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Fiscal Substitution of Investment for Highway Infrastructure

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Abstract

According to the available economics literature, state and local governments use federal grants for transportation infrastructure to substitute for some amount of spending they would have undertaken using nonfederal funds. In most of the literature, researchers studying federal grants for highways have found that state and local governments reduce highway spending from their own funds as federal grants increase. However, less consensus exists over the magnitude of that substitution effect, with a range of effects estimated. Further analysis to clarify the size of the substitution effect would be useful to the work of the Congressional Budget Office, especially if such analysis considered several additional characteristics of the grants and the recipients and if it considered substitution in types of transportation other than highways.

Keywords: grants, highways, infrastructure, state and local government, transportation

JEL Classification: E22, E62, H54, H72, H76, H77

Note

Numbers in the text, tables, and figures may not add up to totals because of rounding.

Contents

Summary

Each year, the federal government invests in expanding and improving the country's transportation infrastructure. Much of that investment takes the form of grants from the federal government to state and local governments. In its work, the Congressional Budget Office has estimated that state and local governments use some of those federal grant funds to replace some nonfederal funds that would have otherwise been used for such investment. Though the economics literature has often provided evidence that such fiscal substitution does occur for investments in highways, less agreement exists around the amount of that substitution.

How Is the Presence of Fiscal Substitution Relevant to CBO's Work?

The federal government spent about $80 billion on transportation infrastructure in 2014, and state and local governments spent close to $300 billion. Of those spending totals, about three-fourths of the federal amount was for capital investment (spending to expand or improve facilities), whereas almost half of state and local spending was for capital investment. Much of that federal spending took the form of grants to state and local governments, and some of it is expected to replace investment that state and local governments would have undertaken on their own. Understanding the extent to which that substitution occurs is helpful to CBO in considering how federal spending affects the economy.

What Is the Evidence of Fiscal Substitution in the Economics Literature?

Attempts to estimate the extent of fiscal substitution of federal investment in transportation infrastructure have focused on highways because that is where most federal transportation investment goes. Researchers have found evidence that state and local governments reduce spending on highways from their own funds as federal grants increase. For an increase of $1 in federal grants, most estimates suggest, state and local governments would reduce spending on highways from their own funds by between $0.20 and $0.80.

Why Are the Findings So Varied?

Several explanations could account for the wide range of estimates of fiscal substitution. Studies rely on different dependent variables: state highway spending, state and local highway spending, and state capital spending on highways. The periods examined in the studies vary, and programs may have undergone changes that altered how states implemented them. In addition, researchers adopted different strategies to address concerns about federal grant funding and state and local spending being endogenously determined.

What Extensions to the Fiscal Substitution Literature Could Be Useful to CBO's Understanding of How Much Investment Occurs From Federal Grants?

Several possible extensions to the fiscal substitution literature would further clarify the conditions under which substitution is likely to occur and how other factors influence that effect. State and local governments may adjust their own spending on capital projects or operations and maintenance in response to federal highway grants. The fiscal condition of state and local

governments and their relation to national economic conditions also are likely to affect substitution. In addition, federal spending changes could be permanent or temporary, large or small, and increases or decreases, each of which could have implications for state and local spending responses. The effects of federal grant programs could be compared with those of other federal programs that subsidize investment in transportation infrastructure.

How Applicable Are Highway Fiscal Substitution Estimates to Other Transportation Modes?

Patterns of funding and decisionmaking authority differ between highways and other modes of transportation, suggesting some caution in applying highway results to other modes. Mass transit is most similar to highways in that spending is shared between the federal government and state and local governments and because decisionmaking generally rests with the state or local government. The federal government has a more direct role in decisions about aviation and water transportation infrastructure, whereas rail relies heavily on the private sector.

Fiscal Substitution in Macroeconomic Modeling

The federal government, together with state and local governments and the private sector, invests in expanding and improving the nation's transportation infrastructure. In several publications, CBO has reported on how much the federal, state, and local governments invest; examined how those investments are funded; and considered options for changing how the federal government pays for those investments (Congressional Budget Office 2013b, 2014, 2016a, 2016b). This paper considers what the economic literature can tell us about how much additional investment occurs from federal spending on transportation infrastructure and how likely state and local governments would be to use federal spending to substitute for investment they would have otherwise pursued.

