Maintaining Maintenance: The Real Effects of Financial Reporting for Infrastructure[*]

Ryan P. McDonough[†]
Assistant Professor of Accounting
Associate Member, Rutgers Center for Governmental Accounting Education and Research
Rutgers University
mcdonough@business.rutgers.edu

Claire J. Yan
Assistant Professor of Accounting
Associate Member, Rutgers Center for Governmental Accounting Education and Research
Rutgers University
cyan@business.rutgers.edu

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[†] McDonough and Yan are at Rutgers Business School—Newark and New Brunswick, 100 Rockafeller Road, Piscataway, NJ 08854.

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Abstract: We use the adoption of GASB 34 to examine whether states' infrastructure reporting policies are associated with their investments in infrastructure maintenance, which is often neglected and deferred to future periods. GASB 34 required governments to report on general infrastructure assets for the first time using one of two reporting methods: the depreciation approach and the modified approach. In light of the increased disclosure requirements associated with the modified approach, we use the modified approach as a proxy for higher quality financial reporting about infrastructure. We find that, relative to states using the depreciation approach, modified approach states invest more to maintain their roads and bridges. We use two-stage least squares and difference-in-differences research designs, as well as several additional analyses, to allay endogeneity concerns. Our results suggest that states' financial reporting policies have real effects that ultimately can directly impact society. Our findings also raise the question of whether stakeholders have sufficient information to ascertain the magnitude and consequences of deferred investments in infrastructure maintenance.

Keywords: Deferred maintenance; financial reporting; GASB Statement No. 34; infrastructure; investment; state and local governments.

JEL Classifications: H76, M41, M48.

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1. Introduction

Public infrastructure assets—such as roads and bridges—are critical resources relied upon by businesses, non-profits, governments, and citizens alike. The U.S. Federal Highway Administration (FHWA) reports that approximately three trillion vehicle miles are traveled per year on over eight million lane miles of public roads, including over 600,000 bridges, that stretch across America's 50 states. State and local governments collectively spend in excess of $100 billion per year on the construction, maintenance, and repair of roads, bridges, and ancillary components (e.g., FHWA 2008, 2019). According to the National Association of State Budget Officers, states' transportation-related outlays are substantial, accounting for approximately 8% of their total expenditures (NASBO 2016).

Despite the importance of the nation's infrastructure and the magnitude of infrastructure spending, chronic underinvestment in infrastructure maintenance remains an issue that has elicited considerable concern among politicians, voters, capital providers, and public interest groups. For instance, the American Society of Civil Engineers (ASCE), which routinely assesses America's infrastructure, has assigned overall infrastructure grades ranging from a "D" to "C-" since the first grades were issued in 1998. Road pavements and bridges have consistently earned below a "C," indicating the presence of substantial deterioration and deficiencies that require attention. The ASCE recently estimated that funding for U.S. infrastructure is approximately $2.6 trillion short of the nearly $6 trillion needed to achieve a "B" infrastructure grade by 2029, and that this gap has been growing. Nearly half of the funding gap is due to insufficient funding for surface transportation systems such as roads and bridges (ASCE 2016, 2017, 2021). Reports such as the ASCE's have led to a heightened interest in the growing backlog of deferred infrastructure maintenance (e.g., Zhao et al. 2019), which calls for a better understanding of governments' infrastructure investment decisions.

We contribute to this important public discourse by assessing whether and to what extent governments' financial reporting policies influence investments in infrastructure maintenance. We focus specifically on states' infrastructure reporting policies. States were first required to report general infrastructure assets in their financial reports in 2001, following the adoption of GASB Statement No. 34, as amended (GASB 34) (see Section 2.1). GASB 34 generally requires governments to depreciate all capital assets, including infrastructure assets. However, following concerns raised by constituents about the GASB's preferred approach of depreciating infrastructure assets, the GASB introduced an alternative option—the modified approach—that governments are permitted to use for infrastructure assets, conditional on satisfying certain requirements.

Governments using the depreciation approach (DA governments or DA states) capitalize and depreciate infrastructure assets similar to other depreciable assets. Governments using the modified approach (MA governments or MA states) capitalize but do not depreciate eligible infrastructure assets; they expense the costs incurred to maintain these infrastructure assets in lieu of recording depreciation (see Appendix B). MA governments are required to provide additional disclosures and schedules demonstrating that the relevant infrastructure assets were maintained at or above the government's predetermined target condition level, as well as comparisons of the estimated annual amount needed and the actual amount spent to maintain those infrastructure assets at or above the established condition level. We find that nearly half of the states—specifically, 23 states—initially adopted the modified approach for roads and bridges.

We use the adoption of GASB 34 as our setting to examine whether and to what extent infrastructure reporting policies are associated with investments in infrastructure maintenance. Although the GASB introduced the modified approach as a compromise rather than its preferred approach (GASB 1999, paragraphs 340–341), we argue that the modified approach may result in higher financial reporting quality related to a government's infrastructure because of the increased disclosure requirements.[1] Higher financial reporting quality increases transparency that engenders more informed governments, which can improve monitoring of and budgeting for ongoing infrastructure investments. Thus, our principal hypothesis is that MA states will be less likely to underinvest in infrastructure by deferring critical maintenance activities. To test this hypothesis, we focus on state-owned roads and bridges because these are the infrastructure assets for which states adopt the modified approach.

Our primary proxies for investments in infrastructure maintenance are based on data that states are required by federal legislation to report to the FHWA, which we supplement with data hand collected from states' annual financial reports and other sources. We focus on investments in infrastructure maintenance because maintenance is critical to making use of and extending the service potential of long-lived infrastructure already in place, which, in turn, directly impacts economic activity, the provision of public services, mobility, and safety within and across state borders. Thus, the first measure, maintenance expenditures, captures the extent to which a state engages in activities that help maintain the condition of roads and bridges and delay or eliminate

[1] For the purposes of this study, we focus specifically on financial reporting for infrastructure assets. We, thus, conceptualize financial reporting quality in this context as the degree to which a government's financial report enables users (such as legislative and oversight bodies, citizens, and creditors) to make informed assessments of whether and the extent to which a government has deferred infrastructure maintenance. Our perspective is consistent with GASB Concepts Statement No. 1, which defines the objectives of general purpose external financial reporting by state and local governments (GASB 1987, paragraphs 77-79). Concepts Statement No. 1 indicates that financial reporting should "show whether current-year citizens received services but shifted part of the payment burden to future-year citizens" and "provide information about a governmental entity's physical and nonfinancial resources . . . including information that can be used to assess the service potential of those resources."

the necessity for future expenditures to restore, rehabilitate, or reconstruct roads and bridges. States spend, on average, approximately $260 million on maintenance each year.

The next two proxies for investments in infrastructure maintenance reflect the condition of roads and bridges. In particular, we use road and bridge condition assessments published by the FHWA to determine the percentage of state-owned roads in disrepair and bridges that are structurally deficient. Road conditions are measured using the International Roughness Index (IRI), which captures pavement smoothness and overall drive quality. Road pavements with a high IRI are considered to be in poor condition (see Section 3.3). Approximately 4% of roads are in poor condition. The FHWA also tracks the condition of bridges as part of its National Bridge Inventory. When the condition of a bridge's components (e.g., its deck, supports, or foundation) or its load-bearing capacity declines, the bridge may be classified as structurally deficient. Although this classification does not necessarily designate a bridge on the brink of collapse, it indicates that a bridge needs maintenance and repairs and should be monitored for safety issues. On average, 8% of square bridge meters are classified as structurally deficient.

Since infrastructure reporting policies are not randomly assigned to states, we take several steps to mitigate potential endogeneity concerns. First, we use a two-stage least squares (2SLS) regression approach. In the first stage, we use the timeliness of states' audited financial reports and biennial budget cycles as instrumental variables for adopting the modified approach, which we argue only affect investments in infrastructure maintenance through their effect on a state's infrastructure reporting policies (see Section 4.1.1). We follow Larcker and Rusticus (2010) and validate these instruments by testing for weak instruments and overidentification. We are unable to reject the validity of the instruments. We include in all regressions controls for economic, infrastructure, and institutional factors that could impact infrastructure reporting and investment.

In the second stage, we use the instrumented modified approach measure and find that, on average, MA states invest more to maintain their infrastructure assets than DA states invest. We also find that a smaller percentage of MA states' roads (bridges) are in poor condition (structurally deficient). Our 2SLS results are similar to the results from OLS estimations using a non-instrumented version of the modified approach measure. These tests support the notion that infrastructure reporting policies can potentially have real consequences in terms of states' infrastructure maintenance decisions.

To further mitigate endogeneity concerns, we use a difference-in-differences (DiD) research design in which we compare changes in the maintenance and condition of MA states' infrastructure (i.e., the "treatment" sample) with the maintenance and condition of DA states' infrastructure (i.e., the "control" sample) before and after the adoption of GASB 34. We include state and year fixed effects to control for state-level differences and time trends. Our OLS and 2SLS findings remain qualitatively similar when employing the DiD research design. Relative to DA states, MA states exhibit an incremental increase in infrastructure maintenance following the adoption of GASB 34's infrastructure reporting provisions. Similarly, MA states have an incremental improvement in bridge conditions. We also assess and provide evidence validating the parallel trends assumption underlying our DiD design (see Section 4.2.2).

We next explore a potential mechanism linking reporting policies to investments in infrastructure maintenance. We argue that the modified approach facilitates improved monitoring of and budgeting for states' infrastructure maintenance decisions, making reductions and diversions of funds initially intended for infrastructure maintenance less likely. Specifically, we examine patterns in midyear budget cuts to infrastructure spending and misallocations of motor fuel taxes (i.e., dedicated revenues for the maintenance of roads and bridges) to understand whether

MA states exhibit greater discipline over maintaining their infrastructure maintenance activities. We find that MA states are less likely to enact a midyear budget cut to their general fund infrastructure spending. In addition, MA states divert a smaller percentage of their motor fuel tax revenues to non-infrastructure purposes (e.g., law enforcement, education, and other general fund programs). These results suggest that the modified approach may promote accountability over taxpayer funds by facilitating investments in infrastructure maintenance programs.

We conduct several supplementary analyses. As an additional and relatively broad proxy for investments in infrastructure maintenance and management, we use infrastructure grades from the Government Performance Project. Across our OLS, 2SLS, and DiD designs, we find that MA states receive higher infrastructure grades than DA states. We also conduct falsification tests demonstrating that infrastructure reporting policies are not associated with the construction of new roads and bridges, which is subject to additional complexity involving right-of-way acquisitions, designing and engineering activities, financing, and politics. Finally, we confirm that our results are robust to dropping select observations with unusual circumstances, such as missing data. Our additional analyses support our main results and help allay concerns that our findings can be attributed to unobserved state characteristics.

This study makes progress in understanding the real effects of financial reporting. We specifically examine the effect of states' infrastructure reporting policies on investments in infrastructure maintenance, thus extending the influential literature examining the role of financial reporting in corporate investment (e.g., Biddle and Hilary 2006; Hope and Thomas 2008; McNichols and Stubben 2008; Biddle et al. 2009; Chen et al. 2011).[2] Rather than focusing on new investments (or capital expenditures), we study investments in the maintenance of assets already

[2] We refer readers to Kanodia and Sapra (2016), Leuz and Wysocki (2016), and Roychowdhury et al. (2019) for recent reviews of the literature addressing the impact of corporate financial reporting on firms' investment behavior.

in use, which can influence present service potential and future investment needs. We document the impact of disclosing infrastructure-related information in states' annual financial reports (e.g., actual and targeted condition levels), and provide evidence suggesting that higher financial reporting quality may increase investments in the maintenance of existing assets. We also extend the literature by demonstrating that infrastructure reporting is associated with improved budget discipline and allocations of designated infrastructure funds.

