Determinants of State and Local Capital Investment: Theory and Evidence*

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July 18, 2025

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. The level of capital spending across states is primarily driven by federal assistance and shows little sensitivity to fiscal rules or politics. These findings are consistent with a model of capital investment in which investment decisions are driven by financing constraints but not by overall economic or political returns.

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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).

Perhaps less well-appreciated is that, while the U.S. federal governments 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 federal assistance and land area accounting for much of the cross-sectional variation. 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 overall economic or political returns. Federal assistance drives much of the 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). 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). While this paper does not focus on the productivity of capital spending per se, it incorporates this recent work by considering productivity as a potential explanatory factor that affects the level of spending.

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 proposes a model of capital investment that is consistent with these findings. 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.[1]

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 synonymous 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

[1]The analysis follows the Census use of "survey" years rather than fiscal years so as to more closely align with calendar year totals. Data for a given survey year contains financial information for governments with fiscal years that ended between July 1 of the prior year and June 30 of the current year. For example, the 2010 survey year pertains to government fiscal years that ended between July 1, 2009 and June 30, 2020. Aggregate state-level data are unavailable for 2001 and 2003.

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 is exploratory in nature. It aims to shed light on the factors most strongly associated with state and local capital spending rather than make strong claims about causality. The analysis begins with an exploration of the aggregate time series and in particular of 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 over time.

To identify the key drivers of capital investment, I use an inductive approach. In each section – aggregate, cross-sectional, and panel – I first explore bivariate relationships between a number of economic and political variables that previous research has found to influence the level of subnational capital investment. I then turn to statistical analysis, beginning in each case with a baseline model that includes key variables widely believed to influence capital investment and government spending more broadly, before adding variables in a step-wise fashion to test alternative arguments about the role of interest rates, ideology, and geography.

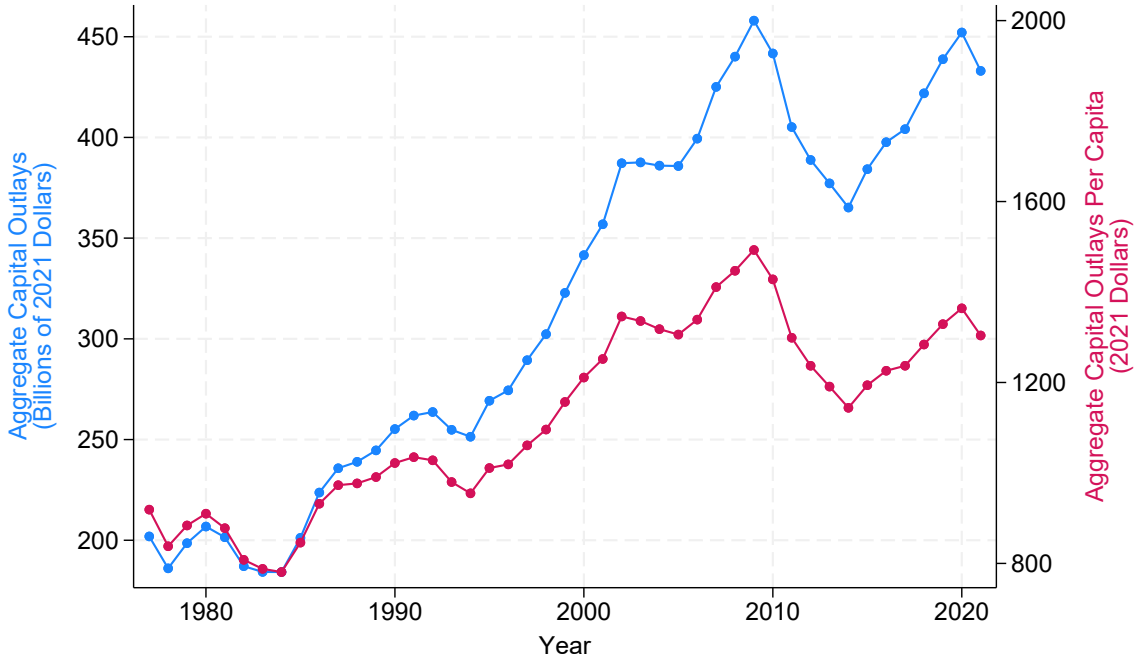
3.1 Temporal Variation in Aggregate Time Series

Figure 1 displays aggregate state and local capital spending in the United States between 1977-2021. The left axis displays aggregate spending in levels (billions of 2021 dollars) while

the right axis displays aggregate spending per capita. Over the last 50 years subnational spending has increased dramatically in both real and per capita terms. Aggregate spending increased from approximately $200 billion in 1977 to $450 billion in 2021, a 125 percent increase in real terms. Per capita spending increased from $900 in 1977 (2021 dollars) 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 slightly, from 11.5 percent in 1977 to 8.5 percent in 2021 (Appendix Figure A2).[2]

[2]An alternative analysis might consider the factors that explain the share of government spending that is devoted to capital investment. However, as the total size of government is shaped by an extremely large set of factors, it is more tractable to focus on the level of capital spending as a distinct variable of interest independent of other forms of government spending.

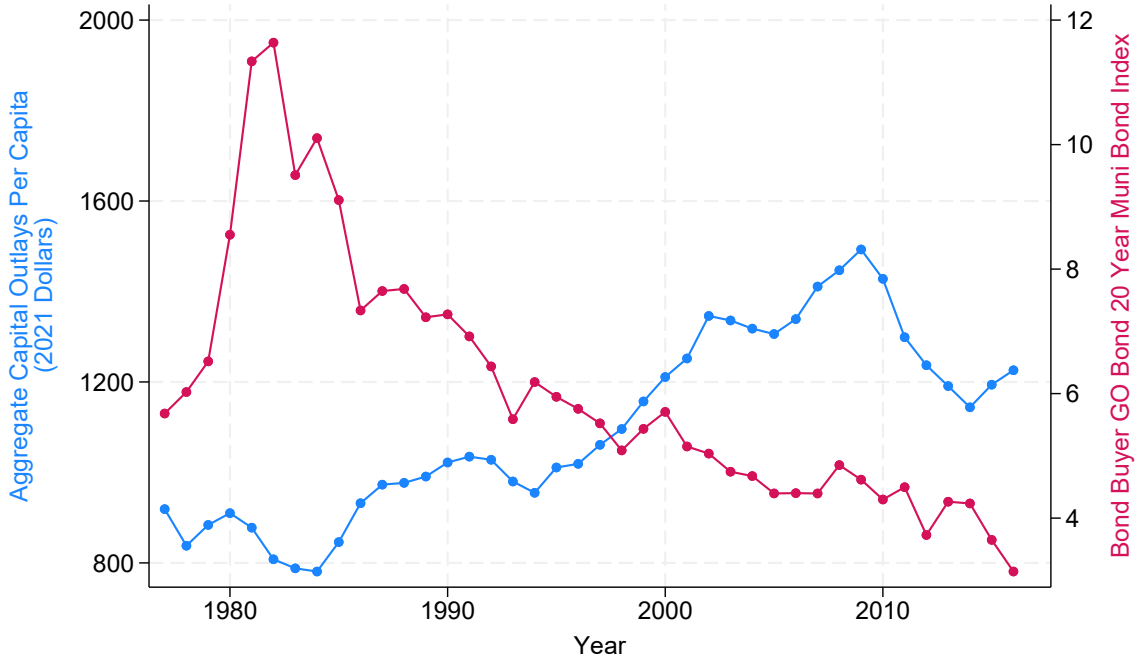
Figure 1: Aggregate State and Local Capital Spending and Aggregate Spending Per Capita



Note: This figure shows aggregate state and local capital spending in the United States over time in billion of 2021 dollars as well as aggregate spending per capita. 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 descriptive analyses before moving on to a regression framework. 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 looks at the relationship between capital spending per capita and interest rates as measured by 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: Aggregate Capital Spending Per Capita and Muni Bond Index



Note: This figure shows aggregate state and local capital spending in the United States over time as well as the Bond Buyer Muni Bond Index for 20 year general obligation bonds.