The question of how much state and local governments use federal grants to substitute for spending that would have otherwise occurred using nonfederal resources is not unique to highway grants. The federal government distributes grants to state and local governments through programs throughout the government (Congressional Budget Office 2013a). Fiscal substitution is probably present to some extent in many of those programs. Hines and Thaler (1995) provide an overview of some issues involved in estimating substitution effects across federal spending for a variety of purposes and discuss why some substitution occurs. Several researchers have considered fiscal substitution in the context of federal grants for education spending (Gordon 2004; Matsudaira, Hosek, and Walsh 2012). Carlino and Inman (2016) consider how federal project aid (including transportation and education grants and general revenue sharing, among other things) affects state spending. They find that states use about half those funds to increase related spending and allocate the rest to savings.

Because state and local governments use both their own funds and federal grants to build infrastructure, they are expected to substitute federal funds for some infrastructure investments

they would otherwise have made using their own funds. Doing so allows those governments to redirect funds they would have spent on infrastructure projects to other spending (or back to taxpayers). To counter that tendency, federal grant programs often require a minimum state and local government funding share (for example, a 20 percent state share for many highway programs) or impose a maintenance-of-effort requirement, so that a state would have to show that its funding reaches some benchmark level that approximates what would have been spent without federal funds. Nonetheless, occasions may exist in which state or local governments would have undertaken an infrastructure project even without federal funds, in which case state and local governments would probably substitute federal funds for some of their own.

CBO undertook macroeconomic analyses of changes in federal investment with respect to baseline projections. The agency estimates that, for an additional $1 in federal funding for all types of investment, nonfederal sources would decrease their own investment by $0.33, for an overall $0.67 increase in investment (see Congressional Budget Office 2016b, p. 4). That parameter differs in two ways from the estimates of fiscal substitution for highway spending discussed in this paper. It incorporates substitution across all types of investment—including spending for education, research and development (R&D), and infrastructure rather than just for highways—in response to a $1 change in overall federal funding for investment. The agency expects that different types of investment prompt different amounts of substitution; for example, in CBO's judgment, federal spending for R&D has a small but noticeable positive effect on private spending for R&D (Congressional Budget Office 2018). In addition, that parameter accounts for changes in investment by both the private sector and state and local governments. By contrast, the estimates of fiscal substitution discussed in this paper include only changes in spending by state and local governments.

Fiscal Substitution in Transportation Infrastructure Spending in the Economics Literature

In examining fiscal substitution of federal spending on transportation infrastructure, researchers in the economics literature have focused on federal grants to state and local governments for highway spending. Highways account for much of federal spending on transportation infrastructure: three-fourths of capital grants, more than two-thirds of all federal capital spending on transportation infrastructure, and more than half of all federal spending on transportation infrastructure, including both capital investment and operations and maintenance.[1] The concentration of studies on highway spending, however, has not resulted in broad consensus

[1] Capital spending includes outlays to buy new structures and equipment as well as expenditures to improve and rehabilitate structures and equipment already in place. Spending on operation and maintenance includes not only the costs of providing necessary operating services and of maintaining and repairing existing capital but also the costs of various other infrastructure-related programs, such as for education on highway safety. (See Congressional Budget Office 2015, p. 3.)

among researchers. Results vary from findings of extensive substitution of federal dollars for state and local funds to just the opposite, that state and local governments increase their own spending in response to additional federal funding (see Table 1). Most studies, however, estimate that state and local governments reduce their spending by between $0.20 and $0.80 for an additional $1 of federal grants. That range of estimates complicates attempts to analyze the economic effects of changes in federal spending for transportation infrastructure because how much a change in federal spending affects the total amount spent for that purpose is unclear.

Evidence of a Fiscal Substitution Effect

Several researchers have concluded that state and local governments reduce spending on highways from their nonfederal funding sources when they receive larger grants for highway projects from the federal government. According to Knight (2002)—an often-cited, high-profile study of highway spending over the 1983–1997 period—an additional dollar of federal highway grants would reduce state spending on highway capital and operations and maintenance by around $0.90 from what states would otherwise would have spent. Knight assumes that the amount of highway grants a state receives is in part a result of a political process. Therefore, he uses a variety of political variables in first-stage regressions to account for differences in highway spending preferences across states and address concerns that federal grants are endogenous to state spending. That study used current federal grants as the explanatory variable, whereas many other studies in the literature rely on some measure of lagged grants to reflect the multiple years that highway projects are likely to take to plan and complete.

