Comments on "Are State Governments Roadblocks to Federal Stimulus? Evidence on the Flypaper Effect from Highway Grants in the 2009 Recovery Act"*

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1 Introduction

In a recent paper published in the *American Economic Journal: Economic Policy*, Leduc and Wilson (2017; hereafter, LW) investigate whether state governments increased their contributions to highway expenditures upon receipt of 2009 Recovery Act highway grants. This comment lays out deficiencies in their analysis with important implications for two of their conclusions. Through our analysis, we construct more accurate explanations for how highway grants influence state governments behavior and the private economy.

First, the authors claim that states dramatically increased their own contributions to highway spending in response to Recovery Act highway grants. They report that one dollar of these grants to a state led to a cumulative increase on highway spending of between $2 and $3 in that state. The authors take this as evidence to conclude "ARRA highway grants led to crowding-in of states own funding for highways."[1]

Second, they estimate the employment effect of the Recovery Act highway grants. LW report that "each $1 million of ARRA highway grants received by a state resulted in approximately 2 road construction jobs created or saved."

This comment shows that: (a) LW's first conclusion is incorrect because of a mistake in how the authors interpret their parameter estimates; (b) LW's second conclusion significantly *understates* the total government cost of road-job creation in the years following the Act's passage.

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[1] "ARRA" abbreviates the Act's full name: the American Recovery and Reinvestment Act.

With respect to (a), we show that while the Act increased state highway spending, this increase may have been due to federal monies—from both the Recovery Act and non-Recovery Act sources—rather than contributions of states' own funds.[2] We reach this conclusion by estimating the Recovery Act highway grants' effect on own-state highway spending. We show that one cannot reject substantial crowding out. For example, one dollar of additional Recovery Act appropriations *reduces* own-state contributions by 60 cents in the four years beginning in the enactment year, according to our benchmark point estimate. LW miss this effect because they do not decompose non-Recovery Act outlays into state and federal sources. As such, they do not disentangle the contributions of each.

With respect to (b), we show that the LW 'two jobs per million dollars' estimate does not reflect the government's overall cost of job creation/savings. First, the cost LW report is in 1997 dollars rather than year-of-enactment dollars (2009).[3] Second, LW do not account for the fact that each Recovery Act highway grant dollar is associated with more than one dollar of total government spending. Once these two adjustments are made, each one million dollars of government highway spending resulting from the Act created/saved only 0.76 road-construction jobs in the four years following the Act's passage.

2 Crowding-Out versus Crowding-In of Own-State Expenditures

LW consider two alternative dependent variables for highway spending: (i) cumulative changes over a four-year horizon, and (ii) year-to-year changes. We focus on their cumulative-change specification because it reflects their strongest evidence of crowding in. Also, it allows one to compute the total spending amount added over an interval of time generated by the Recovery Act. It is analogous to the "cumulative multiplier" concept from the fiscal multiplier literature.[4]

The econometric model is

$$\sum_{t=2009}^{T} \left(S_{i,t} - S_{i,2008}\right) = \beta^c G_i + \zeta_T' \left(\mathbf{X}_{i,T} - \mathbf{X}_{i,2008}\right) + \tilde{f}_T + \tilde{e}_{i,T}. \tag{1}$$

where $S_{i,t}$ is state i highway spending per capita in year t.[5] G_i denotes the per capita appropriations of Recovery Act highway grants to state i. $X_{i,t}$ are a set of controls, which are described in the LW paper. We focus exclusively on the case in which $T = 2012$.

[2] One could alternatively call this variable the state's "unreimbursed" spending.

[3] While LW calculate the job-creation cost in 1997 dollars, they refer to the total Recovery Act highway apportionments in 2009 dollars to estimate the Act's total employment effect.

[4] Ramey and Zubairy (2017) argue compellingly that the cumulative effect of a fiscal stimulus is more useful from a policy perspective than other (sometimes reported) statistics. Our choice of cumulative responses is in concurrence with LW, who write "we view the cumulative effect [...] as a better estimate of the flypaper effect as it accounts for delayed adjustment in state budgetary decisions, as well as possible spillovers of budgetary decisions in one year on budget-making in subsequent years."

[5] The expression in equation (1) reflects the specification in the Stata code provided by the authors on the American

To directly answer the question of how state governments adjusted their own spending in response to Recovery Act highway grants, we redefine the dependent variable in LW's specification. Let

$$\tilde{S}_{i,t} = S_{i,t} - (R_{i,t} + H_{i,t})$$

where $R_{i,t}$ is state i-year t Recovery Act highway outlays and $H_{i,t}$ is the federal non-Recovery Act analog. Then, $\tilde{S}_{i,t}$ is the own-state highway spending. If we use $\sum_{t=2009}^{T}\left(\tilde{S}_{i,t} - \tilde{S}_{i,2008}\right)$ as the dependent variable, then we isolate solely the change in a state's own contributions to highway expenditures.

