Not-for-Publication Appendix to:

The Quantitative Effects of Tax Foresight: Not All States Are Equal.*

Ana María Herrera† Sandeep Kumar Rangaraju‡

Abstract

This paper explores the effect of federal tax news on state economic activity. We estimate a factor-augmented vector autoregression (FAVAR) model, which allows us to consider the possibility that unobserved factors—such as credit and fiscal conditions—might be relevant for modelling the dynamic response of aggregate and state-level economic activity. We identify tax foresight as a shock to the implicit tax rate, measured by the yield spread between the one-year tax-exempt municipal bond and the one-year taxable Treasury bond. Our results suggest that an increase in the implicit tax rate raises national output over much of the anticipation period. In addition, anticipated tax increases give rise to expansions in state personal income and employment. We find that the variation in the responsiveness of economic activity across states is mostly explained by differences in industrial composition and income distribution, as well as by some demographic characteristics such as median income and education. Finally, using a proxy for exogenous changes in federal tax revenues, we investigate the dynamics of state-level personal income and employment. Our results point to considerable heterogeneity in the response across U.S. states. Moreover, they reveal that the long-run multiplier for an anticipated increase in tax revenues is about a tenth of the short-run multiplier for an unanticipated increase in taxes.

Keywords: Policy Foresight, FAVAR, Tax Policy, State Business Cycles.


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A Robustness Checks

A.1 Alternative measures of taxes

The benchmark specification employed in the sections 4.1, 4.2, and 4.3 includes the log growth of real per capita net taxes as a measure of tax revenues along the lines of Blanchard and Perotti (2002). However, the reader may wonder whether our results are robust to including a measure of the tax rates faced by the individual instead of a measure of tax revenue. Thus, we experimented by rotating three different variables, one at a time, as the first variable in the benchmark FAVAR. These variables are: (1) the average personal income tax rate, which is measured as the sum of federal personal income taxes and contributions for government social insurance divided by the personal income tax base; (2) the average corporate income tax rate, which is measured as the federal taxes on corporate income divided by corporate profits; and (3) the average marginal tax rate. The first two variables are available from Mertens and Ravn (2013), whereas the third was calculated on an annual basis by Barro and Redlick (2011). Here, we follow Ramey (2011) and impute the same average marginal tax rate to each of the quarters in a given year. Arguably, the implicit tax rate should contain less information regarding future changes in the average corporate income tax rate than in the average personal income tax rate, as individual holdings of municipal bonds dominate the holdings of other corporate entities (Ang, Bhansali and Xing 2010). Yet, as innovations in the implicit tax rate might have an effect on corporate taxes via their effect on employment, we opt to carry out this robustness check.

We find the responses of aggregate GDP, state personal income growth and state employment growth to be similar in shape for all three cases and to resemble the benchmark responses (see Figures B.1-B.9). The magnitude of the responses when we rotate in the average personal income tax rate or the average marginal tax rate are almost identical. For instance, four quarters after a shock to the implicit tax rate, the cumulative change in average personal income (employment) growth across states equals 0.632% (0.720%) in the benchmark model versus 0.605% (0.700%) when we use the average personal income tax rate. Instead, the responses of both aggregate GDP and state-level economic activity are slightly larger when we rotate in the average corporate income tax rate. In particular, we obtain one-year cumulative changes of 0.735% and 0.807% percentage points for personal income growth and employment growth, respectively.

A.2 Longer Bond Maturities

The reader might also wonder whether using bonds with longer maturities to compute the implicit tax rate affects our results. For instance, Kueng (2014) finds that the 2-year break even tax rate (BERT) –computed using the municipal bond spread– follows the marginal tax rate of the top 1% of the income distribution closer than the 15 year BERT. Clearly, the longer the maturity of the bonds, the longer the horizon over which expectations of future tax changes are computed. To evaluate the effect of considering longer bond maturities, we re-estimated our FAVAR model using the implicit tax rate derived from the yield data of U.S. municipal and Treasury bonds with five year maturity. Figure B.10 illustrates that, regardless of the maturity dates on municipal and Treasury bonds, GDP increases in response to a tax
news shock. In fact, differences between the two impulse response functions are minimal.