Building on the Knight model, the Government Accountability Office (GAO; 2004) finds a smaller substitution effect over a similar period, with state and local governments reducing spending by $0.50 for an additional dollar in highway grants. Those researchers make several choices in designing their model that probably contributed to the different result: they correct for autocorrelation in the error term; they include total spending by both state and local governments, rather than just states, because states divide highway responsibilities differently; and they control for federal grants to states for nonhighway purposes as a way to account for some of the additional fiscal resources state have at their disposal.

Meyers (1987), also cited by GAO, estimates a similarly sized substitution effect, with states reducing highway spending from their own resources by $0.63 for each additional dollar of federal highway grants. Meyers includes as control variables the share of highway spending supplied by grants and the share of other state spending from federal grants, but the analysis omits the interstate highway system. The first-stage regression Meyers uses to deal with the endogeneity of federal grants is not described.

GAO's study also points to Gamkhar (2003), which estimates how a change in obligations for federal highway grants affects state and local spending in the current year and two more years. Gamkhar finds that over those three years state and local governments use an additional $1 in

federal grant obligations to substitute for $0.22 of state and local spending, so that overall highway spending increases by $0.78 on net. Gamkhar's preferred estimation uses obligations as its measure of spending to avoid the endogeneity concerns that would arise from relying on federal expenditures (or outlays) to measure grants because expenditures are typically made to reimburse states for spending they have already undertaken.

Nesbit and Kreft (2009) later examine highway spending from 1994 to 2002, finding that an additional $1 of federal highway grants reduces investment using state funds by $0.24. In a departure from other studies, the researchers include lagged federal highway obligations in their instrumental variable regressions for federal highway grants and control for state revenues specifically earmarked to pay for highway projects.

More recently, Dupor (2017) considers how the highway funding provided for in the American Recovery and Reinvestment Act (ARRA) affected changes in state highway spending. He estimates that states reduced their highway capital spending by $0.81 when federal highway grants increased by $1 from ARRA funds. Dupor's study is unique in the literature for having examined how federal grants affect only highway capital spending by states; by contrast, studies in the rest of the literature include both capital and operations and maintenance spending in their dependent variables. With rare exceptions, federal highway grants are intended to support capital investments and require state and local governments to contribute to those same capital projects from nonfederal funds. Projects funded by ARRA grants, however, did not require state and local governments to fund any portion.

Evidence of Complementarity Between Federal Spending and State and Local Spending

Although most researchers studying how federal highway grants affect state and local highway spending have found evidence of substitution, one recent study reported that federal grants have generated more state spending over time than would otherwise have occurred. Leduc and Wilson (2017) found that states' total spending (on capital as well as operations and maintenance) for highways from their own funds increased in response to the federal grants they received for highway capital investment through ARRA. In a single year, researchers estimated that $1 in ARRA highway funds resulted in an additional $0.70 of total state highway spending, suggesting that states reduced spending from their own funds by $0.30. Over three years, however, Leduc and Wilson found that an additional dollar of ARRA funds generates more than $1 in cumulative state highway spending from nonfederal funds. Their model differs in several ways from much of the literature, including the Dupor study that focused on a similar, though shorter, period. Both the Dupor study and the Leduc and Wilson study include only grants funded through ARRA in their main specifications; in an extension, Leduc and Wilson include regular highway grants as well but do not account separately for grants distributed through ARRA and regular

funding.[2] Leduc and Wilson also rely on a different dependent variable; they include all state spending for highways, including operations and maintenance spending and transfers to local governments, whereas Dupor includes only capital spending for highways by states directly.

Possible Sources of Variations in Estimates of Fiscal Substitution Effect

The literature on fiscal substitution in highway investment offers little consensus on how much states use federal highway grants to offset amounts that they would otherwise spend on their own. Estimates range from nearly complete substitution for state dollars to a doubling of state spending. Several factors contribute to the wide variety of results, including the choice of the appropriate measure to use as a dependent variable, different periods measured, and the approach used to address endogeneity concerns.

