Not-for-Publication Appendix to:

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

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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.
JEL codes: C32, E62, H24, H25.

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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 non-borrowed 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).

Initial Policy Proposal - Enactment	Tax policy event	Legislative lag	Predicted sign on τ_t
January 21,1963 -February 26,1964	*Revenue Act of 1964*: President Kennedy proposed reduction in individual and corporate income tax rates. It is signed by President Johnson	13 months	negative
January 26, 1967-June 1968	*Revenue and Expenditure Control Act of 1968*: President Johnson recommends increase in individual and corporate income surtaxes.	17 months	positive
March 26, 1969-August 7, 1969	Extension of 1968 surtaxes	4 months.	positive
April 21, 1969 -December 30, 1969	*Tax Reform Act of 1969*: President Nixon recommends second extension of 1968 surtaxes.	8 months	positive
September 1971-December 9, 1971	*Revenue Act of 1971*: Increase in personal exemptions, raising the standard deductions.	2 months	negative
January 13,1975-March 29, 1975	*Revenue Act of 1975*: President Ford recommends 10% rebate on income taxes and reduction on corporate income tax rates to fight recession.	2 months	negative
October 6, 1975-December 23, 1975	*Revenue Adjustment Act of 1975*: Extension of 1975 tax reductions.	3 months	negative
January 26, 1976-October 4, 1976	*Tax Reform Act of 1976*: Extension of 1975 tax reductions.	8 months	negative
January 13, 1977-May 23, 1977	*Tax Reduction and Simplification Act of 1977*: President Carter proposes tax reductions and extended 1975 tax laws to stimulate the economy.	4 months	negative
January 19, 1978-November 1978	*Revenue Act of 1978*: Individual and corporate tax rates reduction.	10 months	negative

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Table B.1 – *Continued from previous page*

Initial Policy Proposal - Enactment	Tax policy event	Legislative lag	Predicted sign on τ_t
February 5, 1981-August 13, 1981	*Economic Recovery Tax Act of 1981*: President Regan proposes reduction of individual all tax rates.	6 months	negative
January 26, 1982-September23, 1982	*Tax Equity and Fiscal Responsibility Act of 1982*: President Regan vowed to close tax loopholes and not to retreat from 1981 tax cuts.	9 months	negative
January 25, 1984 - July 18,1984	*Deficit Reduction Act of 1984*: President Regan increased the taxes by closing loopholes.	6 months	positive
January 25, 1985- October 22, 1986	*Tax Reform Act of 1986*: President Regan proposes structural reform in tax laws.	9 months	negative.
June 26,1990-November 5, 1990	*Omnibus Budget Reconciliation Act of 1990* : President Bush increases the income tax rates from 28 to 31 percent.	5 months	positive
February 15,1993-August 10, 1993	*Omnibus Budget Reconciliation Act of 1993*: President Clinton introduced new tax brackets for individual income and corporate taxes to reduce the deficits.	6 months	positive.
June 1997-August 5, 1997	*Tax payer Relief Act of 1997*: President Clinton reduced the top capital gains tax rate from 28 to 20 percent.	2 months	negative
February 5, 2001-June 7, 2001	*Economic Growth and Tax Reconciliation Act of 2001*: President Bush reduces from 6 to 5 tax brackets (expires in 2011).	4 months	negative
January 7,2003-May 28, 2003	*Jobs and Growth Tax Reconciliation Act of 2003*: Accelerated the tax reductions enacted in 2001 tax cuts.	4 months	negative
January 20,2004-October 4, 2005	*Working Families Tax Relief Act of 2003*: Extended many of 2001 tax relief act.	8 months	negative.

Table B.2: Data definitions and sources used in the FAVAR

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

Note: The aggregate variables t_t, g_t, y_t are used in log levels and then included in the FAVAR model.

Table B.3: Correlation with factors

States	**Personal income**			**Employment**		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
New England Region:						
Connecticut	0.643	-0.490	-0.030	0.680	0.344	0.175
Maine	0.482	-0.198	-0.006	0.671	0.268	0.201
Massachusetts	0.658	-0.449	-0.092	0.685	0.325	0.176
New Hampshire	0.633	-0.656	0.221	0.679	0.332	0.106
Rhode Island	0.584	-0.473	-0.038	0.701	0.213	0.176
Vermont	0.704	-0.551	0.011	0.686	0.270	0.087
Mean	**0.617**	**-0.470**	**0.011**	**0.684**	**0.292**	**0.154**
Mideast Region:						
Delaware	0.584	-0.638	0.011	0.524	0.271	0.069
Maryland	0.618	-0.709	0.129	0.728	0.148	0.143
New Jersey	0.683	-0.511	-0.033	0.705	0.334	0.196
New York	0.511	-0.331	-0.131	0.680	0.248	0.129
Pennsylvania	0.584	0.184	-0.392	0.718	0.368	0.080
Mean	**0.596**	**-0.401**	**-0.083**	**0.671**	**0.274**	**0.123**
Great Lakes Region :						
Illinois	0.688	-0.217	-0.384	0.729	0.347	0.190
Indiana	0.764	-0.122	-0.347	0.754	0.422	0.124
Michigan	0.681	-0.044	-0.225	0.608	0.470	0.108
Ohio	0.775	-0.053	-0.297	0.777	0.427	0.109
Wisconsin	0.752	-0.374	-0.237	0.770	0.375	0.177
Mean	**0.732**	**-0.162**	**-0.298**	**0.728**	**0.408**	**0.142**
Plains Region:						
Iowa	0.277	0.160	-0.720	0.660	0.369	0.167
Kansas	0.339	-0.082	-0.473	0.632	0.332	0.072
Minnesota	0.646	-0.443	-0.293	0.773	0.320	0.116
Missouri	0.626	-0.350	-0.388	0.756	0.377	0.160
Nebraska	0.299	-0.027	-0.612	0.586	0.316	0.057
North Dakota	0.095	0.063	-0.457	0.295	0.191	0.021
South Dakota	0.120	0.120	-0.537	0.500	0.269	0.057
Mean	**0.343**	**-0.080**	**-0.497**	**0.600**	**0.310**	**0.093**
Southeast Region:						
Alabama	0.670	-0.078	-0.427	0.730	0.492	0.065
Arkansas	0.419	-0.107	-0.432	0.662	0.396	0.045
Florida	0.541	-0.760	0.255	0.629	0.286	0.112
Georgia	0.653	-0.639	0.200	0.780	0.356	0.084
Kentucky	0.605	0.020	-0.512	0.657	0.436	0.079
Louisiana	0.480	-0.249	-0.370	0.433	0.219	-0.032
Mississippi	0.250	0.202	-0.399	0.661	0.401	0.044
North Carolina	0.674	-0.514	0.074	0.764	0.341	0.129
South Carolina	0.723	-0.398	0.091	0.728	0.371	0.109
Tennessee	0.742	-0.399	-0.164	0.781	0.402	0.047
Virginia	0.617	-0.636	0.188	0.782	0.155	0.129
West Virginia	0.006	0.541	-0.478	0.414	0.207	-0.145
Mean	**0.532**	**-0.251**	**-0.164**	**0.668**	**0.339**	**0.055**

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Table B.3 – *Continued from previous page*

States	**Personal income**			**Employment**		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
Southwest Region:						
Arizona	0.574	-0.718	0.263	0.621	0.315	0.036
New Mexico	0.390	-0.543	0.081	0.499	0.306	-0.062
Oklahoma	0.382	-0.331	-0.452	0.436	0.284	-0.113
Texas	0.579	-0.670	0.132	0.581	0.336	-0.012
Mean	**0.481**	**-0.566**	**0.006**	**0.534**	**0.310**	**-0.038**
Rocky Mountain Region:						
Colarado	0.609	-0.684	-0.008	0.573	0.300	-0.051
Idaho	0.527	-0.252	-0.251	0.504	0.303	-0.102
Montana	0.223	0.068	-0.498	0.376	0.347	0.001
Utah	0.579	-0.695	0.153	0.569	0.286	0.034
Wyoming	0.101	0.295	-0.510	0.208	0.174	-0.050
Mean	**0.408**	**-0.254**	**-0.223**	**0.446**	**0.282**	**-0.034**
Far West Region :						
California	0.571	-0.743	0.256	0.697	0.367	0.196
Nevada	0.497	-0.773	0.235	0.545	0.255	0.065
Oregon	0.714	-0.531	0.002	0.686	0.353	0.146
Washington	0.561	-0.601	0.138	0.608	0.299	0.189
Mean	**0.586**	**-0.662**	**0.158**	**0.634**	**0.318**	**0.149**

Table B.4: Growth rate of personal income and employment -1957Q1-2006Q4

States	Average growth rate of personal Income	Average growth rate of employment
Alabama	0.686	0.502
Arizona	0.593	1.205
Arkansas	0.746	0.657
California	0.508	0.628
Colorado	0.598	0.823
Connecticut	0.593	0.317
Delaware	0.430	0.534
Florida	0.654	1.031
Georgia	0.678	0.729
Idaho	0.570	0.765
Illinois	0.499	0.264
Indiana	0.495	0.397
Iowa	0.571	0.436
Kansas	0.581	0.464
Kentucky	0.644	0.541
Louisiana	0.626	0.464
Maine	0.625	0.409
Maryland	0.632	0.558
Massachusetts	0.650	0.290
Michigan	0.437	0.311
Minnesota	0.641	0.566
Mississippi	0.778	0.591
Missouri	0.552	0.383
Montana	0.489	0.499
Nebraska	0.604	0.497
Nevada	0.485	1.412
New Hampshire	0.676	0.638
New Jersey	0.590	0.376
New Mexico	0.590	0.725
New York	0.560	0.175
North Carolina	0.687	0.677
North Dakota	0.612	0.553
Ohio	0.471	0.273
Oklahoma	0.625	0.524
Oregon	0.512	0.649
Pennsylvania	0.558	0.210
Rhode Island	0.592	0.281
South Carolina	0.714	0.653
South Dakota	0.649	0.559
Tennessee	0.684	0.589
Texas	0.594	0.735
Utah	0.544	0.845
Vermont	0.667	0.547
Virginia	0.704	0.697
Washington	0.560	0.666
West Virginia	0.585	0.191
Wisconsin	0.557	0.469
Wyoming	0.647	0.620
Average values	*0.600*	*0.560*

Table B.5: Data definitions and Sources used in Cross State Regression Analysis

Variable	Description	Source
Dependent variable:		
$\Delta pi4$	Estimated cumulative response of personal income (4 quarter's)	Computed from IRF
$\Delta emp4$	Estimated cumulative response employment (4 quarter's)	Computed from IRF
Independent variables:		
Agriculture	Average agriculture share of total state GDP over the years 1963-2006	BEA (Regional Data)
Construction	Average construction share of total state GDP over the years 1963-2006	BEA (Regional Data)
Manufacturing	Average manufacturing share of total state GDP over the years 1963-2006	BEA (Regional Data)
Retail	Average retail share of total state GDP over the years 1963-2006	BEA (Regional Data)
FIRE	Average finance, insurance and retail share of total state GDP over the years 1963-2006	BEA (Regional Data)
Capint	NAICS capital intensity indexes over the years 1986-2006	BLS
Municipal bond issuer	Dummy variable for states where most municipal bonds are issued	Bloomberg's Municipal Fair Market Bond Index.
Fed_AMTR	Average federal marginal income tax rate for individual states over the years 1977-2006	NBER
State_AMTR	Average state marginal income tax rate for individual states over the years 1977-2006	NBER
Female	Annual average percent of total population that is female, 1970-2006	U.S. Census Bureau
Education	Annual average percent of the total population 25 years and over with a bachelor degree or higher education, 1960-2000	U.S. Census Bureau
Nonwhite	Annual average percent of total population that is nonwhite, 1970-2006	U.S. Census Bureau
Median income	Median income is the average over years 1984-2006	U.S. Census Bureau

Table B.5: Data definitions and Sources used in Cross State Regression Analysis

Variable	Description	Source
Independent variables:		
Median age	Median age for U.S. states, 2000	U.S. Census Bureau
Population density	Population density per square mile, 2000	U.S. Census Bureau
Per-capita federal tax burden	Federal tax burden (per-capita), 2005	Tax Foundation
Top1ps	Annual average share of income held by top 1% income distribution, 1957-2005	Frank (2009)
Top10ps	Annual average share of income held by top 10% income distribution, 1957-2005	Frank (2009)
AGI	Annual average real per capita adjusted gross income by state, 1988-2005	Statistics of Income (SOI)
Capitalgain	Annual average real per capita net capital gains in adjusted gross income by state, 1988-2005	Statistics of Income (SOI)
House	Fraction of state representatives that are democrat,1980-2006	UKCPR
Senate	Fraction of state senators that are democrat,1980-2006	UKCPR

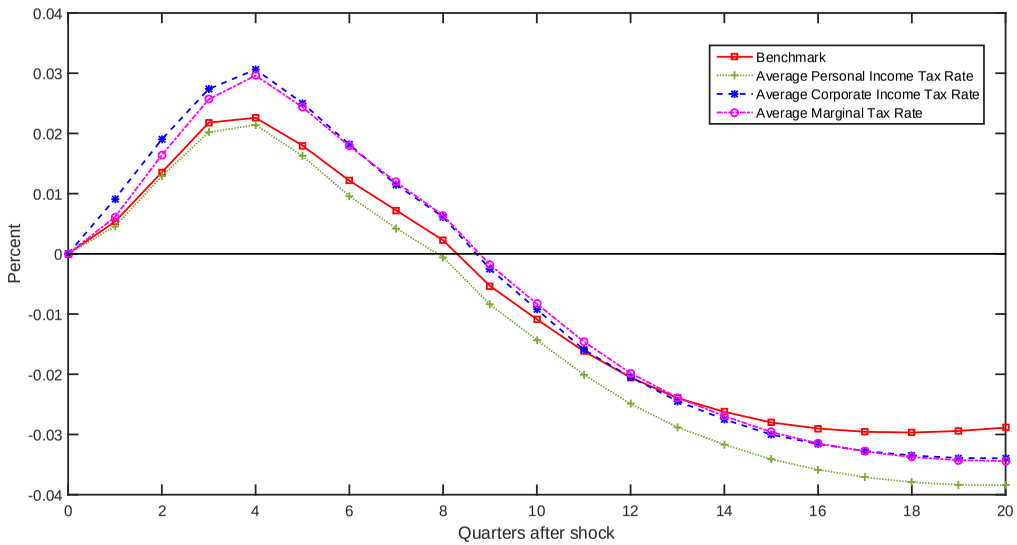
Table B.6: Estimated Equations Explaining Cross-State Variation to Implicit tax rate

VARIABLES	(starting sample: 1984) Δpi4	(starting sample: 1984) Δemp4	(end sample: 2006) Δpi4	(end sample: 2006) Δemp4
Retail		7.975		3.473
		(5.030)		(4.246)
FIRE	-1.117	-2.192	-0.683	-0.843
	(1.847)	(1.759)	(0.483)	(0.710)
Medianincome	1.81e-05*	3.23e-05*	1.88e-05**	1.47e-05
	(9.36e-06)	(1.69e-05)	(7.55e-06)	(1.16e-05)
Education	0.0436**	0.0306	0.0149	0.0242
	(0.0202)	(0.0240)	(0.0137)	(0.0179)
Fed AMTR	0.112***	0.0647*	0.120***	0.0653
	(0.0375)	(0.0367)	(0.0346)	(0.0475)
Top1ps	9.894*	17.64	6.118***	7.342***
	(5.484)	(12.41)	(1.636)	(2.628)
Constant	-3.171***	-4.536**	-4.465***	-3.686***
	(0.885)	(1.934)	(0.684)	(1.135)
Observations	48	48	48	48
R-squared	0.501	0.450	0.597	0.452

*** p<0.01, ** p<0.05, * p<0.1

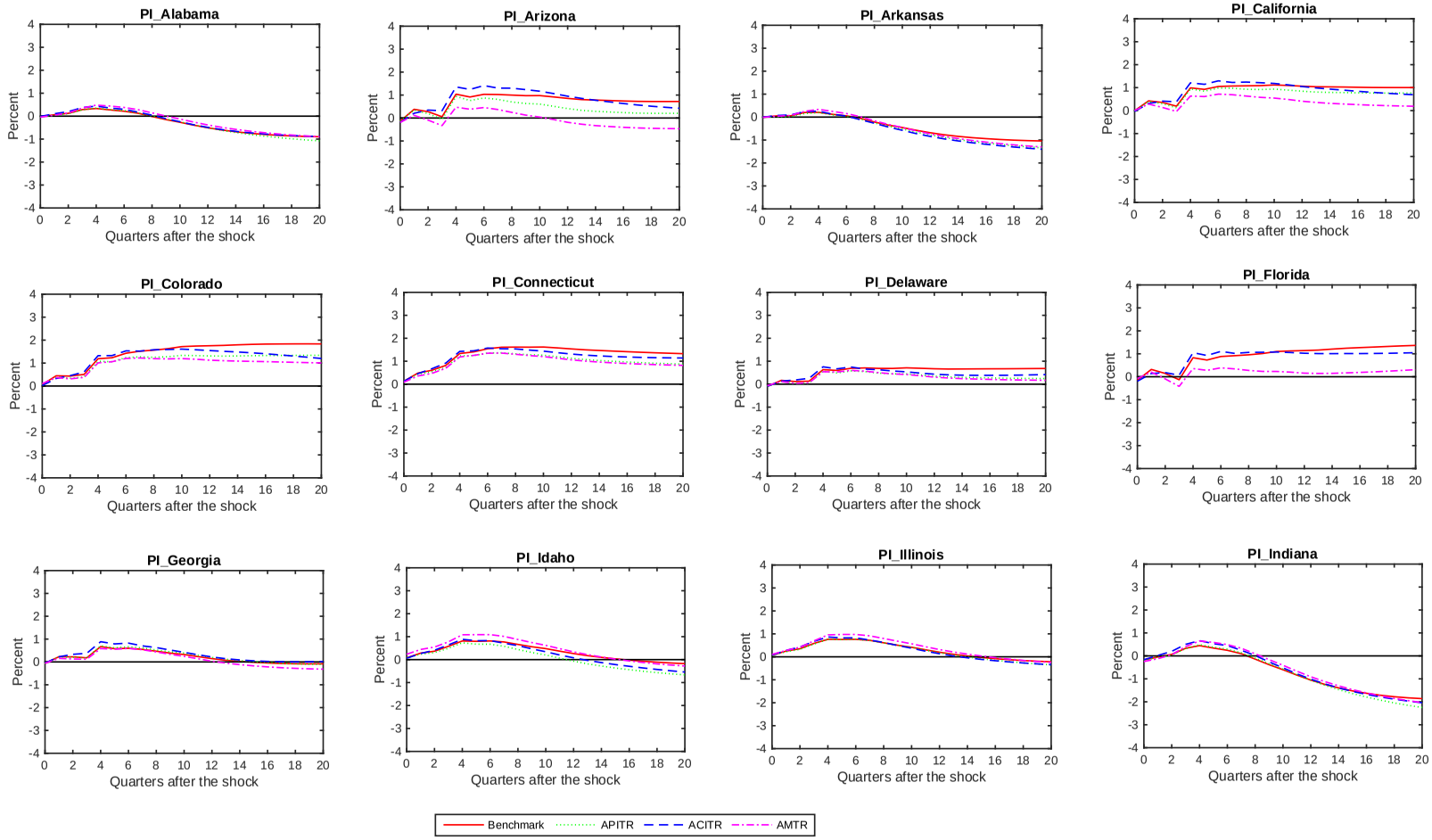
The table reports regressions coefficients and robust standard errors (in parentheses) for the cross-state regressions of the 4-quarter cumulative response of per-capita personal income and employment growth on state-level characteristics. The regressions are estimated by FGLS method. The dependent variable 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.

Figure B.1: Impulse response of real per-capita GDP for alternative FAVAR specification



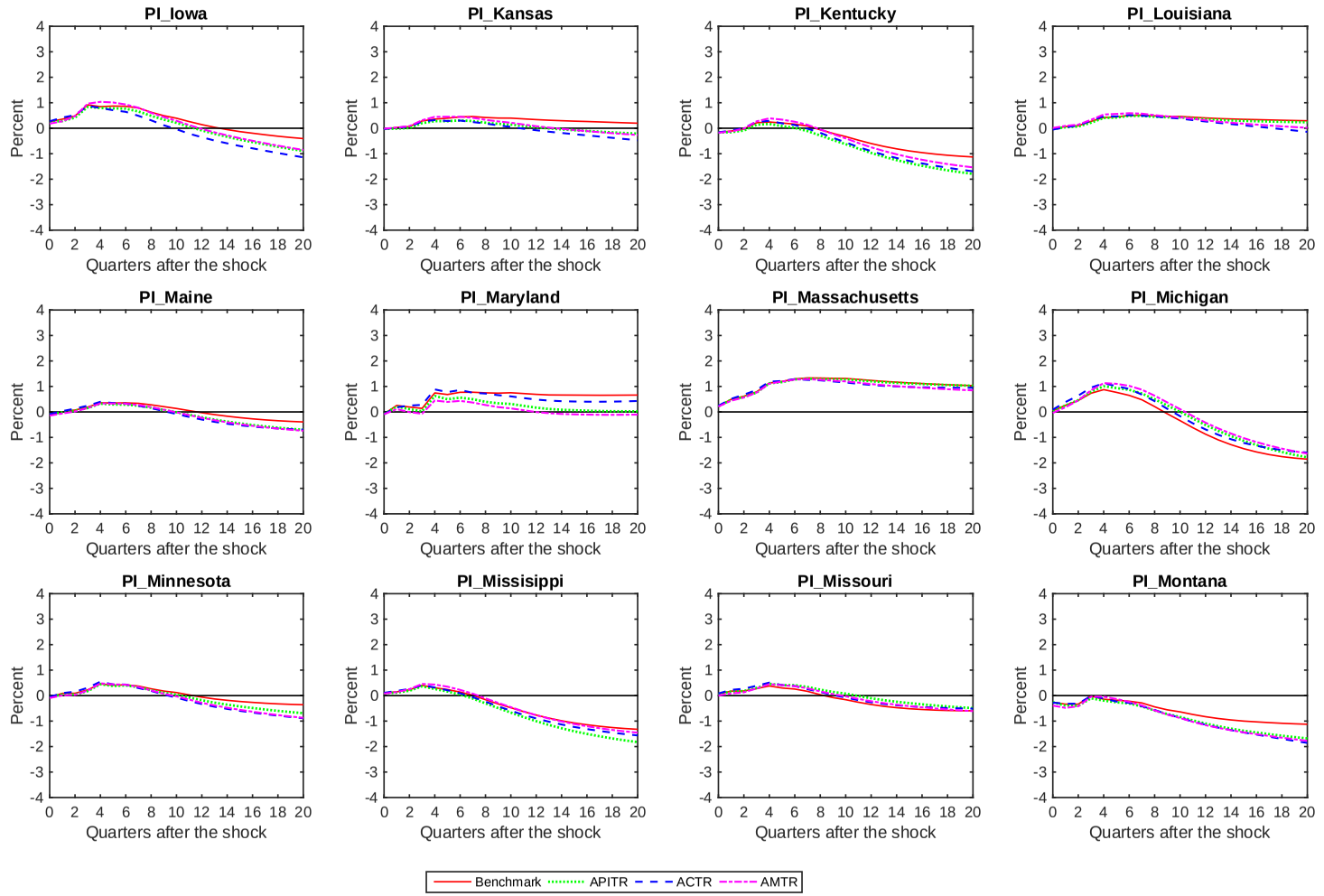
The figure shows the response of real per-capita GDP to one percentage point increase in implicit tax rate. Solid lines are point estimates of real GDP from benchmark model. Dotted lines are point estimates using the average personal income tax rate (APITR) in the benchmark specification. Dashed lines 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



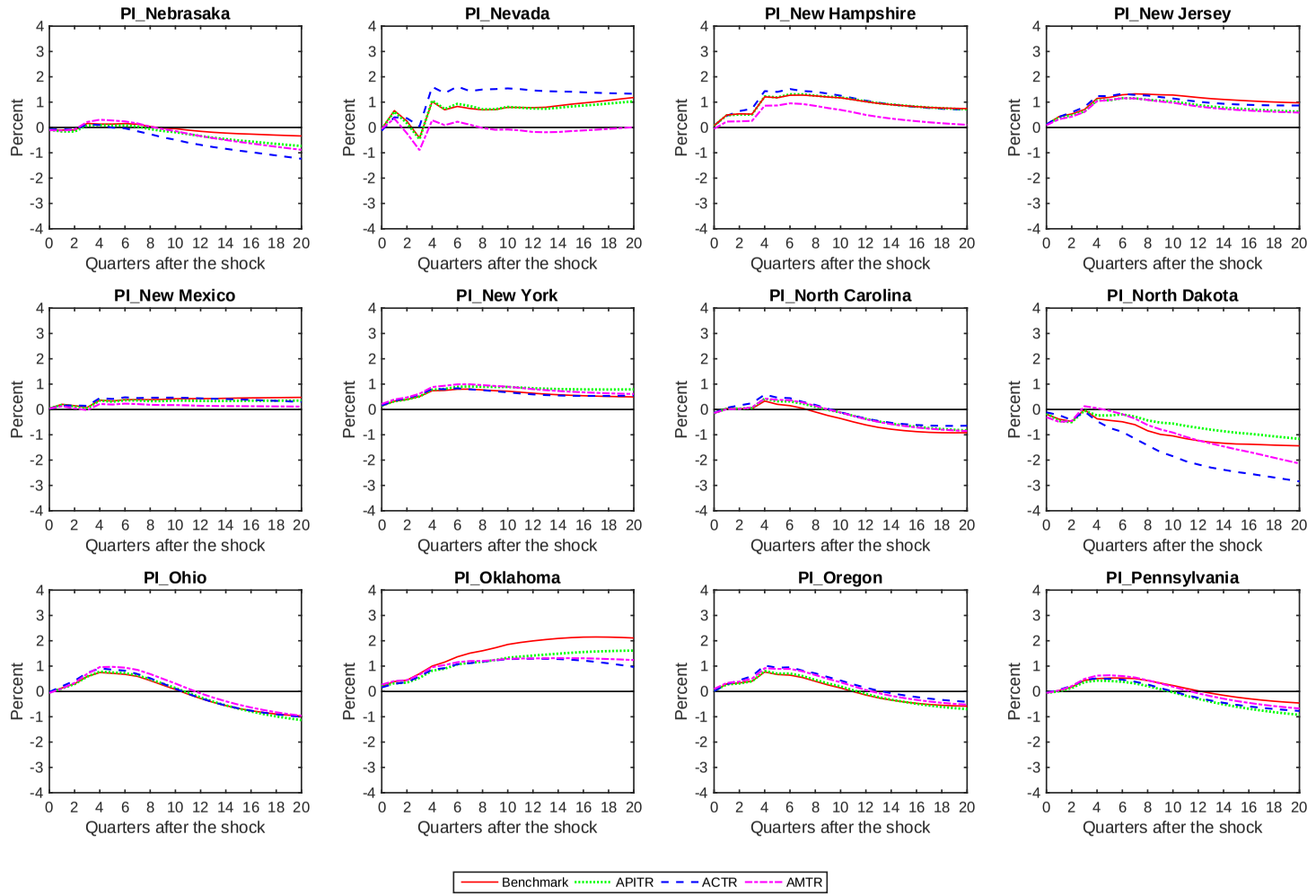
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.3: Impulse responses of state-level personal income for alternative FAVAR specification



