The Fiscal Impact of Federally Capitalized State Infrastructure Banks on Leveraging State and Local Transportation Investment: A Causal Reexamination

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I. Introduction

Meeting future transportation infrastructure needs has emerged as one of the most urgent and persistent challenges facing the United States. With aging and deteriorating systems across highways, bridges, and transit networks, state and local governments are under growing pressure to upgrade their infrastructure in the face of limited and uncertain funding. A central driver of this funding gap is the decline in motor fuel tax revenues—the traditional backbone of federal and state highway funding—which has failed to keep pace with inflation, vehicle fuel efficiency improvements, and shifting transportation patterns. As a result, public infrastructure systems remain underfunded even amid rising demand and public concern.

The American Society of Civil Engineers (ASCE)'s 2025 Report Card for America's Infrastructure gave the nation's infrastructure an overall grade of C, marking the highest rating since the ASCE began issuing report cards in 1998. Nevertheless, the report warns that approximately $9.1 trillion in investment is needed between 2024 and 2033 to restore all graded infrastructure categories to a state of good repair. Even with the historic infusion of federal funds through the Infrastructure Investment and Jobs Act (IIJA) of 2021, total investment needs continue to outpace available funding, particularly at the state and local levels where much of the implementation responsibility lies.

Within the framework of fiscal federalism, the provision of infrastructure is a shared intergovernmental responsibility. While the federal government has historically played a critical role in setting priorities and providing grant-based funding, the bulk of infrastructure execution and financial commitment occurs at the state and local levels. Recognizing the limitations of traditional grant programs, the federal government has introduced a range of innovative financing instruments over the past three decades to complement conventional aid and stimulate local co-investment. Among these innovations is the State Infrastructure Bank (SIB) program, authorized under the National Highway System Designation Act of 1995.

SIBs function as state-run revolving loan funds that are initially capitalized through federal transportation funds and matching state contributions. Modeled after private financial institutions, SIBs provide low-interest loans and credit enhancements to public and private sponsors of transportation projects. What distinguishes them from traditional grants is their revolving nature—loan repayments and accrued interest are recycled into future loans, allowing the fund to multiply its impact over time. According to the U.S. Department of Transportation (1997) and the Government Accountability Office (1996), SIBs were envisioned as a mechanism to increase the financial capacity of states and localities by stretching limited public dollars further through strategic lending.

Since their inception, 31 states have established pilot SIBs, and by July 2023, over 1,200 loans totaling more than $10 billion had been issued. In 2024, renewed momentum around SIBs became evident. Several state legislatures-initiated efforts to reauthorize or enhance their SIB programs, and Florida’s Department of Transportation notably expanded its SIB by allocating additional funds from the federal August redistribution (Tiberghien, Gable, Page, & Cui, 2025). These developments point to a broader interest in revitalizing innovative finance mechanisms amid continued pressure on traditional funding sources.

Despite their policy appeal, SIBs remain under-researched and poorly understood in the academic literature. While they are often promoted as an effective way to leverage federal dollars and induce additional subnational investment, empirical evidence about their true fiscal impact is both limited and methodologically constrained. To date, only three peer-reviewed studies—Ryu (2006, 2007) and Chen (2016)—have empirically evaluated whether SIBs succeed in increasing transportation infrastructure investment. These studies suggest that SIBs may generate substantial leveraging effects, with estimates ranging from $2.50 to $7.50 in additional investment per federal dollar. However, each of these studies relies on observational data and suffers from endogeneity concerns, as states that choose to adopt SIBs may differ systematically from those that do not. Such self-selection introduces bias into estimations of causal impact and undermines confidence in the generalizability of the findings.

In light of these limitations, there is a clear need for a more rigorous, causally credible evaluation of the fiscal impact of SIBs. This study addresses that need by applying a quasi-experimental research design—specifically, a staggered difference-in-differences (DID) approach—to assess whether federally capitalized SIBs have led to increased state and local transportation investment. Focusing on the nine most active SIB states—Arizona, Florida, Michigan, Missouri, Ohio, Oregon, Pennsylvania, South Carolina, and Texas—this research examines SIB activity over a two-decade period, from 1990 to 2010, using a newly constructed panel dataset that captures both fiscal and programmatic variables.

Table 1. Characteristics of State Infrastructure Banks (Million)

State	SIB name	Year established	Years of federal capitalization	Amount of federal capitalization	Total amount of capitalization
Arizona	Arizona Highway Expansion and Loan Program (HELP)	1998	1996 and 1997	46.2	49.0
Florida	Florida State Infrastructure Bank	1995	1996, 1997, 1998, 1999, 2003	101.1	126.3
Michigan	Michigan State Infrastructure Bank	1995	1997	11.1	15.0
Missouri	Missouri Transportation Finance Corporation	1997	1996, 1997, 1999	48.4	59.7
Ohio	Ohio State Infrastructure Bank	1997	1996 and 1997	87.0	127.0
Oregon	Oregon Transportation Infrastructure Bank	1996	1997 and 1997	14.5	15.5
South Carolina	South Carolina Transportation Infrastructure Bank	1997	1997	3.0	66
Pennsylvania	Pennsylvania Infrastructure Bank	1998	1997	17.4	87.2
Texas	Texas State Infrastructure Bank	1995	1996 and 1997	171.3	214.1

Source: Chen 2016.

By taking causality seriously and leveraging recent advances in econometric methods, this study provides new insights into the effectiveness of SIBs as a financing instrument within a multilevel governance context. It also sheds light on how institutional features, program design, and administrative practices influence the capacity of SIBs to mobilize investment. Ultimately, the findings presented here aim to inform both academic debates and policy decisions about the future role of innovative financing in closing America's infrastructure investment gap.