Extent of State and Local Spending Analyzed

The measures of state and local highway spending used as the dependent variable to be explained in various studies differ along three dimensions:

- State spending or state and local spending;
- Capital spending or total spending, including operations and maintenance; and
- Duration of the period over which substitution is measured.[3]

Most of the studies rely solely on state spending as their dependent variable, whereas GAO (2004) and Gamkhar (2003) include both state and local spending for highways. Leduc and Wilson (2017) take an intermediate path, including transfers from states to local governments for highway purposes together with states' own spending but omitting other highway spending by local governments. Although states receive federal highway grants, federal spending formulas require that some of those funds be distributed to local governments. In addition, as GAO points out, states organize their investments in highway infrastructure differently. Some states centralize much of the decisionmaking and spending, whereas in other states local governments take on a larger role.[4] Using the sum of state and local spending, therefore, captures all public

[2] Outlays for non–ARRA-funded highway grants decreased in 2010, offsetting some of the ARRA spending (Congressional Budget Office 2011, p. 12).

[3] Researchers generally have relied on data from the Federal Highway Administration or the Census Bureau.

[4] Some states allow local governments to swap federal funds for a discounted amount of state funds, thereby exempting projects from some federal requirements. In its Federal Fund Exchange Program, the Kansas Department of Transportation (2016, n.d.) exchanges $0.75 to $0.90 of state funds for $1 of local federal obligation authority and permits states to undertake a broader range of projects with those funds than would be possible with federal funds.

investment in highways in the state, regardless of whether highway spending decisions are made by state or local governments.

Only Dupor (2017) uses capital spending by states as a dependent variable, whereas the rest of the literature cited also includes spending on operations and maintenance. Employing capital spending as the dependent variable seems likely to give the clearest assessment of whether state and local governments use federal grants to substitute for their own spending because those grants typically may be used only for capital projects. However, using total spending on highways yields a broader picture of state and local governments' commitment to highway spending and allows for the possibility of misclassified spending.

In addition to choosing the type of spending to include in their analysis, researchers also make choices about the appropriate length of time over which federal funds can be expected to affect state and local spending. Many of the studies estimate a single-year effect of federal grants on state spending, though capital projects are likely to take several years to complete.[5] Gamkhar (2003), taking the view that federal funds committed in a given year are likely to affect state and local spending for several years as projects proceed, presents a cumulative effect on state and local spending over three years. Dupor (2017) and Leduc and Wilson (2017), with their focus on ARRA spending, respectively consider cumulative changes within two years and four years of 2008, rather than annual effects.

Period Examined

The research cited here spans more than 30 years of highway spending. Meyers (1987) covers the earliest period, from 1976 to 1982, with Gamkhar (2003) extending that period to 1990. Knight (2002) and GAO (2004) pick up after that, from the mid-1980s to the late 1990s. Nesbit and Kreft (2009) span from the mid-1990s to the early 2000s. Finally, Dupor (2017) looks at spending from 2008 to 2010, whereas Leduc and Wilson (2017) examine the period from 2009 to 2012, the years most affected by ARRA funds. Over those three decades, several factors complicate efforts to reconcile differences in study results: changes in how programs were administered, the predictability of federal grant amounts, the financing options and interest rates states face, priorities for highway investment, and economic and fiscal conditions.

The analysis by GAO (2004) extends the model to allow substitution rates to vary with different highway bills. GAO finds evidence of a stronger substitution effect in the 1990s than in the 1980s. The set of studies described here does not suggest a comparable pattern of increased

[5] The Federal Highway Administration (2017, p. 39) calculates that, on average, 27 percent of outlays are made in the first year after funds have been obligated, an additional 41 percent in the second year, and 16 percent in the third year.

substitution over time, but the variety of modeling approaches makes comparisons among studies more difficult.

Approaches to Address Endogeneity Concerns

Researchers adopted different strategies to address the fact that the amount of federal grants a state receives in a year is jointly determined with the amount that state and local governments spend on highways. Federal highway grants are typically paid out on a reimbursement basis—the federal government commits grant funds to be available to a state, but the payments are not made until a state expends its own funds on a project and seeks reimbursement from the federal government for that share.

Knight (2002), GAO (2004), and Leduc and Wilson (2017) all use instrumental variables to address the endogeneity of federal grants, including in first-stage regressions instruments that are likely to be correlated with federal grant amounts but not state spending. Knight and GAO use demographic and political variables (party affiliation of government officials and some measure of legislative tenure) as their instruments. Leduc and Wilson find that political variables are not strong instruments for ARRA grants and instead rely on highway characteristics from previous years that are part of the formulas used to allocate federal highway grants between states.

