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State Government Revenue and Expenditures:
A Bootstrap Panel Analysis

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Abstract.

The current fiscal crises that most states in the United States are facing are generally the result of a severe macroeconomic downturn combined with a limited ability of the states to respond to such shocks. States are facing increased demand for public services at the same time revenue is falling. In this context, this paper explores the issue of temporal priority between government expenditures and revenue at the state and local levels. The results show that there is no uniform relationship between government revenue and spending across different states in the US. In fact, about 40% of the states show the absence of any temporal relationship between these two variables. This is quite revealing given the current state of the debate in the academic and policy-making circle. A support for the tax-spend hypothesis is found in 18% of the states while the spend-tax hypothesis is prevalent in another 16%. In 26% of the states, the revenue and expenditures decisions are jointly determined by the government.

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I. Introduction

Fiscal discipline has been a concern for policymakers in many countries, and the local public sector has been the source of fiscal imbalances in a number of these countries. A prime example is the case of the United States. The recent recession that began in 2007 severely reduced state tax revenue and increased demand for government safety-net programs (McNichol and Johnson (2009), Boyd and Dadayan (2010). The result has been large and growing fiscal imbalances that are likely to persist for some time, presenting policy makers with several years of lingering difficulty in balancing budgets.

Nearly all states in the US, except Vermont, have balanced budget requirements preventing states from engaging in deficit spending – that is, allowing planned general fund spending to exceed anticipated revenue in an upcoming budget year. To meet balanced-budget requirements many states have turned to broad-based cuts, rainy day funds, tax hikes and reductions in assistance payments. Policy makers are thus faced with the dilemma of either changing expenditures or taxes. Will changing one or the other actually lead to a balanced budget?

Mahdavi and Westerlund (2008) have shown that addressing the growing fiscal imbalance problem is further complicated by at least two issues. First, the division of the adjustment burden between the expenditure and revenue sides of the budget during periods of fiscal retrenchment requires an evaluation of the initial level of taxes and expenditures to determine if it is politically and economically feasible to change them in the desired direction. Second, in order to determine which variable should be given temporal priority, one has to know whether changes in spending precede, follow, are independent of, or occur simultaneously with changes in taxes.

The fact that states have to balance their budgets could indicate that state governments have very little opportunity to let spending lead revenue, or vice versa. However, balanced budgets are only a *ex ante* claim, and the state governments have used every opportunity to bypass this proclamation. Consequently, state governments can act inter temporally and, thus, it is not unreasonable to expect a dynamic structure in the revenue or spending equation. Dalhberg and Lindstrom (1998) using inter temporal utility maximization model have shown that local governments in Sweden under similar balance budget constraints smooth their consumption over time.

This paper aims to explore the issue of temporal priority between government expenditures and revenue at the state and local levels in the United States. We undertake a panel approach which takes advantage of non-stationary panel data econometric techniques. Unlike many previous papers in this area, this study is based on a panel of multiple time series, rather than just a single time series, thus greatly increasing the amount of available information. Also, estimation for

each state is performed separately in order to avoid the possible aggregation problem associated with the data in earlier studies.

The paper is organized as follows. Section II provides an overview of the hypotheses on the relationship between government expenditures and revenues. Section III reviews the literature while characteristics of US state budgets are described in Section IV. The methodology is discussed in Section V. Section VI discusses the estimation results. The paper ends with a summary and conclusion in Section VII.

II. **Hypotheses**

It is usually assumed by policy analysts that a government determines the level of revenues and expenditures in such a way that it maximizes the society's social welfare. Four possible hypotheses have been advanced on the inter temporal relationship between these two variables in the budgetary process. First, the **tax-spend hypothesis** envisages a unidirectional causality running from government revenues to government expenditures. Friedman (1978), an early proponent, suggested that while an increase in taxes only leads to an increase in government expenditures, reduction in revenue would therefore lead to a lowering of government expenditures. Wagner (1976) and Buchanan and Wagner (1978), on the other hand, argued that due to fiscal illusion, an increase in revenue would lead to a decrease in expenditures. They showed that expenditures funded by anything other than direct taxation leads the public to believe that the price of government expenditures is less than what it should be under direct taxation. Fiscal illusion arises because the public pays less in direct taxation but more in the form of indirect taxation (e.g., crowding out effects and bracket creep caused by inflation). If indirect taxation declines while direct taxation increases, the trend could reduce government spending (Ewing *et al* (2006)).

