Regional Science and Urban Economics 41 (2011) 343–351

Contents lists available at ScienceDirect

Regional Science and Urban Economics

journal homepage: www.elsevier.com/locate/regec

State government response to income fluctuations: Consumption, insurance, and capital expenditures

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ARTICLE INFO

Article history:
Received 14 September 2010
Received in revised form 18 February 2011
Accepted 24 February 2011
Available online 5 March 2011

Keywords:
State government
VAR
Economic fluctuations

ABSTRACT

This paper analyzes state government response to changes in the underlying economy with a view to determining whether, and to what extent, state governments respond to economic fluctuations. Specifically, we build impulse response functions from a panel of US states to examine how states cope with changes in economic conditions. We examine current expenditures, as well as Unemployment Insurance, welfare, and capital spending. Further, we examine how both short and long term debt and state government taxes vary with GSP. Our examination of average state government behavior indicates that states respond slowly to changes in the economy, and that they do not utilize some of the institutional features that are purportedly designed to cushion budgetary impacts. Finally, we find that welfare and UI spending follow separate distinct time paths, but not ones seemingly constrained by institutional barriers.

1. Introduction[1]

The Great Recession of 2008–10 resulting from the housing and related credit bust has intensified interest in how governments respond to economic fluctuations. Among the steps the US federal government has taken in an effort to stabilize the economy is to provide $280 billion in state government administered grants, with the expectation that states will use the resources consistent with stabilization efforts. Very little is known, however, about how state governments respond to economic cycles, which makes it unclear how states might use federal funds designated as 'stimulus.' Our paper finds, in contrast to apparent expectations by the federal government, that state governments typically neither follow smooth consumption paths over time, nor do they expend resources in a counter-cyclical fashion. Rather, states tend to reduce expenditures when tax revenue falls and vice versa, and state governments do so not only for general spending, but in categories of expenditure where the institutional arrangements would make it relatively easy to follow alternative time paths.

There has been little consideration of the relative importance of the time path of state government expenditures in response to temporary variation in state revenue. For example, that residential control over government expenditures may be more important than stabilization is suggested by the fact that 49 states have balanced budget requirements of some kind.[2] Nonetheless, the stabilization objective may impact the design of public policy, so therefore we look at the reduced form response of state taxes and expenditure resulting from changes in economic activity. Our examination takes into account and combines the implicit results of changed income, such as tax revenue responses to changes in the tax base holding tax rates constant, and explicit policy changes such as changes in the tax rates themselves. Similar differentiation is possible on the expenditure side, the level of private activity itself may change expenditures, or state governments may enact explicit policy responses. Even the implicit responses of tax and expenditures, however, may reflect how state governments have designed their policies to respond to variation in economic activity, thus our assumption is that public sector responses are intentional. Our objective here is to capture the nature of the overall total response, while recognizing we are not able to identify whether the implicit responses are designed into public policy, or whether explicit changes are adopted.

The contribution of our work, therefore, is to empirically examine how state government taxes and expenditure have varied in the face of changing economic fortunes for the average state, using time series econometric techniques on a panel of 50 US states from 1963 to 2006. Since we will take a reduced form approach as to the objectives of state governments, a panel vector autoregression (VAR) approach is

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[1] We wish to thank, without implicating, Bent Sorensen, participants at the UH Brown Bag Workshop, participants at the Lincoln Land Institute/Urban Institute Conference on The Effects of the Housing Crisis on State and Local Governments, and two referees for their helpful comments.

[2] Vermont is the only state without a constitutional provision for a balanced budget for at least some part of the state budget. Poterba (1995), however, has documented that the constitutional balanced budget requirements are incomplete for virtually all states (for example state governments often are permitted to borrow for capital expenditures).

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doi:10.1016/j.regsciurbeco.2011.02.005

appropriate to examine how state governments adjust both their expenditures and own source revenues in response to shocks to Gross State Product (GSP).[3] While we are unable to identify whether policy design is undertaken with a long run perspective, we can use our panel VAR estimates on a variety of tax and expenditure categories to be sensitive to some of the institutional constraints that may shape government behavior. The programs we investigate in addition to total current expenditures include capital spending, low income assistance, and unemployment insurance. Capital spending is interesting because in most states this category is not subject to contemporaneous budget constraints, there is extensive use of capital markets that theoretically could be used to smooth expenditures over the business cycle. Low income assistance programs typically see changes in usage in response to economic activity, though often with a lag. Unemployment Insurance (UI) is, of course, a program explicitly designed to smooth incomes for recipients that face unemployment, and there is an explicit savings component since all states maintain a UI savings account (trust fund).[4] We use our panel VAR estimates to develop impulse response functions (IRFs) for each of these expenditure categories, as well for a variety of revenue sources, including taxes, total revenues, long and short term debt, and federal aid to state governments.

Our time series approach to this problem is fundamentally different than, for example, looking at the impact of per capita income in a demand equation for publicly provided goods, such as was initiated in models like Borcherding and Deacon (1972) or Bergstrom and Goodman (1973), and widely followed since. In the demand analysis, it would seem the usual question presumed a long run permanent income approach, whereas our use of impulse response functions looks instead at the response to temporary changes ("shocks"). The question the time series work addresses is whether variation in output within the state has an effect on the public fisc in a way that may differ from standard demand analysis.[5] This is inherently an empirical question, because the pattern of responses to an economic downturn by state governments is certainly subject to several different forces pushing in different directions.

One hypothesis of how state governments might respond to an economic downturn is the "follow the revenue" theory, analogous to the "rule of thumb" consumers of Campbell and Mankiw (1989).[6] This theory states that state governments spend all of their current income each period, so if current income falls then expenditure falls, and vice versa. If this holds, we would expect to see revenue and expenditure track GSP closely.

A more sophisticated alternative, however, is that state governments understand they are agents of their individual residents. If residents follow the consumption path indicated by the permanent income hypothesis (PIH) as proposed by Hall (1978), then states should maintain their expenditures, and only revise very slightly downward their expenditure path to the extent that the estimate of permanent income falls with a negative economic shock. If states attempt to behave according to the PIH theory in this way, some of the same questions arise as when examining individual consumption, such as whether states have access to tools that would allow them to smooth their consumption in the face of a current income shortfall.[7] This concern in part motivates our examination of the separate expenditure categories.

