So, Why Didn't the 2009 Recovery Act Improve the Nation's Highways and Bridges?

Bill Dupor

Although the American Recovery and Reinvestment Act of 2009 (the Recovery Act) provided nearly $28 billion to state governments for improving U.S. highways, the highway system saw no significant improvement. For example, relative to the years before the act, the number of structurally deficient or functionally obsolete bridges was nearly unchanged, the number of workers on highway and bridge construction did not significantly increase, and the annual value of construction put in place for public highways barely budged. The author shows that as states spent Recovery Act highway grants, many simultaneously slashed their own contributions to highway infrastructure, freeing up state dollars for other uses. Next, using a cross-sectional analysis of state highway spending, the author shows that a state's receipt of Recovery Act highway dollars had no statistically significant causal impact on that state's total highway spending. Thus, the amount of actual highway infrastructure investment following the act's passage was likely very similar to that under a no-stimulus counterfactual. (JEL E62, E65, H77, H54)

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There have been renewed calls in policy circles for the U.S. government to increase investment in transportation infrastructure. Proponents claim that the additional investment would raise U.S. productivity in the long run and also boost aggregate employment and output in the short run. Thankfully for the sake of empirical work, the United States has had recent experience with this kind of government intervention. Less than 10 years ago, there was a major add-on to federal highway spending through the 2009 American Recovery and Reinvestment Act (hereafter, the Recovery Act).[1] One component of the act provided $27.5 billion in funding through the Federal Highway Administration (FHWA), nearly the entirety of which was to be allocated to state governments through grants. This add-on represented a major increase in federal funding for highways. The Recovery Act grants equaled 76 percent of (pre-act) 2008 federal-aid highway dollars. They

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also equaled 44 percent of 2008 highway capital improvements made by states from all sources. Certainly there were great hopes for the potential of these new grants to create and save construction jobs as well as improve highways.

In this article, I first show that, despite the tremendous influx of federal funds, the highway system showed little improvement. For example, in 2008, 26.9 percent of the nation's bridges were classified as either structurally deficient or functionally obsolete. In 2011, this percentage was nearly unchanged at 25.4 percent. In the three years following passage of the Recovery Act, the number of workers on federal-aid highway projects changed only negligibly. Moreover, over 40 percent of the U.S. population lived in states where highway construction spending, from all sources, was lower in 2010 (post-passage) than in 2008 (pre-passage). Over the same time, many of these states increased spending on some non-transportation items.

Although the act specified that the highway funds be put to specific use, it is important to recognize that state governments were already spending significant amounts of their own dollars on highways—for example, $50.1 billion in 2008. Upon receipt of new federal funds, states could potentially cut their own contributions to highway capital spending which, in turn, would free up those funds for other uses. Since states were facing budget stress from declining tax revenues resulting from the recession, it stands to reason that states had the incentive to do so. I also explain how the language of the act made it possible for many state government officials to cut states' own spending on highways upon receipt of Recovery Act dollars. In fact, 15 states cut their total highway capital spending (i.e., from all sources) between 2008 and 2010, freeing up their own funds for other uses.

Second, I estimate the grants' effect on highway spending. That is, how much did the grants increase highway infrastructure investment relative to a no-stimulus baseline? I conduct statistical tests, which deliver results consistent with federal aid "crowding out" state spending. Specifically, I run cross-sectional, state-level regressions of per capita Recovery Act FHWA dollars on the post-enactment change in per capita highway infrastructure spending. If there is no crowding out—that is, fiscal substitution—then one would expect a one-for-one dollar increase in highway spending when a state received FHWA Recovery Act grants.

I do not find a one-for-one response. Instead, I find that there is no statistically significant effect of FHWA Recovery Act grants on state highway infrastructure spending. In my benchmark specification, a point estimate indicates that each Recovery Act FHWA grant dollar increased states' highway spending by 19 cents. This qualitative finding is robust to a large set of alternative specifications. Thus, the fiscal substitution hypothesis is able to explain why there was little impact on the nation's highways and bridges following the passage of the Recovery Act. Stated simply, highway infrastructure spending without the act would not have been very different relative to what was actually observed in absence of the act.[2]

