Public Financing under Balanced Budget Rules *

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Abstract

This paper analyzes the impact of a balanced budget rule (BBR) on government financing costs. We construct measures of BBR at the US state government level, and find that states with tighter BBRs are associated with significantly lower state government bond spreads. Furthermore, the credit default swap (CDS) spreads are also significantly lower for states that impose tighter BBRs, indicating the importance of a default risk channel. We then build a simple sovereign default model with BBRs to illustrate the mechanism and conduct event analysis. Our quantitative analysis projects that the debt spreads for the state government of Illinois would reduce by 50% and its debt burden would decline by 33% in ten years if it imposed a BBR today.

Keywords: Public financing, balanced budget rule, sovereign default risk

JEL classification: E62, F34

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1 Introduction

A balanced budget rule (BBR) requires that a government is not allowed to carry over its deficits into the next fiscal year or biennial budget cycle.[1] BBRs, together with other fiscal rules like debt limit rules, are designed to constrain fiscal policy by correcting distorted incentives and containing pressures to overspend. However, they are also believed to amplify business cycles (e.g. Schmitt-Grohé and Uribe, 1997). Following the fiscal expansions during the COVID-19 crisis, many countries faced heightened debt burdens, leading to a new wave of policy interests in imposing fiscal rules like the BBR.

In this paper, we contribute to this discussion by focusing on a novel angle of the economic impact of BBR—the government financing cost channel. Previous studies have pointed out that BBRs reduce governments' propensity to run deficits and lead to more sustainable public finances. However, little is known about the nexus between BBR and government debt spreads. Data show that government bond spreads vary substantially across states, especially during economic downturns. Understanding the regional heterogeneity in government borrowing costs is important in understanding the heterogeneity in fiscal and economic conditions across regions. For example, a high borrowing cost has ramifications of high future debt burdens. It might also discourage current borrowing, leading to higher business cycle volatility. Therefore it's important to delve into the driving forces behind government financing costs. In this paper, we find that fiscal rules, an often neglected factor, can play a critical role.

We identify the link between BBR and government debt spreads by exploiting the policy variation across US states. US states are sovereigns; they can issue bonds and default on their bonds. State governments have defaulted on their debt in history. Also, there are large variations in government spread across states, and the magnitudes are comparable with those of European countries. As for BBR, there is a substantial variation in BBR across states both at the extensive and intensive margins: 20-30% of the states have not imposed a deficit carryover restriction, and for those that do have a BBR in place, there's substantial variation in the extent of imposition, e.g. whether the rule is constitutional or statutory. In addition, unlike most previous studies that treat BBR as a time-invariant factor (due to limited data), we compile a new dataset on state government BBRs that covers multiple years. These variations across regions and over time are

[1] In practice, BBRs vary in stringency and design across governments. They typically only apply to states' operating budgets. Bond finance for capital projects, the purpose of which is borrowing against future revenues, generally does not fall within any constraints of a BBR. (NCSL Fiscal Brief)

therefore helpful for us to identify this relationship more favorably compared with the existing literature.

We start by constructing a data set of state government bond spreads, our primary measure of financing cost facing state governments, together with a new dataset of different measures of state government BBRs. In the empirical exercise, we control for bond-specific characteristics, state-level economic and fiscal conditions, as well as time and state fixed effects. Our baseline result shows that BBRs are significantly *negatively* correlated with state bond spreads. This result holds across different measures of BBR that we consider. It also stands to the two attempts at addressing the concern of the potential endogeneity of time-varying BBRs. We then provide evidence that default risk is likely to be an important channel through which BBR affects state bond spreads: our BBR measures are significantly negatively associated with state government CDS spreads, a direct measure of the default risk component of the state government bond spreads.

To better understand the empirical results, we introduce a BBR in a quantitative sovereign default model à la Arellano (2008). In our framework, the government borrows by issuing state-uncontingent bonds, and is allowed to default on these bonds. The bond price then reflects the magnitude of the government default risk. We then add to this canonical default model by considering an institutional setup in which there is a constitution that requires the local governments to execute a BBR. We model a BBR as a requirement that income must be sufficient to cover spending and the expected interest payment. Under this BBR, when the government issues bonds, it considers that a large debt increases future interest payments. To avoid violating BBR, the government borrows less. The lenders also know that BBRs constrain the government. With lower default risk, the lenders offer the government a more favorable borrowing price. Through this model, we numerically show that imposing a BBR lowers the government default risk, thus lowering the government debt spreads and reducing the debt burden.

Finally, we conduct a quantitative analysis using data from the State of Illinois. The overall fiscal condition for Illinois has been worrisome, and it worsened even more during the pandemic. The government spread for Illinois is much higher than an average state: the average spread in 2009-2020 for Illinois is 237 bps, while the average for other states is 67 bps while in 2020 alone, the average spread was 327 bp. To quantify the impact of introducing a BBR on government spreads in this state, we simulate the model without a BBR, and then introduce a BBR to quantify its impact on the government financing cost and indebtedness. The introduction of a BBR restricts new borrowings and reduces government default risk. With lower default risk, the government bond has a lower spread. We estimate that the government spread would drop by 50% after 10 years of imposing a BBR. The debt burden is projected to fall as well: it would drop by 33% within 10 years.

Literature. Empirically, this paper contributes to early literature on the impacts of BBRs at the state level. State governments in the US are similar to sovereigns—they can design their own fiscal rules, issue bonds and may also default on their bonds. Existing literature mostly focuses on the effects of BBR on a state's budget surplus or deficit. BBRs have significant positive effects on a state's budget surplus (Bohn and Inman, 1996). When deficits occur, a BBR leads to more rapid fiscal adjustment by tax increases and spending cuts to restore fiscal balance (Poterba, 1994, 1996; Hong, 2015). However, the benefits of fiscal balance may come at the expense of the stabilization function of fiscal policy to react to business cycle fluctuations (Eichengreen and Bayoumi, 1994). Empirical evidence of the adverse effects of BBR on a state's stabilization policy is mixed. Lower cyclical variability of the budget balance does not necessarily lead to higher output volatility (Alesina and Bayoumi, 1996; Krol and Svorny, 2007), and BBR can reduce output fluctuations, offsetting less responsiveness of fiscal policy by lower fiscal policy volatility (Fatás and Mihov, 2006). We focus on the effects of BBRs on a state's borrowing cost measured by state government spreads. Our argument that BBRs can lower the required return on a state's bonds by reducing the default probability is in line with Eichengreen and Bayoumi (1994) who show that fiscal restraints lower the required return on general obligation bonds by nearly 50 basis points. Relatedly, Poterba and Rueben (2001) shows that while unexpected deficits are correlated with higher state bond yields, the effect is smaller for states with tight anti-deficit rules. Recent literature also explores government default risk and borrowing cost using state-level spreads (Arellano et al., 2016; Deng, 2019). Our paper is different in that we develop a new dataset of state-level BBRs, and study their impacts on state-level spreads beyond indebtedness or deficits.

Our research relates to the literature on the impact of BBRs on asset pricing for the national governments. In earlier studies, national fiscal rules of Euro area countries and OECD countries show a very weak effect on the bond spreads (see, e.g., Iara and Wolff, 2014; Heinemann et al., 2014; Kumar et al., 2009), which implies their existing fiscal rules are either not strong or credible enough to affect the investors' risk assessment. However, Feld et al. (2017) empirically documents that strong and credible BBRs in the Swiss cantons contribute to lower risk premia. By restoring financial market confidence, a BBR contributes to a decrease in the risk premia by more than 10 basis points. Asatryan et al. (2018) finds that introducing a constitutional BBR leads to a lower probability of sovereign debt crisis. Our contribution is to expand the study to a sub-national level by constructing new measures of state government BBRs, and investigating their impact on state government borrowing costs. A cross-state analysis is more desirable than a cross-country study because nationwide factors can be absorbed in the time fixed effects in the former, while heterogeneity across countries is harder to control in the latter. Nonetheless, our result has clear implications for the fiscal policy at the national government level.