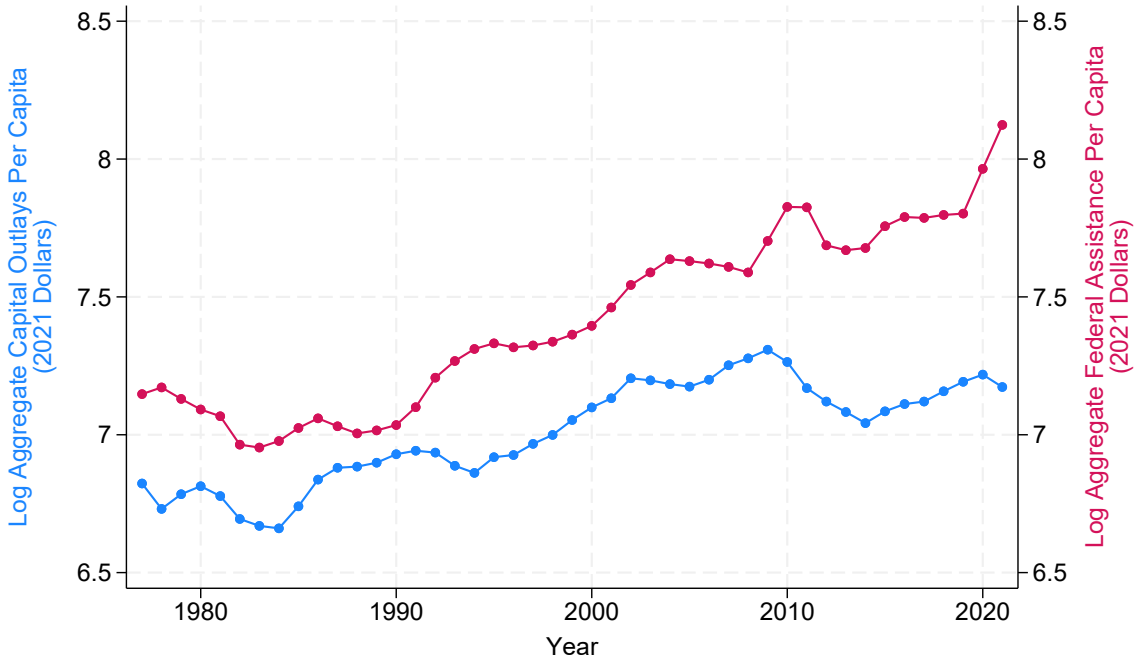
Starting in 1980 the two time series move in opposite directions, with the Muni Bond Index dropping between 1980 and 2016, while aggregate capital spending increased over the same time period. As interest rates fell, it became less expensive for governments to finance their capital projects, and consequently 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.

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).

Figure 3 looks at the relationship between per capita spending and federal assistance. Federal assistance (right-axis) is measured as the aggregate amount of federal transfers received by state and local governments.[3] Both variables in this case are measured on a log scale so as to facilitate comparisons in percentage terms. The two times series move in tandem until 2000, when growth in federal assistance begins to outstrip growth in capital spending. Despite this divergence, the large increase in federal assistance over this time period – a doubling in real terms (increase of a log point) – and the parallel movement of the two trends until the year 2000 point to a potentially significant role for federal support.

Figure 3: Aggregate Capital Spending Per Capita vs. Per Capita Federal Assistance

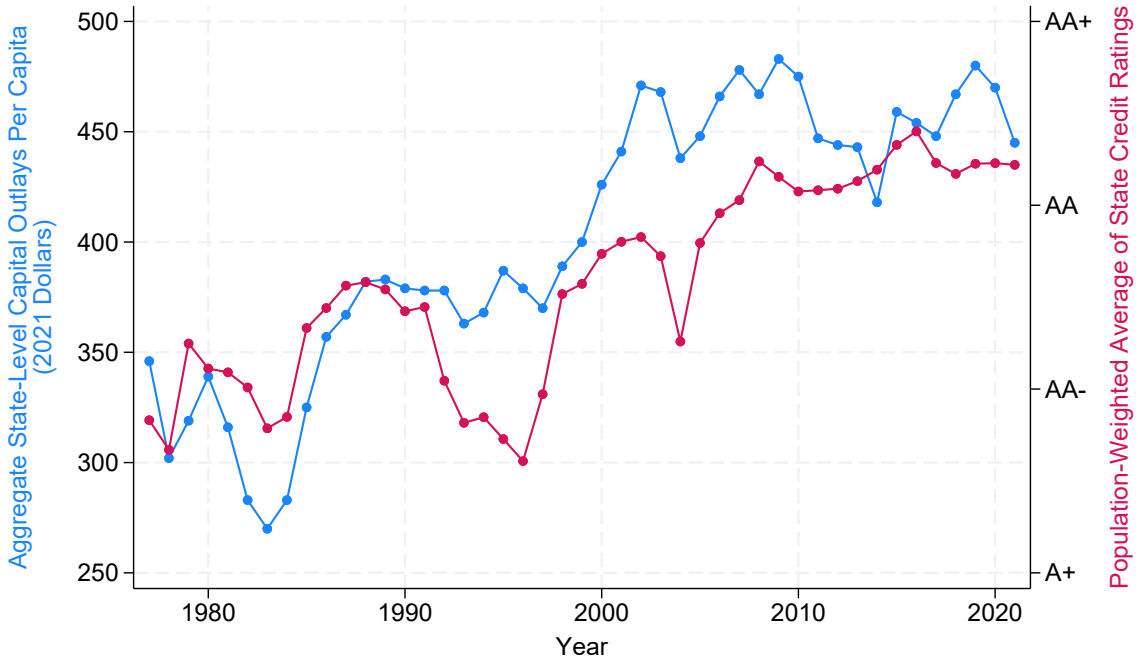


Note: This figure shows aggregate capital spending alongside total federal assistance to state and local governments. Data source: U.S. Census Bureau, Annual Survey of State and Local Government Finances and Census of Governments.

[3]Although it might be preferable to restrict this variable to more specific federal grants aimed at infrastruture spending, the Census of Government data does not provide breakdowns of federal intergovernment revenue in its summary statistics.

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, their fiscal health provides a potentially important indicator of the level of capital investment. Fortunately, data on state credit ratings, a commonly used indicator of fiscal health, is available back to the 1950s. While credit ratings impact the cost of borrowing, already captured above using the Muni Bond Index, they are also a more general measure of fiscal health, reflecting the level of reserves that states carry as well as their ability to draw on their population for resources. Figure 4 plots the evolution of capital outlays against the population-weighted average of state credit ratings (from S&P). In this case, capital outlays are measured at the state-level only (i.e. they exclude local spending) since the credit rating measure only reflect state governments. The two time series track each other closely, though capital spending does not show the same dips as state credit ratings do in the mid 1990s and 2000s. (Appendix Figure A4 plots the overall level of state reserves since 1988, an alternative indicator of state fiscal health, which shows a weaker relationship with state-level spending.)

Figure 4: Aggregate Capital Spending Per Capita vs. Population-Weighted Average of State Credit Ratings



Note: This figure shows aggregate capital spending per capita alongside the population-weighted average of state credit ratings. In this case, 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. Credit ratings come from S&P.

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 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 92 percent of the temporal variance in aggregate capital spending between 1977 and 2021 (Table 1). While other variables – the national unemployment rate, federal assistance, and the average state credit rating – 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 68 percent of the variance in per capita spending. This measure of model fit improves incrementally as the unemployment rate, per capita personal income, average credit rating, and muni bond index are added to the model, however only the unemployment rate and federal assistance are statistically significant. 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.