The remainder of this report is organized as follows. The next section reviews existing empirical studies on SIBs and outlines the theoretical framework for understanding their expected fiscal impact. This is followed by a detailed explanation of the data, research design, and estimation strategy. Empirical findings are then presented, followed by a discussion of implications. The report concludes with a summary of key insights and recommendations for policy and future research.

II. Literature Review

Theoretical Rationale for the Leveraging Effect of SIBs

From a theoretical perspective grounded in intergovernmental finance and public investment theory, State Infrastructure Banks (SIBs) are designed to stimulate subnational infrastructure investment by leveraging limited federal and state funds through a revolving loan fund (RLF) mechanism. As Humphrey and Maurice (1986) argue in their foundational work on revolving funds, the central appeal of the RLF model lies in its ability to recycle capital—loan repayments and interest income are reinvested in future infrastructure projects, thereby multiplying the effect of an initial pool of seed funding. In the case of SIBs, this mechanism is intended to expand the financial capacity of states and localities to finance transportation projects without relying exclusively on traditional grant-based federal aid.

The leveraging effect operates through two channels. First, temporal recycling allows the same capital to fund multiple projects over time, creating a compounding effect on infrastructure investment. Second, financial signaling—the presence of a dedicated, low-interest credit facility—may attract additional non-federal investment, including public-private partnerships or municipal bond financing, by improving project viability and reducing upfront financing constraints.

However, the success of this model hinges on one critical condition: the financial sustainability of the fund. If borrowers fail to repay their loans on time or default entirely, the pool of capital available for reinvestment shrinks, compromising the RLF’s core functionality. Recognizing this risk, SIB programs across states have adopted several safeguards to maintain portfolio health and ensure fund continuity.

Most SIBs implement standardized loan evaluation and underwriting criteria that prioritize the borrower's financial strength, project revenue projections, and repayment capacity. These safeguards mirror private sector lending practices, ensuring that loans are allocated to financially sound projects. In addition, many states maintain statutory authority to intercept state aid in the event of a borrower default, effectively using intergovernmental transfers as collateral. This mechanism serves as a powerful deterrent to nonpayment and significantly lowers credit risk. Collectively, these institutional and legal protections bolster the creditworthiness of SIB portfolios and help maintain the long-term viability of the revolving fund.

In summary, the theoretical justification for SIBs rests on their ability to leverage initial public investment through a well-managed, self-replenishing loan cycle. When properly designed and administered, SIBs represent a fiscally sustainable and policy-responsive tool to address infrastructure investment gaps at the state and local level. Their revolving structure distinguishes them from conventional grant programs, making them an increasingly attractive instrument in an era of constrained public finance.

Existing Empirical Studies

Despite the longstanding use of State Infrastructure Banks (SIBs) as a federal-state financial instrument for transportation infrastructure, empirical research evaluating their effectiveness remains sparse. To date, only three peer-reviewed studies—Ryu (2006, 2007) and Chen (2016)—have directly examined whether SIBs succeed in leveraging additional state and local transportation investment. These studies provide important early insights but are limited by methodological challenges, particularly concerns about endogeneity and selection bias.

In one of the earliest empirical investigations, Ryu (2006) estimates the fiscal impact of federal SIB capitalization funds on state highway spending. The study uses panel data from U.S. states and focuses on the short-term period immediately following the federal capital injections in 1997. The results suggest that each federal dollar deposited into a SIB stretched state highway spending by as much as $7.55 between 1998 and 2000. This finding implies a high fiscal multiplier effect, suggesting that SIBs may be highly effective in mobilizing additional state investment.

However, this initial estimate raised questions about potential overstatement due to the simplicity of the modeling approach. The study does not control for the possibility that states with more pressing infrastructure needs or stronger fiscal institutions were more likely to adopt and use SIBs aggressively. To address some of the limitations in his earlier work, Ryu (2007) conducted a more refined and extended analysis of SIB impacts, focusing on the period from 1998 to 2003. By improving the estimation strategy and accounting for more covariates, the study finds that the federal SIB funds deposited in 1997 yielded a more conservative—but still significant—leverage effect: each federal dollar contributed to approximately $2.57 in additional state highway spending. Ryu concluded that the SIB program had served as a “successful tool to stretch limited state resources” and “exert[ed] much stronger fiscal impacts on state highway expenditures” (p. 64). Nevertheless, the study still relied on observational methods and did not fully address selection bias, leaving open the possibility of confounding factors influencing both SIB adoption and infrastructure investment outcomes.

Building on these foundational studies, Chen (2016) shifts the focus from aggregate federal capitalization amounts to the specific characteristics of awarded SIB loans. This study examines data from seven states between 1998 and 2010, using detailed information on loan disbursement schedules and recipients. Unlike Ryu's studies, which focus solely on state-level highway spending, Chen incorporates combined state and local highway capital expenditures to better capture the full scope of SIB influence. The key finding is that each dollar of lagged SIB loan disbursement (three-year lag) increases current-year capital expenditures by nearly $3.00. This result underscores the potential of SIBs not just as federal-to-state transfers but as true revolving loan funds capable of crowding in additional investment at multiple levels of government.

Chen's study offers important insights into the fiscal dynamics of SIB lending and highlights the revolving nature of loan repayments and interest accumulation. However, like previous work, it does not account for the endogenous nature of program participation. States may self-select into the SIB program based on unobservable characteristics such as institutional capacity, fiscal distress, or infrastructure priorities, which may also affect investment outcomes.

Research Gap

In summary, while existing empirical studies have made important contributions to understanding the potential fiscal impacts of State Infrastructure Banks (SIBs), they suffer from significant methodological limitations that constrain the validity of their conclusions. Chief among these concerns is the issue of endogeneity, which arises from the non-random nature of SIB program adoption across states.