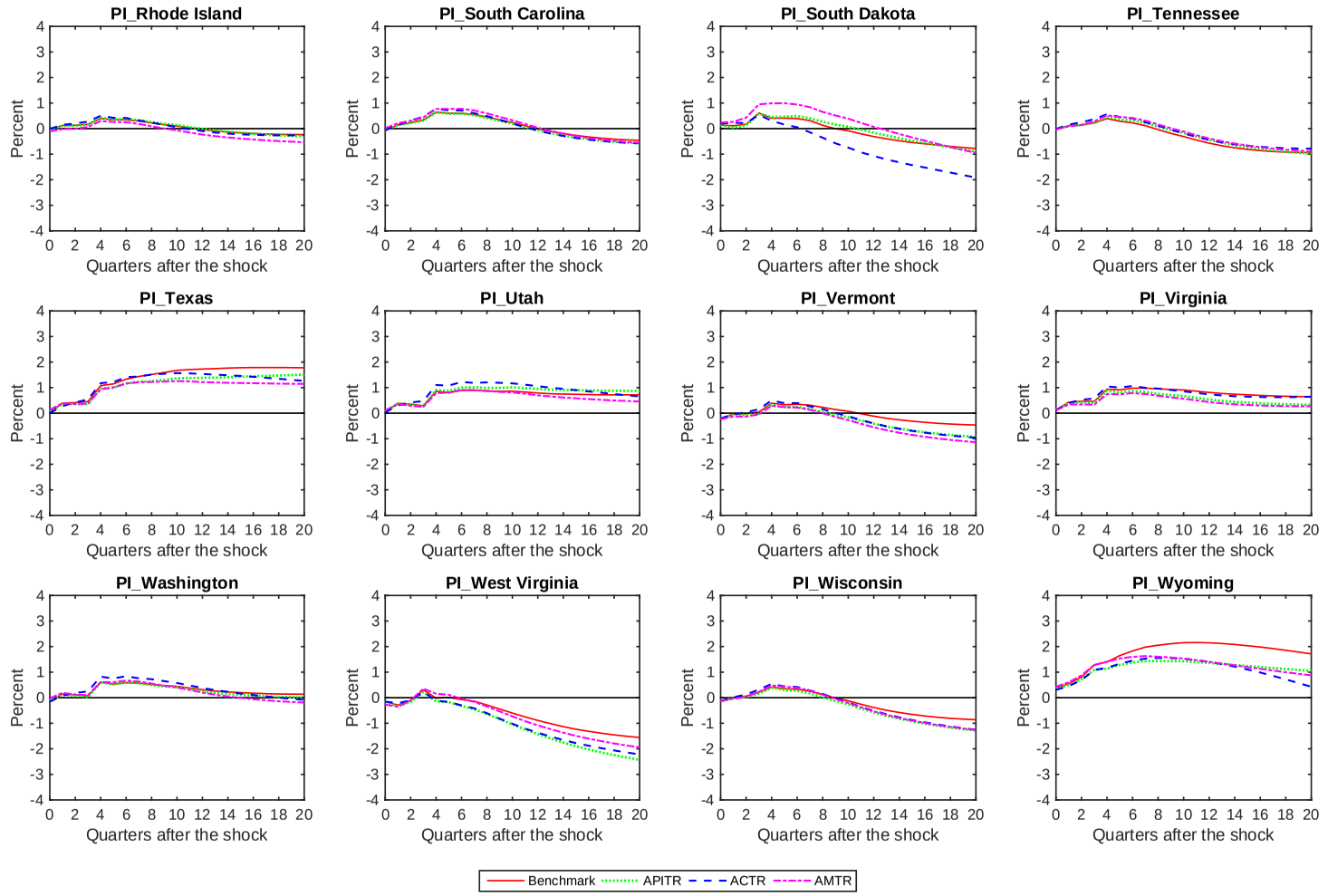
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.4: Impulse responses of state-level personal income for alternative FAVAR specification



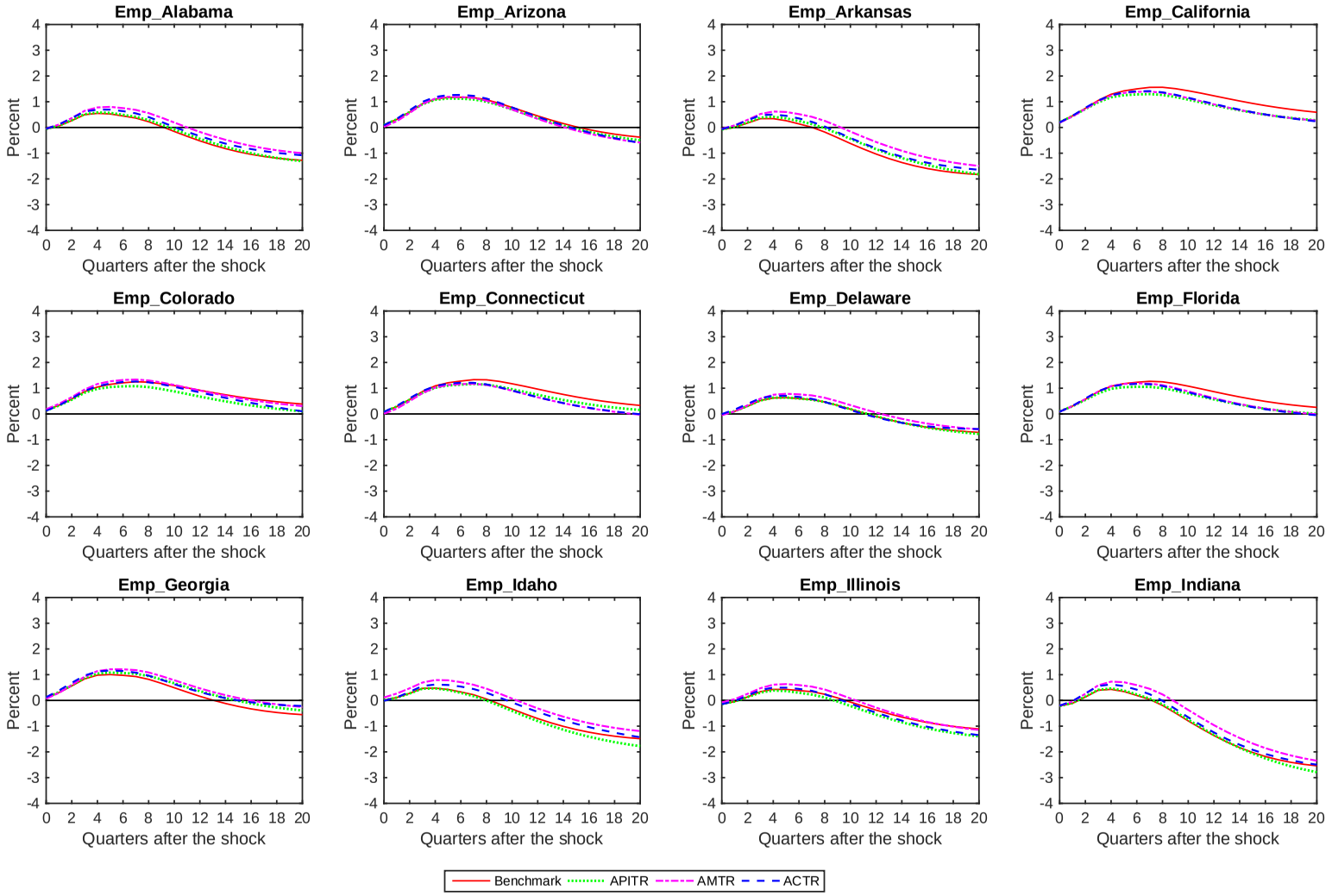
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.5: Impulse responses of state-level personal income for alternative FAVAR specification



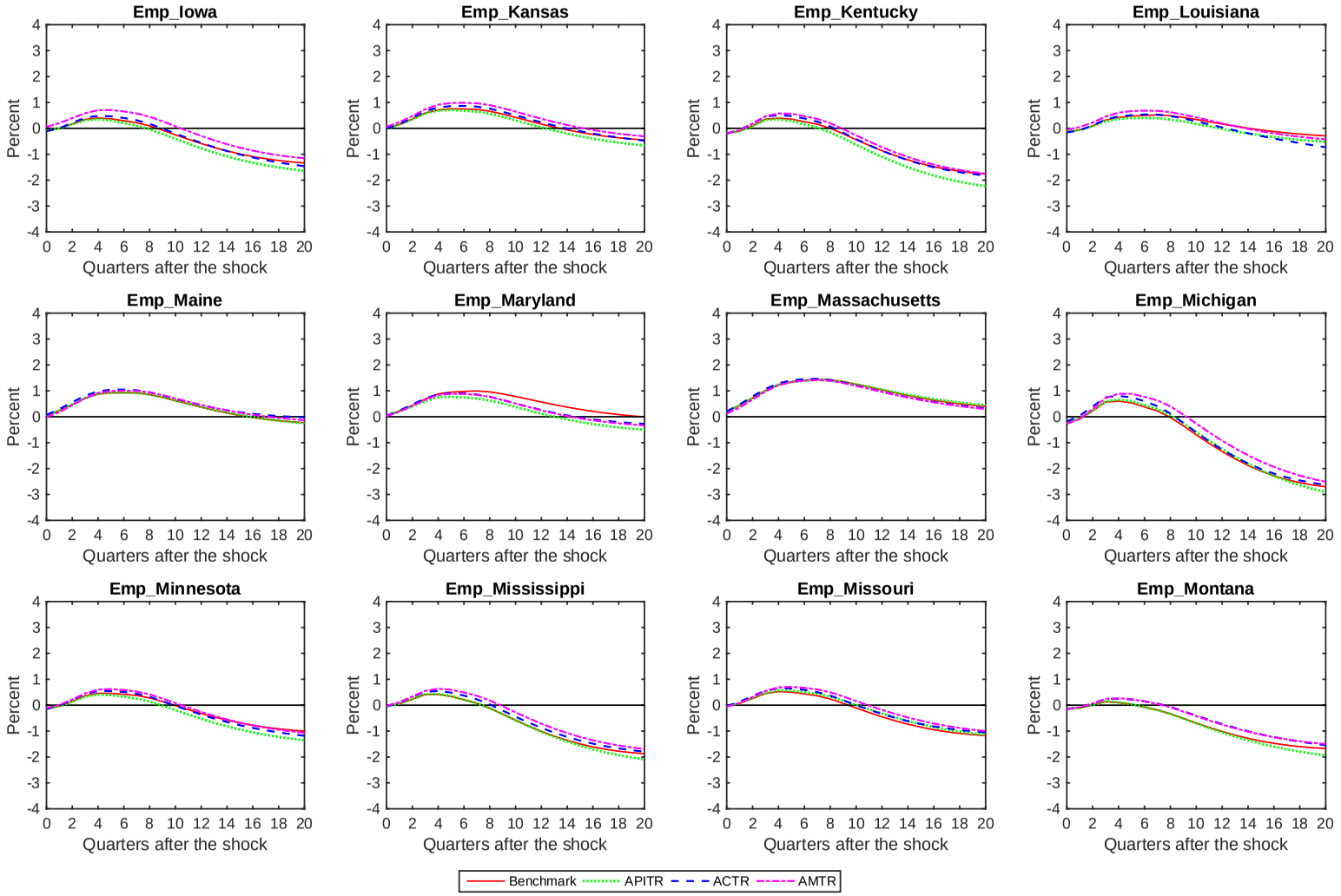
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.6: Impulse responses of state-level employment for alternative FAVAR specification



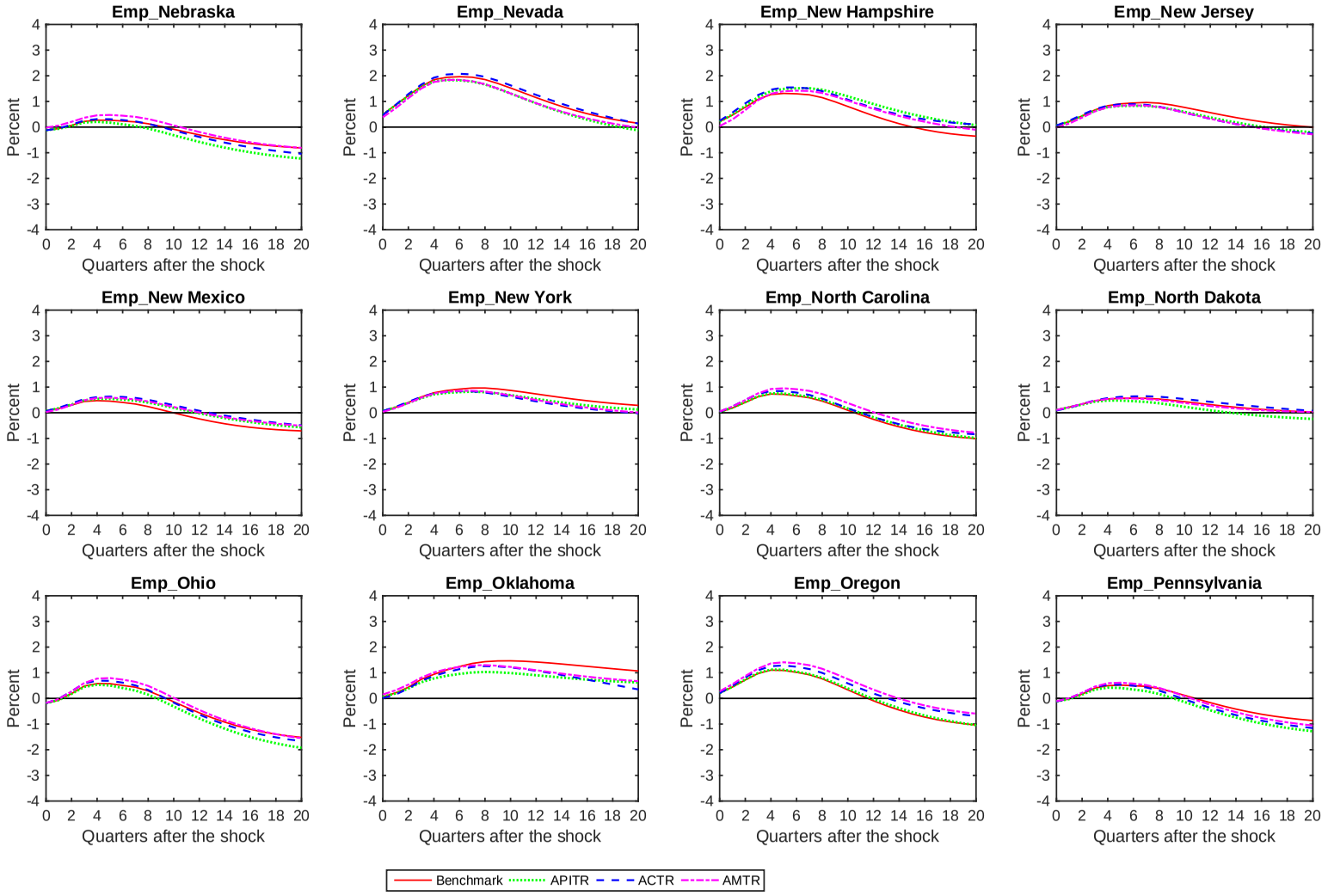
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.7: Impulse responses of state-level employment for alternative FAVAR specification



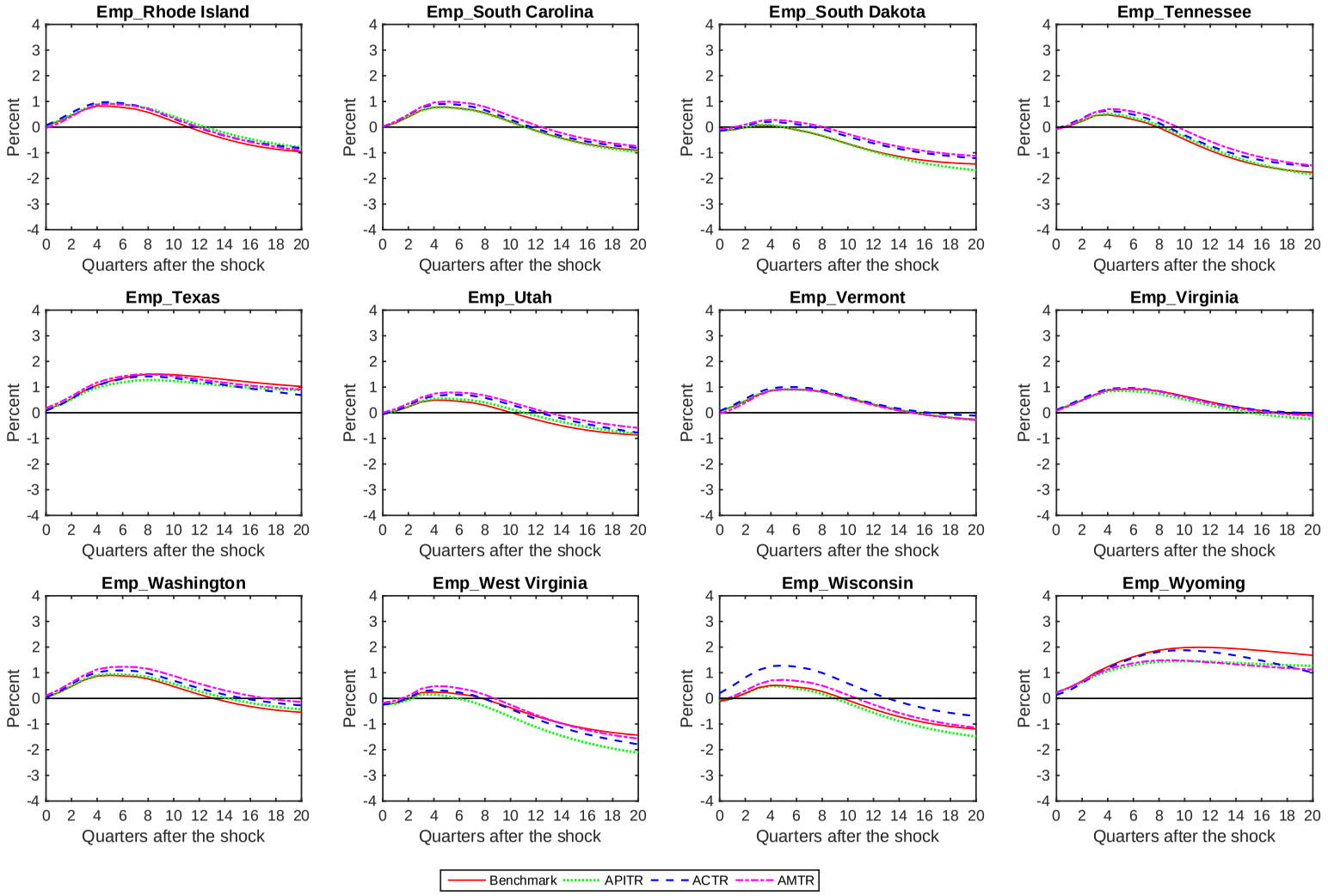
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.8: Impulse responses of state-level employment for alternative FAVAR specification



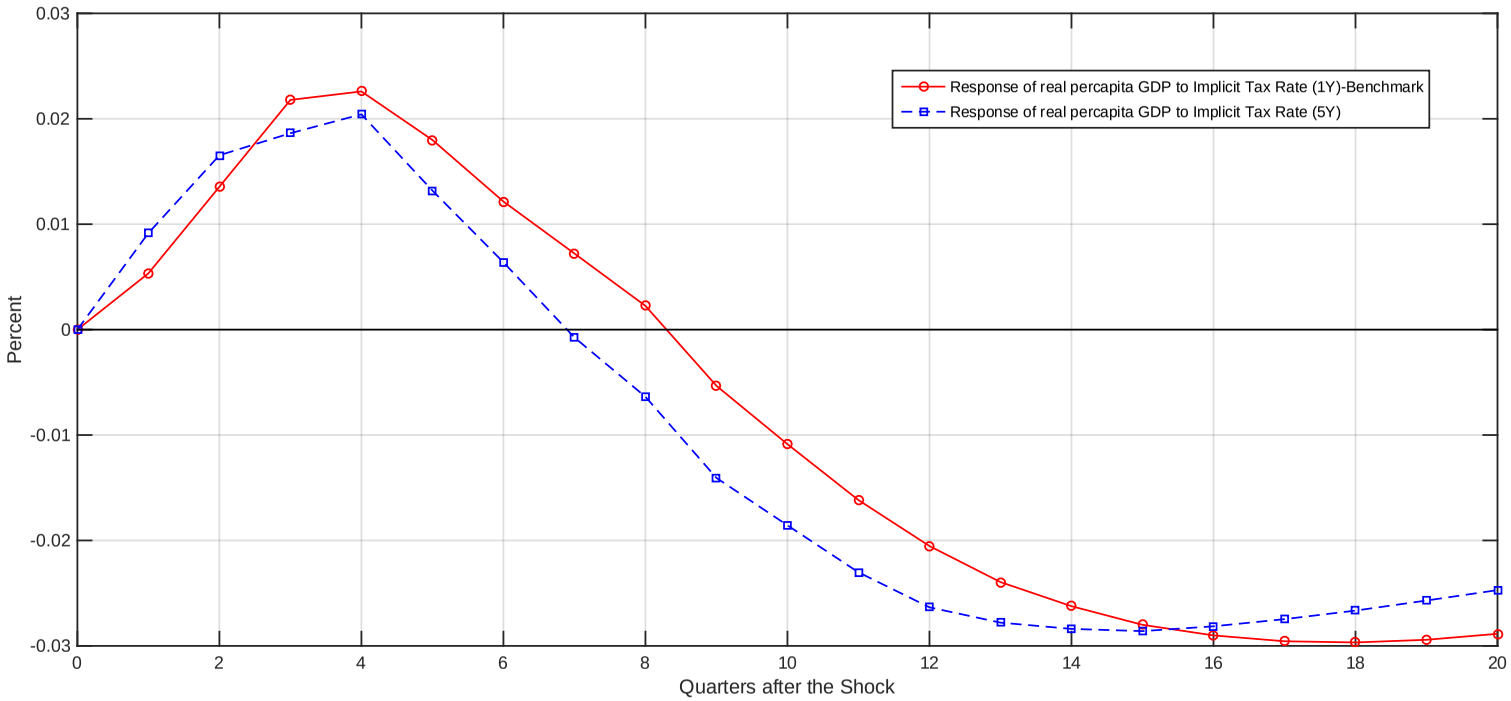
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.9: Impulse responses of state-level employment for alternative FAVAR specification



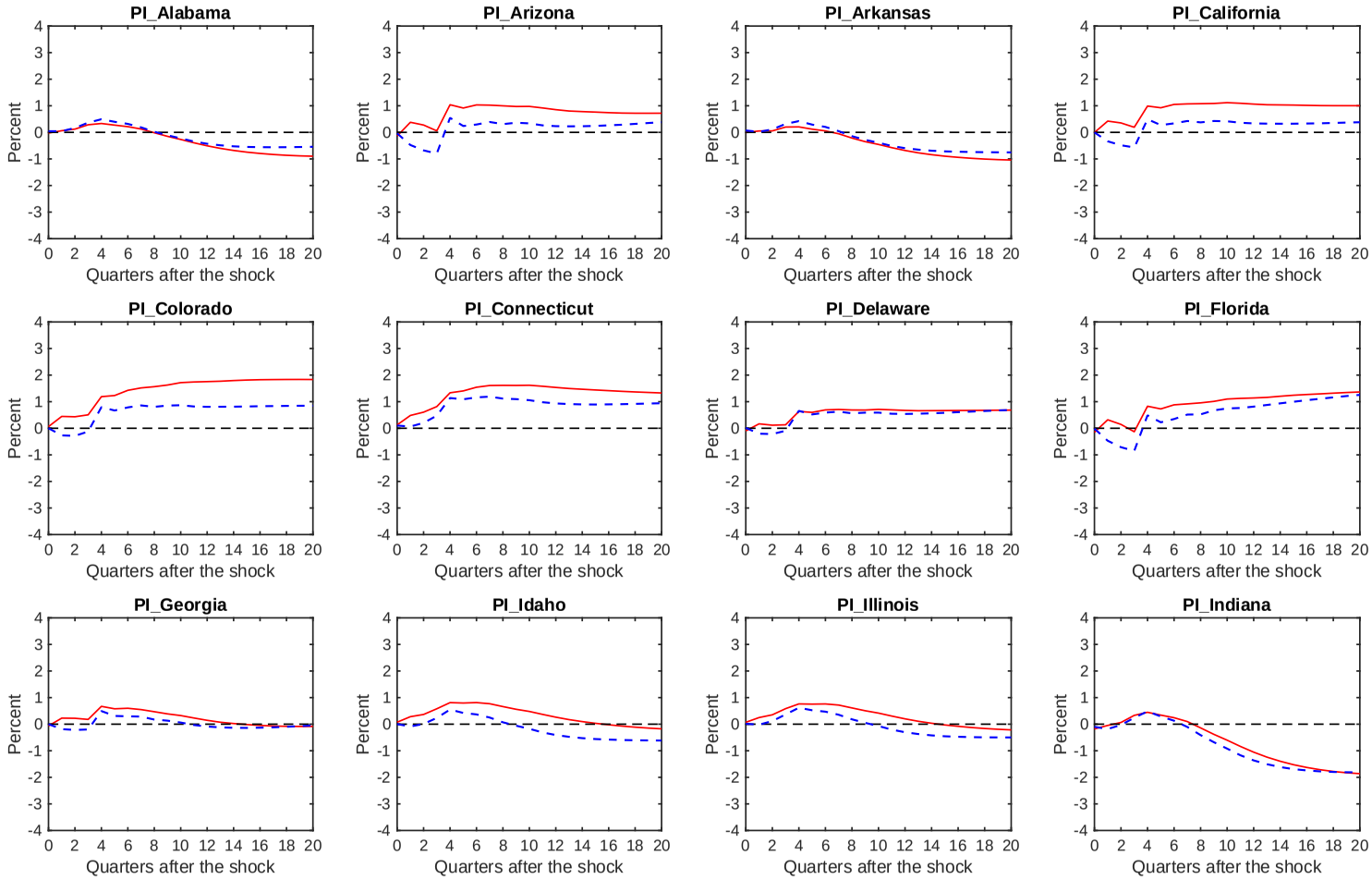
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dotted, dashed, and dashed-dot lines indicate point estimates using different tax variables.