As for the estimated impulse response for state-level personal income and employment, they are also robust to considering longer maturities (see Figures B.11-B.18). Overall, we observe a similar shape in the response of personal income with a peak around 4 quarters for most states and a significant variation in the magnitude of the response across states. For employment, states exhibited similar shaped responses with a peak around 1 quarter after the shock. As it is the case for aggregate economic activity, the estimated effect on state-level economic activity is very similar. For instance, the mean of the 4-quarter cumulative response across states for personal income is 0.477% when we use the 5-year bonds versus 0.632% for the benchmark. This result is consistent with forward looking agents incorporating information about the future path of the income tax rate as soon as news become available.

A.3 Monetary Policy

Work by Rossi and Zubairy (2011) finds that considering fiscal and monetary policy in conjunction is key when analyzing the effect of government spending in VARs. This is also likely to be the case when estimating the effect of tax news. Thus, to formally evaluate the importance of accounting for monetary policy, we re-estimated the FAVAR excluding the federal funds rate. The estimated responses are similar in shape albeit somewhat smaller in magnitude relative to our benchmark model where the federal funds rate is included. For instance, in the model that excludes the fed funds rate, 1% increase in the implicit tax rate leads to one-year cumulative increases of 0.036%, 0.432%, and 0.507% in real per-capita GDP, average state personal income, and average state employment, respectively. Contrast this with our benchmark model where, four quarters after the shock, the increase in real per-capita GDP, state personal income, and state employment growth equaled 0.04%, 0.632%, and 0.739%

We also investigated the robustness of our results to two alternative specifications of monetary policy. First, we augmented our benchmark model by including the log growth of nonborrowed reserves. This alternative specification is motivated by arguments discussed in Christiano, Eichenbaum and Evans (1999) whereby the Federal Reserve targeted nonborrowed reserves during some years, in particular between 1979 and 1982. The results were qualitatively unchanged (see Figures B.19-B.27). The only difference in the impulse responses is a smaller impact of tax news on aggregate and state-level economic activity. For instance, if we include nonborrowed reserves in the model, we estimate increases of 0.574% and 0.655% in the cumulative responses of personal income and employment growth, respectively, a year after the shock.

Then, we experimented with using the term spread, measured as the difference between the 10-year Treasury bond rate and the 3-month Treasury bill rate, as an alternative indicator of the monetary policy stance. In particular, it has been argued that this term spread contains relevant information for the conduct of monetary policy as it captures expectations regarding inflation and output growth (see Ang and Piazzesi 2003, among others). The estimated impulse response functions for aggregate and state-level economic activity are very similar to the benchmark model. More specifically, the average response of personal income and employment growth across states equal 0.609% and 0.782%, respectively.
B Tables

Table B.1: Chronological tax events in United States over the years 1957-2006.
The source of this table is Yang (2007).

<table>
<thead>
<tr>
<th>Initial Policy Proposal - Enactment</th>
<th>Tax policy event</th>
<th>Legislative lag</th>
<th>Predicted sign on $\tau_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 21, 1963 - February 26, 1964</td>
<td><em>Revenue Act of 1964</em>: President Kennedy proposed reduction in individual and corporate income tax rates. It is signed by President Johnson</td>
<td>13 months</td>
<td>negative</td>
</tr>
<tr>
<td>January 26, 1967 - June 1968</td>
<td><em>Revenue and Expenditure Control Act of 1968</em>: President Johnson recommends increase in individual and corporate income surtaxes.</td>
<td>17 months</td>
<td>positive</td>
</tr>
<tr>
<td>March 26, 1969 - August 7, 1969</td>
<td>Extension of 1968 surtaxes</td>
<td>4 months</td>
<td>positive</td>
</tr>
<tr>
<td>April 21, 1969 - December 30, 1969</td>
<td><em>Tax Reform Act of 1969</em>: President Nixon recommends second extension of 1968 surtaxes.</td>
<td>8 months</td>
<td>positive</td>
</tr>
<tr>
<td>September 1971 - December 9, 1971</td>
<td><em>Revenue Act of 1971</em>: Increase in personal exemptions, raising the standard deductions.</td>
<td>2 months</td>
<td>negative</td>
</tr>
<tr>
<td>January 13, 1975 - March 29, 1975</td>
<td><em>Revenue Act of 1975</em>: President Ford recommends 10% rebate on income taxes and reduction on corporate income tax rates to fight recession.</td>
<td>2 months</td>
<td>negative</td>
</tr>
<tr>
<td>October 6, 1975 - December 23, 1975</td>
<td><em>Revenue Adjustment Act of 1975</em>: Extension of 1975 tax reductions.</td>
<td>3 months</td>
<td>negative</td>
</tr>
<tr>
<td>January 13, 1977 - May 23, 1977</td>
<td><em>Tax Reduction and Simplification Act of 1977</em>: President Carter proposes tax reductions and extended 1975 tax laws to stimulate the economy.</td>
<td>4 months</td>
<td>negative</td>
</tr>
</tbody>
</table>