Participation in the federally capitalized SIB program is a state-level policy choice—not the result of an exogenous assignment or experimental design. States that chose to establish and operate SIBs may systematically differ from non-adopting states in terms of their transportation infrastructure needs, fiscal capacity, political preferences, institutional capacity, or propensity to pursue innovative financing tools. These unobserved characteristics may influence both the likelihood of adopting a SIB (treatment assignment) and the level of transportation investment (outcome), thus confounding the observed relationship.

Previous studies have largely relied on observational data and standard regression techniques, which are limited in their ability to establish causal inference in the presence of such confounding factors. As a result, it is difficult to determine whether the observed increases in transportation investment are truly attributable to SIB participation or to underlying state characteristics correlated with both adoption and investment trends.\

Given these concerns, a rigorous causal reexamination of the fiscal impacts of federally capitalized SIBs is necessary. Specifically, there is a clear need for a quasi-experimental design that can more credibly estimate the counterfactual scenario—what transportation investment levels would have looked like in SIB-adopting states had they not implemented the program. Such an approach must address selection bias, account for unobserved heterogeneity across states and time, and isolate the treatment effect of SIB participation from other contemporaneous influences.

This study addresses this research gap by applying the staggered Difference-in-Differences (SDID) method to produce robust and unbiased estimates of treatment effects under non-random treatment assignment. By leveraging a 30-year panel dataset across all 50 states, this study provides the most rigorous and comprehensive causal assessment to date of the extent to which federally capitalized SIBs have succeeded in leveraging additional state and local transportation investment.

III. Research Design

Evaluating the causal impact of federally capitalized State Infrastructure Banks (SIBs) on subnational transportation investment requires a research design that can credibly disentangle the effect of SIB adoption from other contemporaneous influences on state and local infrastructure spending. Because states were not randomly assigned to adopt SIBs, and because program participation was likely influenced by fiscal pressures, infrastructure needs, and institutional capacity, the empirical strategy must address both observed and unobserved confounding factors. This study adopts a staggered Difference-in-Differences (DID) approach to estimate the treatment effect of SIB adoption on transportation capital expenditures. The staggered DID framework is particularly well suited to this context, as states adopted SIB programs at different times and under varying circumstances, creating natural variation in treatment timing across the units of analysis.

The fundamental logic of the DID approach is to compare changes in the outcome variable—transportation capital spending—before and after SIB adoption in treated states, relative to changes in the same outcome over the same period in untreated (or not-yet-treated) states. In a setting with staggered adoption, states that have not yet implemented a SIB serve as contemporaneous controls for those that have, while eventually treated states can also serve as controls in pre-treatment periods. This approach allows for the construction of a counterfactual trend for each treated state based on the experience of otherwise similar units that did not receive the treatment at that time.

To formally estimate this effect, we begin with the following two-way fixed effects specification:

$$Y_{it} = \alpha_i + \delta_t + \beta \cdot \text{SIB}_{it} + \mathbf{X}'_{it}\boldsymbol{\gamma} + \varepsilon_{it}$$

In this model, Y_{it} represents the outcome variable of interest—real per capita capital expenditures on state and local highway infrastructure for state *i* in year *t*. The variable of SIB_{it} is an indicator equal to one if state *i* had an active and federally capitalized SIB in year *t*, and zero otherwise. The parameter β is the coefficient of interest and is interpreted as the average treatment effect on the treated (ATT), capturing the causal impact of SIB implementation on infrastructure investment. The model includes state fixed effects α_i to absorb time-invariant characteristics specific to each state, such as geography, political institutions, or baseline infrastructure conditions. Year fixed effects δ_t control for national policy changes, federal funding availability, macroeconomic cycles, and other shocks common across all states in a given year. The vector X_{it} includes time-varying state-level covariates that may influence both SIB adoption and infrastructure spending. These include indicators of state economic conditions (e.g., real GDP per capita, personal income), demographic pressures (e.g., population size, urbanization), and fiscal and political variables (e.g., fuel tax rates, and partisan control of government). The error term ε_{it} is clustered at the state level to allow for arbitrary autocorrelation within states over time.

However, recent methodological advances have shown that when treatment timing is staggered—as it is in the case of SIB adoption—standard two-way fixed effects estimators can produce biased or inconsistent estimates if treatment effects are heterogeneous across units or time. To overcome these limitations, we implement interaction-weighted estimators as proposed by Sun and Abraham (2021), and group-time average treatment effects following Callaway and Sant'Anna (2021). These models allow treatment effects to vary across cohorts and time, and they avoid the negative weighting problem associated with traditional TWFE models. By separately estimating treatment effects for each adoption cohort and aggregating them using appropriate weights, these methods produce more credible estimates of both average and dynamic policy impacts.

A key assumption of the DID identification strategy is that, in the absence of treatment, the treated and control states would have experienced parallel trends in the outcome variable. To assess the plausibility of this assumption, we estimate event study models that trace the evolution of transportation investment before and after SIB adoption. The event-time specification models the outcome as a function of relative time to treatment:

$$Y_{it} = \alpha_i + \delta_t + \sum_{k \neq -1} \beta_k \cdot D_{i,t+k} + \mathbf{X}'_{it}\gamma + \varepsilon_{it}$$

In this equation, $D_{i,t+k}$ is an indicator for whether year *t* is *k* periods away from SIB adoption in state i, with $k=-1$ (the year before treatment) omitted as the reference period. This model allows us to assess both pre-treatment dynamics and the temporal trajectory of treatment effects. If the pre-treatment coefficients β_k for $k<0$ are statistically indistinguishable from zero, this provides support for the parallel trend' s assumption. Post-treatment coefficients provide insights into the timing, persistence, or attenuation of policy effects.