Table 1: Aggregate Time Series

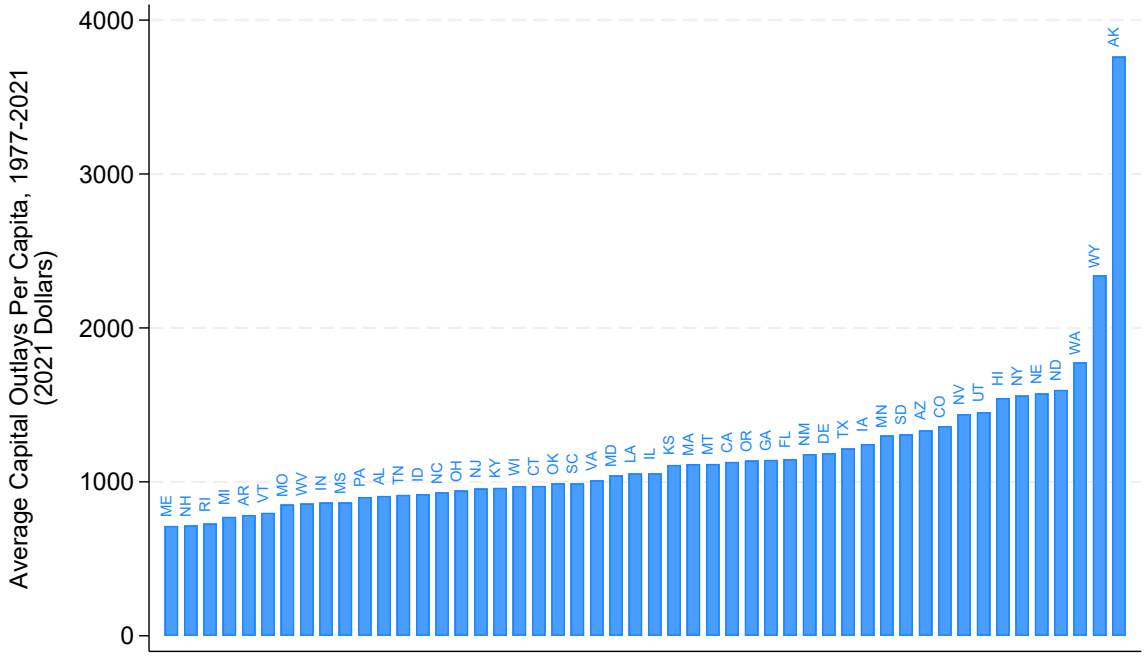
	Capital Spending (Thousands of 2021 Dollars)					Per-Capita Capital Spending (2021 Dollars)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Population	6.41***	6.54***	10.65***	13.74***	16.18***					
	(2.04)	(2.04)	(2.37)	(2.28)	(3.21)					
Population^2	-0.00*	-0.00**	-0.00***	-0.00***	-0.00***					
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)					
Unemployment Rate$_{t-1}$		-4637380*	-6424045***	-5250795***	-6358643**		-36.18***	-30.47**	-32.03***	-39.58***
		(2,748,558)	(1,977,412)	(1,664,829)	(2,615,734)		(10.81)	(11.33)	(10.72)	(8.86)
Federal Assistance			0.23**	0.28***	0.55***					
			(0.10)	(0.10)	(0.08)					
Avg State Credit Rating				45855714***	45881897***				113.52**	52.76
				(9,677,860)	(7,599,693)				(49.41)	(34.86)
Muni Bond Index					3,212,118					7.20
					(2,118,606)					(10.62)
Per Capita Federal Assistance						0.29***	0.27***	0.20*	0.22**	0.31***
						(0.04)	(0.04)	(0.11)	(0.11)	(0.08)
Per Capita Personal Income								0.01	-0.00	0.00
								(0.01)	(0.01)	(0.01)
Observations	45	44	44	44	39	45	44	44	44	39
R^2	0.92	0.92	0.94	0.96	0.97	0.68	0.76	0.76	0.79	0.86
Adjusted R^2	0.91	0.92	0.93	0.95	0.96	0.67	0.75	0.74	0.77	0.84

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Federal assistance measured in 2021 dollars.

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 5 plots the average annual per capita spending of states over this time eperiod. 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 in the Northwest, such as Alaska and Wyoming, spending in excess of $3,000 per capita.

Figure 5: Per Capita Capital Spending Across States



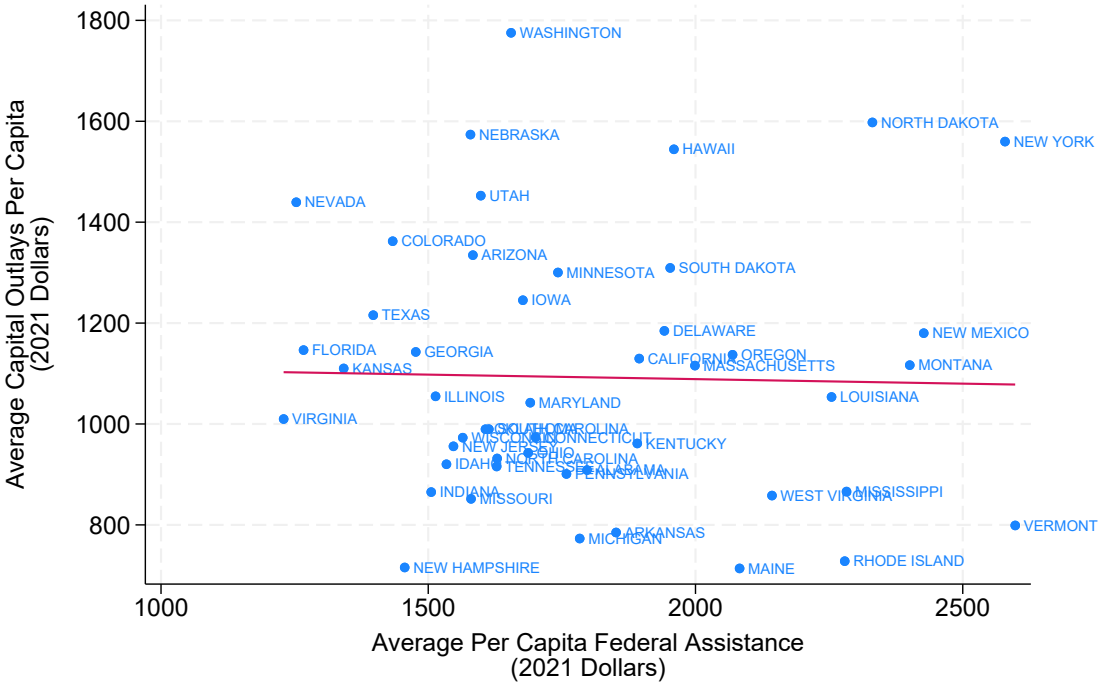
Note: This figure plots average annual capital outlays per capita by state in 2021 dollars. Capital spending is measured as the combined total of state and local spending. The averages are calculated over 1977-2021 (excluding 2001 and 2003).

3.2.1 Economic Factors

To start, I focus on the role of federal spending as Table 1 showed that federal spending is the major factor driving variation in aggregate per-capita spending over time. Figure 6 plots the average per capital federal assistance received by states against their average per

capita capital spending. For the moment, I exclude outliers with unusually high spending, such as Alaska and Wyoming. In contrast to the results from aggregate spending, the figure suggests that variation in federal spending does not explain variation in the levels of spending across states, at least according to a simple bivariate comparison.

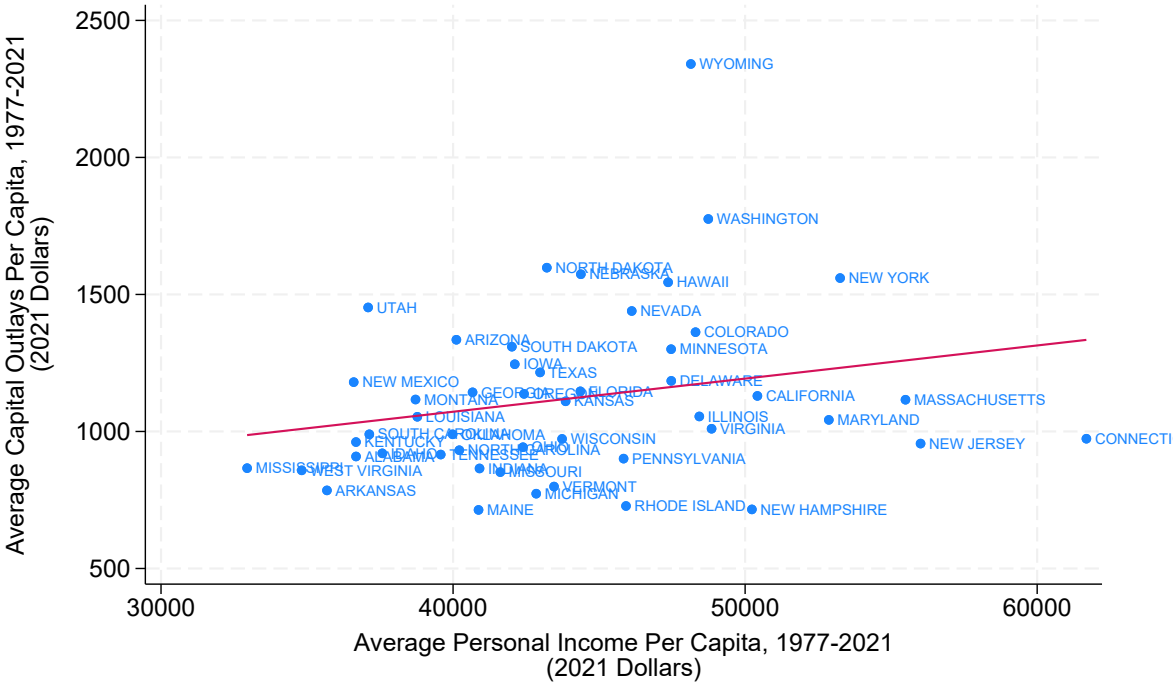
Figure 6: State Capital Spending and Federal Assistance



Note: This figure plots average capital outlays per capita by state against average per capita federal assistance. 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 7 moves on to consider the role of income, as measured by average per-capita income within each state. Prior work has documented 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). Not surprisingly, there appears to be a positive relationship, with higher income states investing more in public capital. However, the slope of the fitted line is only weakly positive, suggesting that this factor explains only a small proportion of the variance.