In addition, our study contributes to insightful academic and practitioner research and commentary previously published in the interdisciplinary infrastructure reporting literature (e.g., Patton and Bean 2001; Yarnell 2004; Benson et al. 2009; Vermeer et al. 2011; Jones et al. 2012; Walker and Jones 2012; Pryor 2013; Bloch et al. 2016; Benson and Marks 2017; Kim and Ebdon 2017), which is a segment of the broader governmental accounting literature (e.g., Plummer et al. 2007; Baber and Gore 2008; Bloch 2016). Researchers have previously indicated a need to provide deeper insights into the consequences of governments' infrastructure reporting policies (e.g., see Vermeer et al. 2011, 398 and 405). Our study addresses this gap in the literature while also responding to calls for more research on governmental financial reporting (see Kim et al. 2020) by expanding our understanding of the real effects of governments' financial reporting policies in the context of infrastructure. Consistent with an emerging literature on the real effects of financial reporting in the public sector (e.g., Naughton et al. 2015; Khumawala et al. 2020; Anantharaman and Chuk 2020), we find that states' reporting policies impact the maintenance of the roads and bridges that form the backbone of the nation.

The evidence we document is useful to the GASB, state and local governments, transportation authorities, municipal bond analysts and rating agencies, and others, such as citizens. Although conventional wisdom asserts that a dollar of prevention is worth more in repairs (or capital expenditures), deferring maintenance and prevention activities remains commonplace in the public and private sectors (e.g., Stein 2003; Graham et al. 2005; Healy and Malhotra 2009; Glaeser and Summers 2017; Caskey and Ozel 2017; Gailmard and Patty 2019). Our findings suggest that DA states may be more likely to head down the slippery path of deferring infrastructure maintenance. This is important because deferred maintenance is a cost that is pushed to future taxpayers in violation of the GASB's accountability principle of interperiod equity (GASB 1987, paragraphs 60-61). Ongoing deferrals potentially set the stage for service cuts, tax increases, and asset sales during periods of substantial fiscal stress (e.g., Costello et al. 2017). Ed Mazur, a former GASB Member, and other government stakeholders have raised concerns about governments not reporting on deferred infrastructure maintenance, making it impossible to ascertain from information disclosed in governments' annual financial reports the extent to which infrastructure maintenance has been deferred. Ed Mazur argued that "[t]here is no single unreported or underreported number on the balance sheets of state and local governments greater than the value of deferred maintenance of infrastructure" (Barrett and Greene 2014). In fact, the Government Performance Project survey found that infrastructure maintenance is a critical challenge for states, with many indicating that infrastructure maintenance is underfunded (Jimenez and Pagano 2012, 133). Our findings lend support to the idea of disclosing infrastructure maintenance expenditures and deferrals in a way that is readily available to governments' financial statement users.

The remainder of the paper proceeds as follows. In Section 2, we review the relevant standards-setting and academic literatures, and we present our hypotheses. In Section 3, we describe the sample and variables, and in Section 4, we discuss the main results. In Section 5, we discuss additional analyses and sensitivity tests. We conclude in Section 6.

2. Literature review and hypotheses

2.1. Accounting and reporting for infrastructure assets under GASB 34

Prior to GASB Statement No. 34, *Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Governments*, which was issued in June 1999, state and local governments issued fund financial statements using the modified accrual basis of accounting for governmental funds and the accrual basis of accounting for proprietary and fiduciary funds but did not prepare government-wide, accrual-basis financial information (e.g., Patton and Hutchison 2013). Governments reported general capital assets (i.e., capital assets pertaining to governmental activities) in the General Fixed Assets Account Group. General infrastructure assets, however, were not previously recorded in the General Fixed Assets Account Group or elsewhere in a government's financial statements.[3]

GASB 34 introduced, among other changes, government-wide, accrual-basis financial statements to the state and local government financial reporting model. State and local governments are required by GASB 34 to capitalize and report capital assets, including infrastructure assets, at historical cost (in some cases, governments were permitted to use the estimated historical cost for capital assets acquired prior to the initial implementation of GASB 34) in the government-wide Statement of Net Position (GASB 1999, paragraphs 18-20 and 149).[4] The effective date for applying the general provisions of GASB 34 for governments with total

[3] The GASB defines infrastructure assets as "long-lived capital assets that normally are stationary in nature and normally can be preserved for a significantly greater number of years than most capital assets" and indicates that "[e]xamples of infrastructure assets include roads, bridges, tunnels, drainage systems, water and sewer systems, dams, and lighting systems" (GASB 1999, paragraph 19).

[4] The Statement of Net Position was referred to as the Statement of Net Assets prior to GASB Statement No. 63, which was issued in June 2011 and was "effective for financial statements for periods beginning after December 15, 2011" (GASB 2011b). For consistency, we use the term Statement of Net Position to refer to both the Statement of Net Position and its predecessor, the Statement of Net Assets. Likewise, we use the term net position to refer to what was previously labeled net assets.

annual revenues of $100 million or more (i.e., Phase 1 governments) was the first fiscal year beginning after June 15, 2001. All state governments were considered Phase 1 governments. Other governments (i.e., Phase 2 and Phase 3 governments) were given an additional one to two years to implement the provisions of GASB 34 depending on the governments' total annual revenues (GASB 1999, paragraph 143). In addition to adopting the general provisions of GASB 34, including the prospective capital asset reporting requirements, Phase 1 and Phase 2 governments were permitted up to four additional years to *retroactively* apply the infrastructure reporting provisions that required governments to capitalize at historical cost, after adjusting for accumulated depreciation, the cost to acquire, construct, or improve major general infrastructure assets during the period from the fiscal year beginning after June 15, 1980 through the date a government implemented the general provisions of GASB 34 (GASB 1999, paragraph 148-149).[5] Vermeer et al. (2011) note that 45 of the 50 states immediately accounted for the retroactive capitalization of infrastructure assets upon implementing GASB 34. The other five states took advantage of some (or all, in the case of Rhode Island) of the four-year grace period.

Upon recording infrastructure assets in the government-wide Statement of Net Position, state and local governments are permitted to select between two approaches for reporting in the government-wide Statement of Activities the estimated cost of using eligible infrastructure assets: the depreciation approach and the modified approach (see Appendix B for an illustration of the accounting). Under the depreciation approach, which is the approach that was initially proposed by the GASB and is used for all other depreciable capital assets, governments allocate to expense the cost of "using up" an infrastructure asset in a systematic manner over the asset's estimated

[5] According to GASB 34, major general infrastructure assets include infrastructure networks (subsystems) associated with governmental activities for which the cost or estimated cost is expected to be at least ten (five) percent of the total cost of all general capital assets reported in the first fiscal year ending after June 15, 1999 (GASB 1999, paragraphs 148, 154, and 156).

useful life (e.g., the straight-line depreciation method). In recognizing the potential limitation of depreciation as an appropriate method for measuring the cost of using long-lived infrastructure assets that governments aim to preserve over time, and responding to concerns expressed about the usefulness of reporting the historical cost and annual depreciation amounts for infrastructure assets, the GASB developed, as a compromise, an alternative infrastructure reporting method—that is, the modified approach—under which a government does not report depreciation expense if certain requirements are met (e.g., GASB 1999, paragraphs 340–341; van Daniker and Harris 1999; Patton and Bean 2001).

Under the modified approach, a government records as an expense all expenditures made for eligible infrastructure assets that are not for additions or improvements (GASB 1999, paragraphs 25 and 132b). Governments using the modified approach must have an asset management system in place that has an inventory of all eligible infrastructure assets and is capable of providing the following information as required supplementary information (RSI): (1) the condition of those eligible infrastructure assets, (2) evidence that those infrastructure assets are being preserved approximately at or above the government's predetermined and disclosed condition level, and (3) an estimate of the cost needed to maintain and preserve the infrastructure assets at or above the established condition level, as well as the actual amount spent in each year (GASB 1999, paragraphs 23-24).[6] If a government does not maintain its modified approach infrastructure assets, if any, at or above the predetermined condition level, the government would be expected to begin using the depreciation approach for the relevant assets (GASB 1999, paragraph 26). Rather than switching to the depreciation approach, a government could instead choose to adjust the condition level needed to satisfy the infrastructure reporting requirements

[6] As part of these requirements, GASB 34 also clarifies that governments must disclose the basis for the condition measurement and the scale used to assess the condition of eligible infrastructure assets (GASB 1999, paragraph 133).

associated with the modified approach. However, paragraph 23 of GASB 34 notes that "the condition level should be established and documented by administrative or executive policy, or by legislative action." Although it is certainly possible to do, adjusting the established condition level is not merely a financial reporting matter. Vermeer et al. (2011, 384) quote a government official who stated it was "politically unpalatable to lower the target condition" level.[7]

2.2. Academic literature related to GASB 34

Academic research related to GASB 34 generally examines the usefulness of the consolidated government-wide financial information, which many consider to be the most significant requirement associated with the GASB 34 financial reporting model. Plummer et al. (2007) were among the first scholars to assess the effects associated with the adoption of GASB 34. They study Texas school districts and find that accrual-based, government-wide measures of financial position are associated with a school district's default risk and that the accrual-based measures of financial position provide information that is incremental to the modified accrual information contained in the governmental fund financial statements. Their study made a novel contribution to the literature by documenting the benefits of GASB 34 and, specifically, the benefits of requiring government-wide financial statements using the accrual basis of accounting.

Subsequent studies have extended Plummer et al. (2007)'s groundbreaking work and have contributed to a growing body of knowledge about the effects of GASB 34. Broadly speaking, the academic literature examining the economic consequences of GASB 34 suggests that government-wide financial information provides useful information to governments' stakeholders above and

[7] We reviewed states' annual financial reports to identify the occurrences in which MA states change their established condition level. During the period 2002-2016, eight MA states changed their condition level for some or all of their infrastructure assets. Five of the eight MA states decreased the condition level: Idaho in 2011, Indiana in 2011, Kentucky in 2011, Nevada in 2016, and Washington in 2016. Three MA states increased the condition level: Colorado in 2006, Delaware in 2008, and Kansas in 2012. Colorado later discontinued its use of the modified approach.

beyond the modified accrual information in the governmental fund financial statements (e.g., Johnson et al. 2012; Pridgen and Wilder 2013; Benson and Marks 2014; Reck and Wilson 2014; Bloch 2016). In particular, the GASB 34 literature offers some support for the notion that government stakeholders—particularly bondholders, bond insurers, and credit rating agencies—use the government-wide information in determining bond yields, insurance premiums, and credit ratings. There is also some empirical evidence suggesting that management's discussion and analysis disclosures, as required by GASB 34, provide useful information to stakeholders (e.g., Bloch 2016; Rich et al. 2016; Rich et al. 2018). We contribute to the GASB 34 literature by focusing on a specific aspect of the GASB 34 reporting model related to infrastructure assets.