IV. Data and Variables

To empirically evaluate the causal impact of federally capitalized State Infrastructure Banks (SIBs) on state and local transportation investment, we construct a novel panel dataset covering all 50 U.S. states over the period 1990 to 2010. This 21-year panel is designed to capture both the early phase of SIB adoption and subsequent program implementation across multiple states. The panel allows us to observe pre-treatment trends and post-treatment effects for both early and late adopters, while providing adequate statistical power and temporal depth for event study and difference-in-differences estimation.

Outcome Variables

The primary outcome variable used in this analysis is combined state and local capital expenditures on highways, measured in real per capita terms. This variable captures total capital outlays—exclusive of maintenance and operations—by both state departments of transportation and local government entities within each state.

Data on highway capital spending are drawn from the Federal Highway Administration's Highway Statistics Series, an authoritative and standardized source that reports annual financial data by state. These data are adjusted for inflation using the GDP deflator and expressed in constant 2010 dollars to ensure comparability across states and years.

Treatment Variable

The treatment variable is a binary indicator capturing whether a given state had an active, federally capitalized State Infrastructure Bank (SIB) in a given year. Specifically, the variable equals 1 if a state had a SIB that was operational—i.e., legally authorized and issuing loans—in year t, and 0 otherwise.

Information on SIB adoption, capitalization, and operation is collected manually from a variety of state-level sources, including official documents from departments of transportation, state legislative records, and administrative rulebooks. This information is then cross-validated using independent sources such as newspaper archives, government reports, and third-party policy evaluations to ensure historical accuracy. The timing of adoption is coded based on the year in which a state began issuing loans through its SIB, rather than the year of legislative authorization alone.

Control Variables

To isolate the impact of SIB adoption from other drivers of transportation investment, the model includes a set of time-varying control variables at the state level. These covariates account for economic, demographic, and political conditions that may influence both the likelihood of SIB adoption and infrastructure spending trends.

Key economic variables include real gross state product per capita, median household income, state revenue and expenditure per capita, and unemployment rates, which capture the broader fiscal capacity and economic climate of each state. Demographic controls include total population, population density, and urbanization rate, which proxy for transportation demand. Political variables include gubernatorial party affiliation, legislative partisan control, and indicators for election years, drawn from sources such as the National Governors Association (NGA), the Council of State Governments (CSG), and the National Conference of State Legislatures (NCSL).

All monetary variables are deflated to 2010 dollars to control for inflation and are expressed on a per capita basis to account for variation in state population sizes. This ensures that comparisons across states reflect changes in fiscal effort and investment behavior rather than differences in scale or cost of living.

Table 2 presents descriptive statistics for all variables used in the empirical analysis, including the outcome variables, treatment indicator, and control variables. The table includes the mean, standard deviation, minimum, and maximum values for each variable across the panel. These statistics provide an overview of the variation in infrastructure spending and institutional conditions across U.S. states over the sample period.

Table 2: Descriptive statistics by group

	Non-Adopters (N=594)		Adopters (N=456)	
	Mean	SD	Mean	SD
State and Local Highway Capital Expenditure	920,812	806,548	1,649,678	1,811,876
State and Local Highway Capital Expenditure per Capita	225.43	96.45	294.01	136.91
Vehicle Miles Travelled per Capita	9.73	1.68	10.49	1.89
Travel Time Index	1.16	0.09	1.18	0.09
Vehicle Registrations per Capita	0.84	0.40	0.84	0.15
Republican Governor	0.51	0.50	0.55	0.50
Percentage of Senate Democratic	0.57	0.18	0.50	0.16
Percentage of House Democratic	0.58	0.17	0.50	0.16

V. Empirical Findings

Baseline Estimates

To evaluate the average treatment effect (ATT) of federally capitalized State Infrastructure Bank (SIB) adoption on transportation infrastructure investment, we begin with a baseline model estimated using staggered Difference-in-Differences (DID). We first estimate a model without covariates (Figure 1) and then include time-varying controls—specifically, vehicle registrations per capita and political party control of the state legislature (Figure 2). Table 3 reports the ATT estimates for both specifications.

Table 3: Average treatment effect of SIB adoption on state and local highway capital spending.

	State & Local Highway Capital Expenditure per capita	
	(1)	(2)
ATT	26.04 (1.85)	25.39* (2.33)
Controls	*No*	*Yes*

Note: t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the uncontrolled specification, we do not observe a statistically significant effect of SIB adoption on combined state and local capital expenditures. However, when controls are added, we find that SIB adoption is associated with an average increase of $25.39 per capita in real highway capital spending. This suggests that controlling for underlying demand for road use (proxied by vehicle registrations) and political orientation improves the precision and consistency of the treatment effect estimate.

Importantly, we test the parallel trends assumption using event-time indicators and find no statistically significant differences in pre-treatment spending levels between treated and untreated states. This is confirmed by the p-values reported in Table 4, which indicate that differences in the years leading up to adoption are not significantly different from zero. These findings provide support for the internal validity of our DID identification strategy.

Table 4: Average treatment effect of SIB adoption on state and local highway capital spending.