Figure B.10: Impulse response of real per-capita GDP (using 5-year bonds)



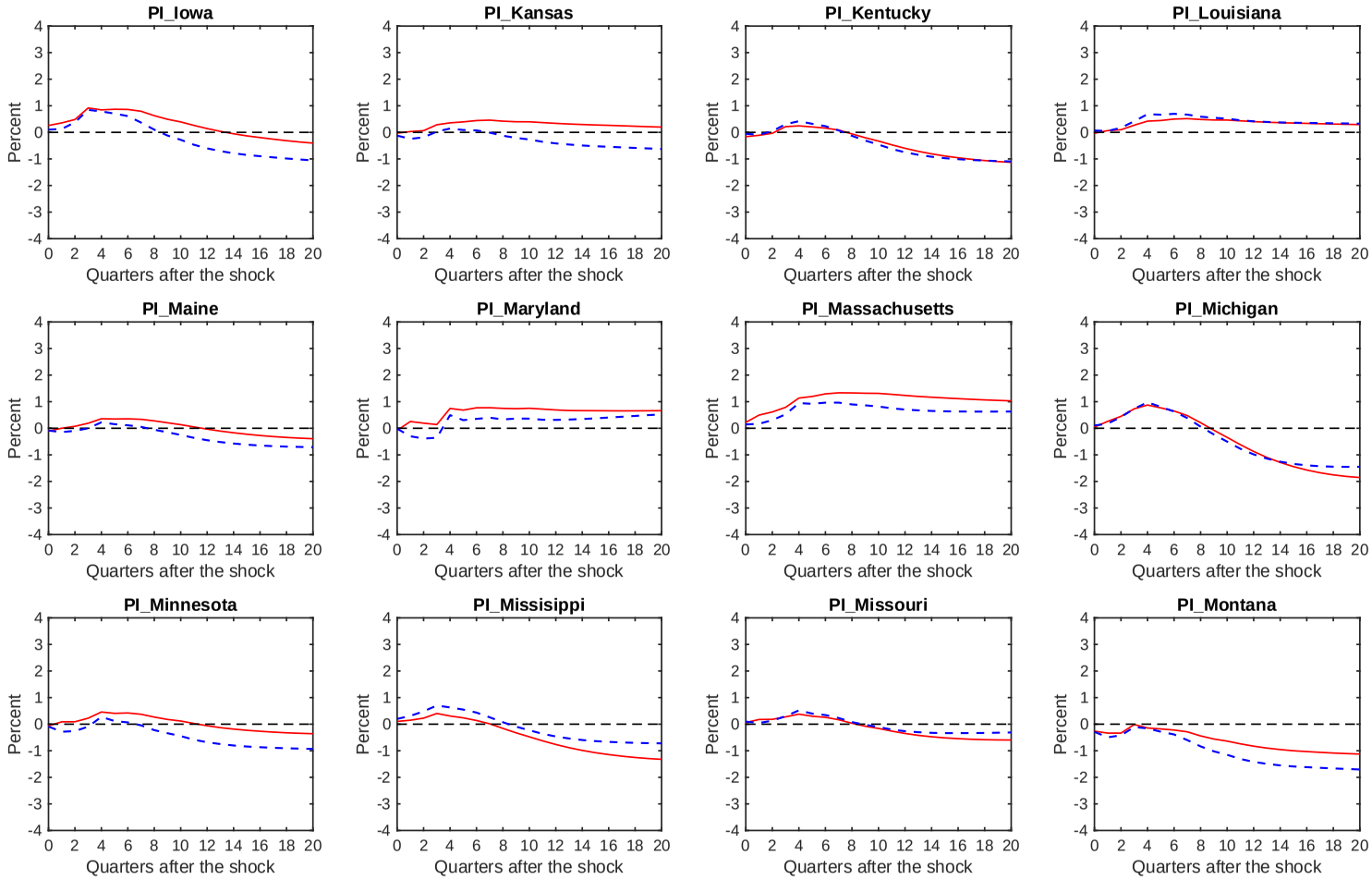
The figure shows the response of real per-capita GDP to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates; dashed indicate the 95 percent confidence intervals constructed following Kilian and Gonclaves (2004) recursive wild-bootstrap method using 10,000 replications.

Figure B.11: Impulse responses of state-level personal income (using 5-year bonds)



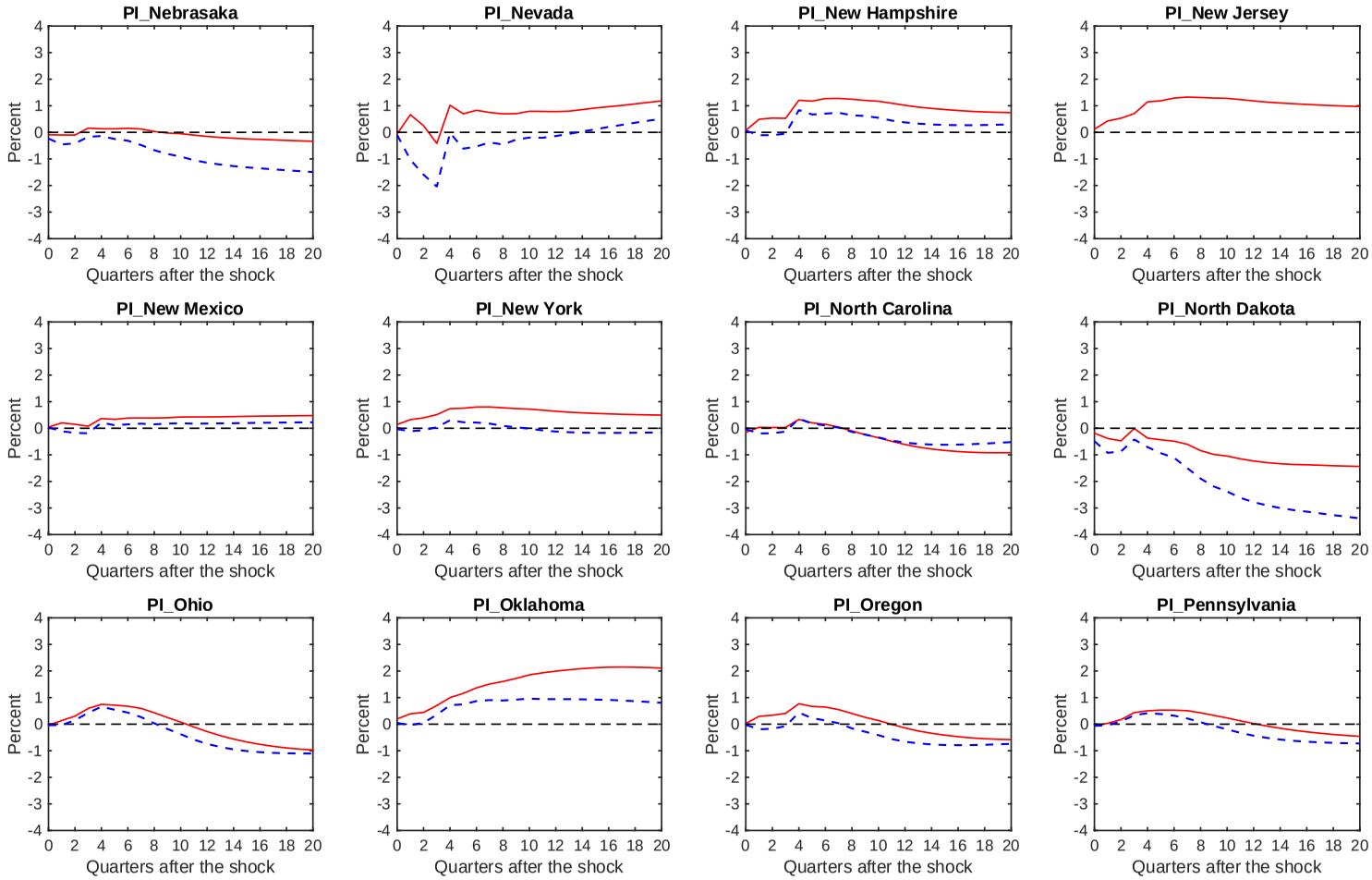
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.12: Impulse responses of state-level personal income (using 5-year bonds)



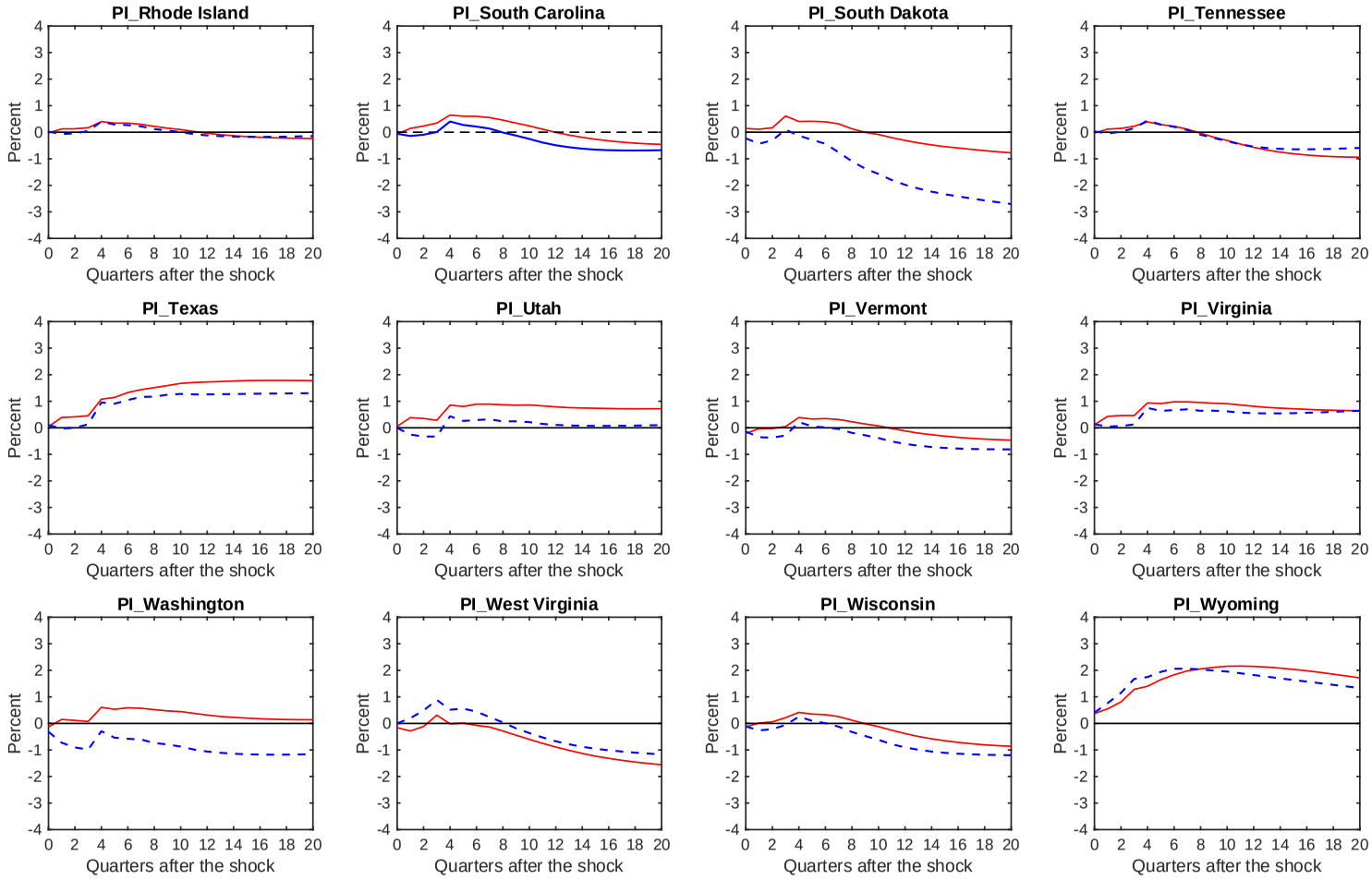
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.13: Impulse responses of state-level personal income (using 5-year bonds)



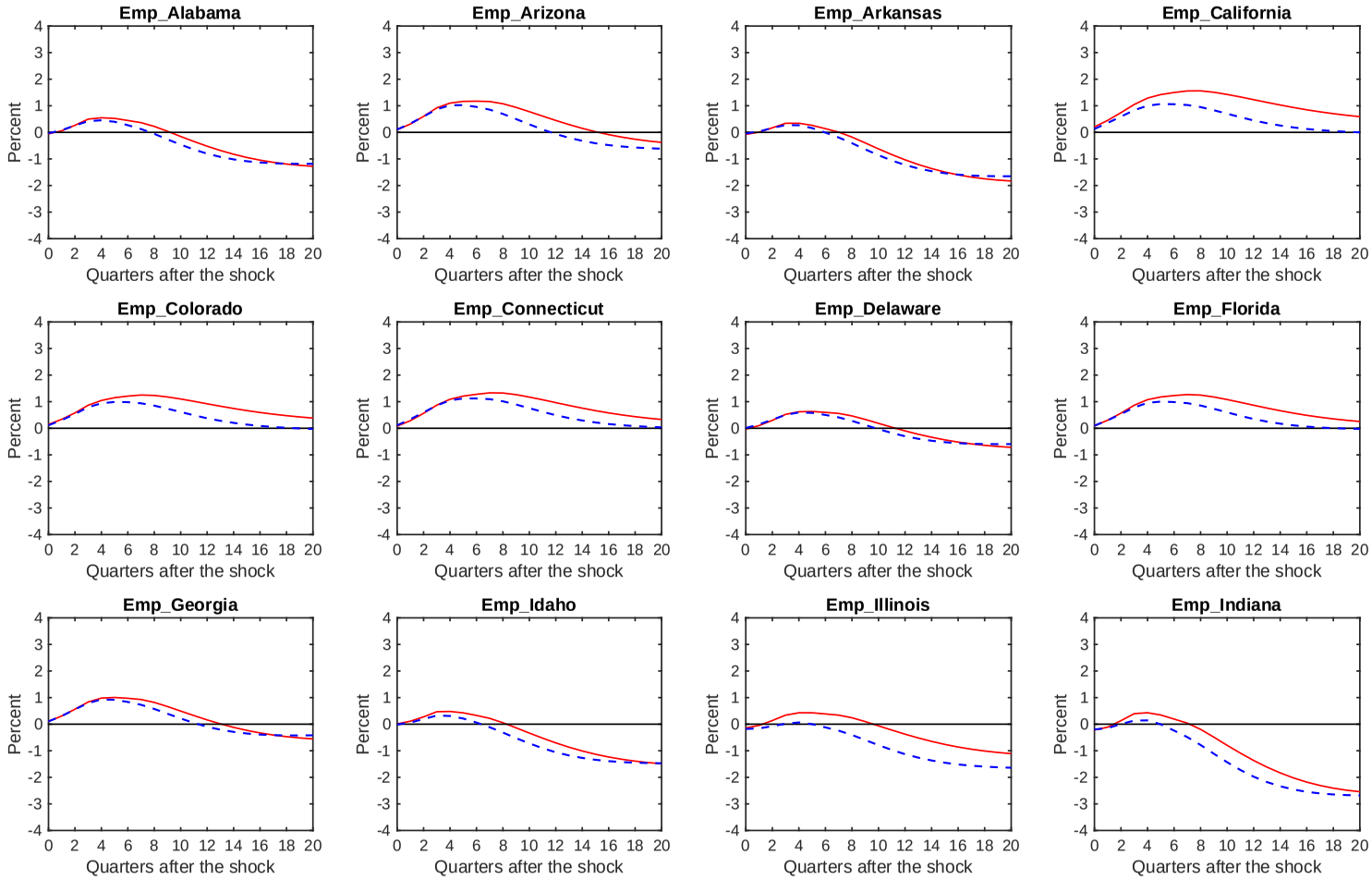
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.14: Impulse responses of state-level personal income (using 5-year bonds)



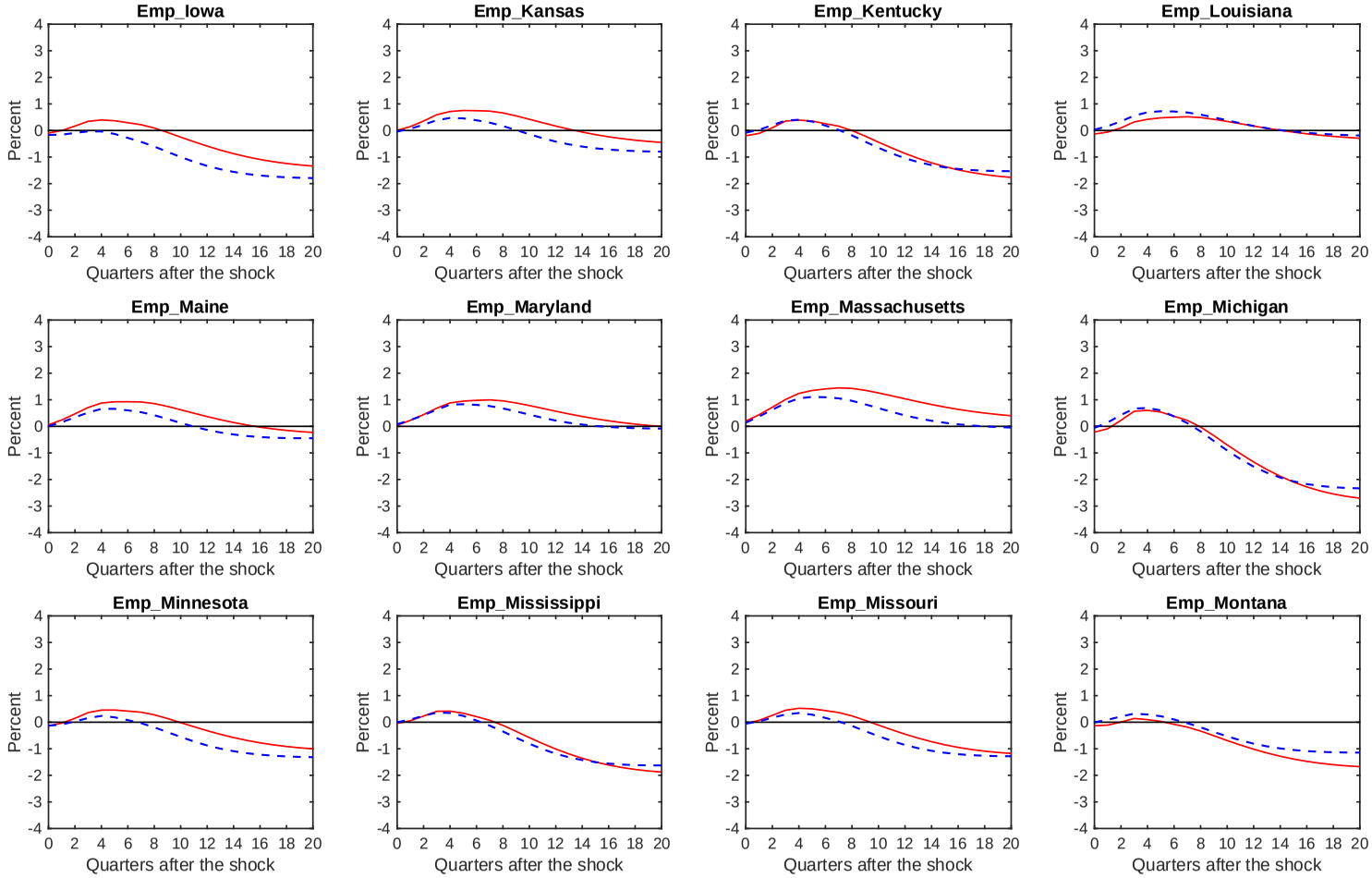
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.15: Impulse responses of state-level employment (using 5-year bonds)



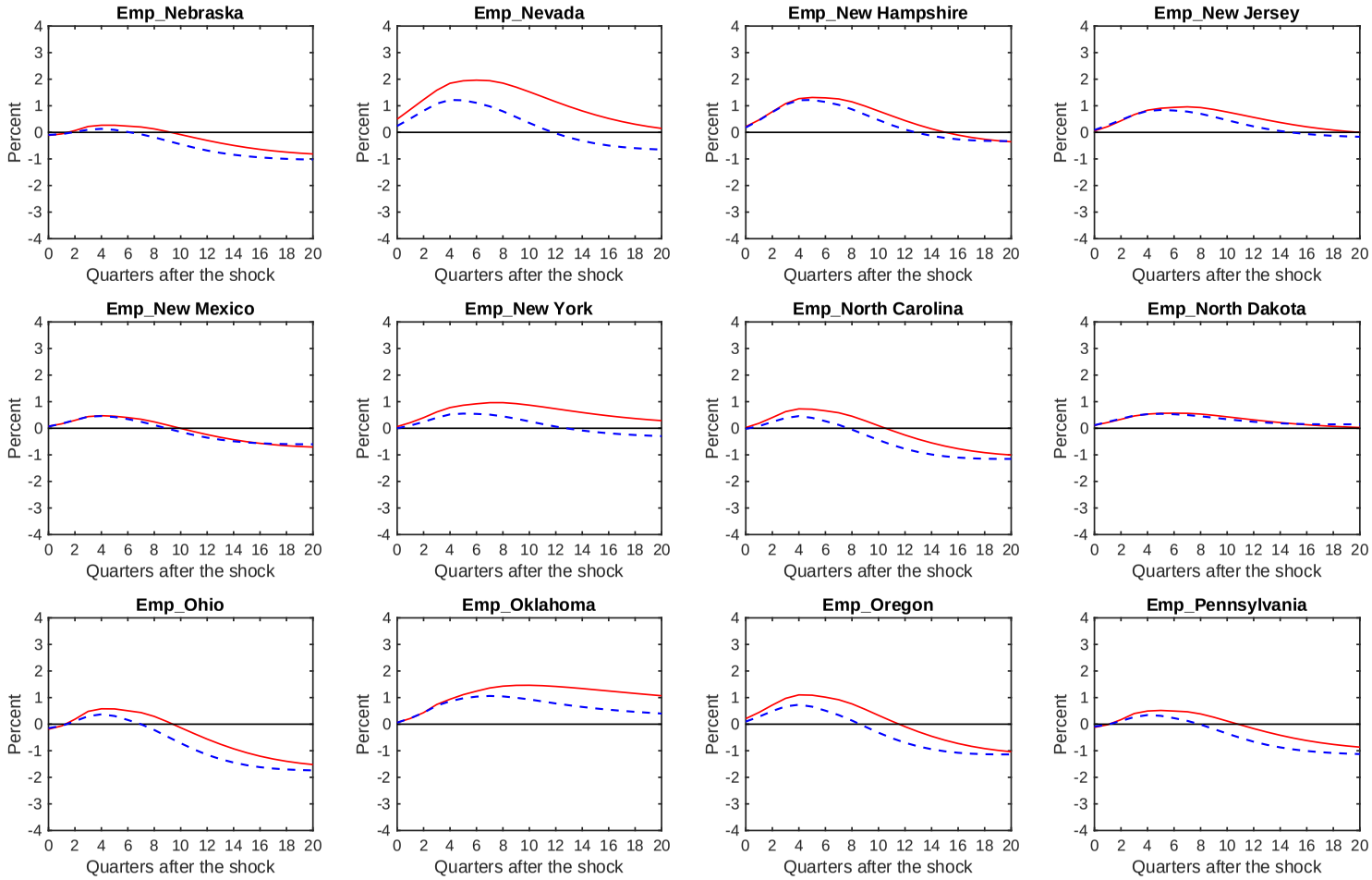
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.16: Impulse responses of state-level employment (using 5-year bonds)



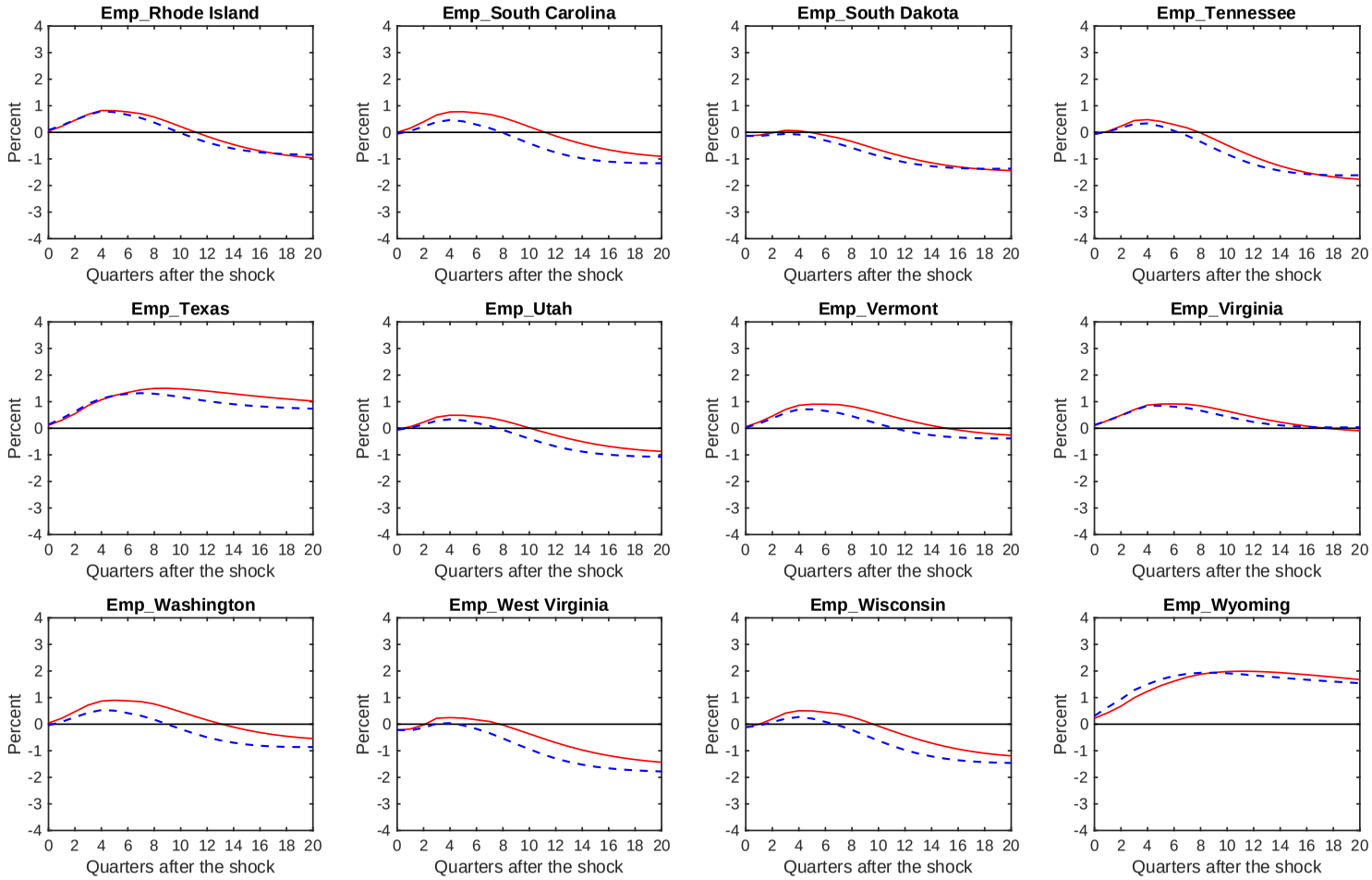
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.17: Impulse responses of state-level employment (using 5-year bonds)