The other studies generally rely on predetermined variables to circumvent endogeneity questions. Federal grants that are obligated in a year are typically paid out to states over several of the following years. That approach suggests that it is reasonable to assume that states take prior years' federal highway obligations into account when determining the highway spending that they will undertake in any given year.

Possible Extensions to the Highway Fiscal Substitution Literature

Knowing the extent to which state and local governments substitute federal funds for their own allows for a better understanding of how much public investment results from an additional dollar of federal spending. To advance that understanding, it would be useful to know how a variety of factors are likely to influence the amount of substitution that occurs and whether grants have effects different from those of other forms of federal subsidies for infrastructure investment such as loans and tax expenditures.

Factors That Might Influence the Substitution Effect

Several factors might affect the rate at which state and local governments substitute federal funds for transportation infrastructure for their own:

- The fiscal constraints and economic conditions faced by state and local governments,
- The expected permanence of any changes in federal grants,

- The size of federal grant changes, and
- The direction of the change in federal grants.

Though not considered in much of the literature, all those effects seem likely to have some bearing on the extent to which state and local governments allow federal grant funding to substitute for state and local funding of infrastructure investment.

Fiscal Condition of State and Local Governments. State and local governments are likely to vary in both their capacity and preferences to invest in transportation infrastructure in response to federal grants. States face different budget constraints that limit their ability to spend, either because of difficult economic conditions or because of differences in statutory, constitutional, or practical limits on spending. An economic downturn is likely to reduce revenue, whereas rapid growth would expand it, giving states and localities different capacities to expand spending on transportation infrastructure without affecting the amount of funding available for other purposes.

When a state or local government faces diminished revenues or an otherwise especially constrained fiscal situation, the rate at which it substitutes federal funds for state and local funds would increase in some cases. However, a state or local government facing fiscal constraints and a decrease in federal grants would seem less likely to be in a position to increase its own spending to replace lost grant funding. An increase in the substitution rate is more likely when state and local investment in transportation infrastructure exceeds the amount required to receive the full federal match and therefore would not put those federal funds at risk. When state and local spending is closer to the amount required to receive the full federal match, increasing the rate of fiscal substitution would be less likely because cutting spending could jeopardize federal funding.

In addition to spending constraints that arise from economic conditions, state and local governments face limits in their ability to access state general funds for investment in highway infrastructure and in the amounts they are permitted to borrow, both in total and for certain projects. Many states have access to dedicated revenue sources for highway projects, such as fuel and vehicle taxes and tolls, but spend limited amounts from the general fund on highways. Capital budgets in some states exclude transportation investment, typically because those states rely on earmarked revenue sources to fund transportation (National Association of State Budget Officers 2014). Some states limit the amounts and types of debts that they permit, whereas others require legislative approval to issue certain types of bonds. States also share funds with local governments for transportation projects, either by formula or through legislated appropriations.

Overall economic conditions also are likely to affect the rate of fiscal substitution that occurs—independently of any effect on the financial conditions of state and local governments. For

example, rising interest rates that increase the cost of borrowing may make states more inclined to substitute regardless of their revenue outlook.

Permanence of Change in Federal Spending. Changes to federal grants for investment in transportation infrastructure can take many forms, probably prompting various responses from state and local governments. A change perceived to be long-lived is likely to offer state and local governments different incentives and a different time frame to adjust their own investments than changes to grants that are either unanticipated or expected to be temporary.

A change in federal grant funding that is expected to be temporary could produce more substitution, particularly in capital spending, than a change expected to be permanent. Because investment projects take time to both plan and execute, state and local governments are likely to have difficulty coming up with additional projects to take on if a temporary increase in federal funding occurs. Instead, state and local governments could reduce their own spending while maintaining the same total level of investment they had planned. Similarly, if federal grant funding fell for a limited period, state and local governments would probably be expected to increase spending from their own funds to avoid disrupting the progress of projects already under way.

If changes in federal grant funding were expected to be permanent, states would probably make different choices. In some cases, they would opt to support more investment overall by maintaining their spending even while receiving larger federal grants. Alternatively, they would be likely to reduce their own spending if they received smaller federal grants that made some projects they would have otherwise pursued unaffordable.