	State & Local Highway Capital Expenditure per capita	
	(1)	(2)
Pre-treat avg	1.699	2.140
	(0.49)	(0.61)
Post-treat avg	24.12	23.70*
	(1.70)	(2.15)
T-6	26.07*	31.54**
	(2.57)	(2.69)
T-5	-13.46	-14.80
	(-1.43)	(-1.42)
T-4	18.75	17.93
	(1.37)	(1.03)
T-3	-9.694	-7.362
	(-0.81)	(-0.62)

T-2	-3.894 (-0.58)	-4.422 (-0.65)
T-1	-7.571 (-1.24)	-10.05 (-1.49)
T+0	15.74* (2.19)	15.74* (2.18)
T+1	26.58* (2.43)	31.85** (2.87)
T+2	24.24 (1.57)	34.27** (2.61)
T+3	25.50 (1.58)	25.31 (1.80)
T+4	36.24* (2.07)	31.03 (1.85)
T+5	28.68* (1.97)	28.67* (2.24)
T+6	33.60* (1.99)	32.32* (2.15)
T+7	35.12 (1.88)	32.15* (2.04)
T+8	38.26 (1.72)	30.87 (1.67)
T+9	29.18 (1.38)	26.02 (1.62)
T+10	14.57 (0.65)	16.51 (0.94)
T+11	11.87 (0.44)	8.349 (0.41)
T+12	29.62 (0.89)	33.88 (1.40)
T+13	25.02	16.88

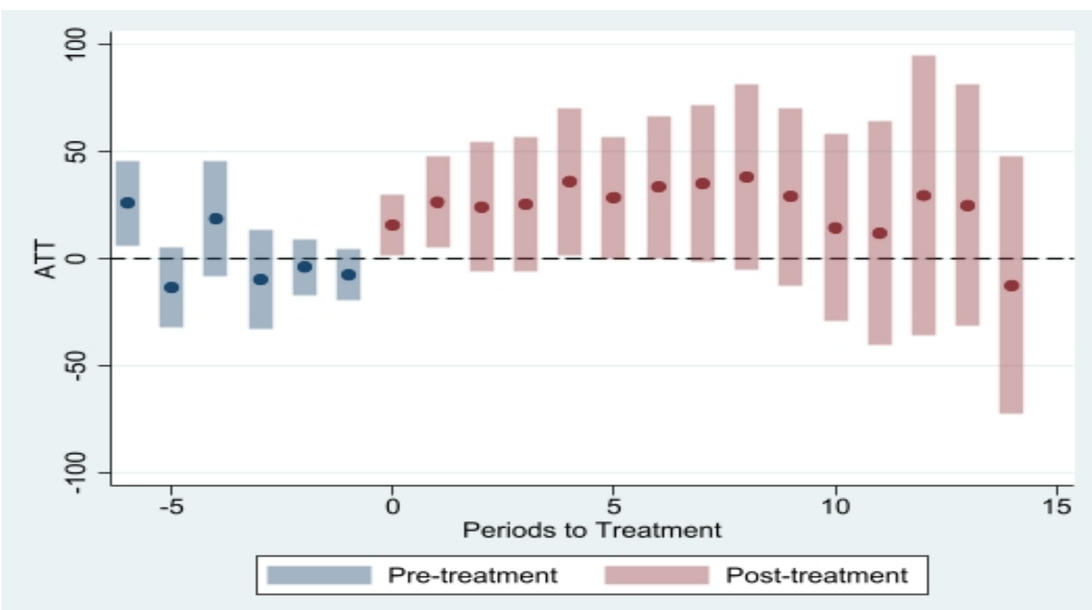
	(0.87)	(0.77)
T+14	-12.46 (-0.41)	-8.373 (-0.27)
Controls	*No*	*Yes*

Note: t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Dynamic Treatment Effects

To explore how the effect of SIB adoption evolves over time, we estimate dynamic treatment effects using an event study approach. As shown in Figure 1, the largest effects occur within the first two years after adoption, with real per capita capital investment increasing significantly in the immediate aftermath of program implementation. The magnitude of the effect then stabilizes and remains relatively consistent for several years before gradually declining around the fifth-year post-adoption. A second sharp increase is observed in year 12, although it is short-lived and followed by another decline.

Figure 1: Average treatment effect per year relative to treatment time



Compared to previous research—most notably Chen (2016), which found that the effects of SIB loans only materialized three years after adoption—our findings suggest that the fiscal response to SIB adoption is more immediate and front-loaded. This may reflect accelerated loan disbursement schedules or faster project mobilization in the years following initial capitalization.

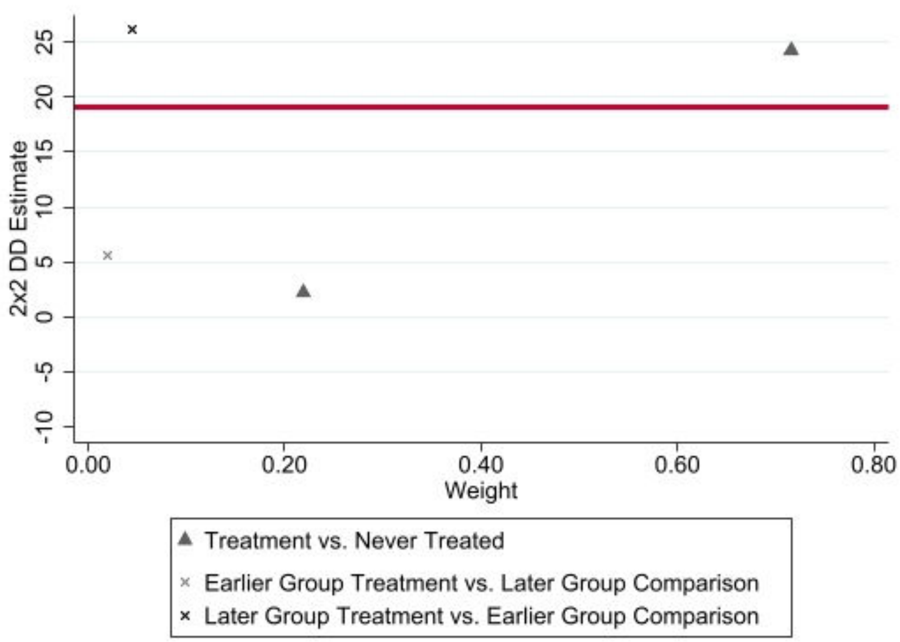
However, the decline in treatment effects over time also points to programmatic limitations. Our examination of loan data from SIBs indicates that many states failed to maintain active lending portfolios. Of the 32 states included in our sample, only 13 maintained consistently active SIB programs throughout the study period. In the majority of states, SIB activity diminished over time, with limited success in expanding the initial capitalization through revolving mechanisms. This is consistent with findings from Ke and Liu (2023), who observed that even among the most active SIBs, demand for loans remained relatively low. Many state and local transportation agencies appear to prefer traditional financing instruments, which may offer simpler administrative processes or better alignment with existing procurement cycles.

