Inconsistent Funding and Infrastructure Costs*

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Abstract

States vary significantly in the consistency of their tax revenue streams from year to year and as a result also vary in the consistency of the resources they devote to infrastructure. Merging data on state revenues and outlays from 1977 to 2019 with data on highway infrastructure projects, we find that states with less consistent funding over those 43 years have fewer bidders per highway project, fewer highway engineers per capita working in the state's Department of Transportation, worse road quality, and higher resurfacing costs per mile of road in 2018 and 2019. Higher costs could thus in part come from reduced competition, deferred maintenance, and worse state capacity that result from less consistent infrastructure funding. We close with several directions we will pursue to move from correlations to better-identified relationships, partly with two new datasets we expect to become available shortly.

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1 Extended Abstract

The reasons behind the high cost of infrastructure projects in the United States have been a major source of inquiry. Researchers have highlighted the role played by interest groups, citizen voice, and a large number of veto points in decision-making (Brooks and Liscow, 2023); slow permitting and low state capacity (Liscow, 2025; Liscow et al., 2025); and contractor risk aversion and procurement auction design (Bolotnyy and Vasserman, 2023). Studies have also painted a picture of the construction sector as highly specialized, with relatively low levels of competition (Liscow et al., 2023), and of recent federal infrastructure spending packages as initiatives with costly backlogs (Balat, 2013) and limited economic stimulus (Garin, 2019; Ramey, 2020).

We build on the existing literature by examining whether variation in infrastructure spending — at the extreme a feast-or-famine model of financing — is a meaningful force behind the high cost of infrastructure. This is partly motivated by the more reliable funding that lower-cost projects abroad tend to have (Goldwyn et al., 2022). We find preliminary evidence that higher variability in state highway capital outlays is associated with higher resurfacing costs per mile of highway. The variability appears to reduce the number of bidders per project, perhaps by making it difficult for contractors to persist through low funding allocation periods; to reduce state capacity by reducing the number of state DOT employees; and to worsen the average road roughness or quality, perhaps due to deferred maintenance that makes eventual repairs costlier. We close by discussing further analyses we intend to pursue.

Our analyses utilize Census of Governments data on annual state-level revenues and expenditures, as well as data from prior work on the characteristics of state Departments of Transportation (DOTs) and 250 randomly selected highway resurfacing projects, 5 per state, started in each state in 2018 or 2019.

We focus on several state-level data series that are available from the Census of Governments from 1977 to 2019. These include:

- **Total Capital Outlays**: Capital outlays relating to the purchase or construction of all capital improvements.
- **Total Highway Capital Outlays**: A subset of capital outlays that are categorized with expenditure functions “Regular (non-toll) Highways” and “Toll Highways”.

We construct three different measures of volatility using these data series. These include:

- **Coefficient of Variation (CV)**: Standard deviation divided by the mean.
- **Mean YoY % Chg**: Mean of the absolute value of year-over-year percentage changes.
- **YoY % Chg SD**: Standard Deviation of year-over-year percentage changes.

Table 1 shows descriptive statistics for our key measures of revenue and outlays over the 43 years of our full sample period, 1977-2019. We use the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) to report all dollar amounts in 2019 USD. The table reveals considerable variation across states and time.

Table 1: Summary Statistics (State-year Government Revenue and Outlays over Full Sample)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Total Revenue	2,150	326,834.00	427,720.00	22,055.30	194,709.00	3,825,060.00
Total Capital Outlays	2,150	21,031.80	22,214.80	1,444.45	14,399.30	198,001.00
Total Highway Capital Outlays	2,150	11,744.00	12,126.90	140.99	8,110.71	149,276.00

Note: All values in thousands of real USD with base year of 2019. The sample runs from 1977 to 2019.

Table 2: Summary Statistics (Measures of Volatility over Full Sample)

Statistic	N	Mean	St. Dev.	Min	Median	Max
Total Revenue CV	50	0.35	0.06	0.24	0.34	0.51
Capital Outlays CV	50	0.30	0.09	0.14	0.30	0.55
Highway Capital Outlays CV	50	0.33	0.11	0.16	0.29	0.62
Total Revenue Mean YoY % Chg	50	9.30	3.28	5.40	8.29	23.48
Capital Outlays Mean YoY % Chg	50	12.64	2.50	7.84	12.82	18.53
Highway Capital Outlays Mean YoY % Chg	50	15.58	6.42	9.51	14.25	48.09
Total Revenue YoY % Chg SD	50	16.18	11.01	7.12	12.73	72.86
Capital Outlays YoY % Chg SD	50	16.94	4.69	10.64	16.57	33.94
Highway Capital Outlays YoY % Chg SD	50	24.41	25.56	12.36	17.77	180.80

Table 2 reports the same summary statistics for the three measures of volatility for each revenue and outlay series of interest. The table reveals significant variability. Across the 50 states, the average mean year-over-year percent change in total revenues is 9.3% and 15.6% in highway capital outlays.