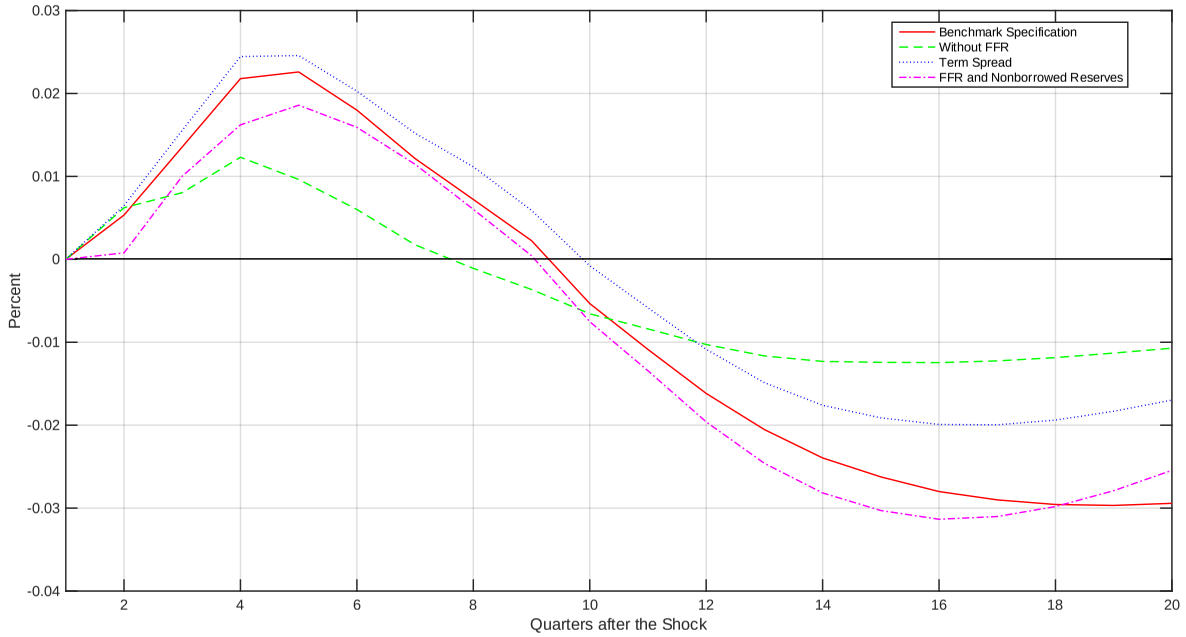
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.18: Impulse responses of state-level employment (using 5-year bonds)



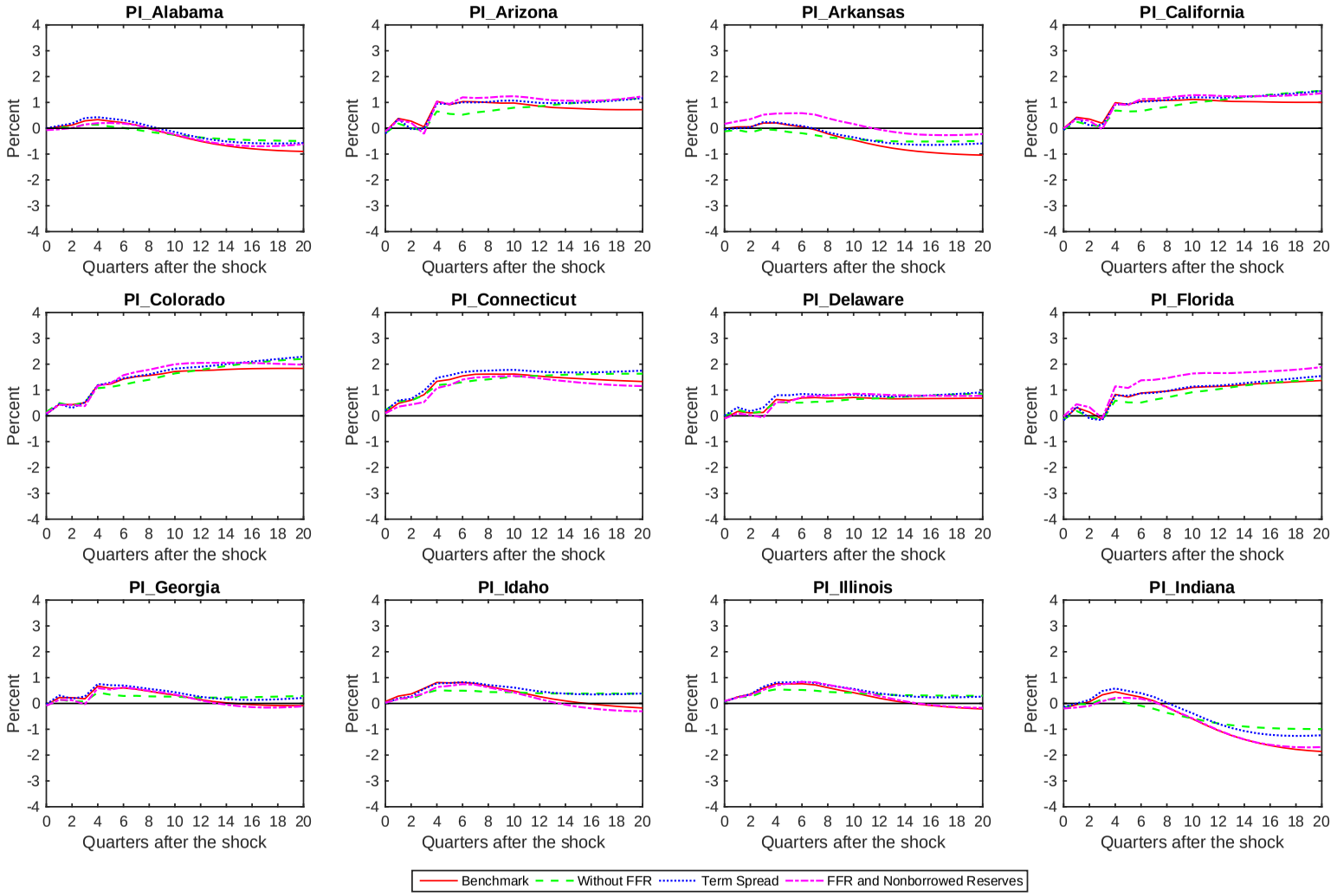
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.19: Impulse response of real per-capita GDP with respect to monetary policy variables in the FAVAR



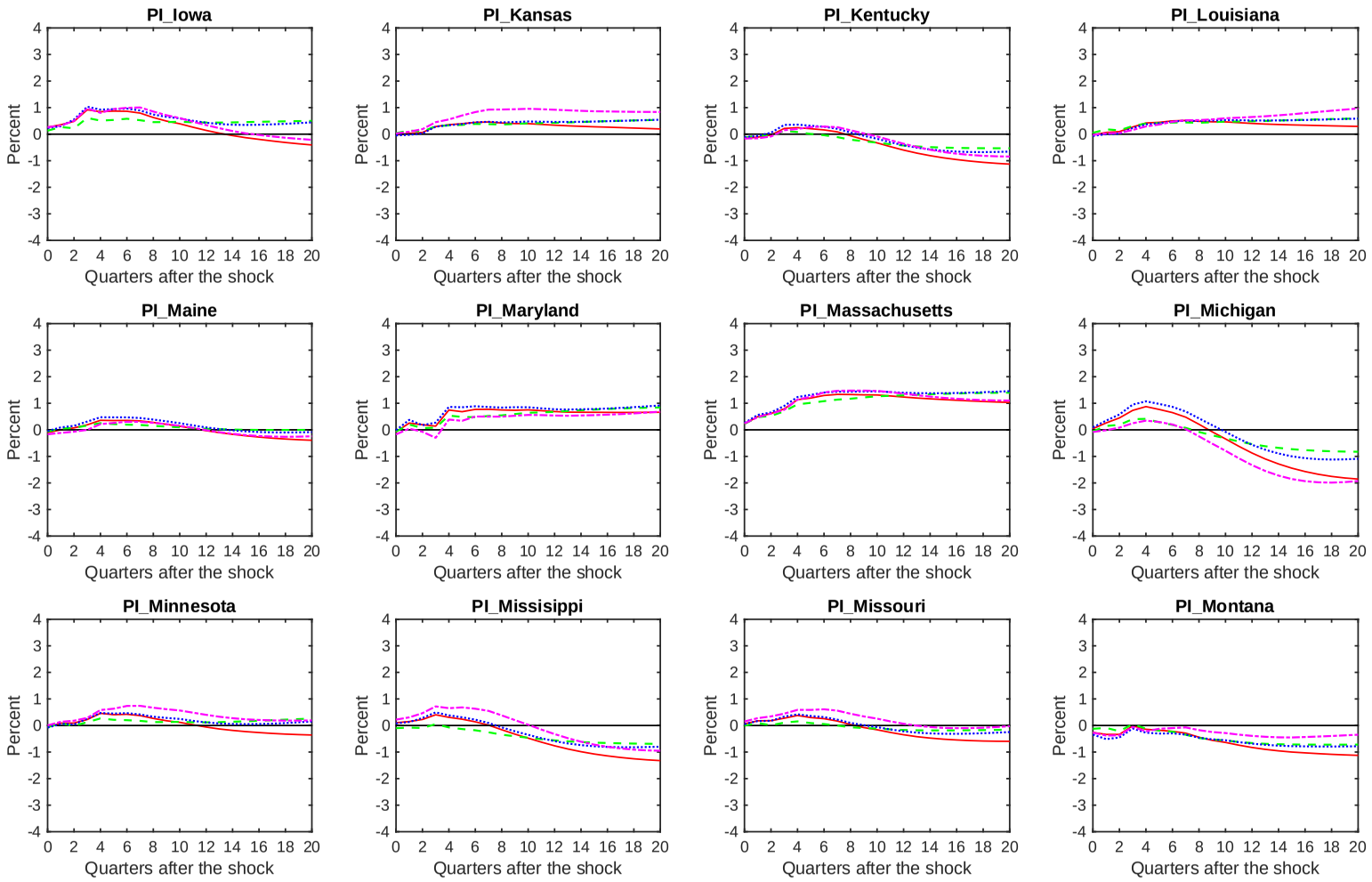
The figure shows the response of real per-capita GDP to a one percentage point increase in the implicit tax rate with respect to different monetary policy variables. The benchmark specification includes the federal funds rate as the monetary policy variable in the FAVAR model. The alternative specification 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.

Figure B.20: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR



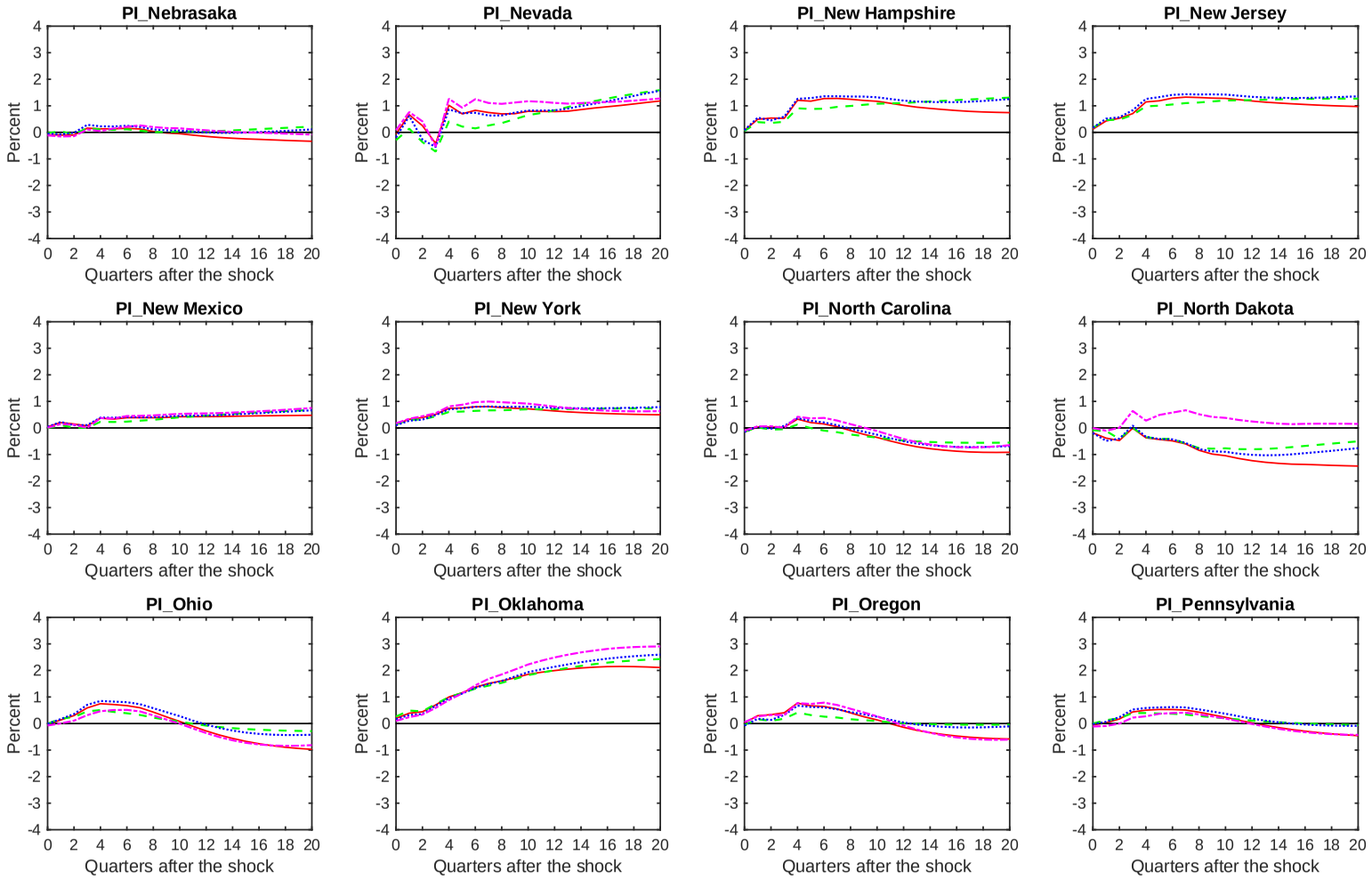
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.21: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR



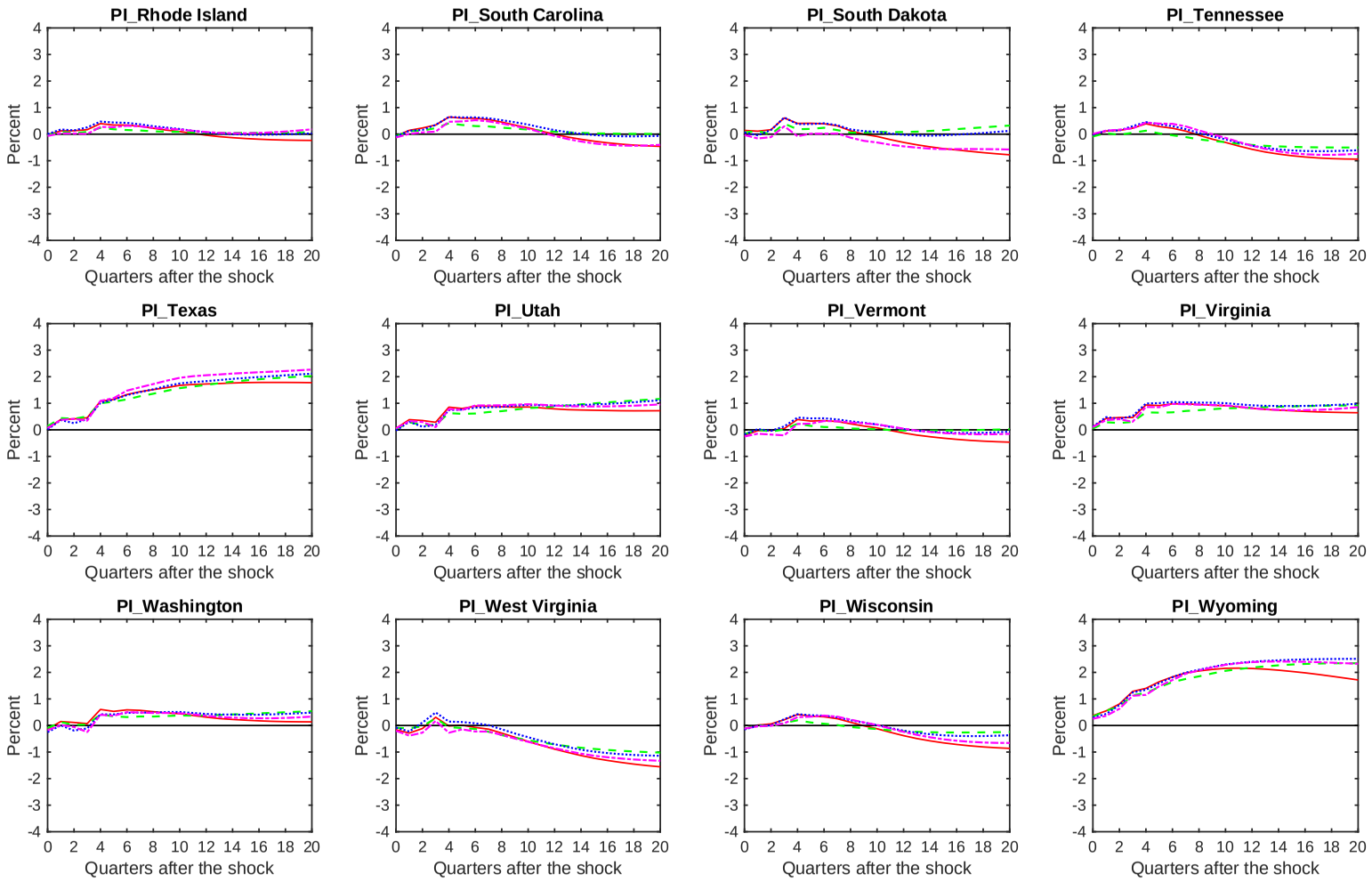
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.22: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR



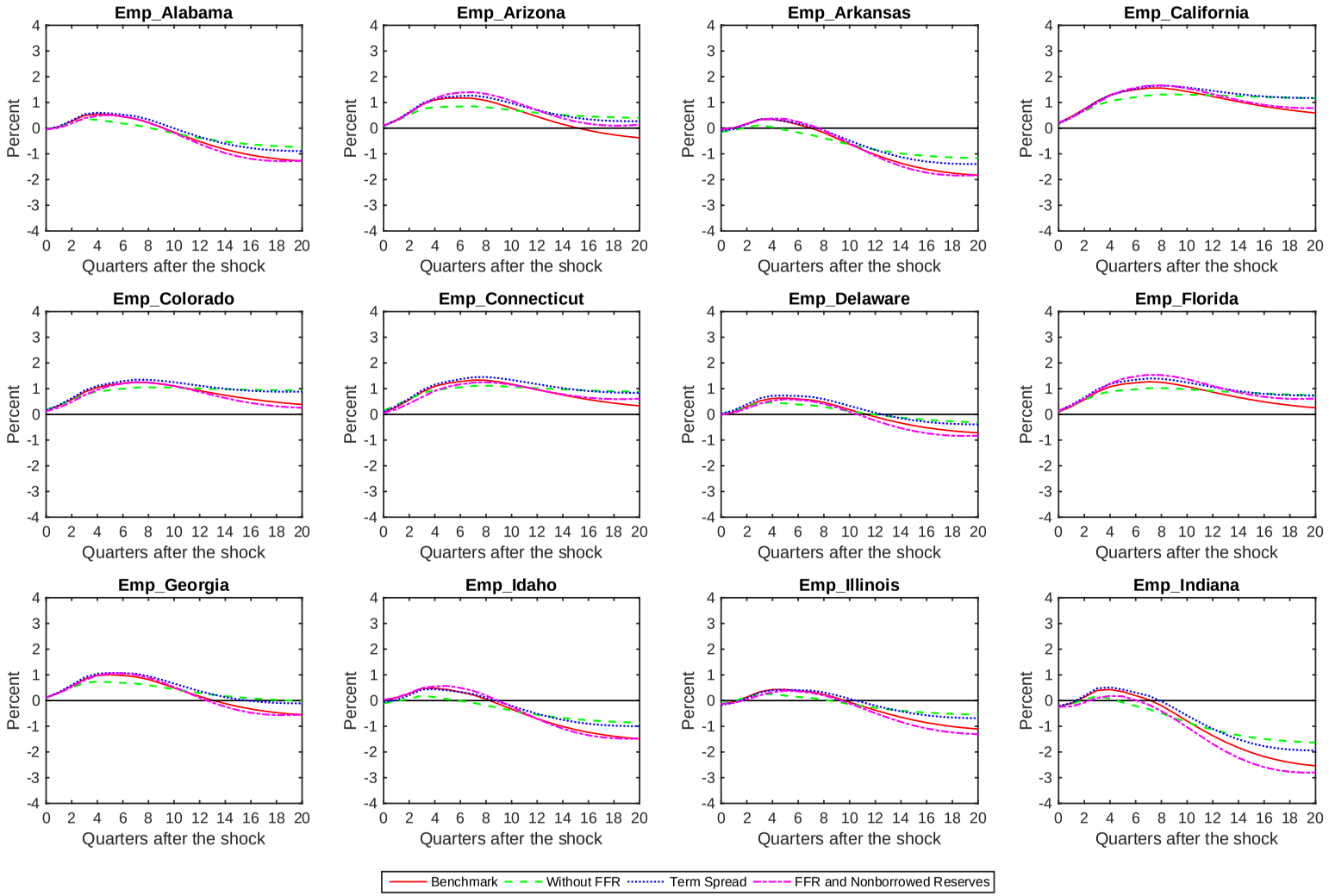
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.23: Impulse responses of state-level personal income with respect to monetary policy variables in the FAVAR



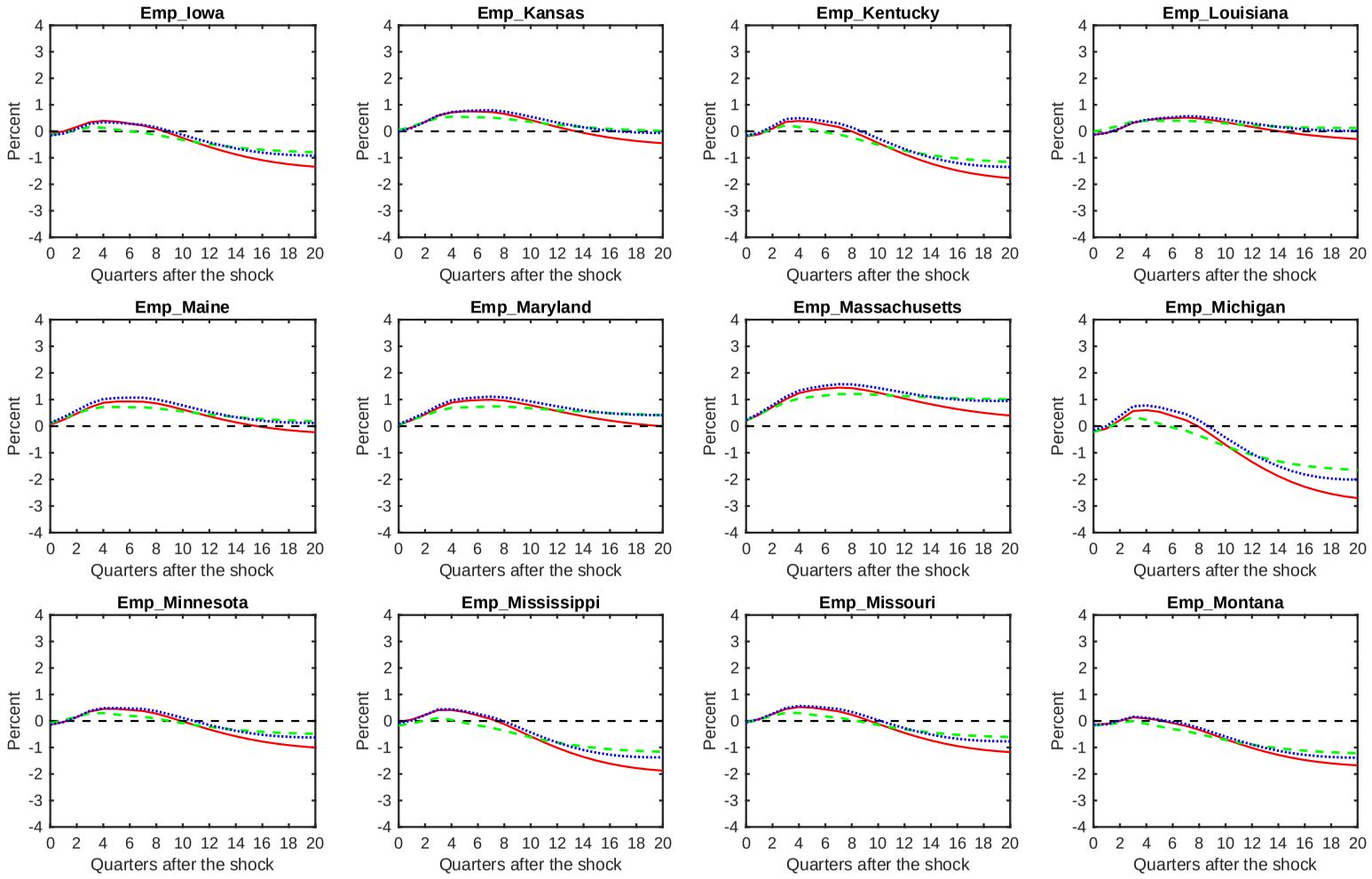
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.24: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR



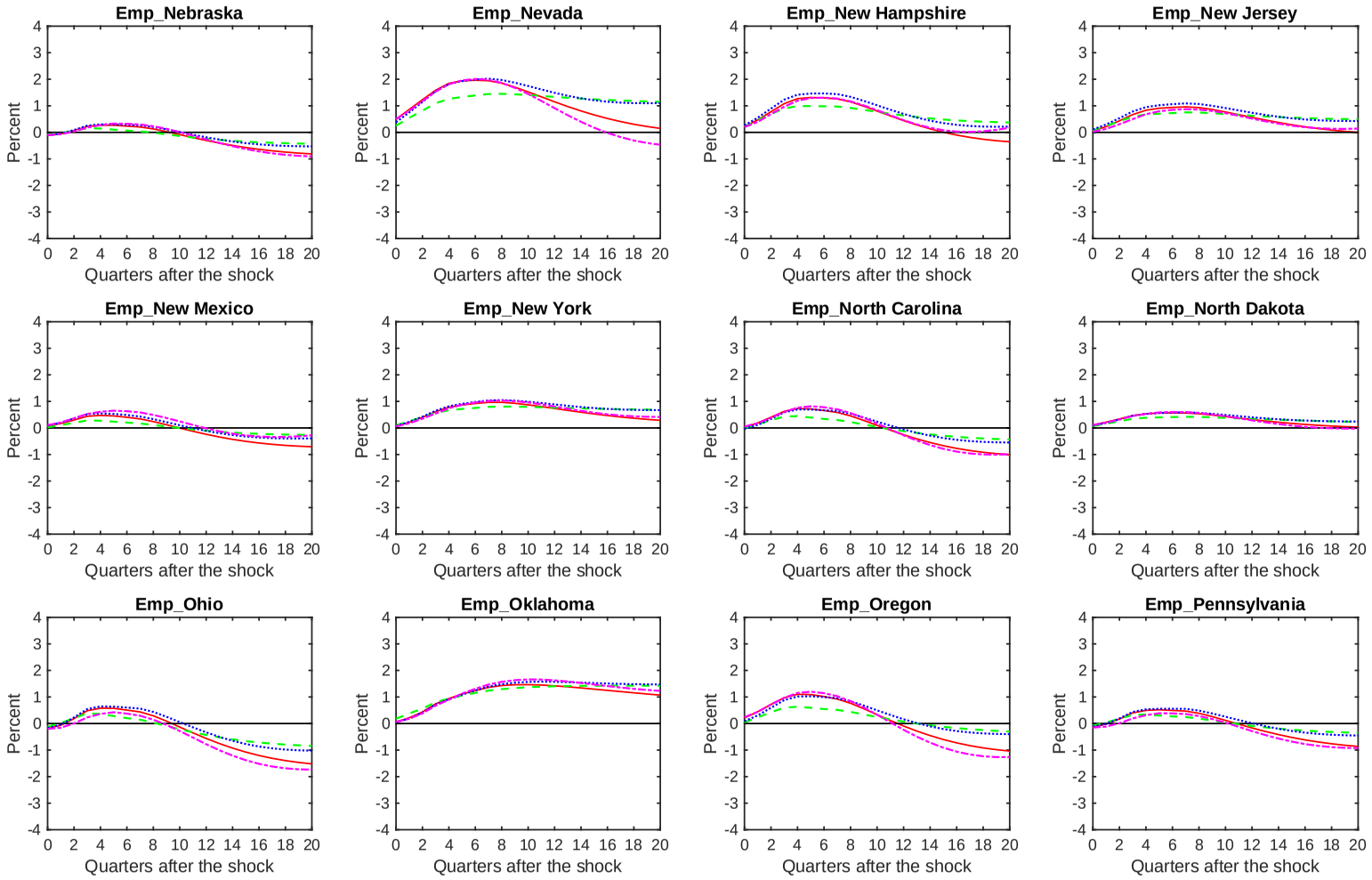
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.25: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR



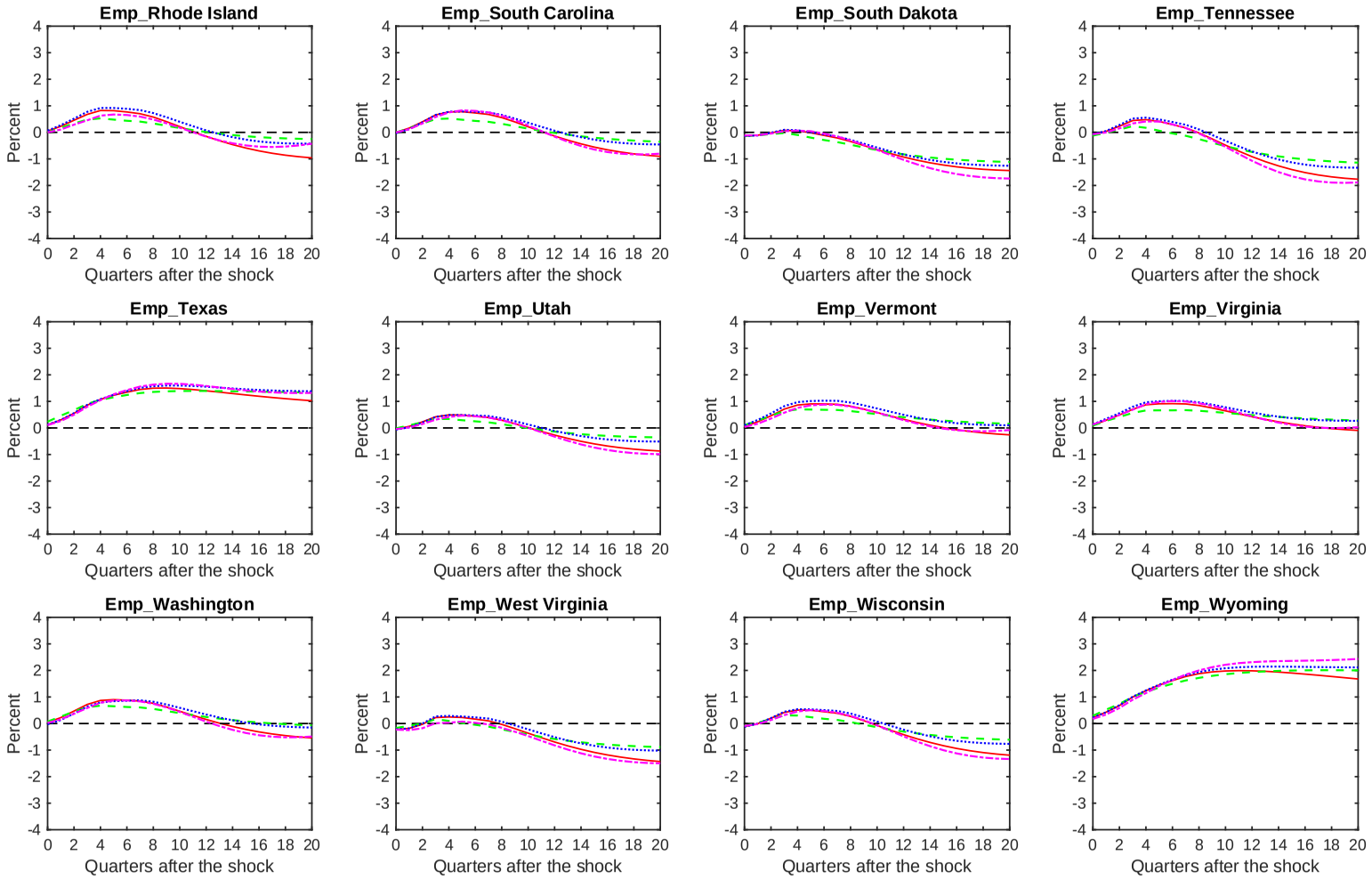
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.26: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR



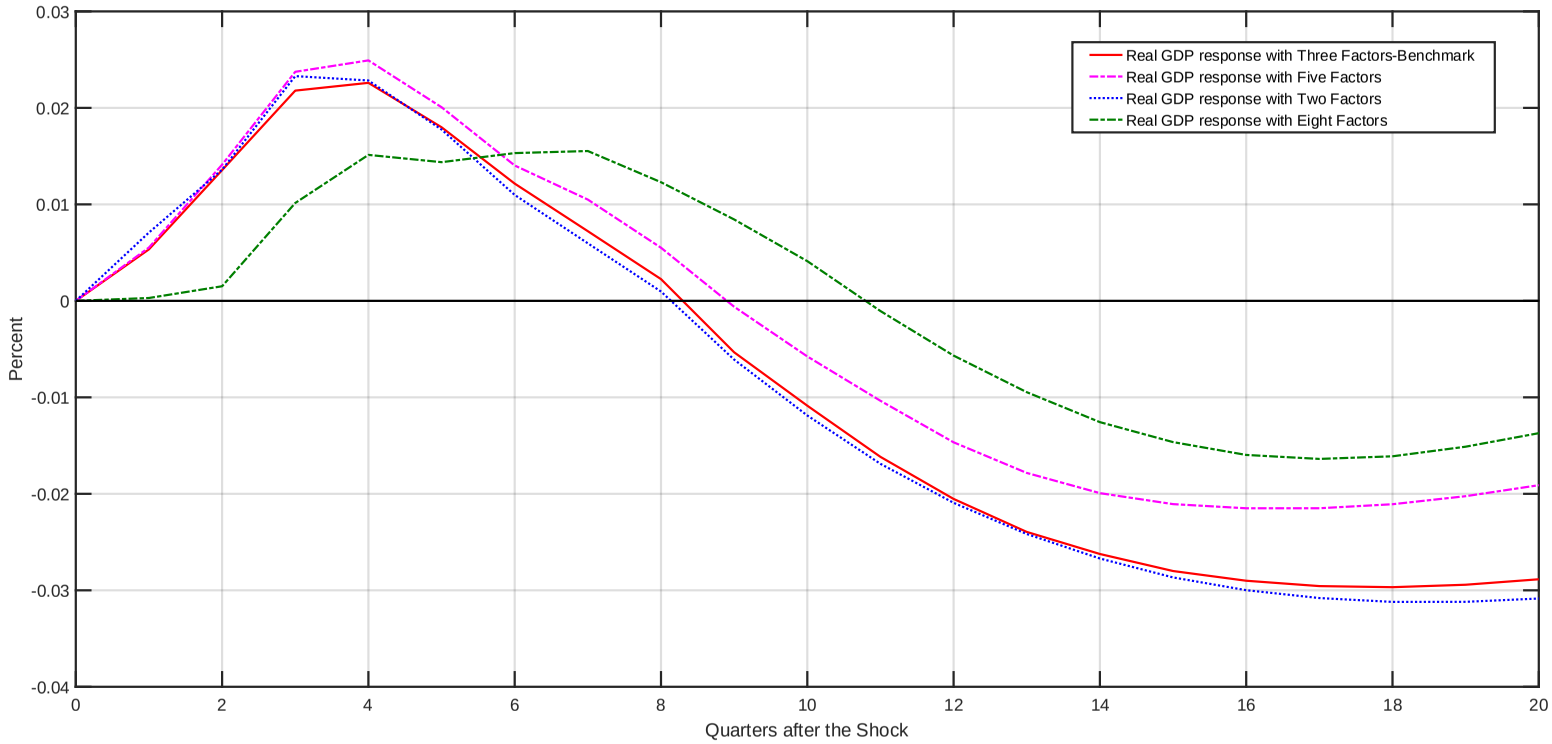
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.27: Impulse responses of state-level employment with respect to monetary policy variables in the FAVAR



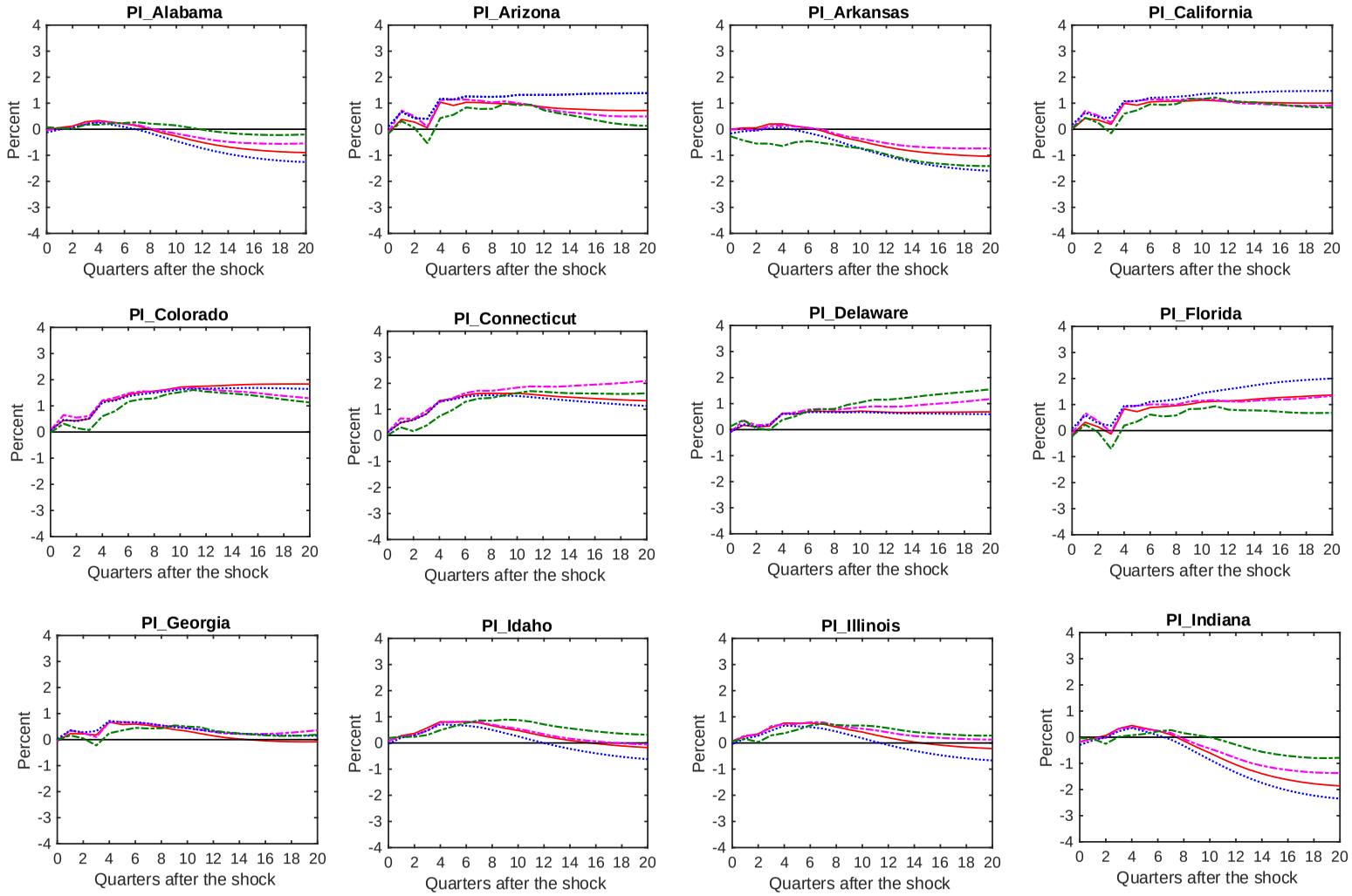
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.28: Impulse response of real per-capita GDP with Two and Five Factors



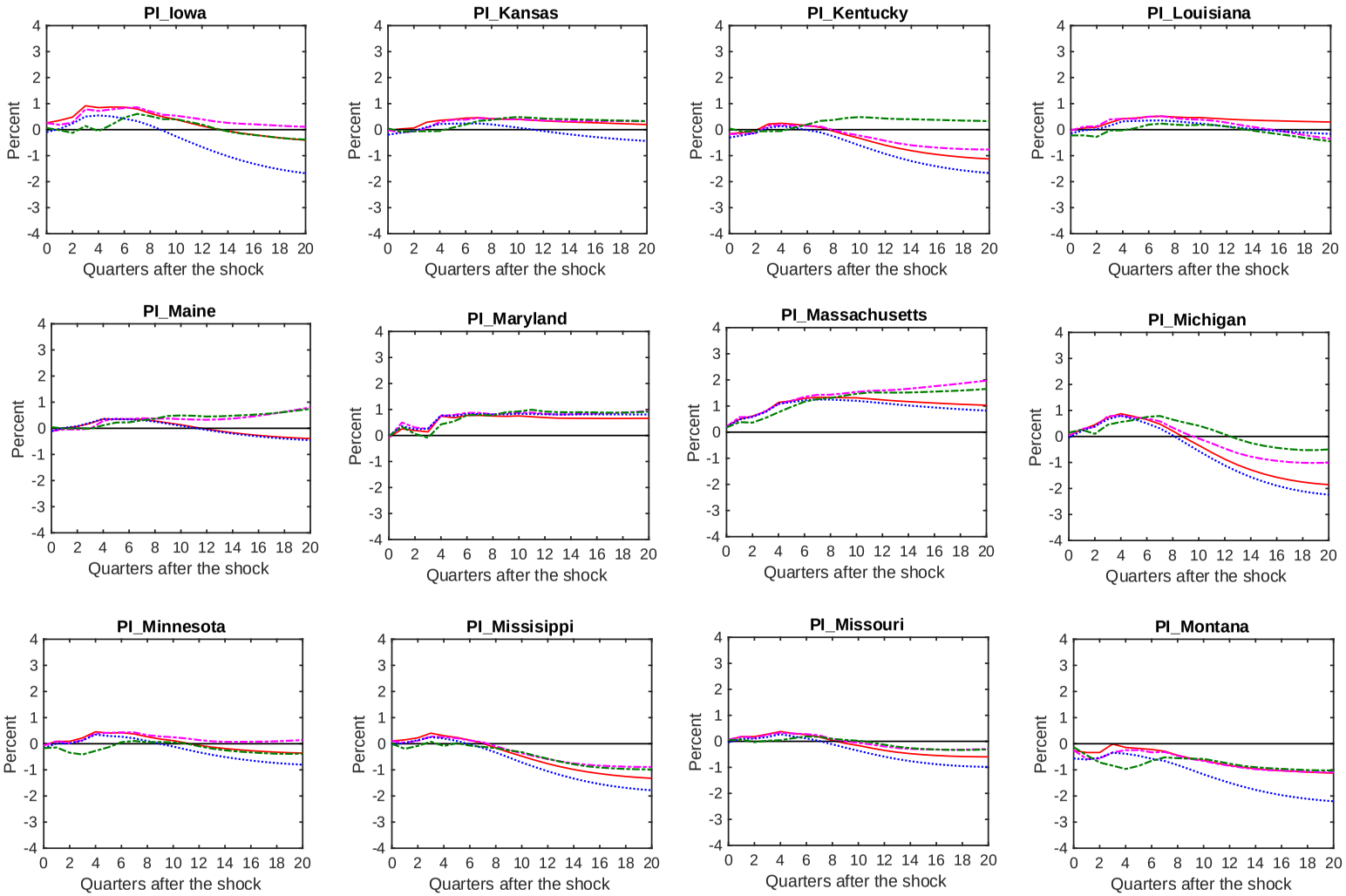
The figure shows the response of real per-capita GDP to a one percentage point increase in the implicit tax rate with respect to different number of factors.

Figure B.29: Impulse responses of state-level personal income with Two and Five Factors



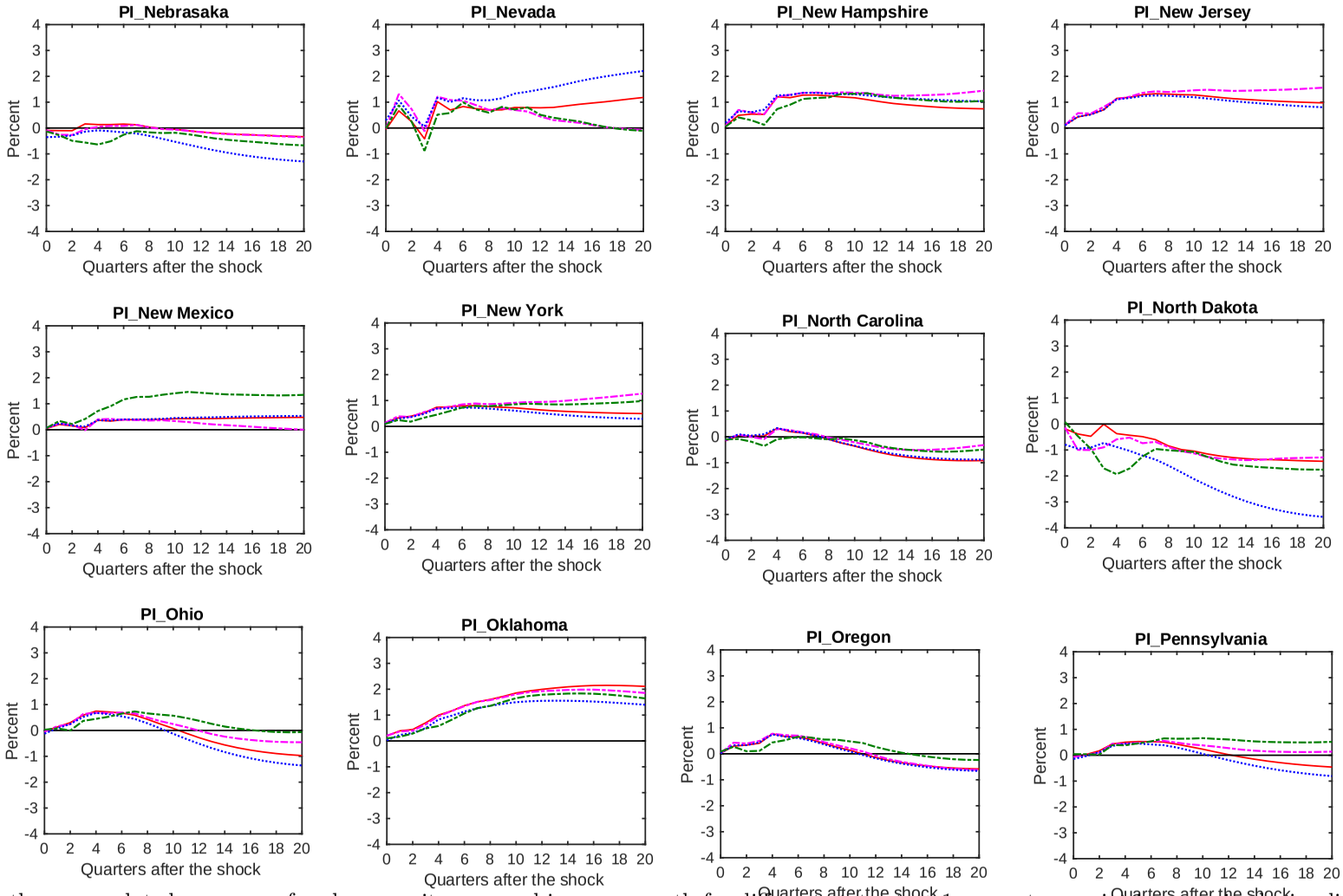
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.30: Impulse responses of state-level personal income with Two and Five Factors



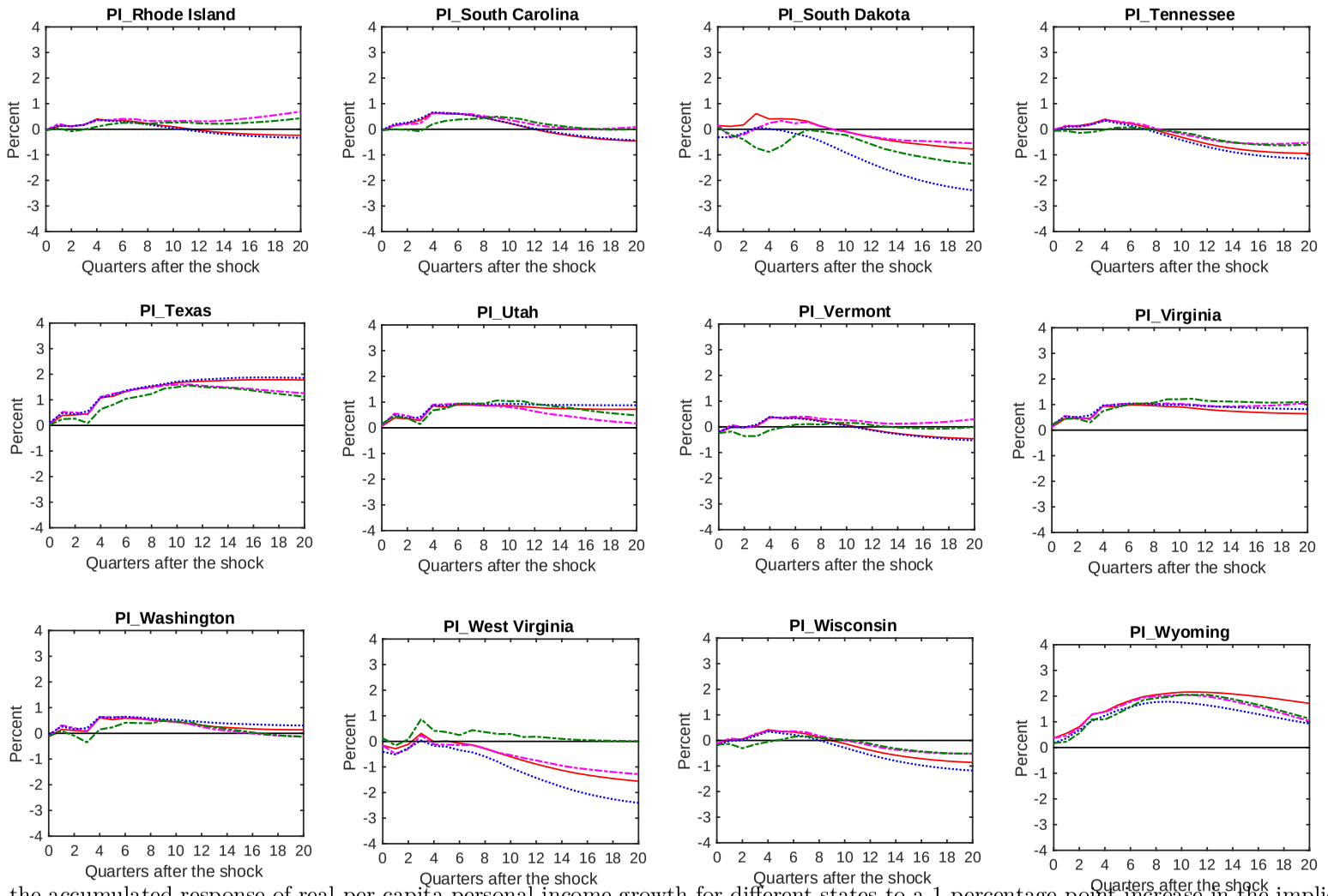
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.31: Impulse responses of state-level personal income with Two and Five Factors