2.3. Academic literature related to infrastructure asset reporting under GASB 34

Recent studies examining infrastructure asset reporting following the adoption of GASB 34 suggest that some governments' initial adoption of the modified approach was motivated by their access to a capital asset management system capable of meeting the modified approach requirements.[8] Studies also suggest that infrastructure grades, pension funding, and population growth (lane miles per capita and debt per capita) are positively (negatively) associated with adopting the modified approach (e.g., Patton and Bean 2001; Yarnell 2004; Benson et al. 2009; Vermeer et al. 2011; Pryor 2013; Benson and Marks 2017). In tests of the economic consequences of states' infrastructure reporting practices, studies generally find that the modified approach is significantly associated with bond spreads and credit ratings (Bloch et al. 2016; Benson and Marks 2017). The findings in these studies are generally consistent with the notion that the modified

[8] Recall, however, that GASB 34 requires all governments to capitalize their infrastructure assets and, if not using the modified approach, to record depreciation (see Section 2.1). In addition, all states are required to report detailed information to the FHWA about their roads and bridges (see Section 3).

approach provides incremental information to stakeholders (i.e., higher financial reporting quality) than the information provided under the depreciation approach.

More closely related to our paper are two studies in the public budgeting and finance literature. Kim and Ebdon (2017) examine highway spending around the adoption of GASB 34 (1995-2009) using a sample of 47 states.[9] They find that the log of capital (maintenance) spending per capita is higher (not statistically different) in their post-GASB 34 period compared to their pre-GASB 34 period (without regard to a state's infrastructure reporting policy). They find no association between their highway spending measures and states' infrastructure reporting approach (limited to the 2005-2009 period). Kim et al. (2018) examine highway road conditions around the adoption of GASB 34 (1995-2009) using a sample of 45 states. They find that the log of the percentage of highway roads in acceptable condition is higher in their post-GASB 34 period; this finding is more pronounced in the modified approach sample (evidenced by a larger estimated regression coefficient). In contrast to Kim and Ebdon (2017), Kim et al. (2018) find that GASB 34 implementation is not associated with the log of highway capital spending per capita but is positively associated with highway maintenance spending (note, they do not test whether the infrastructure reporting approach is associated with these spending variables). They suggest that the relatively high percentage of roads in acceptable condition following the adoption of GASB 34 is, in part, explained by higher maintenance spending in their post-GASB 34 period.

[9] Kim and Ebdon (2017) indicate that they follow Vermeer et al. (2011) to define their post-GASB 34 variable and that "[o]f the 47 states in the study, 43 implemented GASB 34 in 2001; Montana implemented in 2002, Alabama and California in 2003, and Rhode Island in 2004" (Kim and Ebdon 2017, 357). The GASB 34 adoption years used by Kim and Ebdon (2017), as well as Kim et al. (2018), are the years that states applied the retroactive capitalization requirements, for which GASB 34 permitted a four-year grace period (see our discussion in Section 2.1). All of the states did, in fact, adopt GASB 34, including the infrastructure reporting provisions (such as the modified approach disclosures, when appropriate), in their first fiscal year beginning after June 15, 2001. As discussed in Section 3.1, we use states' initial adoption year to demarcate the pre- and post-GASB 34 period.

We advance the nascent infrastructure reporting literature and recent studies demonstrating the real effects of financial reporting in the public sector by documenting the economic consequences of states' infrastructure reporting policies. We use multiple methodologies and triangulate across several empirical proxies to study a relatively long time series of data on investments in both roads and bridges. Importantly, we also provide evidence of an underlying mechanism linking financial reporting to infrastructure outcomes.

2.4. Hypotheses

Similar to the corporate sector (e.g., Stein 2003), government officials generally lack strong incentives to invest in infrastructure maintenance. Unlike reconstruction and new construction projects, maintenance activities go unnoticed and do not present opportunities that generate recognition for politicians (e.g., naming a bridge, building, or road segment). In addition, roads and bridges are generally very long-lived assets, so the effects of deferred maintenance may not be immediately apparent, providing incentives for politicians to defer maintenance spending in order to allocate resources to other programs and services. Evidence suggests that voters do not penalize politicians for forgoing prevention activities—such as maintenance and disaster preparedness—even though prevention is more cost-effective than repairs and relief (Healy and Malhotra 2009; Gailmard and Patty 2019). We argue that financial statement disclosures that link to a government's infrastructure management system may enhance accountability over infrastructure spending decisions.

Our hypotheses are based on the following assertions: (1) the modified approach for reporting infrastructure requires increased disclosure, which we argue results in higher financial reporting quality about a government's infrastructure assets; (2) higher financial reporting quality about infrastructure increases transparency and, thus, potentially enhances governments' monitoring of their infrastructure needs and investments; and (3) increased monitoring makes government officials less inclined to underinvest in infrastructure maintenance.[10] In particular, to the extent the financial reporting information required by the modified approach is a valuable input in budgeting decisions, we conjecture that governments using the modified approach will be less likely to under-budget for and underinvest in infrastructure maintenance because the impact of deferred maintenance will be more clearly reflected in the annual financial report (e.g., Hilary et al. 2019). Hypothesis 1, stated in alternative form, is as follows:

> HYPOTHESIS 1. *The modified approach for reporting infrastructure assets is positively associated with investments in infrastructure maintenance.*

Following the arguments above—i.e., that the modified approach may curtail underinvestments in infrastructure maintenance—we next discuss the mechanism through which the modified approach may impact infrastructure maintenance. We argue that the modified approach is likely to improve monitoring of infrastructure assets and investment decisions, which can facilitate budgeting for the maintenance of those assets. In addition, by establishing infrastructure condition targets, we expect that MA governments will be less likely to reduce or divert funds initially intended for infrastructure maintenance. Specifically, we expect that MA governments will be less likely to enact midyear budget cuts to infrastructure spending in light of enhanced monitoring and accountability facilitated by increased infrastructure financial reporting quality. We also expect that MA governments will be less likely to divert motor fuel taxes (i.e., dedicated infrastructure revenues), which states collect and are generally intended to be used for

[10] Because it is unlikely that government officials will overinvest in the maintenance of existing infrastructure assets, an implicit assumption in our study is that higher levels of maintenance spending reflect less underinvestment. We acknowledge that we do not know the optimal amount of maintenance spending, but conventional wisdom from theoretical and empirical research, as well as from anecdotal accounts, is that spending on maintenance and prevention is commonly sub-optimal from the perspective of minimizing life-cycle costs.

maintenance and repairs, to non-infrastructure purposes. Hypothesis 2, stated in alternative form, is as follows:

> HYPOTHESIS 2. *The modified approach for reporting infrastructure assets is negatively associated with midyear budget cuts and diversions of infrastructure funds to non-infrastructure programs and services.*

We may find that investments in infrastructure maintenance are not associated with a state's adoption of the modified approach because infrastructure assets are unique in the sense that they are critical for governments to provide essential services to the public, for local businesses to operate effectively, and for citizens to travel safely throughout and beyond a government's geographic boundaries. Thus, long-term differences in infrastructure investments (and, by extension, infrastructure condition), if any, may be minimal. It is also possible that DA governments invest more in infrastructure than MA governments invest because recording depreciation on an annual basis provides insights into the decrease in the net book value of those assets, potentially eliciting remedial actions (e.g., maintenance and repairs) from government officials (e.g., Jackson 2008; Jackson et al. 2009).

3. Data and Descriptive Statistics

3.1. Sample

Similar to prior research (e.g., Kido et al. 2012; Naughton et al. 2015; Costello et al. 2017), our sample consists of the 50 state governments of the United States.[11] Although locally-owned infrastructure is also important to citizens, states manage the nation's critical highway network

[11] Although we retain in our sample all 50 states, we note that New Mexico, which does issue an annual financial report, does not prepare GAAP-compliant financial statements during our sample period. Prior to 2012, New Mexico's financial statements were reviewed, but not audited in accordance with generally accepted government auditing standards. Since first being audited, New Mexico has grappled with several financial reporting issues that have prevented their auditor from expressing an opinion on the financial statements. As a sensitivity check, we confirm that our results are robust to dropping, among other states, New Mexico (see Section 5.3).

that carries the bulk of all traffic, and states are required to report information about their roads and bridges to the Federal Highway Administration, which we leverage in this study. In contrast, local governments are not subject to such reporting requirements. For our two-stage least squares regressions, we construct a dataset that spans a state's initial adoption of GASB 34 (generally the fiscal year ending in 2002) through a state's fiscal year ending in 2016.[12] For our difference-in-differences analyses, the sample ranges from 1997 to 2006 (see Section 4.2). We hand collect financial and accounting policy-related information from states' annual financial reports, which we match with data published by the U.S. Census Bureau, the U.S. Department of Transportation's Federal Highway Administration, the National Association of State Budget Officers, and other sources. In Appendix A, we discuss variable definitions and data sources.

In Table 1, we list the states used in our analyses and group them by the infrastructure reporting approach initially adopted. Consistent with prior research (e.g., Vermeer et al. 2011), we find that 46% of states adopted the modified approach for reporting certain infrastructure assets upon implementing the provisions of GASB 34. We also find that only two states (Colorado and Texas) switched from the modified approach to the depreciation approach for reporting certain infrastructure assets during our sample period.[13] We did not identify any states that switched from the depreciation approach to the modified approach.

3.2. State government characteristics

[12] New York's fiscal year ends on March 31. Therefore, the first annual financial report published by New York after adopting GASB 34 was for the fiscal year ending on March 31, 2003. The first post-GASB 34 annual financial report for all other states corresponds to their fiscal years ending in 2002.

[13] In Section 5.3, we confirm that our results are robust to dropping, among other states, Colorado and Texas.

In panel A of Table 2, we provide statistics summarizing the states along key dimensions, and we also report the differences in means between MA and DA states.[14] We use *Population Growth* as a control for changes in the citizen base and demand for services. State populations have grown about 1% per year on average. We use an indicator variable, *Deficit*, which is set equal to one if a state's total net position is negative, and zero otherwise, to control for a state's overall financial condition (Davies et al. 2017). Few states report a negative net position (*Deficit* is 9%, on average). However, researchers have raised concerns about deficiencies in financial reporting for states' liabilities, particularly pension obligations (e.g., Novy-Marx and Rauh 2011; Naughton and Spamann 2015; Naughton et al. 2015; Bonsall et al. 2019). Concerning pensions, we find that the average funded ratio (*Pension Funding*) is 79%. MA states are less likely to report a *Deficit* and, on average, have higher *Pension Funding*. We also account for fiscal constraints. In particular, we control for tax and expenditure limits (*TEL*), which could impact states' infrastructure management practices (Jimenez and Pagano 2012). Approximately 61% of the states maintain tax and expenditure limits. In addition, we control for balanced budget restrictions (*BBR*), which are anti-deficit rules commonly imposed on states' general fund (the main operating fund) that can impact states' annual spending and resource allocation decisions (Costello et al. 2017). 74% of the states have balanced budget restrictions. A larger percentage of MA states have *TEL* and *BBR*.

We employ two instrumental variables, which we discuss in greater detail in Section 4.1. First, we use *Financial Report Timeliness,* a variable we can compute from each post-GASB 34 financial report, to proxy for a state's overall financial reporting capacity. We measure *Financial Report Timeliness* as the log of the number of days between a government's fiscal year-end and

[14] We have 699 observations in the post-GASB 34 period because we require lagged variables (see Section 4). Thus, we have 14 years of data for the independent variables (2002-2015) and dependent variables (2003-2016) and we lose New York's 2002 fiscal year end observation because New York adopted GASB 34 for its fiscal year ending in 2003.

the date of the signed independent auditor's report, which we multiply by –1 for ease of interpretation (i.e., less delay reflects more timely financial reporting). Mean (median) *Financial Report Timeliness* is –2.29 (–2.25); this corresponds to approximately 203 (176) days after the fiscal year-end, which is comparable with prior studies (e.g., GASB 2011a; Henke and Maher 2016). Second, we use *Biennial Budget*, an indicator variable equal to one if a state has a biennial budget cycle, and zero otherwise. Approximately 40% of states have a biennial budget cycle. MA states issue more timely financial reports and are more likely to have biennial budgets.