Theoretically, our framework is most related to Alfaro and Kanczuk (2017) and Hatchondo et al. (2020). Both papers quantitatively examine the welfare implications of alternative fiscal rules in the context of sovereign debt and default. Alfaro and Kanczuk (2017) find that a simple debt limit yields a welfare gain close to the optimal fiscal policy and performs better than the deficit rule. Hatchondo et al. (2020) show that a common spread brake generates larger welfare gains than a common debt brake in a union of heterogeneous economies. While our work does not focus on comparing different fiscal rules or studying their welfare implications, we provide solid empirical evidence on the impact of a widely adopted fiscal rule at the US state level on state government borrowing costs, a specific mechanism also with welfare implications.

The remainder of the paper proceeds as follows. Section 2 constructs and describes our measures of BBR and state government bond spreads. Section 3 conducts empirical studies on the impact of BBRs on government spreads. Section 4 presents a sovereign default model with a BBR. Section 5 parameterizes the model using data from Illinois and quantitatively studies the impact of introducing a BBR. Section 6 concludes and discusses various implications.

2 Data and Summary Statistics

2.1 Data Construction

Measure of BBR. Our first contribution is to build a consistent dataset for alternative measures of state government BBRs. While there has been no consensus on measuring the tightness of state-level BBR, its measurement generally falls under two categories: deficit carryover restrictions and legal requirements. The former is more clear-cut, that is, the state cannot carry over its deficit. The legal requirements, however, take various forms. For example, in the 2021 *Budget Processes in the States* report published by the National Association of State Budget Officers (NASBO), legal restrictions include "governor required to submit balanced budget", "legislature required to pass balanced budget", and "budget signed by governor required to be balanced". And in each category, the requirement can either be "constitutional" or "statutory", referring to different tightness levels. The measurement of BBR, both by public media and academic literature, focuses on different aspects of the two categories. For example, Urban-Brookings Tax Policy Center defines a "strong" balanced budget requirement for a state meeting one or more of the following criteria: governor required to sign a balanced budget, prohibited from carrying over a deficit into the following year, the legislature required to pass a balanced budget accompanied by within-year fiscal controls or limits on supplemental appropriations.[2] Costello et al. (2017), however, exclusively focuses on the defines BBR as a dummy variable equal to 1 if the state has "no-carry-forward" rules, and 0 otherwise, citing that deficit carryover restrictions are the most rigorous and effective in reducing deficit spending.

Our primary measure of BBR follows the baseline measure in Costello et al. (2017): states are considered to have BBR if they are not allowed to carry over a deficit from one fiscal year to another. We collect this information from NASBO's *Budget Processes in the States* report, published in 1987, 1989, 1992, 2008, 2015, and 2021.[3] This report is also the reference source of BBRs in the Book of the States for most years.[4] Because of the lag between survey and publication, we use the information in each publication to measure the in previous year's BBR. The first line of Table 1 summarizes the number of states that imposed this requirement in those years. Most states had a no-carryover rule in place, but the number is not invariant over time – fewer states imposed this rule in the recent decade than previous ones.

Our second measure of BBR, ACIR Index hereafter, borrows the approach of *Fiscal Discipline in the Federal System: National Reform and the Experience of the States* published by the Advisory Commission on Intergovernmental Relations in 1987, which establishes a point system to construct an index for each state's BBR conditions. Our index calculates the degree of BBR stringency based on the total number of points assigned to each category of the aforementioned balanced budget requirements. With slight variation from the original publication, our index awards points for

[2]https://www.taxpolicycenter.org/briefing-book/what-are-state-balanced-budget-requirements-and-how-do-they-work

[3]The 1997, 1999, and 2002 reports do not contain information on whether a state can carry forward its deficit, so are excluded from our sample.

[4]In the 1992, 1995 and 1997 editions of the Book of the States, "State Balanced Budgets" are updated by The Council of State Governments, reflecting literal reading of state constitutions and statutes. To build a consistent sample using a unified definition, we omit these updates from our BBR sample. However, adding these years does not alter the significance of our baseline results.

Table 1: BBR Across US States

	1986	1988	1991	2007	2014	2020
No Deficit Carryover (#)	40	41	37	43	39	36
ACIR Index 0-10 (avg)	8.33	8.54	8.04	8.84	8.22	8.12
Correlation	0.93	0.97	0.97	0.96	0.95	0.97

Notes: The first line summarizes the number of states that imposed a no-carryover rule in each year. The second line presents the average ACIR index across states. The third line shows the correlation of the our two measures of BBR: dummy and index.

whether in the state: governor must submit a balanced budget (1 point), the legislature must pass a balanced budget (2 points), or the state cannot carry a deficit into the next fiscal year (8 points). The index is then the points from the "highest" ranked requirement among the three plus 1 point if the rule is statutory or 2 points if the rule is constitutional, leading to a minimum of 0 if a state has nothing in place, or 10 points if a state does not allow deficit carryover and this requirement is constitutional, or both statutory and constitutional.

Consistent with the first measure, the index measure has a high average, indicating that most states have some form of BBR. And this average tends to be smaller in the recent decade, indicating that the level of BBR is on average less tight than in previous decades. The third line also shows that our two BBR measures are highly correlated. Figure 1 presents a snapshot of the geographic distribution of BBR in 2020. While many states have very tight BBRs—index being 10 or close to 10—there are a number of states with very loose requirements. In particular, the state of Illinois did not forbid carryover of deficit into the next fiscal year, and only required that the legislature must pass a balanced budget. In Section 5, we will study the impact of this lack of strong BBR on this state's financing cost.

Measure of State Government Bond Spreads. Our data on municipal bond issues come from the Securities Data Company's (SDC) Global Public Finance US Municipal New Issues database, which contains rich information on various characteristics of newly issued bonds at the state and local levels, including the issuer information, amount of issues, years to maturity, coupon, prices and yields, and credit ratings, among many others. Different from the transaction-level municipal bond price data, such as the Municipal Securities Rulemaking Board (MSRB) dataset used in Ang et al. (2014) and Schwert (2017), our SDC data contain only newly-issued municipal bonds.

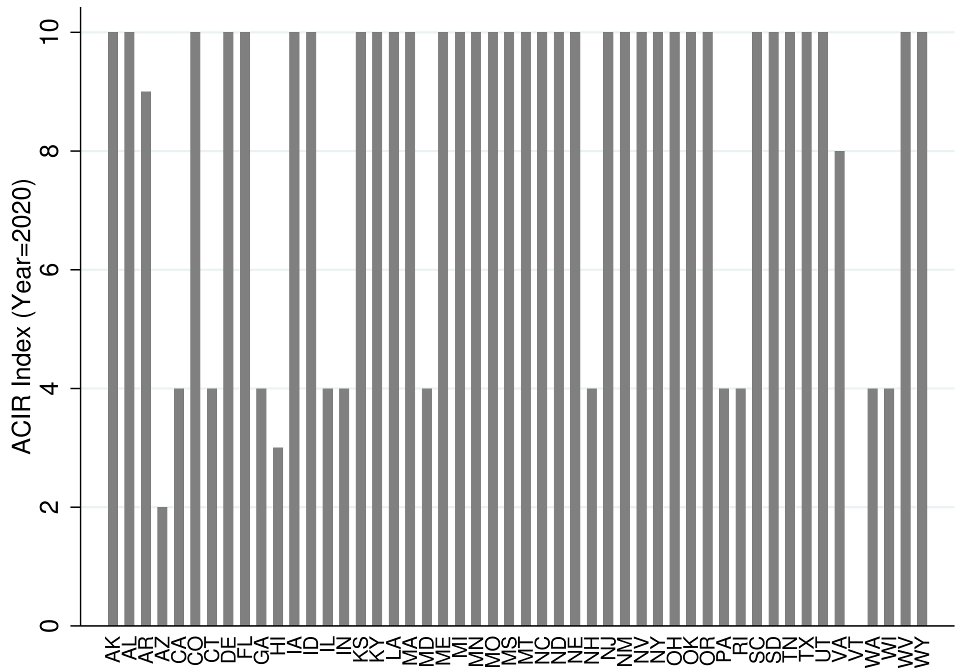


Figure 1: ACIR Index in 2020

Notes: ACIR Index in the year of 2020 by state, from 0 (no BBR) to 10 (strictest form of BBR).