Magnitude of Change in Federal Spending. Large and small changes in grant amounts also are likely to elicit different responses from state and local governments, reflecting their capacity to adjust spending and their backlog of projects. In the literature on fiscal substitution in highway spending, the estimated substitution effects are measured in response to marginal changes in federal grant funds. Large changes in federal grants, or at least large increases, would probably induce greater substitution of federal funds for funding from state and local revenues. At least in the short term, state and local governments are likely to have a limited capacity to absorb those larger federal payments and could reduce their own spending to accommodate them. Getting new projects under way takes time, and state and local governments may opt to put as much of the increased federal funding into projects already under way as possible, thereby crowding out state and local funds. However, if federal matching requirements were binding, state and local governments would have an incentive to spend at least as much as necessary to collect the full amount of federal grants they were eligible to receive.

Direction of Change in Federal Spending. State and local governments may respond asymmetrically to increases and decreases in federal grants. Fiscal substitution is often described as state and local governments' reducing spending from their own revenue sources by some

amount in response to an increase in federal grants. In that case, a symmetric response to a decrease in federal grants would have state and local governments increase their spending by the same amount. However, other outcomes seem possible that have not been well explored in the literature. A state or local government facing fiscal constraints would find it difficult to increase its spending to make up for lost federal funds. Other governments would choose to increase their spending by a relatively larger amount to complete ongoing projects. Gamkhar (2000) allows for such an asymmetric effect and found a slightly larger substitution rate in response to a decrease in federal grants than to an increase. That finding suggests that state and local governments use their own resources to replace reductions in federal grants at a higher rate than they reduce their own spending in response to larger grants. Further exploration of the possibility of asymmetry could reveal more insights.

Nongrant Federal Support

The federal government subsidizes state and local investment in transportation infrastructure through several means besides grants. Credit assistance for specific projects, as loans and federal loan guarantees for state and local governments or their private-sector partners, comes through Transportation Infrastructure Finance and Innovation Act (TIFIA) programs and others like it. More generally, state and local government borrowing receives federal subsidies through the tax system, by exempting interest payments on tax-exempt bonds from income taxes or offering other tax benefits (for more information, see Congressional Budget Office 2009). Those provisions allow state and local governments to issue bonds for infrastructure and other investment projects at a lower interest rate than they would otherwise face. In addition to programs that support state and local investment, the federal government spends directly on its own for investments in transportation infrastructure, both for projects on federal lands and in other places that have a larger federal role, as in inland waterways.

Further studies could consider how much additional infrastructure comes from the different types of federal support and how those programs complement one another.

Fiscal Substitution in Nonhighway Transportation Infrastructure Investment

The literature on fiscal substitution has also focused on highways to the exclusion of investment in other modes of transportation. Although highways receive the most funding, federal, state, and local governments support investment in infrastructure for aviation, ports, mass transit, and rail. Grant program structure, the division of responsibilities, and other sources of financing differ across modes, making it unclear whether any of the highway substitution results are applicable.

Federal, State, and Local Spending Shares Differ Across Modes

Capital spending on highways is funded almost entirely by federal grants to state and local governments and by state and local spending from nonfederal resources (see Table 2). Mass transit is the only other mode that has a similar breakdown between federal and state and local

funding sources, though state and local governments are responsible for a larger share of that investment than they are for highways. Total investment in mass transit infrastructure, however, amounts to only about one-fourth as much as investment in highway infrastructure. Highways and transit together account for about 90 percent of federal grants for transportation infrastructure.

Investment in infrastructure for other modes of transportation takes on different patterns, with private-sector involvement in investment in rail infrastructure and a larger direct federal role for investment in aviation and water infrastructure. The private sector owns most U.S. rail lines and thus is responsible for most investment in their infrastructure. In 2017, railroads invested $25 billion to expand, improve, or maintain rail infrastructure (Association of American Railroads 2018). The role of the federal government in investment is more limited in rail, though some rail projects are funded through intermodal programs involving highways and ports and through the loans and loan guarantees provided in the Railroad Rehabilitation and Improvement Financing program.

Investment in aviation combines federal grants, state and local spending, and direct federal spending. The federal government makes grants to state and local governments and airport authorities, which use those grants together with their own funds to improve and expand airport infrastructure. The federal government also invests on its own account as part of improvements to the national aviation system, including air traffic control programs.

