Cross-Sectional Household Heterogeneity in Responses to Macroeconomic Shocks

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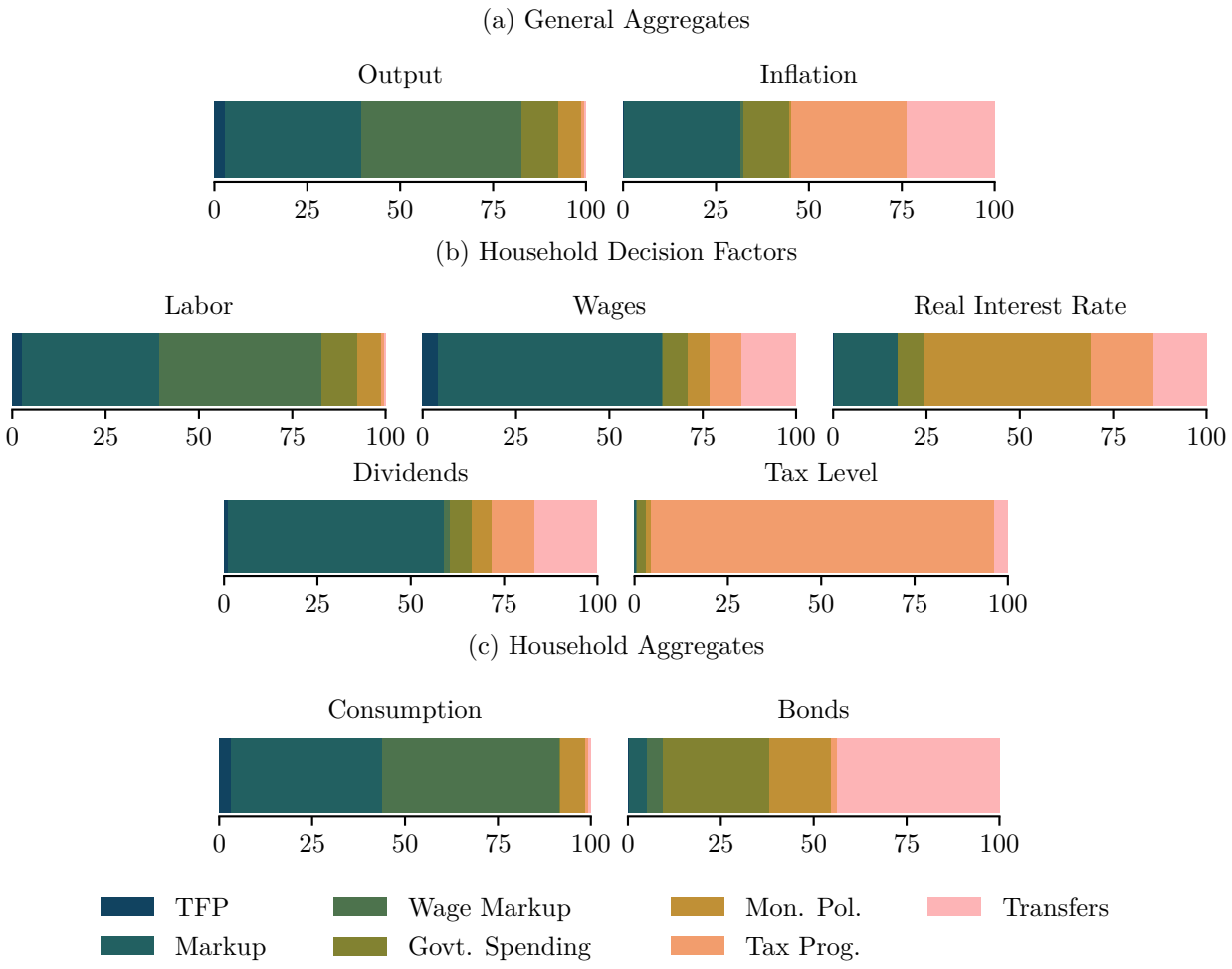
Abstract

*Replication code available at https://github.com/GavinEngelstad/HANK-Honors.

Table 3.1: Computational Parameters

Parameter	**Value**	**Description**
n_b	501	Number of asset gridpoints
$\underline{b}$	0	Borrowing constraint
$\overline{b}$	50	Maximum asset gridpoint
n_z	7	Number of productivity gridpoints
T	300	Sequence space perturbation time horizon

Figure 5.1: Variance Decomposition: Aggregates



Notes: Forecast error variance decomposition calculated at a 4 quarter time horizon.

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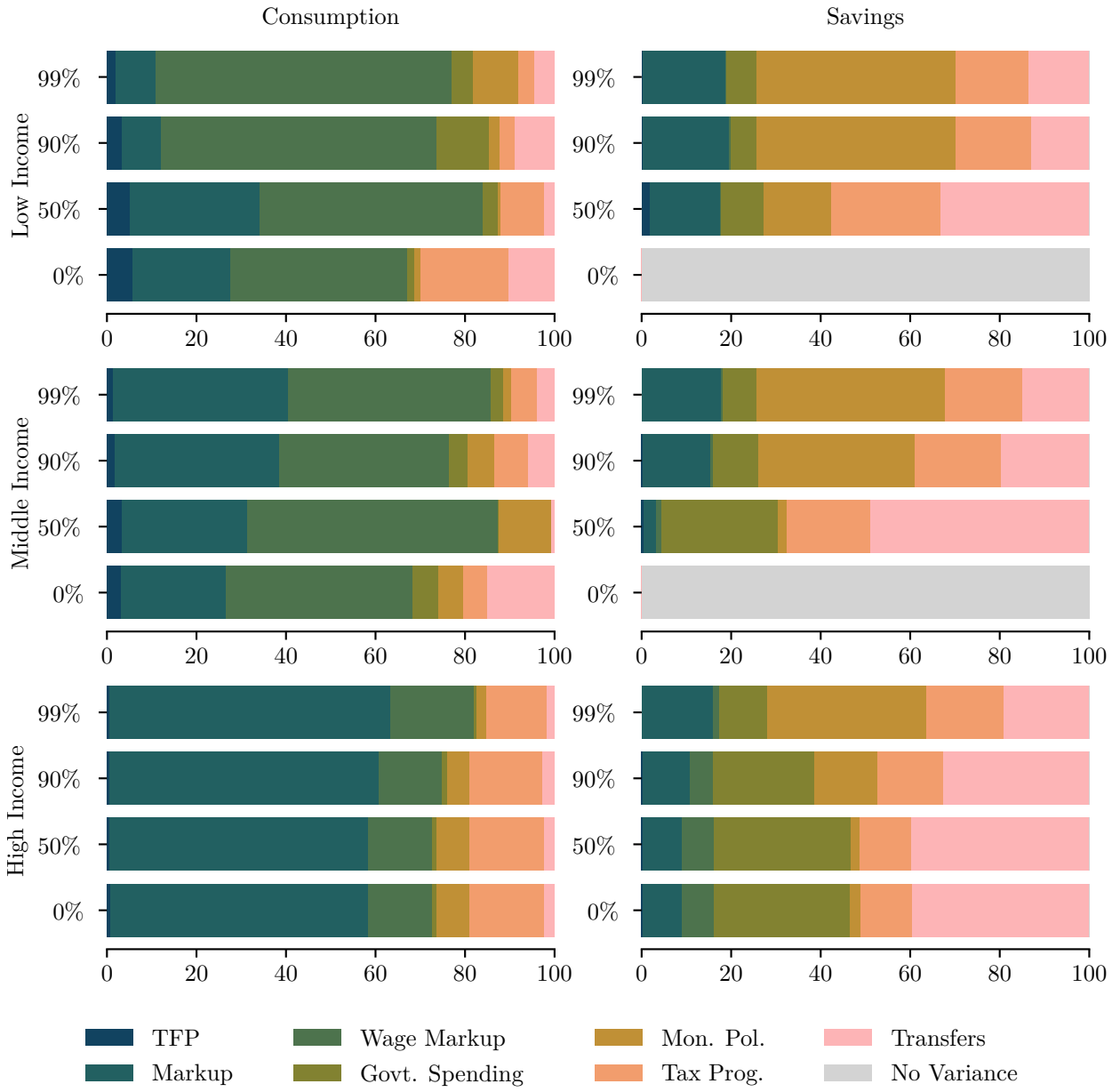
Figure 5.2: Variance Decomposition: Household Decision Rules



Notes: Forecast error variance decomposition calculated at a 4 quarter time horizon. Subplot y-axis is the household position on the wealth distribution.

References

Auclert, Adrien, Matthew Rognlie, and Ludwig Straub. 2024. "The intertemporal keynesian cross." *Journal of Political Economy* 132 (12): 4068–4121.

Figure 7.1: Historical Decomposition: Household Aggregates

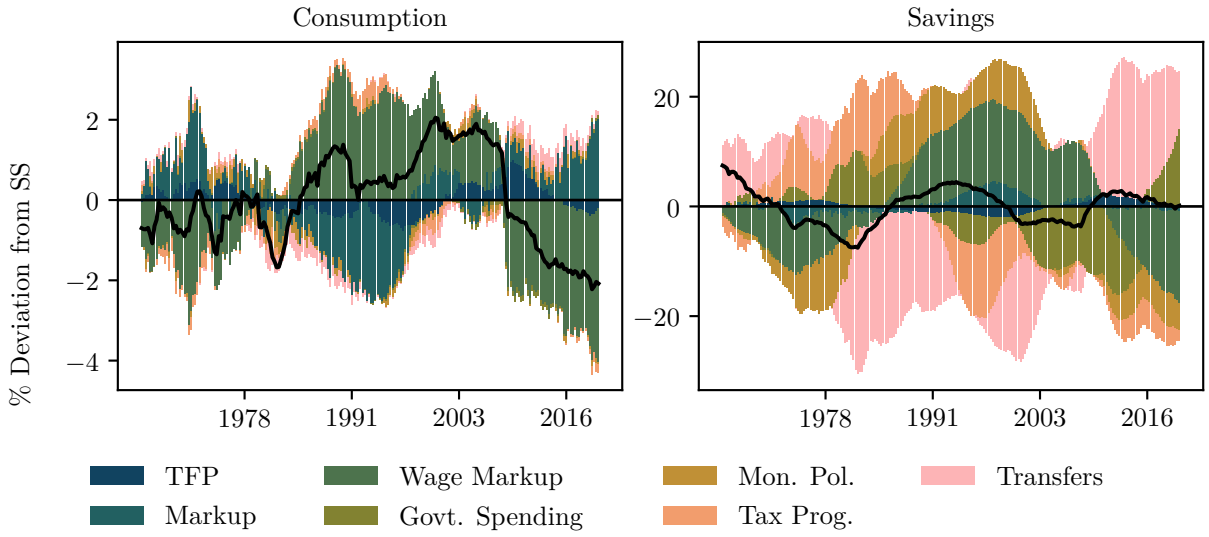


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Table 4.1: Model Parameters

Parameter	**Value**	**Description**	**Target**
Preferences			
β	0.945	Discount rate	2% annual interest rate
γ	4	Risk aversion	Kaplan, Moll, and Violante (2018)
$1/\chi$	1/2	Frisch elasticity	Chetty (2012)
ϕ	3.16	Disutility of labor	$\overline{N} = 1$
$\underline{b}$	0	Borrowing constraint	
Productivity			
ρ_z	0.963	Productivity persistence	Storesletten, Telmer, and Yaron (2004)
σ_z	0.134	Productivity STD	Cross-sectional STD of 0.5
Unions			
κ_W	0.1	Wage Philips Curve	
Firms			
κ	0.1	Philips Curve	
Government			
ρ_B	0.93	Debt persistence	Auclert, Rognlie, and Straub (2024)
$\overline{B}$	0.577	Govt. debt target	57.7% debt to GDP steady state
ω_π	1.5	Taylor inflation	
ω_Y	0	Taylor output	
$\overline{\pi}$	1	Inflation target	0% inflation steady state
Shock SS			
$\overline{A}$	1	TFP	
$\overline{\psi}$	1.2	Markup	20% markup
$\overline{\psi}_W$	1.2	Wage markup	20% markup
$\overline{g}$	0.202	Govt. spending	20.1% govt. spending
$\overline{\eta}$	0.081	Transfers	8.1% transfers
$\overline{\tau}^P$	1.18	Tax progressivity	Heathcote, Storesletten, and Violante (2017)
$\overline{\xi}$	1	Monetary shock	

Table 4.2: Estimation Results

Parameter		**Prior**			**Posterior**			
Shock	Statistic	Distribution	Mean	Std. Dev.	Mode	Mean	5%	95%
TFP	ρ	Beta	0.50	0.15	0.952	0.952	0.934	0.969
	σ	Inv. Gamma	0.20	2.00	0.152	0.154	0.142	0.166
Markup	ρ	Beta	0.50	0.15	0.987	0.983	0.970	0.991
	σ	Inv. Gamma	0.20	2.00	0.549	0.558	0.511	0.611
Wage Markup	ρ	Beta	0.50	0.15	0.997	0.997	0.996	0.997
	σ	Inv. Gamma	0.20	2.00	1.761	1.765	1.621	1.921
Govt. Spend	ρ	Beta	0.50	0.15	0.850	0.856	0.807	0.906
	σ	Inv. Gamma	0.20	2.00	0.648	0.856	0.807	0.906
Mon. Pol.	ρ	Beta	0.50	0.15	0.634	0.627	0.574	0.678
	σ	Inv. Gamma	0.20	2.00	0.440	0.444	0.409	0.481
Tax Prog.	ρ	Beta	0.50	0.15	0.914	0.905	0.874	0.934
	σ	Inv. Gamma	0.20	2.00	1.707	1.852	1.512	2.242
Transfers	ρ	Beta	0.50	0.15	0.834	0.851	0.791	0.918
	σ	Inv. Gamma	0.20	2.00	2.460	2.409	2.050	2.784

Table 5.1: Household Steady State Behavior

	Low Income (10%)				**Middle Income (50%)**				**High Income (90%)**			
	0%	50%	90%	99%	0%	50%	90%	99%	0%	50%	90%	99%
States												
Productivity	0.444	0.444	0.444	0.444	1.000	1.000	1.000	1.000	2.252	2.252	2.252	2.252
Assets	0.000	0.040	1.874	5.896	0.000	0.040	1.874	5.896	0.000	0.040	1.874	5.896
Decisions												
Consumption	0.483	0.507	0.696	0.896	0.744	0.754	0.898	1.079	1.109	1.111	1.200	1.352
Savings	0.000	0.016	1.670	5.512	0.000	0.030	1.730	5.591	0.173	0.211	1.965	5.855
Income												
Wages	0.327	0.327	0.327	0.327	0.737	0.737	0.737	0.737	1.660	1.660	1.660	1.660
	(67.79)	(62.60)	(13.83)	(5.11)	(99.00)	(93.95)	(28.05)	(11.05)	(129.54)	(125.62)	(52.45)	(23.03)
Interest	0.000	0.040	1.883	5.926	0.000	0.040	1.883	5.926	0.000	0.040	1.883	5.926
	(0.00)	(7.66)	(79.60)	(92.47)	(0.00)	(5.10)	(71.67)	(88.83)	(0.00)	(3.03)	(59.51)	(82.22)
Transfers	0.248	0.248	0.248	0.248	0.248	0.248	0.248	0.248	0.248	0.248	0.248	0.248
	(51.30)	(47.37)	(10.47)	(3.86)	(33.27)	(31.57)	(9.42)	(3.71)	(19.33)	(18.74)	(7.83)	(3.44)
Taxes	-0.092	-0.092	-0.092	-0.092	-0.240	-0.240	-0.240	-0.240	-0.626	-0.626	-0.626	-0.626
	(19.09)	(17.63)	(3.89)	(1.44)	(32.27)	(30.62)	(9.14)	(3.60)	(48.86)	(47.38)	(19.79)	(8.69)
Total	0.483	0.523	2.366	6.408	0.744	0.785	2.628	6.670	1.282	1.326	3.165	7.207
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Notes: Income share in parenthesis. Column percentiles correspond to the 0th, 50th, 90th, and 99th wealth percentiles.

