Determinants of State and Local Capital Investment*

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Abstract

The United States faces an infrastructure gap of nearly $3 trillion, with significant consequences for its economic competitiveness and public service provision. As state and local governments build and maintain the majority of the nation's infrastructure, understanding the factors that lead subnational governments to engage in capital spending is critical to supporting economic growth and standards of living. This paper explores a number of factors associated with state and local capital spending since 1977, including population demographics, federal stimulus, interest rates, political ideology, fiscal rules, and geography. In aggregate, spending has increased by 50 percent in real per-capita terms, though it has fallen as a share of total government spending. Federal assistance alone accounts for a large share of the variation in capital investment, while fiscal rules and political factors exhibit little explanatory power. These findings are consistent with a model in which capital investment is shaped primarily by cost pressures rather than economic returns or ideology.

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1 Introduction

Public capital plays a key role in long-run economic growth, standards of living, and international competitiveness. Various empirical studies in U.S. economic history have linked increases in productivity growth with key infrastructure investments, such as sanitation systems and clean water in the early 20th century (Gordon, 2017) and the inter-state highway system in the post-war period (Fernald, 1999). And yet, despite the importance of capital investment, the U.S. faces a significant gap between its current spending trajectory and projected needs. According to the American Society of Civil Engineers (ASCE), this gap will reach $5.6 trillion by 2039, leading to a loss of $10.3 trillion in GDP (ASCE, 2021). Moreover, large scale capital investment is especially critical for meeting climate-change mitigation and adaptation goals (IPCC, 2022).

Perhaps less well-appreciated is that, while the U.S. federal government provides a significant amount of support for infrastructure investment, state and local governments build and maintain the vast majority of public capital, owning 90 percent of non-defense public infrastructure assets (McNichol, 2019). This is for good reason, as local officials are often better positioned to identify investment needs and opportunities. Indeed, the ability of local officials to build infrastructure without federal involvement was a crucial part of the urban development of the late 19th and early 20th centuries (Sbragia, 1996; Schleicher, 2023; Wallis and Weingast, 2005).

Nevertheless, the drivers of state and local capital investment are not well-understood. Most studies that have investigated capital spending examine specific time periods (Fisher and Wassmer, 2015), specific types of subnational governments (Wang and Wu, 2018; Haraldsvik, Hopland and Kvamsdal, 2023; Holtz-Eakin and Rosen, 1993), or specific types of spending (Alm and Dronyk-Trosper, 2021). Moreover, the majority of these studies are narrowly focused on the causal impact of specific mechanisms, such as capital budgeting rules (Poterba, 1995). While a focus on causal identification is integral to the robustness of social science research, it can also limit the scope of inquiry and sideline more general attempts at theory-building. This paper, in contrast, takes a broad view of policymaking and investment in order to identify the key factors driving all forms of subnational capital investment over a span of decades.

This paper studies the evolution of state and local capital spending in the U.S. since 1977, when the Census of Governments first began collecting annual financial information on all large subnational governments. It begins by considering temporal variation in the aggregate time series and examines several factors that correlate strongly with the growth of capital spending over time. Then it moves on to look at factors that explain cross-sectional

differences across states. Finally, it considers the drivers of changes in state spending. In all cases, except where specified, the analysis aggregates state and local spending within each state so as to incorporate municipal investments.

The results are threefold. First, while capital outlays per capita have increased by 50 percent in real terms, they have decreased as a share of total government spending, from 11 percent to 8 percent. Population growth explains 90 percent of the variance in the aggregate level of capital spending, while federal assistance is the most significant driver of aggregate *per capita* spending. Second, cross-sectional differences are the main driver of variation in state panel data, with sparsely populated states such as Alaska and Wyoming spending significantly more than densely populated states. Finally, changes in capital spending are primarily driven by changes in per capita personal income. Neither fiscal rules nor political ideology play a significant role.

These results are consistent with a model of capital investment in which investment decisions are driven by cost-related factors and baseline service requirements but not by economic returns or ideology. Federal assistance drives much of the aggregate and cross-sectional variation, consistent with cost-factors playing a dominant role. Land area is also positively correlated with capital investment in the cross-section, suggesting that states with low population density may feel the need to maintain a basic level of public capital, despite higher fixed costs of infrastructure provision. The findings are also consistent with recent work in political economy examining the determinants of tax and spending patterns that also finds little role for politics or institutions (Mahdavi, Martinez-Alvarez and Ross, 2022).

At the broadest level, this paper contributes to the literature on the political economy of government tax and spending decisions. While much of this literature focuses on the developing world and specifically on the politics of taxation in developing countries (Okunogbe and Tourek, 2024; Besley and Persson, 2014; Hollenbach and Silva, 2019; Christensen and Garfias, 2021; Mahdavi, Martinez-Alvarez and Ross, 2022), a separate strand considers the determinants of fiscal decentralization and subnational capacity (Asatryan, Baskaran and Heinemann, 2017; Berry and Berry, 1992; Qiao, Ding and Liu, 2019). As capital spending frequently involves up-front costs that do not yield an immediate economic or political return, the paper is also related to work on short-term bias and the challenges of policy-making for the long-term (Jacobs, 2016; Jacobs and Matthews, 2012; Jacobs, 2011; Bonfiglioli and Gancia, 2013).

This work also contributes more specifically to the literature and debate around the infrastructure gap. Much of the recent work in this literature has focused on the rising cost of infrastructure and the need for procurement and permitting reform (Brooks and Liscow, 2023; Mehrotra, Turner and Uribe, 2024; Liscow, Nober and Slattery, 2023; Brooks and

Liscow, 2020). Recent studies also highlight how well-targeted policy tools can catalyze complementary private investment – affecting the overall scale of capital formation and therefore the size of the gap (Urpelainen and Yang, 2017; Li et al., 2022). A separate literature that abstracts away from the politics and implementation of infrastructure spending focuses on the productivity and welfare effects of specific urban infrastructure investments (Haughwout, 2002; Biasi, Lafortune and Schönholzer, 2024; Leduc and Wilson, 2013).

The paper proceeds as follows. Section 2 describes the sources of the data and provides summary statistics. Section 3 presents the analysis and consists of three subsections: section 3.1 examines temporal variation in the aggregate time series; section 3.2 examines variation in the cross-section of states, and section 3.3 examines changes in capital spending by state. Section 4 incorporates these findings into a theory of capital investment. Section 5 concludes.

2 Data

For data on capital spending, this paper draws on the Census' Bureau's Census of Governments and Annual Survey of State and Local Finances. The Census conducts a complete census every five years of the nation's state and local governments. In non-census years, it conducts a survey that samples governments with a probability proportional to their size, though all state and large local governments are sampled ever year. Thus, in non-census years, the aggregate financial totals that the Census reports in its summary tables are estimates, whereas in non-census years the aggregates are tabulated from the population of all governments. Among the financial variables that the Census collects is the total amount of capital outlays for each government-year.

The other major source of data on nationwide capital spending frequently used by researchers is the National Income and Product Accounts (NIPA) from the Bureau of Economic Analysis (BEA). However, the NIPA do not break out the data by region or level of government, making it less useful for studying cross-sectional variation. Nevertheless, as shown in Appendix Figure A1, the two data sources produce very similar estimates for the aggregate amount of state and local capital spending over time.

While capital spending is frequently used synonymously with "infrastructure" spending, the boundaries of these terms are not well-defined, and definitions vary across sources (Bennett et al., 2021). The Census data measures spending on "capital outlays". In one survey from 2023, the survey clarifies that capital outlays are "direct expenditures on construction and purchases of equipment, land, and existing structures." They include "productions, additions, replacements, or major structural alterations to buildings or other improvements"

as well as capital leases (Census, 2023). The BEA data include state and local spending on "fixed assets," which includes equipment, structures, and intellectual property products such as software and R&D. While capital is often defined to describe assets that have a useful life that extends beyond one year (GFOA, 2024), infrastructure frequently refers to long-lasting assets that are stationary in nature (GASB, 2023). For consistency, this paper will use the term "capital spending" or "capital investment".

In addition to Census data on capital spending, the analysis that follows draws on a variety of data from other sources. Appendix Table A1 provides a list of sources and summary statistics.