*Continued on next page*
<table>
<thead>
<tr>
<th>Initial Policy Proposal - Enactment</th>
<th>Tax policy event</th>
<th>Legislative lag</th>
<th>Predicted sign on $\tau_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 26, 1982-September 23, 1982</td>
<td><em>Tax Equity and Fiscal Responsibility Act of 1982</em>: President Regan vowed to close tax loopholes and not to retreat from 1981 tax cuts.</td>
<td>9 months</td>
<td>negative</td>
</tr>
<tr>
<td>January 25, 1984 - July 18, 1984</td>
<td><em>Deficit Reduction Act of 1984</em>: President Regan increased the taxes by closing loopholes.</td>
<td>6 months</td>
<td>positive</td>
</tr>
<tr>
<td>June 26, 1990-November 5, 1990</td>
<td><em>Omnibus Budget Reconciliation Act of 1990</em>: President Bush increases the income tax rates from 28 to 31 percent.</td>
<td>5 months</td>
<td>positive</td>
</tr>
<tr>
<td>February 15, 1993-August 10, 1993</td>
<td><em>Omnibus Budget Reconciliation Act of 1993</em>: President Clinton introduced new tax brackets for individual income and corporate taxes to reduce the deficits.</td>
<td>6 months</td>
<td>positive.</td>
</tr>
<tr>
<td>June 1997-August 5, 1997</td>
<td><em>Taxpayer Relief Act of 1997</em>: President Clinton reduced the top capital gains tax rate from 28 to 20 percent.</td>
<td>2 months</td>
<td>negative</td>
</tr>
<tr>
<td>February 5, 2001-June 7, 2001</td>
<td><em>Economic Growth and Tax Reconciliation Act of 2001</em>: President Bush reduces from 6 to 5 tax brackets (expires in 2011).</td>
<td>4 months</td>
<td>negative</td>
</tr>
</tbody>
</table>
Table B.2: Data definitions and sources used in the FAVAR