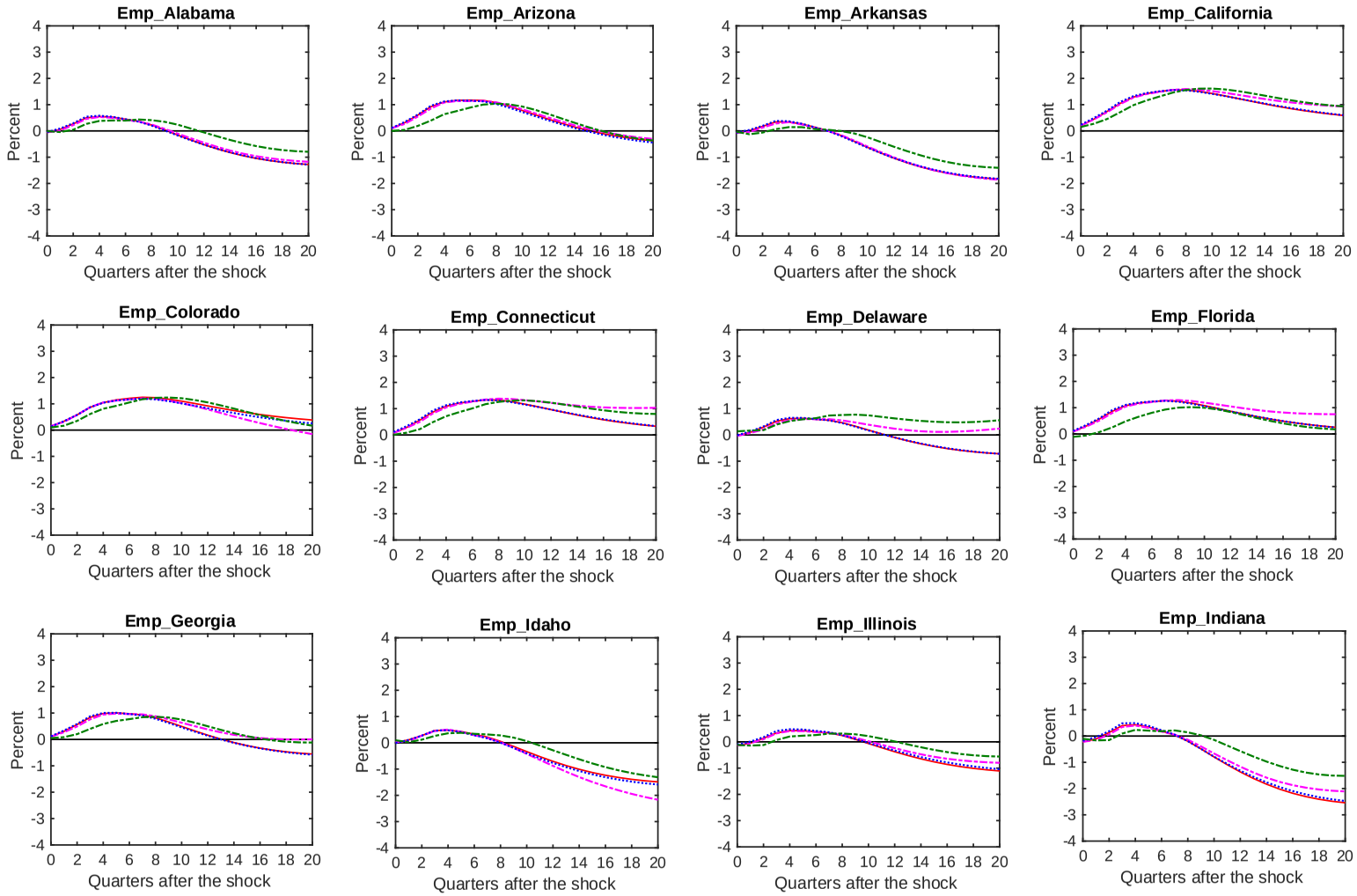
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.32: Impulse responses of state-level personal income with Two and Five Factors



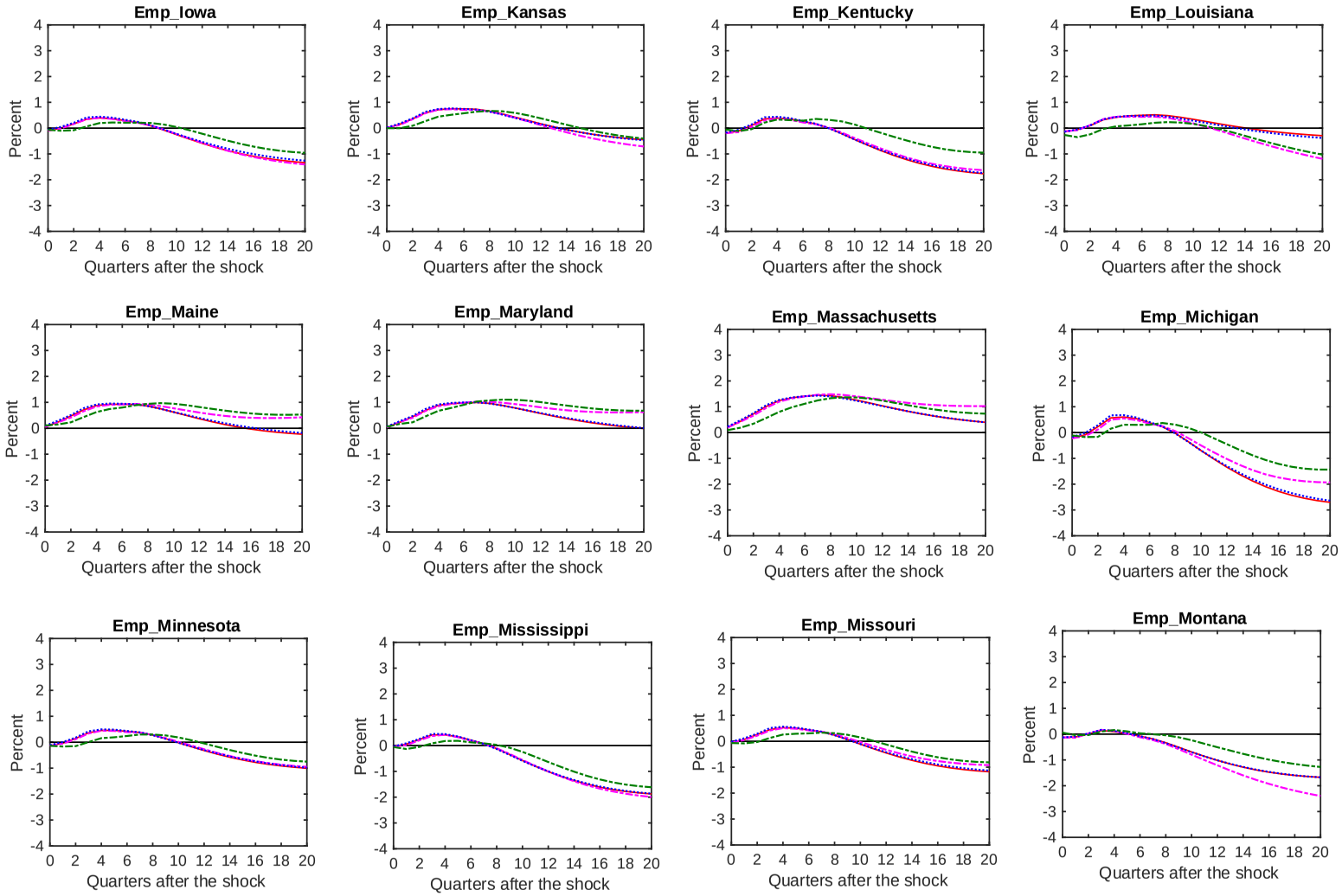
The figure shows the accumulated response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.33: Impulse responses of state-level employment with Two and Five Factors



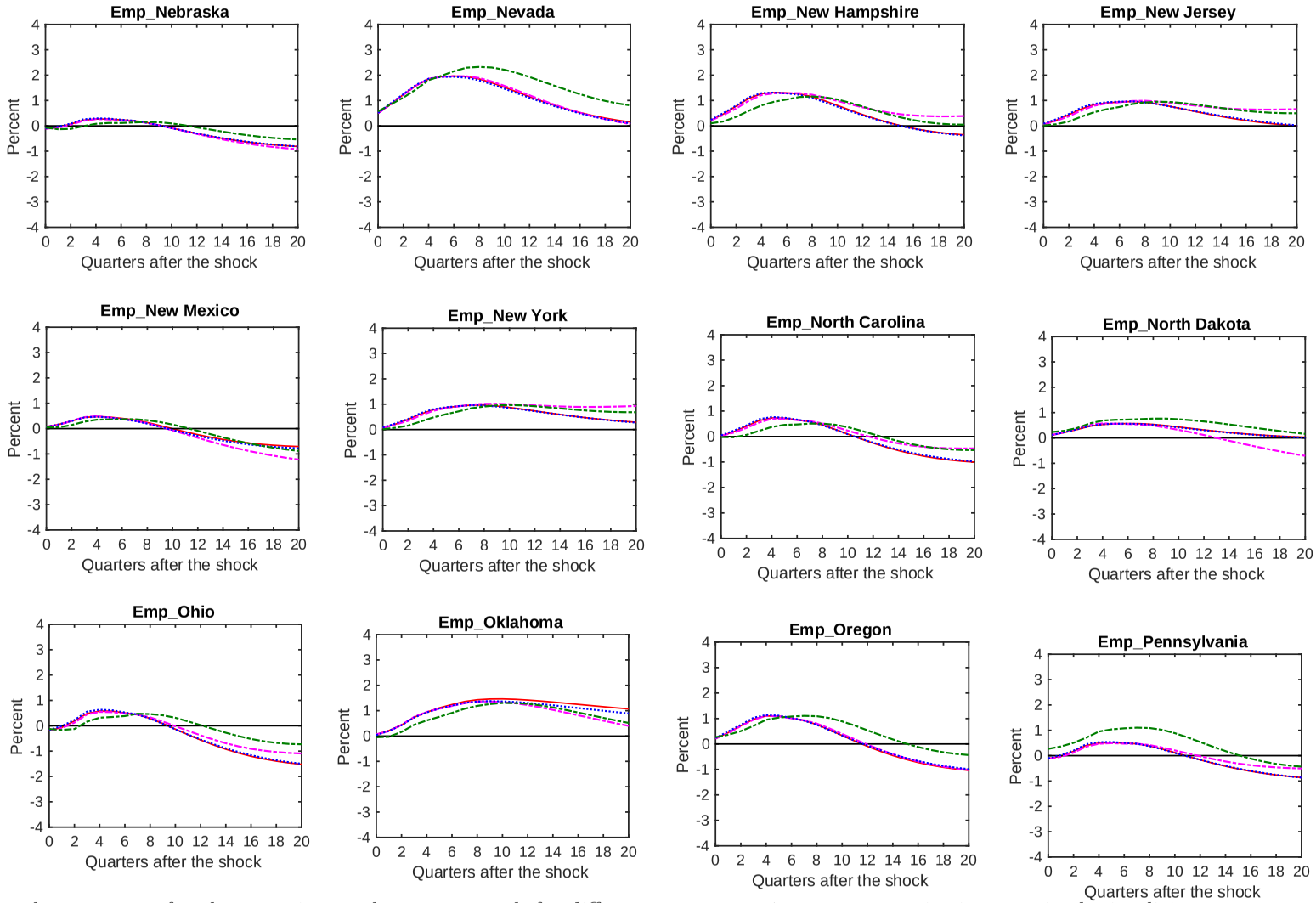
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.34: Impulse responses of state-level employment with Two and Five Factors



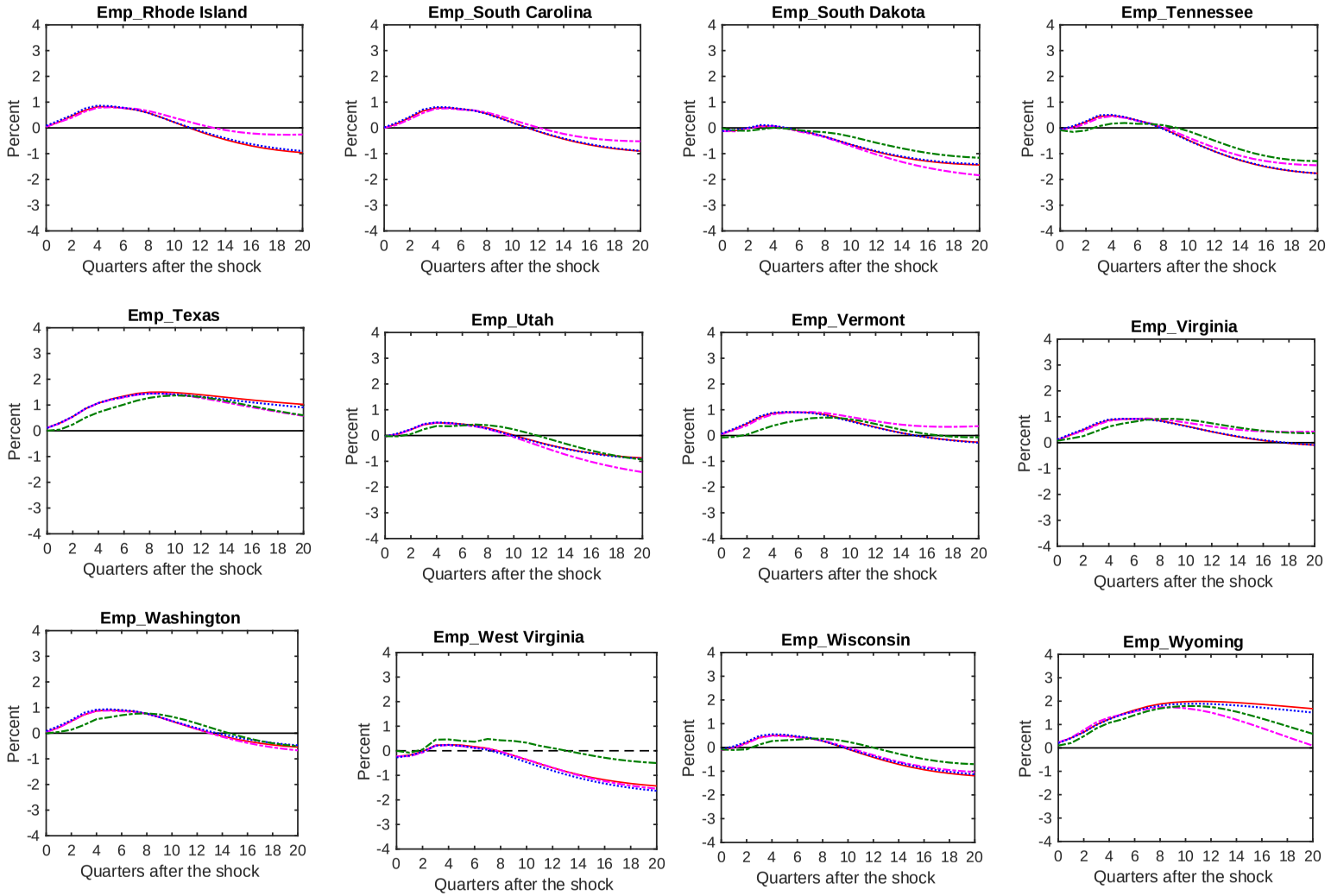
The figure shows the accumulated response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.35: Impulse responses of state-level employment with Two and Five Factors



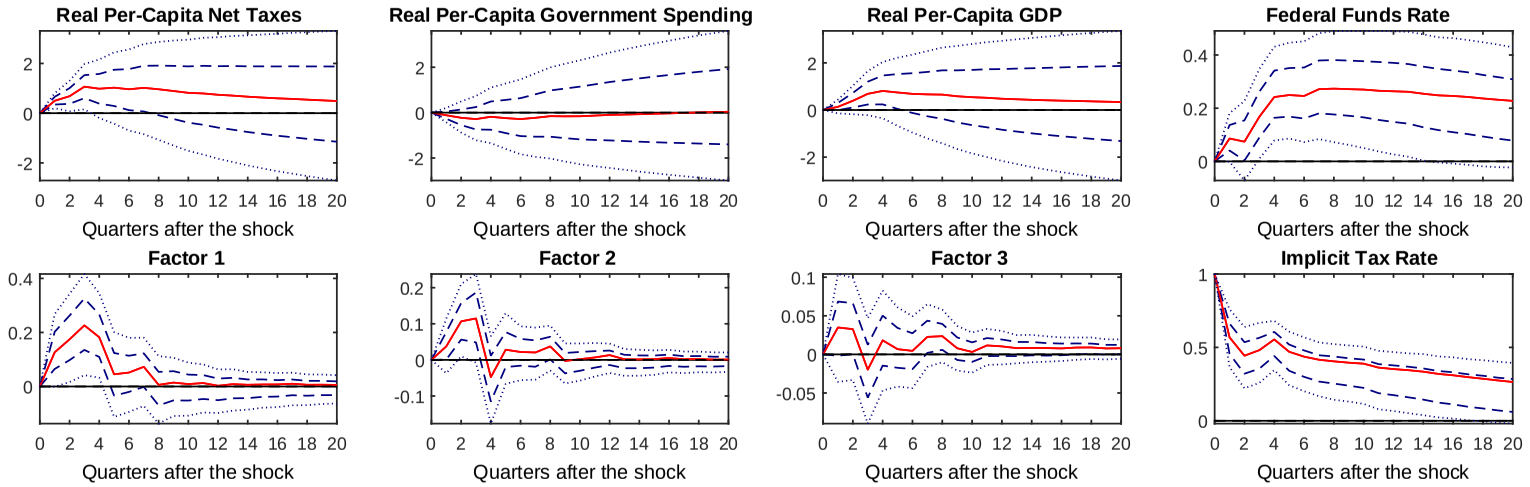
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.36: Impulse responses of state-level employment with Two and Five Factors



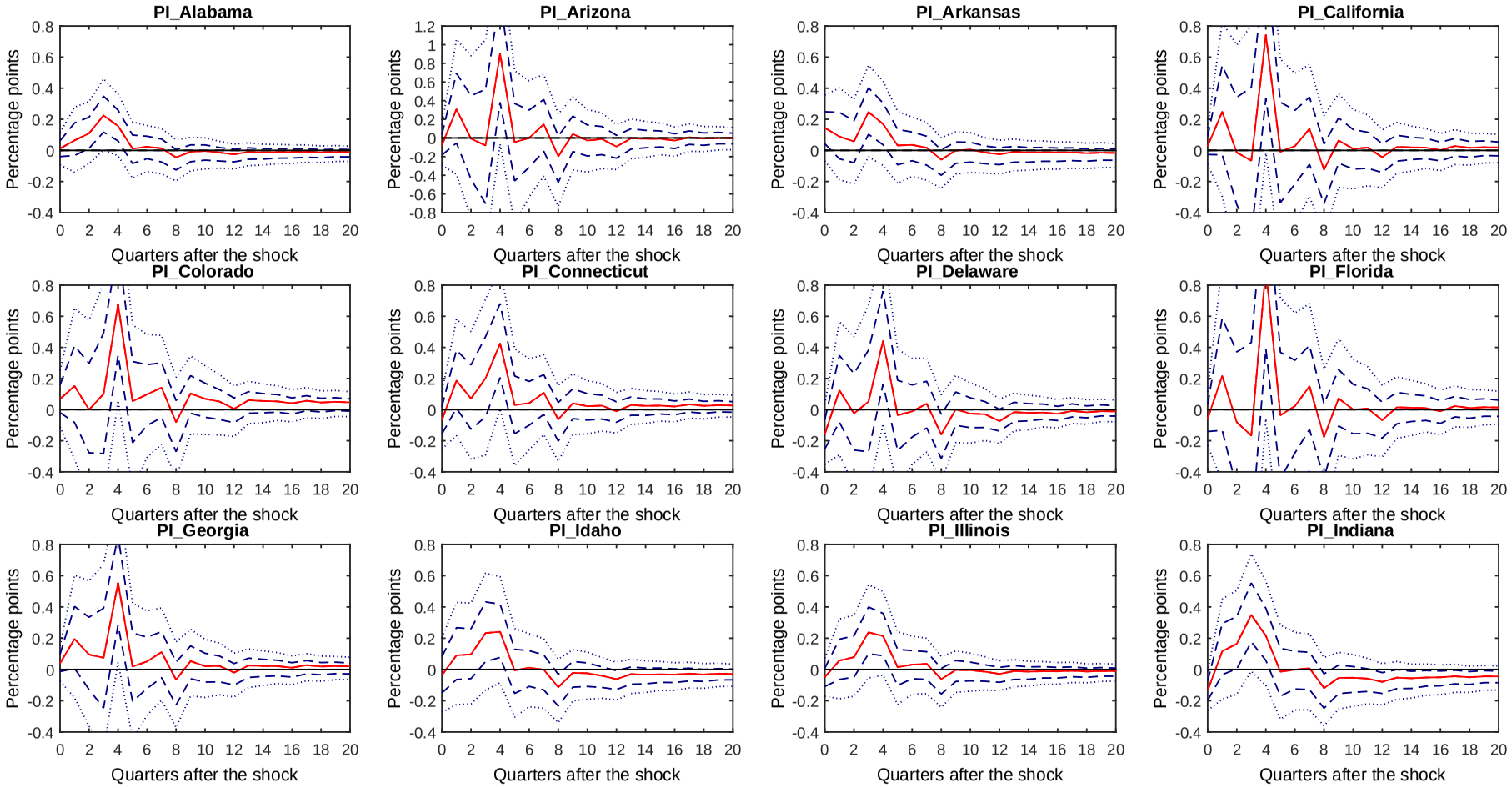
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Solid lines are point estimates with with benchmark specification; dashed lines indicate point estimates of robust specification.

Figure B.37: Impulse responses for aggregate variables and estimated factors- Stochastic Trend Model



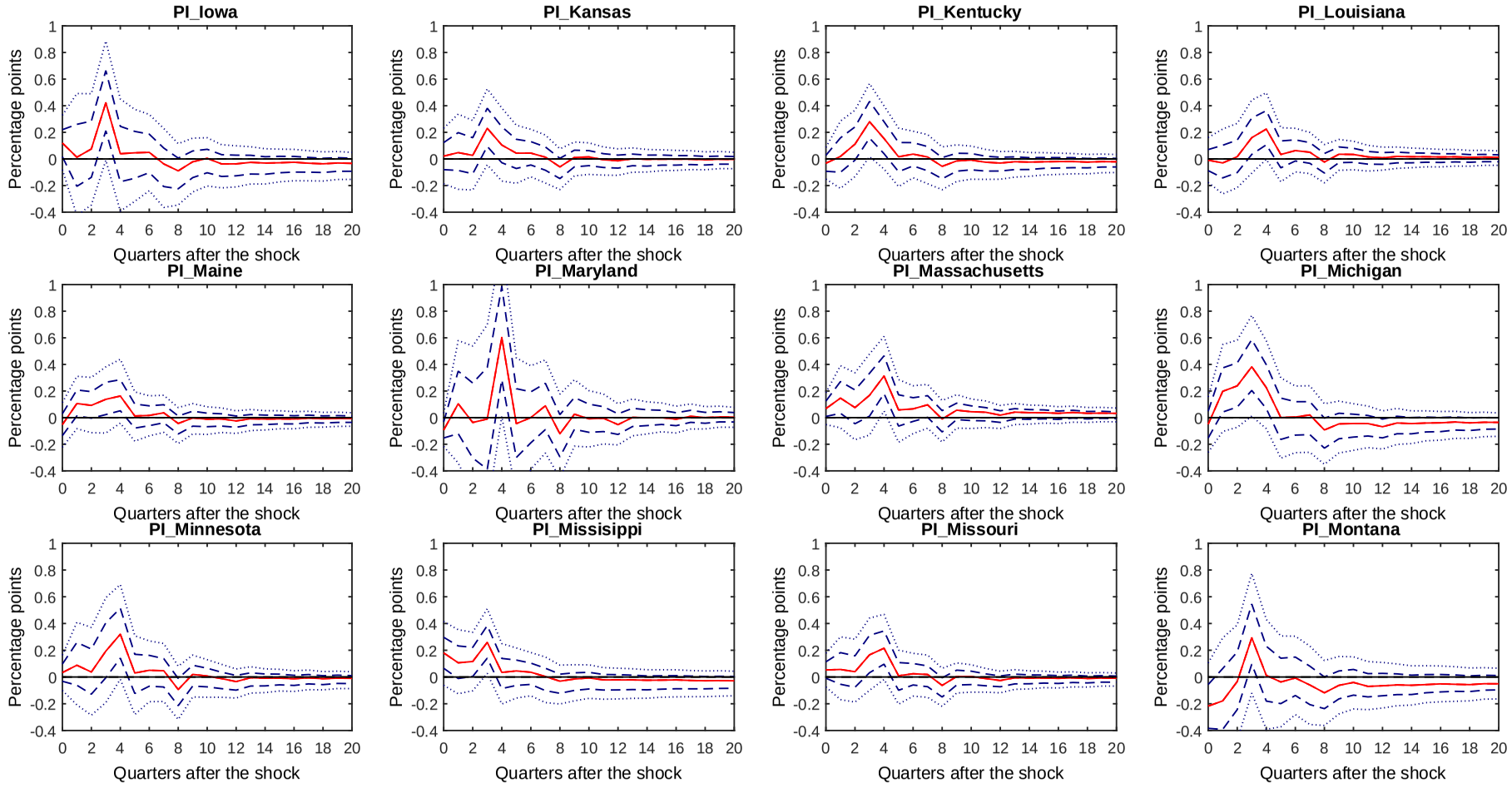
The figure shows the response of the aggregate variables and the regional factors to a one percentage point increase in the implicit tax rate. All responses are reported in percentages. Full lines are point estimates; dashed and dash-dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.38: Impulse responses of state-level personal income-Stochastic Trend Model