A third hypothesis is that the objective of state governments is to maximize its own expenditure, and thus to "let no crisis go unexploited," governments would view an economic downturn as a chance to enact permanent tax and expenditure increases that residents would otherwise resist. If this idea is correct, we would see that despite how current expenditures fluctuate during a temporary income reduction, government expenditure would grow relative to state income in periods immediately following an economic downturn.

A final hypothesis is that state governments segment the policy arena to focus on specific public good problems. This hypothesis would suggest, for example, that state governments design specific policies to respond to economic fluctuations, without necessarily altering other categories of expenditure.[8] The most natural of these policies is Unemployment Insurance (UI), which directly provides income insurance to residents who lose their jobs due to "inadequate demand." Low income assistance expenditures (welfare), and potentially even capital goods spending, however, might also be categories that state governments could use to address fluctuations in economic activity. Especially after the reform in 1996, welfare expenditures could be viewed as a type of income insurance, as recipiency is now designed to be temporary. As such, whether the time path relative to GSP shocks follows UI is in part a test of whether the savings component that exists due to the dedicated trust fund is potentially important. Capital goods expenditures are primarily financed out of long term debt, and so are not generally subject to the contemporaneous budget constraint that affects current expenditure. Thus capital spending could follow a very different path than current spending, combining both the lack of a contemporaneous budget constraint with the possibility that capital spending may be altered to make up shortfalls that the current budget constraint might inflict on current expenditure.

Our approach to examining the details of how state governments respond to economic fluctuations is to estimate panel vector autoregressions (VARs) for 1963–2006 for the 50 US states. This is a reduced form procedure that traces how state governments alter their budgets over time. We impose structure by using a Cholesky decomposition to construct the IRFs, which assumes that the shock to GSP is orthogonal to all other shocks. Thus our analysis illustrates the governmental budgetary response to changes in economic activity, which we present using impulse response functions (IRFs). The reduced form VARs are not making assumptions about causality, which precludes an explicit ability to separate the underlying tastes of state governments compared to the institutional constraints, and which precludes any judgment as to state policy effectiveness at altering incomes. What we do see, however, by our examination of the IRFs from separate categories, is whether the institutional differences affect the time series pattern of governmental responses.

Section 2 of the paper briefly presents the institutional framework of how state governments might respond to fluctuations in income. Section 3 presents the panel data of US states, and how the variable choice reflects the institutional constraints. Section 4 of the paper presents the IRFs that result from estimating VARs for two groups of variables, the expenditure set of variables and the revenue set of variables. In general, we find that state governments have been weak

[3] There is of course a large macroeconomic literature on whether tax and expenditure changes by governments, including even states, can affect incomes (see e.g. Blanchard and Perotti, 2002; or Engemann et al., 2008). The reduced form we present here has as its purpose to discern the pattern of response to changes in economic activity irrespective of the source of policy motivation, and irrespective of the effectiveness of that policy.

[4] Poterba (1994) provides evidence that state fiscal institutions limit the response of state governments to changes in the economic environment. Sorensen et al. (2001) show that the ability of state governments to accumulate savings is affected by state balanced budget rules.

[5] It could be easily argued that income in a public demand equation (whether or not motivated by the median voter model) should be permanent, not transitory income. Several researchers have attempted to study the effect of decreases, rather than increases, in income such as through grants-in-aid.

[6] Mankiw (2000) argues that rule of thumb consumers are an important feature in any macroeconomic model attempting to explain consumer behavior. In the context of our paper, it is important to allow for the possibility that state governments mirror some aspects of consumer behavior.

[7] This argument has more force to the extent that the goods financed by state governments out of the general fund are not necessarily consumption, such as education, prisons, and roads, all of which could be called investment in some sense.

[8] This policy design would be consistent with the Tinbergen (1952) hypothesis that a separate policy needs to be designed to address each separate problem.

instruments for consumption smoothing, and that even in situations where the institutional structure potentially allows smoothing, states do not exploit this structure for that objective. Section 5 summarizes and briefly concludes.

2. Model specification and institutional structure

The empirical specification we use to describe state governmental response to "shocks" in income is a panel VAR. We estimate two groups of variables together, in the first we combine the alternative types of expenditures, in the other we combine alternative revenue sources. In both, the source of the shocks to which we will determine the impulse will be changes in GSP, by using the Cholesky decomposition to construct IRFs. The state government response captured in the VAR estimates is a reduced form reflecting the preferences of politicians and bureaucrats, the economic environment, and the institutional constraints.[9] In the long run, defined as longer than an election cycle, these policy choices will also reflect the choices of the electorate. The purpose of the VAR estimates, therefore, is to characterize the typical political response in a typical institutional environment within state governments to changes in GSP.

To analyze the response of state government expenditures and the impact of a shock on these responses over time we employ a third order panel Vector Autoregression (VAR)[10]:

$$Y_{i,j,t} = \theta_1 Y_{i,j,t-1} + \theta_2 Y_{i,j,t-2} + \theta_3 Y_{i,j,t-3} + U_{i,j,t} \quad (1)$$

where $Y_{i,j,t}$ is a vector containing the GSP, state expenditure or state revenue variables, i indexes states, j indexes the variables which compose the Y vector including GSP as well as the expenditure and revenue variables, and t indexes years. We estimate two sets of panel VARs, one for expenditure and one for revenue, in both cases with gross state product (GSP).[11] For the expenditure variables, an important part of our examination is to separate the state government's "insurance" expenditures from its typical consumption expenditures, and from capital spending, and to separate elements which have an explicit savings structure (UI), an explicit borrowing structure (capital), from categories funded by general revenue (current and welfare expenditure). We also estimate a third panel VAR with only GSP and the income tax share, as only a portion of states levy personal income taxes over the entire sample.

For the revenue VAR, we similarly separate what might be considered consumption smoothing components of revenue from others. Thus we separate state government debt into long and short term debt, and current revenue and taxes from federal aid. We also separately estimate a panel VAR for income taxes separated from total taxes, although with an appropriately reduced sample based on states with income taxes in all years. Most state governments piggyback their state personal income tax programs onto the federal personal income tax, which has a progressive component at the margin. Thus it is not unlikely that state personal income taxes will fluctuate more with GSP than will the other components of state taxes.[12] Capital expenditures are typically not subject to the same contemporaneous budget constraint as are current expenditures, and thus state governments have the option of smoothing both their long term debt and related capital expenditures over time. Short term debt would appear more likely to fluctuate with contemporaneous changes in GSP, depending on the specifics of each state's budgetary rules, and thus may be an element of how state governments are able to smooth their spending.