Second, the **spend-tax hypothesis** suggests that initial expenditure decisions by the government lead to subsequent adjustments in tax policy and revenues to meet expenditure demands. Barro (1979) criticized the Buchanan-Wagner hypothesis of fiscal illusion. Given the Ricardian equivalence proposition that current government borrowing leads to an increase in future tax liability that is fully capitalized by the public, Barro argued that increases in government expenditures lead to increases in taxes. Under this hypothesis, lower government spending would lead to lower deficits. The spend-tax hypothesis suggests a unidirectional causality running from government expenditures to government revenues. Bohn (1991), Mounts and Sowell (1997), Chang *et al* (2002) supported the tax-spend hypothesis whereas Jones and Joulfaian (1991) and Ross and Payne (1998) found evidence in favor of the spend-tax hypothesis.

Third, the **fiscal synchronization** hypothesis suggests that revenue and expenditure decisions are made jointly (Musgrave (1966), Meltzer and Richard (1981)). They argued that, when deciding on the appropriate level of government expenditures and revenues, the voters compare the marginal benefits and costs of government programs. This hypothesis leads to a feedback relationship between government expenditures and revenues. Miller and Russek (1989) and Owoye (1995) found evidence supporting this hypothesis.

Finally, Wildavsky (1988) and Baghestani and McNown (1994) forwarded the **institutional separation** hypothesis which states that decisions on taxation are independent from the allocation of government expenditures. This hypothesis is valid in the absence of any causal relationship between government expenditures and revenues.

III. **Literature Review**

The empirical literature on the relationship between tax receipts and spending has primarily focused on the US federal budget with a few studies analyzing aggregate data at the state and local level. The studies yielded a range of results due in part to differing methodological approach, model specification, the degree of temporal aggregation, sample period considered, etc (see Payne (2003) for a detail survey of the literature).

Studies that have investigated the relationship at the state and local levels have also come up with differing results (again Payne (2003) provides a detail survey, see especially Table 2). Furstenberg et al (1985) found some support for the spend-and-tax hypothesis using aggregate state and local level data for the 1954-82 sample period. Using data from 1952 to 1982, Marlow and Manage (1987) found the presence of a one-way causality from state revenue to expenditures while there was no relationship between these two variables at the local level. Chowdhury (1988) re-examined the results of Marlow and Manage (1987) to find the presence of a feedback between local revenues and expenditures once the estimation is corrected for some statistical anomalies. Miller and Russek (1989) found a feedback between government expenditures and revenues at the state and local levels over the 1946-87 sample period. Using aggregate state level data for the 1929-83 period, Ram (1988) also found support for the spend-and-tax hypothesis.

Holtz-Eakin et al (1989) used a vector autoregressive model to examine the relationship in 171 US local governments over the 1972-80 period. Controlling for federal grants, their results supported the tax-and-spend hypothesis. Using a similar panel approach to annual state level data for 16 countries over the 1955-86 sample period, Joulfaian and Mookerjee (1990) reported results which were consistent with all but the fiscal synchronization hypothesis. The US was one of three countries supporting the tax-and-spend hypothesis. Miller and Frank (1990) applied an

error correction model to aggregate state-local government data and found support for the fiscal synchronization hypothesis.

Payne (1998) tested for the relationship at the state and local level and found significant evidence of relationship running from taxes to spending in 24 states. He found evidence of joint determination between taxes and revenue in 11 states while in 8 states the direction of relationship ran from spending to taxes. He concluded that in a plurality of states, revenue increases lead to further spending increases thus government cannot achieve deficit reduction using policies that would reduce budget deficits through the revenue channel.

Mahdavi and Westerlund (2008) examined the tax-spending nexus using a panel of 50 US state and local government units over 1963-97. Their analysis of the effects of the short-run dynamics indicated that while taxes affected expenditures at the 1% level of significance, expenditures didn't affect taxes at the 5% level. At the 1% level of significance, however, they found a feedback between the two variables. Given their findings that expenditures seem to depend on taxes, they underscored the important role of taxes in controlling budget deficits at the state and local levels.

