Partisanship and Fiscal Policy in Economic Unions: Evidence from U.S. States

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Online Appendix

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A Data appendix

Below we describe the specific data source for the various groups of data, followed by specific variable definitions.

Political data. We assemble a political database including state legislature partisan affiliation, governor party and margin of victory (MOV), and state presidential vote. The state legislature data comes from Klarner (2015). Klarner assembles this open source data set from primary sources. This database also includes a variety of budget power variables assembled by Klarner's study of legal fiscal rules. Using text recognition software, we assembled a database of gubernatorial outcomes from the Council of State Government's Book of States, which provides margin of victory and party affiliation from 1933 to date. Since the vote share can lead to ambiguous outcomes when other parties won the most vote, we manually check the election results whenever third parties are shown as having the most votes. In addition, we check all governors elected within a 5pp MOV. We also collect non-electoral gubernatorial change outcomes from the National Governors Association.[1] Finally, we take state-level presidential voting records from the University of California Santa Barbara's American Presidency Project. Our final data set spans 1963 to 2014 with full fiscal and political data. Note most states switch governors during our sample period. For example, even states that produce landslide victories in some elections, such as California or Texas, had marginally elected governors from both parties.

Fiscal variable definitions. We collect comprehensive data on revenues and expenditures for all states from the U.S. Census Bureau's State and Local Government Finance historical database for 1958 to 2006 by fiscal year. For both expenditures and revenues, the State and Local Government Finance database provides detailed accounts for the end use and source of financing, including purpose of intergovernmental transfers as well as type of spending. The data for 2007-2014 come from the Census' Annual Surveys of State and Local Government Finances.[2]

Our fiscal variables follow U.S. Census Bureau (2006) definitions. Our measure of government expenditures is called "Total Expenditure." The Census defines it as "includ[ing] all amounts of money paid out by a government during its fiscal year [...] other than for retirement of debt, purchase of investment securities, extension of loans, and agency or private trust transactions." (U.S. Census Bureau, 2006, p. 5-1.) This measure is the sum of current operating expenditures, total capital outlays, total spending on assistance and subsidies, total insurance trust benefits, total interest on debt, and total intergovernmental expenditures.

We use "General Revenue" net of federal intergovernmental transfers as the main measure of revenue for our analysis. General Revenue is defined by the Census as "compris[ing] all revenue except that classified as liquor store, utility, or insurance trust revenue." (U.S.

[1] In years with a change in governor party, we assign the governor's political party to the party during the budget process in the first quarter of the previous calendar year. Unless otherwise noted, we drop state-years with independent governors – a rare occurrence, as Figure A.2 shows.

[2] We do not use the preliminary estimate for 2015 because we found that preliminary estimates can be off substantially in 2007 and 2008, when the historical and contemporaneous sources overlap.

Census Bureau, 2006, p. 4-3.) General revenue is the sum of tax revenue, intergovernmental revenue, current charges, and miscellaneous charges. While the Census provides an alternative and larger measure called "Total Revenue" that also includes social insurance trust revenue, the Census requires unrealized gains or losses to be booked in the fiscal year that they occur, which skews the data during recessions.

To measure the constraints on fiscal policy, we also use "total debt" from the census data set. The weakness of this measure is that it is based on the face value of outstanding debt, rather than its market value. However, by focusing on the change in total debt we should limit the importance of the composition problem of debt. We also focus on debt with a maturity of at least one year, which accounts for almost all debt. Our results are, however, robust to using all debt outstanding. The Census discourages using alternative measures, such as the past surplus.[3]

Economic activity. We also use data on state GDP, employment, and population found in the U.S. Bureau of Economic Analysis' Regional Economic Accounts by calendar year. To merge the data set, we line up state fiscal years with the calendar years straddling the end of the previous fiscal year and the beginning of the current fiscal year, to best reflect states' contemporaneous information. The fiscal year in most states typically begins on July 1 and ends on June 30 – for example, expenditures in FY 2010 are for the period July 1, 2009 to June 30, 2010. We assign the political status of the state to be that in the first quarter of the calendar year preceding the fiscal year as it is in the middle of the budget process.

Macroeconomic data. We use the aggregate annual GDP deflator to deflate all nominal variables in our state-level data set. In addition, we collect quarterly data on grants-in-aid to both state and local governments, and on federal, and state and local government expenditures as well as consumption, investment expenditures, and aggregate GDP.

A.1 Political variables

A.2 Revenues

All census data come from https://www.census.gov/govs/local/ and https://www2.census.gov/pub/outgoing/govs/special60/State_Govt_Fin.zip.

$$
\begin{aligned}
TotalRevenues_t &= GeneralRevenues_t + LiquorStoreRevenues_t \\
&\quad + TotalUtilityRevenues + TotalInsuranceTrustRevenues_t \\
GeneralRevenues_t &= TotalTaxesRev_t \\
&\quad + TotalIntergovernmentalTransferRev_t \\
&\quad + TotalGeneralCharges_t + MiscGeneralRevenueRev_t \\
TotalUtilityRevenues_t &= WaterUtilityRevenue_t + ElectricUtilityRev_t
\end{aligned}
$$

[3] "[...] the Census Bureau statistics on government finance cannot be used as financial statements, or to measure a government's fiscal condition. For instance, the difference between a government's total revenue and total expenditure cannot be construed to be a 'surplus' or 'deficit'" (U.S. Census Bureau, 2006, p. 3-13.).

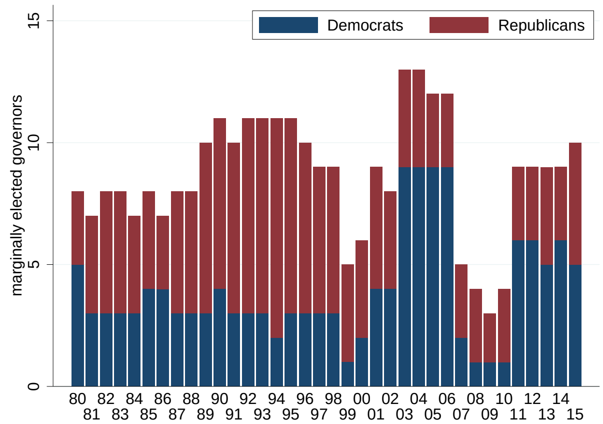


Figure A.1: Democratic and Republican governors elected within a 4pp margin of victory from calendar year 1980 to 2015.

$$
\begin{aligned}
&+ GasUtilityRev_t + TransitUtilityRev_t \\
TotalInsuranceTrustRevenues_t &= TotalEmploymentRetirementRevenue_t \\
&+ TotalUnemploymentRevenue_t \\
&+ TotalWorkerCompensationRevenue_t \\
&+ TotalOtherInsuranceTrustRevenue_t
\end{aligned}
$$

A.2.1 Revenue Definition from Census

- General Government Sector: Within the totals of government revenue and expenditure, internal transfers (e.g., interfund transactions) are "netted out." Therefore, "general revenue" and "general expenditure" represent only revenue from external sources and expenditures to individuals or agencies outside the government, and do not directly reflect any "transfer" or "contributions" to or from the utilities, liquor stores, or insurance trust sectors. See Section 3.9 of the Census classification manual for more information on internal transactions.

- Utilities Sector: In the primary classification of government revenue and expenditure, the term "utility" is used to identify certain types of revenue and expenditure categories. Utility revenue relates only to the revenue from sales of goods or services and by-products to consumers outside the government. Revenue arising from outside other aspects of utility operations is classified as general revenue (e.g., interest earnings). Utility expenditure applies to all expenditures for financing utility facilities, for interest on utility debt, and for operation, maintenance, and other costs involved in producing and selling utility commodities and services to the public (other than noncash transactions like depreciation of assets).

- Liquor Stores Sector: Liquor stores revenue relates only to amounts received from sale of goods and associated services or products. Liquor store expenditure relates only to amounts for purchase of goods for resale and for provision, operation, and maintenance of the stores. Any associated government activity, such as licensing and enforcement of liquor laws or collection of liquor taxes, are classified under the general government sector

- Social Insurance Trust Sector: Insurance trust revenue comprises only (1) retirement and social insurance contributions, including unemployment compensation "taxes" received from employees and other government or private employers, and (2) net earnings on investments set aside to provide income for insurance trusts. Transfers or contributions from other funds of the same government are not classified as insurance trust revenue but rather are reported under special exhibit categories (see Chapters 8 and 9 of the Census manual). Insurance trust expenditure comprises only benefit payments and withdrawals of contributions made from retirement and social insurance trust funds. Costs for administering insurance trust systems are classified under the general government sector.

A.3 Expenditures

$$
\begin{aligned}
TotalExpenditure_t &= TotalIGExpenditure_t DirectExpenditure_t \\
TotalIGExpenditure_t &= TotalIGExpenditure2Federal_t + TotalIGExpenditure2Local_t \\
DirectExpenditure_t &= TotalCurrentOperationalExpendture_t \\
&+ TotalCapitalOutlayExpenditure_t \\
&+ TotalAssistanceAndSubsidies_t + TotalInterestOnDebt_t \\
&+ TotalInsuranceTrustBenefits_t \\
TotalCapitalOutlayExpenditure_t &= TotalConstructions_t + TotalOtherCapitalOutlays_t
\end{aligned}
$$

A.3.1 Expenditures Definition from Census

- Current Operations: Direct expenditure for compensation of own officers and employees and for supplies, materials, and contractual services except any amounts for capital outlay (i.e., for personal services or other objects used in contract construction or government employee construction of permanent structures and for acquisition of property and equipment).
- Interest on Debt: Amounts paid for the use of borrowed money.
- Assistance and Subsidies: Direct cash assistance to foreign governments, private individuals, and nongovernmental organizations (e.g., foreign aid, agricultural supports, public welfare, veteran bonuses, and cash grants for tuition and scholarships) neither in return for goods and services nor in repayment of debt and other claims against the government.
- Capital Outlay: Direct expenditure for purchase or construction, by contract or government employee, construction of buildings and other improvements; for purchase of land, equipment, and existing structures; and for payments on capital leases.
- Intergovernmental expenditure is defined as amounts paid to other governments for performance of specific functions or for general financial support. It includes grants, shared taxes, contingent loans and advances, and any significant and identifiable amounts or reimbursement paid to other governments for performance of general government services or activities.

A.4 Additional Variable Definitions

Variables used in the analysis of state-level panel data:

- Annual GDP deflator: FRED label `A191RD3A086NBEA`.
- Personal Income: BEA Regional Accounts (https://apps.bea.gov/regional/downloadzip.cfm), Table CA4.

- State GDP and its components: BEA Regional Accounts, GDP by State.
- Population: BEA Regional Accounts.

Variables used in the time-series analysis:

- Civilian population above 16: FRED label `CNP16OV`
- Real government consumption and investment: FRED label `GCEC1`
- Real GDP: FRED label `GDPC1`
- GDP deflator: FRED label `GDPDEF`
- State and local government expenditures: FRED label `SLEXPND`
- Federal transfers to state and local governments: FRED label `FGSL`
- Federal government current transfer receipts from persons: FRED label `B233RC1Q027SBEA`
- Federal government current transfer receipts from business: FRED label `W012RC1Q027SBEA`
- Federal government current transfer payments: FRED label `W014RC1Q027SBEA`
- Federal government current tax receipts: FRED label `W006RC1Q027SBEA`

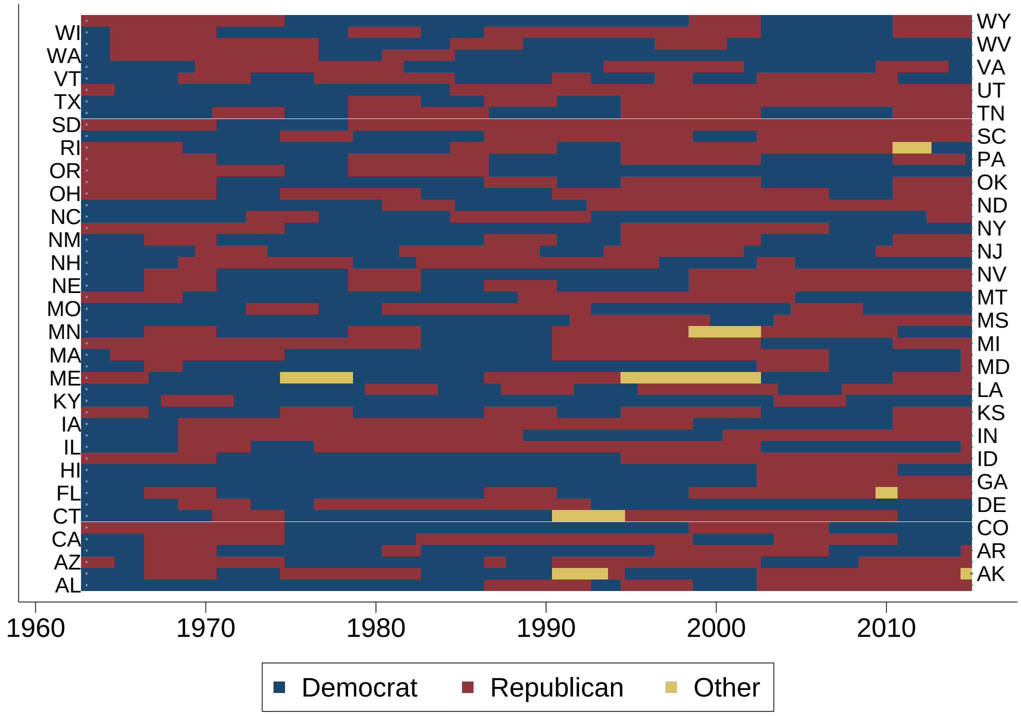
We define taxes as current tax receipts plus transfer receipts from persons and business minus federal transfers, but plus federal transfers to state and local governments. We smooth the population estimate by initializing population to be the value in the data and then updating population as: $Pop_t = \frac{3}{4}Pop_{t-1} + \frac{1}{4}CNP16OV_t$.

Table A.1: Sample means of main variables and the significance of partisan differences in 4pp MOV samples, 1983–2014.

	Full sample	Sample with close elections			Dem=Rep t-stat		
					Fixed effects?		
	1983-2014	Within 4pp.	Dem<4pp.	Rep<4pp.	None	St+Yr	St+Reg×Yr
Expenditure growth	2.6	2.6	2.7	2.5	-0.3	-1.4	1.6
Net general rev gr	2.2	2.8	3.1	2.6	-1.1	-0.9	0.3
Income sales tax rev gr	2.1	2.7	2.9	2.5	-0.6	-0.5	1.1
Tax rev growth	2.0	2.6	2.8	2.5	-0.5	-0.5	0.9
IG growth	3.3	3.3	3.1	3.4	0.3	-0.6	-0.2
IG increases	5.0	4.6	4.6	4.6	0.0	-0.5	-0.4
IG decreases	-1.6	-1.3	-1.5	-1.2	1.0	-0.4	0.2
IG growth excl welfare	2.2	2.9	2.8	3.0	0.1	-0.6	0.8
IG incr excl welfare	4.9	5.3	5.3	5.3	-0.0	-0.4	1.0
IG decr excl welfare	-2.8	-2.4	-2.5	-2.3	0.2	-0.5	0.6
Prior exp growth	2.9	2.0	2.5	1.7	-0.9	-0.4	2.5
Prior IG growth	3.3	3.5	3.9	3.3	-0.3	-0.0	0.5
Prior IG growth excl welfare	2.7	2.0	3.5	0.8	-0.8	-0.3	1.8
Republican incumbent share:	48.0	47.7	50.4	45.6	-0.4	-2.5	0.7
Dem share in legislature	55.9	56.9	54.3	58.5	0.9	4.4	0.4
Observations	1508.0	269.0	113.0	156.0	1.2	.	.

Shares and ratios in percent. All growth rates are real per capita. t-statistics based on standard errors clustered by state and year after removing state and year fixed effects, or state and broad census-region×year fixed effects. t statistics are based on regression. Regressions include only governor dummies.

