, "Getting More Out of State Transportation Infrastructure Spending" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, 2016).

49. The percentage of transit agencies that contract out their services decreased from 9 percent in the early 1980s to 6 percent in 2005. See Suzanne Leland and Olga Smirnova, "Contracting Out Transit Services: Evaluating the Link between Organizational Form and Effectiveness" (presented at the 66th Annual National Conference, Midwest Political Science Association, Chicago, April 6, 2008).

fares, and more efficient allocation of resources with private provision.[50] Efficiency gains are achieved by a combination of lower wages, lower fringe benefits, and more flexible work rules. Private firms also use capital more efficiently and provide fewer services on low-density routes.

Recent partnerships between transit agencies and ridesharing services such as Uber and Lyft indicate some of the ways in which private firms could contribute to more cost-effective transportation.[51] Ridesharing services cannot cost-effectively replace all transit service, but they may have lower costs than transit buses or trains in less dense corridors and during times when overall demand is lower.

How well private firms manage highways or transit depends partly on the competition they face. More competition can lead to better performance. Private highways compete with publicly funded highways and, if privatization becomes widespread, could compete with highways owned by different private owners. In urban areas, mass transit and highways compete with each other.

In the current environment, however, where most highways are publicly funded, competition does present one problem: it is difficult for private highways to earn enough revenue to cover their costs when drivers can use parallel highways at no charge. The problem of diversion from toll highways to parallel free highways could be reduced by rebating fuel taxes to users of private highways or by providing a government subsidy to limit tolls so that more drivers would use the private highway to keep traffic down on the parallel public highways. More widespread privatization of highways would reduce this problem of traffic diversion and make it easier for each highway to charge cost-covering prices.

Local Funding

Until MBUFs are implemented (which might be many years away), PPPs funded by tolls will be feasible only on limited-access highways. Other forms of private road and street funding, such as fees paid to homeowner associations, could work in some areas. But in most existing city and suburban neighborhoods, the funding of roads and streets by local governments might be the best pre-MBUF option.

State highway agencies tend to focus on getting traffic to its destination as quickly as possible, which works well for expressways and major arterials, but not for roads and streets that provide access to retail businesses and residential

50. Matthew Karlaftis, *Privatisation, Regulation and Competition: A Thirty-Year Retrospective on Transit Efficiency* (Paris: OECD Publishing, 2008).
51. Denis Cuff, "Dublin: Uber, Lyft to Partner in Public Transit," *East Bay Times*, August 18, 2016.

neighborhoods. The governance and layout of local roads and streets can have an important impact on local development patterns. Compact, high-value commercial and residential development is more likely to occur on interconnected streets with low speed limits. This kind of development yields more tax revenue per acre and requires less infrastructure per capita, including pavement, water, and sewer lines.[52] Since residents of towns and cities will reap most of the benefits of compact development, local governments have greater incentives to efficiently manage local roads and streets.

As long as local roads and streets are tax funded, it might make sense for local governments to provide subsidies for local transit, even if the transit system itself is privately run. Access to transit and to well-designed streets and highways may be a source of external benefits to local residents. If so, it could be capitalized into property values. If there are external benefits to local residents, it makes sense for part of the residents' taxes to be used to subsidize transit.

Funding transit subsidies locally is preferable to receiving subsidies from federal or state governments, since few taxpayers who live outside the metropolitan area will share the benefits from the local transit service. Local funding will also give the local government an incentive to make decisions consistent with efficient transit provision. For example, transit fare revenue and benefits to residents will be greater if government encourages dense development near transit lines, which local governments can do by changing zoning laws. Competition among cities for businesses and residents will also incentivize efficient management of transit systems and roads.

Autonomous Vehicles

Autonomous vehicles are likely to have an important effect on the transportation system in the future. Although it is hard to predict when such vehicles will be permitted or how long it will take for them to have a measurable effect, that time may not be far off.

Widespread use of autonomous vehicles in urban areas could significantly change the demand for public transportation and relieve congestion. Autonomous vehicles would provide a convenient alternative to public transportation for those who cannot drive or afford their own vehicles. Since there would be no need to pay a driver, a trip in an autonomous vehicle should be less expensive

52. Charles Marohn, "Poor Neighborhoods Make the Best Investments," *Strong Towns*, January 11, 2017.

than taking a taxi or ridesharing service. Uber and Lyft are already offering ride-pooling services that are competitive with mass transit.[53] As autonomous vehicles lower costs further, fewer people will use mass transit, threatening the viability of bus and rail transit service, especially in less dense urban areas where the service is already heavily subsidized.