3.3. Infrastructure measures

We focus on roads and bridges because they represent a substantial and salient component of states' infrastructure assets (and total capital assets) and because, in nearly all cases, MA states use the modified approach for reporting only their roads and bridges.[15] In panel B of Table 2, we report descriptive statistics for our measures related to states' infrastructure. States maintain, on average, approximately 37,000 miles of road lanes (*Lane Miles* is 0.009, on average, and is expressed on a per capita basis) and 4.9 million square meters of bridges (*Bridge Meters* is 0.94, on average, and is also per capita). States' roads and bridges support an average of more than 100 million daily vehicle miles of travel (*DVMT* is 3.31, on average, and is scaled by a state's total lane miles). We use these measures to proxy for infrastructure demand. On average, *Federal Funds* is 5.73, which corresponds to approximately $706 million in federal infrastructure funds. Compared to DA states, MA states have fewer *Lane Miles* and *Bridge Meters* and support more *DVMT*, collectively indicating that MA states experience greater demand for their infrastructure. In addition, MA states receive more *Federal Funds* than DA states.

[15] One exception is Wyoming, which began using the modified approach for its communication infrastructure in the fiscal year ended in 2009.

We develop several measures to proxy for investments in the maintenance of roads and bridges. Recall that the modified approach requires governments to maintain relevant infrastructure assets at or above the government's established condition level and estimate the annual amount needed to maintain those assets at the established condition level (see Section 2.1). As such, our first measure of investment reflects maintenance outlays. *Maintenance* includes the costs incurred to maintain an infrastructure asset—specifically, activities that extend pavement and bridge service life by offsetting the impact of deterioration. Maintenance activities help delay or eliminate the need for road and bridge repairs, such as resurfacing, restoration, rehabilitation, or reconstruction. States spend, on average, $259 million per year on maintenance activities (i.e., *Maintenance* is $1.45, which is expressed per square meter of infrastructure).[16] MA states invest more than DA states invest in infrastructure maintenance.

We employ an additional proxy for investments in infrastructure maintenance based on the condition of states' roads and bridges.[17] Although this data ultimately produces a less direct measure of infrastructure maintenance, condition assessments are useful for testing the underlying assumption that, all else equal, states that invest more (or underinvest less) to maintain their infrastructure assets should have fewer roads in disrepair and structurally deficient bridges. We

[16] As noted, we scale maintenance expenditures by total square meters of roads and bridges. The FHWA reports square meters of bridges, but not roads. To estimate square meters of roads we first convert a state's miles of lanes to meters of lanes. We then convert that amount to square meters by multiplying meters of lanes by an estimate of lane width, 11 feet. We confirm that our results are robust to different lane width assumptions—specifically, 11.5 feet and 12 feet. Unfortunately, we do not know the precise lane width of every road; however, lane widths, on average, are approximately 11-12 feet. We also use alternative deflators, including a state's population and lane miles. Finally, our results remain qualitatively similar if we do not scale maintenance expenditures.

[17] In the relatively rare event that road condition data is missing for any given state-year observation, we take the average of the year before and the year after the missing observation as a replacement for the missing information. Pavement condition information is missing for Rhode Island in 1997, Illinois in 1998, Hawaii in 1998-1999, and Massachusetts in 2014. In addition, pavement condition data are missing for all states in 2010 due to modifications made to the FHWA's Highway Performance Monitoring System software. In our main analyses, we compute 2010 road conditions as the average of 2009 and 2011 road conditions. In Section 5.3 we demonstrate that our results are robust to excluding from the sample various states and years that could influence our results due to data issues.

use International Roughness Index (IRI) values published by the FHWA to measure the condition of states' roads.[18] States' interstate (non-interstate) pavements with an IRI of more than 170 (220) inches per mile are considered to be in poor condition (*Roads_%Poor*). On average, 4% of states' road pavements are in poor condition. The percentage of square meters of bridges that are deemed structurally deficient (*Bridge Meters_%SD*) is, on average, 8%. MA states have fewer roads (bridges) that are in poor condition (structurally deficient) than DA states.

We include in our regressions *High Quality Infrastructure,* which reflects the percentage of road pavements with a relatively smooth ride quality (i.e., an IRI of less than 94 inches per mile), to control for the fact that relatively high infrastructure condition levels may influence the adoption of the modified approach, as well as maintenance costs. *High Quality Infrastructure* is, on average, 61% in MA states and 49% in DA states. Note that the percentage of infrastructure in relatively good condition could result from building new roads and bridges, reconstructing existing assets that have fallen into disrepair, or maintaining existing assets. As a result, *High Quality Infrastructure* is not an ideal measure for investments in infrastructure maintenance.

3.4. Budget cuts and diversions of infrastructure funds

In Section 4.3, we discuss evidence of a mechanism underlying the link between a state's infrastructure reporting policy and investments in infrastructure maintenance. We expect that the modified approach may act as an accountability device that deters states from cutting infrastructure funds (*Midyear Budget Cut*) and reallocating funds earmarked for infrastructure to other programs and services (*MFT Diversions*). Midyear budget cut data is available from 2009 onward; thus, we

[18] Recall that only MA governments disclose in their annual financial reports information about infrastructure condition. In addition, as discussed by Vermeer et al. (2011), MA states use a variety of measurement scales to assess the condition of their infrastructure. It is, thus, necessary to use FHWA data, which is comparable across governments and across time.

have 400 observations instead of 699 observations. In panel B of Table 2, we report that, on average, a state enacts a midyear budget cut to its general fund transportation spending in approximately 15% of the state-year observations. Furthermore, we report that states divert, on average, approximately 8% of motor fuel tax revenues to non-transportation purposes, such as to support general fund expenditures like education. MA states are less likely to enact a midyear budget cut and divert motor fuel taxes.

4. Empirical findings

Our principal hypothesis is based on the idea that higher financial reporting quality associated with the modified approach increases transparency and monitoring, thus improving budgeting for infrastructure maintenance. As a result, we expect MA states to be less likely to underinvest in infrastructure by deferring maintenance outlays. An anecdotal account supporting this argument relates to Texas's switch from the modified approach to the depreciation approach. Following the switch, Texas noted in its annual financial report that "repairs and maintenance expense" decreased more "than the increase in depreciation expense recorded under the depreciation approach."[19] This statement suggests that, after switching to the depreciation approach, Texas curtailed its investments in the maintenance of the infrastructure assets the State had initially planned to maintain when it adopted the modified approach. To gain deeper insights beyond the Texas case, we examine the real effects of infrastructure reporting policies by linking these policies to infrastructure maintenance outcomes across the nation.

4.1. Two-stage least squares regressions

[19] Texas's annual financial reports are available at: https://comptroller.texas.gov/transparency/reports/comprehensive-annual-financial/.

In our setting, unobserved state characteristics could affect both the choice to adopt the modified approach and investments in infrastructure maintenance. It is also possible that both decisions are simultaneously determined. This can, unfortunately, potentially lead to spurious and biased regression estimates. We attempt to mitigate endogeneity concerns using a two-stage least squares (2SLS) regression analysis, which we discuss next.

4.1.1. Determinants of adopting the modified approach for infrastructure reporting

As a first step toward examining the impact of the modified approach on investments in infrastructure maintenance, we model the determinants of adopting the modified approach. In addition to control variables, we include in the first stage model two variables as instruments for *Modified Approach* that plausibly only affect investment through their effect on a state's infrastructure reporting policies. First, we use *Financial Report Timeliness,* which proxies for a state's overall financial reporting capacity and is measured as the log of the number of days between a state's fiscal year-end and the date of the signed independent auditor's report. We expect a state's financial reporting capacity to reduce the cost and, thus, increase the likelihood of adopting the modified approach (which satisfies the relevance criterion) because the modified approach requires a commitment to greater and more precise disclosures about infrastructure, which would be difficult to implement with low financial reporting capacity. The exclusion restriction is unlikely to be violated since higher *Financial Report Timeliness* is unlikely to impact a state's infrastructure maintenance decisions in the absence of undertaking the process needed to generate detailed disclosures about infrastructure (e.g., setting and evaluating condition targets).

Second, we use *Biennial Budget*, an indicator variable equal to one if a state has a biennial budget cycle, and zero otherwise. Biennial budgets proxy for a state's commitment to long-term planning, which likely reduces the cost of, and is compatible with, adopting the modified approach given that the modified approach requires a government to maintain relevant infrastructure at or above an established condition level and, thus, to allocate sufficient resources to meet or beat the targeted condition level each period. However, biennial budgets alone are unlikely to directly impact infrastructure maintenance if a state does not go through the process of establishing the publicly observable infrastructure condition targets required by the modified approach. In the first stage, we estimate the following probit regression model[20]:

$$
\begin{aligned}
Modified\ Approach_{it} = \alpha + \ & \beta_1 Financial\ Report\ Timeliness_{it} + \beta_2 Biennial\ Budget_{it} \\
& + \sum \gamma_k State\ and\ Infrastructure\ Characteristics_{it} \\
& + \eta \text{Year FE} + \psi \text{Region FE} + \varepsilon_{it} \qquad (1)
\end{aligned}
$$

Modified Approach$_{it}$ is an indicator variable that takes the value of one for states using the modified approach for reporting infrastructure assets, and zero otherwise. We add controls for factors that likely influence infrastructure reporting policies and investments in infrastructure maintenance, including measures of a state's infrastructure network, as well as demand and financing for infrastructure—in particular, *Population Growth*, *Lane Miles*, *Bridge Meters*, *DVMT*, *Federal Funds*, and *High Quality Infrastructure*. We control for a state's financial condition using *Deficit* and *Pension Funding*. We also control for institutional factors such as tax and expenditure limits (*TEL*) and balanced budget restrictions (*BBR*). Finally, we include year and region fixed effects, and we cluster standard errors by state and year.[21]

The coefficients from estimating equation (1), which are presented in Table 3, demonstrate that both instruments are positively and significantly associated with *Modified Approach*.

[20] Results remain consistent if we use a linear probability model.

[21] We define four regions—Northeast, Midwest, South, and West—consistent the U.S. Census Bureau's designated regions of the U.S. We include region fixed effects to control for the possibility that environmental and political factors that generally correspond to different U.S. regions may impact infrastructure decisions.

Specifically, the estimated coefficients on *Financial Report Timeliness*[22] and *Biennial Budget* are 2.477 (z-stat = 4.895) and 0.599 (z-stat = 4.883), respectively. Moving to the control variables, we find that the condition of states' infrastructure (*High Quality Infrastructure*), a state's financial condition (*Pension Funding*), and demand for a state's infrastructure network (*DVMT*) are positively associated with *Modified Approach*. Similarly, we find that *Deficit* (a measure of financial condition) and *Lane Miles* (a measure of infrastructure demand) are negatively associated with *Modified Approach*.