(a) Full sample: 1963–2014



(b) Baseline sample: 1983–2014

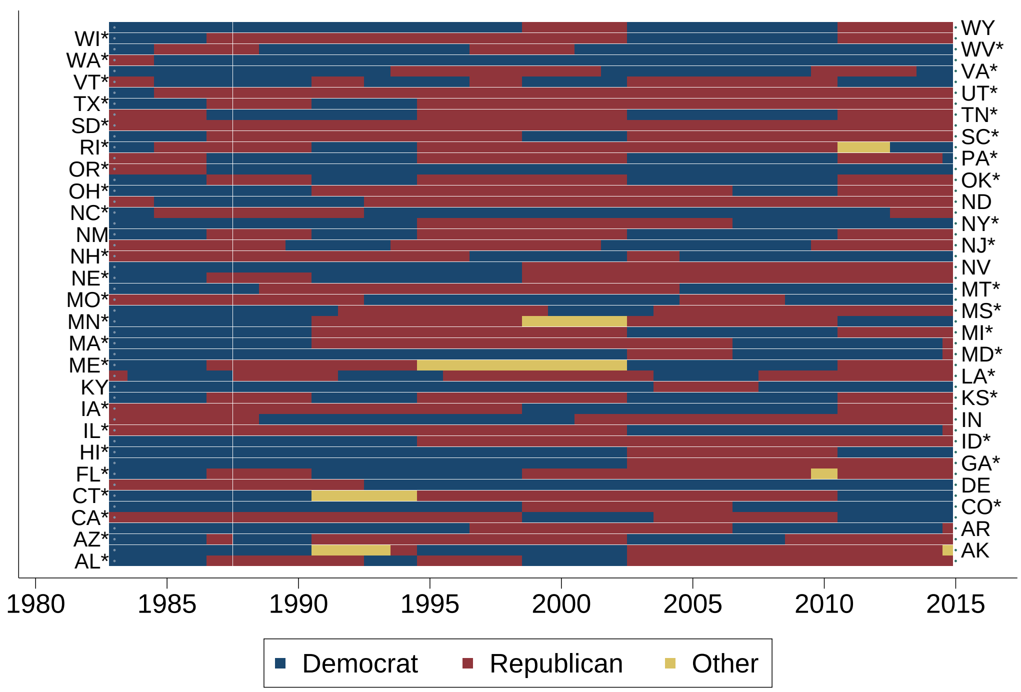


Figure A.2: State composition

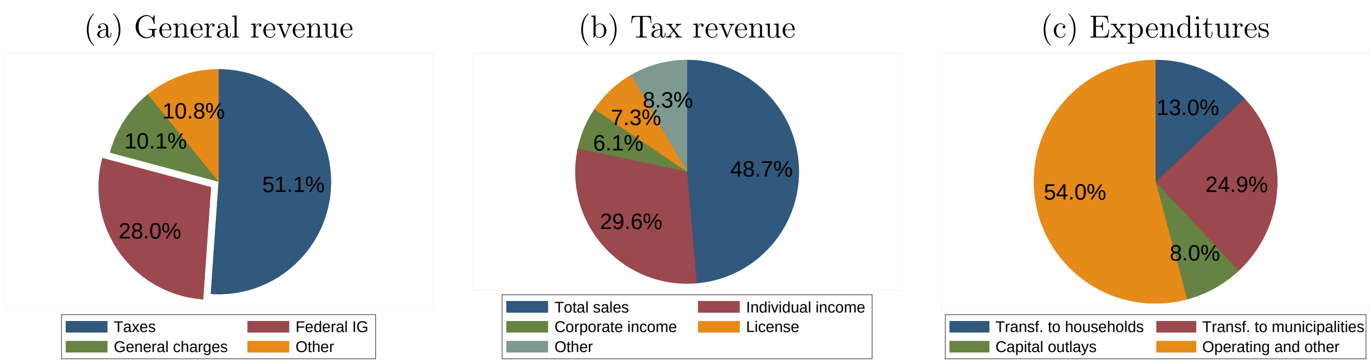


Figure A.3: State budgets: Average shares from 1983–2014

B Identification

B.1 Exogenous interaction variable

Let

$$Y = X\alpha + XD\beta + \epsilon, \tag{B.1}$$

where all variables are zero mean.

X may be correlated with ϵ, so that $\mathbb{E}[X\epsilon] \neq 0$. However, we assume that – in a sample of sufficiently close elections:

$$D \perp\!\!\!\perp (\epsilon, X). \tag{B.2}$$

The OLS estimator of $\theta = [\alpha, \beta]'$ is then given by:

$$\hat{\theta} \equiv \begin{bmatrix} \sum_{i,t} x_{i,t}^2 & \sum_{i,t} x_{i,t}^2 d_{i,t} \\ \sum_{i,t} x_{i,t}^2 d_{i,t} & \sum_{i,t} x_{i,t}^2 d_{i,t}^2 \end{bmatrix}^{-1} \begin{bmatrix} \sum_{i,t} x_{i,t}^2 y_{i,t} \\ \sum_{i,t} x_{i,t} d_{i,t} y_{i,t} \end{bmatrix} = \begin{bmatrix} \sum_{i,t} x_{i,t}^2/N & \sum_{i,t} x_{i,t}^2 d_{i,t}/N \\ \sum_{i,t} x_{i,t}^2 d_{i,t}/N & \sum_{i,t} x_{i,t}^2 d_{i,t}^2/N \end{bmatrix}^{-1} \begin{bmatrix} \sum_{i,t} x_{i,t}^2 y_{i,t}/N \\ \sum_{i,t} x_{i,t} d_{i,t} y_{i,t}/N \end{bmatrix}$$

where N is the sample size.

To see the estimand associated with $\hat{\beta}$, use a LLN and Slutsky's theorem to write:

$$\begin{bmatrix} \sum_{i,t} x_{i,t}^2/N & \sum_{i,t} x_{i,t}^2 d_{i,t}/N \\ \sum_{i,t} x_{i,t}^2 d_{i,t}/N & \sum_{i,t} x_{i,t}^2 d_{i,t}^2/N \end{bmatrix}^{-1} \begin{bmatrix} \sum_{i,t} x_{i,t}^2 y_{i,t}/N \\ \sum_{i,t} x_{i,t} d_{i,t} y_{i,t}/N \end{bmatrix} \xrightarrow{p} \begin{bmatrix} \mathrm{Var}[X] & \mathrm{Cov}[X, XD] \\ \mathrm{Cov}[X, XD] & \mathrm{Var}[XD] \end{bmatrix}^{-1} \begin{bmatrix} \mathrm{Cov}[X, Y] \\ \mathrm{Cov}[XD, Y] \end{bmatrix}$$

We first show that $\mathrm{Cov}[X, XD] = 0$ and $\mathrm{Cov}[XD, Y] = \mathrm{Var}[XD]\beta$, so that $\hat{\beta} \xrightarrow{p} \beta$ under regularity conditions.

1. Claim: $\mathrm{Cov}[X, XD] = 0$.

   $$\mathrm{Cov}[X, XD] = \mathbb{E}[X \times XD] = \mathbb{E}[X^2 \mathbb{E}[D|X]] = \mathbb{E}[X^2 \mathbb{E}[D]] = \mathbb{E}[X^2] \times \mathbb{E}[D] = \mathbb{E}[X^2] \times 0 = 0,$$

   where the first equality follows from the zero mean property of the RHS variables. The second equality is using the law of iterated expectations. The third equality uses Assumption (B.2). We then factor the expectations and use in the second-to-last equality again that D has mean zero.

2. Claim: $\mathrm{Cov}[XD, Y] = \mathrm{Var}[XD]\beta$.

   $$\begin{aligned} \mathrm{Cov}[XD, Y] &= \mathbb{E}[XD \times Y] = \mathbb{E}[X^2 D\alpha + (XD)^2\beta + XD \times \epsilon] \\ &= \mathrm{Var}[XD]\beta + \mathbb{E}[(X^2 + X\epsilon)\mathbb{E}[D|X, \epsilon]] = \mathrm{Var}[XD]\beta + \mathbb{E}[(X^2 + X\epsilon)\mathbb{E}[D]] \\ &= \mathrm{Var}[XD]\beta + \mathbb{E}[(X^2 + X\epsilon)] \times \mathbb{E}[D] = \mathrm{Var}[XD]\beta + 0, \end{aligned}$$

   where the steps mirror that for the previous claim.

Since $\text{Cov}[X, XD] = 0$, $\begin{bmatrix} \text{Var}[X] & \text{Cov}[X, XD] \\ \text{Cov}[X, XD] & \text{Var}[XD] \end{bmatrix}^{-1} = \text{diag}([\text{Var}[X], \text{Var}[XD]])^{-1}$ and, therefore, $\hat{\beta} \xrightarrow{p} \text{Var}[XD]^{-1} \text{Cov}[XD, Y] = \beta$.

In a setting with $Y = X\alpha + XD\beta + \mathbf{W}'\gamma + \epsilon$, the corresponding assumption is that $D \perp\!\!\!\perp (\epsilon, X, \mathbf{W})$.

While we cannot test our assumption in terms of ϵ, we can test the unconditional correlations of X and D. Indeed, as our discussion of Table 1 highlights, there are no significant partisan differences in our main model variables.

B.2 Bias with matching grants

Consider a simple linear model where party affiliation is exogenous to everything else, but IG transfers (IG) are a function of state spending (E) as well as an exogenous component X. Let μ_p be the mean spending by a governor of party p and let γ_p be the party's IG pass-through to spending. Then

$$\begin{aligned} IG &= X + \theta E \\ E &= \mu_p + \gamma_p IG + \omega_p \epsilon \\ &= \frac{\mu_p + \gamma_p X + \omega_p \epsilon}{1 - \gamma_p \theta}, \end{aligned}$$

where $\omega_p \epsilon$ is the exogenous spending shock – whose variance ω_p^2 may be party-specific.

What does the OLS estimator estimate in population?

$$\gamma_{p,OLS} = \frac{\text{Cov}[IG, E]}{\text{Var}[IG]} = \gamma_p + \frac{\text{Cov}[IG, \omega_p \epsilon]}{\text{Var}[IG]}$$

The various terms are:

$$\begin{aligned} \text{Cov}[IG, \omega_p \epsilon] &= \text{Cov}\left[\frac{1 - \gamma_p \theta + \theta \gamma_p}{1 - \gamma_p \theta} X + \theta \frac{\omega_p}{1 - \gamma_p \theta}, \omega_p \epsilon\right] = \frac{\theta}{1 - \gamma_p \theta} \omega_p^2 \\ \text{Var}[IG] &= \text{Var}\left[\frac{1 - \gamma_p \theta + \theta \gamma_p}{1 - \gamma_p \theta} X + \theta \frac{\omega_p}{1 - \gamma_p \theta}\right] = \frac{1}{(1 - \gamma_p \theta)^2} \left(\text{Var}[X] + \theta^2 \omega_p^2\right) \end{aligned}$$

Thus:

$$\gamma_{p,OLS} = \gamma_p + \theta \frac{(1 - \gamma_p \theta)^2}{1 - \gamma_p \theta} \frac{\omega_p^2}{\text{Var}[X] + \theta^2 \omega_p^2} = \gamma_p + \theta(1 - \gamma_p \theta) \frac{\omega_p^2}{\text{Var}[X] + \theta^2 \omega_p^2}$$

If IG is exogenous ($\theta = 0$), then the estimator is consistent. More generally, it is biased.

To get a tractable expression for the bias, assume equal variances of expenditure shocks, i.e., $\omega_p = \omega$, independent of party affiliation. Then the difference between pass-through estimators (which we focus on) is:

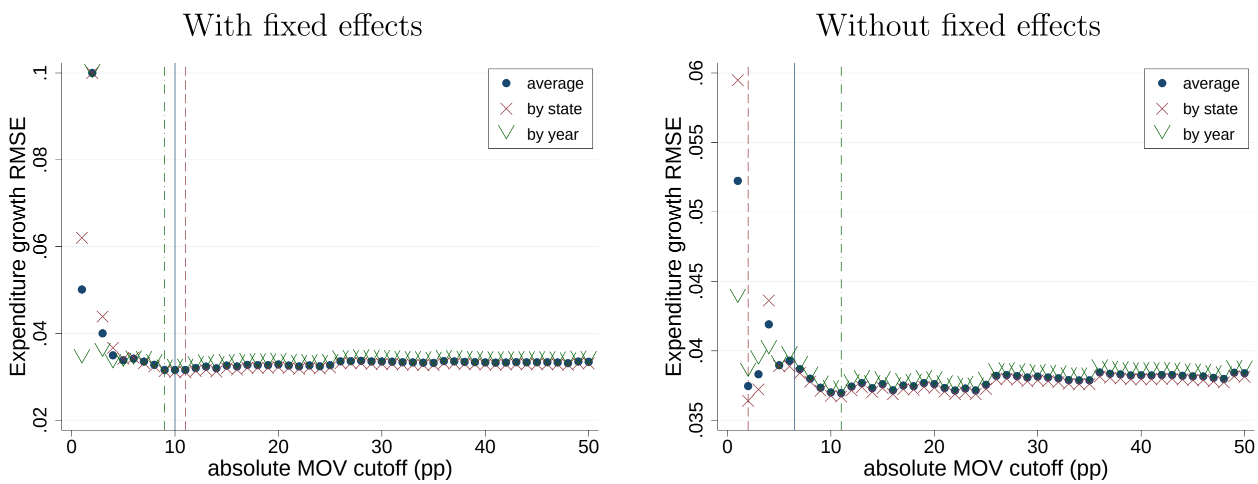
$$\gamma_{R,OLS} - \gamma_{D,OLS} = \gamma_R - \gamma_D + \theta \frac{\omega^2}{\text{Var}[X] + \theta^2 \omega^2} \left(1 - \gamma_R \theta) - (1 - \gamma_D \theta)\right)$$

$$
\begin{aligned}
&= \gamma_R - \gamma_D + \frac{\theta^2\omega^2}{\operatorname{Var}[X] + \theta^2\omega^2}\gamma_D - \gamma_R) \\
&= (\gamma_R - \gamma_D)\frac{\operatorname{Var}[X]}{\operatorname{Var}[X] + \theta^2\omega^2}
\end{aligned}
$$

Thus, under the assumption of equal variance of expenditure shocks, the difference between pass-throughs is proportional to the object of interest $\gamma_R - \gamma_D$ – and biased down. The factor of proportionality approaches unity as the role of matching declines to zero, either because IG is largely exogenous ($\operatorname{Var}[\omega\epsilon]/\operatorname{Var}[X] \to 0$) or because $\theta \searrow 0$.