Table 6.1: Direct Effects Decomposition: Consumption

	Total	**Low Income**				**Middle Income**				**High Income**			
		0th	50th	90th	99th	0th	50th	90th	99th	0th	50th	90th	99th
Variance Components													
Var(L)	0.57	0.14	0.13	0.14	0.17	0.71	0.52	0.43	0.45	1.25	1.24	1.15	1.12
	(70.8)	(130.0)	(1,048.1)	(66.8)	(135.2)	(912.6)	(77.4)	(24.8)	(39.2)	(13.5)	(13.4)	(13.8)	(19.6)
Var(W)	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.01	0.03	0.02	0.02	0.05	0.07
	(0.0)	(2.6)	(22.8)	(1.7)	(12.4)	(18.2)	(0.7)	(0.8)	(3.1)	(0.3)	(0.3)	(0.6)	(1.3)
Var(R)	0.25	0.00	0.02	0.20	0.10	0.00	0.24	0.75	0.35	2.62	2.63	2.30	1.13
	(31.6)	(0.0)	(150.7)	(94.3)	(78.6)	(0.0)	(36.2)	(43.0)	(30.5)	(28.3)	(28.4)	(27.6)	(19.7)
Var(T)	0.09	0.08	0.06	0.09	0.13	0.08	0.06	0.11	0.14	0.12	0.12	0.15	0.15
	(11.3)	(77.6)	(460.0)	(41.9)	(98.2)	(107.3)	(8.2)	(6.3)	(12.2)	(1.3)	(1.3)	(1.7)	(2.7)
Var(τ)	0.00	0.13	0.10	0.01	0.00	0.04	0.01	0.00	0.00	0.26	0.26	0.22	0.19
	(0.6)	(120.7)	(769.9)	(6.0)	(2.7)	(54.7)	(1.7)	(0.1)	(0.3)	(2.9)	(2.8)	(2.7)	(3.2)
Covariance Components													
Cov(L, W)	0.00	-0.02	-0.02	0.02	0.05	-0.10	-0.05	0.08	0.12	0.17	0.17	0.24	0.29
	(0.1)	(-17.5)	(-153.8)	(10.2)	(40.8)	(-123.0)	(-6.8)	(4.3)	(10.9)	(1.8)	(1.9)	(2.8)	(5.0)
Cov(L, R)	0.36	0.00	0.05	0.15	0.03	0.00	0.35	0.55	0.33	1.80	1.80	1.61	1.06
	(44.9)	(0.0)	(382.5)	(71.5)	(25.1)	(0.0)	(52.3)	(31.6)	(28.8)	(19.4)	(19.4)	(19.2)	(18.6)
Cov(L, T)	-0.23	-0.11	-0.08	-0.11	-0.15	-0.24	-0.17	-0.22	-0.25	-0.39	-0.39	-0.41	-0.42
	(-28.2)	(-98.3)	(-686.4)	(-52.9)	(-115.2)	(-306.4)	(-25.2)	(-12.5)	(-21.9)	(-4.2)	(-4.2)	(-4.9)	(-7.3)
Cov(L, τ)	-0.03	-0.13	-0.11	-0.04	-0.02	-0.16	-0.07	0.02	0.03	0.57	0.57	0.51	0.46
	(-3.8)	(-124.5)	(-890.2)	(-19.5)	(-18.4)	(-204.8)	(-9.7)	(1.1)	(3.0)	(6.2)	(6.2)	(6.0)	(8.0)
Cov(W, R)	0.00	0.00	-0.01	0.02	0.01	0.00	-0.03	0.09	0.09	0.24	0.24	0.32	0.26
	(0.1)	(0.0)	(-55.1)	(9.9)	(5.8)	(0.0)	(-4.8)	(5.3)	(7.6)	(2.5)	(2.6)	(3.9)	(4.6)
Cov(W, T)	-0.00	0.01	0.01	-0.02	-0.04	0.03	0.02	-0.04	-0.07	-0.05	-0.05	-0.08	-0.11
	(-0.1)	(12.4)	(99.9)	(-8.1)	(-34.8)	(38.7)	(2.2)	(-2.2)	(-6.1)	(-0.6)	(-0.6)	(-1.0)	(-1.9)
Cov(W, τ)	-0.00	0.02	0.02	-0.01	-0.01	0.02	0.01	0.00	0.01	0.08	0.08	0.10	0.12
	(-0.0)	(16.3)	(130.2)	(-2.8)	(-5.4)	(24.1)	(1.0)	(0.2)	(0.9)	(0.8)	(0.9)	(1.2)	(2.0)
Cov(R, T)	-0.15	0.00	-0.03	-0.12	-0.03	0.00	-0.11	-0.28	-0.18	-0.56	-0.56	-0.57	-0.39
	(-18.4)	(0.0)	(-261.1)	(-56.2)	(-20.9)	(0.0)	(-17.2)	(-15.9)	(-16.0)	(-6.1)	(-6.1)	(-6.8)	(-6.9)
Cov(R, τ)	-0.03	0.00	-0.04	-0.05	-0.01	0.00	-0.05	0.02	0.02	0.82	0.82	0.70	0.43
	(-3.5)	(0.0)	(-336.2)	(-22.7)	(-6.2)	(0.0)	(-7.2)	(1.1)	(1.9)	(8.9)	(8.9)	(8.4)	(7.6)
Cov(T, τ)	0.01	0.10	0.07	0.03	0.02	0.06	0.02	-0.01	-0.02	-0.18	-0.18	-0.18	-0.17
	(1.7)	(96.2)	(594.4)	(15.3)	(15.7)	(74.9)	(3.3)	(-0.6)	(-1.7)	(-1.9)	(-1.9)	(-2.1)	(-3.0)
Total													
Var(c)	0.80	0.11	0.01	0.21	0.13	0.08	0.67	1.74	1.14	9.27	9.27	8.35	5.72
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

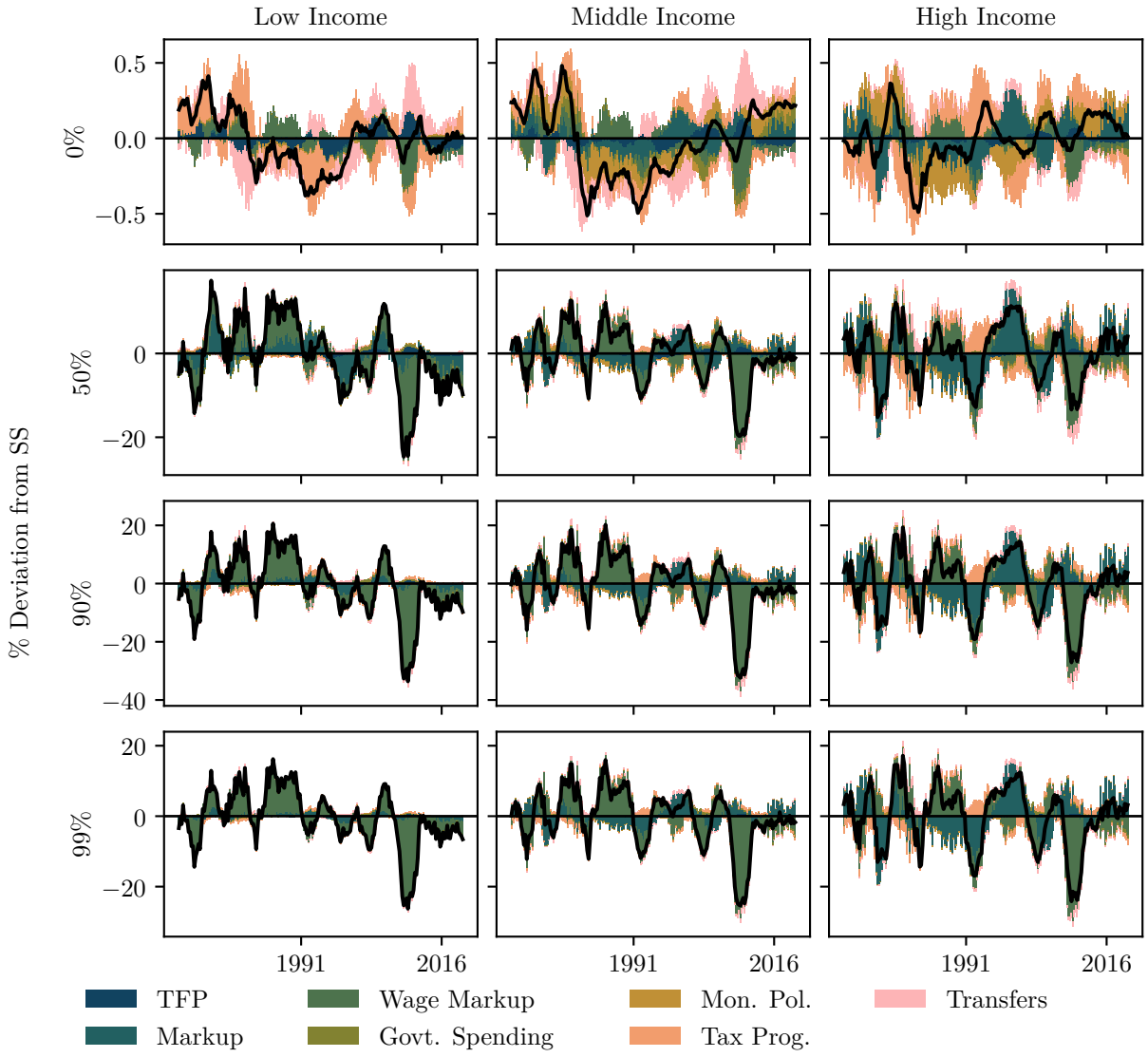
Notes: Forecast error variance decomposition calculated at a 4 quarter time horizon. Variance percent share in parenthesis. Column percentiles correspond to the 0th, 50th, 90th, and 99th wealth percentiles.

Table 6.2: Direct Effects Decomposition: Savings

	Total	**Low Income**				**Middle Income**				**High Income**			
		0th	50th	90th	99th	0th	50th	90th	99th	0th	50th	90th	99th
Variance Components													
Var(L)	0.34	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.03	0.61	0.61	0.68	0.71
	(12.2)	(0.0)	(0.4)	(0.0)	(0.0)	(0.0)	(4.6)	(0.4)	(0.0)	(837.3)	(772.3)	(10.8)	(1.2)
Var(W)	0.12	0.00	0.00	0.01	0.03	0.00	0.00	0.06	0.09	0.18	0.18	0.24	0.29
	(4.4)	(0.0)	(0.3)	(0.2)	(0.0)	(0.0)	(1.3)	(0.6)	(0.1)	(243.5)	(226.6)	(3.8)	(0.5)
Var(R)	5.05	0.00	0.02	7.16	64.35	0.00	0.26	8.69	67.51	2.62	2.70	11.72	71.98
	(182.6)	(0.0)	(43.7)	(87.9)	(95.8)	(0.0)	(76.9)	(92.0)	(97.3)	(3,599.0)	(3,398.3)	(185.9)	(118.0)
Var(T)	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.02
	(0.1)	(0.0)	(5.2)	(0.1)	(0.0)	(0.0)	(1.6)	(0.1)	(0.0)	(16.5)	(15.4)	(0.3)	(0.0)
Var(τ)	0.12	0.00	0.00	0.06	0.09	0.00	0.01	0.05	0.06	0.89	0.89	0.97	1.05
	(4.4)	(0.0)	(4.6)	(0.8)	(0.1)	(0.0)	(2.9)	(0.5)	(0.1)	(1,215.6)	(1,118.6)	(15.4)	(1.7)
Covariance Components													
Cov(L, W)	-0.20	0.00	0.00	0.00	0.01	0.00	-0.00	-0.04	-0.05	-0.31	-0.31	-0.38	-0.43
	(-7.2)	(0.0)	(0.2)	(0.0)	(0.0)	(0.0)	(-1.3)	(-0.4)	(-0.1)	(-419.6)	(-389.0)	(-6.0)	(-0.7)
Cov(L, R)	-1.24	0.00	-0.00	0.05	0.32	0.00	-0.06	-0.28	-0.41	-1.26	-1.29	-2.00	-3.28
	(-45.0)	(0.0)	(-3.5)	(0.6)	(0.5)	(0.0)	(-18.3)	(-3.0)	(-0.6)	(-1,735.0)	(-1,616.9)	(-31.7)	(-5.4)
Cov(L, T)	0.01	0.00	-0.00	-0.00	-0.01	0.00	-0.01	0.01	0.01	0.05	0.05	0.07	0.09
	(0.5)	(0.0)	(-1.5)	(-0.0)	(-0.0)	(0.0)	(-2.2)	(0.1)	(0.0)	(63.1)	(59.5)	(1.2)	(0.1)
Cov(L, τ)	0.20	0.00	-0.00	0.00	0.01	0.00	-0.01	-0.04	-0.04	0.72	0.72	0.79	0.84
	(7.2)	(0.0)	(-1.3)	(0.0)	(0.0)	(0.0)	(-3.7)	(-0.4)	(-0.1)	(985.0)	(907.5)	(12.6)	(1.4)
Cov(W, R)	0.77	0.00	-0.00	0.22	0.82	0.00	0.02	0.55	1.56	0.64	0.66	1.46	3.08
	(28.0)	(0.0)	(-0.5)	(2.7)	(1.2)	(0.0)	(7.1)	(5.9)	(2.2)	(879.8)	(832.5)	(23.2)	(5.1)
Cov(W, T)	-0.01	0.00	-0.00	-0.00	-0.02	0.00	-0.00	-0.02	-0.03	-0.04	-0.04	-0.06	-0.07
	(-0.4)	(0.0)	(-0.8)	(-0.1)	(-0.0)	(0.0)	(-0.1)	(-0.2)	(-0.0)	(-51.3)	(-48.1)	(-0.9)	(-0.1)
Cov(W, τ)	-0.12	0.00	-0.00	0.03	0.05	0.00	0.00	0.05	0.07	-0.39	-0.40	-0.48	-0.55
	(-4.4)	(0.0)	(-0.3)	(0.3)	(0.1)	(0.0)	(1.0)	(0.5)	(0.1)	(-537.0)	(-497.1)	(-7.6)	(-0.9)
Cov(R, T)	-0.08	0.00	0.01	-0.17	-0.76	0.00	0.03	-0.24	-0.86	-0.10	-0.11	-0.41	-1.00
	(-3.0)	(0.0)	(12.3)	(-2.1)	(-1.1)	(0.0)	(7.4)	(-2.6)	(-1.2)	(-136.6)	(-134.6)	(-6.5)	(-1.6)
Cov(R, τ)	-0.77	0.00	0.01	0.34	0.92	0.00	0.05	0.33	0.60	-1.50	-1.53	-2.77	-5.32
	(-28.0)	(0.0)	(14.0)	(4.1)	(1.4)	(0.0)	(14.5)	(3.5)	(0.9)	(-2,054.4)	(-1,922.9)	(-43.9)	(-8.7)
Cov(T, τ)	0.01	0.00	0.00	-0.00	-0.02	0.00	0.01	-0.01	-0.02	0.07	0.07	0.11	0.12
	(0.4)	(0.0)	(4.4)	(-0.0)	(-0.0)	(0.0)	(1.8)	(-0.1)	(-0.0)	(100.0)	(93.7)	(1.7)	(0.2)
Total													
Var(a)	2.76	0.00	0.06	8.15	67.17	0.00	0.34	9.45	69.36	0.07	0.08	6.31	61.02
	(100.0)	(0.0)	(100.0)	(100.0)	(100.0)	(0.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

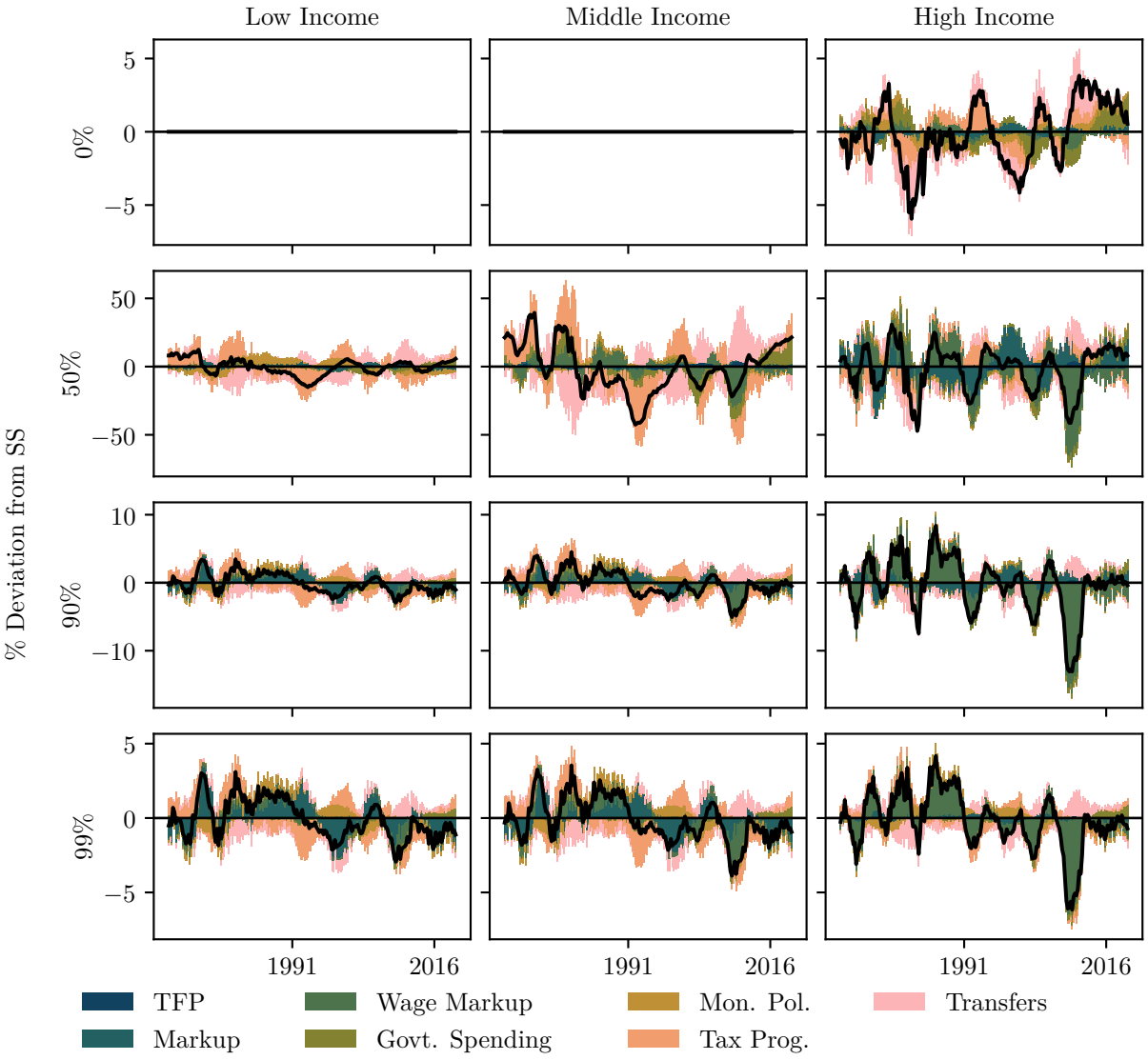
Notes: Forecast error variance decomposition calculated at a 4 quarter time horizon. Variance percent share in parenthesis. Column percentiles correspond to the 0th, 50th, 90th, and 99th wealth percentiles.