3 Analysis

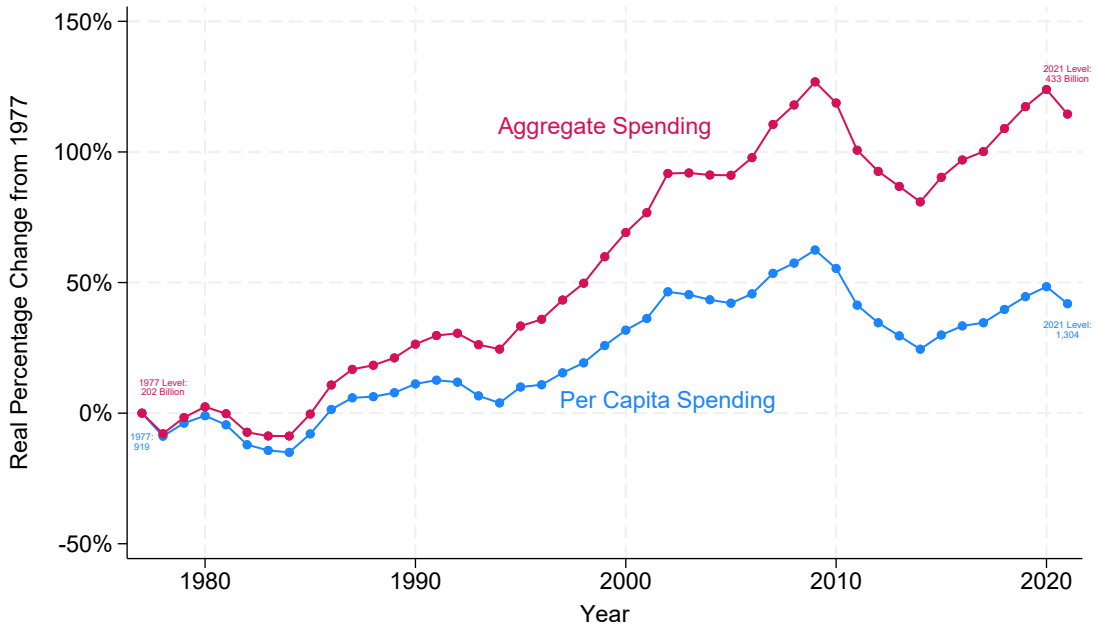
The analysis that follows aims to shed light on the factors most strongly associated with state and local capital spending rather than make strong claims about causality. It begins by documenting variation in the aggregate time series and in particular time-varying factors that can explain temporal variation in the time series. Next, the analysis shifts to studying cross-sectional variation across states, with the focus on *levels* of capital spending. Finally, the analysis shifts to a panel data perspective where the focus is on *changes* in capital spending within states over time.

3.1 Temporal Variation in Aggregate Time Series

Figure 1 displays an indexed plot of aggregate state and local capital spending in the United States between 1977-2021. In order to compare aggregate spending with per capita spending, the plot displays the cumulative percentage change in real terms from the baseline year (1977). Over the last 50 years subnational spending has increased dramatically in both real and per capita terms. Aggregate spending increased 125 percent in real terms, from approximately $200 billion in 1977 (2021 dollars) to $450 billion in 2021. Per capita spending increased from $920 in 1977 to $1,300 in 2021, a 40 percent increase. Growth rates in the two time series begin to diverge in the mid-1990s, with per capita outlays showing little consistent growth in real terms after 2000. Both series peak in the lead up to the 2010 financial crisis, only to fall off significantly in the following years as state and local governments cut back spending, before starting to increase again in 2015. While the increase in capital spending over this time period is dramatic, it is also reflective of broader increases in the state and local

sector as a whole. In fact, as a share of total state and local expenditures, capital spending actually declined, from 11.5 percent in 1977 to 8.5 percent in 2021 (Appendix Figure A2).

Figure 1: Percentage Change in Aggregate State and Local Capital Spending and Aggregate Spending Per Capita



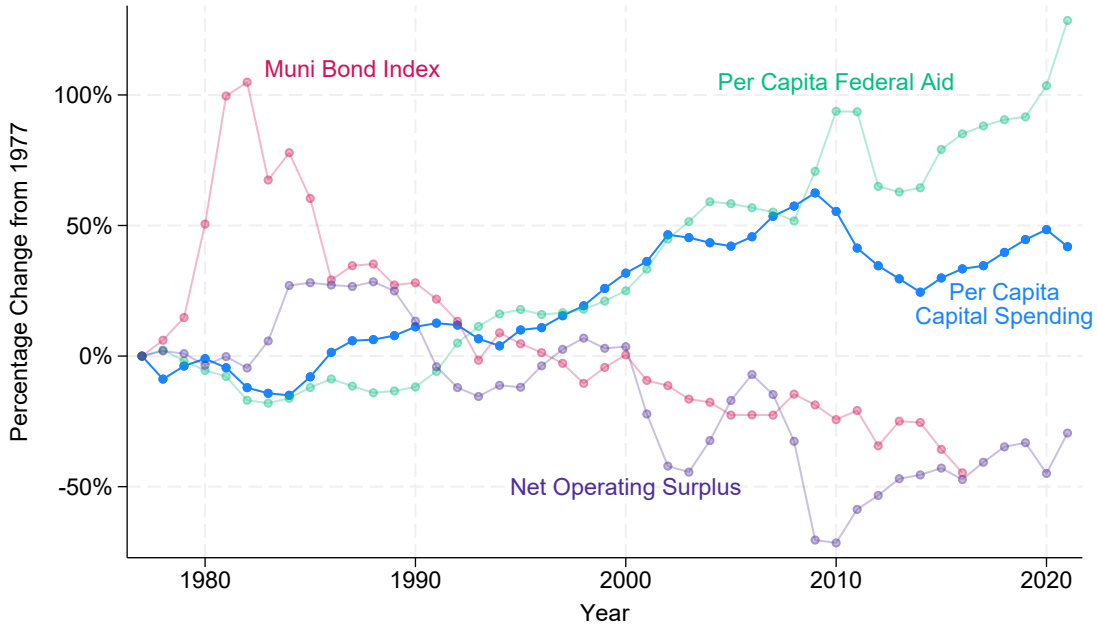
Note: The figure shows the real percentage change in aggregate state and local capital spending in the United States over time as well as the real percentage change in aggregate spending per capita. The marker labels indicate the aggregate levels of spending in the indicated years in billions of 2021 dollars and per capita 2021 dollars respectively. Data source: U.S. Census Bureau, Annual Survey of State and Local Government Finances and Census of Governments.

What explains this rise in spending? The obvious explanation for the rise in the absolute level of spending is population growth. However, the increase in per capita spending highlights the need to account for other factors beyond population. This section explores those factors, beginning with a series of bivariate comparisons before moving on to a regression framework. Figure 2 again shows an indexed plot of per capita spending, this time alongside several other factors that theory and empirics suggest have a role to play in determining aggregate investments: interest rates, federal assistance, and the fiscal health of state and local governments.

Because state and local governments face balanced budget restrictions, and because pay-as-you go financing requires current residents to pay for projects that they may not benefit from, approximately 90 percent of capital projects are debt financed (Marlowe, 2015). This

suggests that capital spending may be sensitive to interest rates, which will significantly impact project costs. Figure 2 measures interest rates using the Bond Buyer's Municipal Bond Index, a benchmark for interest rate trends in the municipal bond market reflecting the average yield to maturity for 20 year general obligation bonds.

Figure 2: Comparisons with Aggregate Capital Spending Per Capita



Note: This figure compares the real percentage change in aggregate per capita state and local capital spending since 1977 to changes in other variables over the same period, including 1) the Bond Buyer Muni Bond Index for 20 year general obligation bonds, 2) aggregate per capita federal assistance to state and local governments (excluding spending on health and hospitals), and 3) net operating surplus of the state and local sector as a share of total expenditures.

Starting in the early 1980s (per capita) capital spending and interest rates move in opposite directions, with the Muni Bond Index dropping between 1982 and 2016, while capital spending increased over the same time period. As interest rates fell, it became less expensive for governments to finance their capital projects, and consequently they increased their capital spending. Thus, the general pattern of the figure is consistent with capital investment being sensitive to the cost of debt. On the other hand, interest rates increased sharply in the late 1970s with no apparent effect on aggregate spending. Similarly, capital spending fell sharply during the financial crisis, whereas interest rates were relatively unchanged, suggesting that while investment in the long-term may have been affected by declining rates, over short time horizons changing rates appear to have little impact. This is consistent with previous research showing that the supply of municipal investment is relatively insensitive to small changes in rates (St. Clair, 2024).

Another factor that may have played a significant role is the level of federal assistance. Because of the role that infrastructure spending plays in fiscal policy - namely as a potentially productive source of economic stimulus (Ramey, 2020) - and because the federal government does not face a balanced budget constraint, the federal government has historically financed a large share of subnational spending. Although specific estimates are hard to come by for all forms of capital investment, approximately 30-40 percent of state and local spending on transportation and water infrastructure is financed by federal grants (Congressional Budget Office, 2015). Indeed, the potentially significant role that the federal government can play in stimulating subnational investment provides the rationale for much of the federal policy in this area, including tax policy aimed at subsidizing public capital investment (St. Clair, 2024).