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Description</th>
<th>Source and Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_M^{t}$</td>
<td>Quarterly</td>
<td>Yield on municipal bonds (1 year)</td>
<td>Leeper, Richter and Walker (2012)</td>
</tr>
<tr>
<td>$r_T^{t}$</td>
<td>Quarterly</td>
<td>Yield on Treasury bonds (1 year)</td>
<td>Leeper, Richter and Walker (2012)</td>
</tr>
<tr>
<td>$\tau_t$</td>
<td>Quarterly</td>
<td>Implicit tax rate (1 year)</td>
<td>$1 - \frac{r_M^{t}}{r_T^{t}}$</td>
</tr>
<tr>
<td>$GCE$</td>
<td>Quarterly</td>
<td>Federal government expenditures</td>
<td>BEA (Table 1.1.5)</td>
</tr>
<tr>
<td>$P16$</td>
<td>Quarterly</td>
<td>Civilian non-institutional population, over 16</td>
<td>BLS (LNU00000000Q)</td>
</tr>
<tr>
<td>$GDP$</td>
<td>Quarterly</td>
<td>Gross domestic product</td>
<td>BEA (Table 1.1.5)</td>
</tr>
<tr>
<td>$RGDP$</td>
<td>Quarterly</td>
<td>Real gross domestic product</td>
<td>BEA (Table 1.1.6)</td>
</tr>
<tr>
<td>$GDPDEF$</td>
<td>Quarterly</td>
<td>GDP deflator</td>
<td>$\frac{GDP}{RGDP}$</td>
</tr>
<tr>
<td>$g_t$</td>
<td>Quarterly</td>
<td>Real per-capita federal government spending</td>
<td>$\frac{GCE}{P16\times GDPDEF}$</td>
</tr>
<tr>
<td>$Net\ Tax$</td>
<td>Quarterly</td>
<td>Federal tax receipts net of transfer payments</td>
<td>BEA (Table 3.2)</td>
</tr>
<tr>
<td>$t_t$</td>
<td>Quarterly</td>
<td>Real per capita federal taxes</td>
<td>$(\frac{Nettax}{P16})$</td>
</tr>
<tr>
<td>$y_t$</td>
<td>Quarterly</td>
<td>Real per-capita GDP</td>
<td>$\frac{RGDP}{P16}$</td>
</tr>
<tr>
<td>$\Delta p_i^t$</td>
<td>Quarterly</td>
<td>Personal income growth rates for individual states, first differences of its log levels</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>$\Delta emp_t$</td>
<td>Quarterly</td>
<td>Employment growth rates for individual states</td>
<td>Hamilton and Owyang(2012)</td>
</tr>
<tr>
<td>$ff_t$</td>
<td>Quarterly</td>
<td>Federal funds Rate</td>
<td>Federal Reserve Bank of St. Louis</td>
</tr>
<tr>
<td>$NBR$</td>
<td>Quarterly</td>
<td>Nonborrowed reserves</td>
<td>Federal Reserve Bank of St. Louis</td>
</tr>
<tr>
<td>$TS$</td>
<td>Quarterly</td>
<td>Term spread</td>
<td>Federal Reserve Bank of St. Louis</td>
</tr>
<tr>
<td>$PCT$</td>
<td>Quarterly</td>
<td>Personal income taxes</td>
<td>BEA</td>
</tr>
<tr>
<td>$CS$</td>
<td>Quarterly</td>
<td>Contributions for government social insurance</td>
<td>BEA (Table 2.2)</td>
</tr>
<tr>
<td>$PTI$</td>
<td>Quarterly</td>
<td>Personal taxable income</td>
<td>BEA (Table 2.1)</td>
</tr>
<tr>
<td>$APITR$</td>
<td>Quarterly</td>
<td>Average personal income tax rate</td>
<td>$\frac{(PCT+CS)}{PTI}$</td>
</tr>
<tr>
<td>$AMTR$</td>
<td>Quarterly</td>
<td>Average marginal income tax rate</td>
<td>Barro and Redlick (2011)</td>
</tr>
</tbody>
</table>

