ESSAYS ON ISSUES
THE FEDERAL RESERVE BANK OF CHICAGO
2015
NUMBER 331

Chicago Fed Letter

Measuring and financing infrastructure investments

by Richard H. Mattoon, senior economist and economic advisor

On November 3, 2014, the Federal Reserve Bank of Chicago held a conference to examine recent research on measuring the economic value of infrastructure investments and to explore new funding models for infrastructure in a time when many state and local governments face fiscal challenges.

Some materials presented at the conference are available at https://chicagofed.org/events/2014/infrastructure-economic-growth-measuring.

In his introductory remarks, Charles Evans, president and CEO of the Federal Reserve Bank of Chicago, noted that while economic research suggests that infrastructure spending generally has positive economic returns, concerns have been raised about the decision-making process behind some individual infrastructure projects and the extent to which that process may have been guided by political rather than economic considerations. Moreover, Evans said that studies have indicated that the return on infrastructure investment can range from modest to substantial depending on the economic conditions that prevail when the investment is made and on the nature of the project (e.g., new construction versus maintenance). Further, Evans observed that revenues from the types of taxes traditionally used to pay for infrastructure have become diminished over the past few years; mechanisms such as the fuel tax (levied by the federal, state, and some local governments) are failing to keep pace with inflation. Evans said that changes to tolls and congestion pricing[1] might be appropriate alternatives to consider.

Evidence on infrastructure investment effects

Therese McGuire (Kellogg School of Management at Northwestern University) presented the results from a study conducted by the Transportation Research Board (TRB) of the National Academies that examined how transportation stimulus spending affects economic downturns.[2] Specifically, the study looked at the impact of the $48.1 billion in transportation funding that was included in the American Recovery and Reinvestment Act (ARRA) passed in February 2009 in response to the Great Recession, which began in late 2007. McGuire noted that previous evaluations of infrastructure programs had found the returns on investment limited by 1) spending that was not timely (i.e., the spending occurred after the recession had already ended); 2) states substituting federal money for state money, meaning that no additional infrastructure spending occurred; and 3) poor project selection. The ARRA tried to address these problems by putting rules in place to ensure that the transportation spending was additive and targeted at "shovel-ready projects." However, McGuire noted that these rules had the effect of states and localities favoring road-paving projects over larger, more-complex infrastructure investments.

The TRB study found that infrastructure spending did increase gross domestic product (GDP) and employment, at least over the short term (within one to two years of the spending), McGuire explained. The magnitude of the economic effect from infrastructure spending varied widely; according to Congressional Budget Office (CBO) estimates in the

TRB study, the output multiplier[3] of federal transfer payments to state and local governments for infrastructure was between 0.4 and 2.2. The study also found that additional infrastructure investment is particularly useful if the recession is expected to be long and/or the pace of recovery slow. Finally, the study showed that the size of the infrastructure stimulus was constrained by the capacity of transportation departments and related industries to execute new projects. To close, is being built; eventually, economic growth picks up again as the infrastructure becomes available for use (usually around six to eight years after federal funding is apportioned). According to Wilson and Leduc's model, the implied output multipliers for state road spending are 1.4 on impact, when the federal highway grant is allocated to the state, and 3.0 at the peak, when the completed infrastructure starts being used; but after reaching the peak, the multiplier

Improving infrastructure will remain a front-burner policy issue given reports of its poor condition nationwide.

McGuire said the TRB recommended the following based on the study's findings:

- Expand the project pipeline at the state and local levels and increase capacity for executing infrastructure projects.
- Improve the design (and eventual execution) of future federal infrastructure stimulus programs (e.g., by establishing and publishing in advance the rules on timely spending of stimulus funds and recordkeeping).
- Measure the impact of federal infrastructure funding on state and local government recipients' fiscal decision-making.
- Define a clear method for evaluating outcomes.