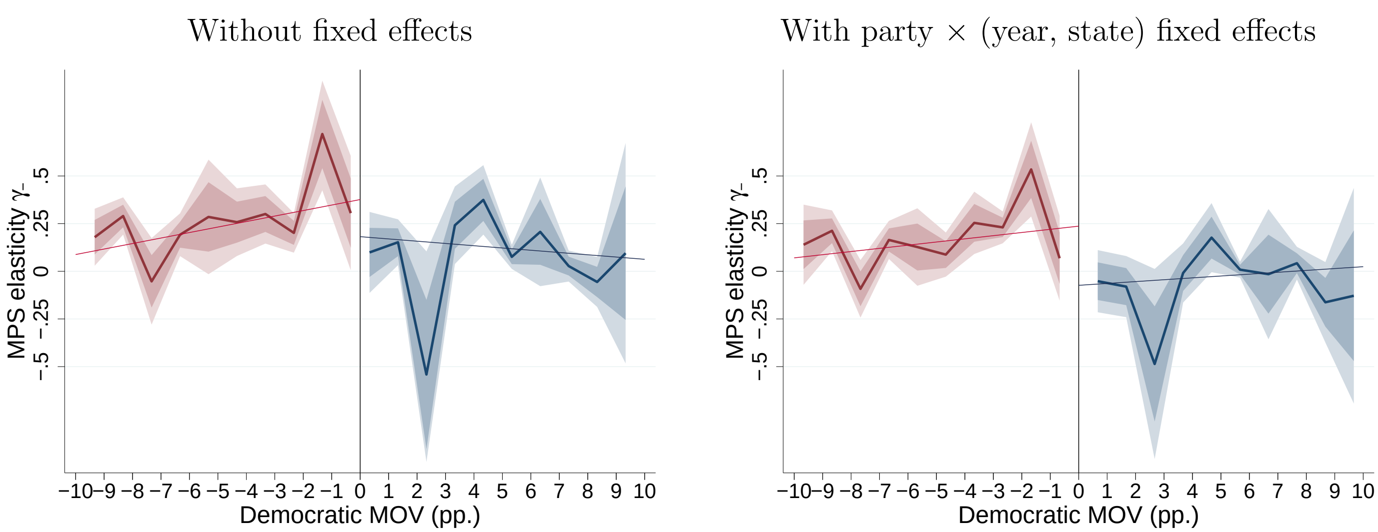
C Additional estimates

C.1 RDD type results



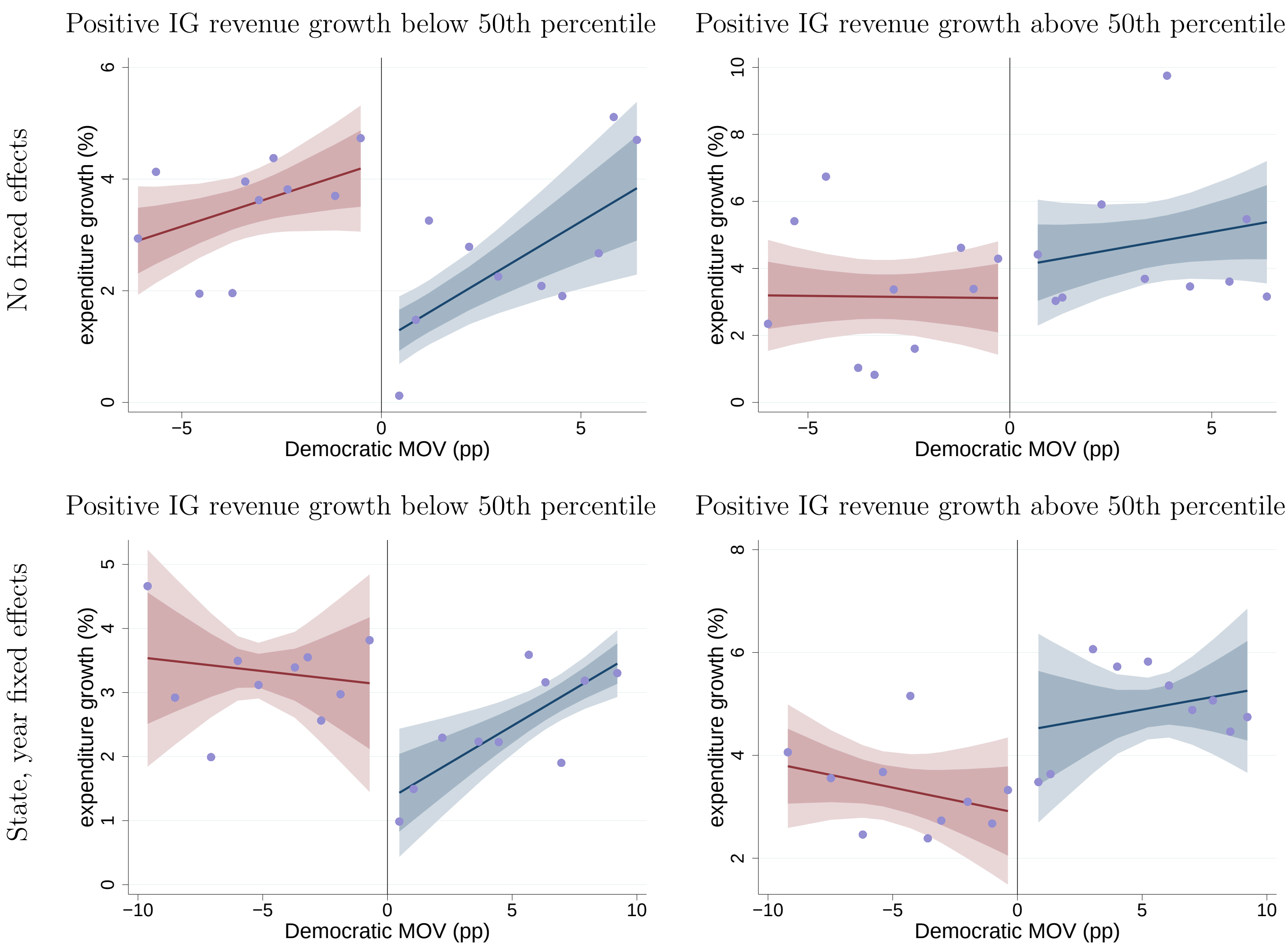
RMSE truncated at 0.1. Underlying regression is (2.3). RMSE is based on within fit, i.e., net of fixed effects for validating the model with fixed effects.

Figure C.1: Choosing optimal bandwidth by minimizing RMSE via cross-validation either by year or by state with party $\times$(year, state) fixed effects and without fixed effects



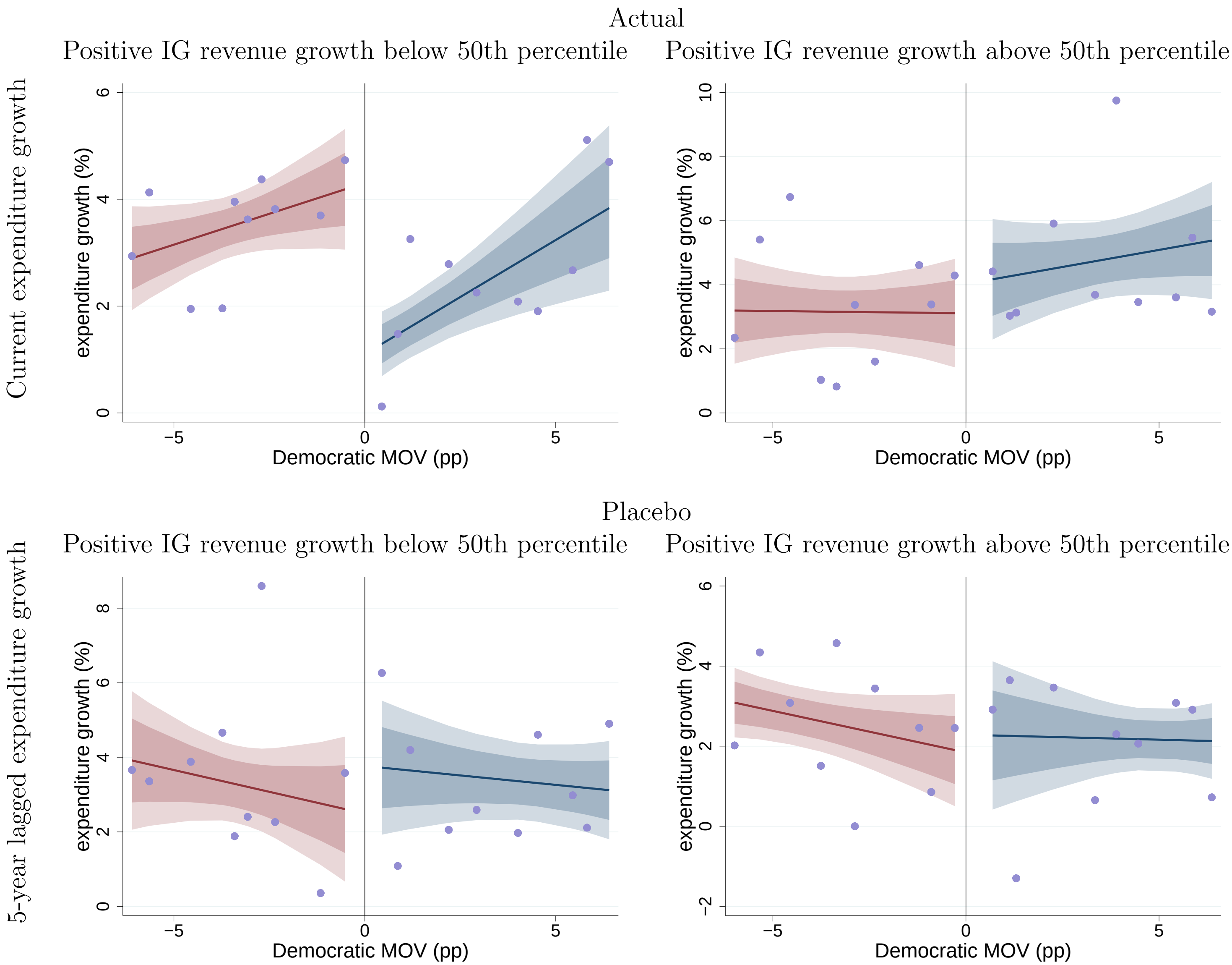
The plots show the estimated marginal propensity to spend (MPS) elasticity along with $\pm 1(\pm 1.65)$s.e. clustered by year and state for each 1pp MOV bin. The standard errors are computed pointwise by estimating (2.3) without MOV controls with party$\times$year and party$\times$state fixed effects (or without any fixed effects) and all slope coefficients and intercepts interacted with dummies for each MOV bin. Overlaid are linear regressions weighted by the inverse squared s.e.

Figure C.2: Illustrating our regression discontinuity in slopes, 1983–2014: Republican governors pass more of IG decreases on to spending cuts.



±1 (±1.65) standard errors, based on coefficient standard errors clustered by year and state. No fixed effects. All observations receive equal weights within the shown MOV range.

Figure C.3: Expenditure growth binned RDD plot by IG transfer growth: Democratic governors increase expenditure more as IG transfers rise.



±1 (±1.65) standard errors, based on coefficient standard errors clustered by year and state. No fixed effects. All observations receive equal weights within the shown MOV range.

Figure C.4: Expenditure growth binned RDD plot by IG transfer growth: Democratic governors increase expenditure more as IG transfers rise. No FE. Placebo test.

C.2 Expenditure growth

Table C.1: Partisan difference in the response to severance tax revenue changes: states with at least 1% severance tax revenue, 1983 to 2014.

	OLS (1)	OLS (2)	OLS (3)	OLS (4)	IV (1)	IV (2)
Δ severance tax rev (t-1)	0.630***	0.633***	0.651***	0.618***	1.699**	1.735**
	(4.30)	(4.44)	(4.39)	(3.60)	(2.48)	(2.30)
Rep x Δ sever. tax rev (t-1)	-0.288***	-0.252***	-0.277***	-0.188	-1.927***	-1.953***
	(-2.86)	(-3.24)	(-4.33)	(-1.12)	(-3.06)	(-2.93)
Republican Gov.	-0.004	-0.006	0.000	-0.003	-0.005	0.000
	(-1.06)	(-0.98)	(.)	(-0.73)	(-0.95)	(.)
R-squared	0.05	0.09	0.11	0.24	-0.06	-0.05
R-sq, within	0.05	0.06	0.06	0.06	-0.10	-0.10
Observations	369	367	363	369	367	363
States	21	19	19	21	19	19
Years	32	32	32	32	32	32
Fixed effects	No	State	Party x State	Year	State	Party x State

Sample of all states with at least 1% of revenue generated by severances taxes five years ago. The following states are ever in the sample: AL, AK, AR, CO, FL, KS, KY, LA, MN, MS, MT, NM, ND, NV, OK, OR, SD, TX, UT, WV, and WY. Standard errors clustered by state and year.

Table C.2: Partisan difference in marginal propensity to spend out of IG revenue in the aftermath of the Great Recession

	(1)	(2)	(3)	(4)	(5)	(6)
4-yr IG growth	0.513***	0.543***	0.584***	0.569***	0.311***	0.525***
	(8.38)	(8.87)	(8.54)	(7.86)	(7.45)	(4.10)
4-yr Republican fraction	-0.022	-0.024	-0.023	-0.027	-0.031	-0.024
	(-0.87)	(-0.97)	(-0.90)	(-1.11)	(-1.10)	(-0.97)
4-yr Rep. x 4-yr IG growth	-0.243*	-0.325**	-0.451***	-0.478***	-0.308***	-0.386**
	(-2.00)	(-2.69)	(-3.14)	(-3.49)	(-3.96)	(-2.54)
R-squared	0.64	0.67	0.70	0.74	0.68	0.53
Observations	50	47	40	40	40	36
Other FE	No	No	No	Region	Region	Region
Exclude wealth funds?	No	Yes	Yes	Yes	Yes	Yes
Line item veto only?	No	No	Yes	Yes	Yes	Yes
Which IG	All	All	All	All	No welfare	Positive growth

Data on all elections. We regress 4-yr expenditure growth regression for $t \in \{2008, 2012\}$: $\ln \frac{E_{s,t}}{E_{s,t-4}} = \alpha_s + \beta_R \left(\frac{1}{4}\sum_{j=1}^{4} Rep_{s,t-j}\right) + \gamma_0 \ln \frac{IG_{s,t}}{IG_{s,t-4}} + \gamma_R \left(\frac{1}{4}\sum_{j=1}^{4} Rep_{s,t-j}\right) \times \ln \frac{IG_{s,t}}{IG_{s,t-4}} + \epsilon_{s,t}$, yielding an effective sample of one difference per state. Standard errors are heteroskedasticity robust.

Table C.3: Marginal propensities to spend (elasticity) by use of expenditure: All elections, cubic MOV controls, 1983 to 2014.

	ExpOther	Educ	PublicWelf	Highways	NatResPark	FinAdmin	Judicial	HousCom	Sanitation	AirTrans
IG incr.	0.358**	0.137	0.232	0.301	0.156	0.258	0.084	2.046	-0.063	3.506
	(2.71)	(1.24)	(1.14)	(1.50)	(0.90)	(0.62)	(0.51)	(1.32)	(-0.05)	(1.47)
IG decr.	0.419	0.061	0.163	0.620	-0.497*	-0.251	0.275	-0.891	-1.990	-2.853
	(1.53)	(0.41)	(1.08)	(1.35)	(-1.85)	(-0.69)	(0.71)	(-0.72)	(-1.14)	(-1.31)
Rep x IG incr.	-0.579***	-0.457**	0.350	0.202	-0.739*	-0.480	-0.050	-3.893**	0.627	-3.963
	(-2.92)	(-2.70)	(0.89)	(0.75)	(-1.95)	(-0.94)	(-0.17)	(-2.11)	(0.35)	(-1.38)
Rep x IG decr.	-0.164	0.502**	0.428	-0.039	1.193**	0.829	-0.349	1.160	4.945	6.652
	(-0.32)	(2.32)	(1.23)	(-0.06)	(2.58)	(1.55)	(-1.00)	(0.66)	(1.34)	(1.31)
R-squared	0.29	0.22	0.38	0.16	0.13	0.14	0.40	0.18	0.12	0.11
R-sq, within	0.04	0.02	0.15	0.06	0.02	0.02	0.03	0.04	0.01	0.02
Observations	1224.00	1497.00	1497.00	1497.00	1497.00	1497.00	1497.00	1478.00	1240.00	1300.00
States	48	48	48	48	48	48	48	48	46	47
Years	26	32	32	32	32	32	32	32	32	32
Expenditure share	33.1	32.7	19.4	8.5	2.4	1.5	1.1	0.6	0.4	0.2

Estimated using equation (2.3). Party by year and party by state fixed effects. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.4: Partisan determinants of total expenditure growth by state governments over longer horizons: (transfers exclude welfare) 1983 to 2014, 4pp MOV

Horizon	(1) 1-year	(2) 2-year	(3) 3-year	(4) 4-year	3-year, alternative specifications			
MOV	≤10%	≤10%	≤10%	≤10%	≤10%	≤10%	≤100%	≤4%
IG incr.	0.181***	0.286***	0.247***	0.268***	0.229***	0.263***	0.282***	0.177***
	(4.16)	(4.07)	(3.12)	(4.34)	(3.05)	(3.02)	(4.19)	(3.21)
Rep x IG incr.	-0.266***	-0.340**	-0.267**	-0.264**	-0.220*	-0.224**	-0.238**	-0.186***
	(-3.49)	(-2.55)	(-2.11)	(-2.13)	(-1.77)	(-2.17)	(-2.62)	(-2.77)
IG decr.	-0.018	-0.114**	-0.148***	-0.133	-0.104*	-0.150***	-0.051	0.070
	(-0.26)	(-2.38)	(-4.50)	(-1.62)	(-1.82)	(-3.01)	(-1.12)	(1.30)
Rep x IG decr.	0.337***	0.351***	0.211*	-0.004	0.255**	0.235**	0.094	0.082
	(3.33)	(4.24)	(1.70)	(-0.02)	(2.38)	(2.33)	(0.78)	(1.02)
R-squared	0.54	0.65	0.68	0.67	0.60	0.69	0.62	0.83
R-sq, within	0.10	0.13	0.12	0.12	0.15	0.13	0.14	0.11
Observations	634.00	634.00	634.00	634.00	636.00	634.00	1497.00	259.00
States	47	47	47	47	47	47	48	41
Years	32	32	32	32	32	32	32	32
StateFE	By party	By party	By party	By party	Yes	Yes	By party	By party
YearFE	By party	By party	By party	By party	Yes	By region	By party	By party
Controls	Linear	Linear	Linear	Linear	Linear	Linear	Cubic	No

Estimated using equation 2.3. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.5: Robustness of partisan determinants of total expenditure growth by state governments: Interaction with economic variables. 5pp MOV sample, 1983 to 2014.