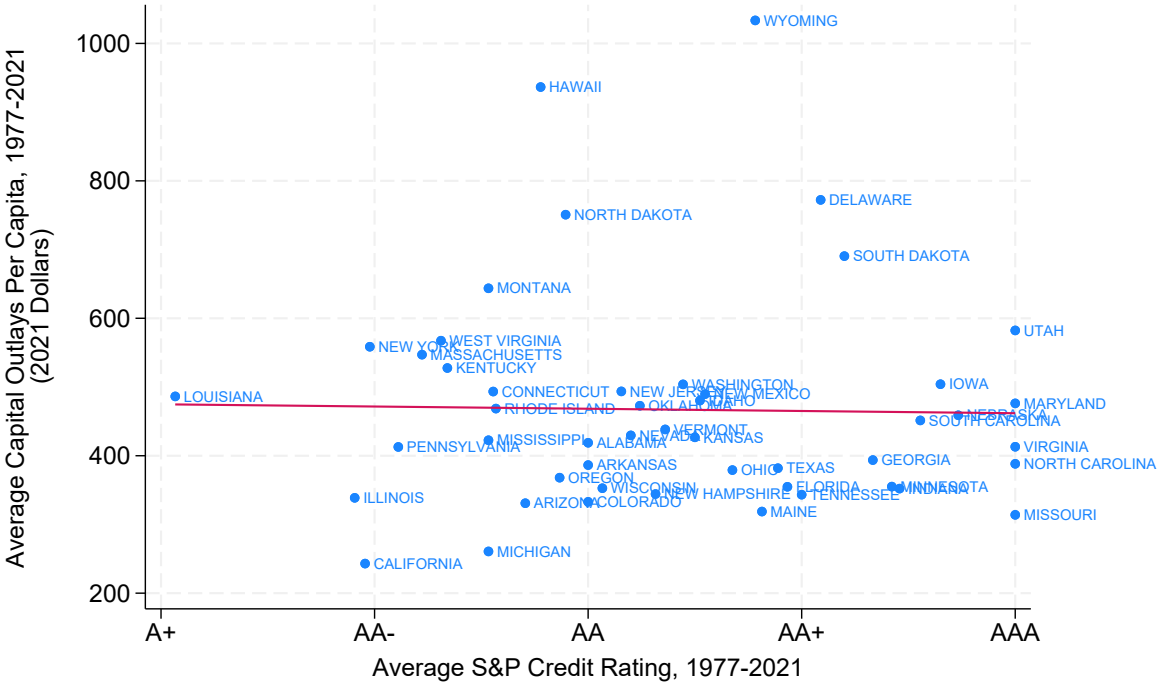
Figure 7: State Capital Spending and Average Personal Income



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 8 considers state credit ratings. As noted above, credit ratings reflect a governments' prospects for solvency. They are a measure of fiscal health and also affect the interest rates that a government pays to issue debt. Despite the potential importance of fiscal health, Figure 8 documents the lack of a correlation between capital spending and credit ratings, with credit ratings averaged and plotted on a linear scale. (Because the credit ratings reflect the average rating of the state government, per capita spending is measured only at the state level.). States with triple A ratings spent no more on a per capita basis than those with lower ratings. Appendix Figure A5 documents a similarly weak relationship between the average level of state rainy day fund balances and the average level of capital investment. State fiscal health alone, as proxied by credit ratings or rainy day fund balances, does not appear to be an important driver of capital investment.

Figure 8: 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 represents state-level spending only (rather than aggregated state and local spending). The figure excludes Alaska.

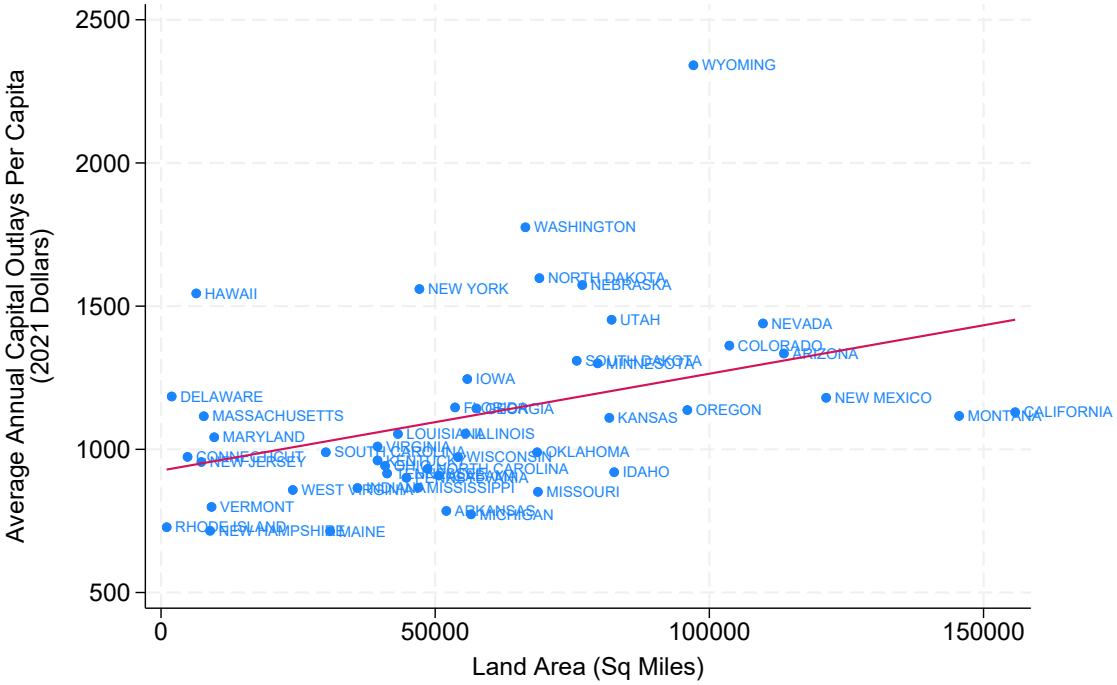
To explore the importance of the benefits of capital investment, Appendix Figure A3 plots capital spending against the infrastructure grades received by states from the ASCE. States with inferior infrastructure (worse grades) might be expected to invest more, given the potentially higher return on these investments. The figure again finds no relationship (over the period 2015-2019), although many of the states with the worst infrastructure are also the poorest, highlighting the potentially confounding effect of income, as states with higher returns on their infrastructure investments may also see less attractive financing terms.

3.2.2 Geographic Factors

Having explored a number of economic factors, I now consider geographic variables. Figure 5 indicated that the states with the highest capital spending per capita are the sparsely populated states of Alaska and Wyoming. Figure 9 looks at the relationship between capital spending and land area. The figure excludes Alaska and Texas because their significantly larger size compared to the other states in the sample makes them outliers, disproportionately affecting the slope of the trend line. The figure confirms that there is indeed a close relationship between per capita spending and land area, even excluding the largest states.

On average, states with more extensive land areas such as Arizona and Nevada spent more on a per-capita basis than small states such as Rhode Island and New Hampshire.

Figure 9: Capital Spending and Land Area



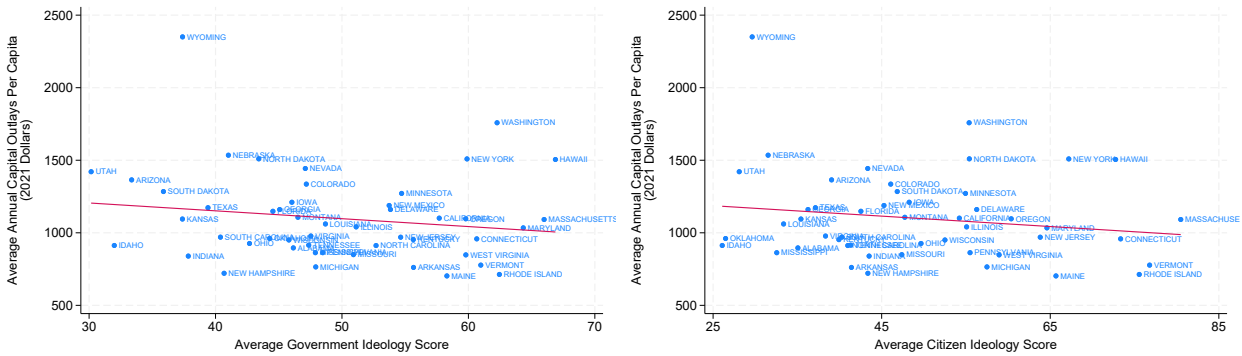
Note: This figure plots the average capital outlays per capita by state against land mass, measured in square miles. Capital spending is averaged over 1977-2021 (excluding 2001 and 2003) and is measured in 2021 dollars. The figure excludes Alaska and Texas.