Daniel Wilson (Federal Reserve Bank of San Francisco) presented findings from joint research with Sylvain Leduc.[4] Their work constructs a new measure of positive shocks (i.e., "windfall" central government funding) to public infrastructure spending by using the timing and structure of federal grants to capture states' expectations of future highway spending. Estimates of the impact from new highway spending on local GDP (and other economic factors, such as employment, wages, and population) can be derived through their model. Wilson said that when a federal highway grant is apportioned to a state, it immediately stimulates economic growth there (over the first year or so), but this effect dissipates for a time as the infrastructure effect fades away over time (it is not permanent). Given these results, their model suggests that infrastructure spending has large near-term and medium-term effects on local economic activity, said Wilson. In sum, he said a sudden jump in the level of federal highway grants leads to more highway spending by states and higher local GDP; and apparently, there is little substitution effect, meaning that the federal funding is additive to state infrastructure spending.

How to pay for infrastructure

Tracy Gordon (Tax Policy Center, Urban Institute and Brookings Institution) discussed the impact of intergovernmental relationships in the United States on infrastructure investments. Gordon noted the United States' infrastructure stock is at 64% of its GDP—slightly below the global average for infrastructure stock's value of around 70% of GDP. U.S. infrastructure investment as a share of GDP had fallen from an annual value of 2.7%, on average, in the 1960s to 1.6% in 2012, she noted. Gordon next turned to the composition of U.S. public infrastructure investment. Federal spending on infrastructure in fiscal year (FY) 2011 was $57 billion, with most of this being distributed to states through the grant process. By comparison, own-source revenue for infrastructure spending was $80 billion for the states and $73 billion for local governments that fiscal year. So, given these FY2011 values, the federal government's role appears to be relatively smaller, but Gordon argued the federal government can do much more with respect to infrastructure than provide direct funding to states and localities. For one, it can help states and localities finance projects by continuing to permit mechanisms such as tax-exempt bonds, which allow them to lower their borrowing costs for building infrastructure. To further fund infrastructure projects, the federal government can let states and localities issue federally subsidized taxable bonds.[5] Moreover, the federal government can provide direct loans and guarantees to help finance state and local infrastructure projects. Gordon also contended that the federal government should continue to help attract infrastructure investment through public–private partnerships (P3s).[6] From 1989 to 2013, P3s funded $61 billion in highway projects. The federal government facilitates the development of new infrastructure P3s through initiatives such as the Build America Transportation Investment Center,[7] which was announced in July 2014; Gordon said this center will serve as the one-stop shop for developers, investors, and state and local governments interested in forming infrastructure P3s. Gordon concluded that the United States is currently on a perilous path, as ever more of the responsibility for funding infrastructure projects is shifting from the federal government to lower levels of government. She argued that to ensure that infrastructure projects are properly funded, the federal government should consider establishing a national infrastructure bank, promote competitive grants, and encourage the formation of state and regional infrastructure banks.

Ben Husch (National Conference of State Legislatures) provided an assessment of the future of federal transportation funding. The current transportation funding law—the Moving Ahead for Progress in the 21st Century Act, or MAP-21—expires on May 31, 2015; and absent either the passage of a new funding bill or an extension of the current law, the Highway Trust Fund[8] will face insolvency and other transportation programs will experience budget shortfalls. A key issue is the use of the federal gas tax to support transportation funding,

noted Husch. The federal tax of 18.4¢ per gallon of gas has not been changed since 1993.[9] Given inflation and increased construction costs since 1993, the purchasing power of gas tax revenues had already fallen by about a third by 2012; it is expected to have dropped by around a half by 2023, according to Husch. This reduced purchasing power has contributed to projected funding gaps for the Highway Trust Fund of $14 billion per year over FY2015–17 and $16 billion per year over FY2018–20, Husch pointed out. Transfers were made from the general fund or dedicated funds to help close the gaps during FY2008–13.[10] In FY2014, the Highway Trust Fund received transfers totaling $20.5 billion from other funds on account of special one-time legislation.[11] Measures such as these cannot sustain the solvency of the Highway Trust Fund, argued Husch.

Husch presented a series of proposals to increase federal tax revenues to fund transportation programs. The largest gains could come from a vehicle miles traveled (VMT) tax on light vehicles (cars and light trucks) of 2¢ per mile, raising an average of $55.9 billion per year over the period 2015–20. Other large revenue gains could come from an 8% sales tax on gasoline, raising $31.1 billion per year over the same period, or an 11% diesel sales tax, raising $15.8 billion per year. Increasing the existing excise tax on gas by 10¢ would yield a revenue gain of $13.4 billion per year over this span.