In order to separate out the federal government's role in Medicaid funding, Figure 2 uses a measure of federal assistance that excludes assistance for health and hospitals.[1] The two time series are remarkably concordant through 2009, highlighting the very strong degree of correspondence between federal support and aggregate capital outlays. Only in 2010 and 2011 do the time series move in opposite directions, with capital investment declines in the wake of the Great Recession despite increasing federal assistance.

While state and local governments rely on federal assistance to finance a portion of their capital investments, they also provide a substantial amount of their own funds. As such, the amount of fiscal slack in the sector is another potentially important indicator of the level of capital investment; while the bond index captures the external cost of borrowing, it does not capture the availability of internal resources. To measure the ability of subnational government to self-finance investment, Figure 2 includes operating balance as a share of total expenditures, a metric employed by the GAO to assess the fiscal health of the sector over time (Government Accountability Office, 2019).[2] As expected, the figure highlights the declines in the fiscal health of state and local governments that occurred during the dot-com bust of the early 2000s and the Great Recession of 2009-2010. However, the figure also makes clear how these economic downturns had little effect on capital spending; capital spending actually rose during these periods, again affirming the importance of countercylical federal aid.[3]

[1] Because the Census does not provide estimates for individual categories of intergovernmental revenue in its summary tables, the level of health assistance was measured by aggregating from the government-level data and then adjusting these values in non-census years using ratios similar to those used by the Census in its estimates of aggregate federal assistance.

[2] Here operating balance is measured as the difference between current receipts (exclusive of federal grants) and current expenditures.

[3] An alternative metric of fiscal reserves, rainy day fund balances, also shows little correlation with aggregate capital investment (Figure A3).

Table 1: Aggregate Time Series

	Log Capital Spending					Per-Capita Capital Spending				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Population (Millions)	0.03***	0.03***	0.03***	0.03***	0.03***					
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)					
Population^2	-0.00***	-0.00***	-0.00***	-0.00**	-0.00**					
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)					
Unemployment Rate$_{t-1}$		-0.02**	-0.02***	-0.03***	-0.03***		-34.53***	-33.04***	-40.46***	-40.92***
		(0.01)	(0.00)	(0.00)	(0.01)		(9.27)	(10.62)	(8.82)	(8.69)
Log Federal Assistance			0.47***	0.51***	0.39***					
			(0.10)	(0.13)	(0.14)					
Muni Bond Index				0.01	0.01				13.18	12.49
				(0.01)	(0.01)				(10.26)	(10.63)
Operating Balance					-0.48					-731.51
					(0.38)					(531.00)
Per Capita Federal Assistance						0.34***	0.32***	0.29**	0.33***	0.21*
						(0.03)	(0.03)	(0.11)	(0.09)	(0.12)
Per Capita Personal Income								0.00	0.01	0.01*
								(0.01)	(0.01)	(0.01)
Observations	45	44	44	39	39	45	44	44	39	39
R^2	0.94	0.95	0.96	0.96	0.96	0.71	0.78	0.78	0.86	0.86
Adjusted R^2	0.93	0.94	0.96	0.95	0.95	0.70	0.77	0.77	0.84	0.84

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All fiscal variables in 2021 dollars.

To consider the relative importance of each of these factors in a multi-factor setting, I turn to a simple regression model. The analysis first considers determinants of (log) aggregate capital spending, then turns to focus on per capita spending. Unsurprisingly, the overwhelming determinant of capital spending is population growth, with population alone explaining 94 percent of the temporal variance in log aggregate capital spending between 1977 and 2021 (Table 1, column 1). While other variables, including the national unemployment rate and federal assistance, are statistically significant, their addition to a multivariate model increases the model's fit (as measured by R^2) only slightly. In contrast, the most important determinant of per capita spending is the level of federal assistance; in isolation, federal assistance explains 71 percent of the variance in per capita spending. This measure of model fit improves incrementally as the unemployment rate, per capita personal income, muni bond index, and operating balance are added to the model, however only the unemployment rate attains significance at the five percent level. Together, these results suggest that while population growth drives overall capital spending levels, variation in per capita spending is more closely tied to federal support and – to a lesser degree – macroeconomic conditions.

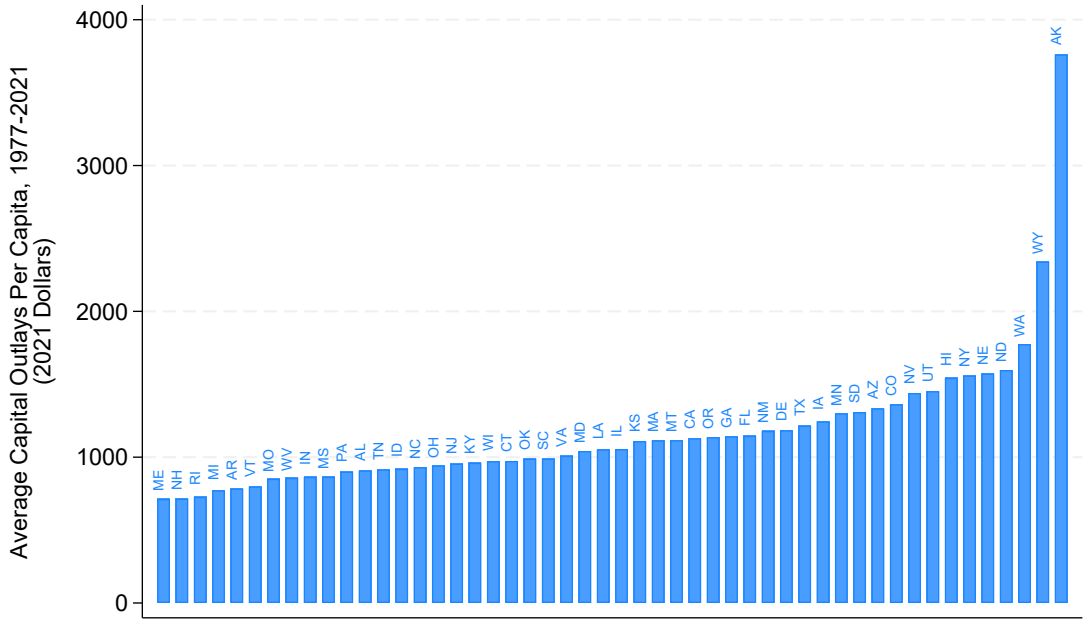
3.2 Levels of Capital Spending Across States

In this section, I turn from considering the drivers of capital spending in the aggregate to focusing on cross-sectional variation across states. That is, I attempt to explain differences in the average level of capital investment across states between 1977-2021. Figure 3 plots the average annual per capita spending of states over this time period. There is substantial variation, with certain northeastern states such as Maine and New Hampshire spending on average less than $1,000 per capita, and other sparsely populated states, such as Alaska and Wyoming, spending in excess of $2,000 per capita.

To account for this variation, I first examine several economic factors, including federal spending, per-capita income, credit-ratings, and the existing state of infrastructure. Surprisingly, despite federal spending being a major factor in aggregate per-capita spending over time, it explains little of the cross-sectional variation in a simple bivariate comparison (Figure A4). Fiscal health too is uncorrelated with variation in capital investment across states, when measured using either credit ratings (Figure A5) or rainy day fund balances (Figure A6), as is the existing state of infrastructure, as measured by the infrastructure grades received by states from the American Society of Civil Engineers (ASCE) (Figure A7). The one variable that does show a link is average per-capita income. Prior work has docu-

mented a strong link between investment and income, which is both a driver of demand for infrastructure as well as a consequence of infrastructure investments (Fisher and Wassmer, 2015; Cook and Munnell, 1990). Thus, it is not surprisingly that higher income states have invested more in public capital, though the relationship is only weakly positive, suggesting that this factor explains only a small proportion of the variance (Figure A8).

Figure 3: Per Capita Capital Spending Across States



Note: This figure plots average annual capital outlays per capita by state in 2021 dollars. Capital spending is measured as the combined total of state and local spending. The averages are calculated over 1977-2021 (excluding 2001 and 2003).

Figure 3 indicates that the states with the highest capital spending per capita are the sparsely populated states of Alaska and Wyoming, suggesting that geography may play a significant role. Indeed, an analysis of the relationship between per capita spending and per capita land area confirms the strength of this relationship (Figure A9). States with low population density such as Wyoming and North Dakota spend significantly more on a per-capita basis than denser states like Rhode Island and New Hampshire.