IV. **State Budget Characteristics**

The largest part of most states' budgets is the general fund, also known as the operating budget. In most states this is where most general tax revenue (e.g., sales and income taxes) goes, and it pays for most of the state's spending on education, health care, public safety, human services, etc. States' major source of revenue is state taxes, mostly personal and corporate income taxes and general sales taxes. Most states have both. Nine states do not have personal income tax – Alaska, Florida, Nevada, new Hampshire, South Dakota, Tennessee, Texas, Washington, and Wyoming; while five states are without a sales tax – Alaska, Delaware, Mntana, New Hampshire, and Oregon. On average, about 25% of state funds come from the federal government.

Education and health care account for about half of what states spend. But states also fund a number of other services, e.g., transportation, corrections, pensions and health benefits for public employees, assistance to low-income families, aid to local governments, etc.

Unlike the federal government, every state except Vermont is required by constitution or statute to balance its budget implying that states cannot pay for ongoing expenditures using borrowed funds. Most states, however, borrow for capital expenses, such as roads and schools, by issuing bonds. Capital expenses are typically not considered part of the general fund. Marlow and Manage (1987) have pointed out the creation of Off-Budget Enterprises in the development of public corporations and quasi-government units as a way to finance fiscal initiatives thereby

raising question about the assumption that states operate under a balanced budget statute. Some states only require the proposed budget be balanced and the actual, ex-post budget. Other states permit a deficit to carry over from one year to the next, while others have a no carryover rule.

V. **Methodology**

A number of recent fiscal sustainability studies have examined the presence of a long-term co-integrating relationship between government revenue and spending. An important feature connected to the presence of such co-integrating relation is the direction of the causality between revenue and spending. In most cases, the presence of causality is examined in the context of a single country or state. Following Afonso and Rault (2009), we undertake a panel approach which takes advantage of non-stationary panel data econometric techniques. It is also relevant in the context of entities seeking to pursue sound fiscal policies within the framework of a federal structure.

We use the panel data approach developed by Kónya (2006), based on a bivariate finite-order vector autoregressive model, and we apply it in our context to general government revenue, R, and spending, G:

$$
\begin{cases}
R_{it} = \alpha_{1,i} + \sum_{j=1}^{p_{1i}} \beta_{1,i,j} R_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{1,i,j} G_{i,t-j} + \varepsilon_{1,i,t} \quad t=1,...,T \quad i=1,...,N \\
\\
G_{it} = \alpha_{2,i} + \sum_{j=1}^{p_{1i}} \beta_{2,i,j} R_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{2,i,j} G_{i,t-j} + \varepsilon_{2,j,t} \quad t=1,...,T \quad i=1,...,N
\end{cases}
\tag{1}
$$

where the index i ($i = 1,..., N$) denotes the state, the index t ($t = 1,...,T$) the period, j the lag, and p_{1i}, p_{2i} and p_{3i}, indicate the longest lags in the system. The error terms are supposed to be white-noises (i.e. they have zero means, constant variances and are individually serially uncorrelated) and may be correlated with each other for a given state, but not across states. System (1) is estimated by the Seemingly Unrelated Regressions (SUR) procedure, since possible links may exist among individual regressions via contemporaneous correlation within the two equations. Wald tests for Granger causality are performed with state specific bootstrap critical values generated by simulations. With respect to system (1), in state i there is one-way Granger-causality from G to R if in the first equation not all γ are zero but in the second all β are zero; there is one-way Granger-causality from R to G if in the first equation all γ are zero but in the second not all β are zero; there is two-way Granger-causality between R to G if neither all β nor all γ are zero; and there is no Granger-causality between R to G if all β and γ are zero.

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This procedure has several advantages. First, it does not assume that the panel is homogeneous, being possible to test for Granger-causality on each individual panel member separately. However, since contemporaneous correlation is allowed across states, it makes possible to exploit the extra information provided by the panel data setting. Second, it does not require re-testing for unit roots and co-integration (since state specific bootstrap critical values are generated), though it still requires the specification of the lag structure. This is an important feature since the unit-root and co-integration tests in general suffer from low power, and different tests often lead to contradictory outcomes (Afonso and Rault (2009)). Third, this approach allows detecting for how many and for which members of the panel there exists one-way, two-way, or no Granger-causality.