Robustness Checks

To validate our baseline findings, we estimate the ATT using an alternative approach developed by Goodman-Bacon (2021), which decomposes the staggered DID into weighted averages of all possible two-by-two comparisons. This estimator considers four types of group comparisons: early adopters vs. late adopters, late adopters vs. early adopters, early adopters vs. never adopters, and late adopters vs. never adopters. The weights assigned to each comparison group depend on the relative sizes of the groups and the timing of treatment.

Figure 2 displays the results from this decomposition. The estimated ATT is approximately $19.16 per capita, which is substantively similar, though slightly lower in magnitude, than the estimate from our controlled baseline model. Notably, we obtain an identical estimate using a naïve DID model that does not account for differential treatment timing. This is likely due to the limited variation in treatment years in our sample—most adoptions occurred within a narrow two-year window (1996–1997)—thus minimizing the impact of treatment timing heterogeneity.

Figure 2: Average Treatment Effect by Goodman-Bacon Decomposition.



Extension Assessing Broader Infrastructure Outcomes

Beyond examining the fiscal impacts of State Infrastructure Banks (SIBs) on capital spending, this study extends the analysis by evaluating whether SIB adoption contributed to broader improvements in the performance of state and local transportation infrastructure systems. In particular, we explore two functional indicators of system use and efficiency: Vehicle Miles Traveled (VMT) per capita and the Travel Time Index (TTI). These metrics provide insights into the utilization and operational effectiveness of transportation networks following infrastructure investment.

The VMT per capita indicator measures the aggregate distance traveled by all vehicles in a state, divided by the population. It captures both infrastructure supply and demand dynamics. An increase in VMT per capita may indicate enhanced network connectivity or capacity, provided it is not solely driven by higher car ownership. The TTI, developed by the Texas A&M Transportation Institute, captures the ratio of peak-period travel time to free-flow travel time, thereby reflecting the extent of traffic congestion in urbanized areas. A lower TTI indicates more efficient traffic flow, which may result from expanded road networks or better traffic management.

To estimate the effect of SIB adoption on these outcomes, we apply the same staggered Difference-in-Differences (DID) approach used in the baseline capital expenditure models. For each outcome, we estimate two specifications. The first omits control variables, while the second includes total vehicle registrations to account for changes in the number of cars on the road, which directly affect both VMT and TTI. Unlike the baseline model—where we control for vehicle registrations on a per capita basis—this specification uses total registrations because

VMT and congestion levels are more directly influenced by the absolute number of vehicles rather than their density per resident.

Controlling for total vehicle registrations is essential for isolating the supply-side impact of SIB-induced infrastructure expansion. In the case of VMT, increases could result from either more vehicles or more miles of roadway. By accounting for the number of vehicles, we are better able to attribute any increase in travel distance to network improvements rather than rising demand alone. Similarly, a change in TTI without adjusting for vehicle growth may conflate reductions in congestion with mere declines in demand. Including this control ensures that any observed improvements in TTI reflect enhanced system capacity rather than shifts in usage patterns.

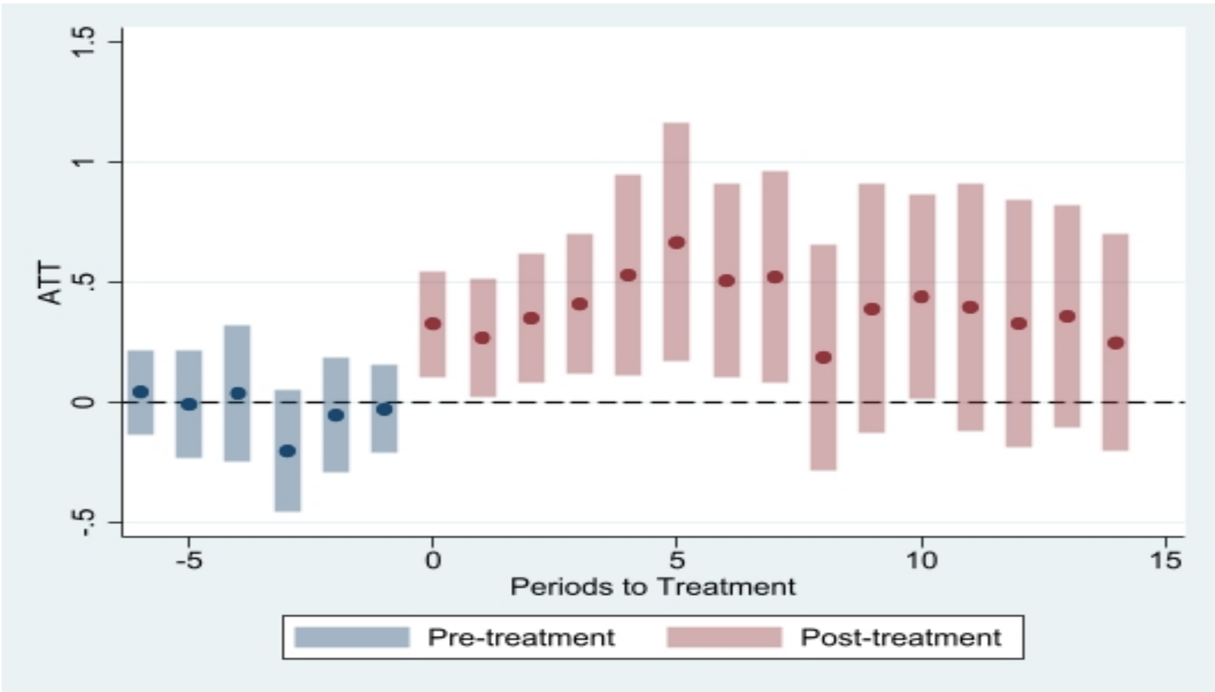
The results of these models are presented in Table 5. Among the four specifications—two for each outcome variable—only one yields a statistically significant treatment effect. Specifically, in the model estimating the impact of SIB adoption on VMT per capita while controlling for total vehicle registrations, we find a statistically significant increase of 0.404 miles per capita annually. This effect, while modest in magnitude, suggests that SIB adoption is associated with increased use of the transportation system, plausibly due to expanded road network mileage or improved connectivity. The corresponding event-study estimates confirm that this treatment effect is stable over time, and that pre-treatment trends between treated and control groups are not statistically different from zero (Figure 3), supporting the parallel trends assumption.