In addition to economics and geography, I also consider political explanations. However, a simple comparison of per-capita investment and ideology using Berry et al's (2010) updated state ideology series indicates that both liberal governments and state with liberal citizens spend *less* per capita (Figure A10). The variables are not highly correlated however, suggesting that political ideology has little explanatory power in this context. An addi-

tional factor that has been proposed to explain variation in capital investment is political institutions, such as debt limits or the existence of separate capital budgets. For example, Poterba (1995) finds that states with capital budgets, particularly those that allow for debt financing, spend more on public capital investment than other states. Fisher and Sullivan (2016) contend that attempts to constrain the level of debt explain the relatively low level of capital investment in New England. Nevertheless, simply binary associations show little support for the idea that fiscal institutions are particularly impactful (Figure A11). States with debt limits appear to spend *more* on average than states without, while states with capital budgets also spend slightly more, though these difference are minor. The difference between states with and without tax and expenditure limitations (TELs) is larger - with TEL states spending $110 less per capita on average – however this difference too is not significant. Although these simple binary associations are limited in their explanatory power, they suggest that fiscal institutions alone do not systematically predict variation in capital spending across states.

Columns 1-6 in Table 2 combine several of the above-referenced variables in a multivariate analysis. Because of the regional variation evident in Figure 3, the analysis begins with a baseline model regressing average per capita capital spending on a set of indicators for the nine census divisions (New England, Mid-Atlantic, etc.) (column 1). To this baseline model, I first add personal income per capita, follwed by the average unemployment rate, per capita federal assistance, per capita land area, and the government's average ideology across the sample period. In the fully loaded model (column 6), only personal income, federal assistance, and land area attain significance. The positive coefficient on personal income and the negative coefficient on the unemployment rate are consistent with a government's level of spending being correlated with the income of its citizens and the average performance of its economy. Similarly, the positive coefficient on land area in the fully-loaded model suggests that the strong relationship between capital spending and density cannot be explained solely by the small-state bias in federal spending (Clemens and Veuger, 2021).

When looking at the model fit, a large proportion of the variation in the outcome variable is explained by region of the country alone; indicators for a state's census division explain 38 percent of the variance in per capita spending (column 1). The model fit, as measured by R^2, increases to 50 percent with the addition of income and unemployment and improves again from 0.50 to 0.89 once federal assistance and land area are added. Taken together, these results suggest that geography and economic capacity are the primary drivers of cross-state variation in capital spending. In contrast, political ideology adds little explanatory power.

Table 2: Cross-Sectional and Panel Analysis

	Cross-Section of States						State Panel					
	Per-Capita Capital Spending						Per-Capita Capital Spending					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Per Capita Personal Income		0.04**	0.04**	0.04***	0.03***	0.03***			0.05***	0.05***	0.05***	0.05***
		(0.01)	(0.02)	(0.01)	(0.01)	(0.01)			(0.01)	(0.01)	(0.02)	(0.02)
Unemployment Rate			31.30	-30.74	-62.13**	-40.78				0.84	0.19	4.86
			(96.75)	(49.31)	(29.46)	(37.55)				(9.67)	(8.35)	(9.70)
Per Capita Federal Assistance				0.54***	0.23***	0.28***					-0.02	-0.00
				(0.15)	(0.07)	(0.07)					(0.08)	(0.08)
Land Area Per Capita					1.82***	1.55***						
					(0.26)	(0.38)						
Government Ideology						-6.94						-1.40
						(5.29)						(0.98)
Indicators for Census Division	Yes	Yes	Yes	Yes	Yes	Yes						
State Fixed Effects							Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects							No	Yes	Yes	Yes	Yes	Yes
Observations	50	50	50	50	50	50	2,150	2,150	2,150	2,150	2,150	1,950
R^2	0.38	0.50	0.50	0.78	0.89	0.90	0.69	0.76	0.80	0.80	0.80	0.81
Adjusted R^2	0.26	0.39	0.38	0.71	0.86	0.86	0.68	0.75	0.79	0.79	0.79	0.80

Note: *** p<0.01, ** p<0.05, * p<0.1. Columns 1-6 show the results of a cross-sectional analysis, with all variables averaged over the 1977-2021 period (excluding 2001 and 2003). Columns 7-12 show the results of a panel analysis, using all state-years 1977-2021 (excluding 2001 and 2003). The measure of federal assistance excludes assistance for health and hospitals. Robust standard errors in parentheses. In columns 7-12, standard errors are clustered by state.

3.3 Changes in Capital Spending

In this section I explore changes within states over time. While the vast majority of states spent more in 2021 than they did in 1977, it is also true that every state spent less on capital spending as a share of total spending (Figure A12). Thus, while state government expenditures grew over this time period, capital spending did not increase at the same rate. Moreover, comparing deviations from within-state and across-state means shows that most of the variation in state-year data is cross-sectional (Figure A13). Nevertheless, I consider the role that changes in economic and political factors play in shaping state capital investments over time.

Changes in per-capita personal income appear to correlate strongly with changes in per-capita investment, suggesting that income explains both cross-sectional and temporal variation in states (Figure A14). On the other hand, there is little relationship between changes in spending and changes in the unemployment rate (Figure A15), or between changes in capital spending and changes in credit ratings (Figure A16), at least over short time horizons. An analysis of changes in government ideology suggest that there may be a relationship between temporal variation in the two time series; while the cross-sectional analysis indicated that more liberal governments spend less on capital investments, governments that became more liberal over the sample period showed greater increases in their capital spending.

Columns 7-12 in Table 2 incorporate many of the above variables into a state-year panel. Columns 7-8 consider only the role of state and year fixed effects. Column 7 shows that state fixed effects alone can explain 69 percent of the variation in state per-capita capital spending. When year fixed effects are included, the R^2 rises to 76 percent. With personal income added to the model, the fit improves to 80 percent. Adding further variables for the unemployment rate, federal assstance, and government ideology has little effect on the model fit, improving the R^2 to 0.81.

4 Discussion

Several take-aways stand out from the data analysis. In the aggregate, the level of state and local capital spending is determined, first and foremost, by population demographics. Per capita spending, in contrast, is largely a function of federal assistance and economic conditions as proxied by the unemployment rate. When looking across states, land area also appears to play a significant role, as does per capita personal income. A panel data analysis shows that the majority of variation at the state-year level consists of cross-sectional differences, with only personal income attaining statistical significance once state and year fixed effects are included. Factors that impact the cost of financing, such as interest rates,

or government credit ratings, appear to play little role, as does the current condition of infrastructure, as proxied by ASCE grades.

Breaking out average capital spending by state (Figure 3) reveals several patterns, most notably that sparsely populated states in the Northwest, including Alaska, Wyoming, Washington, and North Dakota spend twice as much per capita as more densely populated northeastern states such as Maine, New Hampshire, and Rhode Island. Even after controlling for census division and federal assistance, land area appears to play a significant role in per capita spending, potentially indicative of the higher fixed costs faced by states with predominantly rural populations. If capital spending were primarily determined by the return on investments, then states with larger urban populations would likely see significantly higher per capita spending due to greater economies of scale. Instead, the opposite holds true, suggesting that states maintain a baseline level of capital spending, regardless of cost inefficiencies.

In contrast, political factors have little explanatory power. While this result may seem counterintuitive given the liberal preference for greater public investment, it's possible that the desire for greater government investment is counterbalanced by higher regulatory barriers in blue states.

4.1 A Theory of Capital Investment

In principle, an investment in public capital is worth pursuing if the economic (social) benefits exceed the costs. Thus, the decision to invest is a function of cost factors, such as the price of labor and materials, that impact the supply of capital, and benefit factors, such as taxpayer willingness to pay for reduced travel time, that reflect the demand for capital.

In the case of state and local governments, additional factors come into play. The ability to pursue projects with positive social returns is constrained by legal and institutional constraints, such as balanced budget requirements and debt limitations. Governments are frequently liquidity constrained, particularly during economic downturns, as a result of revenue volatility and expenditure rigidities. Of course, legislators are rarely motivated solely by economic returns on investment, and may be more focused on political and ideological concerns. However, as the evidence presented above finds little role for political variables, I set aside politics as a determining factor.

Some of the variables highlighted in the analysis above can be understood as primarily impacting the aggregate cost of capital investment - or alternatively, the ability to find financing – while others impact the benefits. For example, federal assistance clearly impacts

the cost function, as do interest rates. The unemployment rate is correlated with economic conditions, which in turn affect the amount of tax revenue that is available to finance projects in the short term. Personal income likely impacts both the ability to finance projects—jurisdictions with wealthier populations have a larger tax base and thus more tax revenue – as well as demand factors – wealthier citizens may have greater willingness to pay for public goods that they benefit from.