4.1.2. Infrastructure reporting and investment

We next use the instrumented measure of *Modified Approach* estimated from equation (1) in the first stage regression as the primary independent variable of interest in the second stage. Specifically, we test Hypothesis 1 by estimating the following second stage regression model:

$$Infrastructure\ Investment_{it} = \alpha + \beta_1 Modified\ Approach_{it-1} + \sum \gamma_k Controls_{it-1} + \eta \text{Year FE} + \psi \text{Region FE} + \varepsilon_{it} \quad (2)$$

Infrastructure Investment$_{it}$ in equation (2) captures one of several proxies used to measure the extent to which state *i* invests in the maintenance of its infrastructure in year *t*. We also report in Table 4 OLS estimates using a non-instrumented *Modified Approach* measure. For the regressions corresponding to equation (2), which are reported in panels A and B of Table 4, we include year and region fixed effects and cluster standard errors by state and year.

In panel A of Table 4, our dependent variable in equation (1) is *Maintenance*. In the regressions reported in panel A of Table 4, a positive coefficient on β_1 would provide support for

[22] Recall that we take the log of the number of days between a state's fiscal year-end and the date of the signed independent auditor's report and multiply it by –1 such that less negative values correspond to more timely financial reports. The positive coefficient on *Financial Report Timeliness* can be interpreted as a positive association between financial reporting capacity and the adoption of the modified approach.

Hypothesis 1. We find that *Modified Approach* is positively and significantly associated with investments in infrastructure maintenance across both the OLS and the 2SLS regressions. In particular, *Modified Approach* is positively and significantly associated with *Maintenance* in both column (1) (coefficient = 0.238; *t*-stat = 3.758) and column (2) (coefficient = 1.348; *t*-stat = 4.794). These results support the notion that MA states invest more to maintain their infrastructure assets—specifically, by approximately $1.35 more per square meter of infrastructure.[23]

A common concern of accountants, economists, and engineers alike is that deferred infrastructure maintenance can have dire consequences.[24] For instance, a backlog of maintenance needed to preserve the condition of critical infrastructure assets can lead to more substantial infrastructure costs in the future due, in part, to the deterioration of infrastructure.[25] To that end, we address the question of whether MA states maintain their infrastructure in better condition than DA states maintain their infrastructure, which would be consistent with Hypothesis 1. We focus on the percentage of roads in poor condition (*Roads_%Poor*) and the percentage of square bridge meters that are structurally deficient (*Bridge Meters_%SD*) because a relatively high percentage

[23] Our results remain similar when we use alternative scalers for maintenance spending, including total lane miles and population, and when maintenance spending is unscaled.

[24] Transportation authorities and engineers have, for example, examined the cost-effectiveness of infrastructure maintenance, as well as the performance of various maintenance methods (chip seal, crack seal, slurry seal, thin overlay, etc.). Engineers argue that, in the long run, it is less costly to maintain road pavements than it is to allow pavements to deteriorate (i.e., defer maintenance to the future, at which point major repairs or replacement projects may be needed). Pavement maintenance is less costly for transportation authorities (in terms of pavement life-cycle costs), vehicle operators (in terms of fuel consumption, tire wear, and maintenance and repair costs), and the environment (in terms of greenhouse gas emissions). See, for example, Labi and Sinha (2003), Dong and Huang (2012), Wang and Wang (2013), Wang and Wang (2017), and Wang et al. (2020).

[25] In a 2017 keynote speech at the Brookings Institution, former Treasury Secretary Lawrence H. Summers, echoed the argument often made by transportation engineers that it is generally less expensive to maintain infrastructure than it is to replace those assets after they have substantially deteriorated. For instance, Summers quipped that "prevention is cheaper than cure" (Glaeser and Summers 2017). A post about Summers's speech can be found at: http://larrysummers.com/2017/01/16/public-infrastructure-investment-in-the-national-interest/.

of roads and bridges in these two categories would be indicative of a state failing to undertake maintenance activities and, instead, allowing their infrastructure to fall into disrepair.

Our results are reported in panel B of Table 4. A negative coefficient on β_1 would provide support for Hypothesis 1. In columns (1) and (2), the dependent variable is *Roads_%Poor*, and in columns (3) and (4), the dependent variable is *Bridge Meters_%SD*. For each dependent variable, we again use the OLS and 2SLS approaches. We find that *Modified Approach* is negatively and significantly associated with the percentage of roads (bridges) that are in poor condition (structurally deficient). In particular, using the 2SLS regressions we find that *Modified Approach* is negatively and significantly associated with *Roads_%Poor* (coefficient = –0.067; *t*-stat = –3.040) and *Bridge Meters_%SD* (coefficient = –0.058; *t*-stat = –5.339). The results are qualitatively similar under both the OLS and 2SLS approaches, although the estimated coefficients are smaller using the OLS approach. MA states have approximately 7% (6%) fewer roads (square bridge meters) that are in poor condition (structurally deficient).

To address potential problems with the instruments—e.g., the potential for weak instruments and the possibility of a correlation between the instruments and the regression error term (i.e., overidentification)—we conduct several tests suggested by Larcker and Rusticus (2010) to assess their validity. Based on these tests, we conclude that we cannot reject the validity of our instruments. In particular, the first-stage partial *F*-statistic is 76.5, suggesting that we do not have a weak-instruments problem. The partial R^2 of the instruments is 9.6%. We also conduct the overidentifying restrictions test and cannot reject the null hypothesis that the instruments are uncorrelated with the error term (i.e., the *p*-value is greater than 0.10). Finally, we conduct the Durbin-Wu-Hausman test and reject the null, suggesting that the 2SLS model is preferred to OLS. Taken together, the results presented in Table 4 support Hypothesis 1, suggesting that MA states invest more to maintain their infrastructure assets. These results indicate that the modified approach potentially acts as an accountability device that may help MA states better maintain maintenance funding to avoid the costs associated with deferred maintenance.

4.2. Pre- vs. post-GASB 34 differences in infrastructure maintenance

As a complement to the 2SLS estimation, we use a difference-in-differences framework to further mitigate endogeneity concerns. For instance, one potential issue is that states that have always invested more to maintain their infrastructure assets may also have been more likely to adopt the modified approach. It also remains possible that an underlying unobservable factor, such as superior infrastructure management capabilities, causes both the adoption of the modified approach and less underinvestment in infrastructure maintenance. Our difference-in-differences research design helps address these issues and further demonstrates the role of financial reporting in infrastructure maintenance decisions.

4.2.1. Difference-in-differences analyses

We conduct DiD analyses to compare states pre- and post-GASB 34—in particular, we use the 1997-2006 period, which provides five years before and after the adoption of GASB 34. *Post* is set equal to one in the years following the initial adoption of GASB 34—i.e., the fiscal year ending in 2002 and beyond for all states except New York, which adopted GASB 34 in its fiscal year ending in 2003. Since we do not have data for *Deficit* and *Pension Funding* in the pre-GASB 34 period, we instead use *Revenues*, *Expenditures*, and *Debt*, which are based on data provided by the U.S. Census Bureau's annual survey of state and local government finances. We provide statistics summarizing the variables and the differences in means between the pre- and post-GASB 34 period in panel A of Table 5. Moving from the pre- to post-GASB 34 period, we find an increase in *Maintenance,* but no significant changes in *Roads_%Poor* or *Bridge Meters_%SD*. To further test and build support for Hypothesis 1, we estimate the following OLS regression model:

$$Infrastructure\ Investment_{it} = \alpha + \beta_1 Modified\ Approach_{it-1} \times Post_{it-1} + \sum \gamma_k Controls_{it-1} + \eta \text{Year FE} + \varphi State\ FE + \psi \text{Region FE} + \varepsilon_{it} \quad (3)$$

The coefficient of interest in equation (3) is β_1, which captures the incremental change in investments in infrastructure maintenance for MA states (the "treatment" sample) after adopting GASB 34. Note that for the DiD regressions, *Modified Approach* is set equal to one in the pre-GASB 34 period for states that initially adopted the modified approach upon implementing GASB 34 in 2001 (or 2002 in the case of New York). We include year, region, and state fixed effects in our regressions and cluster standard errors by state and year. The state and year fixed effects subsume the main effects of *Post* and *Modified Approach,* which we omit in equation (3).

In panel B of Table 5, we again use as our dependent variable *Maintenance*. We find that the *Modified Approach*×*Post* interaction term is positively and significantly associated with *Maintenance* (coefficient = 0.159; *t*-stat = 2.549), consistent with Hypothesis 1.[26] Thus, relative to DA states, MA states exhibit an incremental increase in infrastructure maintenance of about $0.16 per square meter of infrastructure following the adoption of GASB 34.

Similar to the analyses reported in panel B of Table 4, in panel C of Table 5, we use road and bridge conditions as alternative measures reflecting infrastructure maintenance. We do not find evidence of an incremental improvement in the percentage of roads in disrepair (*Roads_%Poor*) for MA states after adopting GASB 34—although the coefficient in column (1) on the interaction term *Modified Approach*×*Post* is negative, it is not significant at conventional levels. We do, however, find evidence of an incremental improvement in bridge conditions for

[26] As a robustness test, we confirm that these DiD results remain similar in terms of magnitude, sign, and significance if we instead scale maintenance by total lane miles, a state's population, or if we do not scale at all.

MA states. In panel B of Table 5, the coefficient in column (2) on the interaction term *Modified Approach*×*Post* is negative and significant (coefficient = –0.009; *t*-stat = –2.625), suggesting that MA states have an incremental decrease of about 1% in *Bridge Meters_%SD*.[27]

4.2.2. Parallel trends assumption

An important assumption underlying our DiD analyses is that MA and DA states would have had similar patterns of infrastructure maintenance and condition in the absence of adopting the infrastructure reporting provisions of GASB 34. To determine the validity of the parallel trends assumption in our setting, we examine differences in pre-GASB 34 trends between MA and DA states in panel D of Table 5. In particular, we examine the five years before the adoption of GASB 34 and label the latter two years as the pseudo post period. We find no evidence of a differential pre-GASB 34 trend in infrastructure maintenance and condition between MA and DA states, consistent with a valid parallel trends assumption.

4.3. Mechanism tests

We conduct additional tests to provide evidence consistent with a possible mechanism underlying the relation between infrastructure reporting and infrastructure maintenance. To the extent the process required to adhere to the modified approach leads to more informed and disciplined state officials, the modified approach may improve budget outcomes, thus mitigating underinvestment in infrastructure maintenance. To test whether the data supports our intuition, we examine whether *Modified Approach* is associated with budget cuts (*Midyear Budget Cut*) and infrastructure resource diversions (*MFT Diversions*). In particular, we test Hypothesis 2 by estimating the following probit and OLS regressions, respectively:

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[27] In panel B of Table 4 and panel C of Table 5, the bridge condition results are robust to using the number of structurally deficient bridges, rather than the square meters of structurally deficient bridges (*Bridge Meters_%SD*).

$$Midyear\ Budget\ Cut_{it} = \alpha + \beta_1 Modified\ Approach_{it-1} + \sum \gamma_k Controls_{it-1} + \eta \text{Year FE} + \psi \text{Region FE} + \varepsilon_{it} \quad (4)$$

$$MFT\ Diversions_{it} = \alpha + \beta_1 Modified\ Approach_{it-1} + \sum \gamma_k Controls_{it-1} + \eta \text{Year FE} + \psi \text{Region FE} + \varepsilon_{it} \quad (5)$$

The results are reported in Table 6. In column (1), we report that MA states are less likely to enact a midyear budget cut to their general fund transportation spending (coefficient = –0.369; z-stat = –2.209), consistent with increased budget discipline for infrastructure spending. In column (2), we report that MA states are less likely to divert motor fuel tax revenues to non-highway programs and services (e.g., school funding), including diversions to the general fund (coefficient = –0.056; *t*-stat = –4.671). Taken together, these results are consistent with Hypothesis 2 and shed light on the role of improved budgeting and resource allocations as potential mechanisms underlying the documented link between financial reporting and infrastructure maintenance.