In their least squares specification (where the dependent variable is the cumulative change in $S_{i,t}$), LW estimate a coefficient on G_i equal to 1.8. This is the effect of a one-dollar increase in Recovery Act highway apportionments on the accumulated change in state total highway spending. The first column of Table 1 decomposes this effect into three parts. The first row contains exactly their estimate. The dependent variable in the second row is the cumulative change in own-highway spending, a residual constructed by subtracting that of the last two rows out from total state highway spending. Hence, by construction, the least squares coefficient in the first row equals the sum of the coefficients in the remaining rows.

Table 1: Decomposition of the effect of Recovery Act highway apportionments into components, the cumulative-change response between 2009 and 2012 per dollar of apportionment

	OLS	IV/GMM	IV/LIML
	(1)	(2)	(3)
	Coef./SE	Coef./SE	Coef./SE
Change in Total State Spending (LW)	1.83***	2.36***	2.49***
	(0.55)	(0.77)	(0.86)
Change in Own-State Spending	-0.58	0.46	-0.28
	(0.80)	(0.84)	(1.08)
Change in Recovery Act Outlays	1.00***	1.02***	1.00***
	(0.02)	(0.02)	(0.03)
Change in non-Recovery Act Outlays	1.41***	1.74***	1.72***
	(0.45)	(0.42)	(0.46)

Notes: The SEs are robust with respect to heteroskedasticity. Each row reports the results of a separate regression with the same right-hand side variables. All of the controls present in LW's baseline specification are included, but not reported here. * $p < .1$, ** $p < .05$, *** $p < .01$.

Economic Association web site. In contrast, the published paper writes out a slightly different statistical model:

$$\sum_{t=2009}^{T}(S_{i,t} - S_{i,2008}) = \beta^c G_i + \zeta_T' \sum_{t=2009}^{T}(\mathbf{X}_{i,t} - \mathbf{X}_{i,2008}) + \tilde{f}_T + \tilde{e}_{i,T}.$$

The results do not seem to be sensitive to which version is used.

The second row of Table 1 directly measures the flypaper effect. The coefficient on G_i is the cumulative change in own-state highway spending in response to a one dollar increase in Recovery Act highway grants. A coefficient less than zero indicates crowding out and a coefficient greater than zero indicates crowding in. Thus, the coefficient of -0.58 (SE=0.80) in the second row of Table 1 implies crowding out: states reduced their own contributions to highway construction by 58 cents for each Recovery Act highway apportionment dollar. Note that this effect is imprecisely estimated and not statistically different from zero.

The third row of Table 1 shows a dollar-for-dollar response of Recovery Act highway outlays to the corresponding apportionments. Importantly, the last row implies that non-Recovery Act highway outlays responded significantly to the Recovery Act apportionments.

The final two columns report the highway spending response and separate its components for instrumental variables using both limited-information maximum likelihood (LIML) and generalized method of moments (GMM). In one case, the own-spending parameter estimate is negative and in the other it is positive. Most importantly, in both cases one cannot reject substantial crowding-out of Recovery Act grants.

The results in Table 1 overturn a major conclusion of LW's paper: that "both the OLS and 2SLS results strongly reject complete fungibility and instead indicate a very strong flypaper effect." Instead, the point estimates from two of the three specifications imply partial crowding out of own-state spending; moreover, the corresponding confidence intervals are sufficiently wide that one cannot reject extreme crowding out for each of the three specifications.[6]

In their paper, LW implicitly assume that increases in highway spending that were not due to Recovery Act dollars were due to own-state funding changes. Without conducting the decomposition of the kind in our Table 1, one cannot disentangle impact of the various components.

Note that LW do include a discussion of the Act's impact on non-Recovery Act federal highway grants. They conclude "there is no indication that the flypaper effect found for the ARRA highway grants arose because of a failure to account for a flypaper effect of non-ARRA grants." They reach this conclusion by looking at how the Recovery Act apportionment shock varied with contemporaneous non-Recovery Act federal apportionment changes. Their analysis does not consider whether Recovery Act apportionments caused future non-Recovery Act federal outlays to increase, which is at the crux of our findings.

The acceleration of non-Act federal highways outlays might have arisen if state officials worked to expedite the completion of ongoing or soon-to-be-started non-Recovery Act projects so that the new wave of Recovery Act projects could be undertaken. Recall that there were deadlines by which Recovery Act funds needed to be obligated and then spent. It may have been infeasible or undesirable to try to "set aside" ongoing, and less time sensitive, non-Recovery Act projects.

Table 2 demonstrates that our finding regarding crowding out of own-state funding is robust to

[6] Although one cannot reject crowding-in either, the point estimates and large standard errors reported in the second row of Table 1 are not indicative of a "very strong flypaper effect."