To construct a clean and reliable dataset for our use, we follow the data selection steps in the literature such as Novy-Marx and Rauh (2012), Schwert (2017) and Butler and Yi (2021). First, we omit observations that are most likely to contain data errors. Second, we focus only on general obligation bonds that are unsecured by any special-purpose revenue. Third, we include only bonds with fixed coupon rates to accurately calculate bond spreads. Fourth, we winsorize all yield and yield spread variables at 1% and 99% over the sample period to mitigate the impact of outliers. More details on our data cleaning methods are relegated to Appendix A.

Following the procedures above, our dataset contains general obligation bonds issued by US states (including DC), counties, cities and other government entities from 1976 to 2020. As this paper focuses on the relationship between state government fiscal rules and its financing cost, we keep the state government bond only. In addition, as most municipal bonds are exempt from federal and state taxes, it's important to account for tax rates as a source of variation in bond yields in the cross section. Therefore, we adjust the state bond yields by a tax-adjustment factor $\tau_{s,t}$ specified as $1-\tau_{s,t} = (1-\tau_{s,t}^{fed})(1-\tau_{s,t}^{state})$, where $\tau_{s,t}^{fed}$ and $\tau_{s,t}^{state}$ denote the top federal and maximum state income tax rates using data from NBER TAXSIM.

State bond spreads are calculated as the difference between the tax-adjusted yield of a state government bond, readily available from our dataset or calculated from the raw price if the information on yield is missing, and a tax-adjusted synthetic yield, constructed using the corresponding term structure together with the treasury spot rates estimated in Gürkaynak et al. (2007), following the method described in Butler and Yi (2021). The result of this approach is a tax-adjusted spread that depends on the term and coupon structure of each bond issuance. In the empirical analysis, we account for the spread variation caused by this difference by controlling for coupon and maturity in our regressions.

Table 2 provides a description of the dataset used in the empirical analysis. Our sample consists of more than 7,000 observations of bonds issued by the state governments mostly from 1980 to 2020 (with only 3 in 1977, 2 in 1978 and 2 in 1979). There are wide distributions in all of the variables we consider. In particular, the key dependent variable, State Bond Spread, has a mean of 0.772% and a standard deviation of 0.788%. The primary goal of this paper is to understand this considerable variation in state government borrowing costs across states and over time.

Table 2: Descriptive Statistics of State Government Bonds

	(1) **Mean**	(2) **Median**	(3) **S.D.**	(4) **P1**	(5) **P99**	(6) **N**
Maturity	2.678	1.003	4.315	0.233	24.090	7,027
Coupon	4.470	4.500	2.159	0.350	11.000	7,027
Amount (million $)	179.935	63.000	458.433	0.760	1,968.930	7,027
Taxable Bonds (%)	11.755	0.000	32.209	0.000	100.000	7,027
Price	102.510	100.937	4.365	99.283	124.398	7,027
Yield (%)	3.107	3.099	2.023	0.150	8.750	7,027
Tax-Adjusted Yield (%)	2.332	2.121	1.739	0.033	6.995	7,027
State Bond Spread (%)	0.772	0.567	0.788	-0.696	3.776	7,027
Fitch Ratings	6.960	7.000	0.374	5.000	7.000	453
Moody's Ratings	6.924	7.000	0.563	5.000	7.000	512
S&P Rating	6.797	7.000	0.786	4.000	7.000	488
Overall Rating	0.570	0.589	0.065	0.333	0.667	537

Notes: This table presents the mean, median, standard deviation, 1st percentile, 99th percentile and total number of observations (excluding missing data) of each variable. We map rating notches into numerical values, where 1 is the highest rating (Aaa or AAA), 2 the second highest (Aa1 or AA+), and so on. "Overall Rating" is the average of the three normalized rating scores (Fitch, Moody and S&P). We use the average of the three normalized rating scores to represent the final rating score of bonds, though only about 1/5 of the bonds are rated.

Other State-Level Variables. We also include state-level economic and fiscal variables as controls in our regressions. Annual state-level GDP data are taken from the BEA Regional Economic Accounts, and are divided by state population data. State government fiscal variables—debt at end of the fiscal year, total revenue, and total expenditure—are all from the State Government Finances.

2.2 BBR and State Government Bond Spread

Before moving into regression analyses, we start by presenting the comparison of average state bond spreads for states with and without BBR, based on our primary BBR measure. With the caveat in mind that there may be other factors that determine the difference in spreads across states, Table 3 reflects that among the six years that we have data for BBR, in four of them the average spread for BBR states are much lower than their non-BBR-states counterparts, while the year of 1988 is an exception and in the year of 2007, the former is only slightly higher.

Table 3: Average Spread: BBR States v.s. No-BBR States

	1986	1988	1991	2007	2014	2020
No Deficit Carryover	1.35	0.32	0.74	1.06	0.21	0.52
Deficit Carryover Allowed	1.60	0.12	0.92	1.01	0.66	0.80

Notes: Line 1 presents the average state bond spread (in %) across states with BBR (based on our baseline BBR measure). Line 2 are their non-BBR-states counterparts.

3 Empirical Study

In this section, we present our main empirical results on whether imposing a BBR would affect a state government's financing cost. We further provide evidence of the important role played by default risk in driving this relationship.

3.1 Empirical Specification

Our baseline estimation is specified as follows:

$$\text{Spread}_{s,t} = \text{constant} + \beta^{\text{BBR}} \times \text{BBR}_{s,t} + \boldsymbol{\beta}^{\text{control}} \boldsymbol{X_{s,t}} + \gamma_t + \theta_s + \varepsilon_{s,t} \tag{3.1}$$

where $\text{Spread}_{s,t}$, state government bond spread for state s at each issuance, is our primary dependent variable. In our baseline regression, $\text{BBR}_{s,t}$ takes either the dummy variable of whether a state can carry over its deficit, or the ACIR index described in Section 2.1. $\boldsymbol{X_{s,t}}$ is a vector of control variables including bond issuance characteristics (maturity and coupon) and state-level variables (debt to GDP ratio, GDP growth, and/or total revenue to GDP ratio, total expenditures to GDP ratio). In the sovereign default literature, two main variables that drive the government borrowing cost are the debt position and economic condition measured by the output growth. Intuitively, a sovereign with a higher debt position is more likely to default because the benefit of default is likely to be larger, while one with higher economic growth is less likely to default because the cost of default is greater if default punishment is related to the output. Besides these variables, we also consider the possibility of state government fiscal conditions as potential driving forces behind the variation in state spreads: a government with a strong fiscal position—that generates more fiscal revenue or spends less—may be considered by investors as less likely to default on their debt.