My paper adds to two distinct lines of research. First, there is a literature on the effect of intergovernmental grants. Previous researchers have recognized, in theoretical models, the potential incentive for subnational governments to cut their own spending on particular projects upon receipt of new dollars from the national government. Early theoretical contributors include Bradford and Oates (1971). Empirical work that followed has found mixed results concerning fiscal substitution. Hines and Thaler (1995) survey the research and report that

most researchers observe that state grants for a particular purpose tend to be used by states for that purpose. In contrast, Lundqvist, Dahlberg, and Mörk (2014) study how intergovernmental grants impact local governments in Sweden. They find that the grants do not stimulate local public employment. Evans and Owens (2007) study whether federal grants to fund new police hires increased the size of local police forces or simply supplanted local funding. According to their findings, for every four officers payrolled by a grant, in an accounting sense, the force actually increased by slightly more than two officers.[3] The most similar study to mine is by Leduc and Wilson (forthcoming), who also examine Recovery Act FHWA grants.

Second, several studies have used cross-sectional approaches to estimate the effect of Recovery Act spending on economic activity. Some of these include Chodorow et al. (2012), Conley and Dupor (2013), Dupor and McCrory (2017), Dupor and Mehkari (2016), and Feyrer and Sacerdote (2012). Several of these papers find that the act's total spending had small effects on economic activity. My paper provides one potential, at least partial, explanation for that finding: States' use of highway grants to supplement other spending with little positive short-run economic benefits may have contributed to the low impact of the Recovery Act overall.[4]

THE HIGHWAY COMPONENT OF THE RECOVERY ACT

The Recovery Act was signed into law by President Obama on February 17, 2009. The original budget impact of the law was anticipated to be $787 billion. According to the most recent Congressional Budget Office estimates, that cost has increased to $840 billion. Next, Title XII of Division A of the act specified that $27.5 billion be allocated to "restoration, repair, construction and other eligible activities," where eligible activities are defined in a particular pre-existing U.S. code. The FHWA was charged with administering these funds, using guidelines laid out in the act.

Importantly, most of the act's FHWA dollars were allocated to states as grants.[5] These dollars were divided across states using pre-specified factors, including highway usage, the number of highway lane miles, and each state's previous contributions to the Federal Highway Fund. These formulas had been used to allocate previous highway funds and were determined several years before the act's passage.

Whereas typically federal-aid highway grants had required matching funds from the state governments, the drafters of the act intentionally did not require this. Although the Recovery Act grants were *notionally* intended for highway and bridge construction and improvement, states were capable of making the aid effectively fungible. As explained in the introduction, states could potentially cut their own contributions to highways when they received Recovery Act FHWA dollars.

Ohio provides one example of this fungibility at work. Ohio's largest spike in federally funded transportation capital expenditures following the act's passage occurred in its fiscal year (FY) 2011. Ohio's FY 2011 federally funded transportation capital expenditure was $218 million greater than in FY 2008, while its state funding for such was $153 million lower in FY 2011 than in FY 2008.

Table 1

Changes in State Dollars Per Capita Spending Between 2008 and 2010 Following Passage of the Recovery Act: Selected Categories and States

State	Highway infrastructure	Government administration	Government administration plus education
Georgia	–109	–9	82
Texas	–98	20	288
Maryland	–73	4	129
Kentucky	–45	0	147
Virginia	–44	9	5
Florida	–35	–16	–24
Indiana	–28	–18	559
Louisiana	–21	18	13
Alabama	–12	3	–20
Mississippi	–10	20	58
Ohio	–10	–38	131
Hawaii	–9	–58	–169
Illinois	–9	9	83
Colorado	–7	–4	236
Arkansas	–6	–13	129
Kansas	1	24	86