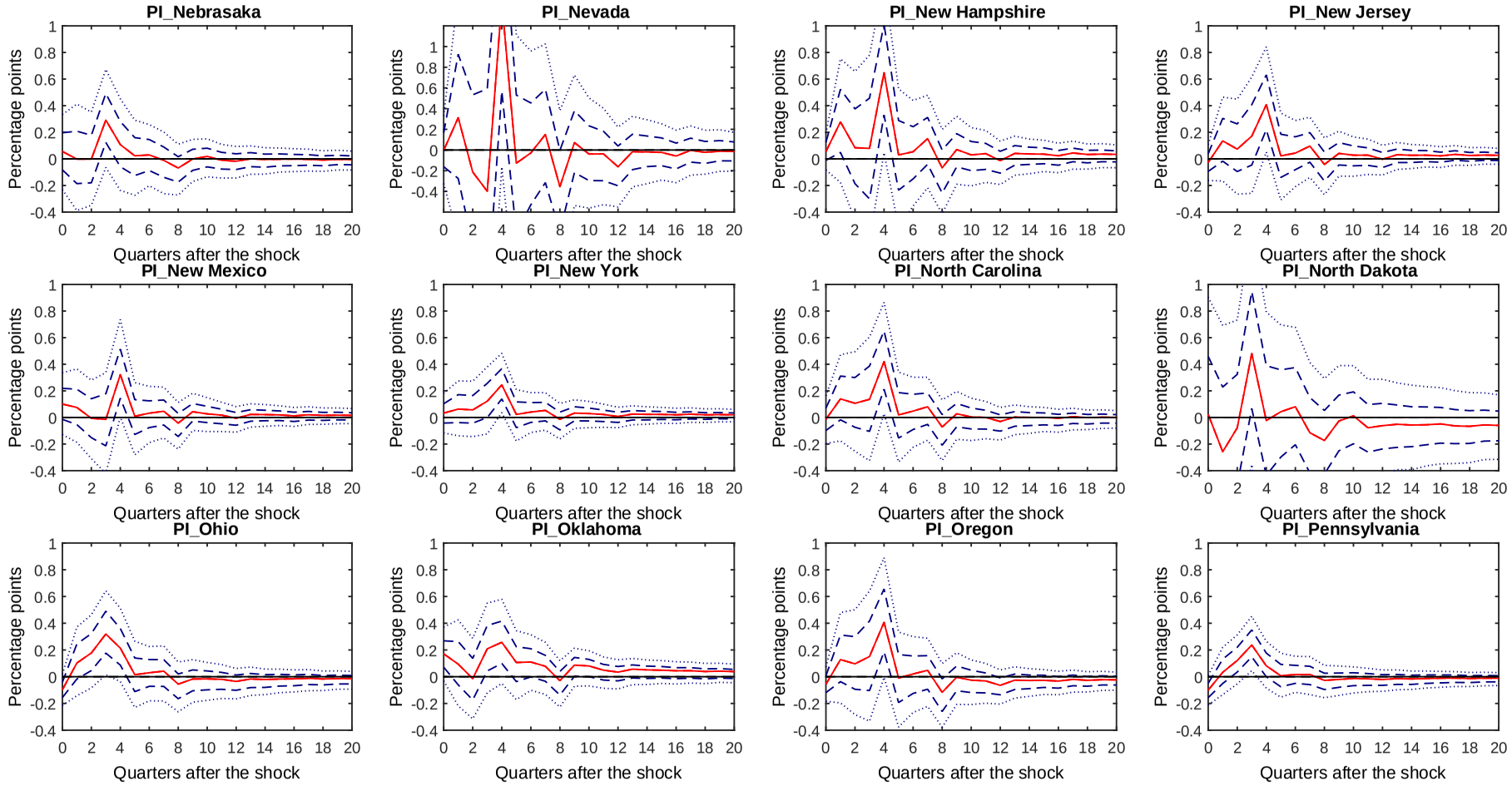
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.39: Impulse responses of state-level personal income-Stochastic Trend Model



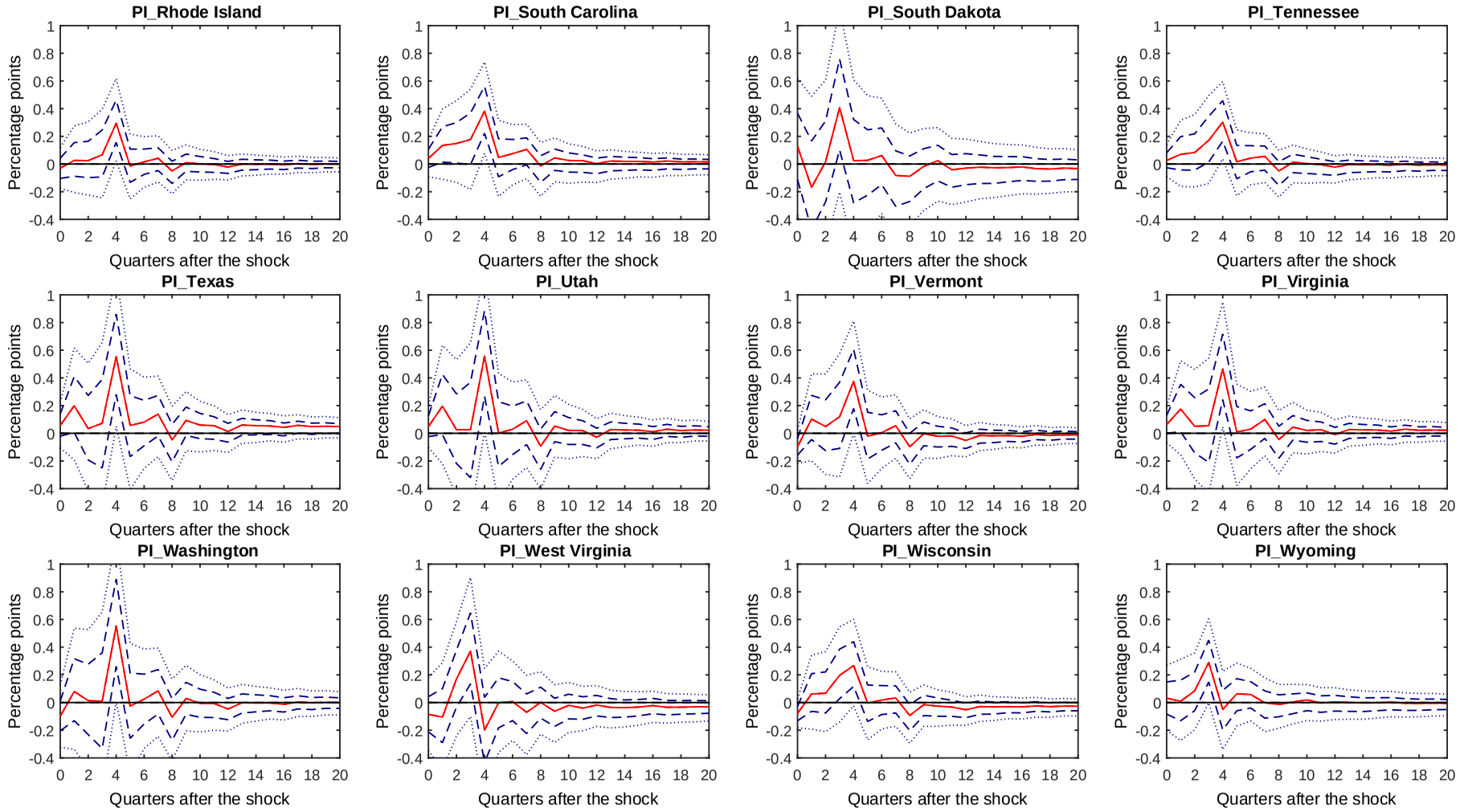
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.40: Impulse responses of state-level personal income-Stochastic Trend Model



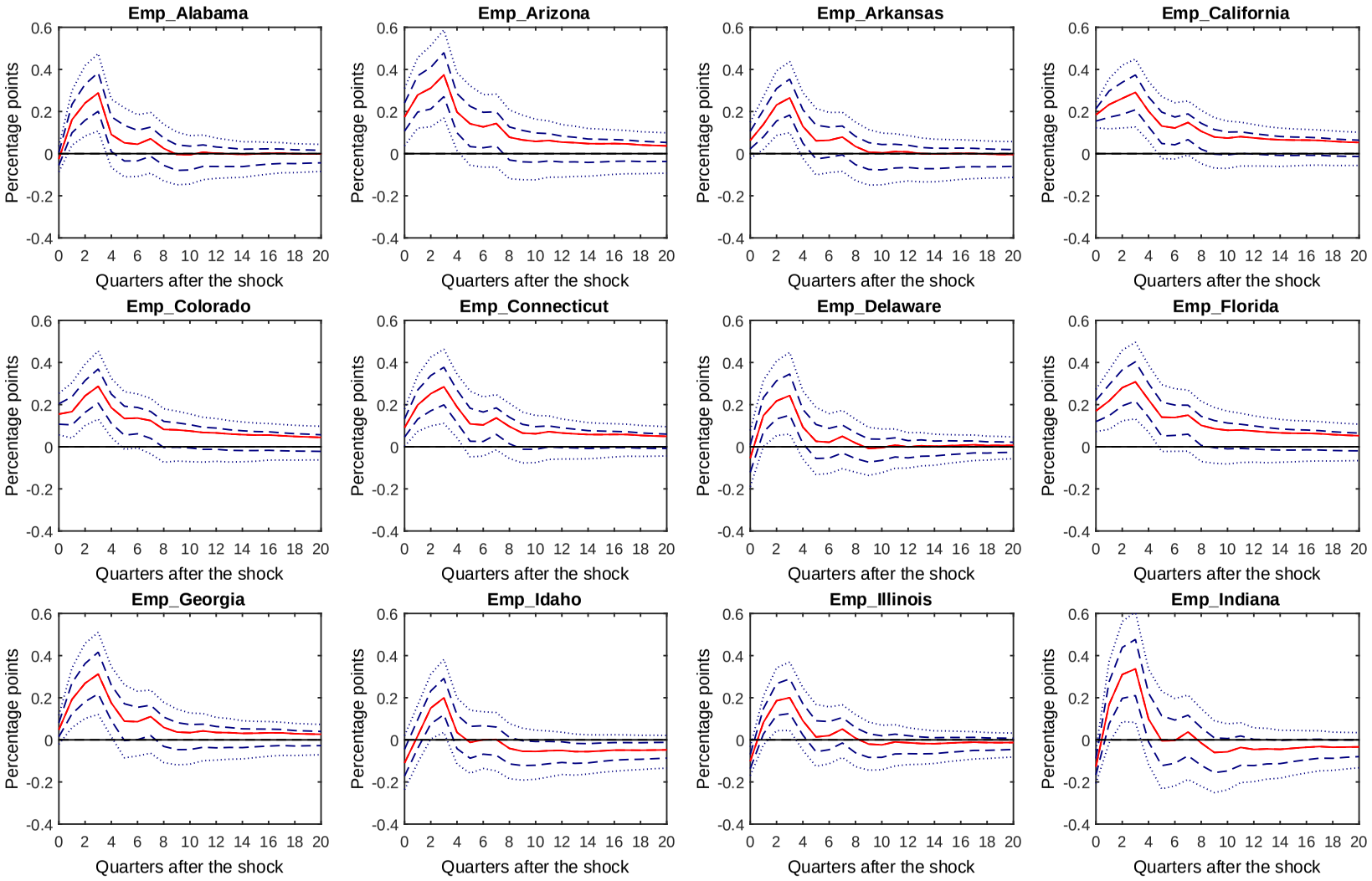
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.41: Impulse responses of state-level personal income-Stochastic Trend Model



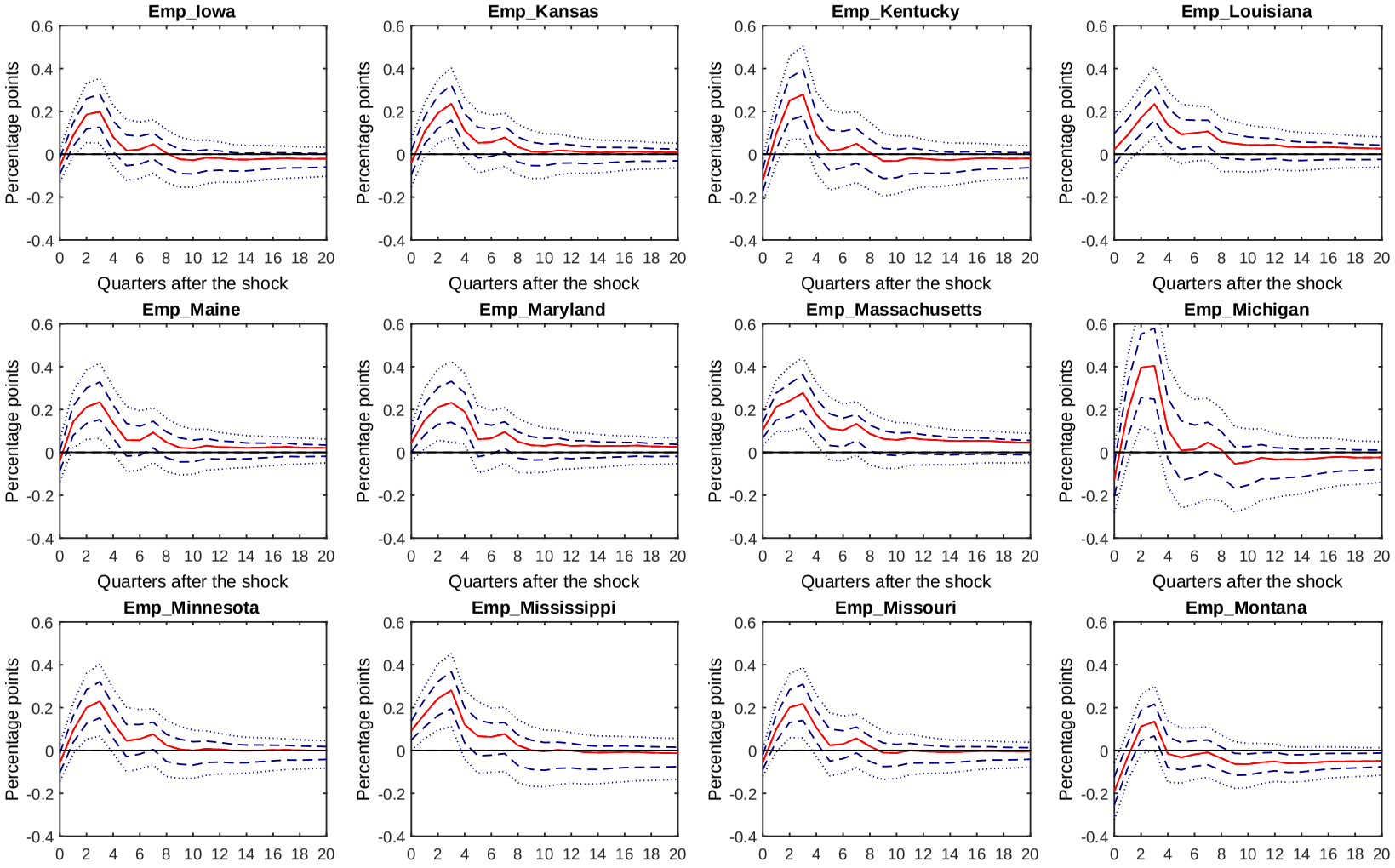
The figure shows the response of real per-capita personal income growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.42: Impulse responses of state-level employment-Stochastic Trend Model



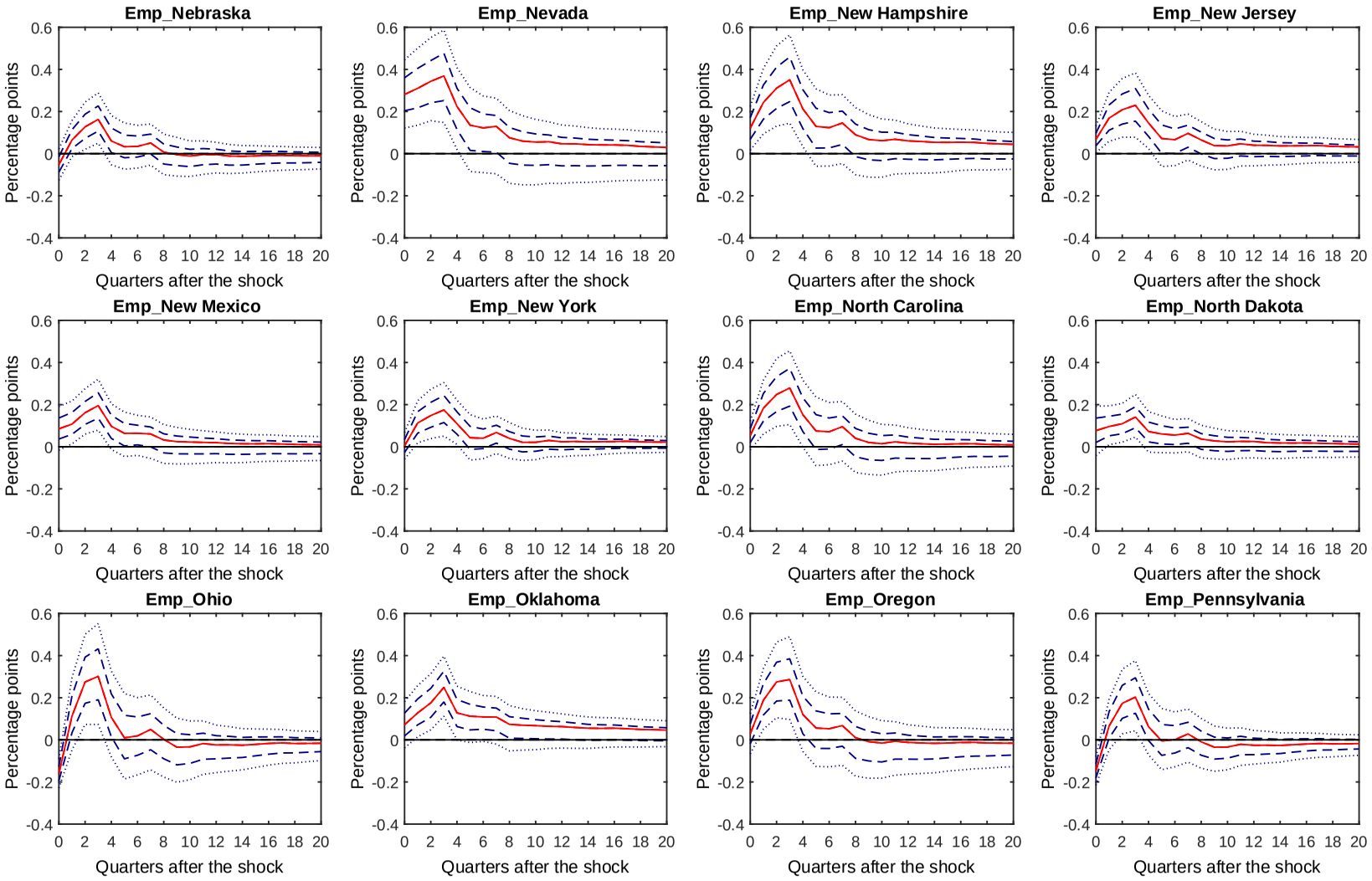
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.43: Impulse responses of state-level employment-Stochastic Trend Model



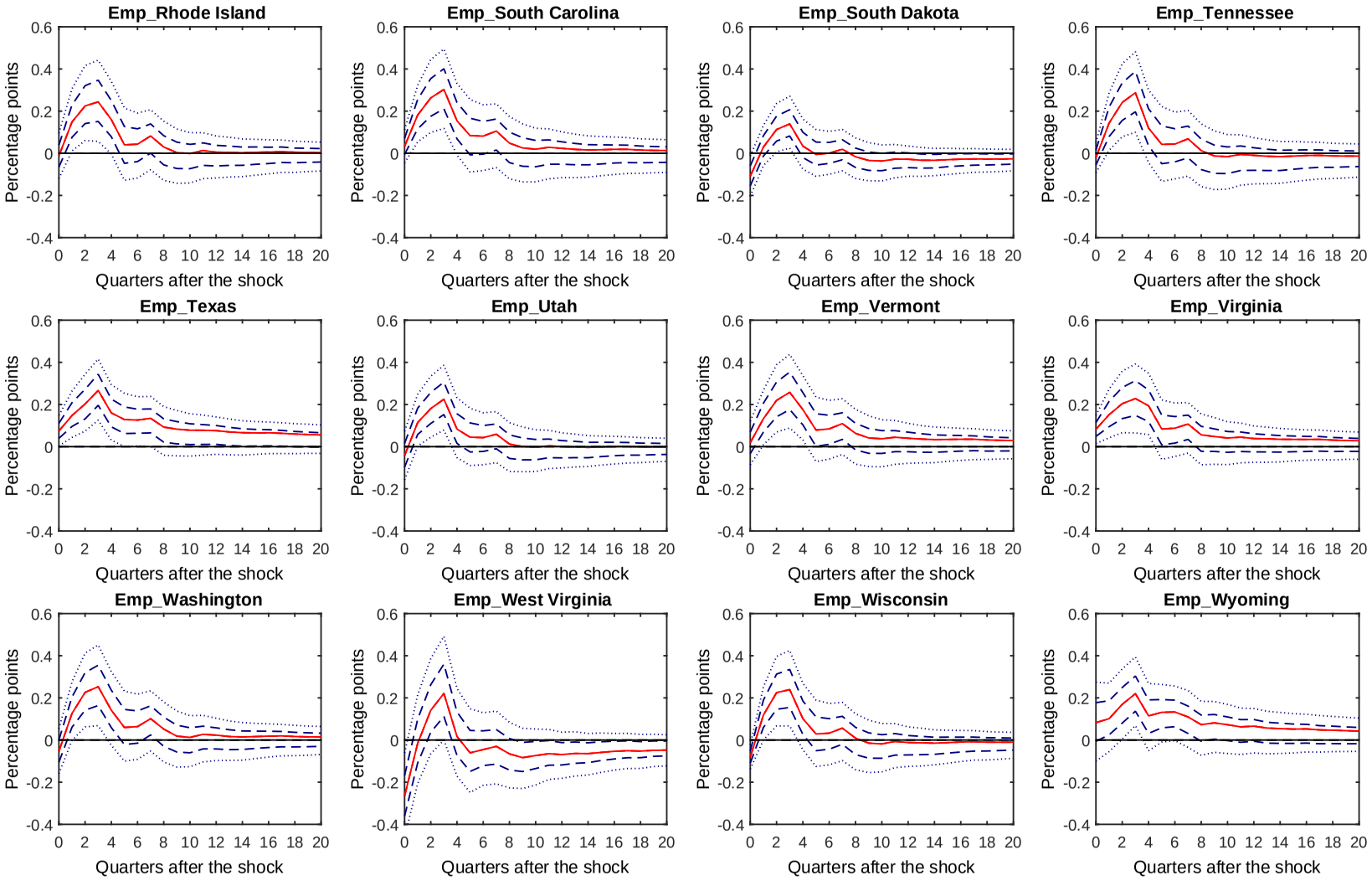
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian, 2004).

Figure B.44: Impulse responses of state-level employment-Stochastic Trend Model



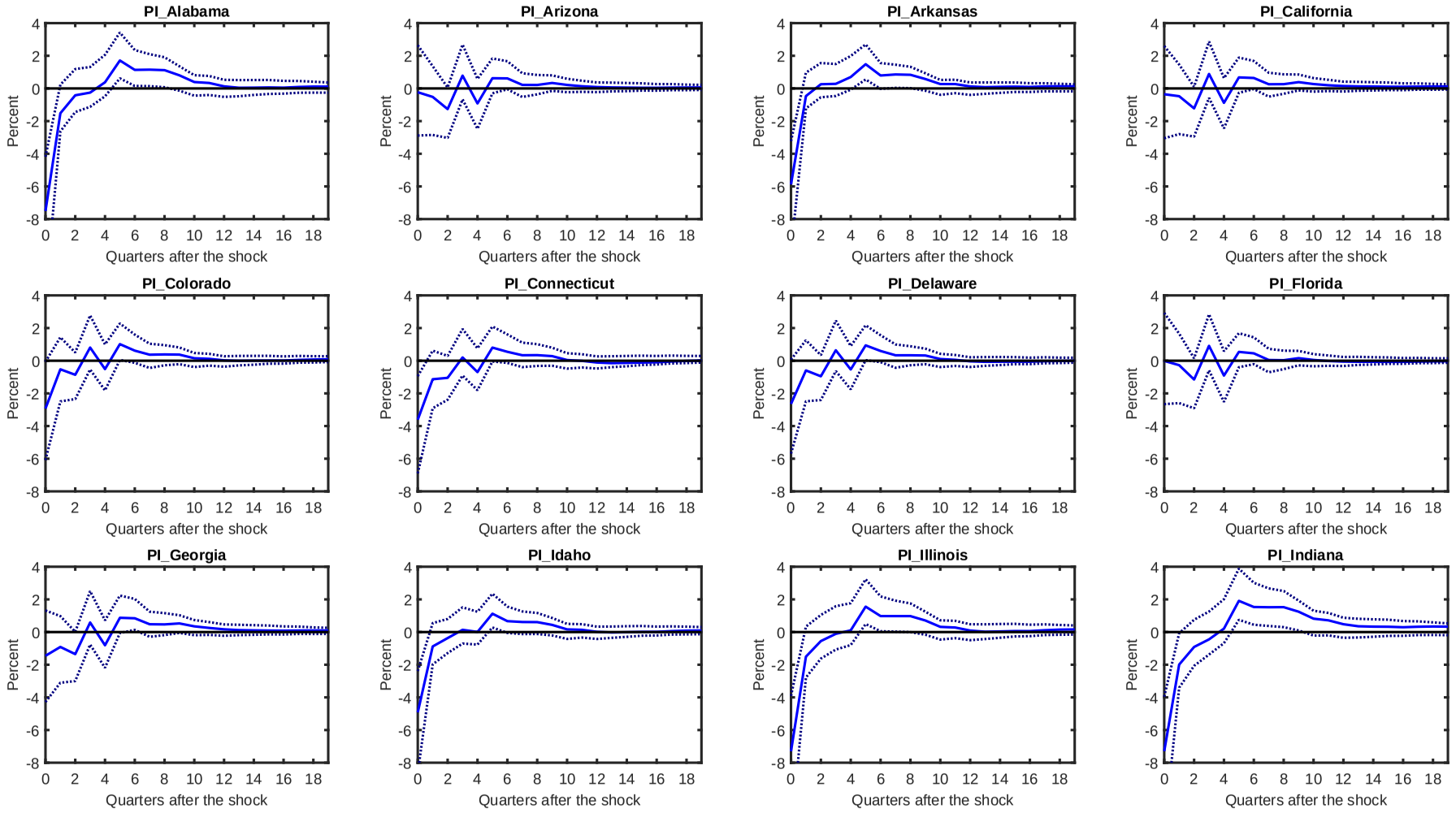
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Goncalves and Kilian,2004).