After testing that our Y_{it} expenditure and revenue variables are covariance-stationary, the panel VAR is inverted to express it as a moving average process to construct impulse response functions.[13] We use the IRFs to represent the dynamic reduced form response of state governments to economic shocks in GSP. The Cholesky decomposition is therefore helpful for analyzing the separate impacts of income shocks from other processes that influence state spending over time.

The basic idea underlying the expectations of state government behavior is that state governments are agents of the residents, responsible for consumption of collective goods. If individuals desire to have a smooth consumption path over time, it would be expected that this desire would translate to publicly consumed goods as well. There are institutional features of state governments, however, that run counter to this expectation. Specifically, most state governments are required to balance their current budget each year, and face prohibitions against borrowing to finance current consumption. Further political competition, to the extent voters are not well informed or far-sighted, suggests that inter-temporal savings is politically difficult because taxpayers would not see consumption commensurate with their taxes.[14] Thus if government tax revenue falls during times of private income shortfalls then it is possible that government consumption would fall by an equal amount.

There are three important institutional elements that might ameliorate, if not eliminate, the constraint of a current balanced budget constraint.[15] Capital expenditures, spending on goods expected to last more than one year, are not generally subject to the same budget constraints as are current expenditures, and are generally financed by debt (Poterba, 1995). In the context of the PIH, this means that states can adjust their borrowing in the face of fluctuating income, and then pay off the debt over generally a long period of time. To the extent capital expenditures are based on a long run view of population needs, capital expenditures could be expected to be the smoothest over time as they are free of institutional constraints based on the contemporaneous economy. On the other hand, during income downturns relative prices for capital goods prices may fall, thus allowing more projects to pass cost–benefit tests, and thus resulting in even counter-cyclical expenditure patterns. Reinforcing this possibility is that because capital expenditures are not financed out of current resources, state governments have the ability to increase consumption despite any decrease in tax revenues. Short run political needs might be consistent with increasing capital expenses if current expenditures are constrained by current resources.[16] Thus we propose to examine how the capital budget, and debt issuance, fluctuates over time as the general economic activity fluctuates.

A second institutional constraint is on the income insurance expenditures of states. Broadly, the programs involved are Unemployment Insurance (UI), and low income assistance. State government responsibility for low income assistance primarily includes cash aid from Temporary Aid to Needy Families (TANF), which replaced Aid to Families with Dependent Children (AFDC) in 1996, and the Medicaid low income health care program.[17] States have a considerable degree of

[9] An additional element in the reduced form might be the spillover of shocks or government response between states.

[10] Our results are not sensitive to higher order panel VARs.

[11] To insure that the variable ordering is not influencing our results, we also estimate a system a separate VAR with total revenue and each of the expenditure categories, and with current expenditure and each of the revenue categories. The resulting IRFs are essentially identical.

[12] See Dye (2004) for a complete discussion of how income taxes might be expected to fluctuate with economic activity relative to other state taxes.

[13] Each of the variables used in the panel VAR was found to be covariance-stationary using the panel unit root test of Im et al. (2003).

[14] The extent to which such pressures are inefficient depends at least in part on the geographic mobility of taxpayers.

[15] We leave a model for how individuals might need to 'over-consume' private goods in response to constrained public consumption for a different project (see Chetty and Saez, 2010).

[16] This conjecture could only be consistent with incompletely informed voters.

[17] State governments receive federal block grant (fixed sum) aid for TANF, and receive cost sharing (matching) federal aid for Medicaid. There are also a host of smaller programs, with various rules about state and local government financial participation.

latitude in both the eligibility rules and benefits levels, and finance both welfare programs out of general revenue. UI is financed through an earmarked tax that essentially is an annual lump sum tax per worker on employers.[18] Like welfare, state governments have been granted wide latitude over eligibility and benefits in UI. Welfare and UI vary considerably in their rules, and maybe even their intent. For example, UI benefits are conditioned on an employment history, and generally provide larger benefits to workers with higher wages. Low income assistance is not conditioned on prior work (although now often work search), and generally provides lower assistance to people with greater sources of income. Nonetheless, use of both programs generally rises when private incomes fall, although increases in low income assistance program recipients lag recipient increases compared to UI, as might be expected because private assets generally need to be virtually exhausted before individuals are eligible for low income assistance. The most interesting institutional difference in the programs, however, is that UI is financed by an earmarked tax on employers, and those funds are put into a Trust Fund that is restricted to be used for UI. On the other hand, low income assistance is financed out of general revenues of the state government, with no explicit savings mechanism. If the institutional constraints are binding, it is therefore possible that the response of the two programs differs as income fluctuations cause state government revenues to fluctuate. Conversely, if state governments are able to circumvent the institutional constraints, to the extent both programs have similar general goals, it might be expected that states would allow expenditures to increase during episodes of reduced economic activity.

The other side of the state government budget constraint is also illustrative of how states respond to shocks in their current income. The key to forming empirical expectations depends on how private agents view state governments. One reason institutions have been designed to enforce current budget constraints on states is that residents may not believe governments are sufficiently disciplined to borrow during periods of low income and pay off the debt in periods of high income.[19] Conversely, if state governments have greater access to capital markets, or access at lower interest rates, it may be more efficient for private agents to use the state government as an agent of consumption smoothing. In this case, taxes should fluctuate by more than income fluctuates, so that state governments essentially provide the financing to individual agents to accommodate income fluctuations. In the former view, it may be that the institutional constraints of UI trust funds and borrowing only for capital goods are important for explaining state government behavior. Conversely, in the latter view, state governments are expected to circumvent these budgetary devices and provide smoothing assistance to individuals if private mechanisms for doing so are relatively costly. A final possibility, of course, is that state governments do not express a clear and consistent view of their purpose, in which case instruments such as progressive income taxes may fluctuate with general economic activity while expenditures are adjusted in response.

3. Data and estimation

The data used to estimate the panel VAR equations are from State Government Finances (SF) produced by the US Census Bureau, except that Gross State Product is from the Bureau of Economic Analysis. The data cover the 50 US states for the period 1963–2006. The data is in real terms per capita, we use SF population data to construct per capita terms and deflate using the Bureau of Labor Statistics' consumer price index for urban consumers (1997 = 100). The means of the data are presented in Table 1.

Table 1
Means of state government spending variables.