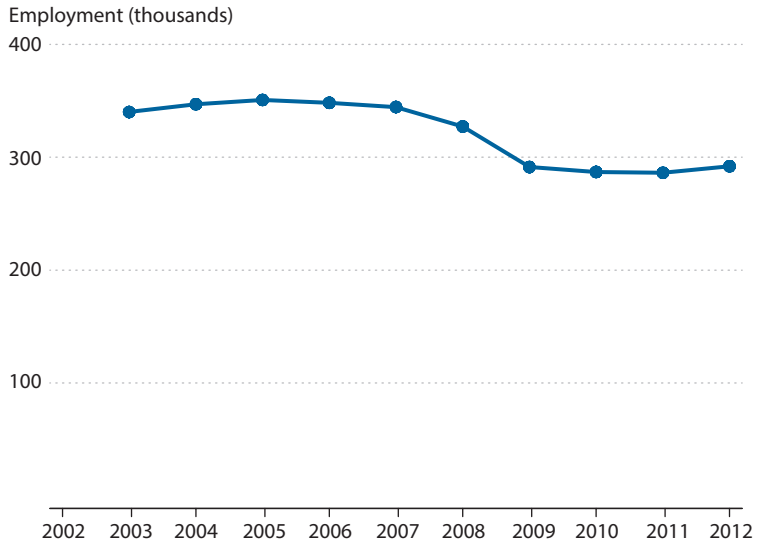
NOTE: Spending in each category reflects state government spending from all sources (i.e., own state and federal).

SOURCE: Author's calculations based on FHWA National Highway Statistics and U.S. Census Bureau Annual Survey of State and Local Governments data.

Not every state treated the act's FHWA dollars as fungible. In those states, the act's grants largely passed through to increased highway spending. Nonetheless, over 40 percent of the U.S. population lived in the 16 states that spent less (or basically the same), from all sources, on highway infrastructure following the act's passage. Column 1 of Table 1 reports for those 16 states the change in per capita highway capital spending between 2008 and 2010. For example, the state of Texas spent $98 less per capita in 2010 than it did in 2008. And this decrease was not part of an overall reduction in the size of its government. The final two columns present each state's change in spending in two other categories: government administration spending and government administration plus education spending. While Texas cut its highway capital spending during the period, it increased its spending on both of these other categories. A similar pattern is evident for many of the other states listed in the table.

Figure 1

Number of Highway, Bridge, and Street Construction Workers



SOURCE: U.S. Bureau of Labor Statistics Establishment Survey.

THE HIGHWAY SYSTEM BEFORE AND AFTER THE ACT'S PASSAGE

In this section, I begin by analyzing measures of both the physical inputs and outputs of public expenditures on highway infrastructure. Figure 1 plots the Bureau of Labor Statistics Establishment Survey's count of workers in the highway, bridge, and street construction industry between 2003 and 2012. Rather than increase upon passage of the act in 2009, this number shows a slight decline, from 327,000 in 2008 to 291,000 in 2009. In the three years that follow, the number of workers remains close to its 2009 level.

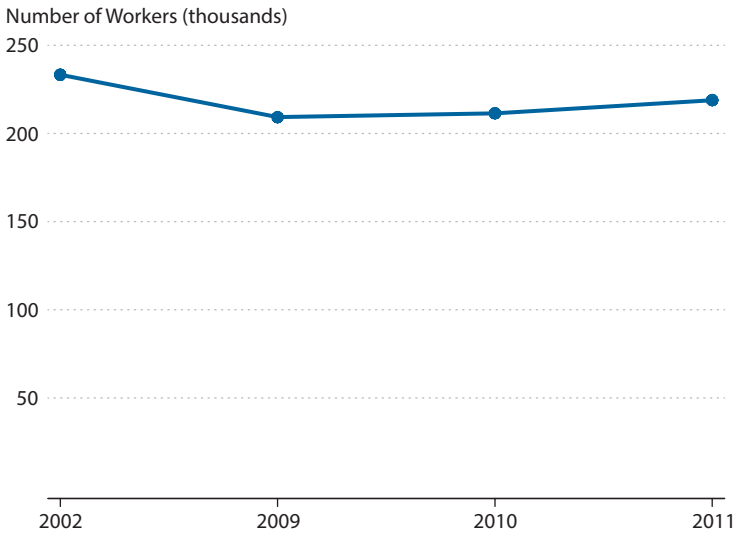
One possible explanation for the lack of a spike in the employment measure is that it includes street construction employment, which was not covered by Recovery Act highway grants. Had highway and bridge construction employment risen and there had been an off-setting decline in street construction employment, the combined amount would have been close to unchanged.

To address this possibility, I construct a more narrow measure of employment: the number of workers on federal-aid highway projects in the summer of each calendar year (Figure 2). These numbers are from the FHWA civil rights records, which I obtained through a Freedom of Information Request Act with the U.S. Department of Transportation. The number of workers declined in the year of passage relative to the previous year, which is followed by a 1 percent increase in 2010 and a 3.5 percent increase in 2011.