3.2.3 Political Factors

Finally, in this section I consider political variables. To start, I look at the relationship between capital spending and political ideology using Berry et al's (2010) updated state ideology series. Figure 10A looks at government ideology, while Figure 10B looks at citizen ideology. The fitted line in both figures is downward sloping, indicating that more liberal governments and citizens spend *less* per capita. The observations also don't show a strong fit with the line, suggesting that political ideology has little explanatory power in this context.

Figure 10: State Capital Spending vs Political Ideology

Figure 10A: Government Ideology **Figure 10B: 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 11 considers politics through a different dimension, namely through institutions that shape the budget process, including whether or not a state has a limit on the amount of debt it can issue (Figure 11A), whether or not a state has a separate capital budget (Figure 11B), and whether or not a state has a limit on the total amount of taxation or spending in the state (a "tax and expenditure limitation" (TEL), Figure 11C). Previous work suggests that fiscal institutions can have a significant impact on the level of infrastructure spending; 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 contend that attempts to constrain the level of debt explain the relatively low level of capital investment in New England (Fisher and Sullivan, 2016). However, the simple binary associations in Figure 11 show little support for the idea that fiscal institutions are particularly impactful. States with debt limits appear to spend more on average than states without. While states with capital budgets spend slightly more, the difference is minor. The difference between states with and without TELS is larger - with TEL states spending $110 less per capita on average – however the difference 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.

Figure 11: Capital Spending vs Fiscal Rules

Figure 11A: State Debt Limit **Figure 11B: Separate Capital Budget**

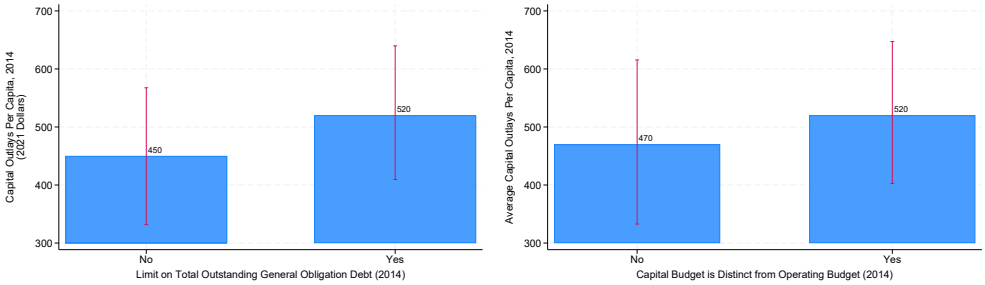
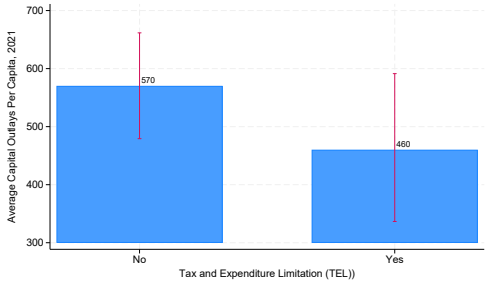


Figure 11C: Statewide Tax and Expenditure Limitation (TEL)



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).

3.2.4 Cross-Sectional Analysis

Table 2 combines several of the above variables in a multivariate analysis. Because of the regional variation evident in Figure 5, 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 due to the importance of economic considerations demonstrated in Figure 7. I then add the average unemployment rate and per capita federal assistance, followed by a state's land area, its average credit rating, and the government's average ideology across the sample period. In the fully loaded model, only personal income, federal assistance, and land area attain significance, and these results hold with or without indicators for census division (columns 7 and 8). 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 is consistent with the strong relationship between spending

and density suggested by the states with the highest spending per capita.

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 0.87 once federal assistance and land area are added. Adding further variables for the credit rating and government ideology do not improve on the model fit. Taken together, these results suggest that regional factors, economic capacity, and geographic scale are the primary drivers of cross-state variation in capital spending. In contrast, political and institutional variables add little explanatory power.

Table 2: Cross-Section

	Per-Capita Capital Spending							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Per Capita Personal Income		0.04**	0.04**	0.04***	0.03***	0.03***	0.03***	0.02***
		(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Unemployment Rate			31.30	-29.37	-89.66**	-83.50*	-51.24	-33.37
			(96.75)	(51.04)	(39.13)	(47.50)	(54.82)	(49.49)
Per Capita Federal Revenue				0.52***	0.37***	0.37***	0.41***	0.37***
				(0.15)	(0.06)	(0.06)	(0.05)	(0.09)
Land Area					2.59***	2.55***	2.03***	3.09***
					(0.52)	(0.59)	(0.66)	(0.59)
Credit Ratings						12.47	14.28	56.15
						(50.30)	(46.70)	(37.39)
Government Ideology							-8.15	-5.97
							(5.02)	(6.30)
Indicators for Census Division	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Observations	50	50	50	50	50	50	50	50
R^2	0.38	0.50	0.50	0.77	0.87	0.87	0.88	0.78
Adjusted R^2	0.26	0.39	0.38	0.70	0.83	0.82	0.83	0.75

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All variables averaged over the 1977-2021 period.

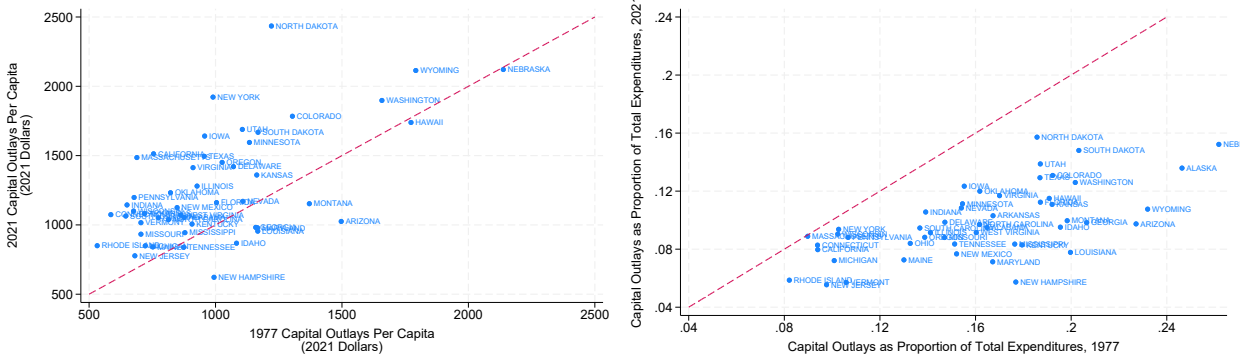
3.3 Changes in Capital Spending

In this section I explore changes within states over time. That is, I examine how much capita capital spending changed over the course of the sample period and what led to these changes.

Figure 12 displays how capital spending changed in real per capita terms between 1977 and 2021 for each state. While the vast majority of states spent more in 2021 than they did in 1977 (Figure 12A), it is also true that every state spent less on capital spending as a share of total spending (Figure 12B). That is, while state government expenditures grew over this time period, capital spending did not increase at the same rate.

Figure 12: Capital Spending by State in 1977 and 2021

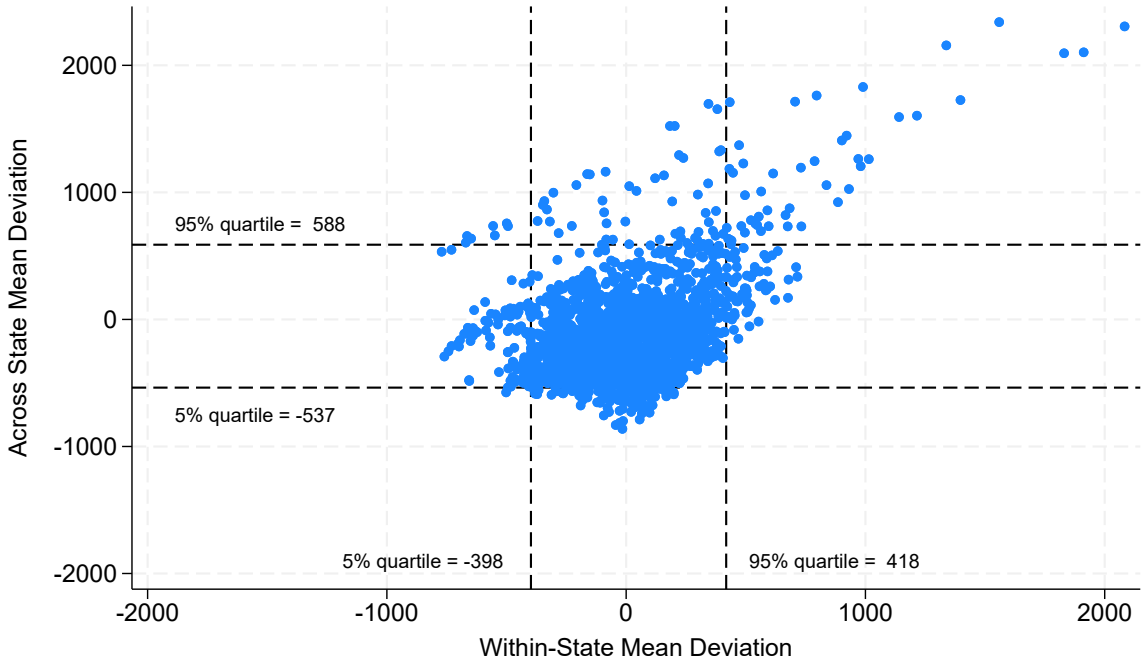
Figure 12A: Per Capita Spending **Figure 12B: As Share of Total**



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 13 displays the differences between a state's annual per capita spending in a given year and the overall state mean (x-axis) and the overall year mean (y-axis). The dotted lines reflect the 95 percent confidence intervals . The confidence intervals show that the differences across states are significantly larger than the within state differences, indicating that the majority of the variation across state-year observations is cross-sectional. Nevertheless, I consider the role that changes in economic and political factors play in shaping state capital investments over time. (Geographic factors, of course, are fixed over time.)