	Control variable					
	(1) None	(2) Debt	(3) IG rev. share	(4) Pop. growth	(5) Exp/GDP	(6) Rev/GDP
Pos IG growth	0.195***	0.189***	0.228***	0.207***	0.141***	0.192***
	(5.90)	(5.75)	(3.83)	(5.64)	(3.44)	(6.38)
Neg IG growth	-0.020	-0.010	-0.022	-0.072	0.023	-0.028
	(-0.27)	(-0.13)	(-0.31)	(-0.94)	(0.24)	(-0.26)
Rep gov x Pos IG growth	-0.233***	-0.232***	-0.293***	-0.233***	-0.170**	-0.242***
	(-3.40)	(-3.33)	(-3.01)	(-3.10)	(-2.57)	(-3.67)
Rep gov x Neg IG growth	0.264**	0.295**	0.254**	0.363***	0.187	0.278**
	(2.69)	(2.68)	(2.36)	(3.87)	(1.58)	(2.06)
Control		-0.008	0.123	-1.507	-1.659**	-0.193
		(-0.88)	(0.44)	(-1.20)	(-2.13)	(-0.25)
Control x Pos IG growth		0.011	-0.849	3.747	-1.743	1.430
		(0.25)	(-1.04)	(1.32)	(-0.58)	(0.33)
Control x Neg IG growth		0.001	0.091	-11.979	0.381	0.560
		(0.05)	(0.06)	(-1.27)	(0.13)	(0.19)
Rep gov x Control x Pos IG growth		0.002	0.680	3.509	2.411	0.214
		(0.04)	(0.55)	(0.60)	(0.75)	(0.04)
Rep gov x Control x Neg IG growth		-0.023	-2.699	19.506*	-6.857*	-9.022
		(-1.10)	(-1.53)	(1.71)	(-1.99)	(-1.61)
Rep gov x Control		0.010	-0.729**	1.182	-2.041*	-1.284
		(1.15)	(-2.64)	(0.77)	(-1.99)	(-1.36)
R-squared	0.65	0.66	0.68	0.67	0.75	0.67
R-sq, within	0.13	0.15	0.21	0.17	0.36	0.17
Observations	313	313	313	313	313	313
States	43	43	43	43	43	43
Years	32	32	32	32	32	32

Estimated using equation 2.3 without MOV controls. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.6: Partisan determinants of total expenditure growth by state governments: 1983 to 2014. Effects of dropping New England and states without line item veto.

	All	w/o NE	Veto	All	w/o NE	Veto	All	w/o NE	Veto
IG incr.	0.193***	0.218***	0.197***	0.228***	0.238***	0.237***	0.194***	0.241***	0.229***
	(6.14)	(7.84)	(6.89)	(7.08)	(8.11)	(7.66)	(5.37)	(8.61)	(8.44)
IG decr.	-0.108	-0.194	-0.053	-0.124	-0.193**	-0.151	-0.034	-0.309***	-0.211**
	(-1.12)	(-1.70)	(-0.45)	(-1.67)	(-2.11)	(-1.44)	(-0.56)	(-2.95)	(-2.26)
Republican Gov.	0.021*	0.033**	0.035**	0.014*	0.010	0.010			
	(1.96)	(2.41)	(2.53)	(1.77)	(1.35)	(1.21)			
Rep x IG incr.	-0.183**	-0.232**	-0.255***	-0.328***	-0.331***	-0.364***	-0.271***	-0.323***	-0.323***
	(-2.05)	(-2.68)	(-3.04)	(-5.16)	(-5.16)	(-4.96)	(-3.88)	(-3.45)	(-4.38)
Rep x IG decr.	0.216*	0.320***	0.220	0.368***	0.419***	0.405***	0.266***	0.591***	0.507***
	(2.00)	(3.43)	(1.64)	(4.35)	(3.98)	(3.38)	(3.58)	(4.29)	(3.96)
R-squared	0.75	0.77	0.75	0.62	0.65	0.64	0.69	0.73	0.72
R-sq, within	0.12	0.16	0.15	0.18	0.21	0.22	0.12	0.16	0.16
Observations	239	200	214	266	229	239	259	221	234
States	40	35	36	41	35	36	41	35	36
Years	31	30	30	32	32	31	32	31	31
State FE	Yes	Yes	Yes	Yes	Yes	Yes	By party	By party	By party
Year FE	By region	By region	By region	Yes	Yes	Yes	By party	By party	By party
Sample	all	w/o NE	Item Veto	all	w/o NE	Item Veto	all	w/o NE	Item Veto

Estimated using equation 2.3 without MOV controls in 4pp sample. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.7: Partisan determinants of total expenditure growth by state governments: 1983 to 2014. Effects of switching governors in sample with line-item veto.

	Veto	Switches	Veto	Switches	Veto	Switches
IG incr.	0.197***	0.195***	0.237***	0.243***	0.229***	0.209***
	(6.89)	(6.06)	(7.66)	(6.01)	(8.44)	(5.87)
IG decr.	-0.053	0.163	-0.151	-0.054	-0.211**	0.098
	(-0.45)	(1.27)	(-1.44)	(-0.37)	(-2.26)	(0.63)
Republican Gov.	0.035**	0.038	0.010	0.015		
	(2.53)	(1.25)	(1.21)	(0.74)		
Rep x IG incr.	-0.255***	-0.076	-0.364***	-0.261***	-0.323***	-0.151*
	(-3.04)	(-0.78)	(-4.96)	(-3.29)	(-4.38)	(-1.79)
Rep x IG decr.	0.220	-0.076	0.405***	0.236	0.507***	0.111
	(1.64)	(-0.71)	(3.38)	(1.62)	(3.96)	(0.65)
R-squared	0.75	0.76	0.64	0.72	0.72	0.78
R-sq, within	0.15	0.25	0.22	0.23	0.16	0.23
Observations	214	83	239	129	234	112
States	36	18	36	25	36	23
Years	30	22	31	28	31	25
State FE	Yes	Yes	Yes	Yes	By party	By party
Year FE	By region	By region	Yes	Yes	By party	By party
Sample	Item Veto	Switch	Item Veto	Switch	Item Veto	Switch

Estimated using equation 2.3 without MOV controls in 4pp sample. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.8: Partisan determinants of total expenditure growth by state governments: 1983 to 2014. Effects of excluding election years.

	All	No elec.	All	No elec.	All	No elec.
IG incr.	0.193***	0.235***	0.228***	0.216***	0.194***	0.229***
	(6.14)	(6.63)	(7.08)	(5.70)	(5.37)	(7.71)
IG decr.	-0.108	0.005	-0.124	-0.076	-0.034	0.061
	(-1.12)	(0.04)	(-1.67)	(-0.84)	(-0.56)	(0.51)
Republican Gov.	0.021*	0.030**	0.014*	0.013		
	(1.96)	(2.66)	(1.77)	(1.40)		
Rep x IG incr.	-0.183**	-0.243**	-0.328***	-0.351***	-0.271***	-0.362***
	(-2.05)	(-2.19)	(-5.16)	(-4.87)	(-3.88)	(-5.17)
Rep x IG decr.	0.216*	0.114	0.368***	0.330***	0.266***	0.180
	(2.00)	(0.77)	(4.35)	(3.18)	(3.58)	(1.27)
R-squared	0.75	0.80	0.62	0.67	0.69	0.74
R-sq, within	0.12	0.20	0.18	0.20	0.12	0.19
Observations	239	158	266	197	259	183
States	40	38	41	40	41	39
Years	31	23	32	30	32	27
State FE	Yes	Yes	Yes	Yes	By party	By party
Year FE	By region	By region	Yes	Yes	By party	By party
Sample	all	No election	all	No election	all	No election

Estimated using equation 2.3 without MOV controls in 4pp sample. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

Table C.9: Legislative control and partisan determinants of total expenditure growth by state governments: Interaction with share of Democratic legislatures in state congress. 5pp MOV, 1983 to 2014.

	(1) Baseline	(2) Item veto	(3) Interacted	(4) Interacted & item veto
Pos IG growth	0.195***	0.214***	0.102***	0.109**
	(5.90)	(7.54)	(2.90)	(2.55)
Neg IG growth	-0.020	-0.078	-0.145	-0.337*
	(-0.27)	(-0.64)	(-1.03)	(-1.85)
Rep gov x Pos IG growth	-0.233***	-0.266***	-0.134*	-0.137
	(-3.40)	(-3.02)	(-1.74)	(-1.57)
Rep gov x Neg IG growth	0.264**	0.327*	0.463***	0.637***
	(2.69)	(1.91)	(2.85)	(3.15)
Control			0.082	-0.049
			(0.82)	(-0.37)
Control x Pos IG growth			1.505**	1.681**
			(2.21)	(2.19)
Control x Neg IG growth			-2.401*	-3.785**
			(-1.99)	(-2.74)
Rep gov x Control x Pos IG growth			-1.456	-1.819*
			(-1.66)	(-1.78)
Rep gov x Control x Neg IG growth			1.842	3.299**
			(1.44)	(2.28)
Rep gov x Control			-0.023	0.120
			(-0.17)	(0.68)
R-squared	0.65	0.68	0.68	0.70
R-sq, within	0.13	0.14	0.22	0.24
Observations	313	270	279	239
States	43	36	41	35
Years	32	31	30	29

Estimated using equation 3.1 without MOV controls but with Democratic share of legislature instead of polarization measure. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

C.3 Private sector activity

Table C.10: Partisan determinants of employment-to-population ratio changes: 1983 to 2014.

	Current ($t-\frac{1}{2}$) total employment					Future ($t+\frac{1}{2}$) emp.	
	with MOV terms				no MOV	with MOV terms	no MOV
MOV cutoff	(1) ≤10pp	(2) ≤10pp	(3) ≤10pp	(4) ≤100pp	(5) ≤4pp	(6) ≤10pp	(7) ≤4pp
IG incr.	2.175	2.081	3.478***	2.854*	4.376**	-0.047	-2.793***
	(1.55)	(1.55)	(2.94)	(1.74)	(2.44)	(-0.04)	(-3.37)
Rep x IG incr.	-3.847**	-3.829**	-5.208***	-4.813**	-4.684**	-0.475	3.680***
	(-2.21)	(-2.23)	(-3.46)	(-2.37)	(-2.52)	(-0.32)	(3.78)
IG decr.	0.093	0.644	-0.141	1.406	-1.199	-1.574	-0.416
	(0.05)	(0.45)	(-0.11)	(1.09)	(-0.63)	(-0.91)	(-0.31)
Rep x IG decr.	-0.755	-1.037	-0.382	-0.923	0.099	0.282	-0.862
	(-0.29)	(-0.62)	(-0.25)	(-0.49)	(0.04)	(0.14)	(-0.58)
Republican Gov.	0.000	0.050	0.132			0.000	
	(0.00)	(0.31)	(0.80)			(0.00)	
R-squared	0.79	0.76	0.84	0.77	0.84	0.78	0.86
R-sq, within	0.05	0.05	0.09	0.07	0.16	0.02	0.10
Observations	634	636	634	1497	259	634	259
States	47	47	47	48	41	47	41
Years	32	32	32	32	32	32	32
State FE	By party	Yes	Yes	By party	By party	By party	By party
Year FE	By party	Yes	By region	By party	By party	By party	By party
Controls	Linear MOV	Linear MOV	Linear MOV	Cubic MOV	No	Linear MOV	No

Estimated using equation 2.3. t-statistics based on standard errors clustered by state and year. p-values based on t-distribution with degrees of freedom equal to the number of year-clusters. ***: $p < 0.1$, **: $p < 0.05$, *: $p < 0.01$.

D Model appendix

D.1 Households

The economy consists of two representative regions, with (population) measures of $n \in (0, 1)$ and $1-n$, respectively. Two types of households live within each region. A measure $\mu \in (0, 1]$ of households is unconstrained, while a measure $1 - \mu$ of households has no access to saving or borrowing. Each household has the same labor endowment and supplies labor elastically.

Constrained home households Constrained households consume their entire income. They maximize utility by setting their labor supply N_t^c and consuming the proceeds.

$$U_t = \max_{\{C_s^u, B_s^u, N_s^u, I_s, u_s, K_s\}_{s \geq t}} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \tilde{u}(C_s^u, N_s; G_s^{st}) \tag{D.1}$$

$$P_t C_t^c \leq W_t N_t^c + Tr_t + Pr_t^c \tag{D.2}$$

Optimality:

$$[N_t^c] \qquad \tilde{u}_{c,t}((1-\tau_t)w_t N_t^c + tr_t + pr_t^c, N_t^c; G_s^{st})(1-\tau_t)\frac{W_t}{P_t} = -\tilde{u}_{c,t}((1-\tau_t)w_t N_t^c + tr_t + pr_t^c, N_t^c; G_s^{st}). \tag{D.3}$$

Preferences:

$$\tilde{u}(C, N; G^{st}) = \frac{\left(\left((1-\kappa_G^c)C^{1-1/\lambda} + \kappa_G^c((1-\phi)G^{st})^{1-1/\lambda}\right)^{\frac{\lambda}{\lambda-1}}\right)^{1-1/\epsilon_c} - 1}{1-1/\epsilon_c} - \kappa_N^c \frac{N^{1+1/\epsilon_N}}{1+1/\epsilon_N}.$$

$$\tilde{u}_c = C^{-1/\epsilon_c}(1-\kappa_G^c)\left((1-\kappa_G^c) + \kappa_G^c(G^{st}/C)^{1-1/\lambda}\right)^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}$$
$$\tilde{u}_N = \kappa_N^c N^{1/\epsilon_N}$$

For future reference, let lowercase letters denote the real counterpart of nominal variables, e.g., $w_t \equiv \frac{W_t}{P_t}$.

$$(1-\tau_t)(1-\kappa_G^c)w_t\left((1-\kappa_G^c) + \kappa_G^c(G^{st}/(w_t N_t^c + tr_t + pr_t^c))^{1-1/\lambda}\right)^{\frac{1-\lambda/\epsilon_C}{\lambda-1}} = \kappa_N^c (N_t^c)^{1/\varepsilon_N} C^{1/\epsilon_C}. \tag{D.4}$$

Given w_t, this equation implicitly pins down labor supply.

Unconstrained home households Unconstrained households choose consumption C_t^u, real bond holdings B_{t-1}^u/P_t, labor supply N_t^u, investment I_t^u, capacity utilization u_t, and physical capital K_{t-1} to maximize lifetime utility subject to the budget constraint, and the law of motion for capital.

$$U_t = \max_{\{C^u_s, B^u_s, N^u_s, I_s, u_s, K_s\}_{s\geq t}} \mathbb{E}_t \sum_{s=t}^{\infty} \beta^{s-t} u(C^u_s, B^u_{s-1}/P_t, N_s; G^{st}_s) \tag{D.5}$$

$$P_t(C^u_t + I_t) + K_{t-1}\delta(u_t) + B^u_t \leq (1-\tau_t)W_t N^u_t + r^k_t u_t K_{t-1} + B^u_{t-1}R^n_{t-1} + Tr_t + Pr_t \tag{D.6}$$

$$K_t \leq (1-\delta(u_t))K_{t-1} + \left(1 - \frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right) I_t \tag{D.7}$$

In the presence of complete markets, the household can also purchase a set of Arrow-Debreu securities at the beginning of time.