State government spending variable	Observations	Mean	Std.dev.	Min	Max
Gross state product per capita	2200	25,117	7329	10,423	90,930
Current spending per capita	2200	2190	1146	420	11,139
Capital spending per capita	2200	299	200	76	2272
Unemployment insurance benefits per capita	2200	92	67	8	634
Public welfare spending per capita	2200	423	289	1	1756
Government revenue per capita	2200	2555	1740	767	21,811
Government expenditure per capita	2200	2780	1383	779	13,887
State individual income taxes paid per capita	1496	415	274	6	1405
Total taxes paid per capita	2200	1336	597	352	9724
Share of individual income taxes paid over total taxes	1496	29%	14%	1%	74%
Government long term debt per capita	2200	1586	1602	57	18,818
Government short term debt per capita	2200	24	68	0	1183

We use annual data on government spending, taxing, and debt decisions to test government behavior, and match this to annual economic data. The reason to do so is because most states budget on an annual basis for both the structure of taxes, and of spending. While all state governments have mechanisms for mid-year budgeting changes, the operation of these mechanisms can be considered part of the state governments' decision-making process.[20] Further, there is a considerable lumpiness in state revenue streams during the year depending on reporting payment requirements. Thus we believe the annual data best reflects how state governments make their fiscal decisions, and model them accordingly.

Three panel VARs are estimated, all with GSP. The expenditure set includes GSP, current government consumption (less UI and welfare), capital spending, UI, and low income assistance. The revenue set consists of GSP, state taxes, long term debt, short term debt, and federal aid. The third VAR is with a reduced data set to estimate a panel VAR with only GSP and the share of tax revenue from individual income taxes.[21] Because these taxes are generally at least nominally progressive, this will allow us to examine whether income taxes rise as a share of total tax revenue, consistent with the nominal progressivity that income taxes are expected to exhibit.

In applying the VAR procedure to our US state panel data, each variable is time demeaned and the mean of all future observations for each state at each year is removed using the Helmert procedure (Arellano and Bover, 1995).[22] The Helmert procedure allows for the use of lagged regressors as instruments to control for potential unobserved heterogeneity with state fixed effects, and the model is estimated using General Methods of Moments (GMM). The matrix of

[18] UI is financed by a specific tax on a base that is a fixed amount of annual wages, except in New Jersey this base is generally less than the minimum wage. All state UI programs operate under a federal programmatic umbrella, but like the low income assistance programs allow considerable leeway for states to set eligibility rules and benefit amounts, see Craig and Palumbo (1999). The UI tax rate, however, does vary by firm.

[19] Similar concerns may affect residents' willingness to allow state government saving accounts.

[20] That is, state policy can be designed to adjust during a year, or can be allowed to adjust by the overall mid-year process. For a semi-annual discussion of state budget adjustments, see "Fiscal Survey of States," by the National Organization of State Budget Officers (2001) (at http://nasbo.org/Publications/FiscalSurvey/tabid/65/Default.aspx). The Spring 2001 report for example (p. vii) discusses how states provide flexibility in their annual budgets.

[21] 16 states were excluded because they did not impose individual income taxes for at least one year during the period of our data, 1963–2006. These states are: Alaska, Connecticut, Florida, Illinois, Indiana, Maine, Michigan, Nebraska, Nevada, Ohio, Pennsylvania, Rhode Island, South Dakota, Texas, Washington, and Wyoming.

[22] We thank Inessa Love at the World Bank for providing the Stata code to estimate panel VARs.

impulse–response functions is constructed from the estimated VAR coefficients, and the standard errors are computed using Monte Carlo simulation (1000 iterations) to generate the confidence intervals.

4. Results

The results of the panel VAR estimates describing state government budgetary responses to fluctuations in GSP are presented in the impulse response functions in Figs. 2–12. We interpret these IRFs as the reduced form response of state governments to an initial shock originating from GSP. Consistent with this view, the IRFs use the Cholesky decomposition with the initial shock to the system from GSP, assumed orthogonal to shocks to other variables. Fig. 1 shows that there is considerable persistence in GSP shocks to the average state, as the second year is slightly larger than the initial shock (equal to 2.9% or one standard deviation), and GSP only slowly falls back to the initial position. Fig. 1 is estimated from the set of expenditure variables, but is virtually identical to the IRF resulting from the revenue VAR. Further, we have extensively experimented with the ordering of the variables within the VAR, and conditional on the initial shock originating from GSP we find no sensitivity to the ordering.[23] The other item to note is that the figures are presented for a positive shock, a negative shock should be interpreted as the inverse as we found no evidence of asymmetry.[24]

Fig. 2 shows the estimated IRF for state government current expenditure, excluding welfare expenditure, with simulated error bands and with GSP from Fig. 1. The IRF is found to slowly adjust to the change in GSP, meaning when the economy experiences a shock to GSP that current expenditure changes more slowly than does GSP. This pattern suggests some smoothing of consumption by state governments in that if the GSP shock is negative, that current expenditure falls more slowly than GSP falls. The graph also shows, however, that after about six years the change in the level of state expenditure exceeds the change in GSP, and stays above it for the duration.

Fig. 3 shows how taxes change in response to a GSP shock. These IRFs are from the VAR consisting of the five revenue variables. Unlike with current expenditures, we see that taxes respond much more quickly than GSP after the first year, and the magnitude relative to the change in GSP is much larger. Thus by the second year after the shock tax changes are larger than the change in GSP, implying a movement toward budgetary surplus when the economy does surprisingly well and a movement towards deficits when it does surprisingly poorly. Fig. 4 shows the IRFs for both taxes and expenditures on the same graph, to show that taxes respond to GSP shocks much more quickly than expenditures, and that the net change is a positive (negative) budget surplus in the early years after a positive (negative) shock. The tax change is comprised of two parts, the natural response of taxes to a change in the tax base, as well as explicit policy changes in either tax rates or tax bases. One possible interpretation of the IRF results is that tax revenue responds to the change in the tax base initially, and that policy change – like that for expenditure – takes some time.

In addition to taxes, states raise money by fees and charges, and they receive grants from the federal government. In Fig. 5 we show the IRF when general revenue is substituted for taxes. The figure shows that changes in general revenue for the state are more muted than changes in tax revenue. Given the rapid increase in tax revenue, this implies that fees and charges change little when GSP experiences a shock. Additionally, as shown in Fig. 6, grants from the federal government also change very little until 15 years after a GSP shock.