Figure 13: Deviation From Within-State Vs. Across-State Averages

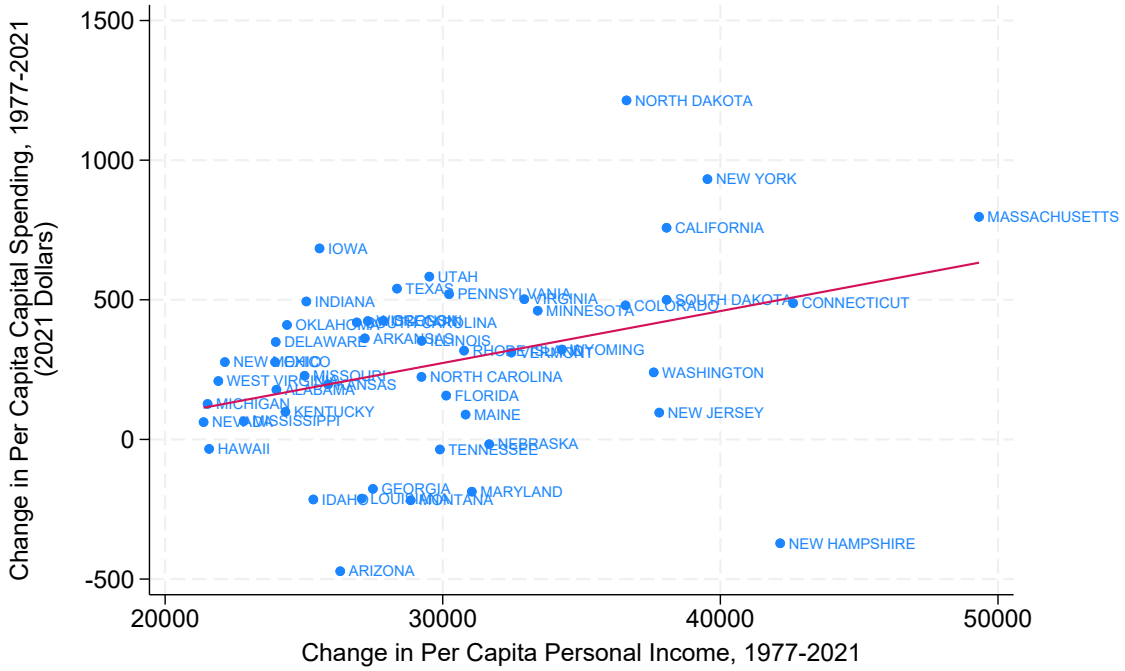


Note: Each point in the graph represents the difference between a state's annual per capita capital spending and the overall state mean (x-axis) and the overall year mean (y-axis). The figure excludes Alaska.

3.3.1 Economic Factors

Figure 14 plots the change in per capita spending in each state between 1977 and 2021 (y-axis) against the change in per capita personal income over the same time period. As in Figure 7, there is a clear positive relationship between income and spending, suggesting that income explains both cross-sectional and temporal variation in states.

Figure 14: 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.

Perhaps surprisingly, however, there is no such clear relationship between spending and economic factors when looking at the unemployment rate as a proxy for economic health. Figure 15 plots the change in capital spending within a state between year t and year t-3 against the change in the unemployment rate between year t and t-3. (This figure focuses on changes over a shorter time horizon given that unemployment rates have not risen or fallen monotonically in the way that personal income has). The fitted line is nearly flat suggesting that while the level of unemployment may matter for the level of capital spending, as evidenced by Table 2, changes in the unemployment rate factor little in changes in spending, at least over short time horizons.

Figure 15: 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 16 compares changes in capital spending with changes in state credit ratings. The figure plots the change in capital spending between year t and year t-3 (y-axis) and the change in the state credit rating between year t and year t-3. (An increase of 1 reflects a one unit improvement in rating, eg. from AA+ to AAA.) The fitted line has a very small positive slope but is close to flat, indicating that over a three year period, changes in a governments financial condition have little bearing on capital spending, consistent with the cross-sectional findings reported in Table 2 above.

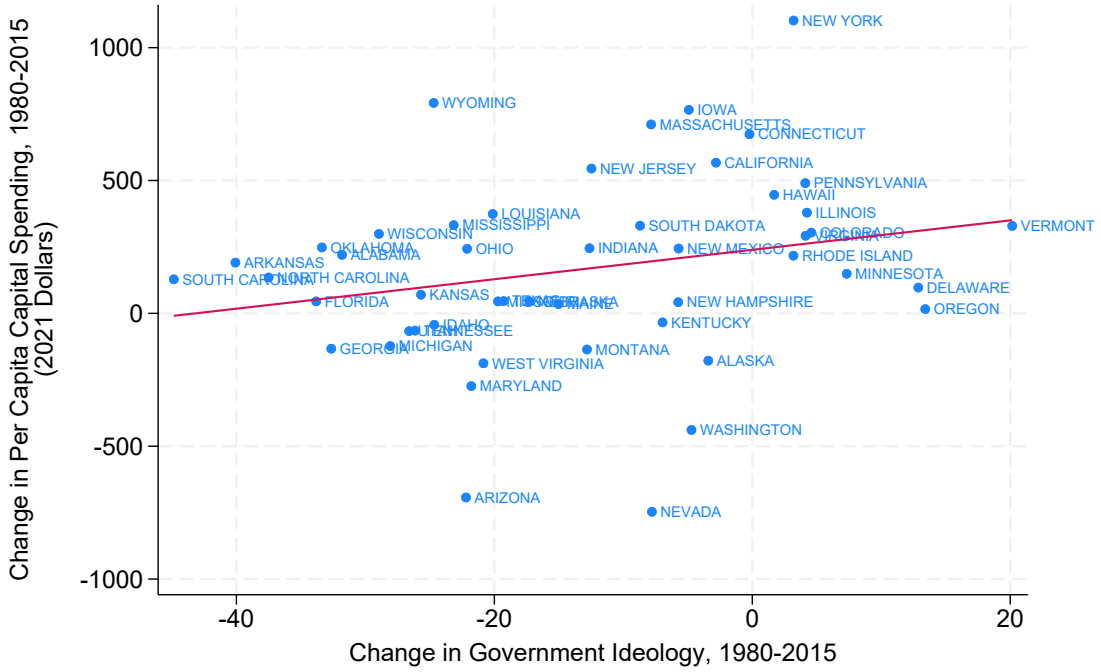
Figure 16: Change in Capital Spending vs Change in Credit Rating

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.

3.3.2 Political Factors

Figure 17 considers the changes in a government's ideology over the time period 1980-2015 and compares this change to the change in capital spending over the same time period. While Figure 10 suggested that there was no relationship between political ideology and capital spending, and that in fact more liberal governments might spend less on capital investments, Figure 17 suggests that governments that become more liberal do in fact show greater increases in their capital spending.

Figure 17: 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.

3.3.3 Panel Data Analysis

Table 3 incorporates the above variables into a state-year panel. Columns 1-2 consider only the role of state and year fixed effects. Column 2 shows that state fixed effects alone can explain 68 percent of the variation in state per-capita capital spending, consistent with Figure 13 above. When year fixed effects are included, the R^2 rises to 75 percent. With personal income added to the model, the fit improves to 81 percent. Adding further variables for the unemployment rate, federal assstance, credit ratings, and government ideology has little effect on the model fit, improving the R^2 to 0.82. Despite the descriptive evidence above indicating a possible relationship between capital investment and changes in political ideology and credit ratings, the only variable that attains statistical significance is per capita income.