Figure 7.2: Historical Decomposition: Household Consumption



Notes: Row labeled by wealth percentile. 12 quarter moving average applied.

Figure 7.3: Historical Decomposition: Household Savings



Notes: Row labeled by wealth percentile. 12 quarter moving average applied.

Figure 7.4: Historical Endogenous Decomposition: Household Aggregates

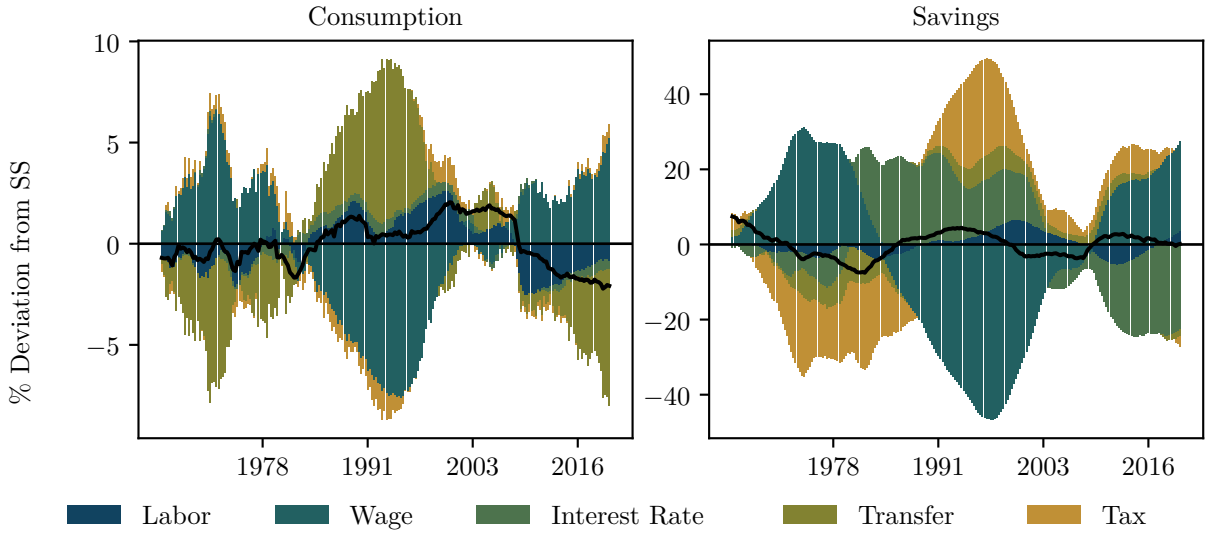
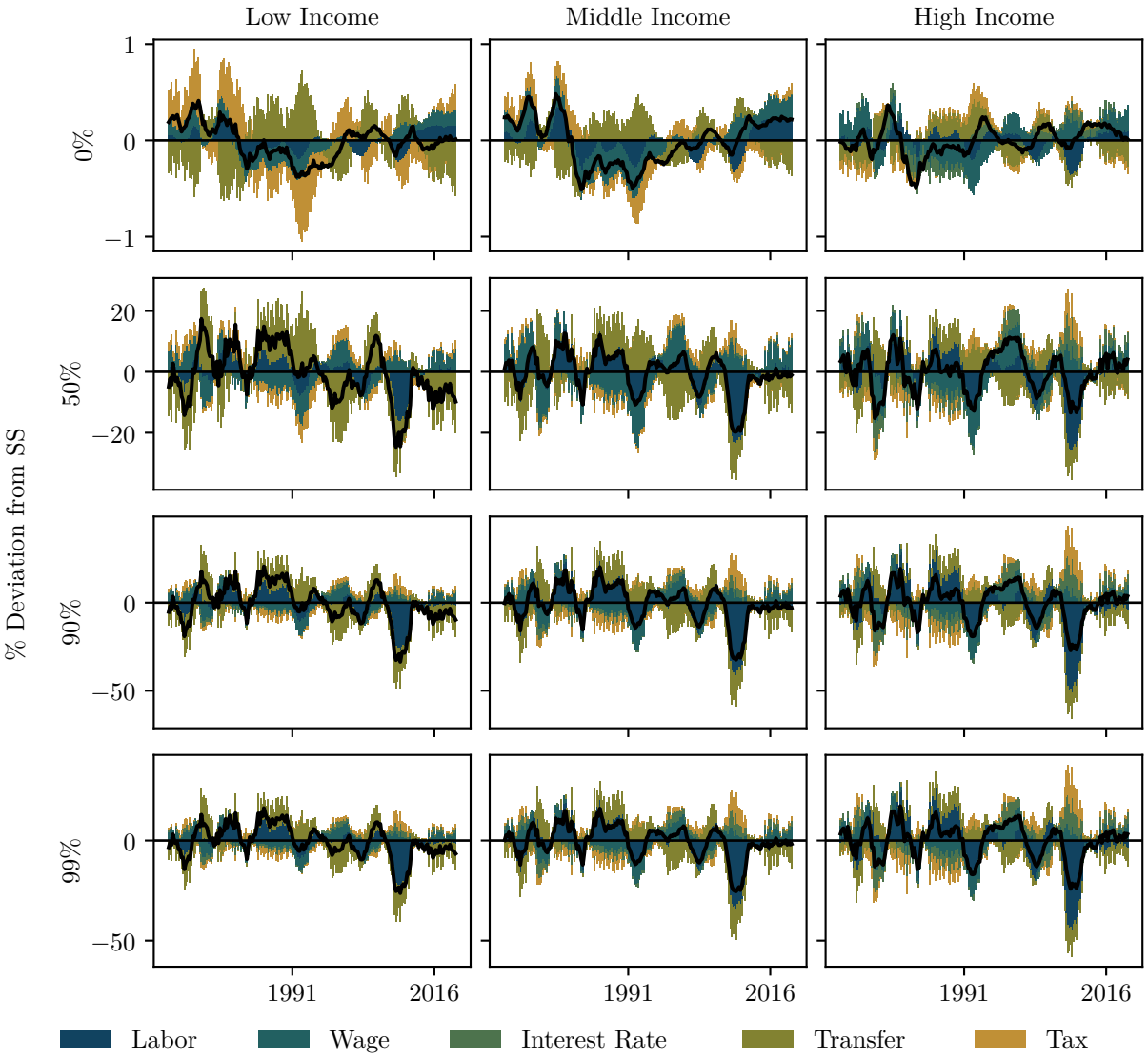
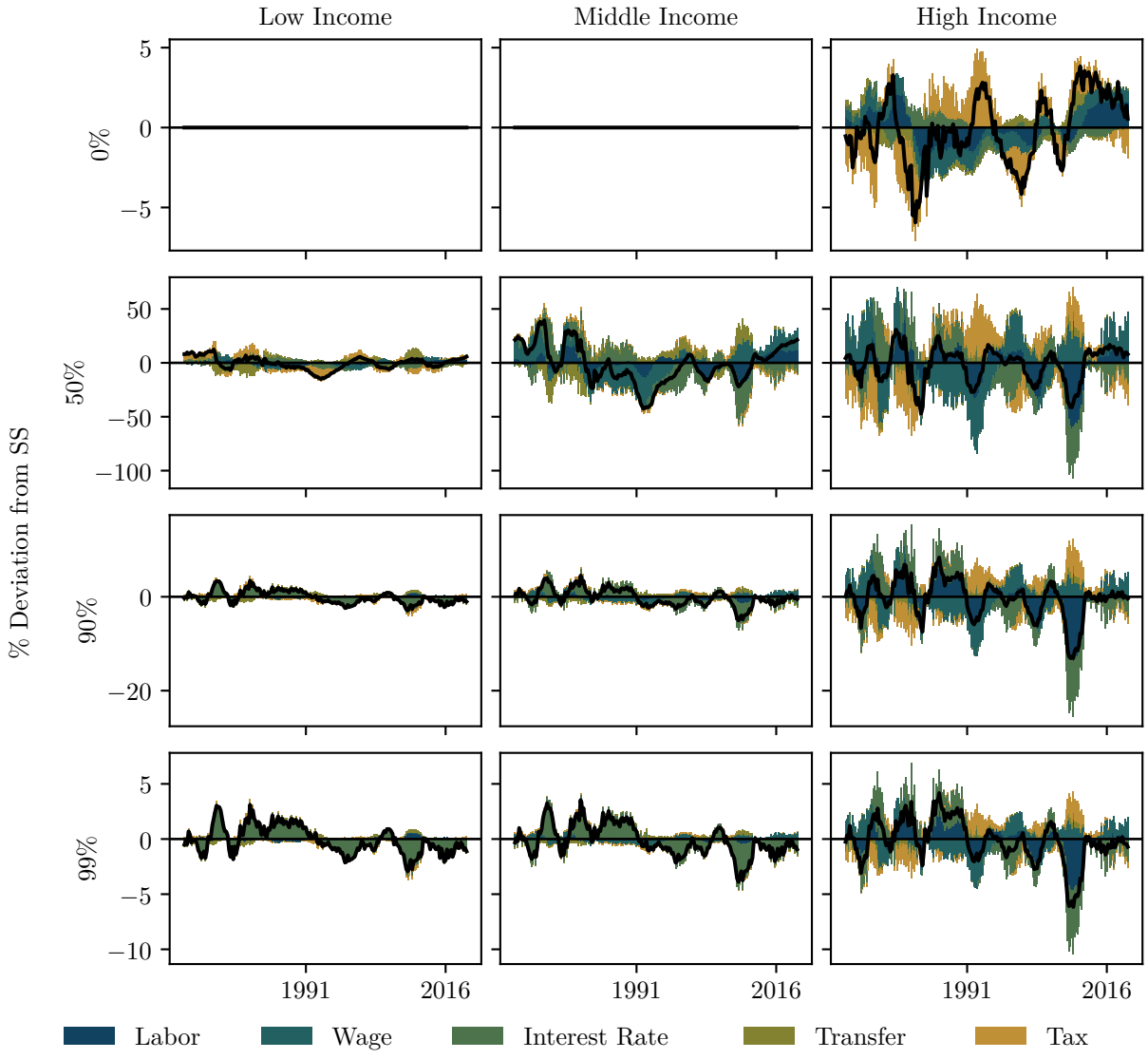


Figure 7.5: Historical Endogenous Decomposition: Household Consumption



Notes: Row labeled by wealth percentile. 12 quarter moving average applied.

Figure 7.6: Historical Endogenous Decomposition: Household Savings



Notes: Row labeled by wealth percentile. 12 quarter moving average applied.