In addition to very small changes in the number of workers in this sector, there was also a very small change in the output of the sector, which I measure two ways. First, Figure 3 plots

Figure 2

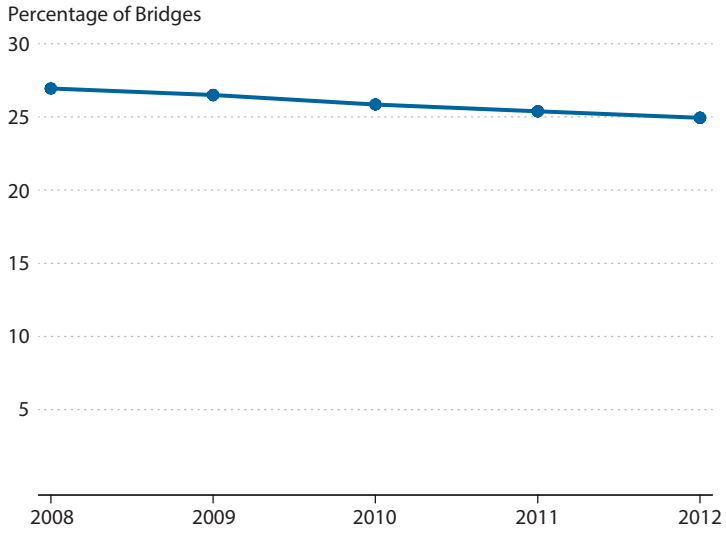
Number of Workers on Federal-Aid Highway Projects



SOURCE: Federal Highway Administration civil rights records. The data cover 47 states. Three states (along with U.S. territories) are not included because of data availability.

Figure 3

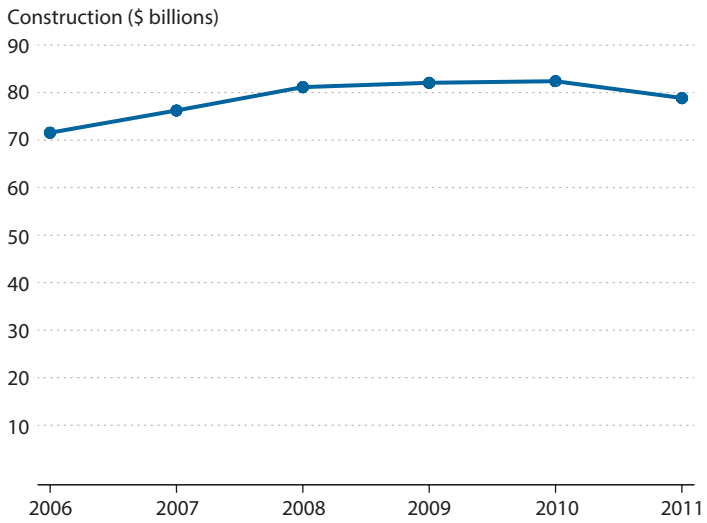
Percentage of Structurally Deficient and Functionally Obsolete Bridges



SOURCE: Federal Highway Administration.

Figure 4

Value of Construction Put in Place for Public Highways



NOTE: Current dollars.

SOURCE: Bureau of the Census.

the percentage of structurally deficient and functionally obsolete bridges in the United States between 2008 and 2012, as measured by the FHWA. It shows only a small decline over the period, despite the tremendous additional funds injected into the federal highway grant program via the Recovery Act.

Figure 4 plots the annual value of public construction put in place in highway and streets between 2006 and 2011, as reported by the Bureau of the Census. In the year prior to the act's passage, this value equaled $81.1 billion. In the two years after the act's passage, it equaled $82.1 billion and $82.4 billion. Thus, there was only a small increase in investment in the mode of transportation the FHWA Recovery grants were intended to support.

MAINTENANCE-OF-EFFORT REQUIREMENT

The act included built-in requirements that attempted to thwart the crowding out of state spending. For instance, a maintenance-of-effort requirement specified that by May 19, 2009, each state's governor needed to certify his or her state's intention to maintain that state's contribution to each transportation category (e.g., highways, mass transit, airports) as a condition on receiving funds for that state.[6] Governors were *not* required to maintain pre-act levels of spending. Instead, it was acceptable to promise to spend less than expenditures in recent years if the government could justify the reduction based on other fiscal considerations.