Table 3: State Panel

	Per-Capita Capital Spending						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Per Capita Personal Income			0.05***	0.05***	0.05***	0.05***	0.06***
			(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Unemployment Rate				0.84	-0.01	0.59	3.72
				(9.67)	(8.42)	(9.46)	(10.43)
Per Capita Federal Revenue					-0.03	-0.03	-0.01
					(0.08)	(0.08)	(0.10)
Credit Ratings						10.65	-0.31
						(18.05)	(20.73)
Government Ideology							-1.73
							(1.16)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,150	2,150	2,150	2,150	2,150	1,856	1,656
R^2	0.69	0.76	0.80	0.80	0.80	0.81	0.82
Adjusted R^2	0.68	0.75	0.79	0.79	0.79	0.80	0.80

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by state in parentheses.

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.

4.1 Economic Factors

By and large, economic factors appear to be the most significant drivers of capital investment, in particular the level of federal assistance. These economic variables are macroeconomic in

nature and proxy for the level of material resources of the residents in a state (per capita income) and local economic conditions (the unemployment rate). 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.

4.2 Geographic Factors

Breaking out average capital spending by state (Figure 5) 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, 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.

4.3 Political Factors

In contrast, political factors do not appear to play a role. The coefficient on government ideology is small and insignificant in both Tables 2 and 3. 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, as highlighted in recent policy discussions (Demsas, 2024).

4.4 Unobserved Factors

In Table 3, state fixed effects alone account for 69 percent of the variance in the outcome variable. Moreover, regional variation - as proxied by indicators for census division – account for 38 percent of the cross-sectional variation (Table 2). These results imply that per-capita capital investment is predominantly a function of time-invariant state- and region-specific factors. This likely includes factors such as weather or geography, which impact both supply and demand factors.

Year fixed effects, reflecting year-specific factors, increase the R^2 in Table 3 from 0.69 to 0.76, indicating that they play less of a role. These year-specific factors likely capture changes in interest rates or shifts in the national political and economic environment that affect all states equally.

4.5 A Model 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 impact 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, expenditure rigidities, and varying access to credit.

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 no 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 play the most significant role. In the aggregate, the only other variable that attains significance at the five percent level is the unemployment rate. Both of these factors 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 the demand for investment – 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 (Figures 8, 16, and A5). After all, states with higher credit ratings and more sizable reserves, should have more resources available for capital investment. However, since rainy day funds are primarily intended to cushion states against downturns (Pew Charitable Trusts, 2014), it is possible that states safeguard the funds in order to ensure the continuity of essential services and do not view reserves as a potential source of financing for capital investments. Similarly, while credit ratings reflect the risk of default on a state's bonds, they may not be a good proxy for a state's fiscal capacity to finance new projects. This is particularly true in models that already control for personal income, which more directly captures the underlying economic resources available to a state, and where the indicator of fiscal health, in this case state credit ratings, does not capture local fiscal capacity.

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 role.

The findings are consistent with a model of capital investment whereby subnational capital spending is primarily determined by the availability of financing and the need to provide a baseline level of service. The cost of financing does not appear to play a large role, as evidence by the lack of association with interest rates. However, states' ability to raise the funds amidst balanced budget requirements and other institutional factors is the main consideration. In contrast, the benefits of infrastructure projects, which impact the economic return on investment, do not appear significant, as evidenced by a lack of association between capital spending and the state of infrastructure.

What implications do these results carry for federal infrastructure 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. Flexible capital planning frameworks may help governments respond quickly to federal funding opportunities. Prudent financial management – such as aligning reserves and debt capacity with long-term needs – helps ensure that governments are fiscally prepared to undertake new projects when funding arises.

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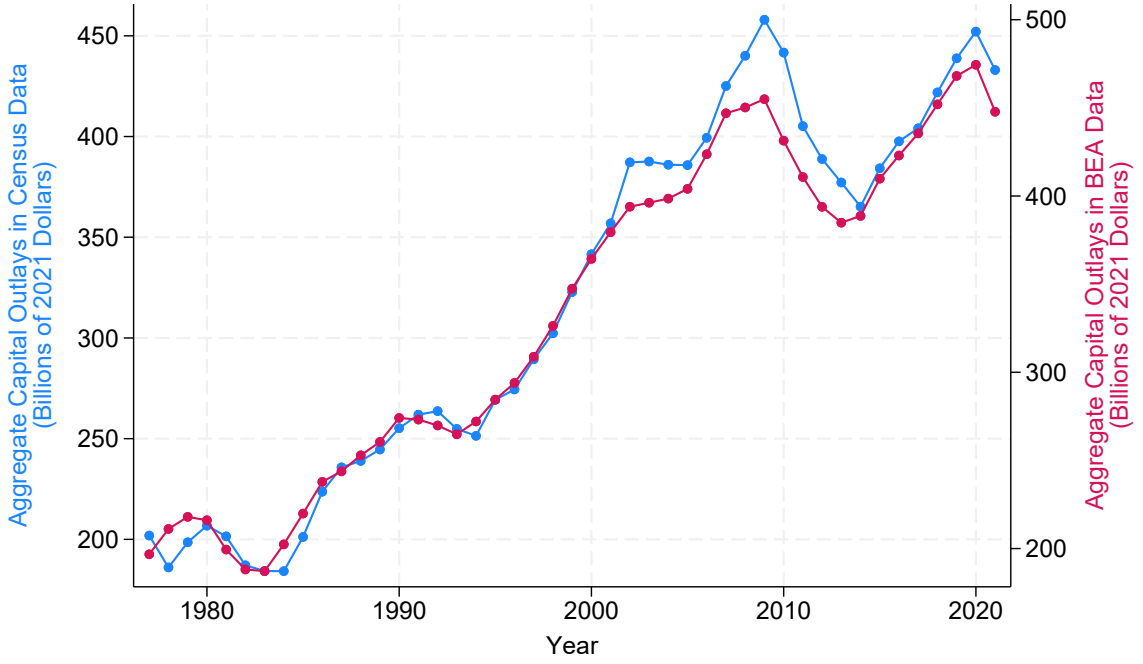
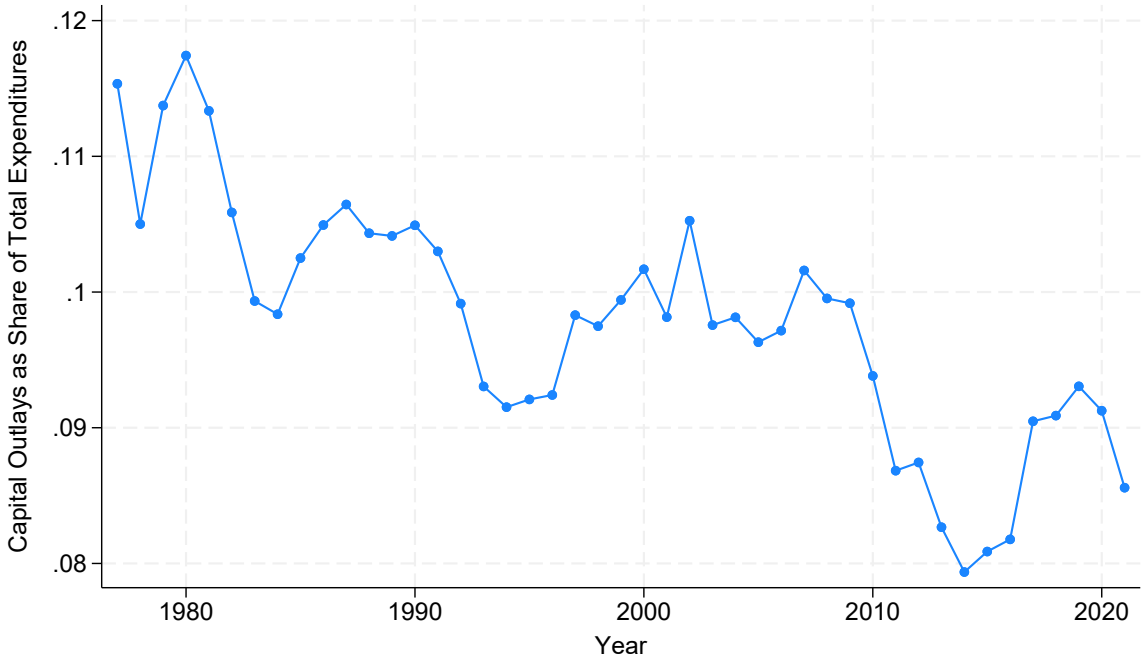
Appendices