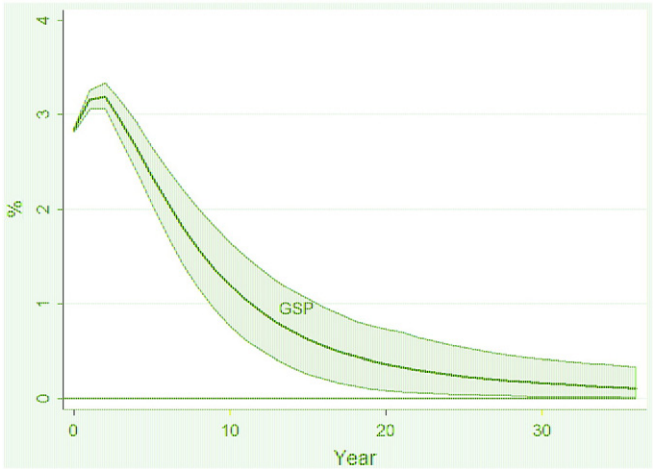

Fig. 1. Impulse response function for GSP. Notes: From five variable panel VAR on GSP, current expenditures, welfare, UI, and capital spending, using 50 states from 1963 to 2006. GSP is real per capita in 1997 dollars. Shaded area is the error band estimated by Monte Carlo simulations (1000 iterations).

Despite that total revenue responds sluggishly to GSP changes, the even slower response of expenditures therefore does not seem to be caused by a binding current revenue constraint.

One natural consequence of finding that tax revenue follows GSP more quickly than expenditures is that short term debt might fluctuate as GSP changes. The potential usage of this instrument varies greatly by state, depending on the balanced budget rules. Nonetheless, Fig. 7 shows that short term debt responds strongly in the first year after a GSP shock in the expected (opposite) direction. What is interesting, however, is that short term debt quickly resumes its usual share relative to total spending.

In terms of the original ideas that might explain the time path of state spending, these results are suggestive that states are apparently "leaning against the wind" of the economy, although our work does not address whether this behavior is intentional. Specifically, we find initial expenditure changes by lower percentages than changes in GSP, while taxes change by more. Thus states tend to run surpluses when the economy expands, and deficits when it contracts. Our

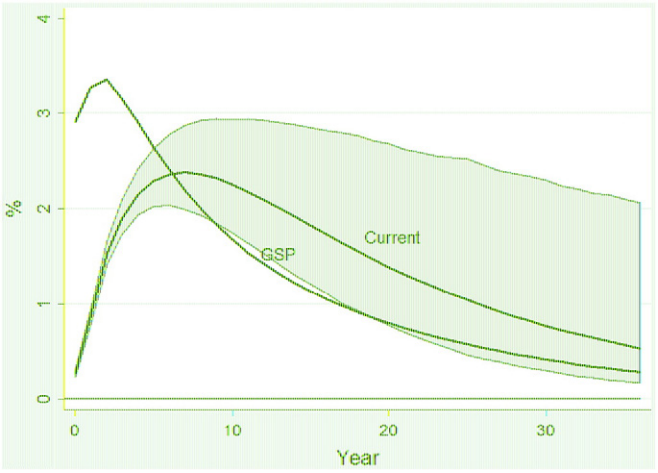

Fig. 2. Impulse response function for current state expenditures. Notes: From five variable panel VAR on GSP, current expenditures, capital, UI, and welfare spending, using Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Current state expenditure is all current expenditure but excludes welfare, UI, or capital spending. The data are per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is from Fig. 1.

[23] This even includes substituting taxes for expenditure in the expenditure set, and expenditures for taxes in the revenue set.

[24] For example, a slope dummy in the panel VAR for decreases in GSP is not significant. It should be noted, however, there are only 589 GSP declines out of a total of 2200 observations.

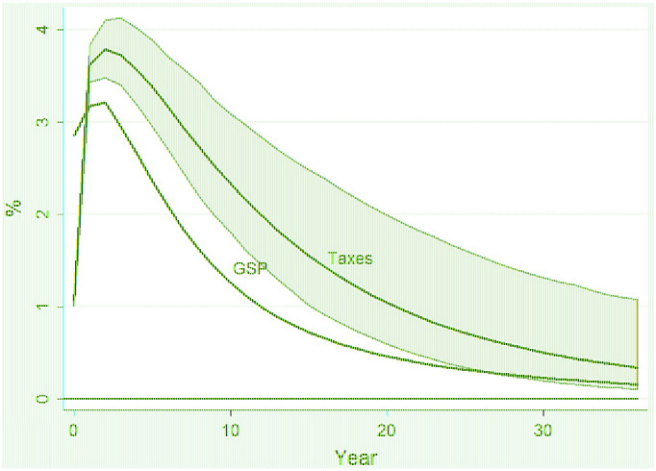

Fig. 3. Impulse response function for state taxes. Notes: From five variable panel VAR for revenue using GSP, total taxes, long term debt, short term debt, and federal aid, using Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. State government taxes comprise only about 40% of total state government revenue, including both business and personal taxes. The data are real per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with all the revenue variables.

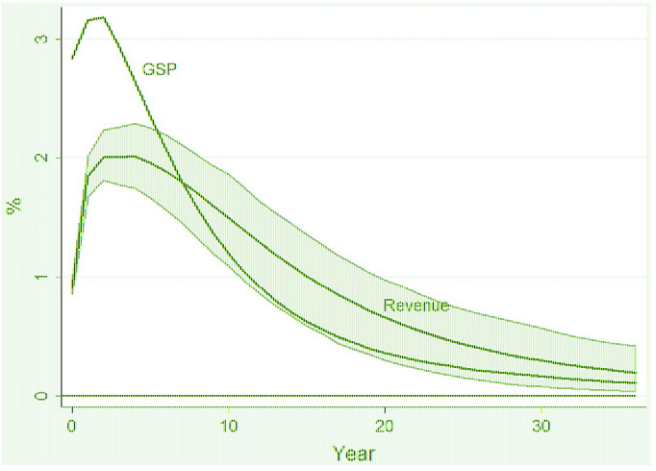

Fig. 5. Impulse response function for state total revenue. Notes: From five variable panel VAR, where taxes have been replaced by total revenue, so that the VAR uses GSP, total revenue, long term debt, short term debt, and federal aid, with the Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. State government revenue includes taxes, charges and fees, and aid from the federal government, but excludes the UI Trust Fund. The data are real per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with all the revenue variables.

results here also suggest, however, that federal aid and fees change much more slowly than GSP, so that the total change in revenue is closer to that of expenditures. There is also evidence that government size changes in the same direction as GSP over a longer period, so that GSP increases result in state government expenditures that are a larger share of the economy and vice versa when the state economy shrinks. To get a more detailed view of how state governments on average respond to GSP fluctuations, and to shed some light on the importance of some institutional details, we turn to the more detailed expenditure categories with significant links to GSP responses, capital spending, UI and welfare.