Recovery Act highway grants were not subject to state matching. The act states "the federal share payable on account of any project or activity carried out…shall be, at the option of

the recipient, up to 100 percent of the total cost thereof" (American Recovery and Reinvestment Act of 2009, H.R.1—93). This wording potentially generated a real problem if federal legislators wanted to ensure that federal highway dollars ended up actually being spent on highways. In Dupor (2013, p. 103), I observe that Representative Bill Shuster, from Pennsylvania, recognized the potential for crowding out during a congressional committee hearing on the development of the act. He states,

> In the legislation that I cannot find—and we have looked through—are there any teeth in there that say, for instance, a State spent $1 billion in maintenance last year, and now we are going to give them $1 billion more, what is to stop the Governor and the legislature who are having budget trouble from going in and saying, Okay, We are going to cut our transportation spending by $500 million and replace it with that from the Federal Government? Are there any teeth in there so we can stop that from happening? Because I think the idea is not to just have a shell game here.

At this point in the meeting, the committee chair then explained to Representative Shuster how the maintenance-of-effort requirement was intended to work. Representative Shuster, quoted in Dupor (2013 p. 103), replied,

> I have seen my Governor. He can dance pretty well, and I have seen him tap dance around issues. It would not surprise me to have the Governor of Pennsylvania slash the budget.

In contrast, a few Recovery Act components did contain strict rules to disincentivize such behavior from state governments. For example, Recovery Act grants administered by the U.S. Department of Education were provided conditional on a state's governor ensuring that the state would keep primary, secondary, and higher education support at least at its FY 2006 levels for the first three years following the act's passage.

ESTIMATING THE COUNTERFACTUAL

A Statistical Model

To assess the causal impact of these highway grants, I compare whether states that received relatively more Recovery Act highway aid engaged more intensely in highway capital improvements. I exploit exogenous variation in states' capacity to attract Recovery Act funds. Fortunately, there was substantial variation in per capita highway aid states received.

I estimate a linear model of state highway capital spending changes as a function of Recovery Act FHWA aid. My highway spending data come from Table SF-2 of the FHWA National Highway Statistics annual reports. Data for Illinois and Indiana were unavailable for one of the years. I use $Y_{t,j}$ to denote capital outlays (from all sources) by state j in fiscal year t.[7] My outcome variable is then the cumulative change in per capita highway capital spending in the two years following the base year of 2008:

$$Y_j^g = \frac{Y_{j,2010} + Y_{j,2009} - 2Y_{j,2008}}{P_j},$$

where P_j is the 2004 population in state j.

The regressor of interest is X_j, Recovery Act highway grant obligations through 2010 to state j scaled by population.[8]

I use least squares to estimate the model. One identifying assumption is that X_j is uncorrelated with the error term in the regression—a valid assumption here. Conley and Dupor (2013) explain that the act's highway dollars were allocated according to formulary rules determined years before the act's passage. Examples of criteria used in the FHWA appropriations formula include each state's share of total vehicle miles traveled on eligible highways and share of total eligible highway lane miles.

The key endogeneity concern is that the federal government might have given relatively more money to states with greater deterioration in their state budgets. In that case, the least-squares estimates might be biased downward relative to the true impact of the act. Given the specific, pre-act formula used to allocate the grants across states, the potential endogeneity is not a problem for my study.

The regression equation is

$$Y_j^g = \alpha X_j + \beta' Z_j + \varepsilon_j,$$

where ε_j is a random i.i.d. error term. Z_j is a vector of conditioning regressors. In the benchmark specification, these are a constant and the log of the state j population.

Conditioning on a measure of population is standard practice in existing cross-sectional studies of the impact of the Recovery Act. See, for example, Chodorow et al. (2012), Conley and Dupor (2013), and Dupor and McCrory (2017).

The coefficient α is the dollar increase in state highway spending for each additional Recovery Act highway grant dollar to the state, in per capita terms through 2010. A coefficient of 1 implies perfect pass-through of federal highway dollars to state spending. A coefficient of zero implies complete crowding out of state spending.