A Data

B Additional Model Details

B.1 Household Decision Rules

B.2 Labor Packer Demand Function

B.3 Wage Philips Curve

B.4 Final Goods Firm Conditions

B.5 Philips Curve

B.6 Aggregation

B.7 Characterization

C Computational Error

TBD

D Estimation Results

Figure D.1: Recursive Means

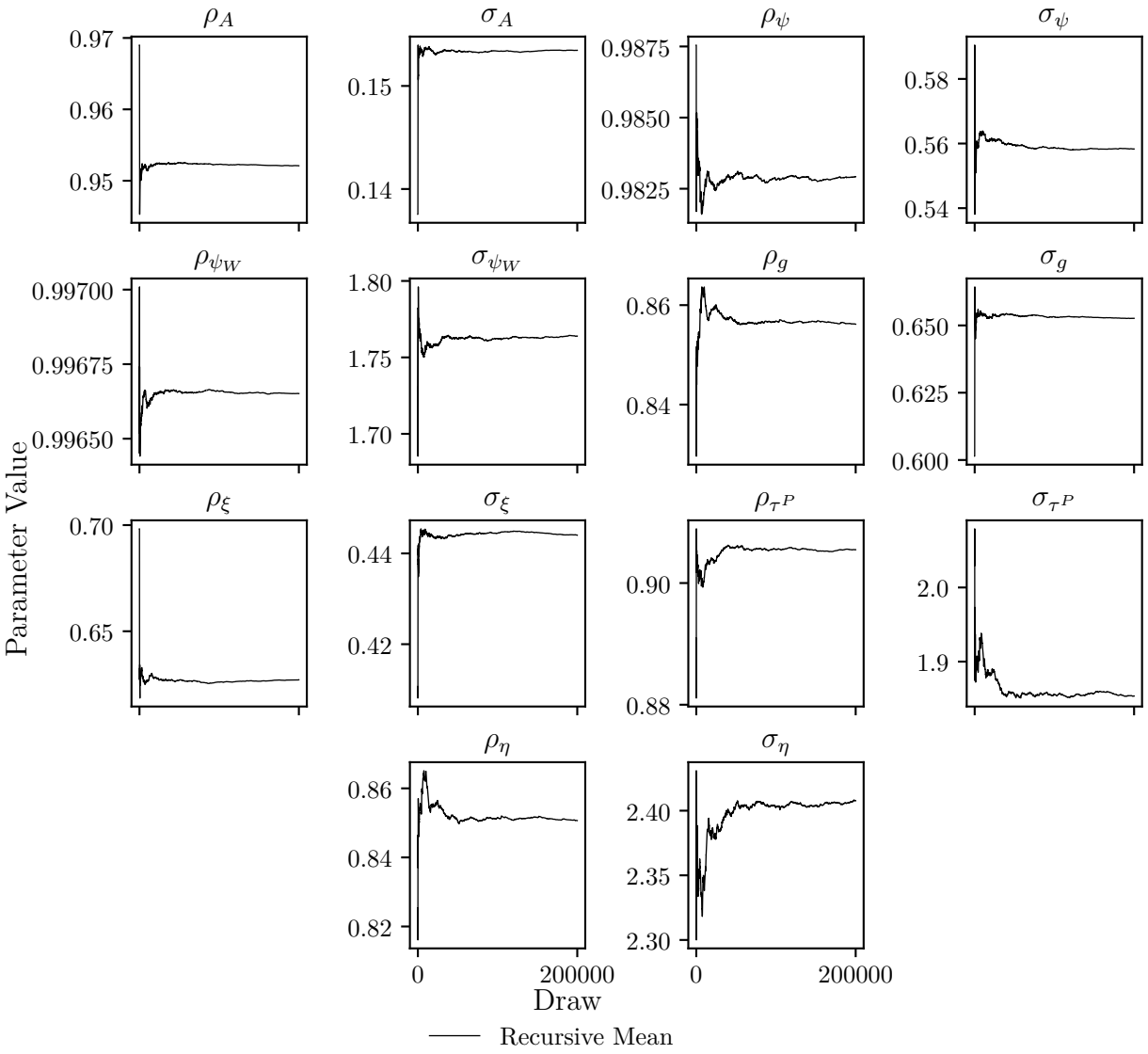


Figure D.2: Posterior Distributions

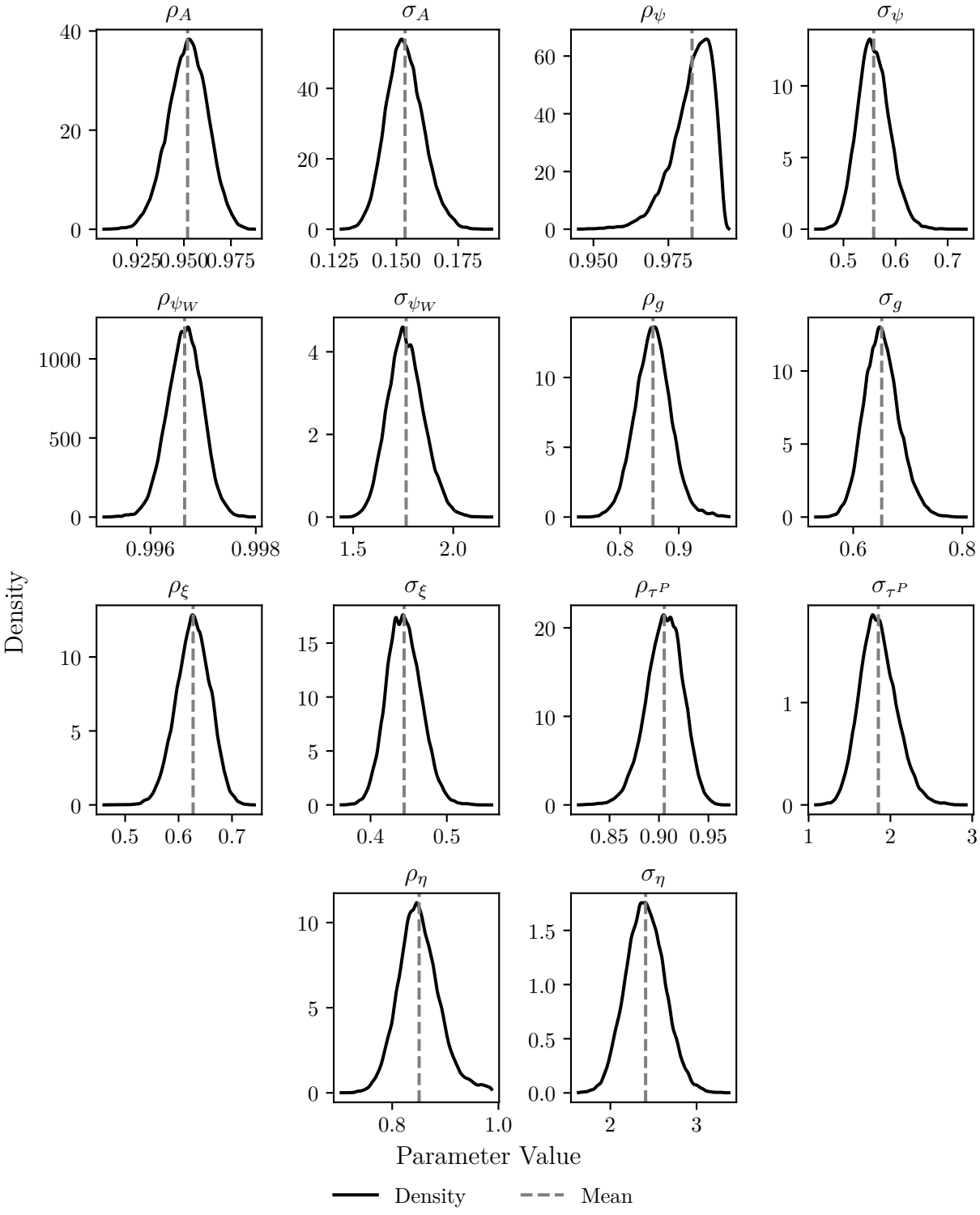
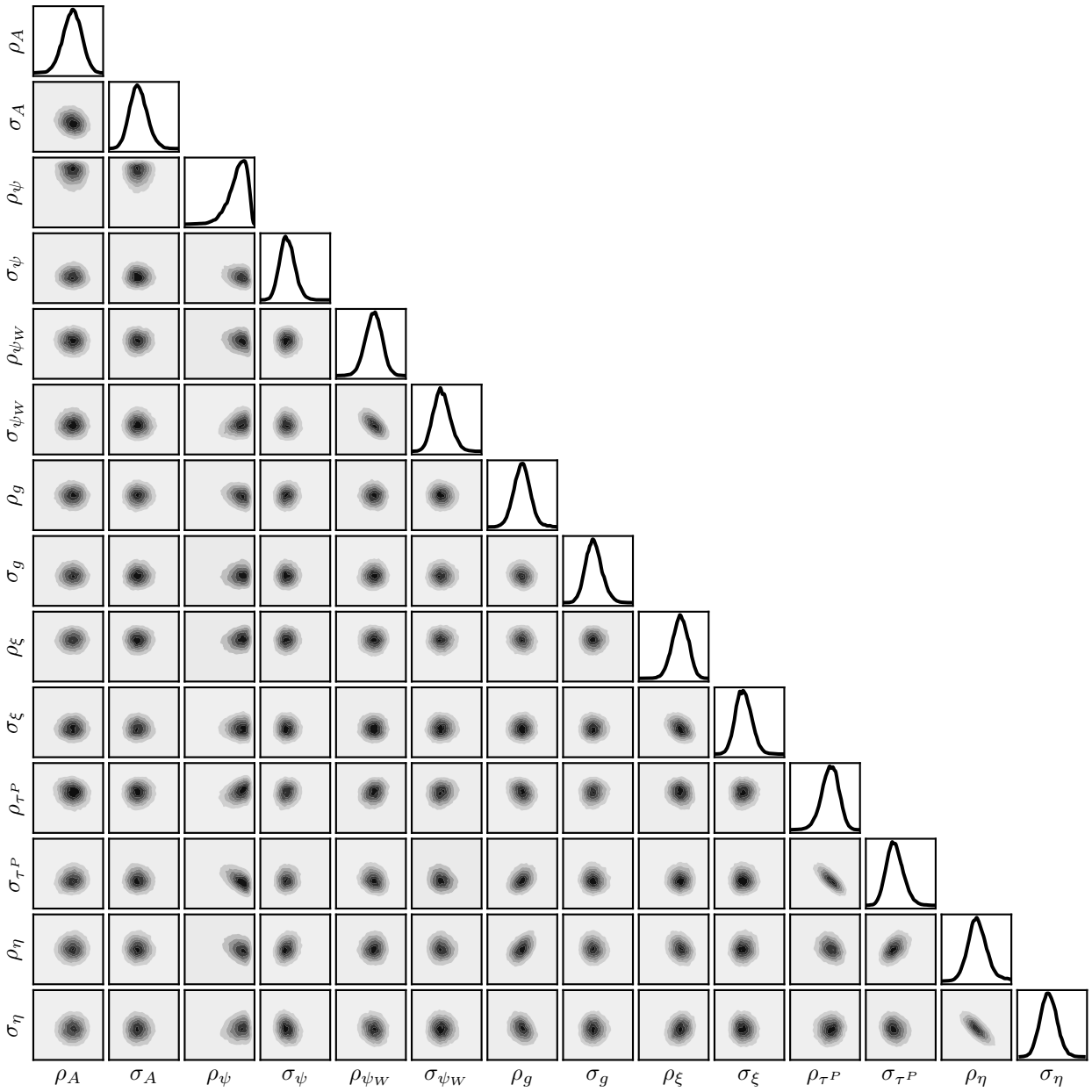