Fig. 8 shows the IRF for capital spending, along with its error bands and the IRF for GSP. It shows that like total current spending, changes in capital spending first lag changes in GSP, but then respond more quickly by growing faster than the GSP growth rate. Despite the initial lag in response, capital spending growth nonetheless surpasses GSP growth much earlier than does current spending (see Fig. 2). One interesting finding is that capital spending growth actually falls back to the GSP growth rate after 26 years, unlike current expenditure that does not revert to the GSP growth rate within the 36 year range of the data estimates.

The stock of long term debt seems to follow a path determined by a completely different process than that determining capital expenditure, as shown in the IRF in Fig. 9. Long term debt is found to fall in the first year after a positive GSP shock, but then begins to increase in a process very like the time path of current expenditures. Within the range of our data, long term debt growth never reverts to the original

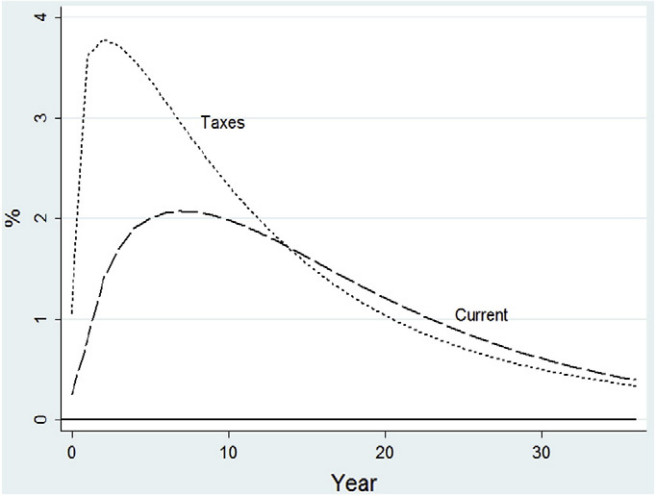

Fig. 4. Impulse response function for state taxes and expenditures. Notes: This combines Figs. 2 and 3. See the notes in those figures. Taxes are from the five variable panel VAR for revenue using while expenditures are from the five variable VARs for expenditures. Data are for the 50 states from 1963 to 2006. The data are real per capita, and show the proportional change.

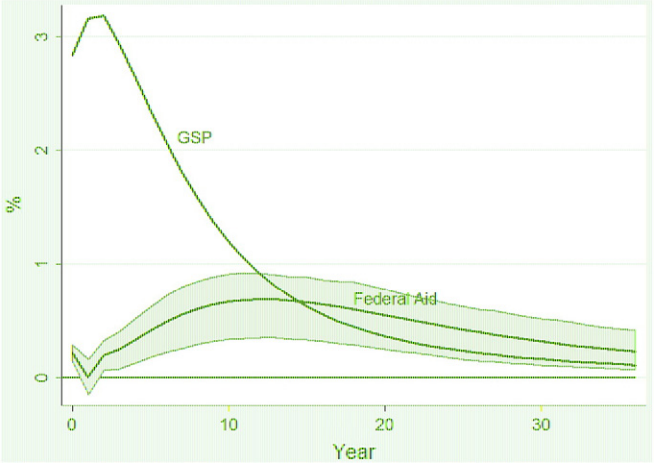

Fig. 6. Impulse response function for federal aid to state governments. Notes: From five variable panel VAR for revenue using GSP, total taxes, long term debt, short term debt, and federal aid, using Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Federal aid is generally targeted to specific projects. The largest categories are generally welfare (especially Medicaid) and highways. There was a small amount of untargeted aid, called general revenue sharing, in the late 1970s and early 1980s. The data are real per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with all the revenue variables.

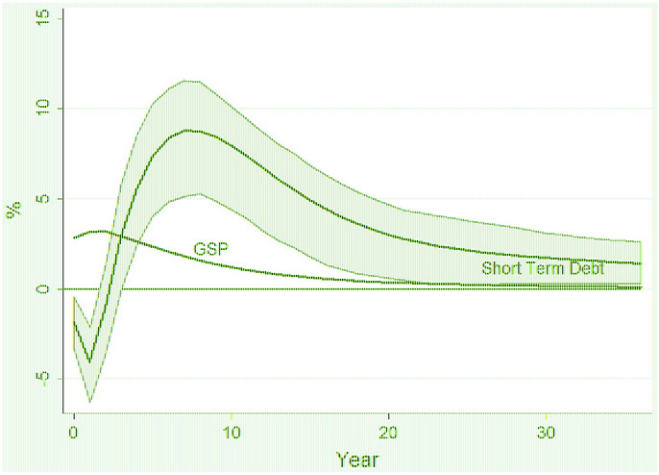

Fig. 7. Impulse response function for state government short term debt. Notes: From five variable panel VAR for revenue using GSP, total taxes, long term debt, short term debt, and federal aid, using Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Short term debt is generally restricted depending on the state, but sometimes can be used to smooth spending between fiscal years. The data are real per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with all the revenue variables.

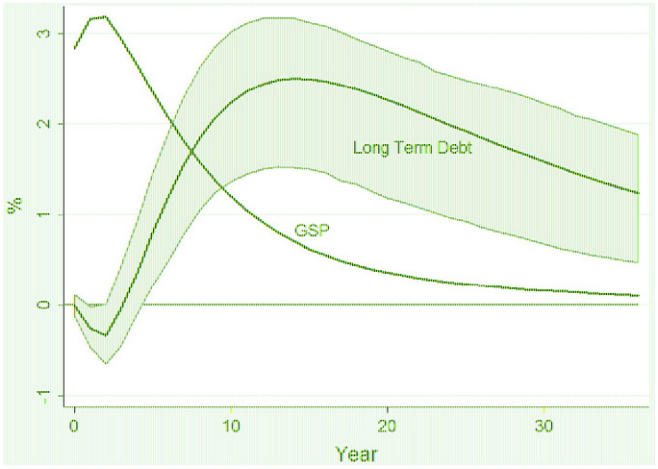

Fig. 9. Impulse response function for long term debt. Notes: From five variable panel VAR for revenue using GSP, total taxes, long term debt, short term debt, and federal aid, using Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Long term debt is generally restricted so that it can be used only for capital projects. The data are in real terms (1997 dollars) per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with all the revenue variables.

growth path of GSP. Further, capital spending seems to grow much sooner than the growth in long term debt, and the growth in debt takes considerable time to 'catch up.' Table 2 presents the cumulative impulse responses, derived from the area under the IRFs. It shows that not until year 27 does the cumulative change in long term debt equal the cumulative change in capital expenditure. In terms of our speculations as to state government motivations, capital spending does not seem to absorb any changes in current expenditure. Further, long term debt does not appear to be compensating for short term fluctuations in taxes relative to expenditures.