CROWDING OUT

Table 2 contains my benchmark finding. The coefficient on Recovery Act FHWA obligations equals 0.19 (0.43 standard error; Column 1). The point estimate implies that, in per capita terms, one additional grant dollar to a state causes 19 cents of additional highway infrastructure in that state. This represents substantial crowding out of state contributions to highways. For each grant dollar, the state government cuts its own contribution to highway infrastructure by 81 cents.

The log of population is an important predictor of state per capita highway spending. The coefficient is negative, so higher-population states experienced relatively less additional highway spending (per capita) in 2009 and 2010. Moreover, the coefficient is statistically different from zero at a 95 percent confidence level. While I include a population measure in the regression, in a related study, Leduc and Wilson (forthcoming) estimate a similar regression but do not include a population control. They find little evidence of crowding out, with their analogous coefficient greater than 1. The difference between my study and theirs is likely due the absence of a population control in their regression, although there are other differences across the two papers' specifications as well.

Table 2

Effect of Recovery Act Highway Grants on State Government Capital Highway Expenditures

	Obligations/ No Weight (1) Coefficient	Outlays/ No Weight (2) Coefficient	Obligations/ Weight (3) Coefficient	Outlays/ Weight (4) Coefficient
Outlays per capita	—	0.37 (0.39)	—	0.38 (0.40)
Obligations per capita	0.19 (0.43)	—	0.16 (0.45)	—
Log population	–57.36** (23.88)	–49.07** (23.21)	–57.71** (23.71)	–48.35** (23.10)
R^2	0.27	0.28	0.27	0.28
N	47	47	47	47

NOTE: ** $p < 0.05$. Standard errors are in parentheses.

Table 3

Effect of Recovery Act Highway Grants on State Government Capital Highway Expenditures, Alternative Specifications

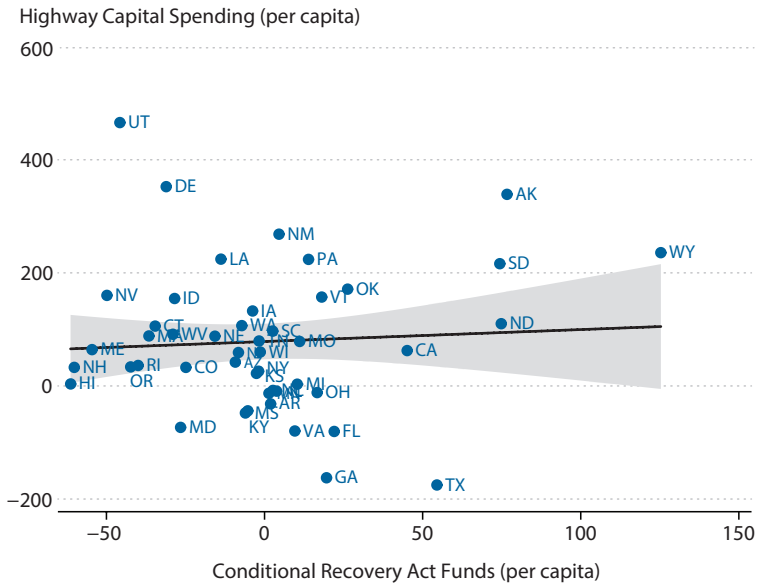
	Benchmark (1) Coefficient	Region FEs (2) Coefficient	Drop AK, HI (3) Coefficient	Drop ND,WY (4) Coefficient
Obligations per capita	0.19 (0.43)	0.09 (0.46)	–0.14 (0.46)	0.39 (0.56)
Log population	–57.36** (23.88)	–68.06** (28.17)	–68.11*** (24.51)	–54.96** (24.86)
R^2	0.27	0.46	0.25	0.26
N	47	47	45	45

NOTE: ** $p < 0.05$ and *** $p < 0.01$. Standard errors are in parentheses. FE; fiscal expenditure.