How is this variability in revenues and outlays associated with infrastructure costs? We approach this question by bringing in project-level data used in Liscow et al. (2025). We work with a subsample of projects that were randomly selected according to the following criteria: 1) classified as "resurfacing," 2) started in 2018 or 2019, 3) project length between 1 and 20 miles, and 4) work done on a state or U.S. highway (non-interstate). 5 projects were selected per state, for a total sample of analysis of 250 projects. Table 3 reports summary statistics for these projects.

Table 3: Highway Resurfacing Projects: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Log Cost per Mile	250	−1.48	0.96	−4.87	1.65
Complex Dummy	251	0.06	0.24	0	1
State Highway Dummy	251	0.66	0.47	0	1
Mileage	250	15.17	13.26	1.00	87.64
Number of Bidders	226	3.27	1.48	1	9
Number of Change Orders	235	4.00	3.23	0.00	13.00
DOT Employment (per 1000)	242	0.93	0.63	0.25	3.29
% Consultant Use	250	57.92	20.88	17.50	95.00
Roughness Index	251	97.01	16.09	72.46	197.52

The outcome of interest is the project level log cost per mile. We use the same controls in our regressions here as the authors used in some of their specifications (Liscow et al., 2025). These include:

- **Complex**: Dummy for whether the project involves non-standard work in addition to road resurfacing.
- **Mileage**: Size of the project in lane-miles.
- **State Highway**: Dummy for whether the project is on a state highway, as opposed to a U.S. highway.
- **Pop. Change 1977-2019 (%)**: Percent change in population calculated from state-level FRED time series data.

Table 4 reports the results of regressions of project-level log cost per mile of highway road resurfacing in 2019 on controls and various different coefficients of variation (CVs). Standard errors are clustered at the state level and CVs are converted into z-scores, allowing us to interpret the reported coefficients as the increase in project cost associated with a one standard deviation increase in outlay variation. We find that a one standard deviation increase in capital outlays is associated with a 29.7% increase in highway road resurfacing costs per mile. The association is similar (26.1%) with highway capital outlays and is demonstrated visually in Figure 1.

Table 5 demonstrates robustness across our measures of volatility. Applying the same z-score standardization approach to a standard deviation of year-over-year percent changes measure of capital outlay and highway capital outlay volatility gives us associations of comparable magnitudes. A one standard deviation increase in capital outlay and highway capital outlay volatility is associated with a 12.2% (not statistically significant) and 18.9% increase in project costs, respectively. After controlling for project complexity, scale, and location, as well as state population growth, we find that states with more volatility in allocations to infrastructure funding appear to pay more for the same work.

Table 4: Outlay Volatility (1977-2019) and Project Costs (2019)

Dependent Variable:	Project-level Log Cost per Mile		
Model:	(1)	(2)	(3)
Variables			
Complex Dummy	1.027***	0.9032***	0.8764***
	(0.2701)	(0.2356)	(0.2556)
Mileage	-0.0232***	-0.0265***	-0.0259***
	(0.0060)	(0.0048)	(0.0049)
State Highway Dummy	-0.2335*	-0.2000	-0.2317*
	(0.1331)	(0.1263)	(0.1242)
Pop. Change 1977-2019 (%)		0.2498**	0.2703**
		(0.1047)	(0.1156)
Capital Outlays CV		0.2968***	
		(0.1010)	
Highway Capital Outlays CV			0.2609**
			(0.0977)
Fit statistics			
Observations	250	250	250
R^2	0.18047	0.31791	0.29748
Adjusted R^2	0.17048	0.30393	0.28308

Clustered (state) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Figure 1: Partial Regression Plot of Highway Capital Outlays CV and Project Costs