Table 5: Average treatment effect of SIB adoption on state highway outcomes

	(1) VMT per capita	(2) VMT per capita	(3) TT index	(4) TT index
ATT	0.275	0.404*	-0.00462	-0.00245
	(1.50)	(2.54)	(-0.88)	(-0.52)
Controls	*No*	*Yes*	*No*	*Yes*

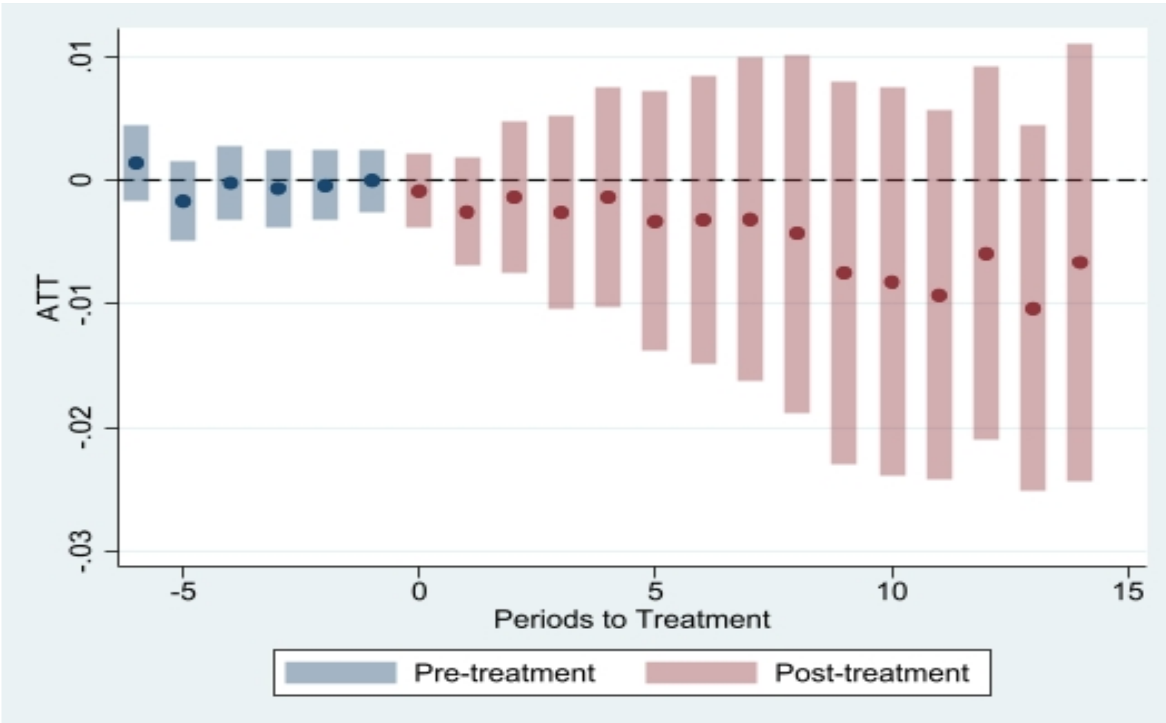
t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 3: Average treatment effect of SIB on state VMT per capita



In contrast, we do not observe statistically significant effects of SIB adoption on the Travel Time Index in either specification. However, Figure 4 illustrate a consistent, albeit modest, year-over-year decline in TTI following adoption, suggesting a possible reduction in congestion. While these effects are not statistically significant, they may indicate incremental improvements in traffic flow resulting from infrastructure enhancements. Pre-treatment trends in TTI are nearly identical between treated and control states, again validating the DID design.

Figure 4: Average treatment effect of SIB on state TTI



Taken together, these extension analyses provide tentative evidence that SIBs may contribute to broader infrastructure performance gains beyond capital expenditure. However, the effects are relatively weak and appear highly contingent on model specification and outcome selection. A key limitation of this extension is the use of VMT and TTI as outcome variables. In much of the transportation economics literature, these indicators are typically treated as demand-side metrics, reflective of user behavior and economic activity, rather than direct outcomes of infrastructure expansion. Consequently, interpreting increases in VMT or declines in TTI as signs of infrastructure success should be done cautiously.