We model preferences of the unconstrained households as having the same functional form as those by the constrained households plus an additively separately demand for bond holdings:

$$u(C, b, N; G^{st}) = \tilde{u}(C, N; G^s t) + \kappa_b \frac{b^{1-1/\epsilon_b}}{1 - 1/\epsilon_b}. \tag{D.8}$$

This implies that the ratio of substitution between consumption and bonds is given by:

$$\frac{u_b}{u_c} = \kappa_b b^{-1/\epsilon_b} \frac{C^{1/\epsilon_c}}{(1 + \kappa^c_G (G^{st}/C)^{1-1/\lambda})^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}} \tag{D.9}$$

Using $\beta^t \lambda_t$ and $\beta^t \nu_t$ as the Lagrange multipliers on (D.48) and (D.7), the FOC are given by:

$$\begin{aligned}
&[C] & u_{c,t} &= \lambda_t P_t \\
&[N] & u_{N,t} &= -\lambda(1-\tau_t)W_t \\
&[B] & \lambda_t &= \mathbb{E}_t\left[\beta\left(\frac{u_{b,t+1}}{P_{t+1}} + \lambda_{t+1}R^n_t\right)\right] \\
&[I] & \lambda_t P_t &= \nu_t\left(1 - \frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2 - \kappa_I\left(\frac{I_t}{I_{t-1}} - 1\right)\frac{I_t}{I_{t-1}}\right) + \mathbb{E}_t\left[\beta\nu_{t+1}\left(\frac{I_{t+1}}{I_t} - 1\right)\frac{I_{t+1}}{I_t}\right] \\
&[K] & \nu_t &= \mathbb{E}_t\left[\beta\left((1-\delta_{t+1})\nu_{t+1} + (r^k_{t+1}u_{t+1} - \delta(u_{t+1}))\lambda_{t+1}\right)\right] \\
&[u] & \nu_t\delta'(u_t)K_{t-1} &= \lambda_t r^k_t K_{t-1}
\end{aligned}$$

Eliminating λ_t and defining $q^n_t \equiv \frac{\nu_t}{\lambda_t}$ and $M^n_{t+1} \equiv \beta \frac{u_{c,t+1}}{u_{c,t}} \frac{P_t}{P_{t+1}}$:

$$[N] \quad \frac{-u_{N,t}}{u_{c,t}} = (1-\tau_t)\frac{W_t}{P_t} \tag{D.10}$$

$$[B] \quad 1 = \mathbb{E}_t\left[M^n_{t+1}\left(\frac{u_{b,t+1}}{u_{c,t+1}} + R^n_t\right)\right] \tag{D.11}$$

$$[I] \qquad P_t = q_t^n\left(1-\frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}}-1\right)^2-\kappa_I\left(\frac{I_t}{I_{t-1}}-1\right)\frac{I_t}{I_{t-1}}\right)+\mathbb{E}_t\left[M_{t+1}^n q_{t+1}^n\left(\frac{I_{t+1}}{I_t}-1\right)\frac{I_{t+1}}{I_t}\right] \tag{D.12}$$

$$[K] \qquad q_t^n = \mathbb{E}_t\left[M_{t+1}^n\left((1-\delta_{t+1})q_{t+1}^n + r_{t+1}^k u_{t+1} - \delta(u_{t+1})\right)\right] \tag{D.13}$$

$$[u] \quad q_t^n\delta'(u_t) = r_t^k \tag{D.14}$$

Utilization costs:

$$\delta(u) = \bar{\delta}_0 + \bar{\delta}_1(u-1) + \frac{1}{2}\bar{\delta}_2(u-1)^2 \tag{D.15}$$

With this specification, $\delta'(1) = \bar{\delta}_1$, $\delta''(1) = \bar{\delta}_2$.

Private sector demand. Total home consumption is given by:

$$C_t = \mu C_t^u + (1-\mu)C_t^c. \tag{D.16}$$

$$N_t = \mu N_t^u + (1-\mu)N_t^c. \tag{D.17}$$

Total home investment is given by:

$$I_t = \mu I_t^c. \tag{D.18}$$

Similar equations hold for bond holdings and capital.

Following Nakamura and Steinsson (2014), the composite consumption (and investment) good is given by an aggregate of home and foreign varieties:

$$C_t = \left(\phi_H^{1/\eta}C_{Ht}^{1-1/\eta} + \phi_F^{1/\eta}\right)^{\frac{\eta}{\eta-1}}, \quad \phi_F = 1-\phi_H, \tag{D.19}$$

where the individual varieties enter as follows:

$$C_{Xt} = \left(\int_0^1 c_{xt}(z)^{1-1/\theta}dz\right)^{\frac{\theta}{\theta-1}}, \qquad X \in \{H, F\}. \tag{D.20}$$

All individual prices p_{xt} are denominated in "dollars" and common across regions.

The corresponding price indices and individual demands are:

$$C_{Xt} = \phi_X C_t\left(\frac{P_{Xt}}{P_t}\right)^{-\eta} \tag{D.21}$$

$$c_{xt}(z) = C_{Xt}\left(\frac{p_{xt}(z)}{P_{Xt}}\right)^{-\theta} \tag{D.22}$$

$$P_{Xt} = \left(\int_0^1 p_{xt}(z)^{1-\theta}dz\right)^{\frac{1}{1-\theta}} \tag{D.23}$$

$$P_t = \left(\phi_H P_{Ht}^{1-\eta} + \phi_F P_{Ft}^{1-\eta}\right)^{\frac{1}{1-\eta}} \tag{D.24}$$

Foreign households. The foreign region is set up symmetrically, with equal demand elasticities and an analogous home bias $\phi_H^* > 1 - n$. $*$ superscripts denote foreign demands.

Perfect risk sharing. With perfect risk sharing we have that:

$$X_t \equiv \frac{P_t^*}{P_t} = M_t \equiv M_t^n \frac{P_{t+1}}{P_t}. \tag{D.25}$$

Also assume that, initially, $NFA_t = 0$.

Imperfect risk sharing. In this case, marginal utility is only equalized ex ante.

To ensure stationarity, we assume that:

$$R_{Ht}^n = R_t^n \exp(-\psi_{NFA} NFA_t) \quad R_{Ft}^n = R_t^n \exp(-\psi_{NFA} NFA_t^*) == R_t^n \exp(\psi_{NFA} NFA_t), \tag{D.26}$$

where households take the net foreign asset position (NFA) as given. These returns also enter the budget constraints of the optimizing household and the local government.

D.2 Firms

Within each region, there is a unit measure of firms, indexed by z. Firms produce

$$y_{xt}(z) = \bar{A}_t (K_t^e)^\alpha N_t(z)^{1-\alpha}. \tag{D.27}$$

Firms face a demand curve given by:

$$D_{ht} = D_{Ht} \left(\frac{p_{ht}(z)}{p_{Ht}} \right)^{-\theta}.$$

Optimal factor demands satisfy:

$$[N_t(z)] \qquad W_t = (1-\alpha) \frac{y_{xt}(z)}{N_t(z)} MC_{ht}(z). \tag{D.28}$$

$$[K_t(z)^e] \qquad r_t^k = \alpha \frac{y_{xt}(z)}{K_t(z)^e} MC_{ht}(z). \tag{D.29}$$

Prices can only reset prices with probability $1 - \xi$ and otherwise increase prices at an exogenous rate $\bar{\Pi} \geq 1$. Home firms' objective is therefore:

$$\mathbb{E}_t \sum_{s=0}^{\infty} \left(\prod_{u=0}^{s-1} M_{t+u}^n \xi \right) \left(P_{h,t}(z) \bar{\Pi}^s D_{H,t+s} \left(\frac{\bar{\Pi}^s P_{h,t}(z)}{P_{H,t+s}} \right)^{-\theta} - W_{t+s} N_{t+s}(z) - r_{t+s}^k K_{t+s}^e(z) \right) \tag{D.30}$$

$$= \mathbb{E}_t \sum_{s=0}^{\infty} \left(\prod_{u=0}^{s-1} M_{t+u}^n \xi \right) \left(P_{h,t}(z) \bar{\Pi}^s D_{H,t+s} \left(\frac{\bar{\Pi}^s P_{h,t}(z)}{P_{H,t+s}} \right)^{-\theta} - MC_{ht} D_{H,t+s} \left(\frac{\bar{\Pi}^s P_{h,t}(z)}{P_{H,t+s}} \right)^{-\theta} \right). \tag{D.31}$$

Optimal pricing:

$$P_{ht}(z) = \frac{\theta}{\theta - 1} \frac{CN_t^n}{CD_t}, \tag{D.32}$$

where

$$CN_t^n \equiv \mathbb{E}_t \sum_{j=0}^{\infty} (\bar{\Pi}^{-\theta} \xi)^j \left(\prod_{u=0}^{j-1} M_{t,t+u}^n \right) y_{h,t+j}(z) MC_{t+j}(z), = y_{h,t}(z) MC_t^n(z) + \mathbb{E}_t [M_{t,t+1}^n \bar{\Pi}^{-\theta} \xi CN_{t+1}^n].$$

$$CD_t \equiv \mathbb{E}_t \sum_{j=0}^{\infty} (\bar{\Pi}^{1-\theta} \xi)^j \left(\prod_{u=0}^{j-1} M_{t,t+u}^n \right) y_{h,t+j}(z) = y_{h,t}(z) + \mathbb{E}_t [M_{t,t+1}^n \bar{\Pi}^{1-\theta} \xi CD_{t+1}].$$

For foreign producers, the above expression applies with discount factor $M_{t,t+1}^{n*}$ and with (f, F) replacing (h, H).

Equivalently, the real target price is:

$$p_{ht}(z) \equiv \frac{P_{ht}(z)}{P_t} = \frac{\theta}{\theta - 1} \frac{CN_t}{CD_t}, \tag{D.33}$$

where

$$CN_t = y_{h,t}(z) MC_t^r(z) + \mathbb{E}_t [M_{t,t+1}^n \Pi_{t+1} \bar{\Pi}^{-\theta} \xi CN_{t+1}].$$

In the foreign region, the real target price is:

$$p_{ft}(z) \equiv \frac{P_{ft}(z)}{P_t} = \frac{\theta}{\theta - 1} \frac{CN_t^*}{CD_t^*}, \tag{D.34}$$

where

$$CN_t^* = y_{f,t}(z) \frac{MC_t^{n^*}(z)}{P_t^*} X_t + \mathbb{E}_t [M_{t,t+1}^{n^*} \Pi_{t+1} \bar{\Pi}^{-\theta} \xi CN_{t+1}^*].$$

Note that CN_t^* is expressed relative to home currency prices, and the future inflation rate is also that of the home region.

The home producer price index becomes:

$$P_{Ht} = \left((1 - \xi) P_{ht}(z)^{1-\theta} + \xi (P_{H,t-1} \bar{\Pi})^{1-\theta} \right)^{\frac{1}{1-\theta}}$$

$$\Leftrightarrow \quad \Pi_{H,t} \equiv \frac{P_{Ht}}{P_{H,t-1}} = \left((1 - \xi) \left(\frac{P_{ht}(z)}{P_t} \frac{P_t}{P_{H,t}} \Pi_{H,t} \right)^{1-\theta} + \xi \bar{\Pi}^{1-\theta} \right)^{\frac{1}{1-\theta}}$$

$$\Leftrightarrow \quad \Pi_{Ht}^{1-\theta} = (1-\xi)\left(\frac{p_{ht}}{p_{Ht}}\Pi_{H,t}\right)^{1-\theta} + \xi\bar{\Pi}^{1-\theta}$$

Similarly, foreign producer price inflation is given by:

$$\Pi_{Ft}^{1-\theta} = (1-\xi)\left(\frac{p_{ft}}{p_{Ft}}\Pi_{F,t}\right)^{1-\theta} + \xi\bar{\Pi}^{1-\theta}$$

using that p_{Ft} is also expressed relative to P_t.

Public infrastructure. We model public infrastructure with a congestion externality in the average level of variety production, $\bar{y}_{ht} \equiv \int_0^1 y_{ht}(z)dz$:

$$\bar{A}_t = A_t^{\frac{1}{1-\zeta}}\left(\frac{K_{t-1}^G}{\bar{y}_{ht}}\right)^{\frac{\zeta}{1-\zeta}}. \tag{D.35}$$

With this choice, the average production level across varieties is given by:

$$\bar{y}_{ht} = A_t(K_{t-1}^G)^{\zeta}((K_t^e)^{\alpha}N_t(z)^{1-\alpha})^{1-\zeta} \approx Y_{Ht}. \tag{D.36}$$

To a first order, this also represents aggregate supply.

Note that by definition:

$$\Pi_{Ht} \equiv \frac{P_{Ht}}{P_{H,t-1}} = \frac{p_{Ht}}{p_{H,t-1}}\Pi_t \quad \Leftrightarrow \quad p_{Ht} = \frac{\Pi_{Ht}}{\Pi_t}p_{H,t-1}. \tag{D.37}$$

D.3 Government

We are considering the cash-less limit, in which monetary policy does not generate revenue for the government.

Monetary authority The monetary authority sets interest rates according to:

$$R_t^n = (\bar{\Pi}/\beta)^{\rho_r}\left(\left(\frac{\bar{\Pi}_t}{\bar{\Pi}}\right)^{\psi_{r\pi}}\left(\frac{\bar{Y}_t}{\bar{Y}}\right)^{\psi_{ry}}\right)^{1-\rho_r}, \tag{D.38}$$

$$\bar{\Pi}_t \equiv n\Pi_t + (1-n)\Pi_t^* \tag{D.39}$$

$$\bar{Y}_t \equiv nY_t + (1-n)Y_t^*. \tag{D.40}$$

State governments

$$G_{st,t} = \psi_{IG}\left(\frac{IG_t}{P_t} - \bar{I}G\right) + G_{st,t}^x$$

$$G_{st,t}^x = (1-\rho_{st,g})\bar{G}^{st} + \rho_{st,g}G_{st,t-1}^x + \omega_{st,g}\epsilon_{st,t}^x$$

Motivated by our estimates that most spending components adjust to changes in transfers, we assume that states spend a fraction $1-\phi$ on public services. These may affect the households' flow utility. States invest the remaining fraction ϕ of overall spending in infrastructure:

$$K_{st,t} = (1-\delta_G)K_{st,t-1} + \phi G_{st,t}. \tag{D.41}$$

States adjust labor taxes to finance the current deficit:

$$(1-\gamma^s)((R^n_{t-1}-1)B^{st}_{t-1} - (\bar{R}^n - 1)\frac{\bar{b}^{st}}{\bar{\Pi}}P_t) + P_t G^{st}_t - P_t\bar{G}^{st}_t - (IG_t - P_t\bar{I}G)+) = \tau^{st}_t W_t N_t - \bar{\tau}^{st}P_t\bar{w}\bar{N}. \tag{D.42}$$

The remainder of the budget is financed through debt issuance. The budget is:

$$P_t G^{st}_t + Tr^{st}_t + R^n_{t-1}B^{st}_{t-1} = B^{st}_t + IG_t + \tau^{st}_t W_t N_t. \tag{D.43}$$

Federal government. The federal government levies lump-sum and distortionary taxes to finance federal government consumption and to provide intergovernmental transfers to states. Nominal per capita transfers are equal to IG_t in each region.

For simplicity, federal transfers and real per capita purchases in the states are exogenous:

$$IG_t = \rho_{IG} IG_{t-1} + \sigma_{IG}\epsilon_{IG,t}. \tag{D.44}$$

$$G^f_t = \rho_{Gf} G^f_{t-1} + \sigma_{Gf}\epsilon_{Gf,t}.. \tag{D.45}$$

Purchases equal real per capita amounts $G^f_{Ht} = G^f_{Ft} = G^f_t$ per region (exogenous).

Nominal budget

$$(nP_t + (1-n)P^*_t)G^f_t + IG_t + Tr^f_t + R^n_{t-1}B^f_{t-1} = \tau^f_t(nW_tN_t + (1-n)W^*_tN^*_t) + B^f_t \tag{D.46}$$

Similar to state governments, labor income taxes finance a fraction of the budget every period (out of steady state):

$$\begin{aligned}(1-\gamma^f)((R^n_{t-1}-1)B^f_{t-1} - (\bar{R}^n-1)P_t\frac{\bar{b}^f}{\bar{\Pi}} + (nP_t + (1-n)P^*_t)G^f_t - \bar{P}\bar{G}^f + IG_t - \overline{IG}) \\ = \tau^f_t(nW_tN_t + (1-n)W^*_tN^*_t) - \bar{\tau}^f\bar{W}\bar{N}.\end{aligned} \tag{D.47}$$

The federal government finances the remaining fraction γ^f of expenditures via nominal debt issuance.