The regression models highlight federal assistance, the unemployment rate, land area, and personal income as factors that most significantly impact capital investment. In the aggregate as well as in the cross-section, federal assistance appears to explain the majority of the variation. Both federal assistance and the unemployment rate primarily impact investment through the availability of financing, suggesting that capital investment is determined, first and foremost, by the availability of resources and the ability to find financing. The benefits of capital spending – which impact the economic return on investment and reflect taxpayer demand – appear to play a lesser role. This finding is reinforced by two patterns: first, capital spending is not higher in states with poor infrastructure, where the benefits of investment would presumably be greatest; second, spending does not appear to vary with political ideology, even though demand for public investment is likely stronger in more liberal states.

A model that explains all of the patterns in the data however must also accomodate land area as a factor that explains a significant proportion of the cross-sectional variation. The fact that capital spending is highest among more sparsely populated states suggests that capital investment is not determined solely by per-unit costs, but also by the requirement to provide baseline levels of capital assets, such as schools, roads, and bridges, regardless of cost efficiencies.

One potential challenge to this simple model is that it does not explain why proxies for state fiscal health, such as credit ratings or rainy day fund balances, do not significantly impact investment. Although states with stronger ratings and larger reserves should, in principle, have greater fiscal capacity to invest, these measures may not capture resources that states actually view as available for capital spending. Rainy day funds are primarily intended to cushion states against downturns (Pew Charitable Trusts, 2014), and thus states may safeguard them to maintain essential services rather than finance capital investments. Likewise, credit ratings assess default risk, not a state's willingness to commit funds to new investment. Viewed through a precautionary saving lens, reserves and high credit ratings may serve primarily as tools for operating stability rather than sources of capital finance.

5 Conclusion

This paper explores the determinants of state and local capital investment since 1977, with a focus on population demographics, federal stimulus, interest rates, political ideology, fiscal rules, and geography. It examines variation in the aggregate time series, as well as variation in the cross-section of states and panel data. The descriptive and statistical results indicate that federal revenue in the form of intergovernmental assistance plays the primary role in impacting the level of capital investment. Other factors that appear significant in fully loaded cross-sectional and panel regressions include personal income per capita and land area. Political ideology, fiscal rules, and interest rates do not appear to play a significant role.

The findings are consistent with a model of capital investment whereby subnational capital spending is primarily determined by the availability of funding and the need to provide a baseline level of service. While the cost of debt does not appear to play a large role, states' ability to raise funds amidst balanced budget requirements and other institutional constraints is a major factor. In contrast, the benefits of infrastructure projects, which impact the economic return, do not appear to be a significant driver of investment, as evidenced by a lack of association between capital spending and the state of infrastructure.

What implications do these results carry for federal and state policy? First, they suggest that while state and local governments build and maintain the majority of public capital, the federal government's role in stimulating capital investment remains unmatched. However, rather than stimulating investment by lowering the cost of debt for subnational governments, direct fiscal assistance may be the most effective mechanism. For state and local governments, the findings highlight the importance of maintaining institutional capacity to effectively leverage federal support and implement investments when opportunities arise.

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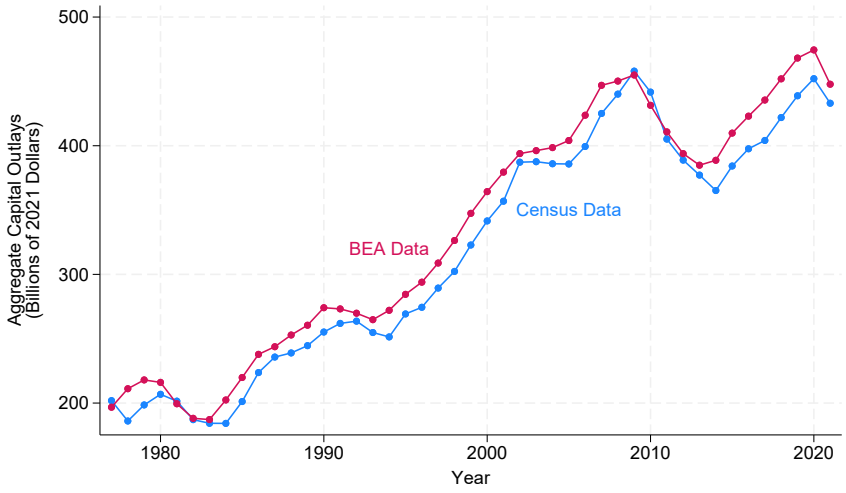
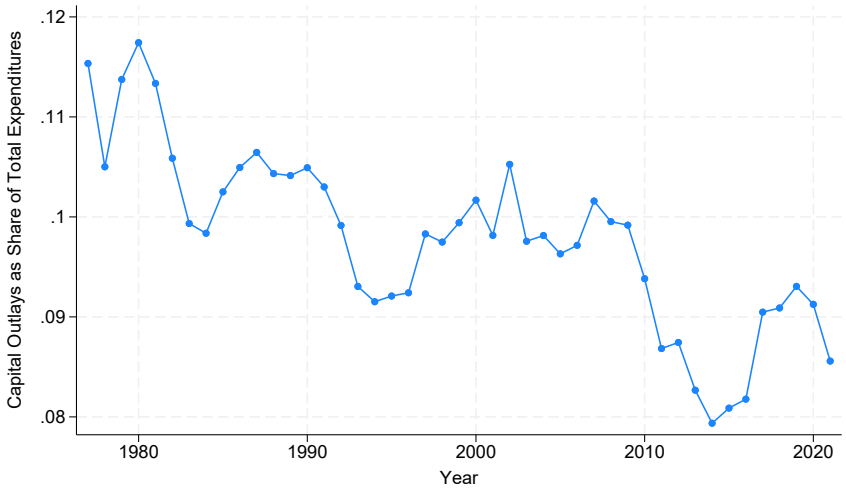
Online Appendices

Figure A1: Comparing Data Sources - Aggregate State and Local Capital Spending



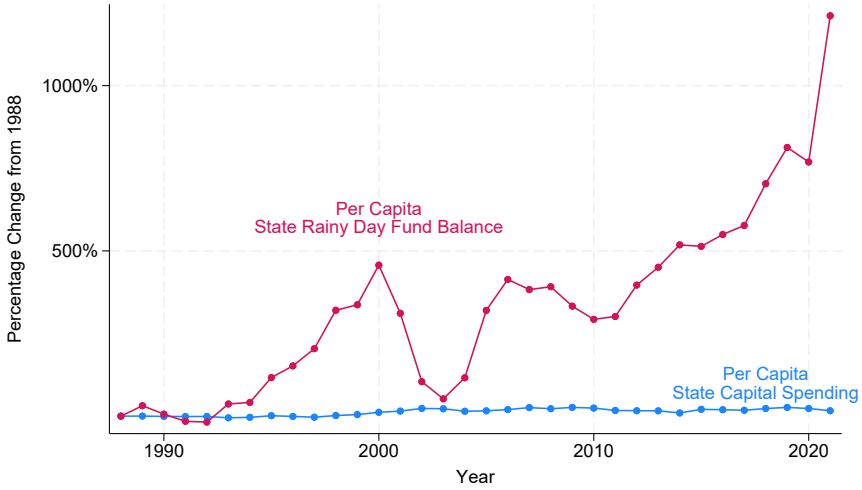
Note: This figure shows aggregate state and local capital spending in the United States as measured by the Census of Governments data (in blue) and BEA's National Income and Product Accounts (in red). Both measures are in billions of 2021 dollars.

Figure A2: Aggregate State and Local Capital Spending as Share of Total Expenditures



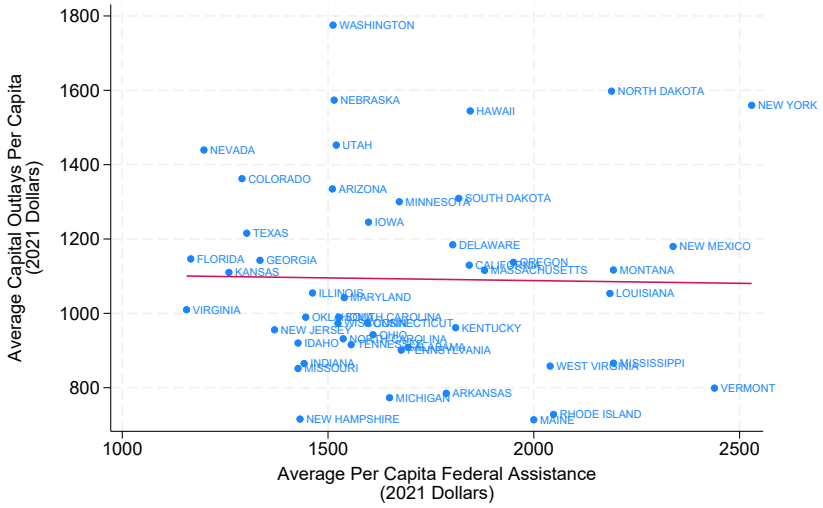
Note: This figure shows how the percentage of total state and local expenditures that are spent on capital outlays has changed over time. Data source: U.S. Census Bureau, Annual Survey of State and Local Government Finances and Census of Governments.