The dataset used in our regression is not a continuous panel, nonetheless, we consider state and/or time fixed effects, capturing the unobserved differences across states that might have influenced the cross-sectional variations, and the unobserved time-varying nationwide factors that might have influenced the variation in state bond spreads over time. Equation (3.1) can also be seen as a generalized difference-in-difference regression, where β^{BBR} measures the average treatment effect.

There are several instances of multiple bond issues for a given state in one year. To avoid aggregation of bond-specific characteristics within a year that may miss information on the variation across each issuance useful for identification, we estimate at the issuance/transaction level, instead of the year level.

3.2 Results

Table 4 presents our main empirical findings. The results for our preferred specifications, including all the controls together with both state and year fixed effects, are shown in Columns (4) and (8). Estimates for BBR coefficient are negative, and significant at at least the 10% level for both specifications. Column (4) shows that imposing a BBR in the form of "no deficit carryover" would on average lead to a -0.166 percentage point decrease in state bond spreads. The estimate is harder to interpret for Panel B results, because a one point increase in the ACIR index does not carry a natural interpretation. Nonetheless, it provides an additional piece of evidence for the negative relationship between BBR and state government financing costs. The estimates for the coefficients on the control variables are very similar across the two panels. Debt to GDP ratio is significantly positively associated with the spread variable, consistent with the predictions of standard theory. The coefficients on GDP growth are negative—again consistent with theory—yet not significantly different from 0. Coefficients on bond-level controls, maturity and coupon, are both anticipated to be significant by construction. Control variables on state government fiscal conditions, revenue and expenditure, both come as significantly correlated with bond spread, yet their signs do not appear consistent with theoretical predictions. Adjusted R-squares in both regressions are over 0.4, indicating a strong explanatory power of the right-hand-side variables included in our baseline specifications.

Turning to other columns, setting aside the two fiscal variables, as shown in Columns (3) and (7), matters little to the baseline estimates. However, omitting time fixed effects, as shown in Columns (1) (2) (5) and (6), alters the sign and the statistical significance of the BBR coefficients. In these specifications, the coefficient estimates of BBR are positive and not significant. This observation highlights the importance of time fixed effects in understanding the variation in state bond spreads across states and over time.

Taken together, our baseline empirical tests suggest a significantly negative relationship between BBRs and government financing costs measured by bond spreads at the state level.

3.3 Robustness Tests

While our baseline estimation result provides a consistently negative correlation between BBRs and state bond spreads, there may still be concerns over the validity of this result. First, the newly-constructed measures of BBR may not capture all the requirements underlying a BBR in reality. Second, there may be omitted factors that systematically affect both fiscal rules and the state bond spreads, leading to biased estimates. To address these concerns, we conduct the following three sets of robustness tests.

An alternative measure of BBR. In addition to the two BBR measures described in the main text, we also provide the estimation result using an alternative measure of BBR using the Urban Institute's definition[5], according to which there are five categories: "Governor must ultimately

[5]https://www.urban.org/research/publication/balanced-budget-requirements.

Table 4: State Bond Spread and BBR

	Panel A: *No Deficit Carryover*				**Panel B**: *ACIR Index*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BBR	0.022	0.029	-0.173**	-0.166**	0.005	0.007	-0.023*	-0.022*
	(0.121)	(0.120)	(0.077)	(0.071)	(0.021)	(0.021)	(0.014)	(0.013)
Debt/GDP	3.867***	3.573**	3.607**	3.261**	3.854***	3.558**	3.582**	3.232**
	(1.319)	(1.508)	(1.479)	(1.380)	(1.317)	(1.513)	(1.545)	(1.445)
ΔGDP	3.797*	2.670	0.013	-0.801	3.781*	2.634	0.019	-0.799
	(1.931)	(2.411)	(1.613)	(1.738)	(1.933)	(2.440)	(1.641)	(1.776)
Maturity	0.067***	0.068***	0.067***	0.067***	0.067***	0.068***	0.068***	0.067***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Coupon	0.089***	0.084***	0.089***	0.091***	0.090***	0.085***	0.088***	0.091***
	(0.020)	(0.024)	(0.028)	(0.028)	(0.020)	(0.023)	(0.027)	(0.028)
Revenue/GDP		5.164		6.726*		5.183		6.806*
		(4.968)		(3.524)		(5.020)		(3.591)
Expenditure/GDP		-7.710		-8.050*		-7.782		-8.100*
		(6.224)		(4.014)		(6.332)		(4.116)
State Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	Yes	Yes	No	No	Yes	Yes
Constant	-0.292**	0.023	0.034	0.146	-0.315*	-0.001	0.101	0.203
	(0.137)	(0.567)	(0.204)	(0.487)	(0.161)	(0.539)	(0.212)	(0.478)
N	977	977	977	977	977	977	977	977
adj. R^2	0.254	0.256	0.436	0.438	0.254	0.256	0.434	0.436

Notes: This table reports the baseline coefficient estimates of (3.1) and their standard errors (clustered by state). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Panel A reports the result using the deficit carryover definition of BBR, while in Panel B, BBR is proxied by the ACIR Index. The control variables on state economic and fiscal conditions including Debt/GDP, per-capita GDP growth ΔGDP, Revenue/GDP and Expenditure/GDP enter the regressions with a one-year lag. We consider two fixed effects—the state fixed effect and the time fixed effect. "Yes" means the corresponding fixed effect is considered in the regression.

sign, no deficit carryover permitted", "Governor must ultimately sign, deficit carryover permitted", "Governor must propose or legislature pass, no deficit carryover permitted", "Governor must propose or legislature pass, deficit carryover permitted" and "none". Although the ranking of tightness of BBR is not clear from this definition, we are sure that the first category is the strongest. Therefore, we define a dummy variable that equals to 1 if a state lies within the first category, and 0 otherwise. We perform the same exercise as in the baseline and present the result in Table B.8. Across the four different specifications, coefficients on BBR are consistently negative, in line with our baseline results. In our most preferred specification with both fiscal control variables and both fixed effects, this coefficient is significantly different from 0 at the 10% level. In terms the magnitude, the estimate of BBR coefficient is similar to that in the baseline regression using the "No Deficit Carryover" dummy variable as the explanatory variable, which lends more support to the robustness of our main conclusion.

Adding state political party information. To address the second concern, we first include one possible omitted factor that might simultaneously drive a state government's preference for fiscal rules and the financial outcomes. In particular, we include political factors besides the aforementioned baseline explanatory variables. We take our data from the National Conference of State Legislatures. States are classified as "Democratic" if both legislative chambers have Democratic majorities. Similarly, "Republican" indicates that both legislative chambers have Republican majorities. A state is "Split" if neither party has majorities in both legislative chambers. Following this classification, we construct two dummy variables "Democratic" and "Republican", and include them as additional explanatory variables. Table B.9 shows that controlling for these variables has minimal impact on our baseline results. In addition, the coefficients on these political party variables are not significantly different from 0, indicating that the difference in political party is not the key factor in explaining the variation in state government financing costs.

Instrumental variable estimation. However, the implementation or abolishment of fiscal rules is likely endogenous to unobserved variables that we fail to account for. We make an attempt using an instrumental variable approach, although not a perfect one, to address this concern. This approach is motivated by the feature of available BBR data that there is a significant gap between the earlier sample (1986, 1988 and 1991) and the rest years (2007, 2014 and 2020). We use the BBR in the early years as an instrument for that in the estimation with the later sample. The validity of this instrument relies on two assumptions. First, state fiscal policies tend to be path-dependent. Therefore, the BBR in the latter sample is correlated with the earlier one. Second, the early-sample BBR is uncorrelated with the unobserved factors driving borrowing costs in the later sample, and it has an impact on government bond spreads in the later sample only via its correlation with the later-sample BBRs. Table B.10 shows the results from this approach. A key takeaway from this table is that the signs of BBR coefficient estimates remain negative, and are also significant at the 10% level in the specifications with fiscal variable controls, as shown in

Columns (2) and (4).