D.4 Home NFA

Consolidating the home budget constraint for the unconstrained and the constrained agent:

$$
\begin{aligned}
&(1-\mu)P_tC_t^c + \mu\left(P_t(C_t^u + I_t^u) + B_t^u\right) \\
&\le (1-\mu)((1-\tau_t)W_tN_t^c + Tr_t + Pr_t^c) + \mu\left((1-\tau_t)W_tN_t^u + r_t^k u_t K_{t-1} + B_{t-1}^u R_{t-1}^n + Tr_t + Pr_t\right) \\
\Leftrightarrow & P_tC_t + P_tI_t + B_t = (1-\tau_t)W_tN_t + r_t^k u_t K_{t-1} + B_{t-1}R_{t-1}^n + Tr_t + Pr_t
\end{aligned} \tag{D.48}
$$

Substituting in for profits:

$$
P_tC_t + P_tI_t + B_t = -\tau W_tN_t + P_{Ht}Y_t + B_{t-1}R_{t-1}^n + Tr_t
$$

Substituting in for state transfers (takes care of state taxes):

$$
P_tC_t + P_tI_t + P_tG_t^{st} + (B_t - B_t^{st}) = IG_t - \tau_t^f W_tN_t + P_{Ht}Y_t + (B_{t-1} - B_{t-1}^{st})(R_{t-1}^n - \psi_{R,NFA}\frac{NFA_{t-1}}{n}) + Tr_t^f
$$

The foreign counterpart is:

$$
\begin{aligned}
&P_t^*C_t^* + P_t^*I_t^* + P_t^*G_t^{st*} + (B_t^* - B_t^{st*}) \\
=&IG_t^* - \tau_t^f W_t^*N_t^* + P_{Ft}Y_t^* + (B_{t-1}^* - B_{t-1}^{st*})(R_{t-1}^n + \psi_{R,NFA}\frac{NFA_{t-1}}{1-n}) + Tr_t^f
\end{aligned}
$$

The population-weighted difference is:

$$
\begin{aligned}
&nP_t(C_t + I_t + G_t^{st}) + n(B_t - B_t^{st}) - (1-n)P_t^*(C_t^* + I_t^* + G_t^{st*}) - (1-n)(B_t^* - B_t^{st*}) \\
=&(1-n)\tau_t^f W_t^*N_t^* - n\tau_t^f W_tN_t + nP_{Ht}Y_t - (1-n)P_{Ft}Y_t^* \\
&+ \left(n(B_{t-1} - B_{t-1}^{st}) - (1-n)(B_t^* - B_t^{st*})\right)(R_{t-1}^n - \psi_{R,NFA}NFA_{t-1})
\end{aligned}
$$

This leads to the following law of motion for the net foreign asset position:

$$
\begin{aligned}
NFA_t \equiv& \frac{n(B_t - B_t^{st}) - (1-n)(B_t^* - B_t^{st*})}{P_t} \\
=&NFA_{t-1}\frac{R_{t-1}^n}{\Pi_t} - \psi_{R,NFA}\frac{NFA_{t-1}^2}{\Pi_t} \\
&+ (1-n)X_t(C_t^* + I_t^* + G_t^{st*}) - n(C_t + I_t + G_t^{st}) + np_{Ht}Y_t - (1-n)p_{Ft}Y_t^* \\
&+ X_t(1-n)\tau_t^f w_t^*N_t^* - n\tau_t^f w_tN_t,
\end{aligned}
$$

where $p_{Xt} = \frac{P_{Xt}}{P_t}$ for $x \in \{H, F\}$ and $X_t \equiv \frac{P_t^*}{P_t}$.

Note: To a first order, around a zero NFA, changes in payments do not matter.

D.5 Market clearing

Market clearing implies:

$$
b_t^f = n(b_t - b_t^{st}) + (1-n)(b_t^* - b_t^{st*}) \tag{D.49}
$$

$$
K_t^e = u_tK_{t-1} \tag{D.50}
$$

$$K_t^{e*} = u_t^* K_{t-1}^* \tag{D.51}$$
$$N_t = \mu N_t^u + (1-\mu) N_t^c \tag{D.52}$$
$$N_t^* = \mu N_t^{u*} + (1-\mu) N_t^{c*} \tag{D.53}$$
$$Y_t = Y_{Ht} = n D_t \left(\frac{P_{Ht}}{P_t}\right)^{-\eta} + (1-n) D_t^* \left(\frac{P_{Ht}}{P_t^*}\right)^{-\eta} \tag{D.54}$$
$$Y_t^* = Y_{Ft} = n D_t \left(\frac{P_{Ft}}{P_t}\right)^{-\eta} + (1-n) D_t^* \left(\frac{P_{Ft}}{P_t^*}\right)^{-\eta} \tag{D.55}$$

where $D_t = \phi_H C_t + \phi_H I_t + \phi_H G_t^{st} + G_t^f$.

Normalization:

$$P_t = 1 \tag{D.56}$$

D.6 Steady state

The model is calibrated at a quarterly frequency.

Capital output ratio. From the Capital FOC:

$$\frac{\bar{K}}{\bar{Y}} = \frac{\alpha}{1/\beta - 1 + \delta}.$$

Overall consumption. Calibrating the combined government spending to GDP ratio yields the aggregate consumption to GDP ratio, given the capital to output ratio:

$$\frac{\bar{C}}{\bar{Y}} = 1 - \frac{\bar{G}}{\bar{Y}} - \delta \bar{K}\bar{Y}.$$

Group consumption. Constrained agents' consumption follows from their budget constraint, given the calibration assumption that they provide the same amount of labor in steady state:

$$\frac{\bar{C}^c}{\bar{Y}} = (1-\alpha)\left(1 - \frac{1}{\theta}\right)(1 - \bar{\tau}^f - \bar{\tau}^{st}) + \frac{tr^s t + \mathrm{tr}^f}{\bar{Y}} + \kappa_{pr}^c \frac{1}{\theta}.$$

Consumption of the unconstrained is the residual:

$$\frac{\bar{C}^u}{\bar{Y}} = \frac{1}{\mu}\frac{\bar{C}}{\bar{Y}} - \frac{1-\mu}{\mu}\frac{\bar{C}^c}{\bar{Y}}$$

Optimal government consumption. We calibrate the weight in the utility function so that in steady state, the provision of public services is optimal. From the CES aggregator over private consumption and public services $(1-\phi)G_{st}$, we have that the MRS is given by:

$$MRS^c_{G,C} = \kappa^c_G G_{st}^{-1/\lambda}(1-\phi)^{1-1/\lambda}(C^c)^{1/\lambda} \overset{!}{=} 1 \quad \Leftrightarrow \quad \kappa^c_G = \left(\frac{G_{st}}{C^c}\right)^{1/\lambda}(1-\phi)^{1/\lambda-1}$$

Consequently, the CES aggregator in steady state is given by:

$$\left((\bar{C}^c)^{1-1/\lambda} + \kappa^c_G((1-\phi)G^{st})^{1-1/\lambda}\right)^{\frac{\lambda}{\lambda-1}} = \bar{C}^c\left(1+\frac{\bar{G}^{st}}{\bar{C}^c}\right)^{\frac{\lambda}{\lambda-1}} \tag{D.57}$$

Optimal state infrastructure. Infrastructure is chosen to maximize average output net of investment (ignoring the one quarter time to build):

$$\max_{K^G_t} \overline{A}(K^G_t)^{\zeta}(N_t^{1-\alpha}K_t^{\alpha})^{1-\zeta} - \delta K^G_t$$

$$[K^G_t]: \quad \frac{\zeta Y_t}{K^G_t} = \delta$$

$$\implies \delta\overline{K}^G = \overline{I}^{st} = \zeta\overline{Y} \implies \zeta = \frac{\overline{I}^{st}}{\overline{Y}}$$

Monetary policy. Absent a premium for government securities, the nominal interest rate is simply:

$$\bar{R}^n = \frac{1}{\beta}\frac{1}{\bar{\Pi}}.$$

Federal government.

$$\frac{\overline{tr}^f}{\bar{Y}} = \bar{\tau}^f(1-\alpha)\left(1-\frac{1}{\theta}\right) - \frac{\bar{G}^f}{\bar{Y}} - \frac{\bar{I}G}{\bar{Y}} - \left(\frac{\bar{R}^n}{\bar{\Pi}}-1\right)\frac{\bar{b}^f}{\bar{Y}},$$

where $\frac{\bar{b}}{\bar{Y}} = 0.7 \times 4$ and $\frac{\bar{I}G}{\bar{Y}} = 0.05$ and $\bar{\tau}^f = 0.30$.

We also calibrate $\frac{\bar{G}}{\bar{Y}} = 0.20$ and $\frac{\bar{G}^f}{\bar{Y}} = 0.6\frac{\bar{G}}{\bar{Y}} = 0.12$.

State government.

$$\frac{\overline{tr}^{st}}{\bar{Y}} = \bar{\tau}^{st}(1-\alpha)\left(1-\frac{1}{\theta}\right) - \frac{\bar{G}^{st}}{\bar{Y}} + \frac{\bar{I}G}{\bar{Y}} - \left(\frac{\bar{R}^n}{\bar{\Pi}}-1\right)\frac{\bar{b}^{st}}{\bar{Y}},$$

where $\frac{\bar{b}}{\bar{Y}} = 0.05 \times 4$ and $\frac{\bar{I}G}{\bar{Y}} = 0.05$ and $\bar{\tau}^{st} = 0.05$.

The share of state infrastructure spending is:

$$\phi = \frac{\delta\bar{K}^g/\bar{Y}}{\bar{G}^{st}/\bar{Y}} = \frac{\zeta}{\bar{G}^{st}/\bar{Y}}$$

Constrained households We choose κ_N^c such that $\bar{N}^c = \bar{N}^u = \bar{N} = \frac{1}{3}$.

$$\kappa_N^c = (1-\tau)(1-\alpha)(1-\frac{1}{\theta})\left(1+(\bar{G}^{st}/\bar{C}^c)\right)^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}(\bar{N}^c)^{-(1+1/\varepsilon_N)}\bar{Y}(C^c)^{-1/\epsilon_C}. \tag{D.58}$$

Consumption follows from the budget constraint as:

$$\frac{(1-\mu)\bar{C}^c}{\bar{Y}} = (1-\bar{\tau})(1-\alpha)(1-\frac{1}{\theta})(1-\mu)+(1-\mu)\frac{Tr}{\bar{Y}}+(1-\mu)\kappa_{Pr}^c\frac{1}{\theta}, \tag{D.59}$$

where κ_{Pr}^c determines which fraction (if any) of profits households receive.

Unconstrained households κ_N^u is determined analogously as for the constrained households.

D.7 Fiscal rule estimates

Table D.1: Full sample estimate of the tax adjustment rule

	(1)	(2)	(3)	(4)
Lagged tax rate		-0.1191***	-0.1192***	-0.1901***
		(-6.40)	(-6.43)	(-7.24)
Lagged interest on debt (% change)	0.0005**	0.0005**	0.0005**	0.0006*
	(2.29)	(2.04)	(2.04)	(1.99)
Exp Growth	0.0064***	0.0056***		
	(5.19)	(4.74)		
IG transfers (% change)	-0.0011*	-0.0010*		
	(-1.87)	(-1.83)		
Exp net of IG (% change)			0.0055***	0.0046***
			(4.70)	(4.07)
R-squared	0.34	0.38	0.38	0.44
R-sq, within	0.02	0.08	0.08	0.12
Observations	2372	2372	2372	1499
States	50	50	50	48
Years	50	50	50	32
StateFE	Yes	Yes	Yes	Yes
YearFE	By region	By region	By region	By region
IG to Exp	0.25	0.25	0.25	0.25
Net expenditure to GDP			0.09	0.09
Coefficient G net of IG			0.070	0.064
Debt to GDP			0.07	0.07
Interest on debt to GDP		0.004	0.004	0.004
Coefficient Int on Debt		0.158	0.158	0.217
Annual persistence		0.88	0.88	0.81

Table D.2: Full sample estimate of the other fiscal adjustment rules

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged LHS	-0.1901***	-0.1194***	-0.1708***	-0.1731***	-0.1649***	-0.1656***
	(-7.24)	(-6.39)	(-6.63)	(-6.66)	(-8.07)	(-7.96)
Lagged interest on debt (% change)	0.0006*		-0.0033		0.0063	
	(1.99)		(-0.62)		(0.68)	
Exp net of IG (% change)	0.0046***	0.0054***				
	(4.07)	(4.68)				
Lagged Total debt (% change)		0.0073		1.8573*		1.9060
		(0.17)		(1.76)		(1.06)
LD.TaxRate			2.2061***	2.2300***	1.8984**	1.9407**
			(4.95)	(5.01)	(2.41)	(2.45)
R-squared	0.44	0.38	0.45	0.45	0.41	0.41
R-sq, within	0.12	0.08	0.10	0.10	0.09	0.09
Observations	1499	2372	1499	1499	1499	1499
States	48	50	48	48	48	48
Years	32	50	32	32	32	32
StateFE	Yes	Yes	Yes	Yes	Yes	Yes
YearFE	By region	By region	By region	By region	By region	By region
LHS	Δrate	Δrate	Exp. growth	Exp. growth	Transf. growth	Transf. growth

D.8 Dynare

D.8.1 Variables

One-off

1. Exchange rate X_t

$$X_t = \left(\phi_H^* p_{Ht}^{1-\eta} + (1-\phi_H^*) p_{Ft}^{1-\eta}\right)^{\frac{1}{1-\eta}}$$

2. Net foreign asset position NFA_t

$$\begin{aligned} NFA_t =& NFA_{t-1}\frac{R_{t-1}^n}{\Pi_t} - \psi_{R,NFA}\frac{NFA_{t-1}^2}{\Pi_t} \\ &+ (1-n)X_t(C_t^* + I_t^* + G_t^{st*}) - n(C_t + I_t + G_t^{st}) + np_{Ht}Y_t - (1-n)p_{Ft}Y_t^* \\ &+ \tau_t^f \left(X_t(1-n)w_t^* N_t^* - nw_tN_t\right), \end{aligned}$$

3. FFR R_t^n

$$R_t^n = (\bar{\Pi}/\beta)^{\rho_r}\left(\left(\frac{\bar{\Pi}_t}{\bar{\Pi}}\right)^{\psi_{r\pi}}\left(\frac{\bar{Y}_t}{\bar{\bar{Y}}}\right)^{\psi_{ry}}\right)^{1-\rho_r}$$

4. Federal labor income tax rate τ_t^f.

$$\begin{aligned} &(1-\gamma^f)((R_{t-1}^n - 1)\frac{b_{t-1}^f}{\Pi_t} - (\bar{R}^n - 1)\frac{\bar{b}^f}{\bar{\Pi}} + (n + (1-n)X_t^*)G_t^f - \bar{G}^f + ig_t - \overline{IG}) \\ &= \tau_t^f(nw_tN_t + (1-n)w_t^*N_t^*) - \bar{\tau}^f\bar{w}\bar{N}. \end{aligned}$$

5. Federal bond issuance b_t^f

$$(n + (1-n)X_t)G_t^f + \frac{IG_t}{P_t} + tr_t^f + \frac{R_{t-1}^n}{\Pi_t}b_{t-1}^f = \tau_t^f(nw_tN_t + (1-n)X_tw_t^*N_t^*) + b_t^f$$

6. Federal purchases G_t^f
   AR(1)

7. Federal IG transfers IG_t.
   AR(1)

8. Federal transfers to agents tr_t^f.
   constant

9. Aggregate inflation $\bar{\Pi}_t$

$$\bar{\Pi}_t = n\Pi_t + (1-n)\Pi_t^*.$$

10. Aggregate output $\bar{Y}_t$.

$$\bar{Y}_t = nY_t + (1-n)Y_t^*.$$

11. bond market clearing b_t.

$$b_t^f = n(b_t - b_t^{st}) + (1-n)(b_t^* - b_t^{st*})$$

12. foreign budget constraint b_t^*

$$X_t\left(C_t^{u*} + \frac{1}{\mu}I_t^*\right) + \frac{1}{\mu}b_t^* = (1-\tau_t^f - \tau_t^{st*})X_t w_t^* N_t^{u*} + \frac{1}{\mu}X_t r_t^{k,r*} u_t^* K_{t-1}^* + \frac{1}{\mu}b_{t-1}^* \frac{R_{t-1}^n}{\Pi_t} + X_t \frac{Tr_t^{st*}}{P_t^*} + \frac{Tr_t^f}{P_t}$$
$$+ \frac{1-(1-\mu)\kappa_{prc}}{\mu} X_t \left(Y_{F,t} - r_t^{k,r*} u_t^* K_{t-1}^* - w_t^* N_t^*\right)$$

Symmetric

S1 Production function $\rightarrow N_t, N_t^*$

$$Y_{Ht} = A_t (K_{t-1}^G)^\zeta ((K_t^e)^\alpha N_t^{1-\alpha})^{1-\zeta}$$

Normalize $\bar{Y}_H = 1$. Then

$$\begin{aligned}\bar{A}_t &= (K_{t-1}^G)^{-\zeta}((K_t^e)^\alpha \bar{N}^{1-\alpha})^{-(1-\zeta)} \\ &= \left(\phi_k \frac{\bar{G}^{st}}{\bar{Y}}\right)^{-\zeta} \left(\left(\frac{\alpha(1-1/\theta)}{1/\beta-(1-\delta)}\right)^\alpha \bar{N}^{1-\alpha}\right)^{-(1-\zeta)}\end{aligned}$$

using that

$$\frac{\bar{Y}}{\bar{K}} = \frac{1/\beta-(1-\delta)}{\alpha(1-1/\theta)}$$

S2 Stochastic discount factor M_t, M_t^*

$$M_t = \beta \frac{u_{c,t+1}}{u_{c,t}} \frac{1}{\Pi_{t+1}}$$

In steady state:

$$\bar{M}^n = \frac{\beta}{\bar{\Pi}}$$

S3 Marginal utility of income $\rightarrow C_t^u, C_t^{u*}$

$$u_c = C^{-1/\epsilon_c}(1-\kappa_G^u)\left((1-\kappa_G^u)+\kappa_G^u((1-\psi_g^k)G^{st}/C)^{1-1/\lambda}\right)^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}$$

S4 Resource constraint $\rightarrow Y_{Ht}, Y_{Ft}$

$\phi_H^* < 1$ is equivalent to $(1-\phi_H) < 1/n - 1$ or $2 < 1/n + \Phi_H$. For $n \leq \frac{1}{2}$, this assumption is always satisfied. This requires $\phi_H \geq \frac{2n-1}{n} \in (0,1)$ for $n \in (0.5, 1)$.