Figure A3: Capital Investment and Aggregate State Rainy Day Fund Balances



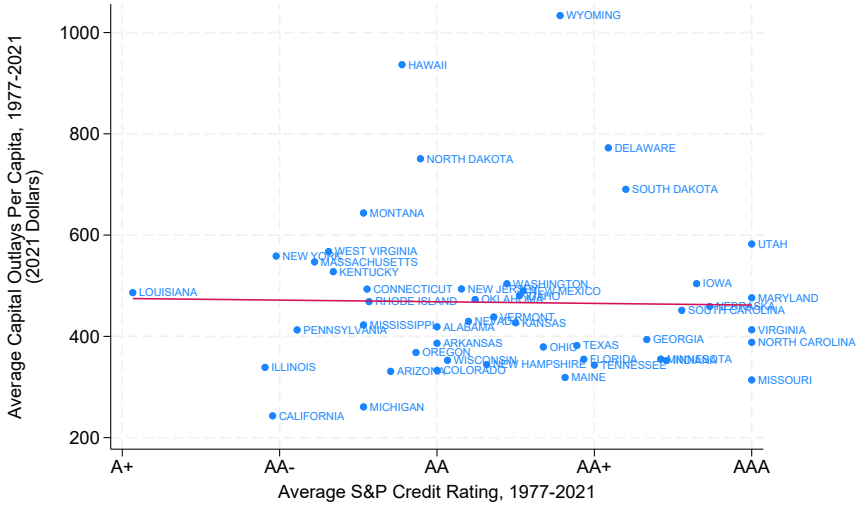
Note: This figure compares the real percentage change in aggregate per capita state capital investment since 1988 to the percentage change in per capita state rainy day fund balances over the same time period. Capital spending is measured in 2021 dollars and represents state-level spending only (rather than aggregated state and local spending).

Figure A4: State Capital Spending and Federal Assistance



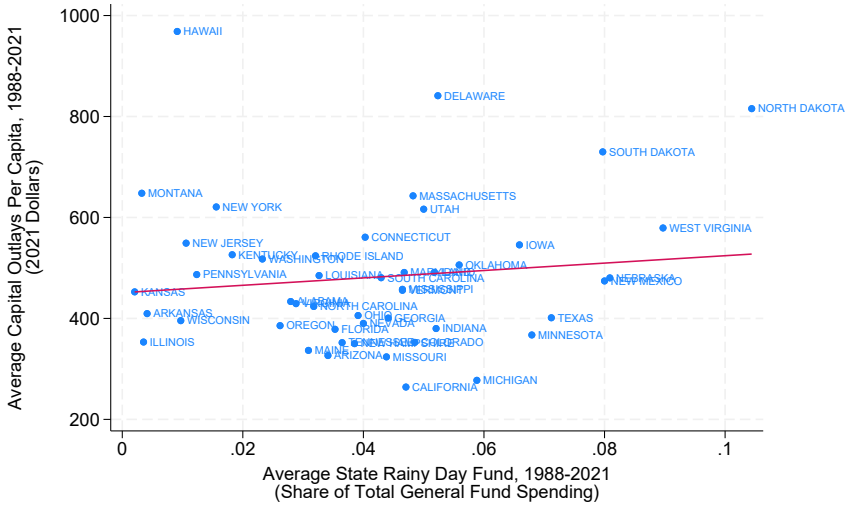
Note: This figure plots average capital outlays per capita by state against average per capita federal assistance. The measure of federal assistance excludes assistance for health and hospitals. Capital spending and federal assistance are measured as the combined total of state and local measures. The averages are calculated over 1977-2021 (excluding 2001 and 2003). The figure excludes Alaska and Wyoming.

Figure A5: Capital Spending and Credit Ratings



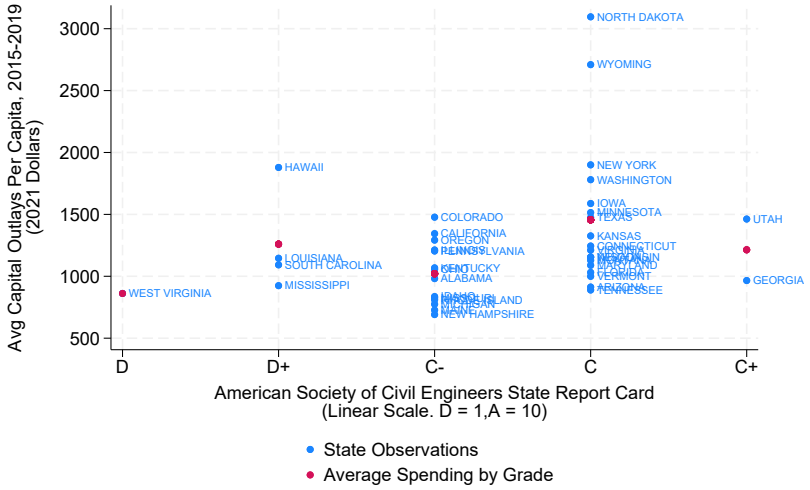
Note: This figure plots the average capital outlays per capita by state against the state's average credit rating from S&P. Both variables are averaged over 1977-2021 (excluding 2001 and 2003). Capital spending is measured in 2021 dollars and represent state-level spending only (rather than aggregated state and local spending). The figure excludes Alaska.

Figure A6: Capital Spending and State Rainy Day Fund Balances



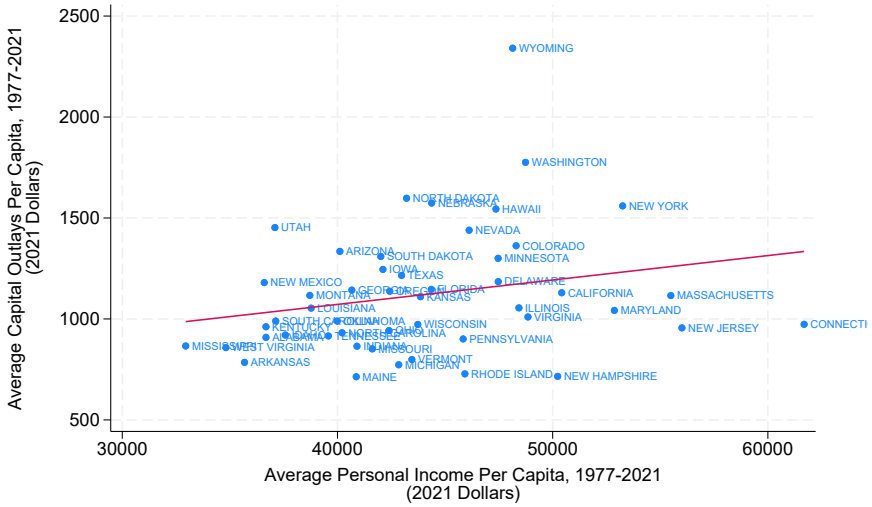
Note: This figure shows average capital spending per capita over the period 1988-2021 alongside the average state rainy day fund over the same period, expressed as a share of general fund expenditures. Capital spending is measured at the state level only (i.e. does not include local government aggregates). Capital spending data come from the Census of Governments. Rainy day fund balances come from NASBO.