Note: The aggregate variables $t_t$, $g_t$, $y_t$ are used in log levels and then included in the FAVAR model.
<table>
<thead>
<tr>
<th>States</th>
<th>Personal income</th>
<th></th>
<th></th>
<th>Employment</th>
<th></th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>Factor 1</td>
<td>Factor 2</td>
<td>Factor 3</td>
<td>Factor 1</td>
<td>Factor 2</td>
<td>Factor 3</td>
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<tr>
<td>New England Region:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Connecticut</td>
<td>0.643</td>
<td>-0.490</td>
<td>-0.030</td>
<td>0.680</td>
<td>0.344</td>
<td>0.175</td>
</tr>
<tr>
<td>Maine</td>
<td>0.482</td>
<td>-0.198</td>
<td>-0.006</td>
<td>0.671</td>
<td>0.268</td>
<td>0.201</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>0.658</td>
<td>-0.449</td>
<td>-0.092</td>
<td>0.685</td>
<td>0.325</td>
<td>0.176</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>0.633</td>
<td>-0.656</td>
<td>0.221</td>
<td>0.679</td>
<td>0.332</td>
<td>0.106</td>
</tr>
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<td>Rhode Island</td>
<td>0.584</td>
<td>-0.473</td>
<td>-0.038</td>
<td>0.701</td>
<td>0.213</td>
<td>0.176</td>
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<td>Vermont</td>
<td>0.704</td>
<td>-0.551</td>
<td>0.011</td>
<td>0.686</td>
<td>0.270</td>
<td>0.087</td>
</tr>
<tr>
<td>Mean</td>
<td>0.617</td>
<td>-0.470</td>
<td>0.011</td>
<td>0.684</td>
<td>0.292</td>
<td>0.154</td>
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<td>Mideast Region:</td>
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<tr>
<td>Delaware</td>
<td>0.584</td>
<td>-0.638</td>
<td>0.011</td>
<td>0.524</td>
<td>0.271</td>
<td>0.069</td>
</tr>
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<td>Maryland</td>
<td>0.618</td>
<td>-0.709</td>
<td>0.129</td>
<td>0.728</td>
<td>0.148</td>
<td>0.143</td>
</tr>
<tr>
<td>New Jersey</td>
<td>0.683</td>
<td>-0.511</td>
<td>-0.033</td>
<td>0.705</td>
<td>0.334</td>
<td>0.196</td>
</tr>
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<td>New York</td>
<td>0.511</td>
<td>-0.331</td>
<td>-0.131</td>
<td>0.680</td>
<td>0.248</td>
<td>0.129</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>0.584</td>
<td>0.184</td>
<td>-0.392</td>
<td>0.718</td>
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<td>0.080</td>
</tr>
<tr>
<td>Mean</td>
<td>0.596</td>
<td>-0.401</td>
<td>-0.083</td>
<td>0.671</td>
<td>0.274</td>
<td>0.123</td>
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<td></td>
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<tr>
<td>Illinois</td>
<td>0.688</td>
<td>-0.217</td>
<td>-0.384</td>
<td>0.729</td>
<td>0.347</td>
<td>0.190</td>
</tr>
<tr>
<td>Indiana</td>
<td>0.764</td>
<td>-0.122</td>
<td>-0.347</td>
<td>0.754</td>
<td>0.422</td>
<td>0.124</td>
</tr>
<tr>
<td>Michigan</td>
<td>0.681</td>
<td>-0.044</td>
<td>-0.225</td>
<td>0.608</td>
<td>0.470</td>
<td>0.108</td>
</tr>
<tr>
<td>Ohio</td>
<td>0.775</td>
<td>-0.053</td>
<td>-0.297</td>
<td>0.777</td>
<td>0.427</td>
<td>0.109</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>0.752</td>
<td>-0.374</td>
<td>-0.237</td>
<td>0.770</td>
<td>0.375</td>
<td>0.177</td>
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<tr>
<td>Mean</td>
<td>0.732</td>
<td>-0.162</td>
<td>-0.298</td>
<td>0.728</td>
<td>0.408</td>
<td>0.142</td>
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<td>Plains Region:</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Iowa</td>
<td>0.277</td>
<td>0.160</td>
<td>-0.720</td>
<td>0.660</td>
<td>0.369</td>
<td>0.167</td>
</tr>
<tr>
<td>Kansas</td>
<td>0.339</td>
<td>-0.082</td>
<td>-0.473</td>
<td>0.632</td>
<td>0.332</td>
<td>0.072</td>
</tr>
<tr>
<td>Minnesota</td>
<td>0.646</td>
<td>-0.443</td>
<td>-0.293</td>
<td>0.773</td>
<td>0.320</td>
<td>0.116</td>
</tr>
<tr>
<td>Missouri</td>
<td>0.626</td>
<td>-0.350</td>
<td>-0.388</td>
<td>0.756</td>
<td>0.377</td>
<td>0.160</td>
</tr>
<tr>
<td>Nebraska</td>
<td>0.299</td>
<td>-0.027</td>
<td>-0.612</td>
<td>0.586</td>
<td>0.316</td>
<td>0.057</td>
</tr>
<tr>
<td>North Dakota</td>
<td>0.095</td>
<td>0.063</td>
<td>-0.457</td>
<td>0.295</td>
<td>0.191</td>
<td>0.021</td>
</tr>
<tr>
<td>South Dakota</td>
<td>0.120</td>
<td>0.120</td>
<td>-0.537</td>
<td>0.500</td>
<td>0.269</td>
<td>0.057</td>
</tr>
<tr>
<td>Mean</td>
<td>0.343</td>
<td>-0.080</td>
<td>-0.497</td>
<td>0.600</td>
<td>0.310</td>
<td>0.093</td>
</tr>
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<td>Southeast Region:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alabama</td>
<td>0.670</td>
<td>-0.078</td>
<td>-0.427</td>
<td>0.730</td>
<td>0.492</td>
<td>0.065</td>
</tr>
<tr>
<td>Arkansas</td>
<td>0.419</td>
<td>-0.107</td>
<td>-0.432</td>
<td>0.662</td>
<td>0.396</td>
<td>0.045</td>
</tr>
<tr>
<td>Florida</td>