Figure D.3: Posterior Covariences



E Aggregate IRFs

Figure E.1: TFP (A) Shock Impulse Response Functions

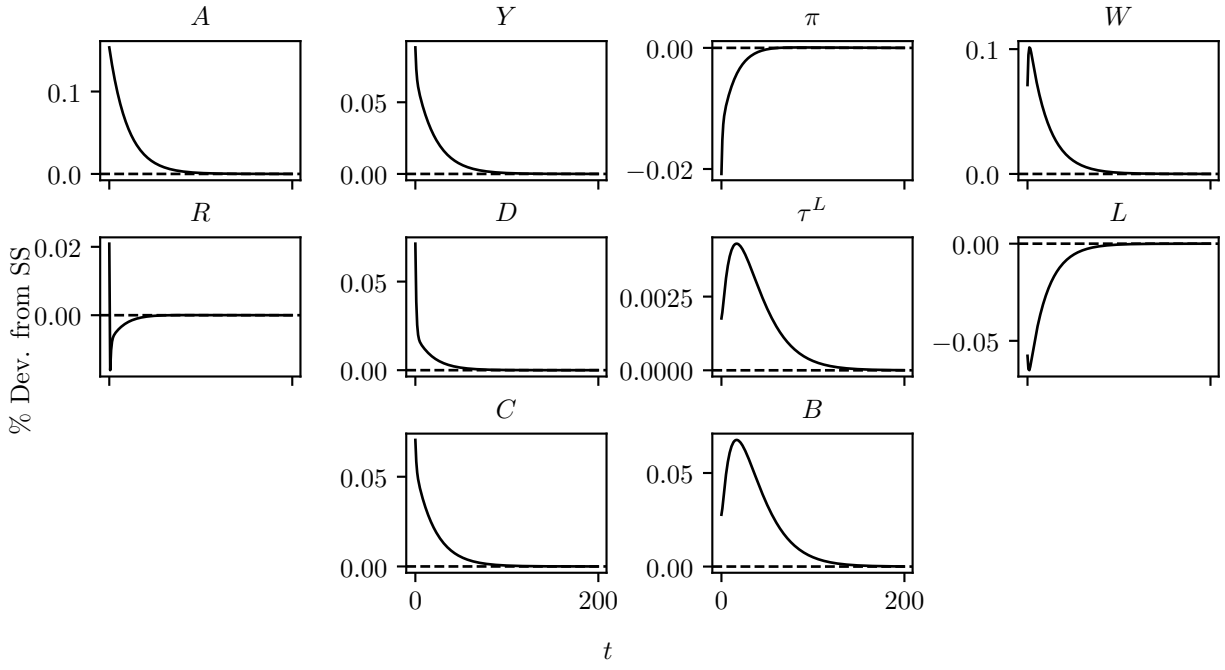


Figure E.2: Price Markup (ψ) Shock Impulse Response Functions

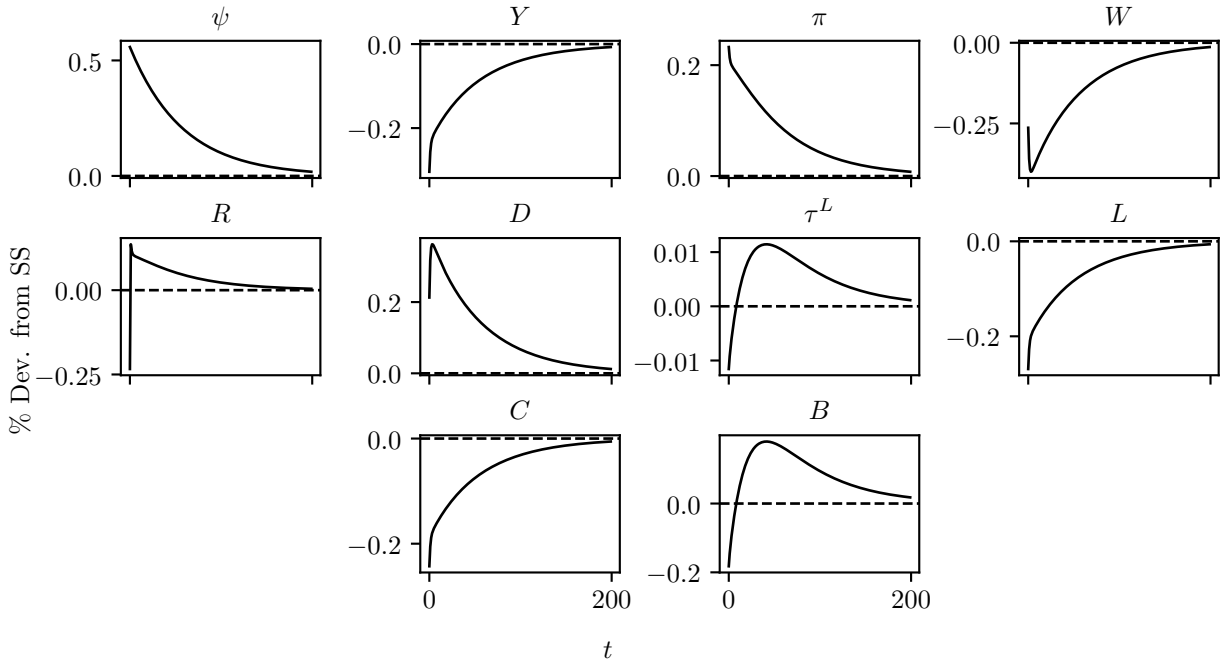


Figure E.3: Wage Markup (ψ_W) Shock Impulse Response Functions

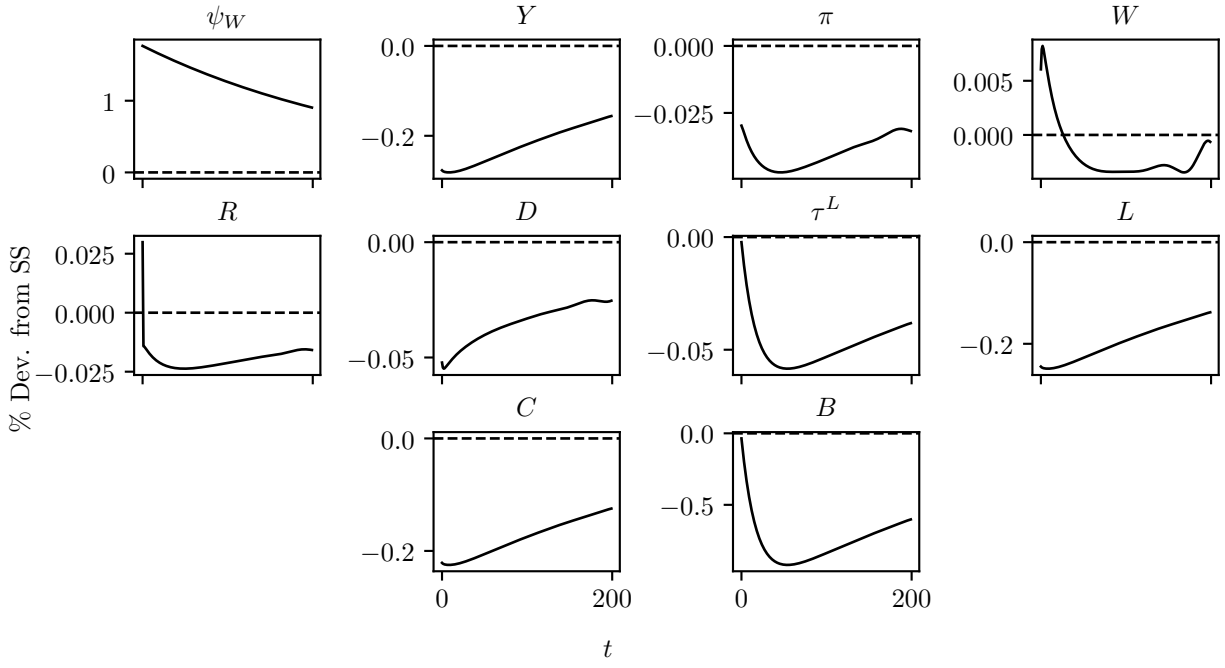


Figure E.4: Govt. Spending (g) Shock Impulse Response Functions

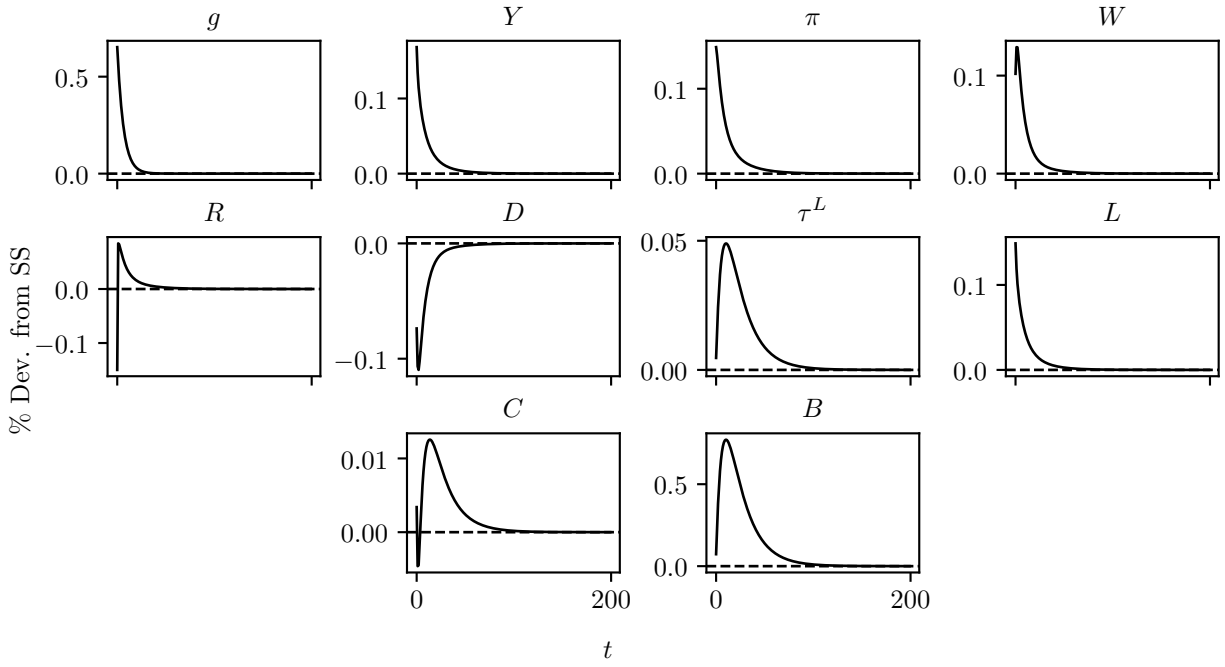


Figure E.5: Monetary Policy (ξ) Shock Impulse Response Functions

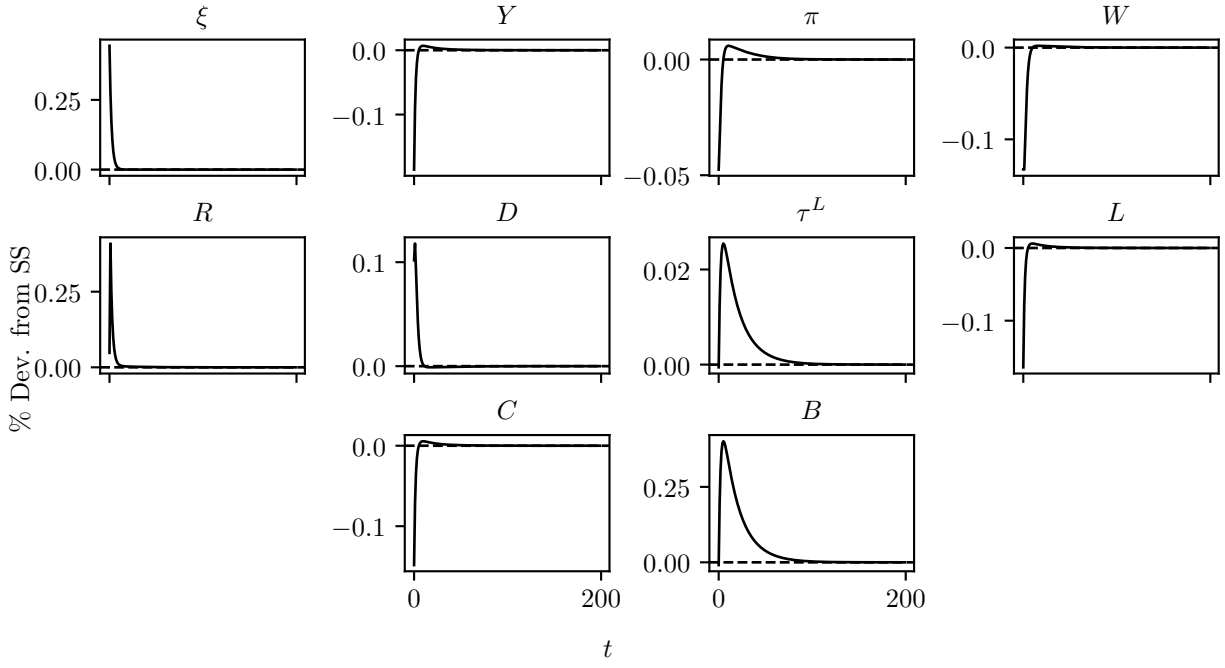


Figure E.6: Tax Progressivity (τ^P) Shock Impulse Response Functions

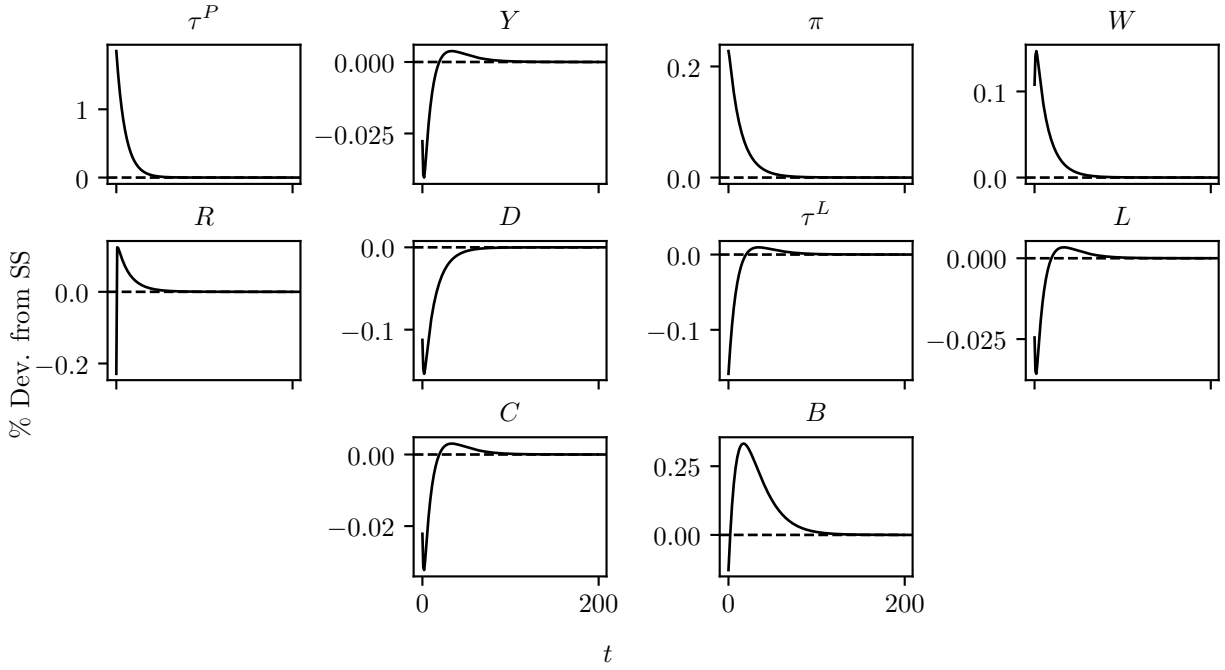
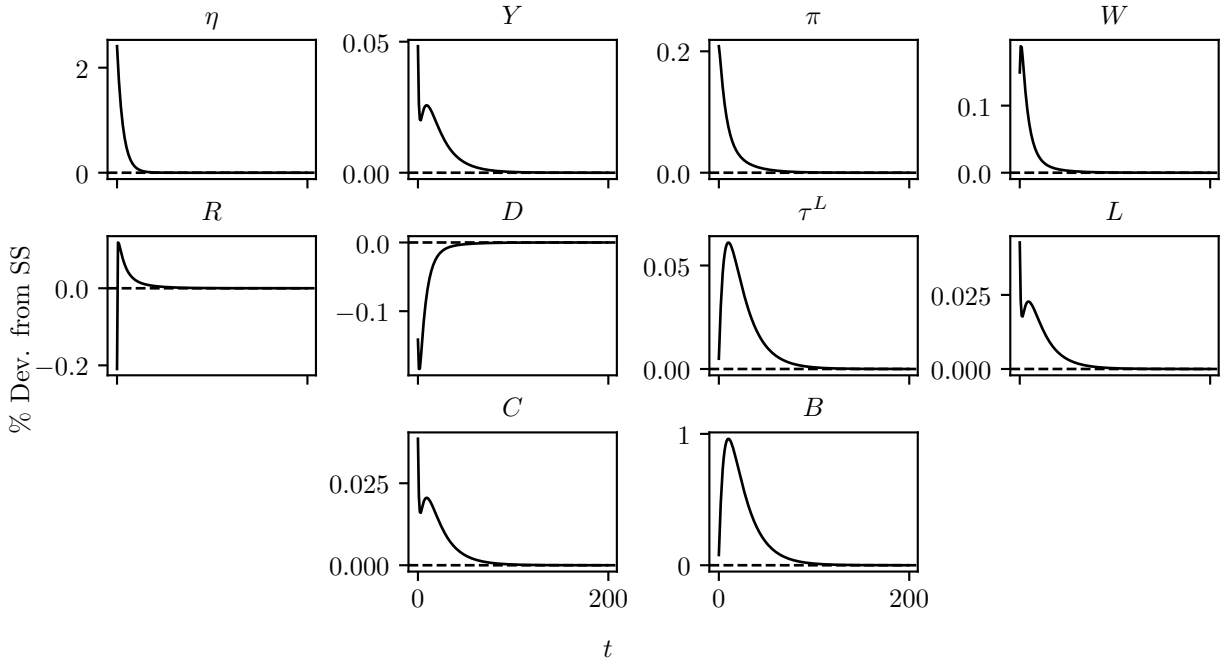