5. Additional Analyses

5.1. Government Performance Project Grades

As an additional and relatively broad measure of investments in infrastructure maintenance, we use infrastructure grades from the Government Performance Project studies published in 2001, 2005, and 2008 for the 50 states (i.e., GPP 2001; GPP 2005; Barrett and Greene 2008). The infrastructure grades enable us to proxy for dimensions of states' infrastructure maintenance and management that are difficult to observe and quantify using other data sources. A state's infrastructure grade reflects its ability to budget for, monitor, and maintain its infrastructure assets. As reported in panel B of Table 2, *GPP_Infrastructure* is, on average, 9.98, which corresponds approximately to a "B" average. There is, however, significant variation across states, with some scoring very high (e.g., Utah) and others scoring very low (e.g., Oklahoma). Over time, there has been some change in the average grade, which has generally trended slightly downward but has nevertheless remained consistent at the median. MA states earn higher grades, on average.

In Table 7, *GPP_Infrastructure* is the dependent variable, taking the place of *Maintenance* in equations (1) and (2). In panel A, we report OLS and 2SLS regression estimates and use the 2005 and 2008 GPP grades. We find that *Modified Approach* is positively and significantly associated with *GPP_Infrastructure* (coefficients = 0.829 and 1.922; *t*-stats = 1.750 and 1.911). We also find, and report in panel B, that MA states experience an incremental increase in *GPP_Infrastructure* from pre- (2001) to post-GASB 34 (2008), relative to DA states (the coefficient on *Modified Approach*×*Post* is 1.266; *t*-stat = 2.066).

5.2. Falsification tests

In our primary analyses, we focus on maintenance outlays as we expect that the financial reporting requirements associated with the modified approach could lead to improved maintenance of existing infrastructure assets. We do not view spending on new construction as a proxy for investments in infrastructure maintenance because new construction results in new or expanded roads and bridges and is subject to additional complexity that involves planning and design, acquiring rights of way, financing, and political factors. As a falsification test, we replace *Maintenance* with *New Construction* in equations (2) and (3) and report the results in Table 8. We find that *Modified Approach* is not associated with *New Construction* at conventional levels of statistical significance in both the OLS and 2SLS estimations reported in panel A and the difference-in-differences analysis reported in panel B. The fact that we find no evidence of an association between *Modified Approach* and *New Construction* helps to allay concerns about an omitted variable bias in our main results.

5.3. Dropping select observations

To confirm that our results are not sensitive to a few states with unusual circumstances, we rerun our primary analyses after excluding specific observations one at a time and then as a group. In particular, we confirm that our results are robust to excluding Colorado and Texas, two states that switched from the modified approach to the depreciation approach during the sample period. We also confirm that our results are robust to dropping Hawaii, which has limited pre-GASB 34 Federal Highway Administration data, and Wyoming, which accounts for its infrastructure assets in a discretely presented component unit rather than as part of the consolidated primary government financial statements. We drop New Mexico because its financial reports are not GAAP-compliant, as discussed in Section 3.1. We also drop all five states and rerun our analyses. Finally, we drop the five states—Alabama, Alaska, California, Rhode Island, and Montana—that used some or all of the grace period provided by GASB 34 to apply the retroactive infrastructure reporting provisions (see Section 2.1). In all cases, our results remain similar in terms of the magnitude, sign, and statistical significance of our coefficients of interest.

We also confirm that our results are robust to removing 2010 from our sample. As noted in footnote 16, road length and pavement condition data are missing for all states in 2010 due to modifications made to the FHWA's Highway Performance Monitoring System software. As a result, we estimate road length and pavement condition data for 2010 by taking the average of 2009 and 2011. Our results remain qualitatively similar in terms of the magnitude, sign, and statistical significance of our coefficients of interest when we drop 2010 from the sample.

6. Conclusion

We conduct a comprehensive examination of state governments' infrastructure reporting policies. States manage large infrastructure networks. Approximately 57%, or $11.8 billion on average, of states' net capital assets are infrastructure assets such as the critical road and bridge networks that connect the nation and are relied upon for travel, commerce, and national security. Following the adoption of the accounting and reporting requirements mandated by GASB 34, nearly half of the states initially elected the modified approach for reporting certain infrastructure assets (i.e., roads and bridges). We assess whether and to what extent the modified approach is associated with states' investments in infrastructure maintenance.

Our evidence suggests that the modified approach—which we argue results in higher-quality financial reporting about a states' infrastructure—is positively associated with the maintenance and condition of states' roads and bridges. We also provide evidence of a mechanism linking financial reporting to infrastructure maintenance decisions. In particular, our findings suggest that states using the modified approach are less likely to cut or divert funds earmarked for infrastructure spending. Our results collectively suggest that governments' infrastructure reporting policies have important implications for investments in infrastructure maintenance. Our findings contribute to advancing the academic literature examining the real effects of financial reporting.

Given the accountability focus of governmental financial reporting, this study is relevant to the GASB, state and local governments, transportation authorities, municipal bond analysts and rating agencies, and other stakeholders, such as citizens. Financial statement users lack sufficient information about governments' infrastructure to determine the extent to which a government has deferred maintenance. Such deferrals go unreported and ultimately push the costs to future taxpayers in violation of the GASB's fundamental accountability principle of interperiod equity.

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Appendix A
Variable Descriptions

Variable	Description and Source
BBR	An indicator variable equal to one if a state cannot carry over a deficit from one fiscal period to the next fiscal period, and zero otherwise. Source: NCSL (2010).
Biennial Budget	An indicator variable equal to one if a state has a biennial budget cycle, and zero otherwise. Source: Snell (2011).
Bridge Meters	Total square meters of bridge deck area corresponding to a state's bridges (per capita). Source: U.S. Federal Highway Administration, National Bridge Inventory.
Bridge Meters_%SD	The percentage of a state's square meters of bridge deck area classified as structurally deficient. Source: U.S. Federal Highway Administration, National Bridge Inventory.
Debt	A state's total outstanding debt (per capita). Source: U.S. Census Bureau, Annual Survey of State and Local Government Finances.
Deficit	An indicator variable equal to one if a state reports a negative net position, and zero otherwise. Source: Annual Financial Report, Government-wide Statement of Net Assets/Position, total net position of the primary government.
DVMT	Daily vehicle-miles of travel on a state's roads (scaled by a state's total lane miles). Source: U.S. Federal Highway Administration, Highway Statistics Series.
Expenditures	A state's total expenditures (per capita). Source: U.S. Census Bureau, Annual Survey of State and Local Government Finances.
Federal Funds	The log of the amount of funds received for a states' infrastructure investments from the Federal Highway Administration and other federal agencies. Source: U.S. Federal Highway Administration, Highway Statistics Series.
Financial Report Timeliness	The log of the number of days between a state's fiscal year-end and the date of the signed independent auditor's report. In our regression analyses, we multiply this variable by -1 for ease of interpretation (less negative values correspond to more timely financial reports). Source: Annual Financial Report, independent auditor's report.
GPP_Infrastructure	A state's infrastructure grade, which is coded from 15 (A+) to 1 (F-). Source: GPP 2001; GPP 2005; Barrett and Greene 2008.
High Quality Infrastructure	The percentage of a state's roads with an International Roughness Index of less than 94 inches per mile. Source: U.S. Federal Highway Administration, Highway Statistics Series.
Lane Miles	The total length (in miles) of a state's roads multiplied by the number of lanes (per capita). Source: U.S. Federal Highway Administration, Highway Statistics Series.

Maintenance	A state's expenditures on activities aimed at maintaining roads and bridges as close as possible to their original condition, including preventive maintenance that delay or eliminate the need for future resurfacing, restoration, rehabilitation, and reconstruction by offsetting the effects of deterioration from age, weather, use, damage, failure, and design or construction faults (scaled by total square meters of roads and bridges). Source: U.S. Federal Highway Administration, Highway Statistics Series.
MFT Diversions	The percentage of motor fuel tax revenues allocated to a state's General Fund or other non-highway purposes. Source: U.S. Federal Highway Administration, Highway Statistics Series.
Midyear Budget Cut	An indicator variable equal to one if a state enacts a midyear budget cut to general fund transportation spending, and zero otherwise. Source: National Association of State Budget Officers.
Modified Approach	An indicator variable equal to one if a state uses the modified approach for reporting infrastructure assets, and zero otherwise. Source: Annual Financial Report, Notes to the Basic Financial Statements.
New Construction	A state's expenditures for the construction of new roads and bridges (scaled by total square meters of roads and bridges). Source: U.S. Federal Highway Administration, Highway Statistics Series.
Pension Funding	Pension assets (on an actuarial basis) divided by the actuarial accrued liabilities. Source: Pew Charitable Trusts. Data accessed at: https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2018/04/the-state-pension-funding-gap-2016
Population Growth	Annual percentage change in a state's population. Source: U.S. Census Bureau.
Post	Indicator variable equal to one in the years following the initial adoption of GASB Statement No. 34, and zero otherwise. Source: GASB (1999) and states' annual financial reports.
Revenues	A state's total revenues (per capita). Source: U.S. Census Bureau, Annual Survey of State and Local Government Finances.
Roads_%Poor	The percentage of a state's interstate (non-interstate) roads with an International Roughness Index of more than 170 (220) inches per mile. Source: U.S. Federal Highway Administration, Highway Statistics Series.
TEL	Indicator variable equal to one if a state has tax and expenditure limits (i.e., revenue limits, spending limits, or both), and zero otherwise. Source: Waisanen (2010).

Appendix B

Accounting for Infrastructure Assets under the Depreciation Accounting and Modified Approaches

This appendix provides an illustration of the accounting for infrastructure assets in the government-wide financial statements. GASB 34 permits governments to choose between two methods of reporting infrastructure assets: the depreciation approach and the modified approach (GASB 1999, paragraph 20). Under the depreciation approach, governments report infrastructure assets, net of accumulated depreciation, in the Statement of Net Position and report annual depreciation expense in the Statement of Activities. Because governments commonly aim to preserve their infrastructure assets over time, the GASB allows governments to use the modified approach for reporting infrastructure assets, if certain conditions are met. Under the modified approach, governments report annual preservation costs in lieu of reporting depreciation for eligible infrastructure assets.

The following illustration follows from Appendix A of Vermeer et al. (2011, 407) and summarizes the accounting for infrastructure assets in the government-wide financial statements under both infrastructure reporting approaches.