<td>0.541</td>
<td>-0.760</td>
<td>0.255</td>
<td>0.629</td>
<td>0.286</td>
<td>0.112</td>
</tr>
<tr>
<td>Georgia</td>
<td>0.653</td>
<td>-0.639</td>
<td>0.200</td>
<td>0.780</td>
<td>0.356</td>
<td>0.084</td>
</tr>
<tr>
<td>Kentucky</td>
<td>0.605</td>
<td>0.020</td>
<td>-0.512</td>
<td>0.657</td>
<td>0.436</td>
<td>0.079</td>
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<td>Louisiana</td>
<td>0.480</td>
<td>-0.249</td>
<td>-0.370</td>
<td>0.433</td>
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<td>-0.032</td>
</tr>
<tr>
<td>Mississippi</td>
<td>0.250</td>
<td>0.202</td>
<td>-0.399</td>
<td>0.661</td>
<td>0.401</td>
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<td>Wisconsin</td>
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<td>Wyoming</td>
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<tr>
<td><strong>Average values</strong></td>
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Table B.5: Data definitions and Sources used in Cross State Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
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<tr>
<td><strong>Dependent variable:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta p4 )</td>
<td>Estimated cumulative response of personal income (4 quarter’s)</td>
<td>Computed from IRF</td>
</tr>
<tr>
<td>( \Delta emp4 )</td>
<td>Estimated cumulative response employment (4 quarter’s)</td>
<td>Computed from IRF</td>
</tr>
<tr>
<td><strong>Independent variables:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>Average agriculture share of total state GDP over the years 1963-2006</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>Construction</td>
<td>Average construction share of total state GDP over the years 1963-2006</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Average manufacturing share of total state GDP over the years 1963-2006</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>Retail</td>
<td>Average retail share of total state GDP over the years 1963-2006</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>FIRE</td>
<td>Average finance, insurance and retail share of total state GDP over the years 1963-2006</td>
<td>BEA (Regional Data)</td>
</tr>
<tr>
<td>Capint</td>
<td>NAICS capital intensity indexes over the years 1986-2006</td>
<td>BLS</td>
</tr>
<tr>
<td>Municipal bond issuer</td>
<td>Dummy variable for states where most municipal bonds are issued</td>
<td>Bloomberg’s Municipal Fair Market Bond Index.</td>
</tr>
<tr>
<td>Fed_AMTR</td>
<td>Average federal marginal income tax rate for individual states over the years 1977-2006</td>
<td>NBER</td>
</tr>
<tr>
<td>State_AMTR</td>
<td>Average state marginal income tax rate for individual states over the years 1977-2006</td>
<td>NBER</td>
</tr>
<tr>
<td>Female</td>
<td>Annual average percent of total population that is female, 1970-2006</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>Education</td>
<td>Annual average percent of the total population 25 years and over with a bachelor degree or higher education, 1960-2000</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>Nonwhite</td>
<td>Annual average percent of total population that is nonwhite, 1970-2006</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>Median income</td>
<td>Median income is the average over years 1984-2006</td>
<td>U.S. Census Bureau</td>
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<tr>
<td>Variable</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------</td>
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<tr>
<td>Median age</td>
<td>Median age for U.S. states, 2000</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>Population density</td>
<td>Population density per square mile, 2000</td>
<td>U.S. Census Bureau</td>
</tr>
<tr>
<td>Per-capita federal tax burden</td>
<td>Federal tax burden (per-capita), 2005</td>
<td>Tax Foundation</td>
</tr>
<tr>
<td>Top1ps</td>
<td>Annual average share of income held by top 1% income distribution, 1957-2005</td>
<td>Frank (2009)</td>
</tr>
<tr>
<td>Top10ps</td>
<td>Annual average share of income held by top 10% income distribution, 1957-2005</td>
<td>Frank (2009)</td>
</tr>
<tr>
<td>AGI</td>
<td>Annual average real per capita adjusted gross income by state, 1988-2005</td>
<td>Statistics of Income (SOI)</td>
</tr>
<tr>
<td>Capitalgain</td>
<td>Annual average real per capita net capital gains in adjusted gross income by state, 1988-2005</td>
<td>Statistics of Income (SOI)</td>
</tr>
<tr>
<td>House</td>
<td>Fraction of state representatives that are democrat, 1980-2006</td>
<td>UKCPR</td>
</tr>
<tr>
<td>Senate</td>
<td>Fraction of state senators that are democrat, 1980-2006</td>
<td>UKCPR</td>
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Table B.6: Estimated Equations Explaining Cross-State Variation to Implicit tax rate