To more accurately assess whether SIBs have fulfilled their long-term objectives, future research should focus on developing more precise, supply-side measures of infrastructure development. Potential indicators include the total miles of state and local roads added, the number and size of projects financed, and quantitative assessments of road and bridge conditions, such as pavement quality indices or bridge sufficiency ratings. In addition, efforts to more clearly define and operationalize the broader goals of the SIB program—whether financial sustainability, project acceleration, or network expansion—would greatly enhance evaluation strategies.

Overall, while this study provides initial insights into the possible downstream benefits of SIB adoption on infrastructure system performance, it also highlights the need for more targeted and theoretically grounded metrics to fully capture the impact of this policy innovation.

Limitations and Future Directions

While our analysis provides new causal evidence on the fiscal and infrastructure effects of SIBs, it also reveals important limitations in the program's implementation. The observed decline in effectiveness over time—driven in part by the waning activity of many state programs—highlights structural weaknesses in the revolving fund model, such as insufficient capitalization growth, limited borrower demand, and administrative complexity.

Moreover, the use of VMT and TTI as proxy outcomes has interpretive challenges. In the transportation planning literature, these indicators are often treated as measures of demand pressure, not supply outcomes. Consequently, future research should explore direct measures of infrastructure capacity and quality, such as total lane miles added, the number of projects financed, or road condition indices. These metrics would more directly capture the supply-side effects of SIB investments.

To better assess whether SIBs are achieving their broader goals, a clearer articulation of the program's theory of change and intended outcomes is needed. This would help align evaluation efforts with the full scope of the program's objectives, including not only capital mobilization, but also economic development, project acceleration, and financial innovation at the subnational level.

VI. Conclusion and Discussion

State Infrastructure Banks (SIBs) were introduced as an innovative response to a growing mismatch between the scale of transportation infrastructure needs and the capacity of traditional funding sources to meet them. Declining motor fuel tax revenues, aging infrastructure assets, and rising demand from population growth and increased vehicle usage have strained the ability of state and local governments to maintain, upgrade, and expand their transportation networks. SIBs were designed to address this fiscal challenge by offering a revolving fund mechanism that uses federal seed capital and state matching funds to finance transportation projects through repayable loans. In doing so, they aim not only to supplement conventional grant-based systems but also to create a sustainable and leveraged source of infrastructure finance.

This study provides rigorous causal evidence that SIBs have contributed meaningfully to increasing state and local highway capital investment. Using a staggered Difference-in-Differences approach, we find that SIB adoption is associated with significant increases in real per capita transportation infrastructure spending, particularly in the immediate years following implementation. These results hold across multiple model specifications and remain robust under alternative estimation techniques. The findings support the theoretical logic that SIBs can amplify the fiscal capacity of subnational governments by recycling repayments into new lending activity and leveraging public dollars through credit enhancement tools.

Yet, while the overall fiscal effect of SIB adoption is positive, the analysis also reveals important limitations in program implementation and long-term performance. The magnitude of the treatment effect declines over time, and only a minority of states have maintained active SIB operations throughout the study period. Many programs appear to have become dormant after exhausting their initial capitalization. Loan volumes decreased, revolving activity slowed, and in some cases, states reverted to more familiar financing tools. Our findings align with previous research suggesting that SIBs often face challenges in generating sufficient loan demand, maintaining administrative capacity, and aligning with state-level procurement or project development processes.

This decline in utilization undermines the full potential of SIBs to serve as a sustained and scalable solution to infrastructure financing challenges. In many cases, SIBs remain underused, with available funds sitting idle or being redirected toward other state fiscal priorities. Furthermore, inconsistencies in program design and institutional support across states contribute to uneven performance and make it difficult to generalize lessons or establish best practices.

The findings of this study point to a clear need for policy attention and institutional reform. First, to strengthen the leveraging capacity of SIBs, federal and state governments should consider recapitalization mechanisms that reward continued lending performance and program sustainability. Second, technical assistance programs—possibly coordinated by the U.S. Department of Transportation—could help states improve their program design, underwriting standards, and marketing to potential borrowers. Third, greater integration of SIBs into broader state infrastructure strategies and long-term capital plans could ensure that loan funds are more directly tied to high-priority and shovel-ready projects.

Moreover, policymakers should explore opportunities to increase the attractiveness of SIB financing to local governments and private project sponsors. Streamlining administrative processes, reducing transaction costs, and providing guidance on how SIBs can complement or substitute for municipal bonds or other federal financing programs may expand the pipeline of eligible and interested borrowers. Enhanced transparency in loan performance and reporting, as well as peer-to-peer learning between high-performing and underperforming states, can also contribute to institutional learning and accountability.

Finally, future evaluation efforts should go beyond fiscal inputs and outputs to examine the infrastructure outcomes and public value generated by SIB-financed projects. While this study provides some preliminary evidence of increased vehicle miles traveled (VMT) and reduced traffic congestion following SIB adoption, more direct indicators of infrastructure expansion—such as lane miles added, bridges rehabilitated, or pavement quality scores—would offer a fuller picture of program impact. A deeper articulation of the broader goals of the SIB program, coupled with refined metrics of success, will be essential for assessing its contribution to sustainable and equitable transportation systems.

In conclusion, SIBs represent a promising but underutilized tool in the intergovernmental finance toolkit. When structured and managed effectively, they can expand investment capacity, promote fiscal discipline, and accelerate project delivery. However, realizing this potential requires renewed commitment to strengthening institutional capacity, fostering borrower engagement, and aligning program operations with long-term infrastructure strategies. As the U.S. faces a new era of transportation and climate investment under the Infrastructure Investment and Jobs Act and beyond, the lessons from SIB implementation offer important insights for the design of future financing innovations.

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