$\phi_F = 1-\phi_H, \phi_F^* = 1-\phi_H^* = \frac{1-n-n(1-\phi_H)}{1-n}$.

$$(1-n)Y_{Ft} = \left(n\phi_F(C_t + G_t^{st} + I_t) + nG_t^f + (1-n)\phi_F^*(C_t^* + G_t^{st*} + I_t^*)X_t^\eta\right)\left(\frac{P_{Ft}}{P_t}\right)^{-\eta}$$

$$\begin{aligned} nY_{Ht} &= \left(n\phi_H(C_t + G_t^{st} + I_t) + nG_t^f + (1-n)\phi_H^*(C_t^* + G_t^{st*} + I_t^*)X_t^\eta\right)\left(\frac{P_{Ht}}{P_t}\right)^{-\eta} \\ &= \left(n\phi_H(C_t + G_t^{st} + I_t) + nG_t^f + n(1-\phi_H)(C_t^* + G_t^{st*} + I_t^*)X_t^\eta\right)\left(\frac{P_{Ht}}{P_t}\right)^{-\eta} \end{aligned}$$

using that $\phi_H^* = (1-\phi_H)\frac{n}{1-n}$. In the symmetric steady state:

$$\begin{aligned} \frac{\bar{C}}{\bar{Y}} &= 1 - \frac{\bar{G}}{\bar{Y}} - \frac{\bar{I}}{\bar{Y}} \\ &= 1 - \frac{\bar{G}}{\bar{Y}} - \delta\frac{\alpha(1-1/\theta)}{1/\beta+\delta-1} \end{aligned}$$

S5 Constrained consumption C_t^c, C_t^{c*}

$$C_t^c = (1-(\tau_t^f + \tau_t^{st}))w_t N_t^c + tr_t + \kappa_{pr}^c(Y_{Ht} - r_t^k K_{t-1}u_t - w_t N_t)$$

In steady state:

$$\frac{\bar{C}^c}{\bar{Y}} = (1-\bar{\tau}^f - \bar{\tau}^{st})(1-\alpha)(1-1/\theta) + \frac{\overline{tr}}{\bar{Y}} + \frac{1}{\theta}\kappa_{pr}^c$$

S6 Overall consumption C_t, C_t^*

$$C_t = \mu C_t^u + (1-\mu)C_t^c$$

S7 Labor supply N_t, N_t^*

$$N_t = \mu N_t^u + (1-\mu)N_t^c$$

Calibrated to $\bar{N} = \frac{1}{3}$.

S8 Constrained labor supply N_t^c, N_t^{c*}

$$(1-\tau_t)(1-\kappa_G^c)w_t\left((1-\kappa_G^c)+\kappa_G^c(G^{st}/(w_tN_t^c+tr_t+pr_t^c))^{1-1/\lambda}\right)^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}=\kappa_N^c(N_t^c)^{1/\varepsilon_N}C^{1/\epsilon_C}.$$

Implies κ_N^c

S9 Unconstrained labor supply N_t^u, N_t^{u*}
analogous as for constrained
Implies κ_N^u

S10 Investment I_t, I_t^*

$$1=q_t\left(1-\frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}}-1\right)^2-\kappa_I\left(\frac{I_t}{I_{t-1}}-1\right)\frac{I_t}{I_{t-1}}\right)+\mathbb{E}_t\left[M_{t+1}^n\Pi_{t+1}q_{t+1}\left(\frac{I_{t+1}}{I_t}-1\right)\frac{I_{t+1}}{I_t}\right]$$

In steady state

$$\frac{\bar{I}}{\bar{Y}}=\frac{\delta\bar{K}}{\bar{Y}}=\delta\frac{\alpha(1-1/\theta)}{1/\beta+\delta-1}.$$

S11 Utilization u_t, u_t^*

$$\bar{\delta}_1+\bar{\delta}_2(u_t-1)=\frac{r_t^{k,r}}{q_t}$$

In steady state, $\bar{u}=1$ and $\bar{\delta}_1=\frac{1}{\beta}+\delta-1$.

S12 Tobin's Q q_t, q_t^*

$$q_t=\mathbb{E}_t\left[M_{t+1}^n\Pi_{t+1}\left((1-\delta_{t+1})q_{t+1}+r_{t+1}^k u_{t+1}-\delta(u_{t+1})\right)\right]$$

In steady state, $\bar{q}=1$.

S13 Capital K_t, K_t^*

$$K_t=(1-\delta(u_t))K_{t-1}+\left(1-\frac{\kappa_I}{2}\left(\frac{I_t}{I_{t-1}}-1\right)^2\right)I_t$$

In steady state:

$$\frac{\bar{K}}{\bar{Y}}=\frac{\alpha(1-1/\theta)}{1/\beta+\delta-1}$$

S14 Bond Euler equation $\rightarrow u_{c,t}, u_{c,t}^*$

$$1=\mathbb{E}_t\left[M_{t+1}^n\left(\frac{u_{b,t+1}}{u_{c,t+1}}+(R_t^n-\psi_{r,NFA}NFA_t)\right)\right],$$

where

$$\frac{u_b}{u_c} = \kappa_b b^{-1/\epsilon_b}(1-\kappa_G^u)\frac{(C^u)^{1/\epsilon_c}}{((1-\kappa_G^u)+\kappa_G^u(G^{st}/C^u)^{1-1/\lambda})^{\frac{1-\lambda/\epsilon_C}{\lambda-1}}}$$

Calibrate κ_b to match $\bar{b} = \bar{b}^f + \bar{b}^{st}$.

S15 Relative producer prices $p_{H,t}, p_{F,t}$

$$1 = \left(\phi_H p_{Ht}^{1-\eta} + (1-\phi_H) p_{Ft}^{1-\eta}\right)^{\frac{1}{1-\eta}}$$

$$p_{H,t} = p_{H,t-1}\frac{\Pi_{H,t}}{\Pi_t}$$

In steady state, relative prices are unity.

S16 Real wages w_t, w_t^*.

$$\begin{aligned} w_t &= (1-\alpha)\frac{y_{Ht}}{N_t} mc_{ht}^r. \\ &= \frac{1-\alpha}{\alpha}\frac{K_t^e}{N_t} r_t^{k,r}. \end{aligned}$$

In steady state:

$$\bar{w} = (1-\alpha)(1-1/\theta)\frac{1}{\bar{N}},$$

using that steady state output is unity.

S17 Rental rate of capital r_t^k, r_t^{k*}

$$r_t^{k,r} = \alpha\frac{y_{Ht}}{K_{t-1}u_t} mc_{ht}^r.$$

S18 State capital K_t^{st}, K_t^{st*}.

$$K_{st,t} = (1-\delta_G)K_{st,t-1} + \phi G_{st,t}.$$

S19 State transfers tr_t^{st}, tr_t^{st*}.
constant

S20 State debt issuance b_t^{st}, b_t^{st*}

$$G_t^{st} + tr_t^{st} + \frac{R_{t-1}^n}{\Pi_t} b_{t-1}^{st} = b_t^{st} + \frac{IG_t}{P_t} + \tau_t^{st} w_t N_t.$$

and

$$X_t G_t^{st*} + X_t tr_t^{st*} + \frac{R_{t-1}^n}{\Pi_t} b_{t-1}^{st} = b_t^{st} + X_t \frac{IG_t}{P_t} + X_t \tau_t^{st} w_t^* N_t^*.$$

Calibrate debt, set transfers in steady state:

$$\frac{\overline{tr}^{st}}{\bar{Y}} = \bar{\tau}^{st}(1-\alpha)\left(1 - \frac{1}{\theta}\right) - \left(\frac{\bar{R}_n}{\bar{\Pi}} - 1\right)\frac{\bar{b}^{st}}{\bar{Y}} - \frac{\bar{G}^{st}}{\bar{Y}}$$

S21 State labor income tax rate $\tau_t^{st}, \tau_t^{st*}$.

$$(1-\gamma^s)((R_{t-1}^n - 1)\frac{b_{t-1}^{st}}{\Pi_t} - (\bar{R}^n - 1)\frac{\bar{b}^{st}}{\bar{\Pi}}) + G_t^{st} - \bar{G}_t^{st} - (\frac{IG_t}{P_t} - \bar{I}G) +) = \tau_t^{st} w_t N_t - \bar{\tau}^{st}\bar{W}\bar{N}.$$

Calibrated.

S22 State government spending G_t^{st}, G_t^{st*}

$$G_{st,t} = \psi_{IG}(\frac{IG_t}{P_t} - \bar{I}G) + G_{st,t}^x$$

S23 Exogenous state government spending $G_{x,t}^{st}, G_{x,t}^{st*}$

$$G_{st,t}^x = (1-\rho_{st,g})\bar{G}^{st} + \rho_{st,g} G_{st,t-1}^x + \omega_{st,g}\epsilon_{st,t}^x$$

S24 Producer price inflation Π_{Ht}, Π_{Ft}

$$\Pi_{Ht}^{1-\theta} = (1-\xi)\left(\frac{p_{ht}}{p_{Ht}}\Pi_{H,t}\right)^{1-\theta} + \xi\bar{\Pi}^{1-\theta}$$

$$\Pi_{Ft}^{1-\theta} = (1-\xi)\left(\frac{p_{ft}}{p_{Ft}}\Pi_{F,t}\right)^{1-\theta} + \xi\bar{\Pi}^{1-\theta}$$

In steady state, $\Pi_H = \Pi_F = \bar{\Pi}$.

S25 State inflation Π_t, Π_t^*

$$\left(\frac{P_t^*}{P_{t-1}^*}\right)^{1-\eta} = \phi_H^* \frac{P_{Ht}^{1-\eta}}{\phi_H^* P_{H,t-1}^{1-\eta} + (1-\phi_H^*)P_{F,t-1}^{1-\eta}} + (1-\phi_H^*)\frac{P_{Ft}^{1-\eta}}{\phi_H^* P_{H,t-1}^{1-\eta} + (1-\phi_H^*)P_{F,t-1}^{1-\eta}}$$

$$\Leftrightarrow (\Pi_t^*)^{1-\eta} = \phi_H^* \frac{\Pi_{Ht}^{1-\eta}}{\phi_H^* + (1-\phi_H^*)(p_{F,t-1}/p_{H,t-1})^{1-\eta}} + (1-\phi_H^*)\frac{\Pi_{Ft}^{1-\eta}}{\phi_H^*(p_{H,t-1}/p_{F,t-1})^{1-\eta} + (1-\phi_H^*)}$$

$$\Pi_t = \Pi_t^* \frac{X_{t-1}}{X_t}.$$

$$\hat{\pi}_t = \phi_H \hat{\pi}_{H,t} + (1-\phi_H)\hat{\pi}_{F,t}$$
$$\hat{\pi}^*_t = \phi^*_H \hat{\pi}_{H,t} + (1-\phi^*_H)\hat{\pi}_{F,t}$$

S26 Calvo denominators CD_t, CD^*_t

$$CD_t = Y_{Ht} + \mathbb{E}_t[M^n_{t,t+1}\bar{\Pi}^{1-\theta}\xi CD_{t+1}].$$

In steady state:

$$\overline{CD} = \frac{\bar{Y}_H}{1-\beta\xi\bar{\Pi}^{-\theta}}$$

S27 Calvo (real) numerators CN_t, CN^*_t

$$CN_t = Y_{H,t}MC^r_t + \mathbb{E}_t[M^n_{t,t+1}\Pi_{t+1}\bar{\Pi}^{-\theta}\xi CN_{t+1}]$$
$$CN^*_t = Y_{F,t}MC^{r*}_t + \mathbb{E}_t[M^{n*}_{t,t+1}\Pi_{t+1}\bar{\Pi}^{-\theta}\xi CN^*_{t+1}]$$

In steady state:

$$\overline{CN} = \frac{\bar{Y}_H}{1-\beta\xi\bar{\Pi}^{-\theta}}\left(1-\frac{1}{\theta}\right).$$

Note: Effectively omitted one budget constraint, since only difference of private sector (aggregated) budget constraint enters.

D.9 Additional model results

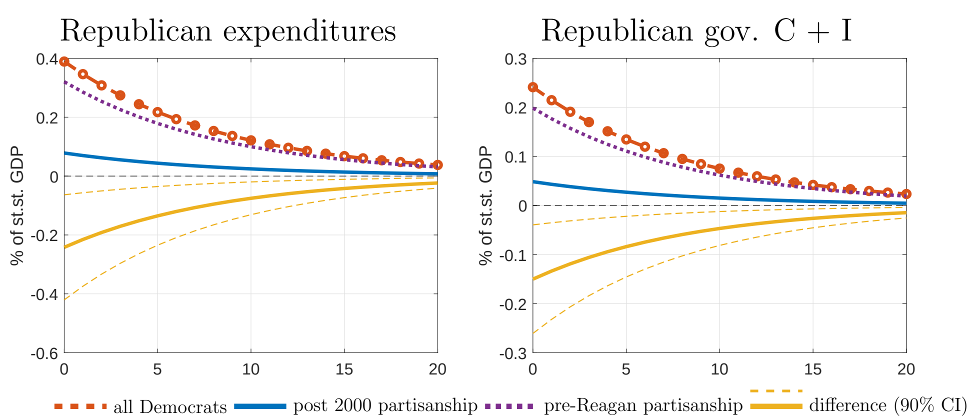


Figure D.1: IRFs: Expenditures and government consumption and fixed investment

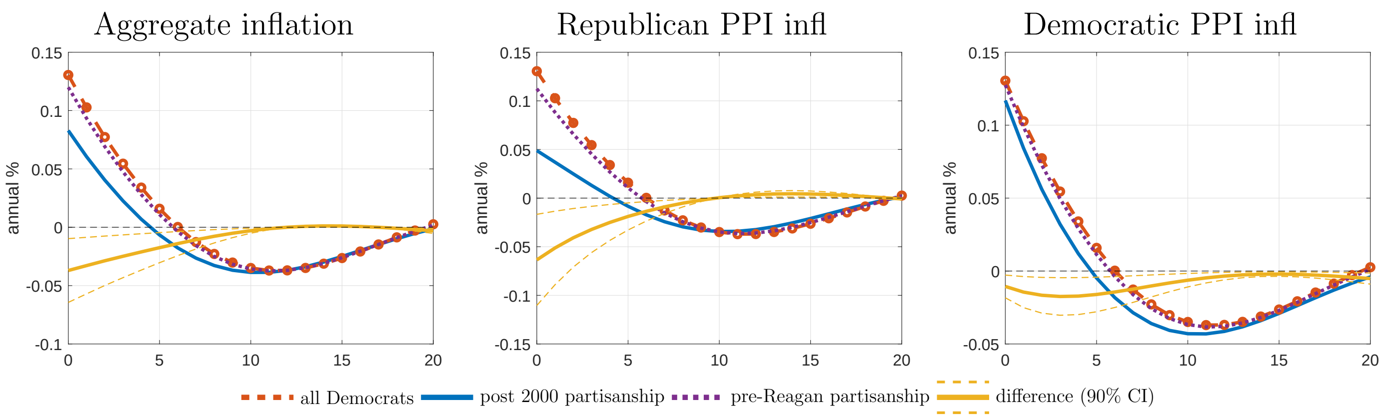


Figure D.2: Responses of inflation following a shock to IG transfers

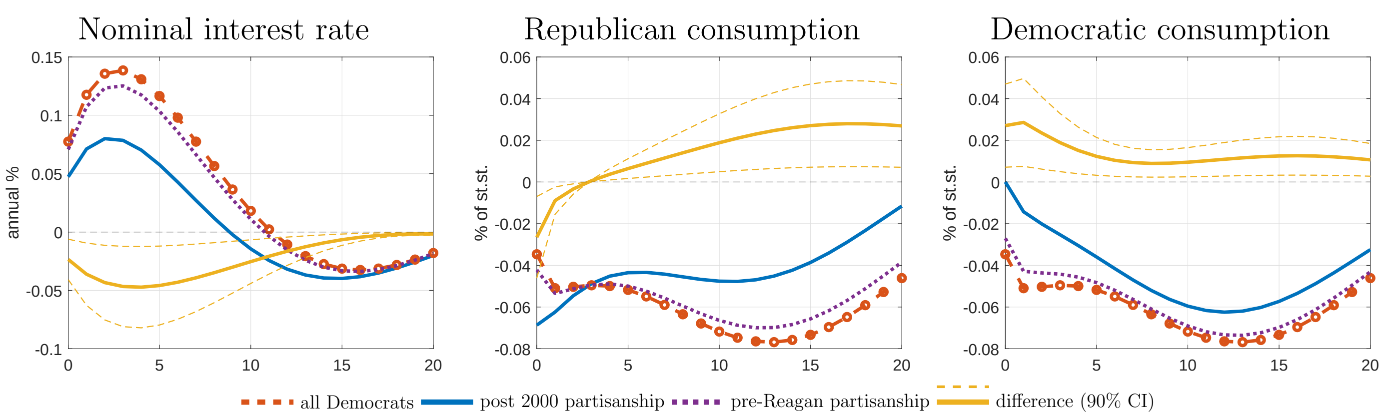


Figure D.3: Responses of interest rates and consumption following a shock to IG transfers