Given the uncertainty surrounding the reauthorization of MAP-21, some states have decided not to wait on the federal government, opting instead to shore up their own funding resources, Husch observed. For example, Pennsylvania and Virginia have placed a variable-rate wholesale tax on the price of a barrel of oil. In Massachusetts, New Hampshire, Vermont, and Maryland, the state fuel tax has been indexed to the rate of inflation. And in Wyoming, the state gas tax was raised by 10¢ per gallon in 2013, said Husch.

John Roberts (Michigan State Budget Office) presented Governor Rick Snyder's proposal to increase infrastructure spending by $1.2 billion per year in Michigan. Roberts explained that Michigan had gone through a protracted period of decline in the 2000s (starting long before the Great Recession), delaying several infrastructure investments (such as those to improve highways and broadband web access). In addition, since FY2013, the state has had to use general funds rather than dedicated funds in order to receive the full match of federal infrastructure dollars. To adequately fund future infrastructure investments, Governor Snyder has proposed a combination of a 33¢ increase in the wholesale tax on motor fuel and increases in vehicle registration fees. Specifically, registration fees for heavy trucks would increase by 25%, while those for light vehicles would jump by 60%.

Roberts concluded by discussing some of the challenges to Governor Snyder's proposal. First, additional infrastructure spending has to demonstrate an economic impact. In particular, given the importance of the supply chain to the auto industry, investments in infrastructure have to eventually demonstrate that they helped productivity rise for that core industry. Second, the proposal's new tax structure has to improve the ability to purchase infrastructure. Reliance on a fixed tax per gallon structure ensures that the revenue will erode over time given current trends, Roberts noted. Third, any proposed revenue change to fund infrastructure must avoid being contingent on state constitutional change, which requires two-thirds approval from the state legislature (that level of consensus would make most policy changes impractical). Finally, any change in infrastructure funding or spending would need to take into account numerous interested parties that want different types of infrastructure improvements (e.g., fixing roads versus mass transit).

James Whitty (Oregon Department of Transportation) explained Oregon's efforts to explore an alternative to collecting a fuel tax to fund infrastructure investments: its new program for a vehicle miles traveled tax. The program is voluntary and will include up to 5,000 light vehicles when it begins on July 1, 2015. A key motivation behind testing out the VMT tax is that while fuel efficiency may be reducing the yield from gas taxes, the actual volume of miles traveled continues to rise. As such, a VMT tax reflects road usage more accurately than does a fuel consumption tax. In Oregon's case, only 56% of tax revenues available to improve roads in 2011–13 came from state and federal fuel tax sources, said Whitty.

Whitty shared that the new program's participants will be charged 1.5¢ per mile driven and will receive fuel tax credits. According to Whitty, the program was designed to address five main public concerns about a VMT tax:

- *Privacy*. The program does not require information about a vehicle's location, and access to personally identifiable information is limited by law. Mileage data are destroyed after 30 days.
- *Government bureaucracy*. For the sake of efficiency and to provide more options to the public, the state government bid out aspects of the program to commercial account managers. These managers offer a wide range of products for VMT tracking and reporting. Those volunteering for the program will have choices in which service provider to use and which type of device to install in their vehicles.

ISSN 0895-0164

- *Complexity.* Under the program, taxpayers are offered options to make their participation fairly simple and convenient. They get to choose the tracking service provider; how to report their VMT (all miles driven or miles driven by road type—e.g., public versus private roads); and how to pay their VMT taxes (by cash, check, credit, debit, or electronic funds transfer).
- *Cost of operation.* The program needs to add accounts to become financially feasible. With 10,000 participants, administrative costs would equal 55% of revenues. However, with 4 million participants, these costs drop to 3.3%.
- *Fairness.* Two classes of in-state drivers may object to a VMT tax: 1) rural drivers, who are likely to do more off-road driving than their urban and suburban counterparts and 2) owners of hybrid or electric vehicles, who currently pay reduced or no fuel taxes. Nonresident drivers might also object to incurring a VMT tax. Whitty argued that at 1.5¢ per mile, the actual burden of the tax would not be large for the vast majority of drivers, even rural drivers and those driving hybrid or electric vehicles. Nonresident drivers would not be subject to the VMT tax but would still be subject to the fuel tax—at least until an 11-state consortium is able to implement a regional road usage charge system.