Figure A7: State Capital Spending vs. Condition of Infrastructure



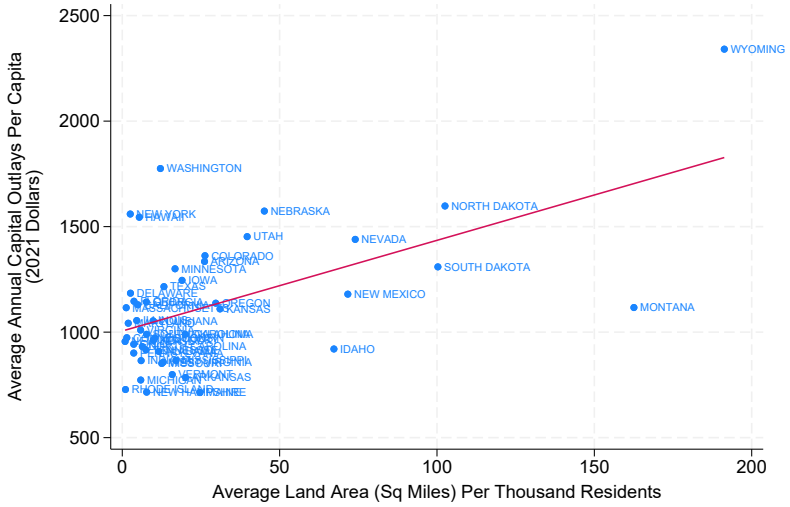
Note: This figure compares states' per capita spending with the grades awarded to them by the American Society of Civil Engineers (ASCE) for the condition of their infrastructure. Capital spending is measured as the total of state and local spending within each state. It is measured in 2021 dollars, and then averaged across 2015-2019. The ASCE awarded one grade to each state over the period 2017-2024.

Figure A8: State Capital Spending and Average Personal Income



Note: This figure plots average capital outlays per capita by state against average per capita income. Capital spending within each state is measured as the combined total of state and local spending. All spending is in terms of 2021 dollars, and averages are calculated over 1977 to 2021 (excluding 2001 and 2003). Data on personal income comes from the Bureau of Economic Analysis (BEA). The figure excludes Alaska.

Figure A9: Capital Spending and Land Area



Note: This figure plots the average capital outlays per capita by state against land mass per capita, measured in square miles per million residents. Capital spending is averaged over 1977-2021 (excluding 2001 and 2003) and is measured in 2021 dollars. The figure excludes Alaska.

Figure A10: State Capital Spending vs Political Ideology

Figure A10A: Government Ideology

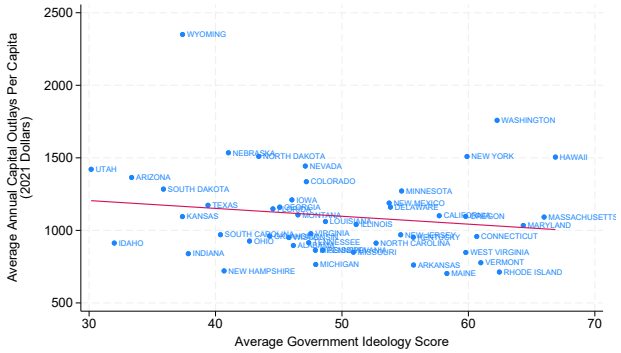
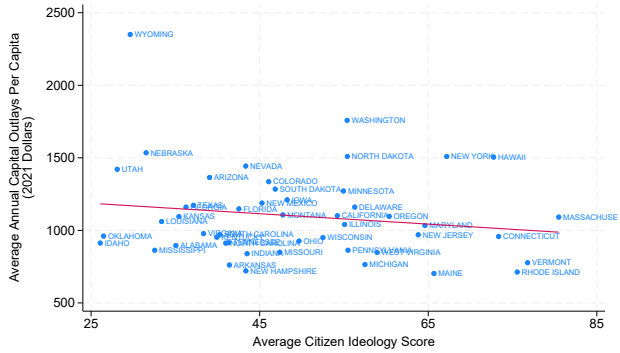


Figure A10B: Citizen Ideology



Note: This figure plots average annual per capita capital spending for all states against government ideology (Figure A) and citizen ideology scores (Figure B). Higher ideology scores represent more liberal governments/citizens. The ideology scores are based on Berry et. al's updated political ideology measures. All variables are averaged over 1977-2017 (excluding 2001 and 2003). Capital spending within each state is measured as the combined total of state and local spending. The figure excludes Alaska.

Figure A11: Capital Spending vs Fiscal Rules

Figure A11A: State Debt Limit Figure A11B: Separate Capital Budget

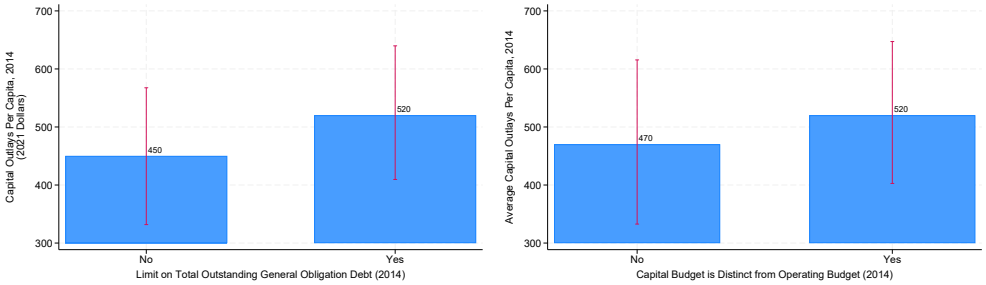
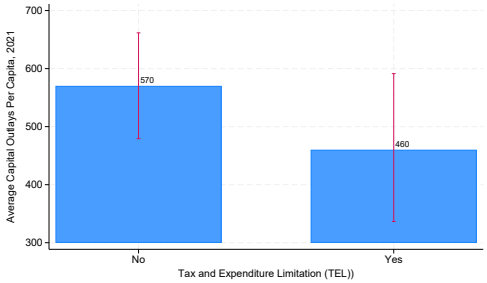


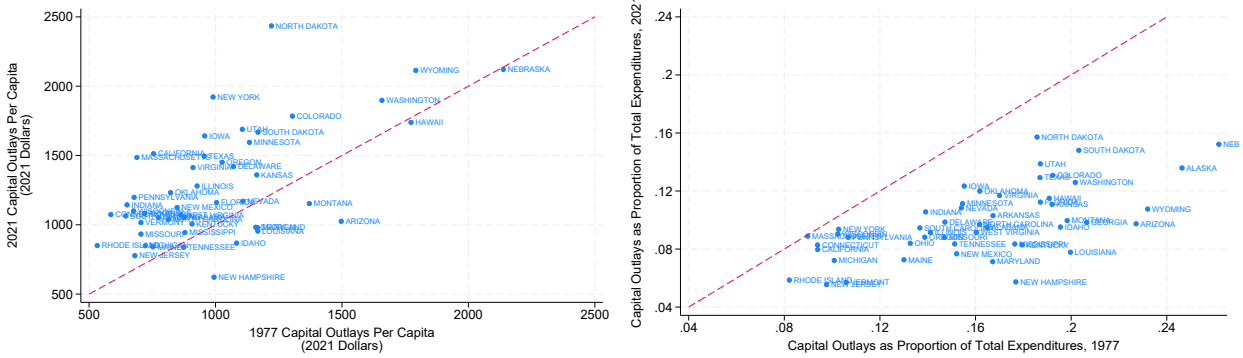
Figure A11C: Statewide Tax and Expenditure Limitation (TEL)



Note: Figure A compares per-capita capital spending in 2014 in states with and without a limit on the total amount of outstanding general obligation debt. Figure B compares per-capita capita spending in 2014 among states that do and do not produce a capital budget that is distinct from the operating budget. Figure C compares per-capita capita spending in 2014 among states with and without a statewide tax and expenditure limitation (TEL). In all three figures capital spending is based only on state-level spending (i.e. does not include local spending). Data on referenda requirements and capital budgeting procedures come from NASBO (2014). Data on TELs come from NASBO (2021).

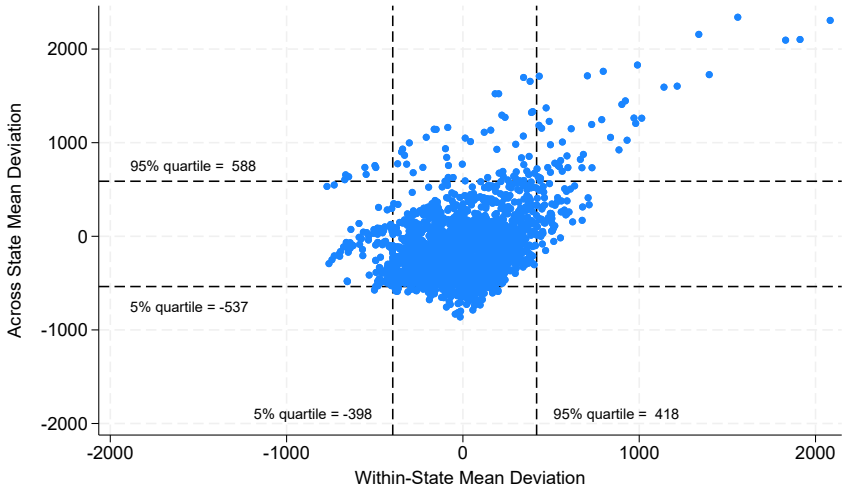
Figure A12: Capital Spending by State in 1977 and 2021