Column 2 of the table presents results when obligations are replaced with outlays. The results are qualitatively unchanged. There is no statistically significant effect of Recovery Act highway grants on the change in state highway spending; and, moreover, the coefficient on the population measure is negative and statistically different from zero. Columns 3 and 4 of the table provide identical specifications to those in the first two columns, except I weight the regression by the natural log of the population. Again, the results are qualitatively unchanged. Moreover, this estimate is not statistically different from zero. As such, I cannot reject the hypothesis of a *complete crowding out* of state highway spending by Recovery Act highway funds.[9]

Figure 5

Comparison of State-Level Highway Infrastructure Spending and Conditional Recovery Act Highway Grants



NOTE: The highway grant measure controls for the natural log of state population. The solid line is the best linear fit of the data, and the shaded area is the corresponding 90 percent confidence region.

Table 3 provides alternative specifications. Each specification uses obligations per capita as the independent variable of interest. These include adding eight region dummies and dropping two alternative pairs of states. I drop Alaska and Hawaii from one specification because they are not part of the contiguous United States. In another specification, I drop North Dakota and Wyoming because they saw major increases in tax revenues as a result of increases in oil prices and shale oil production over this period. None of these alternative specifications substantially affect my results.

Figure 5 represents the paper's main finding graphically. It contains a scatter plot where each point corresponds to a state, with the Recovery Act FHWA obligations per capita (after controlling for log population) on the horizontal axis and the accumulated per capita change in highway spending on the vertical axis. Note that there is little discernable positive or negative correlation in the data. If there were no crowding out (i.e., each grant dollar was spent on highways) and no other disturbances, then the points would lie on the 45-degree line. The solid line indicates the best linear fit of the data, with the slope equal to the coefficient α. The shaded region is the 90 percent confidence interval. Since the coefficient is not statistically different from zero, this region contains a flat response of grant obligations to highway infrastructure spending.

FINAL REMARKS: NOTHING NEW UNDER THE SUN

The combination of fungible grants and the incentives for state governments to shift funds implied that little of the Recovery Act's highway funds may have ended up being spent on highways. Actual highway infrastructure spending may have been very similar to that under a no-Recovery Act counterfactual. I established the result by discussing the language used in the act, reporting post-passage measures of highway infrastructure inputs and outputs, and conducting a cross-state comparison of states' behavior following the receipt of funds.

I conclude with a more general observation about the Recovery Act's highway component. Astonishingly, economists foresaw some of the problems with the Recovery Act decades ago. The potential for crowding out, as originally described in Bradford and Oates (1971), predicted what unfolded with the Recovery Act's highway infrastructure program.

Another example of this prescience is Friedman (1960). He remarked that one problem with fiscal and monetary policy is they suffer from "long and variable lags." As noted in Dupor (2013), two years after the act's passage, only 56 percent of the $48.1 billion in transportation dollars had been spent.

Finally, Gramlich (1978) discusses how federal aid to state and local governments could lead to increased savings by those governments. Thirty-four years later, Cogan and Taylor (2012) show that on aggregate, at least during the early phase of the Recovery Act, the combined state and local governments accumulated financial assets. ■

NOTES

[1] Grabell (2012) contains a useful, nontechnical introduction to the Recovery Act.

[2] This paper is part of a large project I have pursued on the Recovery Act over the past six years. For example, see Conley and Dupor (2013). The material here builds on that work. Note that the use of regressions to estimate the pass-through of the act's FHWA dollars to states' highway capital expenditures first appeared in Leduc and Wilson (forthcoming).

[3] See Knight (2002) for another example of crowding out of federal grants.

[4] Note that this paper does not address the economy-wide impact on employment or output of the federal highway grants. This is because, while states did not spend FHWA grants on highway construction, the grants did free up state dollars for other uses. Whether there was a substantial impact on activity in other sectors of the economy as a result of the freed-up state funds is beyond the scope of this paper.

[5] There were a small number of set-asides, such as $60 million for forest highways on federal lands.

[6] Maintenance-of-effort requirements applied to $101 billion of the act's grant, according to the U.S. General Accountability Office (2009).

[7] I do not transform nominal variables into real variables because my time interval only covers three years and this was an extremely low inflation period for the United States.

[8] These reports were provided weekly by the various federal agencies tasked with dispersing the act's funds. These reports had been published on the federal government's publicly available website Recovery.gov until the website was taken down after its funding ended. Many of the reports, including the one used in this study, have been archived on my website: billdupor.weebly.com.

[9] The standard error on the regression is sufficiently large that one can also not reject, at conventional confidence levels, only a small amount of crowding in.

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