Figure E.7: Household Transfer (η) Shock Impulse Response Functions



F Forecast Error Variance Decomposition Calculation

G Household Decision Rules

Figure G.1: Household Decision Rules

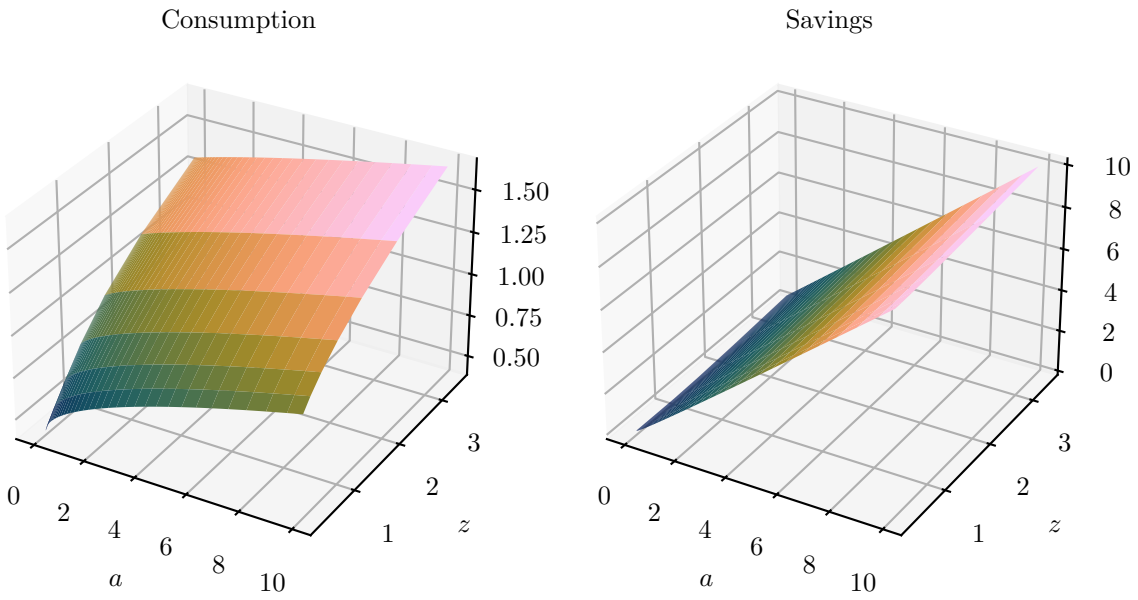


Figure G.2: Household Income Shares

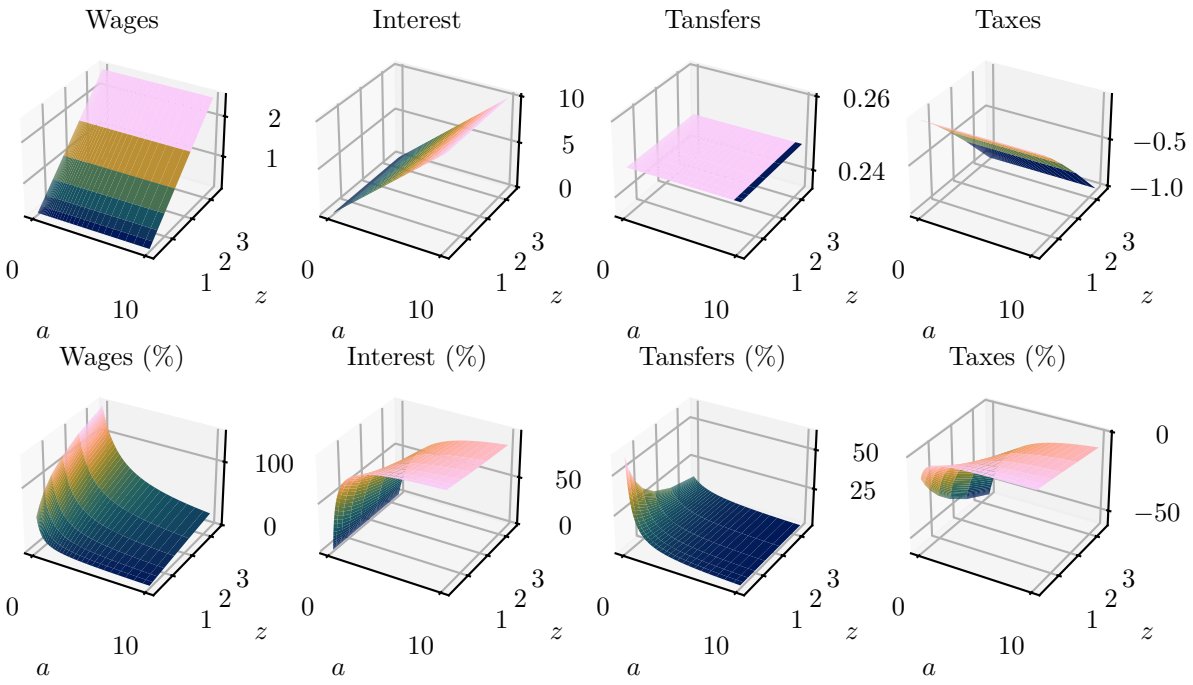


Figure G.3: Consumption Response to a TFP Shock

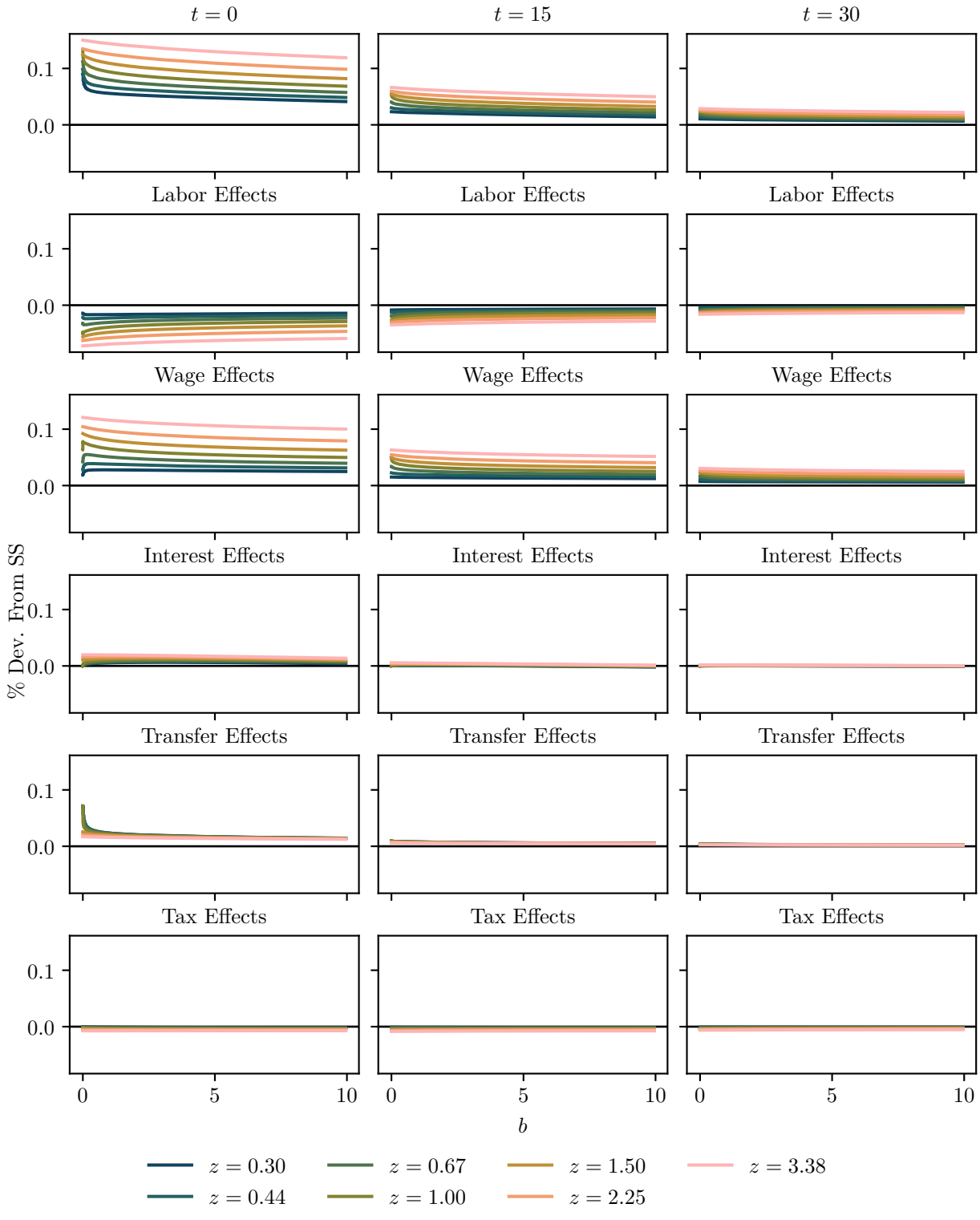


Figure G.4: Savings Response to a TFP Shock

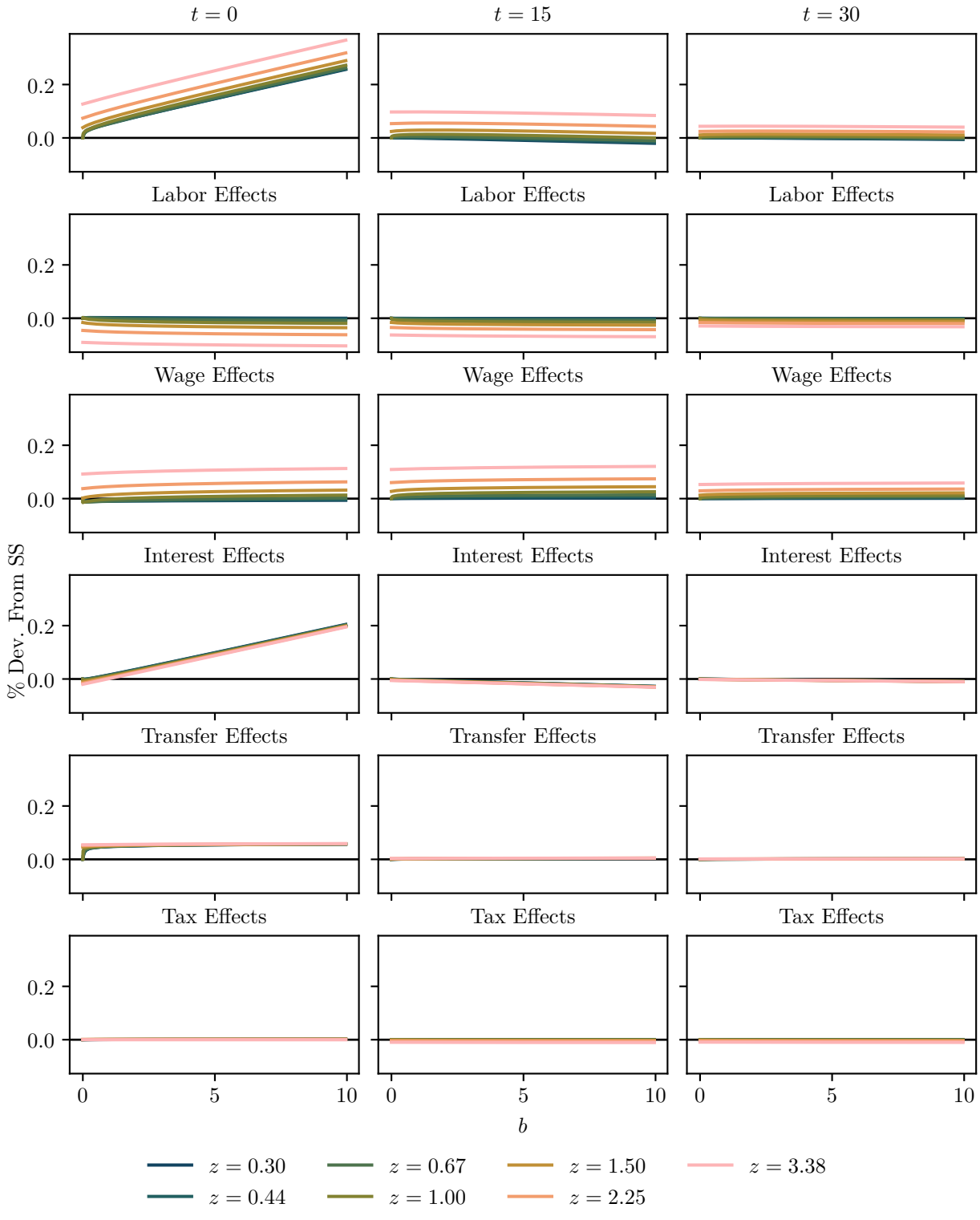


Figure G.5: Consumption Response to a Markup Shock

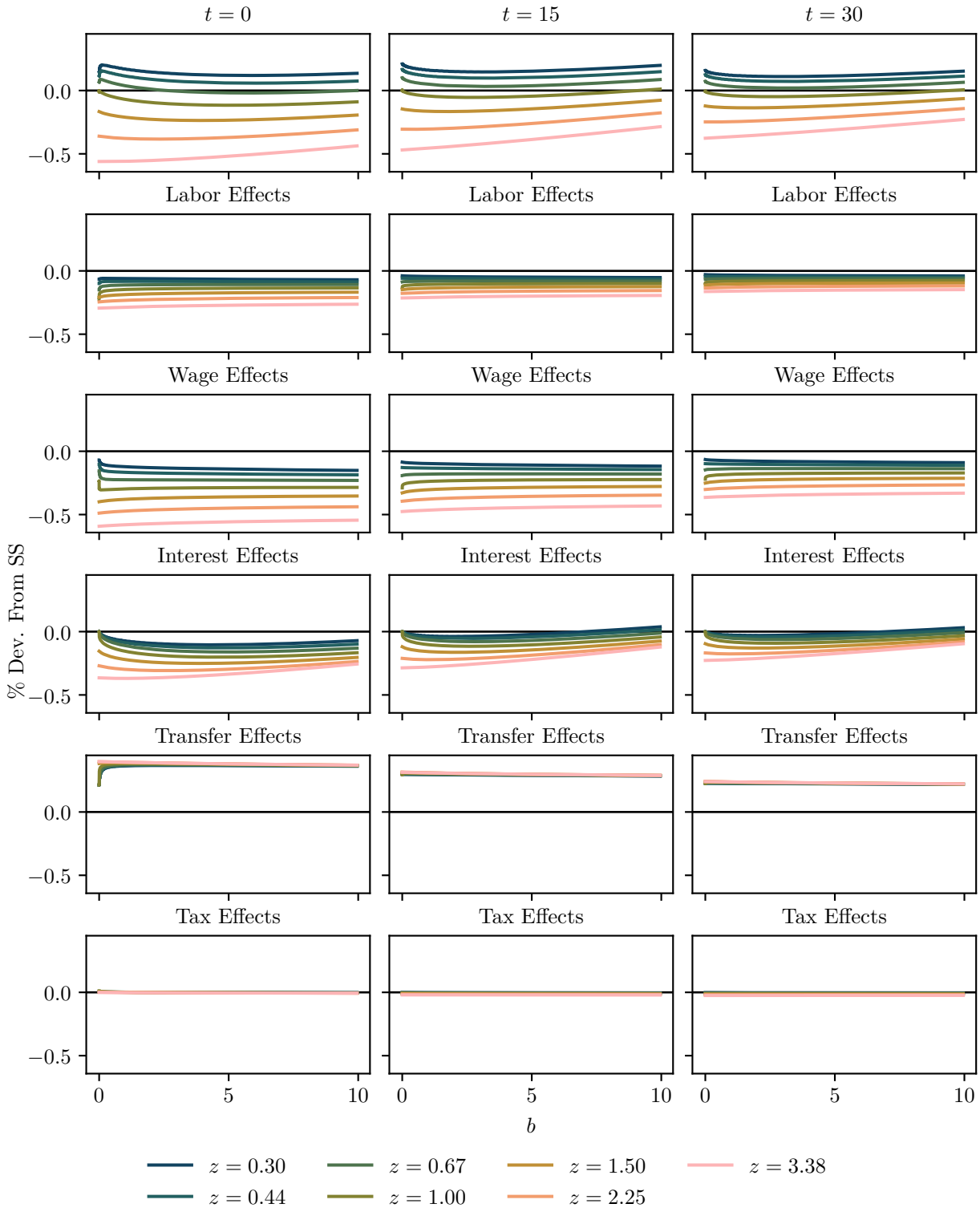