As the share of vehicles that are autonomous increases, highways should also be able to accommodate more vehicles without increasing congestion. Autonomous vehicles could coordinate with each other to reduce or eliminate bottlenecks that are caused by the actions of human drivers. This effect would also likely decrease the demand for mass transit.

Despite these projections, the extent to which mass transit will be hurt by use of autonomous vehicles remains an open question. For instance, autonomous buses and trains could reduce the cost of transit systems as well as the cost of car use, helping transit systems to stay competitive a little bit longer.

CONCLUSION

More transportation infrastructure spending can produce positive net benefits if it is well targeted. But such targeting is unlikely if the federal government provides the revenue for this increased spending. State and local governments can make better decisions about transportation infrastructure investment than can the federal government, particularly if funding comes from state and local taxes or from user fees. Greater reliance on direct user fees, in the form of tolls or MBUFs (for highway users) or higher fares (for mass transit users), is especially likely to produce efficient allocation of resources.

In the case of highways, it would not be administratively difficult for states to take over collection of federal fuel taxes and for each state to keep all or most of the revenue it collects. Reducing or eliminating the federal role in transit funding would be more difficult. If federal funding were cut, and if state or local governments intended to sustain their previous levels of transit funding, the state or locality would either have to raise taxes or incur an opportunity cost in lower highway funding if it used additional fuel tax revenue for transit.

Additional spending on highways, especially where better maintenance is needed or where congestion is severe, could come from tolls. Toll revenue, especially if the level of tolls varied with congestion, could provide a signal about which highways deserve priority for investment and maintenance.

53. Phillip Class, "Uber Will Be the Uber of Mass Transit," *On-Demand*, June 8, 2015.

Without additional federal revenue, some local transit systems might not be able to afford the same level of service they offered in the past. The withdrawal of federal support would force state or local governments to make the hard decisions about how to run transit systems more efficiently, including which routes to cut because they do not attract enough riders. If enough local residents value living in dense urban neighborhoods with good access to transit, they will organize to convince local governments to make other changes, such as enacting new zoning laws, that would facilitate more efficient provision of transit. Congestion tolls on highways would also likely contribute to increased demand for transit in some metropolitan areas.

Rather than increasing funding or continuing to provide revenue from the general fund to pay for highways and transit, the federal government should change the rules that govern federal aid to highways to permit direct user fees, whether in the form of tolls or MBUFs. As part of this change, the federal government could also consider rules to limit state or local government discretion to divert toll revenue to highway alternatives such as mass transit. Such a safeguard, perhaps combined with an arrangement to rebate fuel taxes to users of toll highways, would reduce opposition to tolls in some quarters, particularly among truckers.

An additional advantage of transferring authority and responsibility for transportation infrastructure from the federal government to state and local governments is that it would encourage competition among the states. This competition would allow some states to experiment with privatizing their infrastructure, which could lead other states to imitate the most cost-effective approaches.

ABOUT THE AUTHORS

Veronique de Rugy is a senior research fellow at the Mercatus Center at George Mason University and a nationally syndicated columnist. Her primary research interests include the US economy, the federal budget, homeland security, taxation, tax competition, and financial privacy. She has testified numerous times before Congress on the economic effects of fiscal stimulus, debt and deficits, and regulation. De Rugy contributes a weekly opinion column to the Creators Syndicate, writes regular columns for *Reason* magazine, and blogs about economics at National Review Online's *The Corner*. Previously, de Rugy has been a resident fellow at the American Enterprise Institute, a policy analyst at the Cato Institute, and a research fellow at the Atlas Economic Research Foundation. Before moving to the United States, she oversaw academic programs in France for the Institute for Humane Studies–Europe. She received her MA in economics from the Paris Dauphine University and her PhD in economics from the Pantheon-Sorbonne University.

Tracy Miller is a senior policy research editor at the Mercatus Center at George Mason University. Previously, he was associate professor of economics and fellow for the Center for Vision and Values at Grove City College. His research interests include transportation policy, property rights, health economics, and environmental policy. He has published articles on agricultural policy, international trade, environmental policy, and transportation policy. He received his PhD in economics from the University of Chicago. He also holds a master's degree in agricultural economics from Michigan State University and a BS in forestry from Virginia Polytechnic Institute and State University.