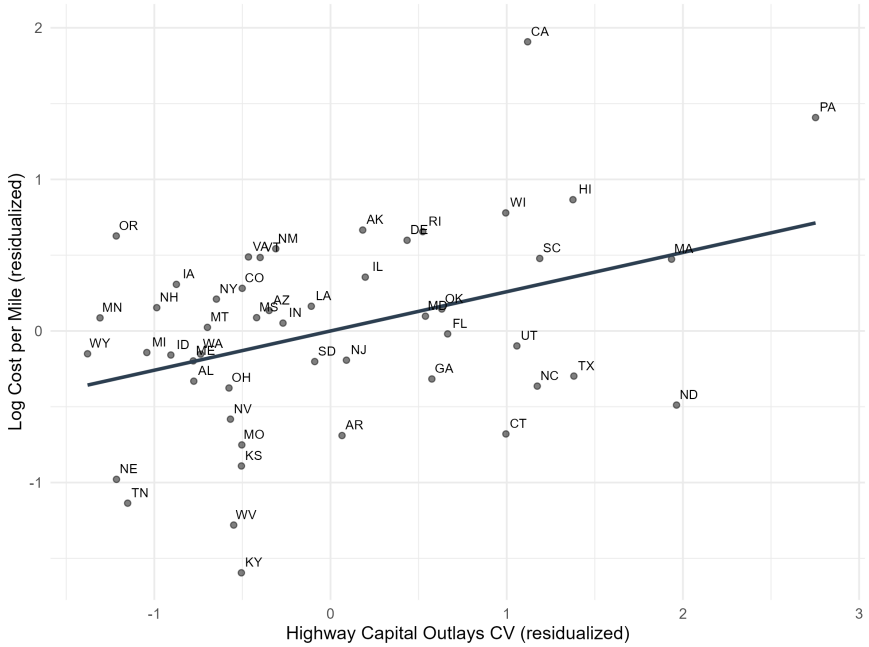


Table 5: Outlay Volatility (1977-2019) and Project Costs (2019), Robustness

Dependent Variable:	Project-level Log Cost per Mile		
Model:	(1)	(2)	(3)
Variables			
Complex Dummy	1.027***	0.9568***	0.9767***
	(0.2701)	(0.2017)	(0.2009)
Mileage	-0.0232***	-0.0259***	-0.0242***
	(0.0060)	(0.0057)	(0.0055)
State Highway Dummy	-0.2335*	-0.2128	-0.1443
	(0.1331)	(0.1314)	(0.1183)
Pop. Change 1977-2019 (%)		0.3058**	0.3411***
		(0.1344)	(0.1237)
Capital Outlays YoY % Chg SD		0.1218	
		(0.0907)	
Highway Capital Outlays YoY % Chg SD			0.1889***
			(0.0445)
Fit statistics			
Observations	250	250	250
R^2	0.18047	0.24349	0.26594
Adjusted R^2	0.17048	0.22799	0.25090

Clustered (state) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

What could be driving the association between funding variability and infrastructure costs? To shed light on this question we look at whether funding variability is also associated with factors addressed in prior work (Liscow et al., 2025). These include:

- **Number of Bidders**: Project-level number of bidders.
- **Number of Change Orders**: Number of changes made to the original project design.
- **DOT Employment**: Employment in the state Department of Transportation's Highway Department, per capita.
- **% Consultant Use**: Percent of highway projects where the state Department of Transportation used external consultants to draw up project plans.
- **Roughness Index**: The International Roughness Index measures the total amount of vertical motion that a vehicle's suspension experiences in a kilometer of travel. The higher the number, the worse the road quality.

Table 6 reports our findings. The regression specifications included controls for project complexity, mileage, a state highway dummy, log population density, log payroll, and, for models where road roughness is not the outcome, the roughness index. As in previous regression tables, the variation measure (here the standard deviation of year-over-year percentage changes) is standardized into a z-score for interpretability.

A one standard deviation increase in state-level highway capital outlay variability is associated with a statistically significant decrease of 0.7% in the number of contractors who bid on highway resurfacing projects, a decrease of 4.7% in the number of change orders, a decrease of 0.4% in the number of DOT Highway Department employees per capita, and a 11.9% increase in the roughness of the state's highways. We also find a not statistically significant but positive association between highway capital outlay variability and the usage of outside consultants.