Accounting for Infrastructure Assets Under GASB Statement No. 34

	Depreciation Approach			**Modified Approach**		
Transaction		**Debit**	**Credit**		**Debit**	**Credit**
Construct bridge	Infrastructure	50,000		Infrastructure	50,000	
	Cash		50,000	Cash		50,000
Improve bridge	Infrastructure	10,000		Infrastructure	10,000	
	Cash		10,000	Cash		10,000
Extend useful life of bridge	Infrastructure	7,500		Expense	7,500	
(i.e., preservation costs)	Cash		7,500	Cash		7,500
Perform regular maintenance	Expense	2,000		Expense	2,000	
	Cash		2,000	Cash		2,000
Record depreciation expense	Depreciation Expense	6,000		No journal entry required.		
	Accum. Depreciation		6,000			

TABLE 1
Sample composition

50 state governments, by infrastructure reporting approach				
Modified approach:				
Alabama	Idaho	Minnesota	Texas	
Arizona	Indiana	Nebraska	Utah	
California	Kansas	Nevada	Washington	
Colorado	Kentucky	New York	Wisconsin	
Delaware	Maine	Ohio	Wyoming	
Florida	Michigan	Tennessee		
Depreciation approach:				
Alaska	Iowa	Montana	Oklahoma	Vermont
Arkansas	Louisiana	New Hampshire	Oregon	Virginia
Connecticut	Maryland	New Jersey	Pennsylvania	West Virginia
Georgia	Massachusetts	New Mexico	Rhode Island	
Hawaii	Mississippi	North Carolina	South Carolina	
Illinois	Missouri	North Dakota	South Dakota	

Notes: In this table, we list the 50 state governments used in the analyses presented in Tables 2-8. The state governments are grouped according to their initial adoption of either the modified approach or the depreciation approach for reporting infrastructure assets. Colorado switched to the depreciation approach for its bridges in 2008 and for its roads in 2010 after initially adopting the modified approach for both bridges and roads. Texas initially adopted the modified approach for its roads only, and then later switched to the depreciation approach in 2014.

TABLE 2
Descriptive statistics

Panel A: State government characteristics

	Full Sample			MA States			DA States			$Mean_{MA} - Mean_{DA}$
	N	Mean	Median	N	Mean	Median	N	Mean	Median	
Population Growth	699	0.008	0.010	314	0.010	0.010	385	0.007	0.010	0.003
Deficit	699	0.091	0.000	314	0.025	0.000	385	0.145	0.000	-0.120***
Pension Funding	699	0.786	0.790	314	0.837	0.840	385	0.744	0.730	0.093***
TEL	699	0.610	1.000	314	0.665	1.000	385	0.564	1.000	0.101***
BBR	699	0.740	1.000	314	0.783	1.000	385	0.705	1.000	0.078**
Financial Report Timeliness	699	-2.285	-2.245	314	-2.250	-2.240	385	-2.313	-2.262	0.063***
Biennial Budget	699	0.391	0.000	314	0.484	0.000	385	0.316	0.000	0.168***

Panel B: Infrastructure-related variables

	Full Sample			MA States			DA States			$Mean_{MA} - Mean_{DA}$
	N	Mean	Median	N	Mean	Median	N	Mean	Median	
Maintenance	699	1.448	1.050	314	1.550	1.158	385	1.366	0.931	0.184**
Roads_%Poor	699	0.040	0.030	314	0.030	0.020	385	0.048	0.030	-0.018***
Bridge Meters_%SD	699	0.082	0.070	314	0.063	0.050	385	0.097	0.090	-0.034***
Lane Miles	699	0.009	0.007	314	0.007	0.005	385	0.011	0.008	-0.004***
DVMT	699	3.313	2.547	314	3.498	3.294	385	3.163	2.307	0.335*
Bridge Meters	699	0.942	0.795	314	0.829	0.753	385	1.034	0.878	-0.205***
Federal Funds	699	5.726	5.724	314	5.773	5.781	385	5.689	5.696	0.084***
High Quality Infrastructure	699	0.541	0.540	314	0.609	0.600	385	0.486	0.480	0.123***
Midyear Budget Cut	400	0.150	0.000	174	0.138	0.000	226	0.159	0.000	-0.021**
MFT Diversions	699	0.085	0.026	314	0.063	0.021	385	0.103	0.038	-0.040***
GPP_Infrastructure	100	9.980	10.000	46	10.613	11.000	54	9.435	9.000	1.178***

Notes: In this table, we tabulate descriptive statistics for the full sample, modified approach (MA) states, and depreciation approach (DA) states. In panel A, we present measures of government characteristics, and in panel B, we present measures related to states' infrastructure. In the last column of both panels, we compare the means of all variables across MA and DA states. Refer to Appendix A for variable definitions. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed *t*-tests.

TABLE 3
First stage: determinants of adopting the modified approach

Independent variables:	**Dependent variable:** *Modified Approach*
Financial Report Timeliness	2.477***
	(4.895)
Biennial Budget	0.599***
	(4.883)
Population Growth	2.495
	(0.238)
Lane Miles	-58.849***
	(-3.955)
DVMT	0.101**
	(2.230)
Bridge Meters	-0.064
	(-0.421)
Federal Funds	0.108
	(1.156)
Deficit	-0.555*
	(-1.810)
Pension Funding	1.846***
	(3.306)
TEL	0.150
	(1.139)
BBR	0.148
	(0.902)
High Quality Infrastructure	3.724***
	(8.893)
Intercept	0.796
	(0.449)
Year Fixed Effects	Yes
Region Fixed Effects	Yes
Observations	699
Pseudo-R^2	0.349
First-stage Partial R^2	0.096
First-stage Partial F-statistic	76.533
p-value of Partial F-statistic	0.000

Notes: In this table, we present the first-stage regression results from examining the factors associated with states' infrastructure reporting policies. We use a probit regression model to estimate equation (1). The primary variables of interest are the two variables included as instruments for *Modified Approach*—*Financial Report Timeliness* and *Biennial Budget*. Refer to

Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. Z-statistics (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.

TABLE 4
Second stage: infrastructure reporting and investments in infrastructure maintenance

Panel A: Infrastructure maintenance expenditures

	Dependent variable: *Maintenance*	
	OLS	2SLS
Independent variables:	(1)	(2)
Modified Approach	0.238***	1.348***
	(3.758)	(4.794)
Population Growth	7.897	7.502
	(1.627)	(1.352)
Lane Miles	-11.924**	-1.651
	(-2.015)	(-0.253)
DVMT	0.191***	0.149***
	(6.177)	(3.855)
Bridge Meters	-0.249***	-0.213***
	(-3.623)	(-2.617)
Federal Funds	0.116**	0.075
	(2.009)	(1.114)
Deficit	-0.300*	0.003
	(-1.715)	(0.014)
Pension Funding	0.147	-0.472
	(0.543)	(-1.456)
TEL	-0.128**	-0.208***
	(-1.985)	(-2.607)
BBR	0.345***	0.357***
	(3.647)	(3.266)
High Quality Infrastructure	-1.298***	-2.463***
	(-5.681)	(-6.417)
Intercept	-0.756	1.153
	(-0.881)	(1.084)
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Observations	699	699
Adjusted R^2	0.464	0.300
Overidentifying Restrictions Test (*p*-value)		0.679
Durbin-Wu-Hausman Test (*p*-value)		0.000

Panel B: Infrastructure condition

	Dependent variable: *Roads_%Poor*		Dependent variable: *Bridge Meters_%SD*	
	OLS	2SLS	OLS	2SLS
Independent variables:	(1)	(2)	(3)	(4)
Modified Approach	-0.005***	-0.067***	-0.011***	-0.058***
	(-2.626)	(-3.040)	(-3.960)	(-5.339)
Population Growth	-0.278*	-0.265*	-1.238***	-1.232***
	(-1.794)	(-1.737)	(-5.512)	(-4.622)
Lane Miles	0.349**	0.250*	2.172***	1.729***
	(2.331)	(1.733)	(8.442)	(5.085)
DVMT	0.009***	0.009***	-0.001	0.000
	(10.905)	(11.296)	(-1.307)	(0.207)
Bridge Meters	-0.001	-0.002	-0.018***	-0.019***
	(-0.406)	(-0.544)	(-4.918)	(-4.532)
Federal Funds	-0.003	-0.002	0.014***	0.016***
	(-1.514)	(-1.318)	(5.560)	(6.125)
Deficit	0.002	0.002	0.007*	0.006*
	(0.857)	(0.886)	(1.933)	(1.775)
Pension Funding	-0.008	-0.003	-0.050***	-0.023*
	(-1.160)	(-0.343)	(-5.199)	(-1.827)
TEL	0.003	0.004*	0.011***	0.015***
	(1.389)	(1.835)	(3.740)	(4.111)
BBR	-0.003	-0.003	0.008**	0.007*
	(-1.157)	(-1.165)	(2.007)	(1.693)
High Quality Infrastructure	-0.093***	-0.081***	-0.110***	-0.060***
	(-13.113)	(-8.278)	(-11.763)	(-4.346)
Intercept	0.090***	0.107***	-0.009	-0.090**
	(3.824)	(4.129)	(-0.244)	(-2.153)
Year Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Observations	699	699	699	699
Adjusted R^2	0.654	0.642	0.576	0.432
Overidentifying Restrictions Test (*p*-value)		0.963		0.823
Durbin-Wu-Hausman Test (*p*-value)		0.009		0.000

Notes: In this table, we present an analysis of the effect of infrastructure reporting on investments in infrastructure maintenance. We measure investments in infrastructure maintenance using *Maintenance* in panel A and using *Roads_%Poor* and *Bridge Meters_%SD* in panel B. In panel A, we estimate equation (2) in column (1) using OLS and the non-instrumented version of *Modified Approach*, and in column (2) using the two-stage least squares (2SLS) approach (the first stage is presented in Table 3). In panel B, we estimate equation (2) in columns (1) and (3) using OLS and the non-instrumented version of *Modified Approach*, and in columns (2) and (4) using the 2SLS approach. Refer to Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. *T*-statistics (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.

TABLE 5
Difference-in-differences design

Panel A: Descriptive statistics for difference-in-differences regressions

	Full Sample			Pre-GASB 34			Post-GASB 34			
	N	Mean	Median	N	Mean	Median	N	Mean	Median	$Mean_{POST} - Mean_{PRE}$
Maintenance	500	1.035	0.841	250	0.936	0.778	250	1.134	0.890	0.198***
Roads_%Poor	500	0.035	0.020	250	0.036	0.020	250	0.034	0.020	-0.002
Bridge Meters_%SD	500	0.098	0.080	250	0.102	0.080	250	0.094	0.080	-0.008
Population Growth	500	0.010	0.010	250	0.011	0.010	250	0.010	0.010	-0.001
Lane Miles	500	0.010	0.007	250	0.010	0.007	250	0.010	0.007	0.000
DVMT	500	3.259	2.525	250	3.129	2.421	250	3.390	2.642	0.261
Bridge Meters	500	0.924	0.785	250	0.917	0.785	250	0.931	0.785	0.014
Federal Funds	500	5.574	5.572	250	5.505	5.484	250	5.644	5.648	0.139***
Revenues	500	4.829	4.540	250	4.369	4.025	250	5.290	5.065	0.921***
Expenditures	500	4.442	4.185	250	3.852	3.645	250	5.032	4.775	1.180***
Debt	500	2.516	2.000	250	2.162	1.695	250	2.870	2.355	0.708***
TEL	500	0.562	1.000	250	0.532	1.000	250	0.592	1.000	0.060
BBR	500	0.740	1.000	250	0.740	1.000	250	0.740	1.000	0.000
High Quality Infrastructure	500	0.480	0.480	250	0.449	0.440	250	0.512	0.510	0.063***

Panel B: Infrastructure maintenance expenditures

Independent variables:	Dependent variable: *Maintenance*
Modified Approach×Post	0.159**
	(2.549)
Population Growth	-1.249
	(-0.316)
Lane Miles	3.250
	(0.177)
DVMT	0.200**
	(2.039)
Bridge Meters	-1.097*
	(-1.806)
Federal Funds	0.109
	(0.983)
Revenues	-0.041*
	(-1.798)
Expenditures	0.029
	(0.465)
Debt	-0.033
	(-0.912)
TEL	0.040
	(0.375)
BBR	0.924**
	(2.242)
High Quality Infrastructure	0.114
	(0.621)
Intercept	-0.809
	(-0.508)
Year Fixed Effects	Yes
Region Fixed Effects	Yes
State Fixed Effects	Yes
Observations	500
Adjusted R^2	0.799