VI. **Estimation Results**

Variables and data: We use state government revenue and spending data as a ratio of state gross state product. Apart from the fact that ratios of nominal magnitudes are commonly used in the literature, it is also important to scale the variables for the panel approach (See Afonso and Rault (2009) on this issue). State revenue is measured by real state and local tax receipt while state expenditures is measured by real state and local government consumption expenditures. Government consumption expenditures exclude interest payments on debt and mandated social transfers to individuals, and are the best measure available of state and local government discretionary spending. It includes spending on education, public welfare, hospitals, health, highways, police and correction. The state revenue include revenue from taxation of sales and gross receipts, individual income, corporate net income, motor vehicle licenses, and miscellaneous revenue sources not shown separately. The sample period runs from 1970 to 2009. All data are taken from the Bureau of Economic Analysis. Figure 1 graphs the data for the sample period.

Prior to estimation we have to specify the number of lags for each variable. We use the Akaike Information Criterion (AIC). Ideally, the lag structure should be allowed to vary across states, variables and equations. However, given the large data set that we have, it would increase the computational burden substantially. So we allow four maximal lag parameters and choose the combination which minimizes the AIC. We next test for Granger causality from *G to R* and from *R to G* performing Wald Test with state specific bootstrap critical values. Apart from the lag structure, the equations have also been estimated with a time trend. The time trend is a proxy variable that might substitute for some variables that are missing from the original specifications. Note that the bootstrap causality test that we use does not require unit root testing.

The Granger causality test results for the null hypothesis Revenue doesn't cause Spending (R doesn't cause G) is given in Table 1. Note that the bootstrap critical values are substantially

higher than the chi-square critical values associated with the Wald test, and also that they vary considerably from one state to another and from one table to another. In case of nineteen states, the null hypothesis that R doesn't cause G is rejected. Revenue positively causes spending in twelve states thus supporting the findings reported in Friedman (1978); while the negative relationship found in the remaining seven states is similar to the results given in Wagner (1976) and Buchanan and Wager (1978).

The results for the second Granger causality test (Spending doesn't cause Revenue) is given in Table 2. Again in nineteen cases the null hypothesis of spending doesn't cause revenue is rejected. Among these nineteen cases, spending positively causes revenue in ten cases and negatively in nine cases.

The summary result from the two Tables are reported in Table 3. This Table shows that there is no uniform relationship between government revenue and spending across different states in the US. This is similar to the findings reported in Payne (1998). A one-way causality from government revenue to spending is found in nine states - Colorado, Georgia, Kansas, Mississippi, Montana, New Hampshire, Tennessee, Washington and Wisconsin. Manage and Marlow (1987) and Chowdhury (1988) also found support for the tax-spend hypothesis at the aggregate state government level. Holtz-Eakin et al (1989) reported support for the tax-spend hypothesis in 171 municipal governments while Joulfaian and Mookerjee (1990) reported support for the hypothesis in Massachusetts. Payne (1998) found support for the tax-spend hypothesis in 24 states.

The fact that government spending follows revenue in these states suggest a pro-cyclical expenditure policy for the state governments. In this context, these governments could enhance the effectiveness of fiscal policy by making budget expenditure less driven by revenue availability. This would avoid the costs and instability that variations in public spending generate. The authorities could resort to medium-term expenditures that can be planned and insulated from volatile short-term revenue availability.

Another eight states - Alabama, Alaska, Arkansas, Florida, Illinois, Kentucky, Louisiana and Texas – show the presence of causality running from spending to revenue suggesting that a government's revenue constraint adjusts to changes in expenditures with some lag in these states. Von Furstenberg *et al* (1986) also reported support for the spend-tax hypothesis at aggregate state and local government levels. Payne (1998) found support for this hypothesis in eight states.

On the other hand, a feedback between these two variables exist in thirteen countries showing support for the fiscal synchronization hypothesis. These thirteen states are – Arizona, California, Connecticut, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia and West Virginia. Unlike this paper, Joulfaian and Mookerjee (1990) reported a one-way causality from tax to spend in Massachusetts. Interestingly, institutional

separation hypothesis finds support in the remaining twenty states showing no relationship exists between spending and revenue decisions.