Once the program has been up and running a while, Oregon will make its institutional knowledge (including its technology, business standards, and private sector contacts) available to other states that are interested in setting up pilot VMT tax programs, said Whitty. Sharing this information should save other states time and money.

The use of P3s was the focus of the talk by Stephen Beitler (Chicago Infrastructure Trust, or CIT). Designed to attract private investment for public infrastructure projects, the CIT was started in 2013. It focuses on P3 projects in four areas: energy, transportation, development, and communications. Potential projects are identified through proposals generated by the trust on its own, proposals generated by the trust and a private party, and unsolicited proposals, which can be submitted by anyone. The trust then uses an open bid process to identify the private sector partner. Beitler said that projects worth an estimated $2 billion are currently in the trust's pipeline. The CIT's first project was an energy retrofit of city buildings, which will reduce energy consumption by at least 10%. The project will be financed through an energy service agreement[12] over the next 15 years; this type of infrastructure financing does not impact the city's overall credit capacity. A similar CIT project will retrofit the city's public pools, whose old mechanical systems consume a lot of energy.

To close, Beitler discussed some future CIT projects: developing and implementing a property assessed clean energy (PACE) scheme[13] for buildings used in the nonprofit, commercial, and industrial sectors; replacing Chicago's 400,000 outdoor lights with high-efficiency LEDs; providing 4G connectivity on the city's subway system; and building compressed natural gas fueling infrastructure throughout the city to encourage the use of vehicles that emit fewer greenhouse gases than those with petroleum engines and to lower fuel costs for some forms of mass transit.

Conclusion

Given reports of poor infrastructure quality throughout the nation, improving infrastructure will remain a front-burner policy issue. Developing new funding models and better evaluation systems will be critical to addressing future infrastructure needs.

[1] For details, see http://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm.

[2] See http://onlinepubs.trb.org/onlinepubs/sr/sr312.pdf. McGuire served as the chair of the TRB committee responsible for putting together this report.

[3] The output multiplier equals the change in GDP per dollar of added government spending (or tax cuts) during a specified period.

[4] Sylvain Leduc and Daniel Wilson, 2013, "Roads to prosperity or bridges to nowhere? Theory and evidence on the impact of public infrastructure investment," in *NBER Macroeconomics Annual 2012*, Daron Acemoglu, Jonathan Parker, and Michael Woodford (eds.), Chicago: University of Chicago Press, pp. 89–142.

[5] These bonds would be similar to Build America Bonds (BABs), but with a slightly lower federal subsidy, Gordon indicated. For more on BABs (which are no longer available for issuance), see www.treasury.gov/initiatives/recovery/Pages/babs.aspx.

[6] Typically, P3s are contracts between a public sector authority and private sector entity, whereby infrastructure or services traditionally delivered by government are provided by the private party, usually in return for (part of) a revenue stream. P3s allow governments to make capital investments without issuing debt or raising taxes to pay for them. For some P3 examples, see https://www.chicagofed.org/publications/chicago-fed-letter/2012/june-299a.

[7] For more details, see www.dot.gov/buildamerica.

[8] For the fund's status, see https://www.fhwa.dot.gov/highwaytrustfund/.

[9] See www.fhwa.dot.gov/infrastructure/gastax.cfm.

[10] For details on the dedicated funds drawn from, see www.epa.gov/oust/ltffacts.htm.

[11] For details on the legislation that made this possible, see http://online.wsj.com/articles/welcome-to-the-world-of-pension-smoothing-1407800119 (available by subscription).

[12] See www.docstoc.com/docs/170141074/Service-Agreement-Financing-Summary.

[13] For details on PACE (a new way to finance energy-efficient upgrades to buildings), see http://pacenow.org/about-pace/what-is-pace/.