3.4 Inspecting the Mechanism

Schwert (2017) shows that the tax-adjusted municipal bond yield spread can be decomposed into a default risk component, and an illiquidity compensation component. In this section, we proceed to understand the channels through which BBR affects government borrowing costs and highlight the role of sovereign default risk. To understand the correlation between BBR and default risk, we use state government CDS spreads (premia) to measure the default component of state bond spread. The CDS data are readily available from Bloomberg, and they provide a direct measure of the state government credit default risk perceived by the investors. They are available for 19 states from 2010 to 2020, and 10 states for 2009. To increase the size of sample used in estimation, we impute the BBR for 2009 by assuming that it's the same as that of 2007, the closest year to 2009 with available BBR data. Therefore, we are able to run a pooled OLS regression using 48 observations[6].

We find that BBR is negatively correlated with CDS in all of our specifications: with or without fiscal control variables, including the dummy or index as a proxy for BBR. Columns (2) and (4) of Table 5 present the coefficient estimates controlling for fiscal variables, our preferred specifications. It's evident that coefficients on BBR for both measures are significantly negative at the 10% level. This result implies that other things being equal, imposing a BBR (Column (2)) or tighter BBR (Column (2)) would lead to a significantly lower government default risk, thus leading to lower borrowing costs for state governments. In Appendix B Table B.11 and B.12, we present more results using different standard errors by assuming homoscedasticity, and doing a sub-sample analysis.

These results indicate the crucial role played by the default risk channel in explaining the negative correlation between BBR and state government bond spreads. In the next sections, we rely on this finding to quantify the impact of BBRs in a sovereign default model.

[6]Panel regressions controlling for fixed effects are not feasible because of the small sample size.

Table 5: CDS spreads and BBR

	Panel A: *No Deficit Carryover*		**Panel B**: *ACIR Index*	
	(1)	(2)	(3)	(4)
BBR	-0.435	-0.434*	-0.072	-0.072*
	(0.283)	(0.246)	(0.048)	(0.041)
Debt/GDP	-0.920	1.701	-0.923	1.696
	(2.254)	(1.718)	(2.270)	(1.738)
ΔGDP	-10.470***	-4.746	-10.515***	-4.786
	(3.386)	(2.890)	(3.415)	(2.899)
Revenue/GDP		-19.667***		-19.650***
		(6.855)		(6.855)
Expenditure/GDP		10.784		10.834
		(6.999)		(7.029)
Constant	1.355***	2.234***	1.644***	2.510***
	(0.414)	(0.566)	(0.601)	(0.707)
N	48	48	48	48
adj. R^2	0.142	0.344	0.140	0.341

Notes: This table reports the baseline parameter estimates and their robust standard errors (in parentheses). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Effective sample period: 2009, 2014 and 2020. BBR takes the "No Deficit Carryover" dummy variable in Panel A, and the "ACIR Index" in Panel B. The estimations are pooled OLS regressions of all the observations. CDS data source: Bloomberg.

4 Model

Empirical results show that states with tighter BBRs are associated with significantly lower state government spreads, and default risk is a plausible explanation for our main empirical finding. In this section, we use a simple sovereign default model à la Arellano (2008) to illustrate the mechanism.

Consider a region as a small open economy which receives a stochastic stream of income y_t. The households have a discount factor β and a constant relative risk aversion utility function over consumption c_t given by:

$$u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}, \tag{4.2}$$

where σ is the risk aversion parameter. Households pay taxes τy_t to the state government, where τ is the tax rate ($\tau > 0$), and receive transfer T_t from the government.

The government has access to tax revenue τy_t. It borrows by issuing bonds and returns the proceeds as a transfer to the households. Thus, it can be viewed as the government borrow as a representative for the households.

The government borrows by issuing state-uncontingent long-term bonds to the rest of the world's risk-neutral lenders. Let q_t be the bond price that promises to pay one unit of the consumption good next period. The governments can default on their bonds. The lenders recognize that the governments may default and set the bond price q_t to break even in expectation. Thus, the bond prices are endogenously determined and reflect government default risk. If the government defaults, it is excluded from the borrowing market for a period of time. The government regains the ability to borrow with probability λ. In the case of default, there is an exogenous cost that reduces income: $y^d = h(y) < y$. Since federal government transfer does not fall into BBRs, we abstract it from our model for simplicity.

4.1 Recursive Formulation

We describe the government with recursive formulation and then characterize the recursive equilibrium. Each period the local economy starts with a level of local income y and public debt B. We omit the time subscript t to simplify notation, and we use x' to denote variable x in the next period. The timing of the model is as follows. At the beginning of each period, the income y is observed. A fraction ϕ of government debt matures and the remaining 1-ϕ fraction remains outstanding. Given tax revenue, the government decides whether to repay its debt or not. If the government repays its debt, it can choose new borrowing B'. If the government defaults, it enters into financial autarky and the economy suffers an income loss and the income becomes $y^d < y$.

The government with access to the financial markets chooses whether or not to default to maximize the households' welfare:

$$V(y, B) = \max\{V^c(y, B), V^d(y)\}, \tag{4.3}$$

where V^c denotes the non-defaulting value and V^d the default value. Let $D(y, B) = 1$ denotes default. If the government does not default, it can choose new debt level, B', by solving the following dynamic programming problem:

$$V^c(y, B) = \max_{\{c, B'\}} \quad u(c) + \beta \mathbb{E}\left[V(y', B')\right], \tag{4.4}$$

subject to household budget constraint and government budget constraint:

$$c = (1-\tau)y + T, \tag{4.5}$$

$$c \geq 0, \tag{4.6}$$

$$T + \phi B = \tau y + Q(y, B')\big(B' - (1-\phi)B\big), \tag{4.7}$$

where T is government transfer to the households, B is the stock of debt (bonds), ϕB is debt repayment, τy is government tax revenue, and $Q(y, B')$ is bond price. Combining (4.5) and (4.7), we get the resource constraint: $c + \phi B = y + Q(y, B')\big(B' - (1-\phi)B\big)$ which also indicates that tax is non-distortionary in the model.

If the government defaults, the local economy suffers a loss of income from y to y^d and enters into financial autarky. During financial autarky, the government cannot issue bonds to borrow. With probability λ, the government returns to the financial market. The default value is then given by:

$$V^d(y) = \max_{\{c\}} \quad u(c) + \beta \mathbb{E}\left[\lambda V(y', 0) + (1-\lambda)V^d(y')\right], \tag{4.8}$$

subject to the resource constraint:

$$c = y^d. \tag{4.9}$$

The lenders are competitive and risk-neutral. They face a constant world interest rate r and are willing to lend to the government as long as they break even in expected value. Moreover, the lenders are aware of the government's incentives to default on its bonds. Thus, in equilibrium, the break-even condition implies that the bond price schedule $Q(y, B')$ satisfies:

$$Q(y, B') = \frac{1}{1+r}\mathbb{E}\left[(1 - D(y', B'))(\phi + (1-\phi)Q(y', B''))\right], \tag{4.10}$$

where $D(y', B') = 1$ denotes default. The bond price compensates the lenders for their losses during sovereign defaults. The bond price captures the entire future path of default probabilities through its dependence on $Q(y', B'')$. The government spread on its bond is defined as $spread(y, B') = \phi / Q(y, B') - (\phi + r)$, where r is risk-free interest rate.