Table 2: Response of own-state highway spending to Recovery Act highway apportionments, alternative specifications

	OLS	IV/GMM	IV/LIML
	(1)	(2)	(3)
	Coef./SE	Coef./SE	Coef./SE
Lagged Dependent Variable	-0.621	-0.293	-0.658
	(0.750)	(0.781)	(0.853)
1998-2008 Highway Spending Trend	-0.830	-0.378	-0.831
	(0.813)	(0.795)	(0.878)
2003-07 House Price Appreciation	-0.659	-0.391	-0.829
	(0.814)	(0.808)	(0.922)
2002-05 House Price Appreciation	-0.581	-0.192	-0.668
	(0.823)	(0.833)	(0.942)
2008 Leading Indicators	-0.423	-0.189	-0.533
	(0.758)	(0.795)	(0.873)
2006-08 Leading Indicator Change	-0.545	-0.238	-0.700
	(0.828)	(0.861)	(0.950)
Political Party Controls Level	-0.781	-0.458	-0.800
	(0.887)	(0.892)	(0.938)
Drop Control Variables	1.323	1.852	0.696
	(1.235)	(1.203)	(1.485)
Include AK	-0.554	-0.324	-0.678
	(0.717)	(0.785)	(0.851)
Exclude Outliers (WY & ND)	0.367	0.937	0.890
	(0.662)	(0.761)	(0.795)
Congressional Power Instruments	-0.581	0.461	1.596
	(0.802)	(1.557)	(2.871)
STP Formula Simulated Instrument	-0.581	-0.526	-0.526
	(0.802)	(0.856)	(0.856)
Exclude State-to-Local Transfers	-0.947	-0.026	-1.049
	(0.978)	(1.089)	(1.229)

Notes: The SEs are robust with respect to heteroskedasticity. All of the controls present in LW's baseline specification are included, but not reported here. * $p < .1$, ** $p < .05$, *** $p < .01$.

many alternative specifications of the econometric model.

3 The Impact on Employment of the Act

LW also study the Act's impact on highway, bridge and construction employment. They report that a one million dollar increase in Recovery Act apportionments increased employment by roughly 2 persons from 2008 to 2010, resulting in a cost per job of approximately $500 thousand.[7] They calculate this estimate by estimating equation (1), where the dependent variable becomes the change in employment in the highway, bridge and construction industry.

There are two issues with their calculations. First, LW do not adjust for their finding that Recovery Act highway apportionments increased overall highway spending (from all sources) in the years following the Act's passage. As such, LW potentially *understate* the total government cost of road-job creation by a large amount. Second, LW report the cost of a job in 1997 dollars rather than converting the amount into 2009 dollars, the year of enactment.

Next, we make the appropriate adjustments to their calculations to reflect the full cost of job creation/savings. We use the cumulative-change specification described in (1) for reasons described earlier. First, we note that in their benchmark instrumental variables specification, one additional Recovery Act apportionment dollar generated $2.36 dollars of total spending (in 1997 dollars) in the first four years following enactment. Next, a $1 million (in 1997 dollars) increase in Recovery Act apportionments generates 2.4 jobs in the first four years of enactment.[8]

To derive the cost per job, we take the ratio of the spending response to the jobs response following a $1 million apportionment shock. This equals $980,000 ($\approx \$2.36M \div 2.4$). This means that jobs were created at a cost of $980,000 in 1997 dollars. The cost in 2009 dollars is $1.31M ($\approx \$980,000 \times 1.34$).[9] Thus, the two adjustments imply the cost of job creation/savings, in the highway, bridges and road construction industry, of Recovery Act-driven highway spending is $1.3 million per job or, alternatively, 0.76 jobs per million dollars spent.

4 Conclusion

Addressing the troubles with the LW study helps bring the cross-sectional highway evidence of crowding out into closer line with the results of several studies that examine crowding out using different approaches. Conley and Dupor (2013) explain how states had the legal capacity

[7] By one job, we mean more precisely one job-year, or a job lasting one year.

[8] To make both the spending and employment effects comparable, we re-estimate the employment effects specification from the authors' Appendix B as the cumulative increase in employment rather than the change in employment from 2008 to 2010. The coefficient on Recovery Act apportionments is 0.0024 (SE = 0.0054) when using 2SLS, if GMM is used instead, the coefficient becomes -0.0008 (SE = 0.0035). In either case, the employment effect is not statistically different from zero.

[9] The ratio of the average annual consumer price index in 2009 to that in 1997 equals 1.34.

to, and many proceeded to, cut their own contribution to highway capital spending upon the receipt of Recovery Act highway funds. Dupor (2013) documents how the potential problems with maintenance-of-effort requirements in generating crowding out were severe enough to be discussed in Congress during the debate over the legislation.

Using aggregate data, Cogan and Taylor (2012) and Inman (2010) find that state governments responded to additional federal grants, through the Recovery Act, by reducing borrowing, which implied that total state-government purchases changed very little. As Inman (2010) writes, "States are important agents for federal macro-policy, but agents with their own needs and objectives."

Our finding of a high cost of job creation (e.g., $1.3 million per road-job) point estimate, that in itself was not statistically different from zero, is consistent with evidence of either no or a weak effect on private employment from the Recovery Act found in Conley and Dupor (2013).

Finally, in this comment, we have not disputed LW's result that overall highway spending increased as a result of Recovery Act highway apportionments. That issue is beyond the scope of this paper. In ongoing research, we are studying whether the finding regarding overall spending is robust to changes in model specifications, such as the choice of control variables and the influence of outliers.

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