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



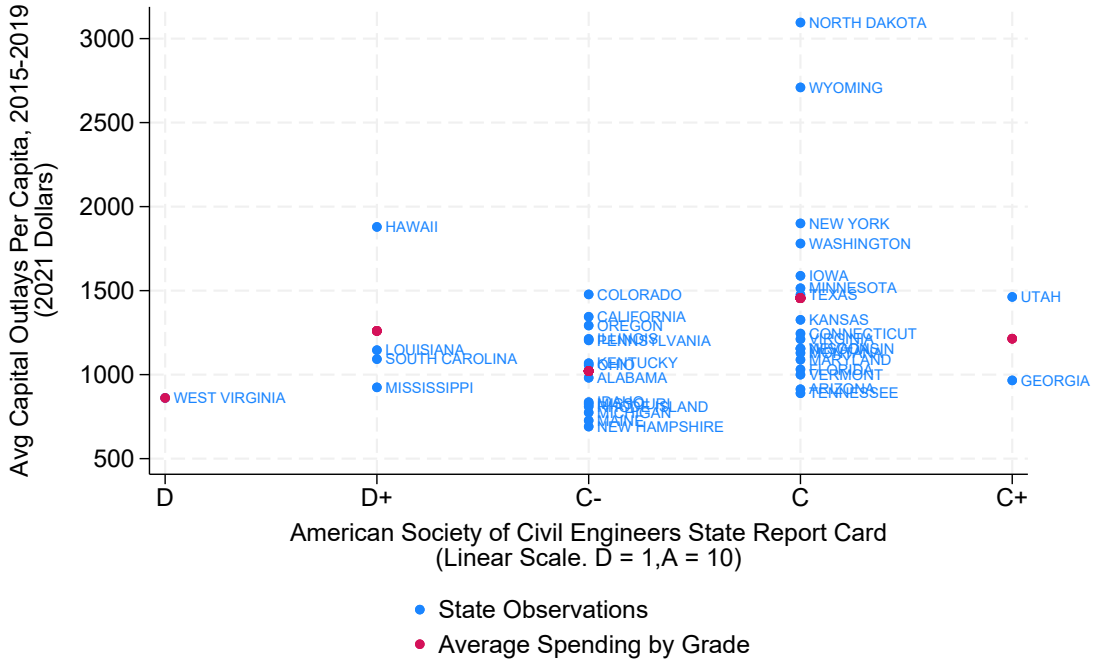
Note: This figure shows aggregate state and local capital spending in the United States as measured by the Census of Governments data (left axis) and BEA's National Income and Product Accounts (right axis). Both measures are in billions of 2021 dollars.

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



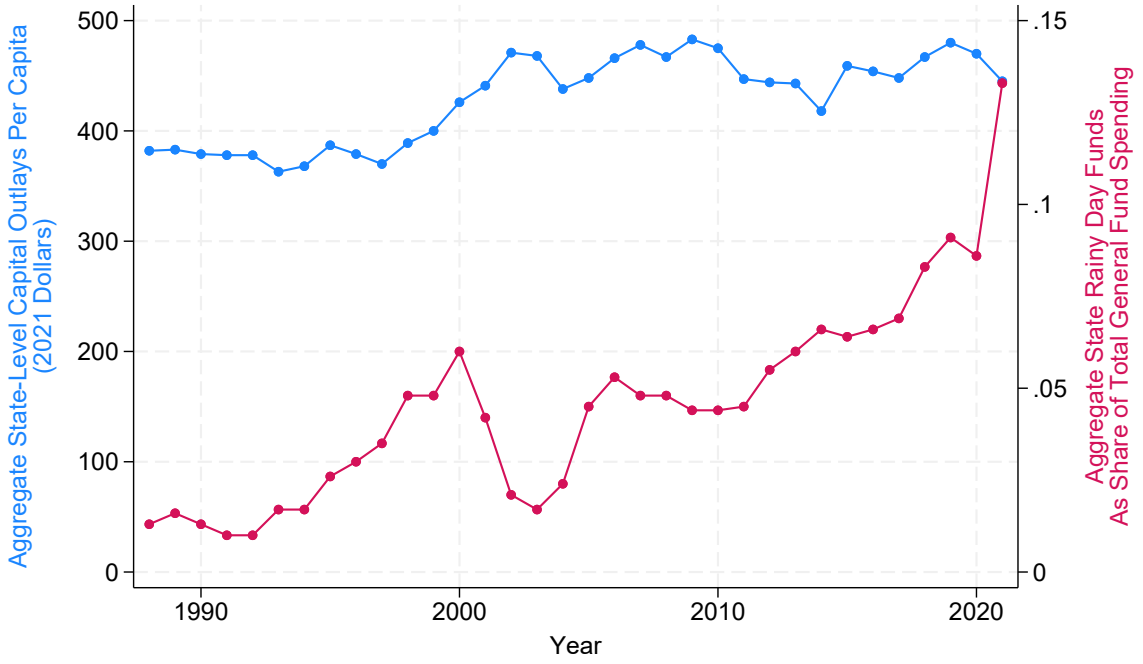
Note: This figure shows how the percentage of total state and local expenditures that are spent on capital outlays has changed over time. Data source: U.S. Census Bureau, Annual Survey of State and Local Government Finances and Census of Governments.

Figure A3: State Capital Spending vs. Condition of Infrastructure



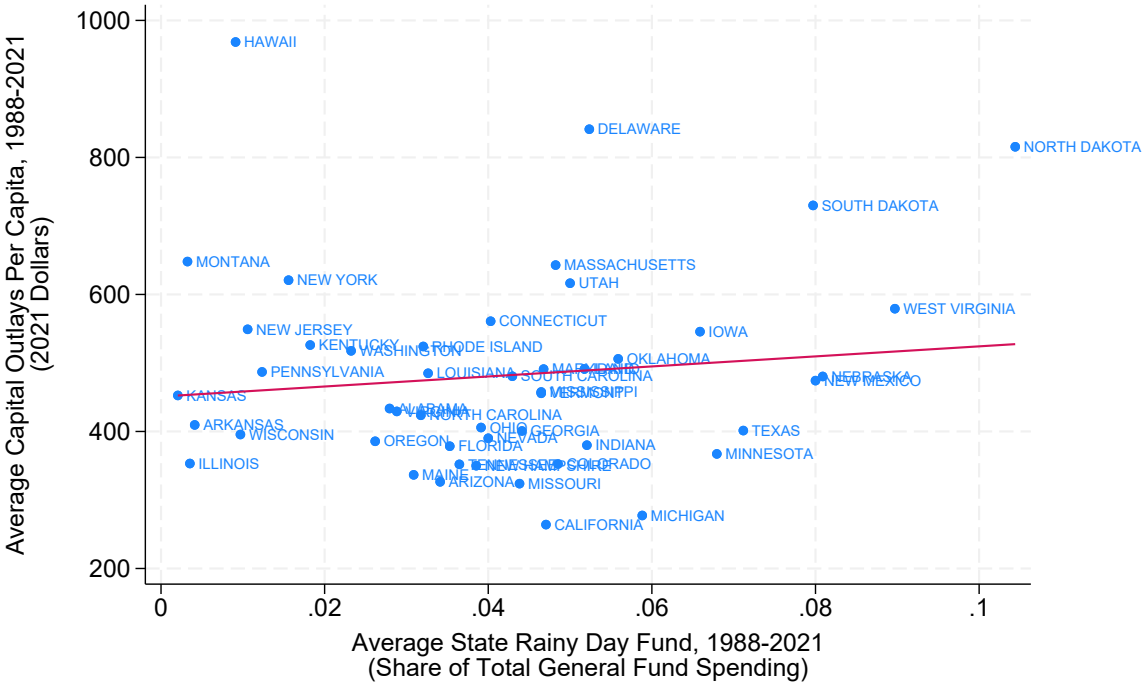
Note: This figure compares states' per capita spending with the grades awarded to them by the American Society of Civil Engineers (ASCE) for the condition of their infrastructure. Capital spending is measured as the total of state and local spending within each state. It is measured in 2021 dollars,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

Figure A4: Aggregate Capital Spending at State Level vs. State Rainy Day Fund Balances



Note: This figure shows aggregate capital spending per capita alongside the average state rainy day fund as a share of general fund expenditures. In this case, 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. Rainy day fund balances have increased significantly since 1988, from approximately 2 percent of general fund spending to nearly 15 percent, exceeding the growth rate in state-level spending, which has grown approximately 20 percent over the same time period. Capital outlays have remained more or less constant in per capita terms since 2002, while rainy day funds have more than doubled.

Figure A5: 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.

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
Intergovernmental Revenue from Federal Government (2021 Dollars)	Census of Governments	Aggregate Annual	1,749	571	1,047	3,374
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 (Thousands of Square Miles)	Census	State	56	37	1	156
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 as Share of General Fund Spending	National Association of State Budget Officers (NASBO)	Aggregate Annual	0.05	0.03	0.01	0.13

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