The other areas where state governments have an administrative instrument that would allow them to save for the future is in UI, as UI is operated through a Trust Fund that is explicitly designed to carry balances from one year to the next. If policy remains constant, it would be expected that UI would follow the inverse path of GSP. That is, when the economy receives a positive shock, we would expect UI expenditures to fall, and conversely in the presence of a negative shock we would expect UI expenditures to increase. Fig. 10 shows that these expectations do not generally match the average behavior of state governments. As expected, UI spending falls significantly when a positive GSP shock first occurs. As GSP growth moderates, UI spending is found to start increasing so that by only seven after the initial shock UI expenditure growth exceeds that of GSP. This higher growth rate is found to extend for the entire time span of our data. Thus it appears unlikely that consumption smoothing for the cyclically unemployed is the primary motivation for UI. That is, UI serves its counter-cyclical purpose in the short run, but within a relatively brief span the spending pattern takes on other characteristics.

The other state expenditure category with characteristics similar in many respects to UI is low income assistance (welfare). An important difference in the two programs is that welfare does not have the explicit savings component such as for UI. Nonetheless, Craig and Palumbo (1999) found that UI and cash welfare assistance were

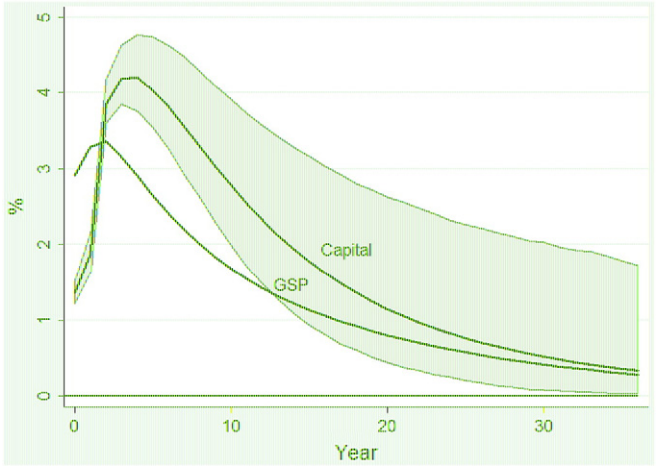

Fig. 8. Impulse response function for state government capital spending. Notes: From five variable panel VAR on GSP, current expenditures, capital, UI, and welfare, using the Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Capital spending data are real per capita (1997 dollars), changes are proportionate to the original level. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is from Fig. 1.

Table 2
Cumulative impulse response for capital spending and debt.

	Capital expenditure		Long term debt	
	GSP	Capital	GSP	Long term debt
Average per capita (1997 dollars)	$25,117	299	25,117	1586
Cumulative impulse Response				
0 year[a]	2.89%	1.43%	2.85%	0.05%
4 years	15.46%	15.27%	14.85%	0.47%
18 year	36.37%	47.02%	31.75%	31.52%
27 year	40.86%	52.26%	35.15%	51.71%

Notes: The average dollar per capita, over the years 1963–2006, for each variable is reported in this table.
The cumulative impulse response is the area under the impulse response function and reflects the percentage change.
The cumulative impulse responses of Capital and GSP are almost identical in year 4.
The cumulative impulse responses of long term debt and GSP are identical in year 18.
The cumulative impulse responses of capital and long term debt are almost identical in year 27.
[a] This is the assumed response after the initial shock, which is 2.9% of GSP (one standard deviation).

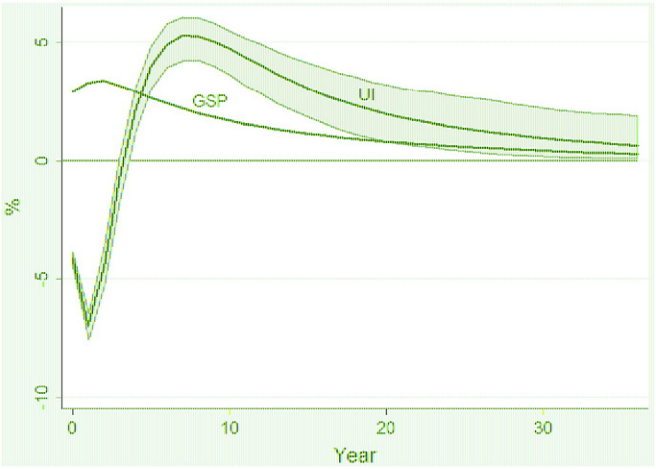

Fig. 10. Impulse response function for state government unemployment insurance expenditure. Notes: From five variable panel VAR on GSP, current expenditures, capital, UI, and welfare, using the Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. UI spending data are per capita, and shows the proportional change. The spending is out of the UI Trust Fund, supported by the earmarked tax on employers. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is from Fig. 1.

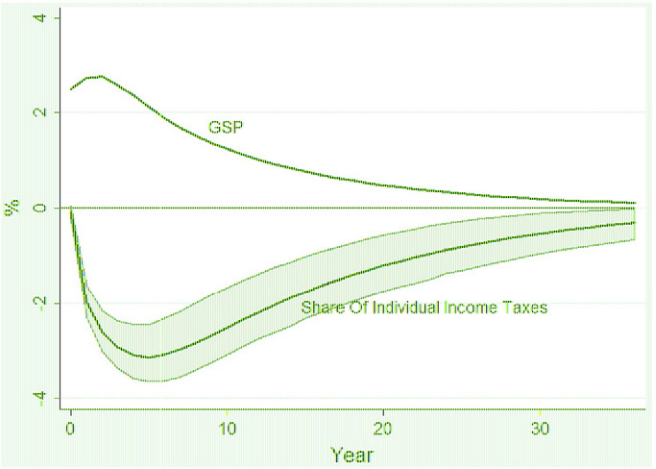

Fig. 12. Impulse response function for the share of income in total taxes Notes: From two variable panel VAR with only GSP and income tax share, using the Cholesky decomposition for the 34 states with personal income taxes for all years from 1963 to 2006. The excluded states are: Alaska, Connecticut, Florida, Illinois, Indiana, Maine, Michigan, Nebraska, Nevada, Ohio, Pennsylvania, Rhode Island, South Dakota, Texas, Washington, and Wyoming. The data are real (1997 dollars) per capita, and show the proportional change. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is very similar to Fig. 1, but estimated with this reduced data set.