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<th>Δemp4</th>
<th>Δpi4</th>
<th>Δemp4</th>
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<td></td>
<td>(5.030)</td>
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<td>(4.246)</td>
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<tr>
<td>FIRE</td>
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<td>-0.683</td>
<td>-0.843</td>
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<tr>
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<td>(1.847)</td>
<td>(1.759)</td>
<td>(0.483)</td>
<td>(0.710)</td>
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<tr>
<td>Medianincome</td>
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<td>3.23e-05*</td>
<td>1.88e-05**</td>
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<tr>
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<td>(9.36e-06)</td>
<td>(1.69e-05)</td>
<td>(7.55e-06)</td>
<td>(1.16e-05)</td>
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<td>(0.0202)</td>
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<td>0.120***</td>
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<td>17.64</td>
<td>6.118***</td>
<td>7.342***</td>
</tr>
<tr>
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<td>(5.484)</td>
<td>(12.41)</td>
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<td>48</td>
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<td>48</td>
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<td>R-squared</td>
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<td>0.597</td>
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*** p<0.01, ** p<0.05, * p<0.1

The table reports regression coefficients and robust standard errors (in parentheses) for the cross-state regressions of the 4-quarter cumulative response of per-capita personal income and employment growth on state-level characteristics. The regressions are estimated by FGLS method. The dependent variable is the 4-quarter cumulative response of real per-capita personal income and employment growth to a 1 percentage point shock to the implicit tax rate computed based on the estimated FAVAR impulse response functions.
The figure shows the response of real per-capita GDP to one percentage point increase in implicit tax rate. Solid lines are point estimates of real GDP from benchmark model. Dotted lines are point estimates using the average personal income tax rate (APITR) in the benchmark specification. Dashed lines are point estimates for real GDP using the average corporate tax rate (ACITR) in the benchmark specification. Finally, dashed-dot lines are point estimates for real GDP using average marginal tax rate (AMTR) in the benchmark specification.
Figure B.2: Impulse responses of state-level personal income for alternative FAVAR specification.

The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
Figure B.5: Impulse responses of state-level personal income for alternative FAVAR specification

The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
Figure B.9: Impulse responses of state-level employment for alternative FAVAR specification

The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.
The figure shows the response of real per-capita GDP to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates; dashed indicate the 95 percent confidence intervals constructed following Kilian and Gonclaves (2004) recursive wild-bootstrap method using 10,000 replications.
Figure B.11: Impulse responses of state-level personal income (using 5-year bonds)

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.12: Impulse responses of state-level personal income (using 5-year bonds)

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.14: Impulse responses of state-level personal income (using 5-year bonds)

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.15: Impulse responses of state-level employment (using 5-year bonds)

The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.18: Impulse responses of state-level employment (using 5-year bonds)

The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the response of real per-capita GDP to a one percentage point increase in the implicit tax rate with respect to different monetary policy variables. The benchmark specification includes the federal funds rate as the monetary policy variable in the FAVAR model. The alternative specification consists: (a) without FFR: excluding federal funds rate from benchmark specification; (b) Long term spread: we augmented our benchmark specification by including the term spread as alternative indicator for monetary policy; (c) nonborrowed reserves: we augment our benchmark specification by including log of nonborrowed reserves in addition to federal funds rate in the benchmark specification.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.21: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.23: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.24: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR

The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.26: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR.

The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.27: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR

The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.28: Impulse response of real per-capita GDP with Two and Five Factors

The figure shows the response of real per-capita GDP to a one percentage point increase in the implicit tax rate with respect to different number of factors.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.31: Impulse responses of state-level personal income with Two and Five Factors

The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.35: Impulse responses of state-level employment with Two and Five Factors

The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
Figure B.36: Impulse responses of state-level employment with Two and Five Factors

The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.
The figure shows the response of the aggregate variables and the regional factors to a one percentage point increase in the implicit tax rate. All responses are reported in percentages. Full lines are point estimates; dashed and dash-dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
The figure shows the impulse responses of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).
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The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lunsford, 2016).
Figure B.46: Impulse responses of state-level personal income- Proxy FAVAR Model

The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsford, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsford, 2016).
Figure B.48: Impulse responses of state-level personal income-Proxy FAVAR Model

The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsford, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenue increases of 1% of GDP. Full lines are point estimates; dashed and dotted lines indicate the 68% confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsdin, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsford, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lumsford, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lunsford, 2016).
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP. Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lunsford, 2016).