4.2 Government financing with a BBR

We are ready to analyze government financing with a balanced budget rule (BBR). We model a BBR as a requirement that when the government makes the budget for the next fiscal year, its tax revenues must be sufficient to cover spending and expected interest payments. When making a borrowing decision for B', it must consider the expected interest payment for their debt. More specifically, given the aggregate state variables $S = (y, B)$, a BBR requires that

$$\tau y \geq T + \phi B' - Q\left(y, B'\right)\left(B' - (1-\phi)B\right), \tag{4.11}$$

where $\phi B'$ is what government is expected to repay, $Q(y, B')\big(B' - (1-\phi)B\big)$ is the government proceeds from borrowing. The part the government pays back more than it borrows (the gap between the two terms) is the interest payment. (4.11) says that when making borrowing decisions, a BBR requires that the tax revenues are sufficient to cover spending and debt interest payment. A BBR imposes an additional constraint on government financing, as (4.11) is equivalent to

$$B' \leq \frac{1}{\phi}\left[\tau y - T + Q(y, B')\big(B' - (1-\phi)B\big)\right]. \tag{4.12}$$

Under a BBR, the local government still maximizes the households' welfare by choosing whether to default or not. If the local government does not default, it can choose new borrowing, B', by solving a similar dynamic programming problem but with BBR as another constraint. Here, unlike (4.4), we combine the household budget constraint and government constraint as the resource constraint. The repayment value for the government is given by:

$$V^c(y, B) = \max_{\{c, B'\}} \quad u(c) + \beta \mathbb{E}\left[V(y', B')\right], \tag{4.13}$$

subject to the resource constraint and the BBR:

$$c + \phi B = y + Q(y, B')\big(B' - (1-\phi)B\big) \tag{4.14}$$

$$c \geq 0 \tag{4.15}$$

$$\tau y \geq T + \phi B' - Q\left(y, B'\right)\left(B' - (1-\phi)B\right) \tag{4.16}$$

If the government defaults, the maximization problem is the same as before because the budget constraint under default already satisfies the BBR.

Recursive equilibrium. The recursive equilibrium under a BBR consists of policy functions for consumption $c(y, B)$, transfers $T(y, B)$, borrowing $B'(y, B))$, default set $D(y, B)$; the government value functions $V(y, B)$, $V^c(y, B)$, and $V^d(y)$; and government bond price $Q(y, B')$ such that:

1. Taking the government policies as given, household consumption $c(y, B)$ satisfies household budget constraint (4.5) and (4.6).

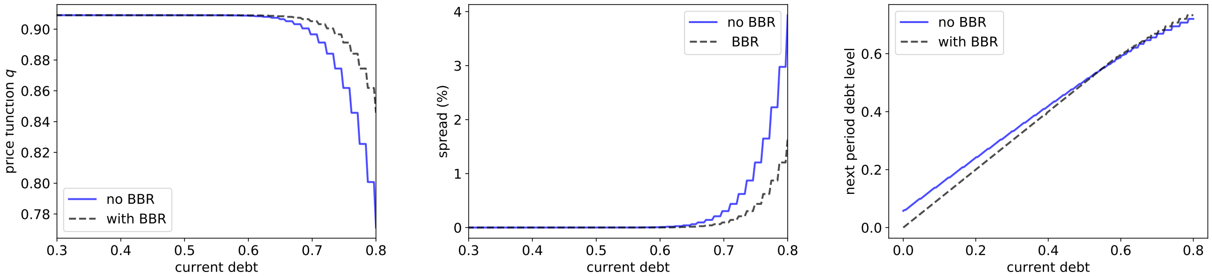
2. Taking the bond price schedule $Q(y, B')$ as given, the government's choices for borrowing $B'(y, B)$, default set $D(y, B)$, along with its value functions $V(y, B)$, $V^c(y, B)$, and $V^d(y)$, solve the government's problem (4.3), where the repayment value $V^c(y, B)$ is given by (4.13) and the default value $V^d(y)$ is given by (4.8).

3. The government bond price schedule (4.10) reflects the government's default probability and satisfies the lenders' break-even condition.

4.3 Impact of a Balanced Budget Rule

In this section, we show the impact of a BBR on government borrowing and spreads. To visualize the impacts, we plot the decision rules of new debt level B' and bond price and spreads as a function of the current debt level. The figures are plotted with the parameters listed in Section 5.

Figure 2 plots the decision rules under the case with a BBR and without a BBR. Panel (a) and (b) plot bond price function q and bond spreads as a function of the current debt level. With more debt, bond prices decrease, and spreads increase because of higher default risk. A lower bond price q indicates that the government obtains less funding for the same repayment, thus facing more expensive financing. The solid blue lines plot for the case without a BBR, and the dashed black lines plot for the case with a BBR. With a BBR, the bond price function is higher and the bond price is lower. This is because when the government has a BBR, it is further constrained in issuing next-period debt, lowering the government default risk. Panel (c) plots next period debt. With a BBR, the next period debt is lower than the case without a BBR.



(a) Price function (b) Spreads (c) Next period debt

Figure 2: Decision Rules

Notes: This figure plots bond prices, bond spreads, and next period debt level as functions of total debt for the case without a BBR and the case with a BBR. The x-axis is total debt. The y-axis is bond price in Panel (a), bond spread in Panel (b), and next period debt level in Panel (c). The solid blue lines plot for the case without a BBR and the dashed black lines plot for the case with a BBR. The figures are plotted with parameters listed in Section 5.

5 A Case Study

We parameterize the model without a BBR using data from the State of Illinois. We chose Illinois because its overall financial condition was quite worrisome for many years and had only worsened during the pandemic. Based on the state's audited financial report in the fiscal year 2020, Illinois had a Taxpayer Burden of $57,000, earning it an "F" grade from Truth in Accounting.[7] The CDS spread for Illinois is also higher than other states. The average CDS spread in 2009-2020 for Illinois was 237 bps, while the average for other states is 67 bps. In 2020, the year average CDS spread was 327 bps, much higher than other many other states. A high spread means that when issuing bonds, the government needs to offer a higher interest rate, increasing debt service and making it even harder for the government to roll over debt. If imposing a BBR can lower the bond spreads for the newly-issued bonds, it could potentially be a way to help Illinois step out of this fiscal crisis.

The model is calibrated at an annual frequency. The stochastic income y follows a first-order autoregressive process: $\log(y_t) = \rho \log(y_{t-1}) + \varepsilon_t$, where ε_t follows a normal distribution with mean zero and a standard deviation of σ_y. If the government defaults, the economy suffers an income loss. Following Arellano (2008), the revenue loss function is $y_d = h(y) = \min\{y, \gamma \mathbb{E} y\}$.

We parameterize the model to match key properties of data in the State of Illinois from 2009 to 2020. There are two groups of parameters. The first group of parameters is assigned following

[7] `https://www.data-z.org/state_data_and_comparisons/detail/illinois`

literature or estimated using data, and those in the second group are chosen to match relevant empirical moments jointly. The first group includes $\{r, \sigma, \phi, \lambda, \tau, \rho, \sigma_y\}$. The annual risk-free rate r is 2%. The risk aversion parameter σ is set to 2, a commonly used value in literature. The fraction of debt repayment for long-term debt ϕ is set to 0.2. The return parameter λ is 0.25, so that a defaulting government is excluded from financial markets for four years on average. Tax revenue is about 5.2% of total state GDP for Illinois in the data, which gives τ. The parameters for the income process $\{\rho, \sigma_y\}$ are estimated using output data in Illinois.