VII.   **Summary and Conclusion**

The current fiscal crises that most states in the United States are facing are generally the result of a severe macroeconomic downturn combined with a limited ability of the states to respond to such shocks. States are facing increased demand for public services at the same time revenue is falling. In this context, this paper explores the issue of temporal priority between government expenditures and revenue at the state and local levels. An examination of each state was conducted to avoid the possible aggregation problem associated with the most earlier studies. The results show that there is no uniform relationship between government revenue and spending across different states in the US. In fact, about 40% of the states show the absence of any temporal relationship between these two variables. This is quite revealing given the current state of the debate in the academic and policy-making circle. A support for the tax-spend hypothesis is found in 18% of the states while the spend-tax hypothesis is prevalent in another 16%. In 26% of the states, the revenue and expenditures decisions are jointly determined by the government.

Given the absence of any uniform result in the states, future studies should concentrate on the experience of individual states rather than trying to deduce general conclusions from all the states.

Table 1: **Causality from state government revenue to spending**

State	Estimated Coefficient	Test Statistic	Bootstrap Critical Values 1%	5%
Alabama	0.347	3.654	20.996	12.994
Arizona	-1.212	21.732*	23.741	16.990
Arkansas	0.730	12.044	29.056	20.166
California	2.017	25.997*	32.776	21.950
Colorado	0.955	28.006**	23.912	17.005
Connecticut	0.454	32.910**	28.077	19.733
Delaware	2.996	8.044	33.021	23.835
Florida	1.676	2.000	19.844	12.822
Georgia	-1.061	42.056*	46.011	35.543
Idaho	3.886	12.068	33.775	26.001
Illinois	0.987	6.090	22.056	13.090
Iowa	0.093	3.008	31.324	20.067
Kansas	1.522	25.065*	30.056	21.923
Kentucky	1.207	7.334	38.421	27.043
Louisiana	0.993	15.044	39.055	26.273
Maine	0.521	3.067	19.043	15.022
Maryland	0.777	20.996*	31.560	17.556
Massachusetts	0.932	34.034**	28.917	19.657
Michigan	1.644	38.442**	29.659	18.253
Minnesota	1.274	5.889	38.067	21.895
Mississippi	0.944	39.021**	31.945	21.565
Missouri	0.633	7.544	54.675	39.612
Montana	1.676	56.231**	39.453	26.012

State	Estimated Coefficient	Test Statistic	Bootstrap Critical Value	
			1%	5%
Nebraska	0.993	4.996	31.078	17.055
Nevada	1.422	13.955	39.045	26.034
New Hampshire	-0.217	36.073*	42.454	29.184
New Jersey	-0.662	37.956**	31.334	20.045
New Mexico	2.711	13.887	47.022	35.442
New York	-1.933	54.987**	40.867	25.011
North Carolina	0.621	18.066	49.022	34.671
North Dakota	1.002	5.097	26.910	21.428
Ohio	1.301	23.532*	25.912	18.031
Oklahoma	3.033	19.997	42.067	31.755
Oregon	1.619	17.944	45.121	32.062
Pennsylvania	-0.822	43.855**	40.411	30.944
Rhode Island	0.729	9.112	32.997	21.625
South Carolina	0.643	6.075	52.990	33.088
South Dakota	0.056	3.034	29.676	20.610
Tennessee	0.820	66.911	45.055	32.810
Texas	0.062	5.830	25.089	12.022
Utah	0.195	8.064	32.711	18.053
Vermont	1.833	34.911	45.017	40.425
Virginia	0.776	23.677*	31.044	22.073
Washington	2.064	31.845**	28.944	18.453
West Virginia	1.733	43.655**	41.355	30.811
Wisconsin	-1.720	40.386**	35.922	26.121
Wyoming	0.313	5.025	20.188	15.824

**, *: significance at the 1% and 5% levels, respectively.

H0: R does not cause G.