The federal government's investment in water transportation infrastructure is generally carried out by the Army Corps of Engineers (ACOE), which is responsible for the waterside infrastructure through projects such as dredging ports and waterways. State and local governments, through associated port authorities, are typically responsible for landside investments at ports, though they often also contract with port operators from the private sector to manage and operate terminals at seaports. Although state and local port authorities request improvements to waterside infrastructure, such as port-deepening projects, the ACOE pays for and implements the projects. The port authorities then reimburse the Corps for a portion of the costs.

Similar differences in federal spending across modes also are evident in total spending on each mode of transportation both for capital and for operations and maintenance (see Table 3). For highways and mass transit, state and local governments take on an even larger share of operations and maintenance spending, with relatively little additional federal funding for those purposes. In aviation and water transportation, however, the federal government and state and local governments all spend on operations and maintenance. Grants are not an important part of that spending, however, because the federal government spends directly on operations and maintenance for those modes.

Federal and State Roles Differ Across Transportation Modes

The differences between transportation modes extend beyond which levels of government spend on infrastructure and operations (see Table 4). Programs' cost-sharing requirements vary. The linked sources of revenue that state and local governments can rely on differ across modes. The authority to make spending decisions also differs, though some connections exist between decisionmaking and funding. The current role of the private sector is mostly limited, with rail standing in sharp contrast.

For state and local transportation projects that receive federal grants, those grants usually fund well over half the project. For highways and mass transit capital projects, the federal share is typically 80 percent. However, state and local government capital investments account for more than twice as much as a required 20 percent share would have them contribute (see Table 2). For aviation and water transportation, the maximum federal share varies. Small airports are generally eligible to receive a larger federal share than larger airports. Similarly, the maximum federal share is higher for capital projects in shallower harbors. Inland waterway projects have the largest federal share, at 100 percent.

State and local governments rely on several funding sources to pay for their share of investment in transportation infrastructure. General fund and bond proceeds are sometimes used, though state and local laws and budgeting practices often limit their use. Other revenue sources are more closely linked to a particular mode of transportation. Tolls and fuel and vehicle taxes are used for highways and fare box revenues for mass transit. Airport and port authorities charge carriers to use their facilities and can charge fees to traveling passengers.

For most transportation infrastructure programs, state and local governments can choose which projects to support with federal grant money, subject to the rules and conditions of the grant program. Decisions about how to spend other federal investment funds for aviation rest with the federal government. Harbor projects are decided at the federal level as well, but they require Congressional approval for ACOE projects.

Decisions about rail investments are made by the private firms that own the railroads themselves, though government maintains a regulatory role. For most other modes, the private sector typically operates as an agent of a state or local government, as a contractor or in some form of public-private partnership (Congressional Budget Office 2014). Many ports are structured differently because port authorities often lease terminals to private port operators, which are likely to play a role in deciding on and funding infrastructure improvements on the land side, whereas the federal government makes decisions on waterside projects.

Relevance of Highway Substitution Findings to Other Transportation Modes

Given the commonalities between highways and mass transit in their funding patterns and the division of responsibilities between the federal government and state and local governments, mass transit seems the mode of transportation most likely to experience fiscal substitution similar

to that for highways. Rail's reliance on the private sector means that if federal programs that provide financial assistance for investment in rail infrastructure substitute for other investment in rail, private investment would be more likely to be reduced than state and local investment.

Greater uncertainty surrounds the extent to which highway fiscal substitution findings are likely to apply to investment in infrastructure for aviation and water transportation. In both cases, the governing authority's ability to raise revenue is more directly linked to the infrastructure it constructs than it is for highways. For example, an airport or a port can control access to its infrastructure through landing fees, passenger charges, or lease agreements for terminal space. Though the current highway system sometimes imposes tolls, they are used less often and therefore are less likely to limit access than is the case for ports and airports. The federal government also plays a more direct role in investment decisions for both ports and aviation, choosing which harbor projects to undertake and deciding how to design the national aviation system. Those differences make it less likely that estimates of fiscal substitution obtained for highway investment apply to federal investment in air and water transportation as well.