The second group includes parameters $\{\beta, \gamma\}$. We choose these parameters to jointly target Illinois's average spread (2.37%) and the average debt-to-GDP ratio (0.084). We solve the model using global methods. Given the model policy functions, we perform simulations to obtain the model-implied counterparts of our targets. We jointly choose the parameters to match the sample moments by minimizing the sum of the distance between the moments in the model and their corresponding counterparts in the data. Table 6 reports all the parameter values.

Table 6: Parameters

Parameter	Description	Value	Target/Source
r	Risk-free rate	2%	Conventional value
σ	Risk aversion	2	Conventional value
ϕ	Fraction of bonds maturing	0.2	Average bond maturity
λ	Return parameter	0.25	Conventional value
τ	Tax rate	5.2%	Data of Illinois
ρ	Persistence of income process	0.98	Data of Illinois
σ_y	Volatility of income process	0.02	Data of Illinois
β	Discount factor	0.964	Debt-to-GDP ratio
γ	Loss function parameter	0.98	Mean of spread

To explore the quantitative role of imposing a BBR on government spreads and debt, we further simulate the model without a BBR, then in a certain period (denote it as period 0), we introduce a BBR for the government. For simulations, we simulate 30,000 paths for 500 periods, then drop the first 100 periods to eliminate the influence of the arbitrary (but reasonable) choice of the initial guesses. We then take the average of government spreads and variables related to government debt across the paths. Table 7 lists the predicted government spreads, debt, and interest payment after imposing a BBR in year 0. After 10 years, the government spread drops from about 2.4% to about 1.2%. After imposing a BBR, the government has a smaller debt burden. The government debt-to-GDP ratio drops from about 9.1% to 6.1%. Debt as a fraction of tax revenue declines from 175% to 117%, and interest payment declines from 6.96% of tax revenue to 4.23% of tax revenue. Imposing a balanced budget rule that the tax revenues must be sufficient to cover spending and expected interest payments for the government of Illinois could reduce its government spreads by 50% and reduce its indebtedness by 33% in ten years.

Table 7: Predicted Government Spreads and Indebtedness After Imposing a BBR

Year	Government Spread(%)	Debt/GDP(%)	Debt/Tax revenue(%)	Interest payment/GDP (%)	Interest payment/Tax revenue (%)
0	2.389	9.09	174.808	0.362	6.962
1	2.247	8.74	168.077	0.356	6.846
2	2.064	8.368	160.923	0.341	6.558
3	1.915	8.02	154.231	0.319	6.135
4	1.807	7.684	147.769	0.301	5.788
5	1.67	7.362	141.577	0.282	5.423
6	1.494	7.059	135.750	0.264	5.077
7	1.449	6.791	130.596	0.254	4.885
8	1.347	6.538	125.731	0.241	4.635
9	1.286	6.303	121.212	0.227	4.365
10	1.205	6.075	116.827	0.220	4.231

Notes: This table reports predicted government spreads and variables related to indebtedness after imposing a BBR in year 0.

6 Conclusion

In this paper, we study how public financing costs are affected by the BBR, an often neglected factor in understanding the variation in government bond spreads across governments and over time. Using data on US state government bond spreads and a new dataset on state government BBRs, we document that government spreads are negatively associated with the presence or the tightness of BBRs. A canonical sovereign default model combined with a BBR could generate a result consistent with the empirical finding. The intuition is that governments tend to run down debt and deficits under a BBR, a result corroborated by previous empirical studies, making the newly-issued debt less risky for the investors. We also find that the difference between government spreads with and without a BBR is larger when the current debt level is higher, implying that the heavily-indebted states tend to benefit more from the lower financing costs following the introduction of a BBR. Calibrated to Illinois, our model shows that imposing a BBR for this state would reduce its borrowing cost by as much as 50% and its indebtedness by 33% in ten years.

Although we focus on US states in our analysis, our result passes through seamlessly to BBRs at the national government level. In light of the heavy debt burdens facing many sovereigns, a natural policy implication of our result is that imposing a BBR might be attractive to a government that sources its funds from the debt market, because one with a BBR is associated with a significantly lower borrowing cost. In fact, a lower government borrowing cost may have more implications than is discussed above. First, lower government spreads might be associated with a stronger local labor market by reducing labor outflow. Alessandria et al. (2020) show that high sovereign spreads are associated with labor outflows using cross-country data. Similarly, Deng (2019) finds a similar pattern using US state-level data. The net migration rate for the state of Illinois, a state with no BBR and high government spreads, has been negative and in the bottom quintile across US states for years (-1.23% in year 2017 according to IRS migration dataset). Lower government spreads and better government fiscal conditions could attract more workers and firms into Illinois and boost the local economy.

Second, a lower borrowing cost would strengthen the government's ability to borrow in the government debt market, which has implications for public goods provision and migration. Yi (2021) shows that following a shock to the access to credit, municipalities tend to cut infrastructure investment, and public service quality deteriorates, manifested in increased water contamination and prolonged power outages. As a result, high-income residents leave while low-income ones have limited mobility and suffer from the long-term consequences of public spending shocks.

Third, having access to debt with lower costs may help stabilize the local economic fluctuations. The low financing cost associated with a BBR is especially valuable for a government during economic downturns, when its financing need in order to stimulate the local economy is the strongest. Therefore, our study provides a new perspective on understanding the links between fiscal rules and local business cycles, a classical yet unsettled issue (Alesina and Bayoumi, 1996; Krol and Svorny, 2007; Levinson, 1998).

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Online Appendix (Not for Publication)

A Data Details

Data Cleaning. In the first data cleaning step, we omit observations with missing values for price, yield and yield spreads, coupon rates greater than 20%, yield to maturity greater than 50% or less than 0, price less than 50 or greater than 150, years to maturity less than 0, or maturity less than 0 or greater than 99.

Construct the spread measure. We calculate the state bond spread as the difference in yields between a municipal bond and a synthetic treasury bond with equivalent coupon and maturity date, following a procedure as follows. First, for each municipal bond, we solve for the theoretical price on a synthetic treasury bond with the same maturity date and coupon rate by calculating the present value of its coupon payments and face value using the US Treasury yield curve.

$$P_N^T = \sum_{n=1}^{N} \frac{C/2}{(1+r_n^T/2)^n} + \frac{100}{\left(1+r_N^T/2\right)^N}$$

where r_n^T is the set of treasury spot rates estimated in Gürkaynak et al. (2007). Then, we calculate the yield-to-maturity of the synthetic Treasury bond using this price, the coupon payments, and the face value. Last, we take the difference between the municipal bond yield and the synthetic Treasury bond yield. This procedure is similar to the yield spread calculation in Longstaff et al. (2005), Ang et al. (2014) among others.

Tax-adjusted synthetic price is constructed based on Section 3.4 of Ang et al. (2014).

$$P_N^{T\prime} = \sum_{n=1}^{N} \frac{C(1-\tau_{s,t})/2}{(1+r_n^T/2)^n} + \frac{100}{\left(1+r_N^T/2\right)^N}$$

with $\tau_{s,t}$ defined in the main text.

B More Empirical Results

Table B.8 provides the first robustness check for our baseline regression results using the Urban Institute's definition[8] of the highest level of stringency of the state-level BBR (stringency=5): the

[8] https://www.urban.org/research/publication/balanced-budget-requirements

governor must ultimately sign, and no deficit carryover is permitted. Table B.9 presents the second robustness test by controlling for state-level political party control over the legislative chambers. Table B.10 reports the IV estimation result.