Figure B.45: Impulse responses of state-level employment-Stochastic Trend Model



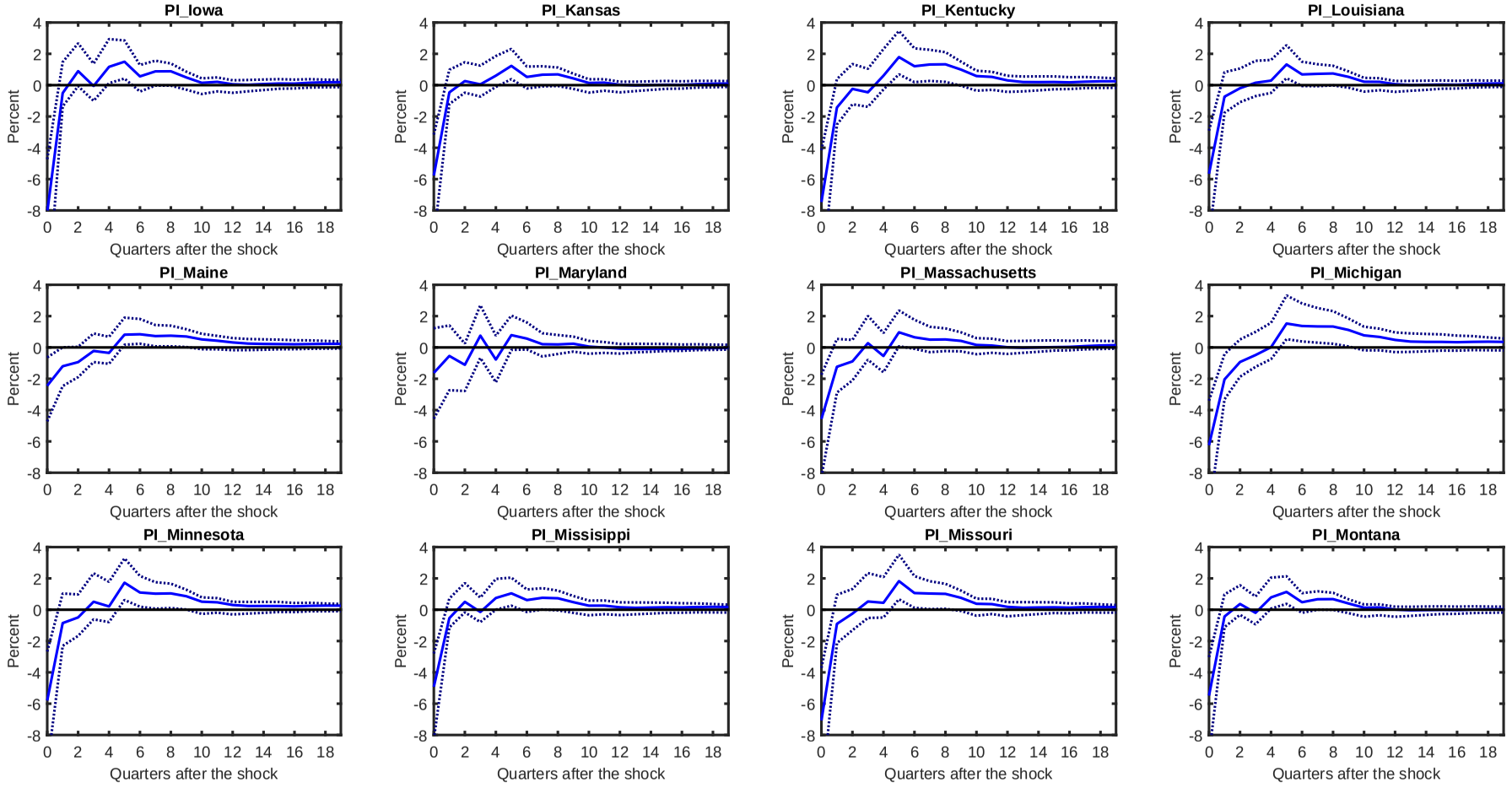
The figure shows the response of real per-capita employment growth for different states to a 1 percentage point increase in the implicit tax rate. Full lines are point estimates; dashed and dot lines indicate the 68 and 95 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications (Jentsch and Lunsford, 2016).

Figure B.46: Impulse responses of state-level personal income- Proxy FAVAR Model



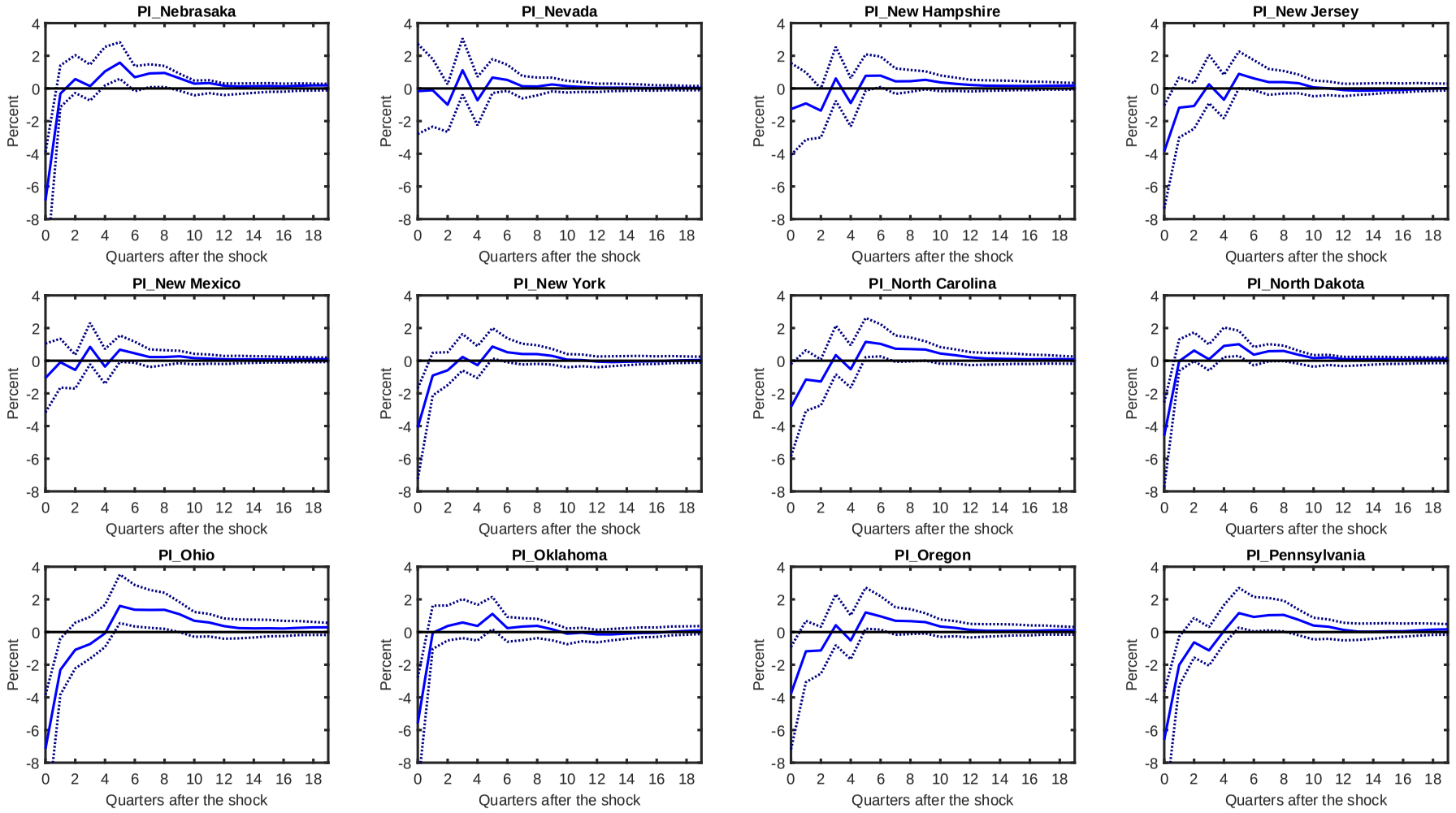
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.47: Impulse responses of state-level personal income-Proxy FAVAR Model



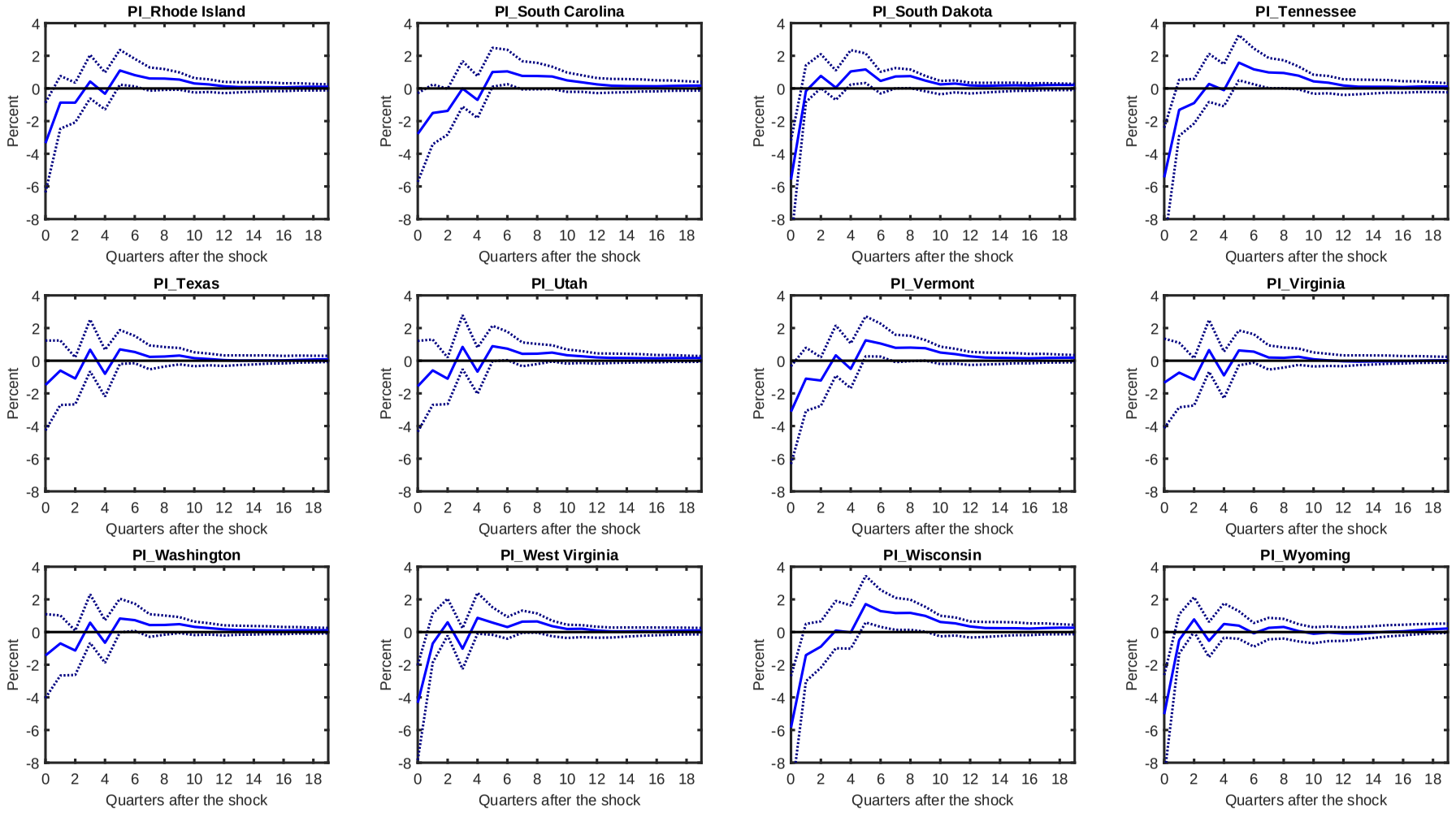
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.48: Impulse responses of state-level personal income-Proxy FAVAR Model



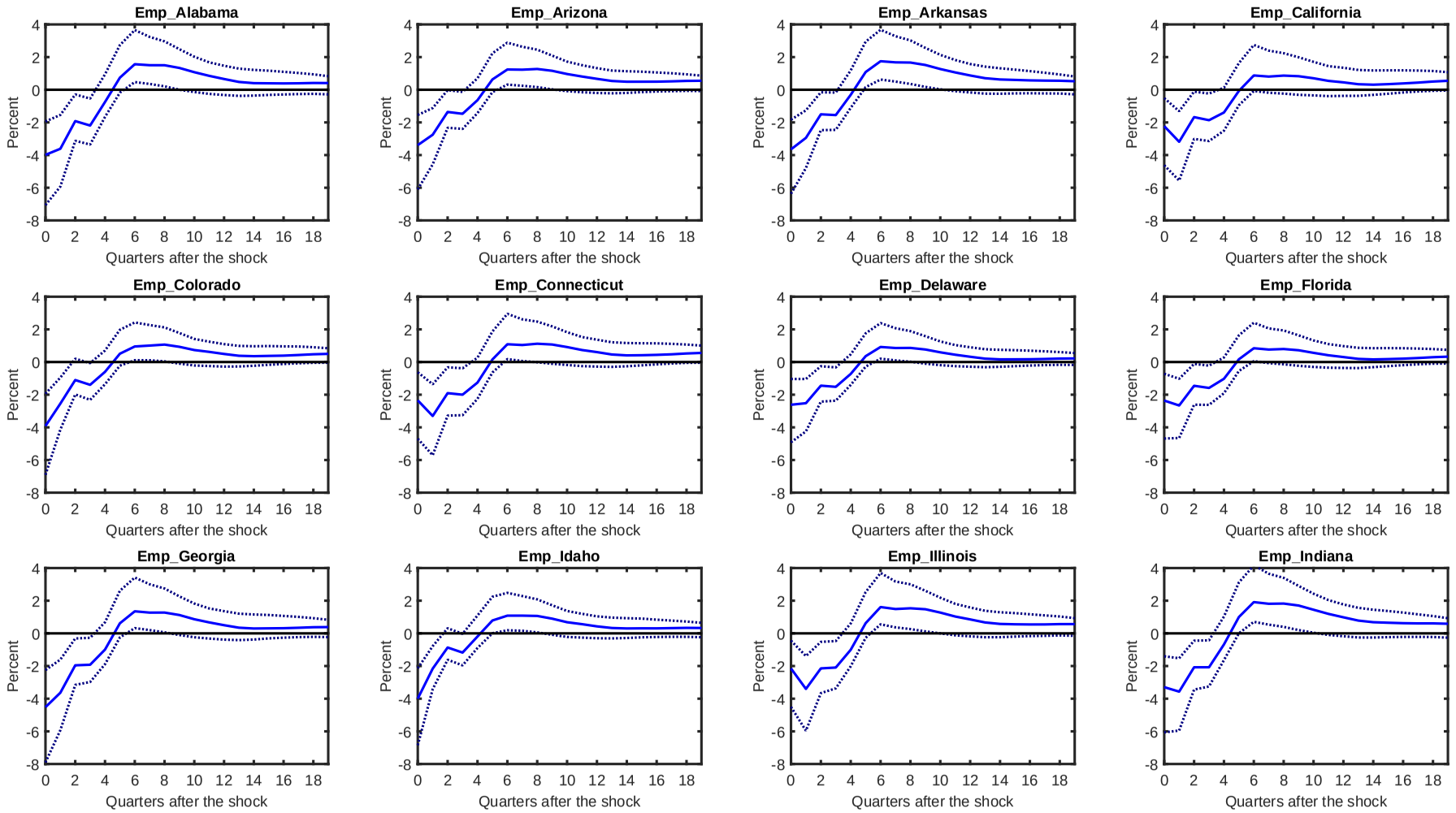
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.49: Impulse responses of state-level personal income-Proxy FAVARModel



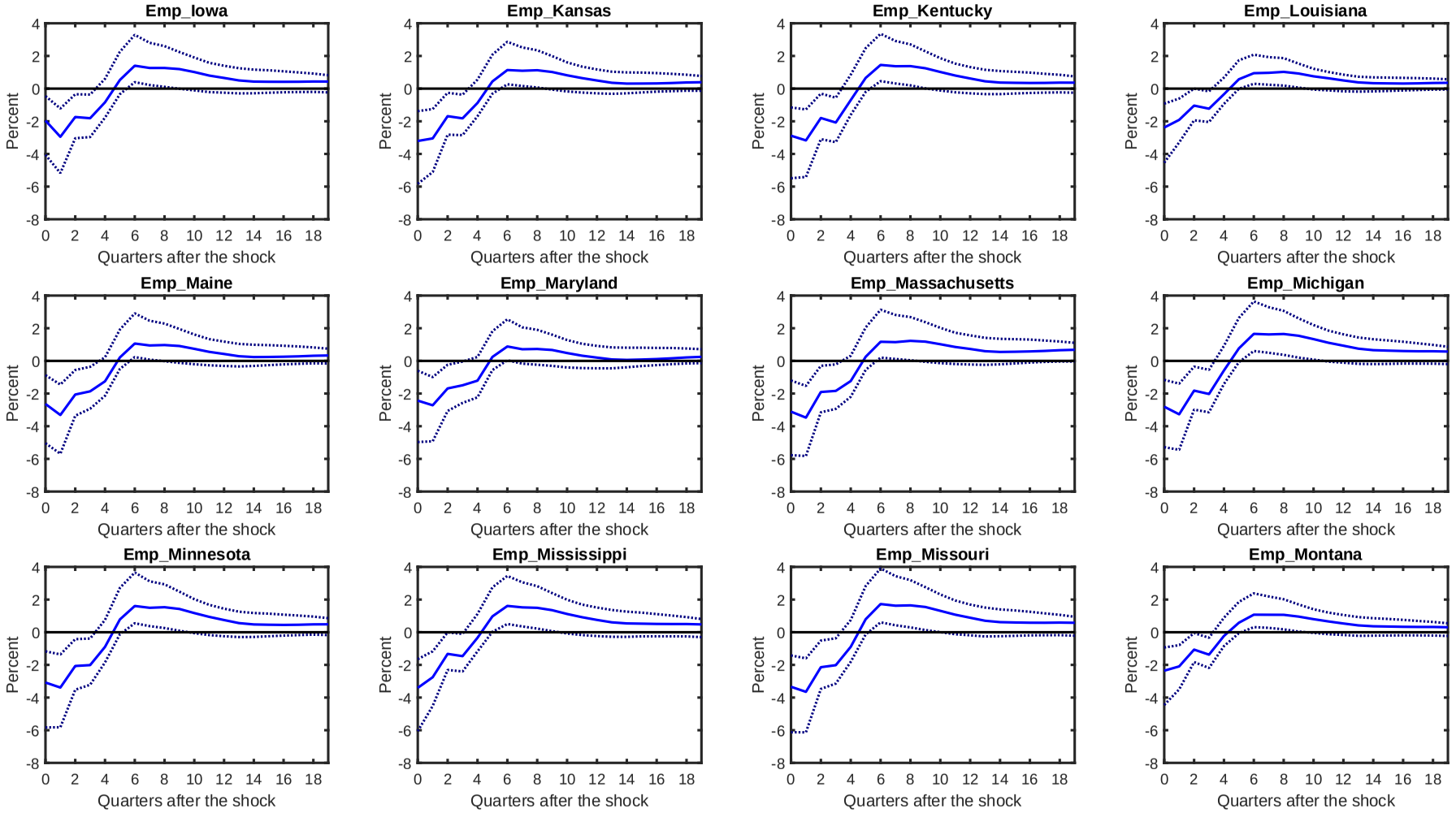
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.50: Impulse responses of state-level employment-Proxy FAVAR Model



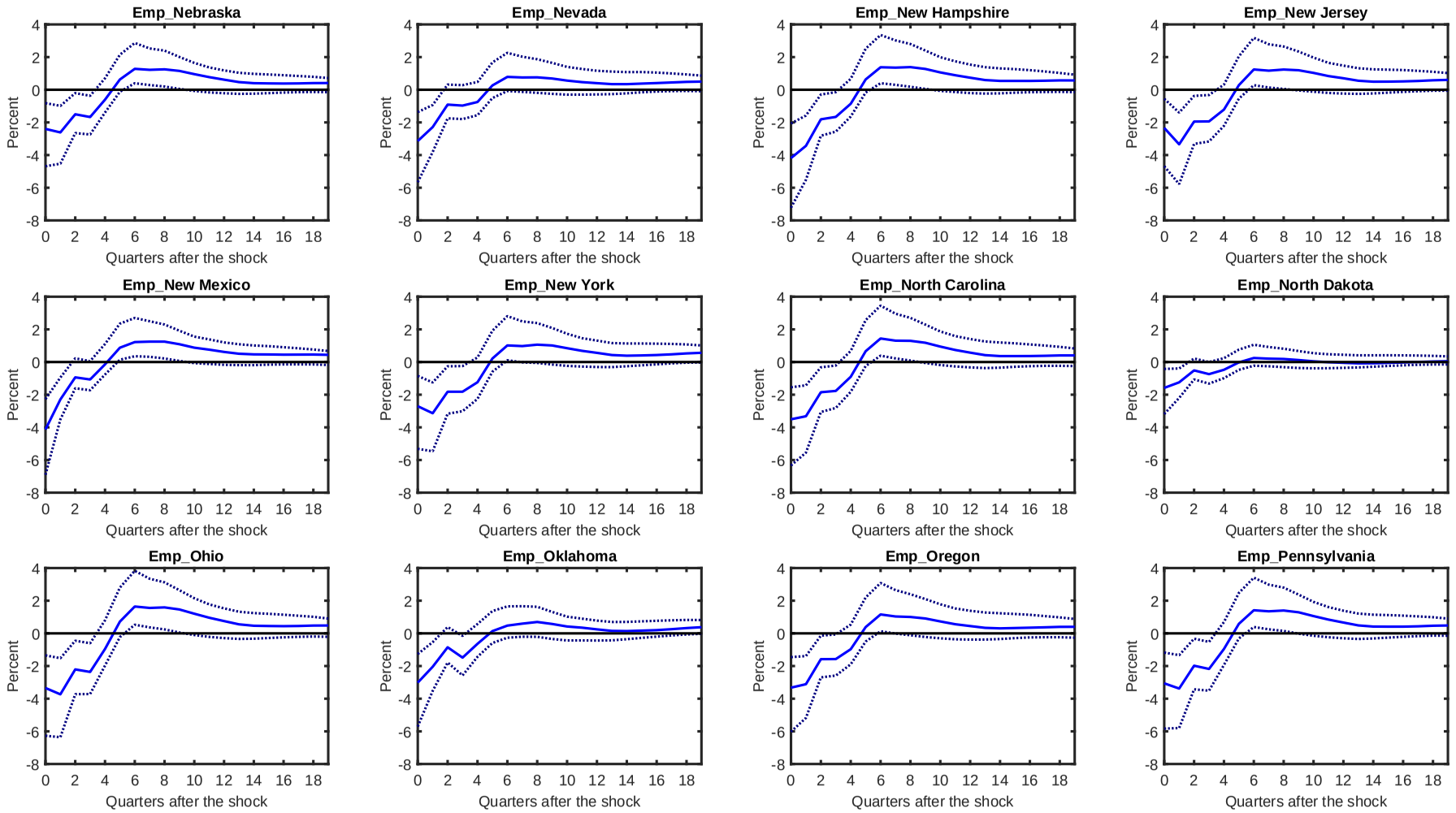
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.51: Impulse responses of state-level employment-Proxy FAVARModel



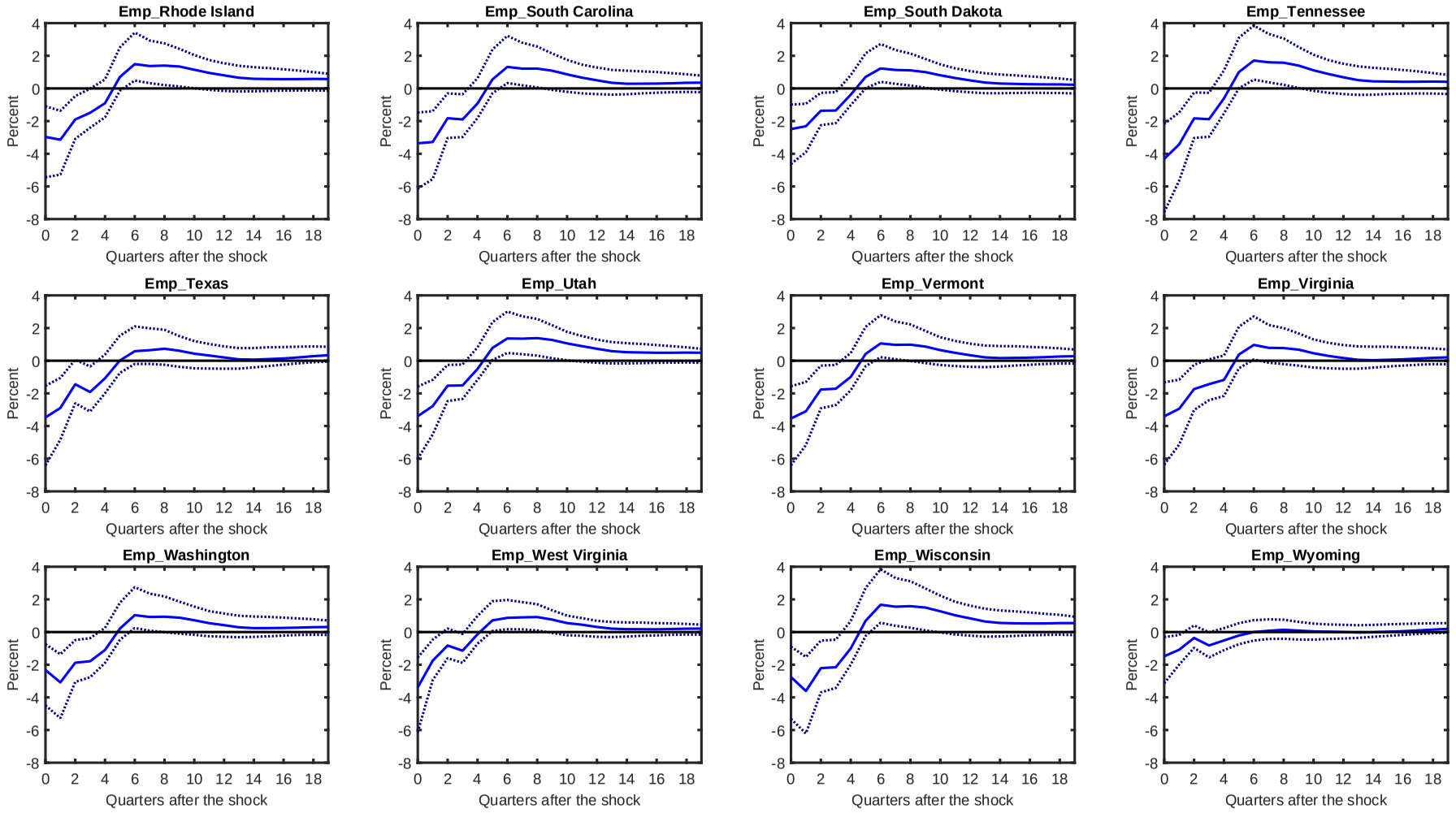
The figure shows the response of real per-capita employment growth for different states to tax revenues increase of 1% of GDP.
Full lines are point estimates; dashed and dot lines indicate the 68 percent confidence intervals constructed using a recursive wild-bootstrap method with 10,000 replications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

Figure B.52: Impulse responses of state-level employment-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 Lunsford, 2016).

Figure B.53: Impulse responses of state-level employment-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 Lunsford, 2016).