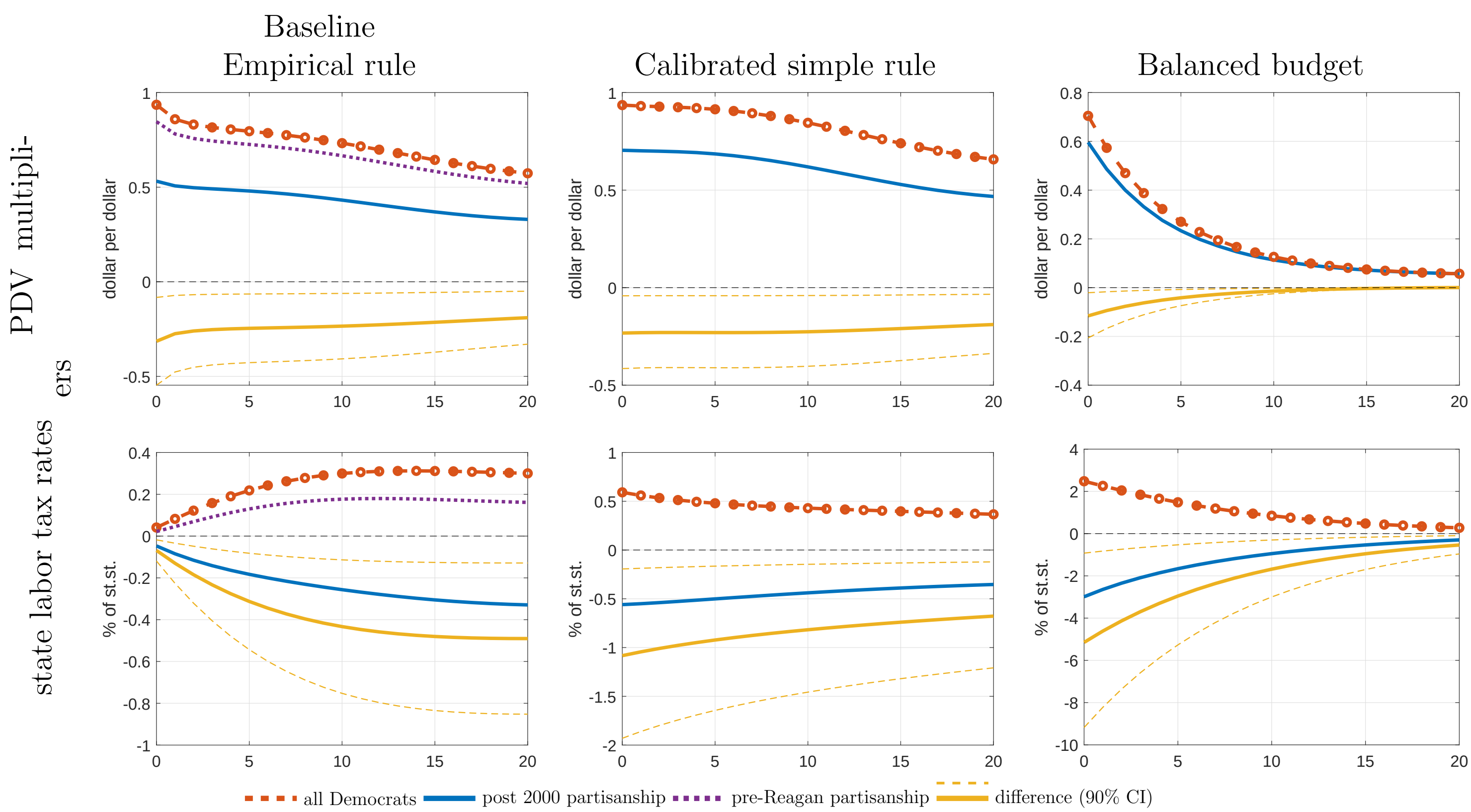


Figure D.4: PDV multipliers and distortionary taxes

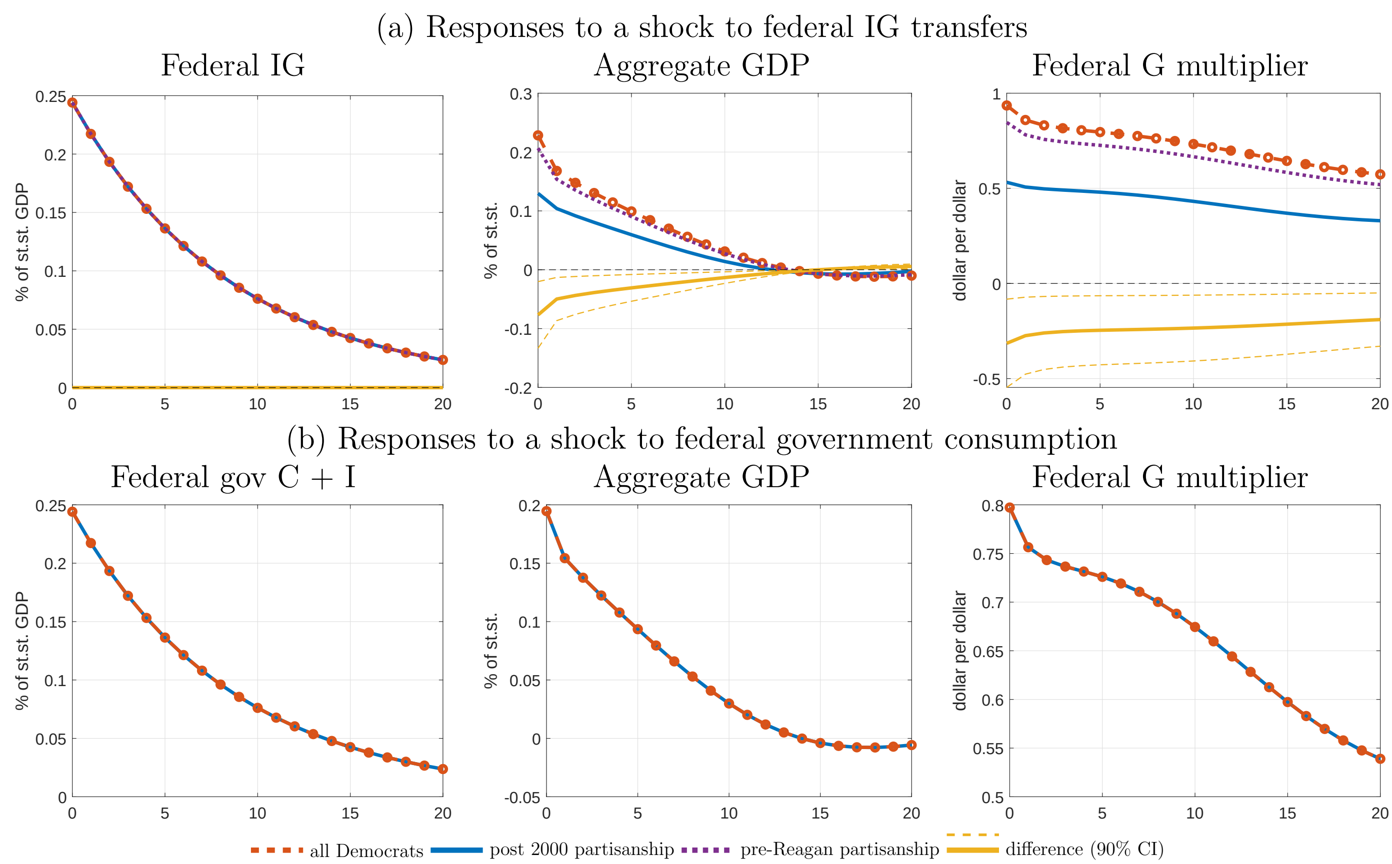


Figure D.5: IRFs: Fiscal stimulus, GDP response, and PDV multipliers. Comparison of IG transfer and federal G shocks

E Additional time series estimates

Table E.1: Reduced-form output effects of IG innovations and share of Republican governors: Local projections regression with single lag for various horizons, 1964q1–2018q3.

(a) Real GDP on IG transfers

	Impact	h=1	h=2	h=3	h=4
Intergov. Transfers (IG)	-0.008	-0.007	-0.023	-0.027	-0.017
	(-0.80)	(-0.42)	(-1.08)	(-1.29)	(-0.71)
Fraction Rep Gov x IG	-0.176**	-0.325*	-0.476**	-0.542**	-0.495*
	(-2.08)	(-1.92)	(-2.50)	(-2.33)	(-1.88)
Fraction Rep Gov.	0.892	1.709	2.745	3.347	4.202
	(1.26)	(1.22)	(1.39)	(1.38)	(1.56)
R-squared	1.00	1.00	1.00	0.99	0.99
Observations	219	218	217	216	215

(b) Intergovernmental transfers on IG transfers

	Impact	h=1	h=2	h=3	h=4
Intergov. Transfers (IG)	1.000	0.532***	0.837***	0.668***	0.806***
		(2.76)	(6.82)	(3.45)	(4.70)
Fraction Rep Gov x IG	0.000	-0.309	0.558	-0.752	1.708
		(-0.38)	(0.84)	(-0.75)	(1.35)
Fraction Rep Gov.	0.000	-2.243	-0.784	-2.445	0.814
		(-0.52)	(-0.12)	(-0.27)	(0.07)
R-squared	1.00	0.99	0.99	0.98	0.97
Observations	219	218	217	216	215

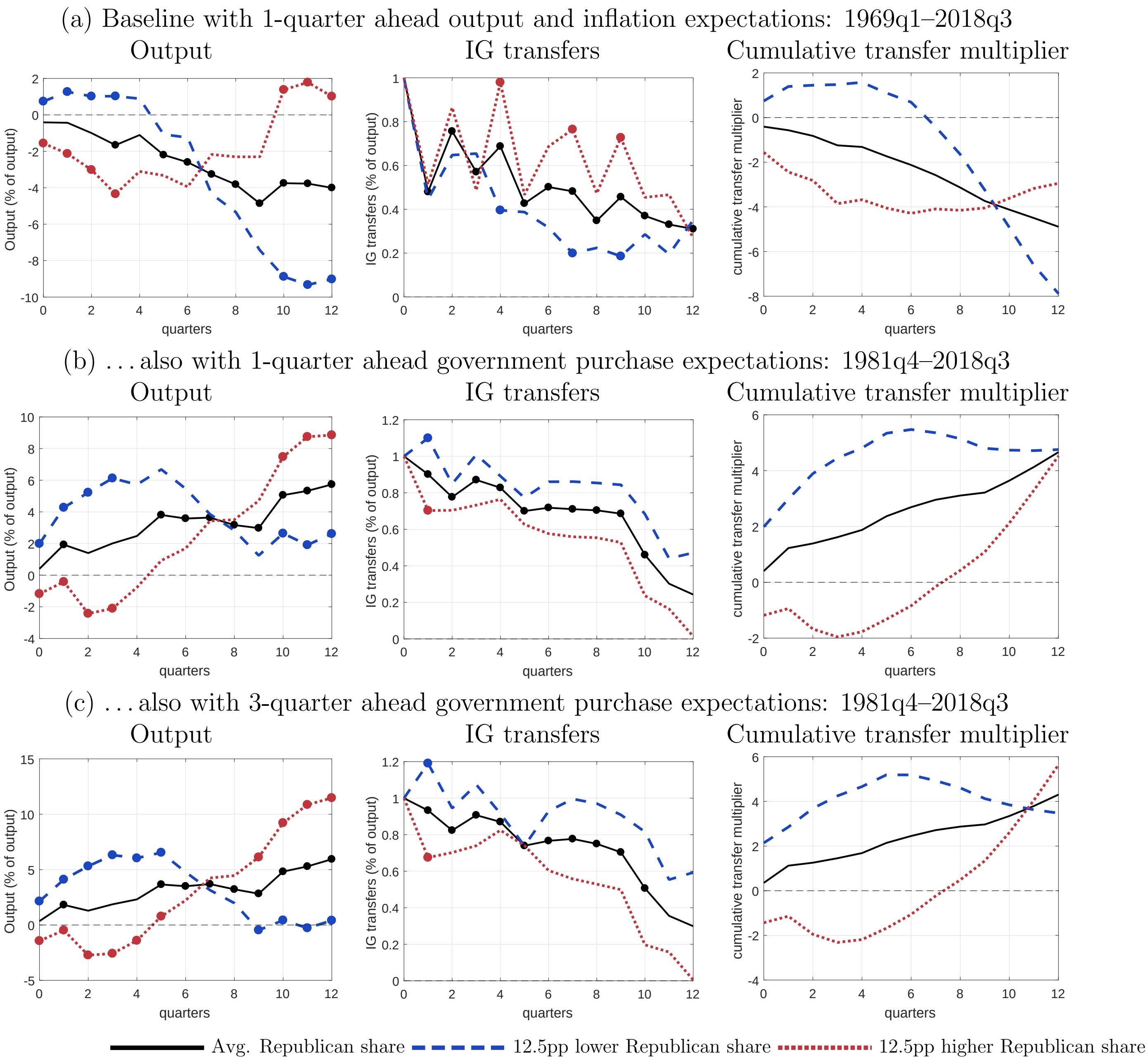
(c) Government purchases on GDP

	Impact	h=1	h=2	h=3	h=4
Gov. purchases (G)	0.153**	0.077	0.105	0.022	0.032
	(2.21)	(0.76)	(0.77)	(0.14)	(0.17)
Fraction Rep Gov x G	-0.365	-0.664	-0.101	0.183	0.625
	(-0.48)	(-0.66)	(-0.08)	(0.14)	(0.42)
Fraction Rep Gov.	0.605	1.390	2.423	3.090	4.009
	(0.81)	(0.98)	(1.22)	(1.28)	(1.47)
R-squared	1.00	1.00	1.00	0.99	0.99
Observations	219	218	217	216	215

(d) Government purchases on purchases

	Impact	h=1	h=2	h=3	h=4
Gov. purchases (G)	1.000	1.039***	1.091***	1.183***	1.306***
		(13.06)	(7.84)	(7.36)	(7.17)
Fraction Rep Gov x G	0.000	-0.097	0.574	1.502	1.257
		(-0.17)	(0.66)	(1.32)	(0.97)
Fraction Rep Gov.	0.000	1.584	3.775**	5.904**	8.036***
		(1.60)	(2.07)	(2.45)	(3.02)
R-squared	1.00	0.99	0.98	0.98	0.97
Observations	219	218	217	216	215

Inference based on Newey-West heteroskedasticity and autocorrelation robust standard errors with six lags. Coefficients on control variables omitted.



For the output and IG transfer IRF, filled markers denote significance at the 10% level or higher. Inference based on Newey-West heteroskedasticity and autocorrelation robust standard errors with two more lags than the response horizon. For the deviations from the baseline, the markers indicate significant differences from the baseline. For the cumulative multiplier, the figure shows point estimates only. Panel (a) adds the (lagged) one quarter ahead real GDP growth and GDP inflation expectations to the variables in the baseline model in Figure 7. Panel (b) additionally includes the (lagged) one quarter ahead real growth in federal government purchases and in state and local government purchases. Panel (c) also adds the (lagged) three quarter ahead real growth in federal government purchases and in state and local government purchases. In all three cases, we also add the interactions with the lagged share of Republican governors.

Figure E.1: Responses to innovations in intergovernmental transfer: Direct regressions with controls for expectations