Figure G.6: Savings Response to a Markup Shock

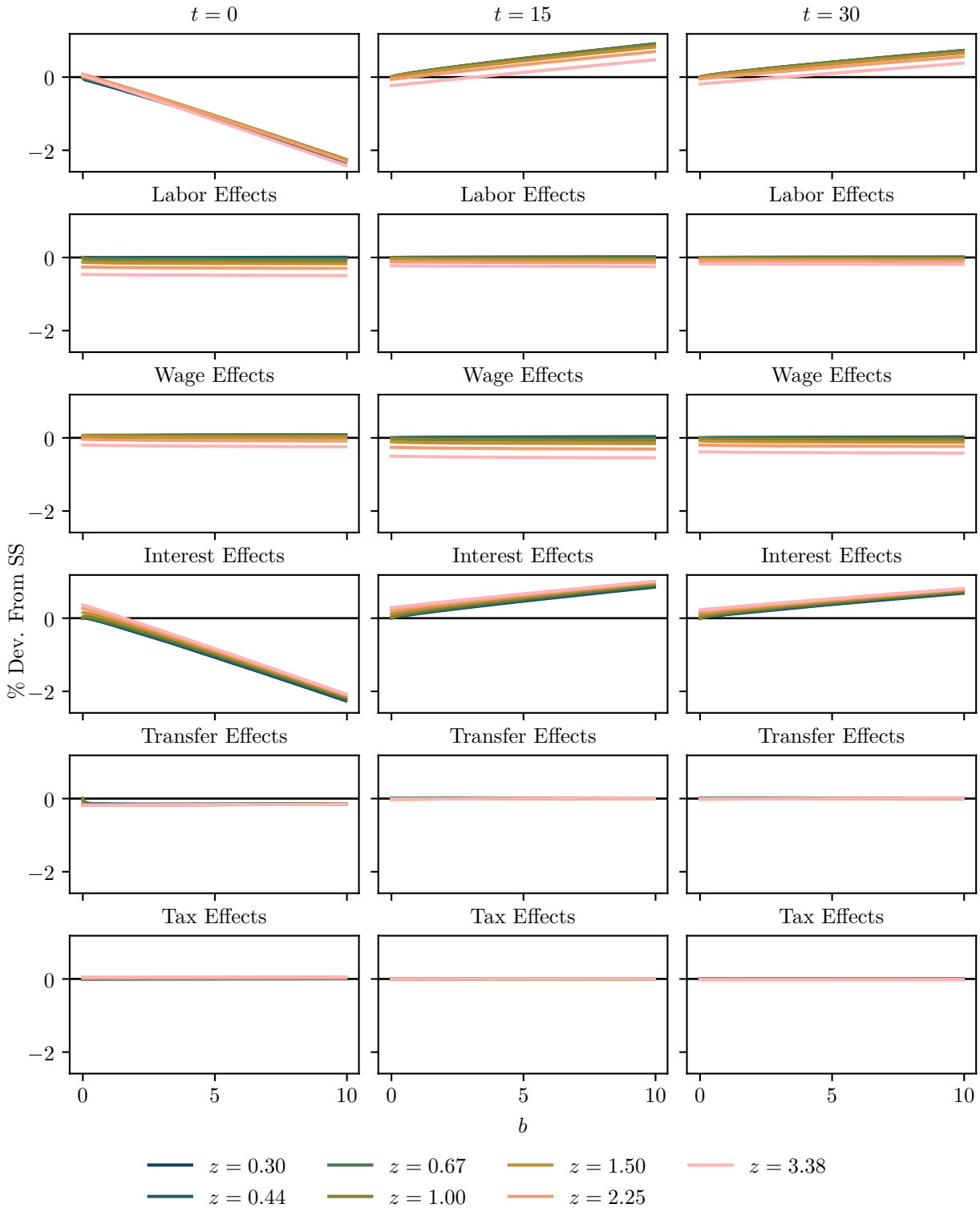


Figure G.7: Consumption Response to a Wage Markup Shock

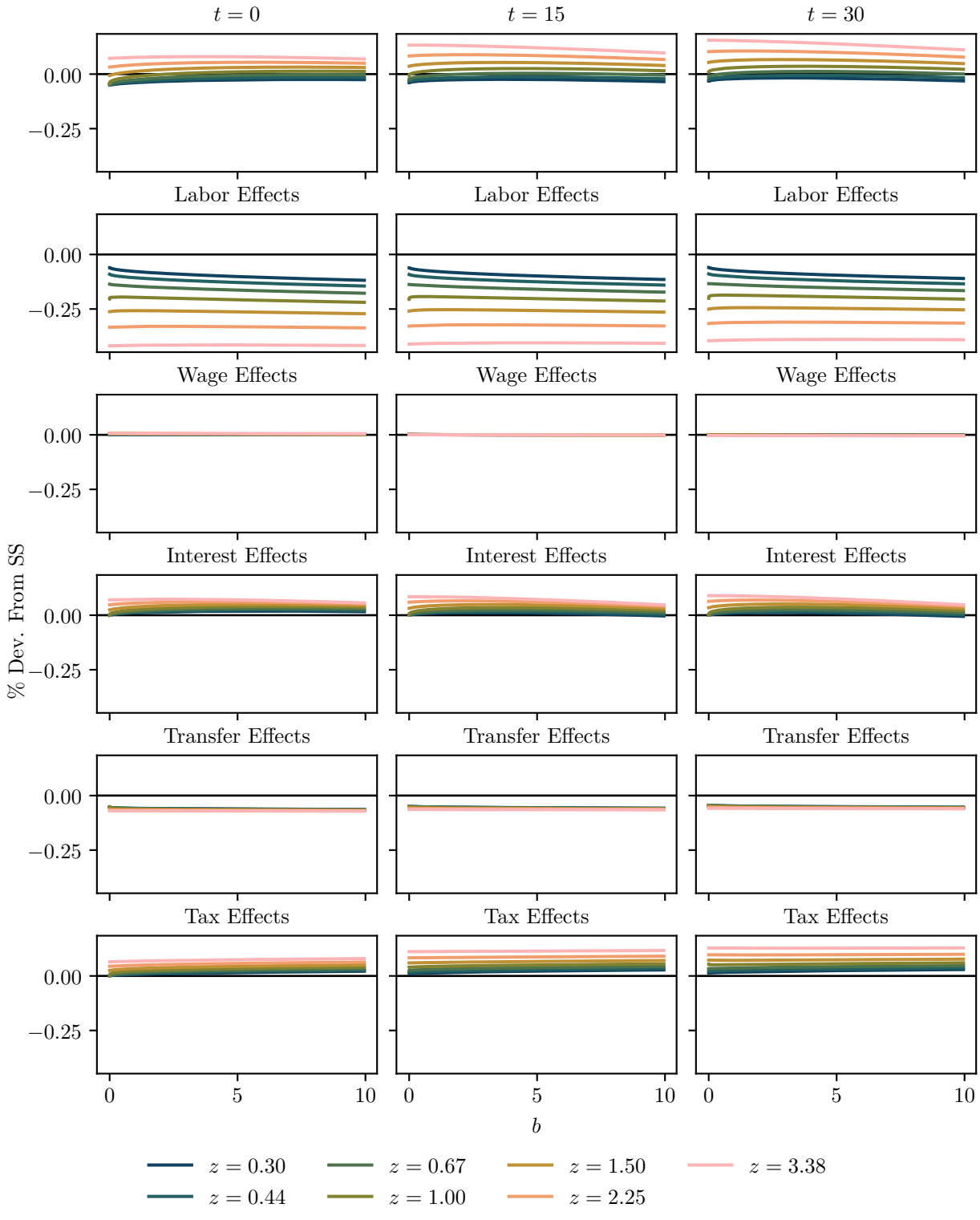


Figure G.8: Savings Response to a Wage Markup Shock

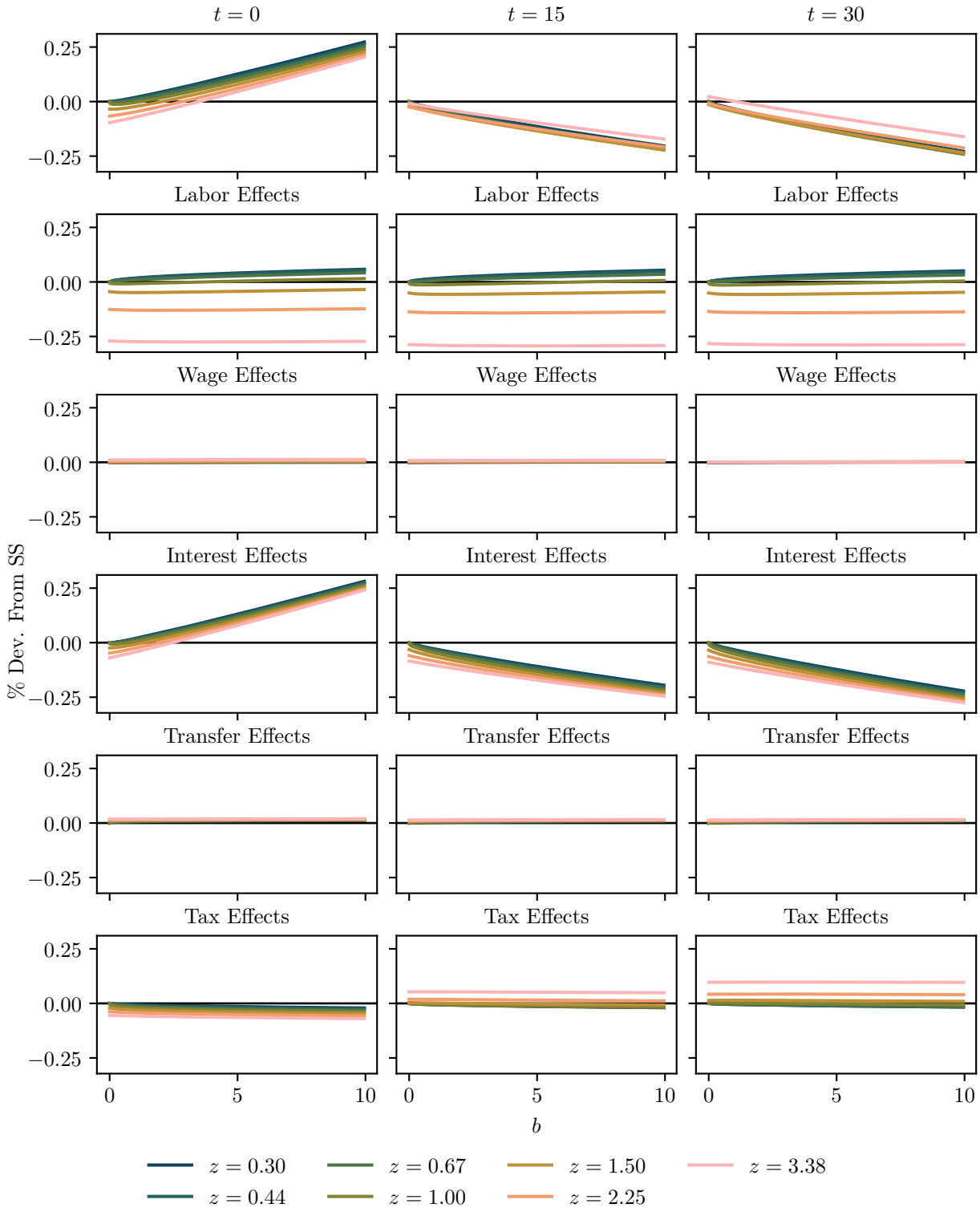


Figure G.9: Consumption Response to a Government Spending Shock

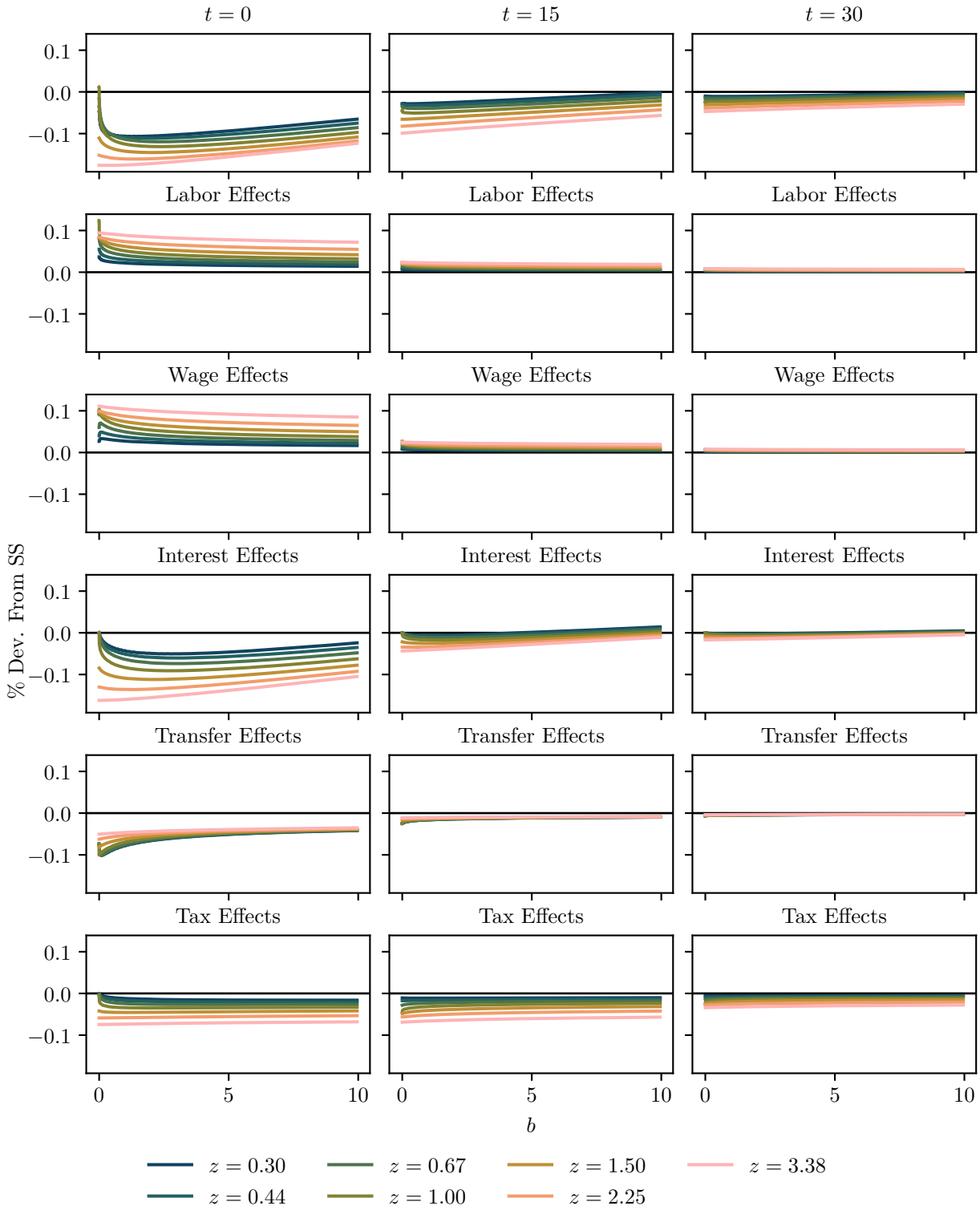


Figure G.10: Savings Response to a Government Spending Shock

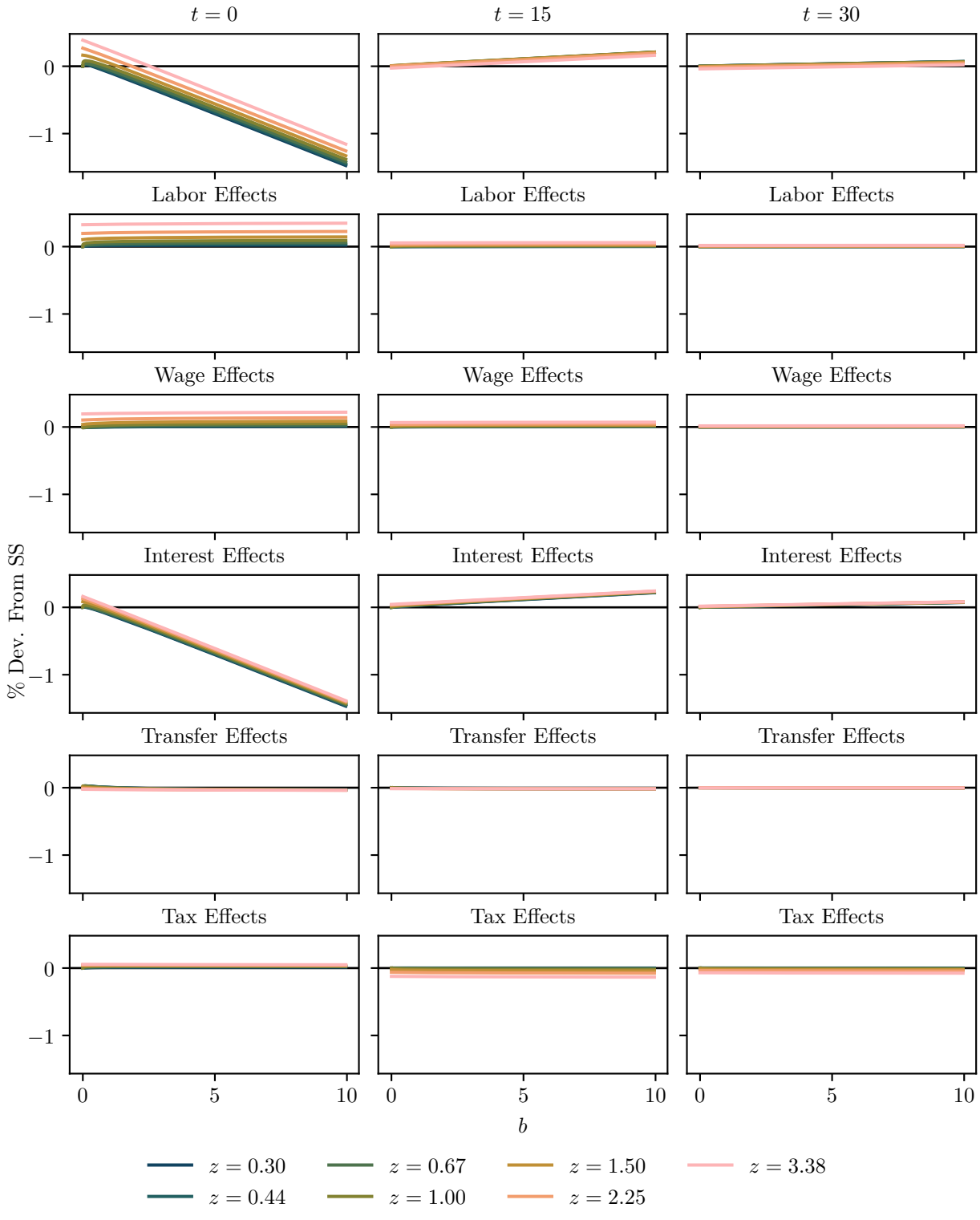


Figure G.11: Consumption Response to a Monetary Policy Shock

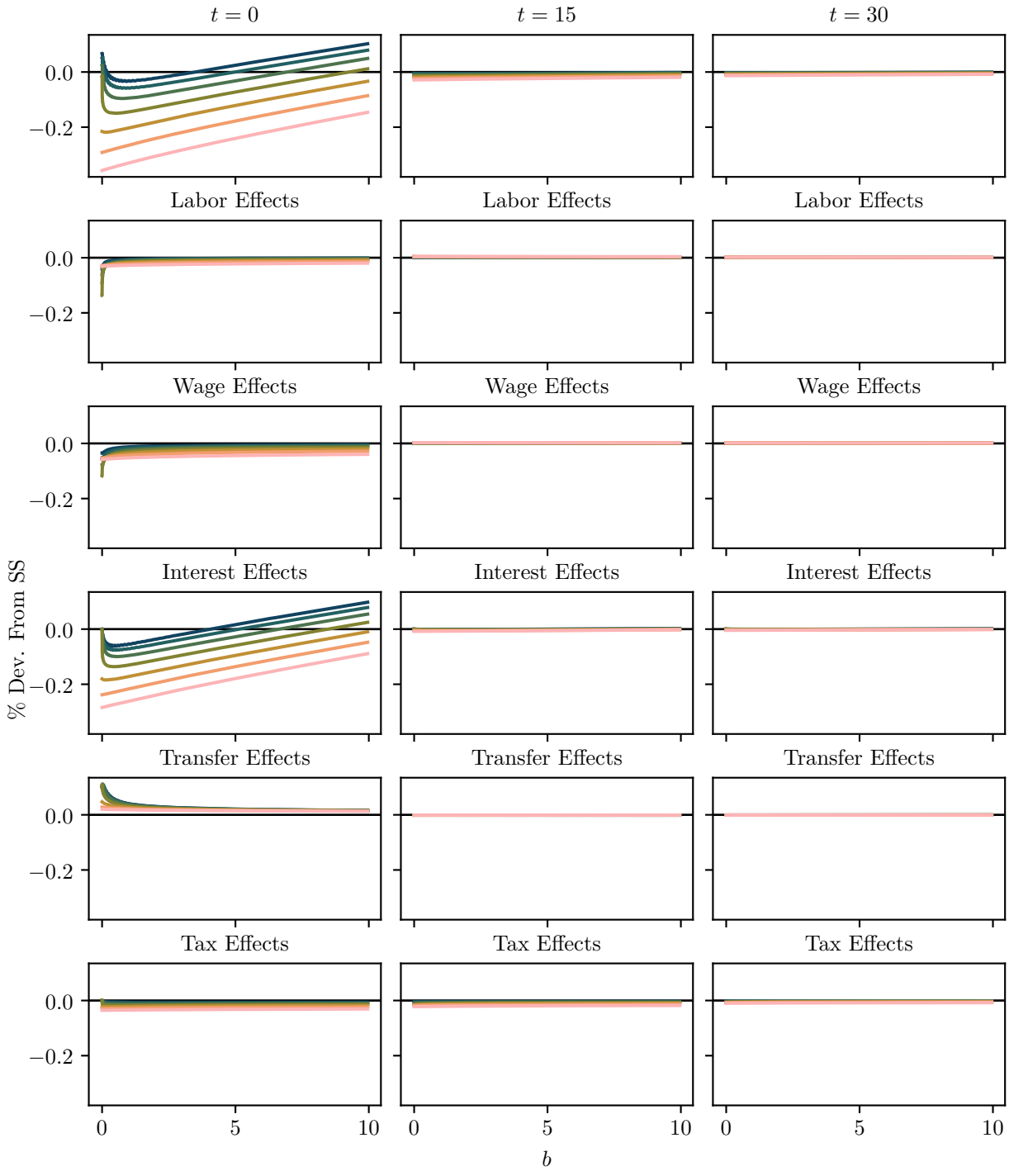