Panel C: Infrastructure condition

	Dependent variable:	
	Roads_%Poor	*Bridge Meters_%SD*
Independent variables:	(1)	(2)
Modified Approach×Post	-0.001	-0.009***
	(-0.209)	(-2.625)
Population Growth	-0.073	0.214
	(-0.262)	(0.897)
Lane Miles	0.056	-3.066*
	(0.049)	(-1.661)
DVMT	0.006	-0.003
	(1.084)	(-0.472)
Bridge Meters	0.066	-0.077**
	(1.637)	(-2.268)
Federal Funds	-0.001	-0.003
	(-0.220)	(-0.557)
Revenues	0.001	0.003
	(0.665)	(1.581)
Expenditures	-0.001	0.005
	(-0.260)	(1.267)
Debt	-0.002	0.002
	(-0.506)	(1.008)
TEL	-0.004	0.015*
	(-0.591)	(1.709)
BBR	-0.058**	0.041*
	(-2.081)	(1.771)
High Quality Infrastructure	-0.053***	-0.006
	(-4.929)	(-0.674)
Intercept	0.010	0.163**
	(0.133)	(1.979)
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
State Fixed Effects	Yes	Yes
Observations	500	500
Adjusted R^2	0.761	0.903

Panel D: Tests of parallel trends assumption

	Dependent variable:		
	Maintenance	*Roads_%Poor*	*Bridge Meters_%SD*
Independent variables:	(1)	(2)	(3)
Modified Approach×Pseudo Post	0.001	0.006	-0.007
	(0.020)	(1.013)	(-0.879)
Population Growth	7.998*	-0.454	-0.550
	(1.688)	(-0.814)	(-0.676)
Lane Miles	-9.668	0.079	-2.991
	(-0.334)	(0.041)	(-0.969)
DVMT	0.043	0.001	-0.008
	(0.622)	(0.072)	(-0.676)
Bridge Meters	-0.052	0.250***	-0.056
	(-0.089)	(3.610)	(-0.998)
Federal Funds	-0.008	-0.000	-0.007
	(-0.065)	(-0.041)	(-0.805)
Revenues	-0.008	-0.000	0.002
	(-0.382)	(-0.032)	(0.884)
Expenditures	0.231*	0.001	0.000
	(1.682)	(0.042)	(0.056)
Debt	-0.065	0.001	0.011**
	(-0.912)	(0.120)	(2.548)
TEL	0.406***	-0.013	0.013**
	(4.835)	(-0.619)	(2.289)
BBR	0.467	-0.079	0.044
	(1.043)	(-0.689)	(0.591)
High Quality Infrastructure	0.237*	-0.049***	-0.021
	(1.968)	(-2.936)	(-1.375)
Intercept	-0.234	-0.079	0.270**
	(-0.132)	(-0.448)	(2.153)
Year Fixed Effects	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Observations	250	250	250
Adjusted R^2	0.874	0.720	0.850

Notes: This table presents our analysis of the pre- vs. post-GASB 34 differences in investments in infrastructure maintenance between modified approach (MA) and depreciation approach (DA) states using a difference-in-differences (DiD) research design. In panel A, we report descriptive statistics for all variables during the 5-year pre- and 5-year post-GASB 34 periods used in our DiD analyses. We tabulate descriptive statistics for the full DiD sample, the pre-GASB 34 sample, and the post-GASB 34 sample. In the last column of panel A, we compare the means of all variables across the pre- and post-periods. For the regressions reported in panels (B)-(D), which are tests of equation (3), we measure investments in infrastructure maintenance using maintenance expenditures (*Maintenance*) and using infrastructure condition (*Roads_%Poor* and *Bridge Meters_%SD*). Panel D tests the parallel trends assumption using a pseudo-pre-post analysis. *Pseudo Post* equals one for the latter two years of the pre-GASB 34 period. Refer to Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. *T*-statistics (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.

TABLE 6
Mechanism tests: budget cuts and diversions of infrastructure funds

	Dependent variable:	
	Midyear Budget Cut	*MFT Diversions*
Independent variables:	(1)	(2)
Modified Approach	-0.369**	-0.056***
	(-2.209)	(-4.671)
Population Growth	-28.624	-0.163
	(-1.515)	(-0.188)
Lane Miles	24.928	-0.585
	(1.217)	(-0.613)
DVMT	0.106	0.004
	(1.406)	(0.932)
Bridge Meters	0.309*	-0.012
	(1.805)	(-0.793)
Federal Funds	-2.582**	-0.001
	(-2.068)	(-0.074)
Deficit	0.463	-0.095***
	(1.023)	(-4.941)
Pension Funding	0.684	-0.067
	(1.114)	(-1.628)
TEL	0.213	0.033***
	(0.737)	(2.977)
BBR	-0.274*	-0.019
	(-1.730)	(-1.429)
High Quality Infrastructure	0.934*	0.132***
	(1.710)	(2.999)
Intercept	-0.765	0.059
	(-0.898)	(0.542)
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Observations	400	699
Pseudo-R^2/ Adjusted R^2	0.221	0.133

Notes: In this table, we present tests of potential mechanisms underlying the relation between infrastructure reporting and investment. In particular, we estimate equations (4) and (5) to examine whether the modified approach improves budgeting and resource allocation decisions. For the probit regression reported in column (1) and OLS regression in column (2), we proxy for improved budgeting using midyear budget cuts to general fund transportation spending (*Midyear Budget Cut*) and resource allocations decisions using diversions of motor fuel tax receipts to non-infrastructure programs and services *(MFT Diversions*). Refer to Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. Z-statistics in column (1) and *T*-statistics in column (2) (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.

TABLE 7
Infrastructure reporting and GPP infrastructure grades

Panel A: Infrastructure grades post-GASB 34

	Dependent variable: *GPP_Infrastructure*	
	OLS	2SLS
Independent variables:	(1)	(2)
Modified Approach	0.829*	1.922*
	(1.750)	(1.911)
Population Growth	19.154	7.963
	(0.603)	(0.264)
Lane Miles	-7.450	-4.396
	(-0.247)	(-0.139)
DVMT	-0.004	-0.086
	(-0.035)	(-0.706)
Bridge Meters	-0.670	-0.643
	(-1.485)	(-1.458)
Federal Funds	-0.091	-0.181
	(-0.359)	(-0.660)
Deficit	-1.212	-0.906
	(-1.518)	(-1.017)
Pension Funding	3.972***	4.009***
	(3.198)	(3.387)
TEL	-0.254	-0.332
	(-0.545)	(-0.719)
BBR	-0.194	-0.023
	(-0.374)	(-0.049)
High Quality Infrastructure	-0.935	-1.915
	(-0.757)	(-1.277)
Intercept	9.290**	10.401**
	(2.557)	(2.567)
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Observations	100	100
Adjusted R^2	0.186	0.165
Overidentifying Restrictions Test (*p*-value)		0.728
Durbin-Wu-Hausman Test (*p*-value)		0.066

Panel B: Infrastructure grades, pre- vs. post-GASB 34

Independent variables:	**Dependent variable:** *GPP_Infrastructure*
Modified Approach×Post	1.266**
	(2.066)
Population Growth	43.247
	(0.999)
Lane Miles	240.056*
	(1.984)
DVMT	0.802
	(0.568)
Bridge Meters	1.082
	(0.262)
Federal Funds	-0.135
	(-0.171)
Revenues	-0.782*
	(-1.786)
Expenditures	1.472***
	(3.605)
Debt	-0.957**
	(-2.325)
TEL	-0.236
	(-0.189)
BBR	-7.237*
	(-1.957)
High Quality Infrastructure	3.278
	(1.500)
Intercept	6.648
	(0.546)
Year Fixed Effects	Yes
Region Fixed Effects	Yes
State Fixed Effects	Yes
Observations	100
Adjusted R^2	0.599

Notes: In this table presents, we repeat our tests of equation (2) and (3), as reported in Tables 4 and 5, using an alternative proxy for investments in infrastructure maintenance (*GPP_Infrastructure*). Panel A, column (1), reports the OLS regression results using a non-instrumented *Modified Approach* measure. Panel A column (2) reports the 2SLS regression results using the instrumented measure of *Modified Approach* estimated using the first stage regression reported in Table 3. Panel B presents estimates from a difference-in-differences research design. In panel B, the pre-GASB 34 period corresponds to the 2001 GPP grades, and *Post* corresponds to the 2008 GPP grades. Refer to Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. *T*-statistics (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.

TABLE 8
Infrastructure reporting and new construction spending

Panel A: New construction spending post-GASB 34

	Dependent variable: *New Construction*	
	OLS	2SLS
Independent variables:	(1)	(2)
Modified Approach	-0.098	0.410
	(-0.994)	(1.135)
Population Growth	-22.098**	-23.541**
	(-2.395)	(-2.528)
Lane Miles	-24.521**	-19.618*
	(-2.385)	(-1.888)
DVMT	0.123**	0.106*
	(2.094)	(1.700)
Bridge Meters	0.177	0.190*
	(1.572)	(1.704)
Federal Funds	-0.033	-0.053
	(-0.436)	(-0.675)
Deficit	0.702	0.853*
	(1.561)	(1.793)
Pension Funding	1.108***	0.851**
	(2.749)	(2.223)
TEL	0.357***	0.318***
	(3.629)	(3.220)
BBR	-0.308**	-0.296**
	(-2.317)	(-2.178)
High Quality Infrastructure	0.247	-0.262
	(0.790)	(-0.554)
Intercept	0.088	0.400
	(0.074)	(0.324)
Year Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Observations	549	549
Adjusted R^2	0.174	0.151
Overidentifying Restrictions Test (*p*-value)		0.751
Durbin-Wu-Hausman Test (*p*-value)		0.009

Panel B: New construction spending, pre- vs. post-GASB 34

Independent variables:	**Dependent variable:** *New Construction*
Modified Approach×Post	0.125
	(0.779)
Population Growth	-22.682**
	(-2.318)
Lane Miles	94.672*
	(1.718)
DVMT	0.167
	(0.691)
Bridge Meters	-1.664
	(-1.141)
Federal Funds	0.314
	(0.765)
Revenues	-0.063
	(-1.085)
Expenditures	-0.086
	(-0.483)
Debt	0.293
	(1.316)
TEL	-0.030
	(-0.162)
BBR	0.780
	(0.753)
High Quality Infrastructure	-0.005
	(-0.011)
Intercept	-2.862
	(-0.519)
Year Fixed Effects	Yes
Region Fixed Effects	Yes
State Fixed Effects	Yes
Observations	500
Adjusted R^2	0.705

Notes: This table presents results from falsification tests that examine whether *Modified Approach* is associated with *New Construction* spending. Panel A column (1) reports the OLS regression results using a non-instrumented *Modified Approach* measure. Panel A column (2) reports the 2SLS regression results using the instrumented measure of *Modified Approach* estimated using the first stage regression in Table 3. Panel B presents pre-vs. post-GASB 34 differences (five years pre- and five years post-GASB 34) in *New Construction* spending between MA and DA states with a difference-in-differences research design. Refer to Appendix A for variable definitions. All continuous variables are winsorized at the top and bottom one percent of their distribution. *T*-statistics (reported in parentheses) are based on robust standard errors adjusted for heteroscedasticity and two-way clustering by government and year. The superscripts *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively, using two-tailed tests.