Table B.8: State Bond Spread and BBR (alternative measure by the Urban Institute)

	(1)	(2)	(3)	(4)
BBR	-0.039	-0.042	-0.135	-0.147*
	(0.081)	(0.083)	(0.088)	(0.083)
Debt/GDP	4.041***	3.741**	3.861**	3.505**
	(1.348)	(1.516)	(1.608)	(1.443)
ΔGDP	3.767*	2.736	-0.178	-1.151
	(1.879)	(2.276)	(1.640)	(1.757)
Maturity	0.068***	0.068***	0.068***	0.067***
	(0.007)	(0.007)	(0.007)	(0.007)
Coupon	0.090***	0.086***	0.092***	0.095***
	(0.020)	(0.023)	(0.028)	(0.028)
Revenue/GDP		5.312		7.731**
		(4.596)		(3.587)
Expenditure/GDP		-7.481		-9.506**
		(5.867)		(4.251)
State Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	Yes	Yes
Constant	-0.265*	0.003	-0.036	0.132
	(0.146)	(0.582)	(0.213)	(0.494)
N	969	969	969	969
adj. R^2	0.253	0.254	0.434	0.437

Notes: This table reports the baseline parameter estimates and their standard errors clustered by state, shown in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. BBR is defined based on the five categories defined by the Urban Institute, and is equal to 1 if in a given state, "the governor must ultimately sign, and no deficit carryover permitted". Other variables are defined the same as those in the baseline regression.

Table B.9: Controlling for State Political Factors

	Panel A: *No Deficit Carryover*		**Panel B**: *ACIR Index*	
	(1)	(2)	(3)	(4)
BBR	-0.174**	-0.166**	-0.024	-0.022*
	(0.079)	(0.072)	(0.014)	(0.013)
Debt/GDP	3.700**	3.357**	3.678**	3.331**
	(1.512)	(1.415)	(1.569)	(1.470)
ΔGDP	-0.073	-0.927	-0.069	-0.928
	(1.567)	(1.726)	(1.594)	(1.763)
Maturity	0.067***	0.067***	0.068***	0.067***
	(0.007)	(0.007)	(0.007)	(0.007)
Coupon	0.089***	0.091***	0.088***	0.090***
	(0.028)	(0.028)	(0.027)	(0.028)
Revenue/GDP		6.892*		6.973*
		(3.494)		(3.550)
Expenditure/GDP		-8.314**		-8.369**
		(4.002)		(4.091)
Democratic	-0.011	-0.011	-0.011	-0.012
	(0.085)	(0.080)	(0.085)	(0.081)
Republican	0.067	0.076	0.069	0.078
	(0.114)	(0.111)	(0.116)	(0.114)
State Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Constant	0.025	0.145	0.093	0.205
	(0.214)	(0.495)	(0.210)	(0.483)
N	977	977	977	977
adj. R^2	0.435	0.437	0.434	0.436

Notes: This table reports the regression results with the political party control in the state legislative chambers as an additional set of control variables. Clustered-by-state standard errors are in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. In particular, political party control is a set of indicator variables {Democratic, Split, Republican} and refers to which political party holds the majority of seats in the state Senate and the state House. "Democratic" indicates that both legislative chambers have Democratic majorities, "Split" indicates that neither party has majorities in both legislative chambers, and "Republican" indicates both legislative chambers have Republican majorities. Data source: National Conference of State Legislatures.

Table B.10: IV Regression Results

	BBR in 1986 as Instruments		BBR in 1991 as Instruments	
	(1)	(2)	(3)	(4)
BBR	-0.619*	-1.288*	-0.589	-1.300*
	(0.353)	(0.749)	(0.506)	(0.733)
Debt/GDP	0.750	-3.151	NA	-4.861
	(6.164)	(7.398)	NA	(7.750)
ΔGDP	NA	2.754	-1.275	0.655
	NA	(6.240)	(3.456)	(4.519)
Maturity	0.063***	0.062***	0.063***	0.062***
	(0.008)	(0.009)	(0.008)	(0.008)
Coupon	0.070	0.066	0.068	0.064
	(0.043)	(0.045)	(0.043)	(0.044)
Revenue/GDP		NA		NA
		NA		NA
Expenditure/GDP		-7.745		-8.593
		(7.508)		(8.125)
State Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Constant	1.050	2.687*	1.144***	3.053*
	(0.735)	(1.430)	(0.358)	(1.570)
N	555	555	572	572

Notes: This table reports the coefficient estimates with the IV approach, and their standard errors (clustered by state). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. BBR takes the "No Deficit Carryover" dummy. Columns (1) and (2) report the results using the 1986 BBR as the instrumental variable. Columns (3) and (4) report the results using the 1991 BBR as the instrumental variable. "NA" means that the explanatory variable has a colinearity problem, and is therefore omitted from the regression.

Table B.11 repeats the exercise of Table 5 but without considering a robust standard error for each coefficient estimate. Table B.12 presents a sub-sample analysis of Table 5 to address the concern of: (1) our imputation for 2009, and (2) the possibility of 2020 as a special year (because of COVID-19). However, it's worth noting that the sample sizes in these regressions are very small, which may lead to small-sample biases.

Table B.11: CDS and BBR (non-robust standard error)

	Panel A: *No Deficit Carryover*		**Panel B**: *ACIR Index*	
	(1)	(2)	(3)	(4)
BBR	-0.435**	-0.434**	-0.072**	-0.072**
	(0.193)	(0.170)	(0.032)	(0.029)
Debt/GDP	-0.920	1.701	-0.923	1.696
	(2.410)	(2.369)	(2.417)	(2.382)
ΔGDP	-10.470***	-4.746	-10.515***	-4.786
	(3.826)	(3.653)	(3.839)	(3.671)
Revenue/GDP		-19.667***		-19.650***
		(5.954)		(5.969)
Expenditure/GDP		10.784		10.834
		(6.969)		(6.989)
Constant	1.355***	2.234***	1.644***	2.510***
	(0.310)	(0.454)	(0.419)	(0.509)
N	48	48	48	48
adj. R^2	0.142	0.344	0.140	0.341

Notes: This table reports the baseline parameter estimates and their (non-robust) standard errors shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Effective sample period: 2009, 2014 and 2020.

Table B.12: CDS and BBR: Sub-samples

	2014				2014 & 2020			
BBR	-0.315*	-0.400**	-0.053*	-0.066**	-0.398*	-0.344*	-0.066*	-0.056*
	(0.166)	(0.170)	(0.028)	(0.029)	(0.199)	(0.195)	(0.034)	(0.033)
Debt/GDP	0.218	0.468	0.201	0.447	-0.286	2.548	-0.293	2.560
	(2.187)	(2.618)	(2.203)	(2.680)	(2.620)	(2.884)	(2.632)	(2.911)
ΔGDP	-1.535	-1.923	-1.680	-2.081	-1.445	-1.428	-1.519	-1.449
	(4.482)	(4.249)	(4.507)	(4.321)	(6.312)	(6.054)	(6.333)	(6.084)
Revenue/GDP		-12.043		-11.732		-11.040		-10.983
		(8.246)		(8.334)		(7.749)		(7.768)
Expenditure/GDP		6.449		6.380		1.263		1.269
		(9.334)		(9.483)		(8.251)		(8.280)
Constant	0.727**	1.638***	0.941**	1.863***	0.926**	2.004***	1.192**	2.216***
	(0.305)	(0.544)	(0.396)	(0.608)	(0.389)	(0.613)	(0.495)	(0.663)
N	19	19	19	19	38	38	38	38
adj. R^2	0.112	0.223	0.107	0.204	0.055	0.137	0.053	0.132

Notes: This table reports the baseline parameter estimates and their standard errors shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Effective sample period: 2014 only for the first panel; 2014 and 2020 for the second panel.