Figure G.12: Savings Response to a Monetary Policy Shock

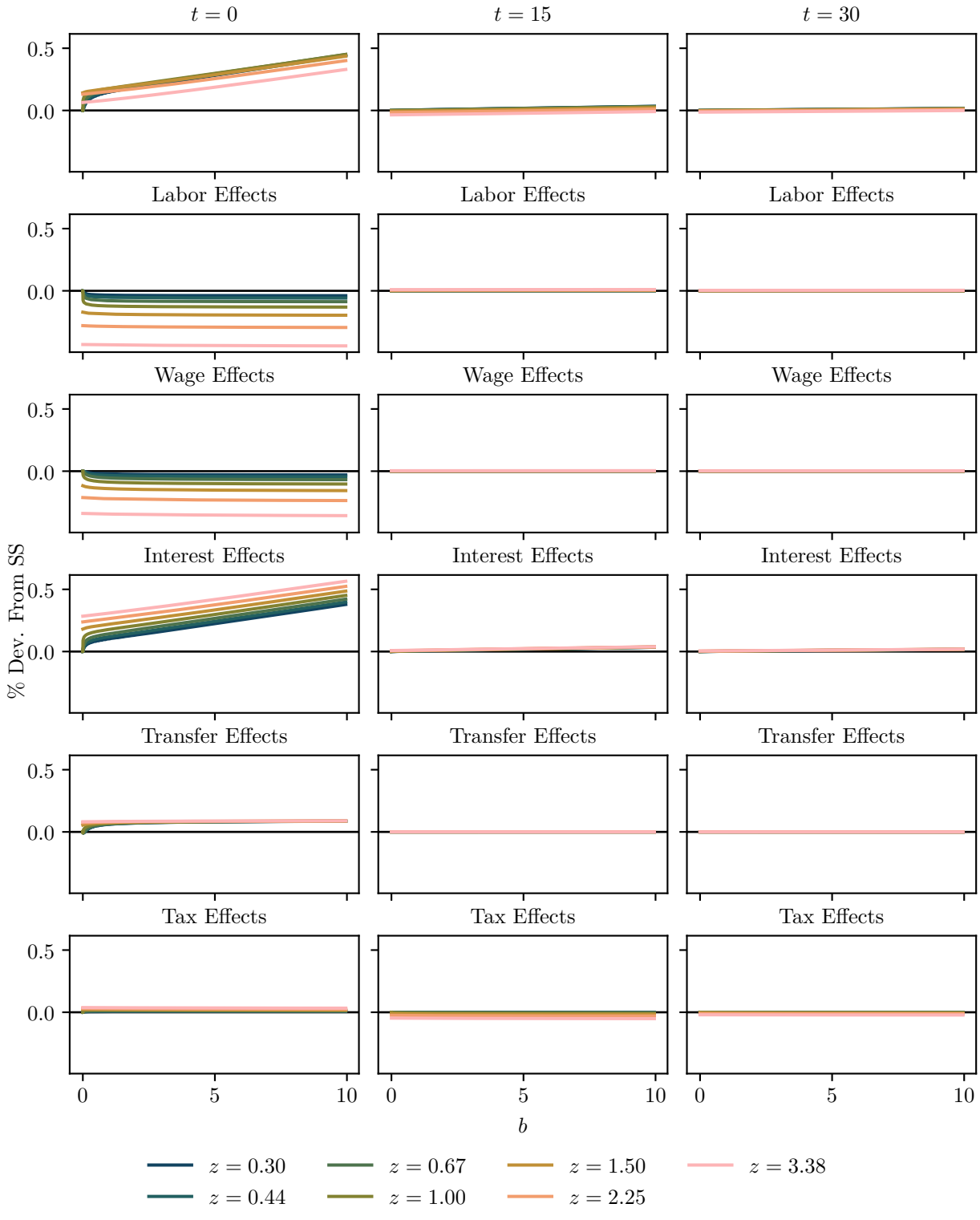


Figure G.13: Consumption Response to a Government Transfer Shock

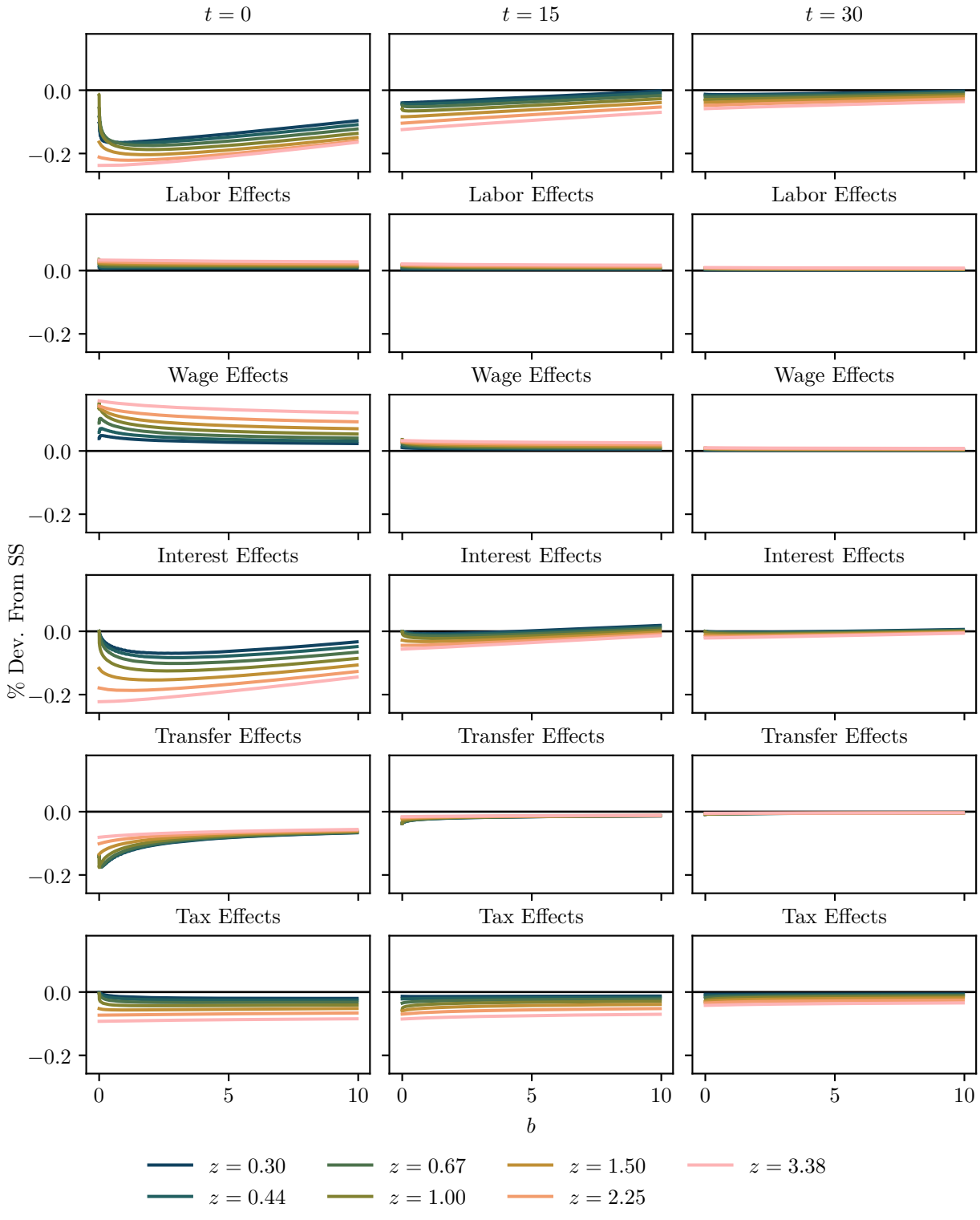


Figure G.14: Savings Response to a Government Transfer Shock

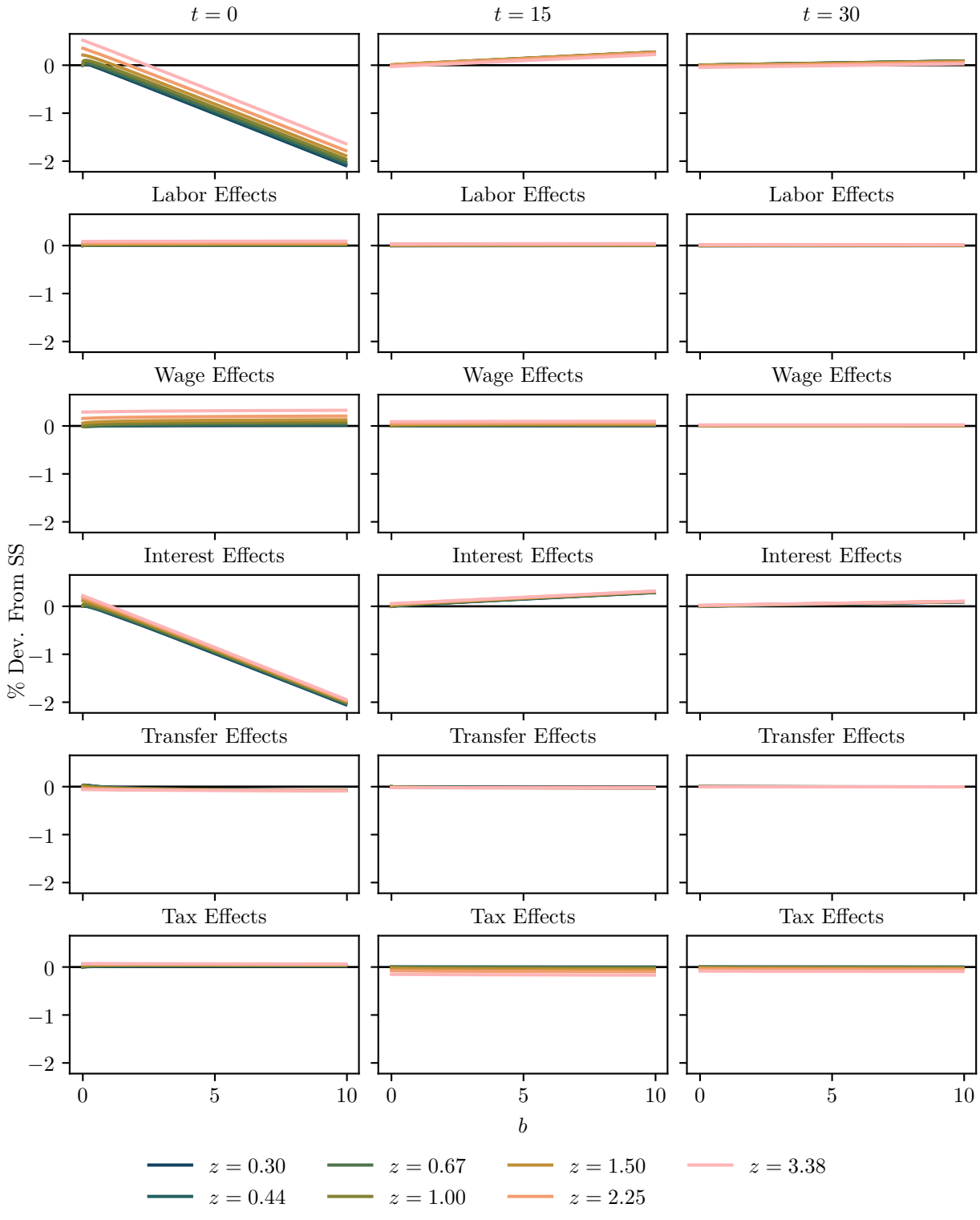


Figure G.15: Consumption Response to a Tax Progressivity Shock

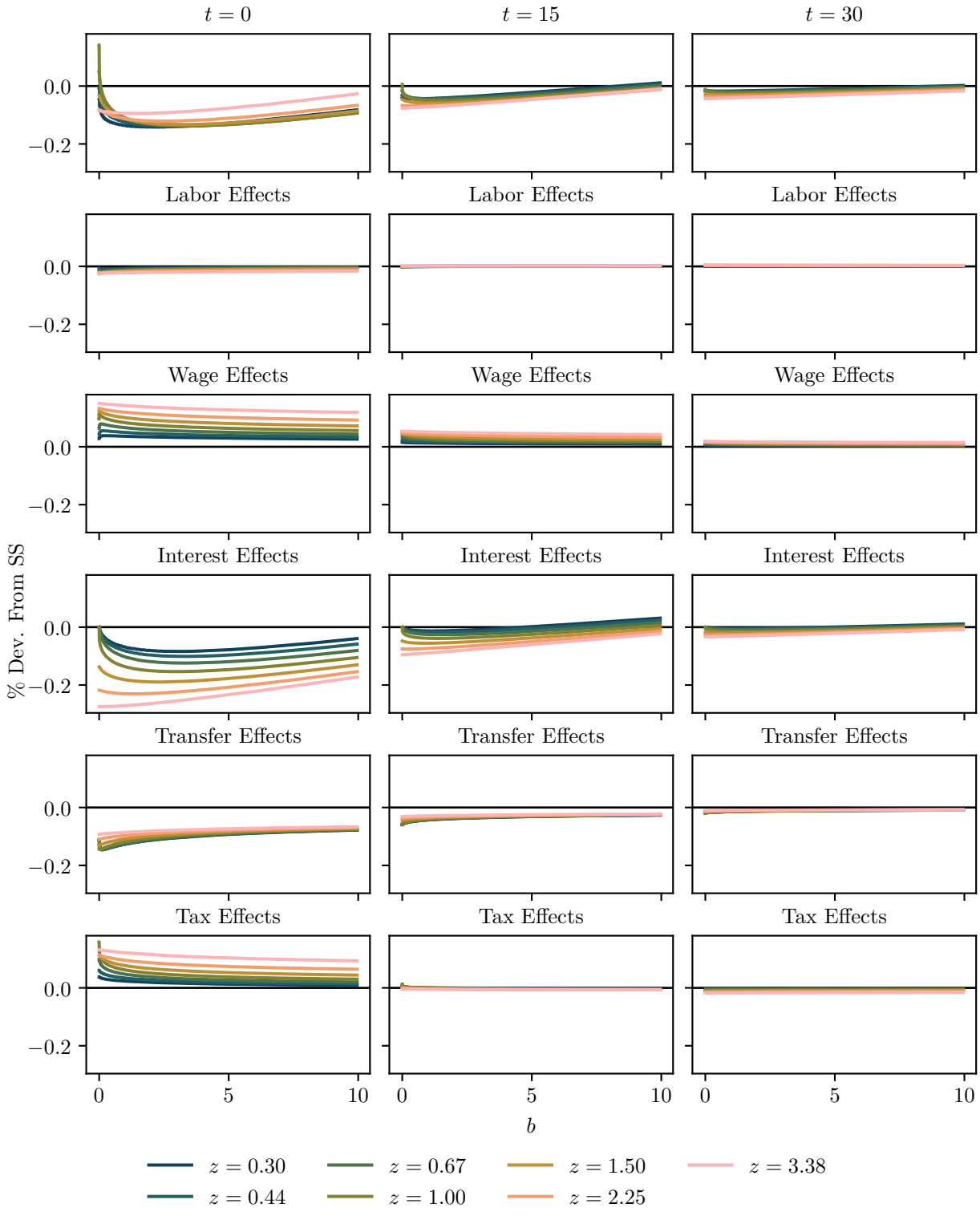
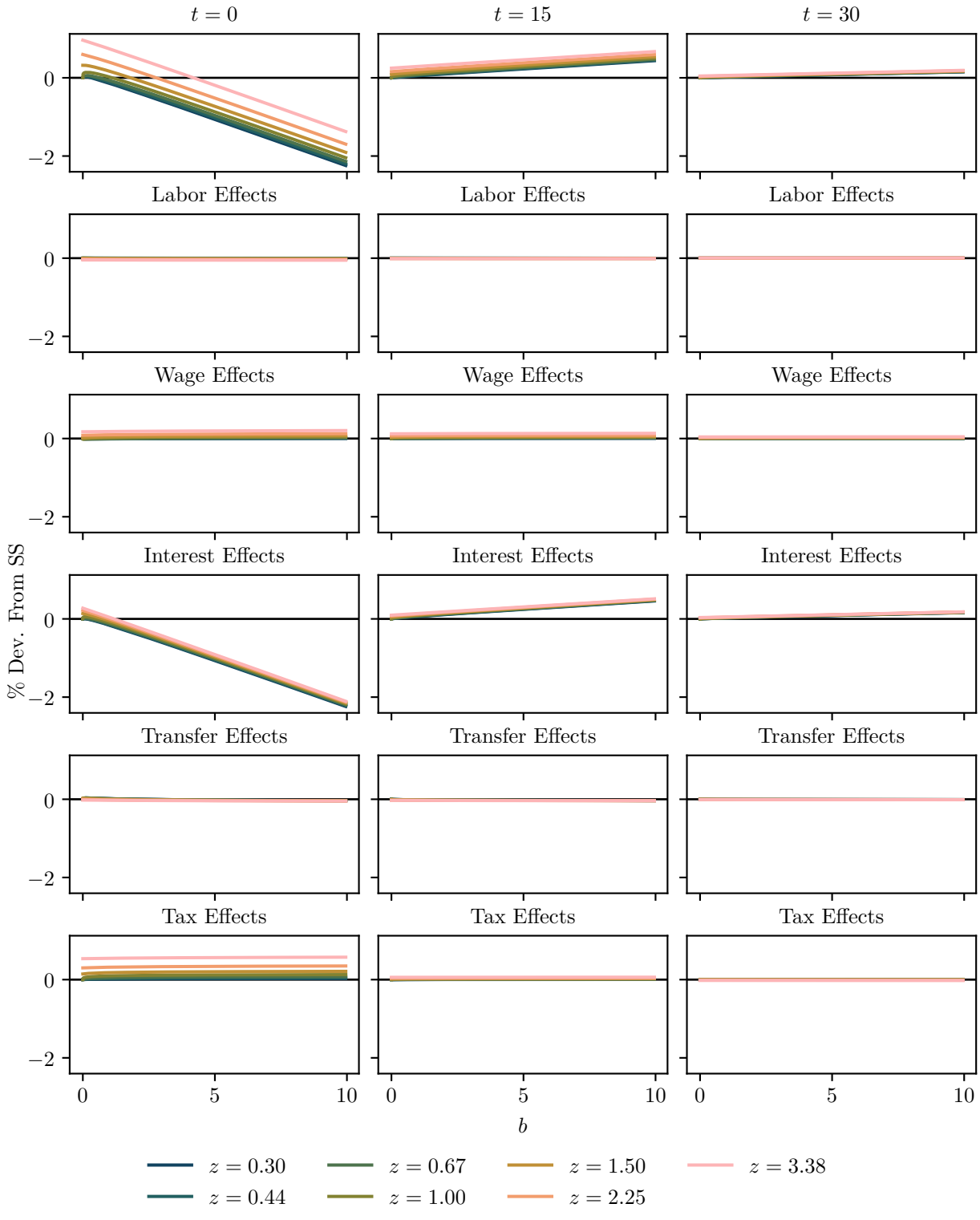


Figure G.16: Savings Response to a Tax Progressivity Shock



H Additional Historical Decompostions

Figure H.1: Fitted Historical Decompositions