Figure A12A: Per Capita Spending Figure A12B: As Share of Total



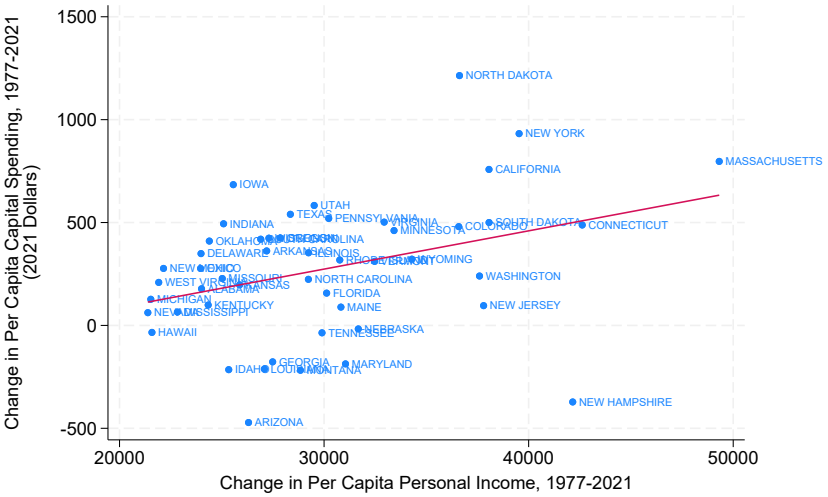
Note: This figure compares the total amount of capital spending in each state in 1977 and 2021. Figure A looks at per capita spending (in 2021 dollars). Figure B looks as capital spending as a share of total expenditures. Capital spending and total expenditures are measured as the combined total of state and local spending. Figure A excludes Alaska.

Figure A13: Deviation From Within-State Vs. Across-State Averages



Note: Each point in the graph represents the difference between a state's annual per capita capital spending and the overall state mean (x-axis) and the overall year mean (y-axis). The figure excludes Alaska.

Figure A14: Change in Per Capita Capital Spending vs Per Capita Income

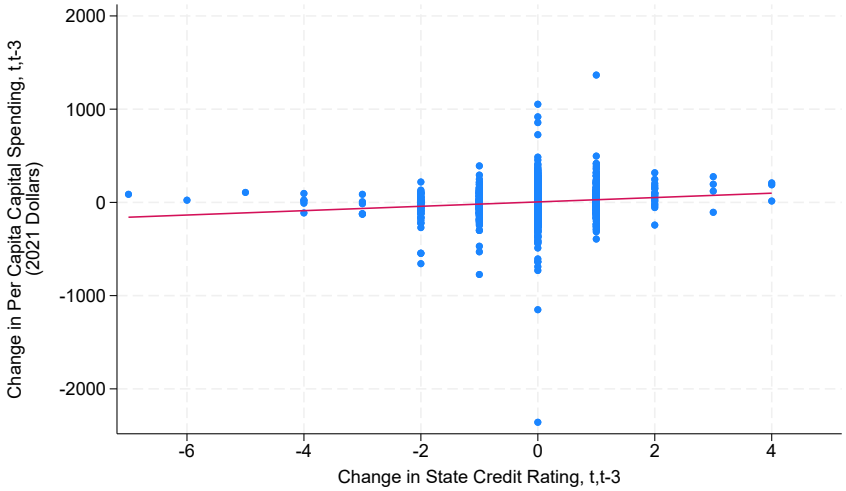


Note: This figure compares the change in per capita capital spending between 1977 and 2021 in each state with the change in per capita income over the same time period. Capital spending is measured as the combined total of state and local spending within each state in 2021 dollars. The figure excludes Alaska.

Figure A15: Change in Capital Spending vs Change in Unemployment Rate

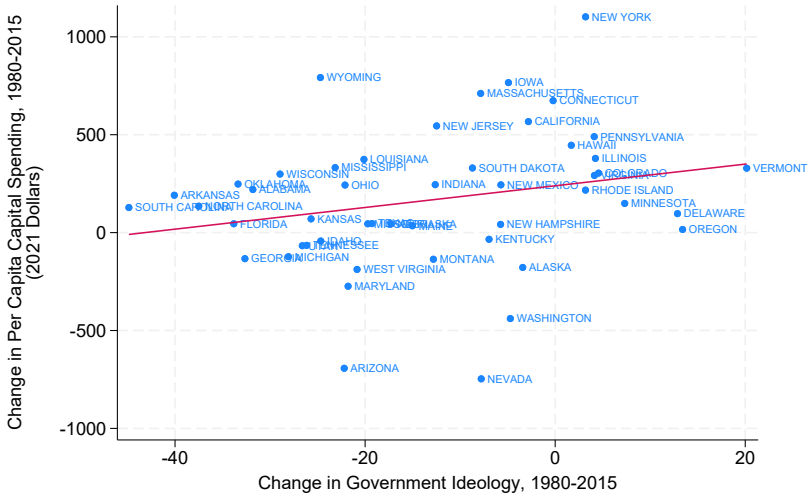
Note: Each point in the figure represents the change in a state's per capita capital spending from year t-3 to year t (y-axis) and the change in a state's unemployment rate over the same period (x-axis). Capital spending is measured as the combined total of state and local spending within each state in 2021 dollars. The figure excludes Alaska.

Figure A16: Change in Capital Spending vs Change in Credit Rating



Note: Each point in the figure represents the change in a state's per capita capital spending from year t-3 to year t (y-axis) and the change in a state's credit rating from S&P (measured on a linear scale) over the same period (x-axis). Capital spending is measured only at the state level and does not include local spending. A one point increase in credit rating corresponds to a one unit improvement in rating, eg. from AA+ to AAA.

Figure A17: Change in Capital Spending vs Change in Government Ideology



Note: This figure compares the change in per capita capital spending between 1980 and 2015 in each state with the change in government ideology over the same time period. Capital spending is measured as the combined total of state and local spending within each state in 2021 dollars. Positive changes in ideology scores represent a change in a more liberal direction. The ideology scores are based on Berry et. al's (2010) updated political ideology measures. The figure excludes North Dakota.

Table A1: Data Sources and Summary Statistics

Variable	Source	Summary Level	Mean	SD	Min	Max
Capital Outlays (Billions of 2021 Dollars)	Census of Governments	Aggregate Annual	323	92	184	458
Capital Outlays Per Capita (2021 Dollars)	Census of Governments	Aggregate Annual	1,124	201	781	1,493
Bond Buyer Muni Bond Index	Federal Reserve Bank of St.Louis	Annual	6	2	3	12
Federal Assistance Per Capita (Excluding Health and Hospitals) (2021 Dollars)	Census of Governments	Aggregate Annual	1,652	505	1,010	2,816
State and Local Operating Balance as Share of Expenditures	Bureau of Economic Analysis	Aggregate Annual	-0.22	0.05	-0.33	-0.14
State Credit Ratings	S&P Global	State Annual	8	1	1	10
Population (Millions)	Census	National Annual	277	36	220	332
Unemployment Rate	Bureau of Labor Statistics	National Annual	6	2	4	10
Personal Income Per Capita (Thousands of 2021 Dollars)	Bureau of Economic Analysis	National Annual	46	8	33	64
Land Area Per Capita (Square Miles Per Thousand Residents)	Census	State	45	141	1	1417
Government Ideology	Revised state ideology series based on Berry et al (1998, 2010)	State Averages Over 1977-2017	49	9	30	67
Citizen Ideology	Revised state ideology series based on Berry et al (1998, 2010)	State Averages Over 1977-2017	49	14	26	80
State Limit on Total Outstanding General Obligation Debt	National Association of State Budget Officers (NASBO)	State (2014)	0.76	0.43	0	1
Separate Capital Budget	National Association of State Budget Officers (NASBO)	State (2014)	0.64	0.48	0	1
State Tax and Expenditure Limitation (TEL)	National Association of State Budget Officers (NASBO)	State (2021)	0.52	0.50	0	1
Capital Spending as Share of Total Spending	Census	Aggregate Annual	0.12	0.01	0.10	0.14
Investment in Fixed Assets (Billions of 2021 Dollars)	Bureau of Economic Analysis	Aggregate Annual	333	94	188	474
Infrastructure Grades	American Society of Civil Engineers	State	3	1	1	5
State Rainy Day Fund Balances (Billions)	National Association of State Budget Officers (NASBO)	Aggregate Annual	34	26	6	122

Note: Capital outlays are measured as the combined total of state and local spending.