Table 2: Causality from state government spending to revenue

State	Estimated Coefficient	Test Statistic	Bootstrap Critical Value 1%	5%
Alabama	-2.322	34.823**	30.888	20.612
Arizona	1.622	45.008**	42.778	35.024
Arkansas	2.957	40.768**	36.024	26.311
California	-0.522	56.044**	50.322	35.088
Colorado	1.399	23.886	49.026	40.655
Connecticut	2.022	48.033**	38.009	30.156
Delaware	1.412	14.733	30.055	20.643
Florida	2.933	49.087**	43.011	34.017
Georgia	1.722	18.565	55.127	41.057
Idaho	0.712	3.998	24.773	16.992
Illinois	-0.055	43.009*	56.443	42.629
Iowa	0.821	8.387	34.054	21.712
Kansas	0.292	12.822	28.944	20.155
Kentucky	0.917	35.746*	41.846	33.068
Louisiana	1.922	43.754*	50.922	41.318
Maine	1.522	18.006	46.812	30.917
Maryland	1.619	29.750*	32.923	26.847
Massachusetts	0.739	39.044**	38.233	5.814
Michigan	-0.712	45.622*	49.633	40.713
Minnesota	1.663	18.478	43.714	37.065
Mississippi	1.620	37.933	58.645	50.177
Missouri	0.619	17.085	41.555	29.645
Montana	0.632	17.006	33.854	25.759

State	Estimated Coefficient	Test Statistic	Bootstrap Critical Value 1%	5%
Nebraska	1.994	16.989	37.876	26.023
Nevada	2.856	8.034	45.121	36.076
New Hampshire	2.005	18.966	38.934	30.832
New Jersey	-1.834	42.768*	51.887	40.943
New Mexico	2.074	21.677	45.812	32.818
New York	-3.000	64.776*	69.034	51.717
North Carolina	1.069	6.937	34.813	28.053
North Dakota	0.924	15.008	42.713	28.733
Ohio	0.853	41.056*	32.990	20.870
Oklahoma	0.765	12.078	28.987	19.643
Oregon	1.072	10.887	37.834	30.712
Pennsylvania	-0.827	55.711**	50.932	40.611
Rhode Island	1.009	17.009	43.123	29.045
South Carolina	0.432	16.044	38.334	21.645
South Dakota	0.197	12.943	39.033	30.836
Tennessee	0.004	9.778	41.730	30.061
Texas	-0.069	56.767*	63.997	50.121
Utah	0.044	13.843	39.612	30.124
Vermont	0.529	8.935	23.833	17.035
Virginia	-1.059	43.542**	41.445	29.754
Washington	0.877	31.067	46.911	37.512
West Virginia	2.054	54.099*	60.412	52.787
Wisconsin	0.611	13.998	29.554	20.610
Wyoming	0.810	16.573	42.111	34.934

**, *: significance at the 1%, 5% levels, respectively.
H0: G does not cause R.

Table 3: Summary of Results

Relationship	Number of States	States
Revenue -→ Spending	Nine	Colorado, Georgia, Kansas, Mississippi, Montana New Hampshire, Tennessee, Washington, Wisconsin
Spending → Revenue	Eight	Alabama, Alaska, Arkansas, Florida, Illinois, Kentucky, Louisiana, Texas
Feedback	Thirteen	Arizona, California, Connecticut, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, West Virginia
No Causality	Twenty	Delaware, Hawaii, Idaho, Iowa, Maine, Minnesota, Missouri, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, Rhode Rhode island, South Carolina, South Dakota, Utah, Vermont, Wyoming

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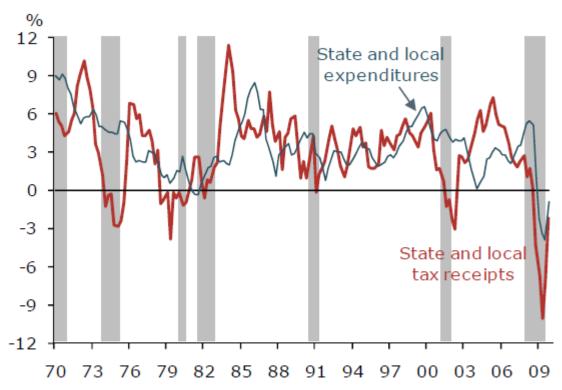Ross, K., Payne, J. (1998) "A reexamination of budgetary disequilibria", *Public Finance Review*, 26, 67-79.

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Figure 1

Spending adjustments failed to match revenue losses

Sources: Bureau of Economic Analysis and authors' calculations.