substitutes in state government behavior, indicating some commonality. Fig. 11 shows the IRF for welfare spending in response to a positive GSP shock. We find a small drop in welfare spending in the first year following a positive GSP shock. Nonetheless, after only one year, welfare spending begins to follow the economic changes. It takes a longer period than for UI before welfare growth rates exceed the GSP growth rate, but once that switch has occurred, welfare continues to grow at a faster rate than GSP for the remainder of the period. It is starker to describe the same process in reverse. After a drop in GSP welfare rises for only a year, and welfare is quickly cut to correspond to reduced economic activity rather than serving as a form of income insurance for residents generally. Given that the low income segments of the population are more likely to be less capable of accessing private means of smoothing income, this description of state governments suggests that smoothing is not an important element of state policy design. The similarity in the response path for UI and welfare suggests that the institutional feature of the savings Trust Fund for UI does not have a large role in altering the time path that would otherwise exist.

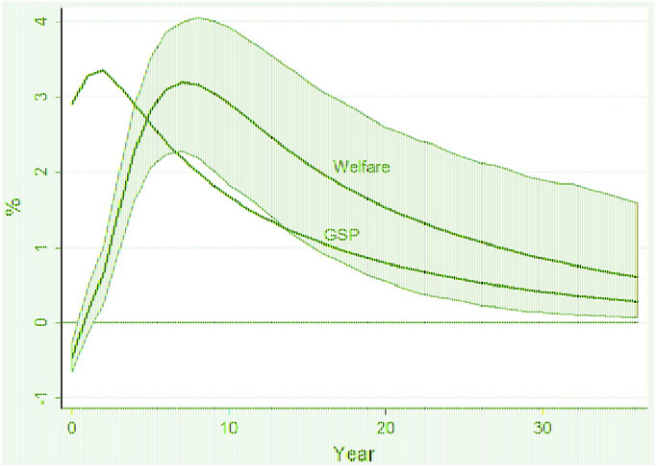

Fig. 11. Impulse response function for state government welfare expenditure. Notes: From five variable panel VAR on GSP, current expenditures, capital, UI, and welfare, using the Cholesky decomposition for the 50 states from 1963 to 2006. As explained in the text, we assume that the shock originates in GSP, but find the results are not sensitive to the ordering of the remaining variables. Welfare spending primarily consists of Medicaid and AFDC until 1996, and Medicaid and TANF after 1996. The data are per capita, and show the proportional change. The spending is supported only by the state government general fund, but includes significant levels of federal aid. Shaded area is the error band for state spending estimated by Monte Carlo simulations (1000 iterations). GSP is from Fig. 1.

The final potentially counter-cyclical fiscal instrument available to state governments is personal income taxes, as their progressive nature suggests they would grow more quickly than average with a positive income shock, and decline more quickly than average with a negative shock. Fig. 12 is based on the 34 states that have personal income taxes over our entire time period, but it shows that this hypothesis does not explain average state government behavior. Indeed, the figure shows that if there is a positive GSP shock, the share of total taxes that are personal income taxes falls. That is, the personal income tax system of most states is found to be less elastic to income changes than are sales or corporate taxes.[25]

5. Summary and conclusion

The objective of this paper has been to describe how state governments have responded over time to unexpected fluctuations in economic activity. On one hand, interest in the extent to which states change taxes and expenditures as the economy fluctuates is interesting from a macroeconomic perspective, both with an eye towards total economic activity and with an understanding that individuals may not have adequate tools by which to smooth their own consumption. On the other hand, the topic is interesting because while citizens have imposed general balanced budget constraints on their state governments, they have also created a series of institutions by which states may smooth activities over the business cycle if they so choose. Our examination of state government expenditures and revenue has been conducted with both of these potential objectives in mind.

The only apparent evidence we find that state governments are acting to smooth their behavior over the business cycle is that changes in spending out of the general fund for current expenditures lag

[25] Nationwide, sales taxes are a slightly smaller share of taxes than are personal income taxes, corporate income taxes are much smaller.

changes in the overall economy. This lag is found despite that we also find that taxes respond more quickly than expenditures to changes in the general economy. Because of the reduced form nature of the VAR, it is not possible to explicitly differentiate whether state behavior is because of institutional constraints, or because of the expressed demand from the state government. Certainly the behavior we observe is consistent with the average state simply having costly adjustment of its ongoing programs. One reason to think so is that we do not find that any of the other governmental institutions appear to effectively change state behavior. For example, UI follows a counter-cyclical pattern only at the very beginning of a shock. After the initial period, states act to increase (decrease) UI total expenditures even after a positive (negative) shock. Low income assistance spending is similar, except that the initial counter-cyclical period is only one year. Capital spending and debt financing similarly show no tendency to "lean against the wind" except for short term debt at the beginning of a cycle. Finally, even personal income taxes, which we expected to behave counter-cyclically, look to be more stable than the rest of the sources of tax receipts.

Thus our conclusion from this reduced form examination of how state governments behave has not uncovered any systematic behavior by states indicating that assisting taxpayers to smooth consumption over the business cycle, or that smoothing government consumption, is explaining much behavior. If institutions do not explain the lack of observed smoothing by state governments, we are left with believing that smoothing is not the states' objective. There are at least two possible reasons for such a possibility. One is that other objectives are more important for state politicians. For example, the demands for each constituency of state spending may differentially fluctuate with GSP, and the overall size and response of government spending may not be part of the state government's decision process. Alternatively, it may be that individuals have a wide range of rather successful smoothing institutions at their disposal, including the federal government, and thus that residents do not believe they need states to attempt to smooth consumption and/or income. Finally, it may be that the institutional structure of states has evolved with other concerns, such as the desire to have the government act responsibly by limiting expenditures to equal revenue, and that the differences in institutions between expenditure categories is insufficient to cause variation in the amount of smoothing state governments can provide.

Clearly more extensive research will be needed to confirm whether it is indeed tastes, or constraints, which affect state government behavior in the face of economic fluctuations. We have not yet, for example, examined whether heterogeneity between states is a result of the institutional environment, whether tastes systematically vary over states, or whether there are more fundamental concerns that obviate the need for state governments to be concerned over this aspect of the economy.

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