Table 6: Highway Capital Outlay Volatility (1977-2019) and Project and DOT Characteristics (2019)

Dependent Variables:	# Bidders	# Change Orders	DOT Employment	% Consultant Use	Roughness Index
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
YoY Change SD	-0.0074**	-0.0470***	-0.0036**	0.0317	0.1186***
	(0.0031)	(0.0100)	(0.0018)	(0.0549)	(0.0337)
Fit statistics					
Observations	226	235	242	250	250
R^2	0.10374	0.41424	0.44907	0.25738	0.48515
Adjusted R^2	0.07069	0.39350	0.43015	0.23272	0.47025

Clustered (state) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Taken together, our analyses suggest that infrastructure funding variability might be leading to higher infrastructure costs through decreased competition in the procurement process, worse project designs and project management due to fewer engineers and project designers in-house, and deferred maintenance resulting in worse road conditions at the point at which repair is initiated. If the magnitudes of the associations we report above are to be taken seriously, the deferred maintenance channel would appear to be the most powerful of these channels.

2 Next Steps

The associations we document above are descriptive. Funding volatility is not randomly assigned: states with less consistent outlays may differ systematically in fiscal capacity, political institutions, geography, and construction market conditions, any of which could independently affect resurfacing costs. Moreover, our current outcome data (a cross-section of 250 projects from 2019) cannot support designs that exploit changes in fiscal institutions over time. Our next steps address both limitations by combining new sources of quasi-experimental variation in funding consistency with two much larger project-level datasets that we expect to be analysis-ready by fall 2026.

The first dataset, assembled by Cailin Slattery from FOIA requests to state Departments of Transportation, contains over 130,000 highway projects in almost all states, with expected and realized costs and timelines, bid-level records, and itemized bid tabulations that allow for like-for-like comparison of project scope across states. Coverage for most states spans roughly 2010–2025, and several states' records extend considerably further back in time. The second dataset, obtained by Zach Liscow via FOIA from the Federal Highway Administration's Financial Management Information System (FMIS), covers the universe of federal reimbursements to states for federally funded projects from the 1950s to the present — 3.85 million reimbursements comprising 1.2 million projects — with funding program codes, improvement types, locations, and timelines. Together, these data will replace a single-year cross-section with project-level cost panels spanning, respectively, one to three decades and seven decades, which will make the following research designs feasible.

First, we plan a shift-share design built on the composition of state tax bases. States differ persistently in their reliance on volatile revenue sources, as corporate and personal income taxes fluctuate far more over the business cycle than property or general sales taxes (Cornia and Nelson, 2010). Interacting each state's predetermined tax-base shares with national fluctuations in the corresponding bases yields a predicted revenue volatility measure that we can use as an instrument for realized volatility in capital outlays. With the panel of project costs, we can estimate whether within-state movements in predicted funding volatility raise infrastructure procurement costs.

Second, we plan to exploit changes in state budget institutions. Budget periodicity is correlated with expenditure volatility (Kim and Wang, 2015), and there is meaningful within-state variation: Arkansas moved to annual budgeting in 2010 — the first year of its project cost data — permitting an event-study comparison against similar states in the state panel, while earlier transitions, including Nebraska's 1972 and 1987 switches

and the nine states that adopted annual budgets in the 1970s (Snell, 2011), allow for comparisons using the FMIS data. Because formal budget periodicity often overstates the institutional difference, with several nominally biennial states running supplemental processes that render budgeting effectively annual, we will code treatment intensity carefully and, in our preferred specifications, use periodicity changes as first-stage shifters of outlay volatility. Tax and expenditure limitations offer similar sharp variation: for example, Colorado's 1992 TABOR amendment increased revenue volatility (St. Clair, 2012), and the FMIS panel, supplemented by the longest-running state panels, provides the pre-period needed for synthetic control comparisons of procurement outcomes around such adoptions.

Third, roughly 90 percent of federal-aid highway funds are apportioned by statutory formula, and these formulas have been revised across successive surface transportation reauthorizations and stimulus packages (such as the 2009 American Recovery and Reinvestment Act) (Kirk, 2019). Because FMIS records the funding program behind every reimbursement, we can measure each state's exposure to a given formula revision directly and treat these revisions as state-specific shocks to the level and predictability of highway funding. Importantly, a given positive spending shock should be more impactful in states that are more dependent on federal funds at the baseline, providing a testable prediction of the impact of these shocks.

Finally, we plan to use fiscal stabilization institutions to probe mechanisms. Rule-bound rainy day funds are associated with smoother expenditures (Wagner and Elder, 2005); if funding inconsistency raises costs through the channels we document (thinner bidder pools, depleted DOT capacity, and deferred maintenance) the volatility–cost relationship should attenuate in states whose stabilization rules insulate capital budgets from revenue shocks, a prediction we can test in the state panel where bidder-level outcomes are observed directly.

We expect both datasets to be available in fall 2026 and to have results from these designs, along with a full paper draft, ready by the conference in January 2027.

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