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Tables

Table 1. **[Return to Text]**
Substitution Rate Estimates From Literature on Highway Grants

Study	Main Substitution Rate Estimate	Period Studied	Dependent Variable
Meyers (1987)	–0.6	1976–1982	State spending for highways
Knight (2002)	–0.9	1983–1997	State spending for highways
Gamkhar (2003)	–0.2[a]	1976–1990	State and local spending for highways
Government Accountability Office (2004)	–0.5	1983–2000	State and local spending for highways
Nesbit and Kreft (2009)	–0.2	1974–2002	State highway spending
Dupor (2017)	–0.8[b]	2008–2010	State capital spending for highways
Leduc and Wilson (2017)	1.3[b]	2008–2012	State spending for highways, including transfers to local governments

Source: Congressional Budget Office.

a. Substitution rates are calculated as the cumulative effect of a change in spending in response over three years.

b. This substitution rate is based on the cumulative change in state highway spending over the period.

Table 2. **[Return to Text 1; 2]**

Public Capital Spending for Transportation Infrastructure, 2014

	Capital Spending[a] Millions of 2014 dollars			Share of Total Capital Spending Percent		
	Federal		State and Local, Net of Grants	Federal		State and Local, Net of Grants
Transportation Mode	Grants	Other Spending		Grants	Other Spending	
Highways	43,538	0	48,324	47	0	53
Mass Transit[b]	8,077	0	14,669	36	0	64
Rail[b]	2,317	17	n.a.	99	1	n.a.
Aviation	3,152	2,604	7,513	24	20	57
Water Transportation[c]	80	1,960	2,389	2	44	54

Source: Congressional Budget Office, using data from Office of Management and Budget, Census Bureau, and Army Corps of Engineers.

n.a. = not applicable.

a. Spending is reported for the federal fiscal year 2014. Outlays are reported at the federal level. State and local spending is adjusted to the federal fiscal year. For more details on spending measure, see Congressional Budget Office (2015, pp. 30–31).

b. State and local governments do not report expenditures for freight rail to the Census Bureau but do report expenditures for passenger rail under the mass transit category.

c. Water transportation includes navigation outlays by the Army Corps of Engineers that would typically be included in the Water Resources budget function.

Table 3. [Return to Text]

Total Public Spending for Transportation Infrastructure, 2014

	Total Spending[a] Millions of 2014 dollars			Share of Total Spending Percent		
	Federal			Federal		
Transportation Mode	Grants	Other Spending	State and Local, Net of Grants	Grants	Other Spending	State and Local, Net of Grants
Highways	44,851	1,467	118,345	27	1	72
Mass Transit[b]	12,345	165	52,908	19	0	81
Rail[b]	2,657	342	n.a.	89	11	n.a.
Aviation	3,152	12,868	20,027	9	36	56
Water Transportation[c]	80	6,318	5,573	1	53	47

Source: Congressional Budget Office, using data from Office of Management and Budget, Census Bureau, and Army Corps of Engineers.

n.a. = not applicable.

a. Spending is reported for the federal fiscal year 2014. Outlays are reported at the federal level. State and local spending is adjusted to the federal fiscal year. For more details on spending measure, see Congressional Budget Office (2015, pp. 30–31).

b. State and local governments do not report expenditures for freight rail to the Census Bureau but do report expenditures for passenger rail under the mass transit category.

c. Water transportation includes navigation outlays by the Army Corps of Engineers that would typically be included in the Water Resources budget function.

Table 4. [Return to Text]

Infrastructure Spending Features by Transportation Mode

	Features of Infrastructure Spending			
Transportation Mode	**Typical Maximum Federal Share**	**Mode-Specific State and Local Revenue Sources**	**Federal/State and Local Decisionmaking Roles**	**Private-Sector Presence**
Highways	80% capital	Tolls, fuel taxes, vehicle taxes	State/local choose projects subject to federal rules and conditions	Contracts, public-private partnership
Mass Transit	80% capital, 50% operations	Passenger fares	State/local choose projects subject to federal rules and conditions	Contracts, public-private partnership
Rail	n.a.	n.a.	Regulatory	Privately owned and operated
Aviation	75%–90% capital	Passenger facility charges, terminal rents, landing fees, concessions	State/local choose projects subject to federal rules and conditions; federal designs national aviation system	Contracts, public-private partnership
Water Transportation	40%–100% construction, 50%–100% operations	Terminal leases, port charges	Federal decides water projects with Congressional approval[a]	Terminal operators, some private ports

Source: Congressional Budget Office.

n.a. = not applicable.

a. The state or local port authority chooses land projects and may receive federal funds through other federal transportation programs.