A Appendix

A.1 Data Sources

A.1.1 US

In Figure 1, Panel b, the debt value is from Hall and Sargent (2021). GDP data before 1930 is from Johnston and Williamson (2023); after 1930, GDP data is from the FRED series FYGDP.

For tax and spending, NIPA/OMB provides annual data of total receipts, outlays and interest payments from 1947 on the FRED website. We use total receipts as T_t, and the difference between total outlays and interest payments as X_t.

According to the OMB description, the governmental receipts are taxes and other collections from the public. For example, social security taxes are counted as taxes, and therefore social security benefit payments must be treated as outlays.[2] Outlays are the measure of Government spending. They are payments that liquidate obligations.[3] The OMB budget data records outlays when obligations are paid, in the amount that is paid. The Federal Government also collects income from the public through market-oriented activities. Collections from these activities are subtracted from gross outlays, rather than added to taxes and other governmental receipts.[4] For example, premiums for healthcare benefits is counted as off-settings in outlays rather than components of the receipts. The difference between governmental receipts and outlays plus the interest payment, which is provided by OMB (we use FRED website's data), is the primary surplus or deficit.

For the market value of debt, the Dallas Fed provides the market value of total debt held by public, V_t, from the 1930s.

For GDP and inflation, we use NIPA data from the FRED website.

[2] See table 17.1 in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_17_receipts_fy2024.pdf for list of the source for receipts account.

[3] See chapter *Outlays* in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_15_concepts_fy2024.pdf

[4] See table 18.1 in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_18_offsetting_fy2024.pdf for details.

A.1.2 UK

For tax and spending, we use Bank of England's data file, *A millennium of macroeconomic data*. Government expenditure, X_t, is total government expenditure (Sheet A27, Column C) minus interest payments (Sheet A27, Column H). Government revenue, T_t, is from Sheet A27, Column N.

For GDP and inflation, we take the nominal GDP time series from BOE dataset and inflation data from FRED UK CPI inflation (CPIIUKA).

For the market value of debt, we use the data of Ellison and Scott (2020).

A.2 Tables and figures: US

Table A.1: Summary statistics of US (NIPA) data, 1947–2020

sv_t is computed with parameters $\rho = 0.999$, $\beta = 0.997$; sv_t ($\rho = 0.99$) is computed with parameters $\rho = 0.99$, $\beta = 0.971$.

Variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.023	0.057	-0.334	2.022	0.021	0.188	-0.180	0.200
Δx_t	0.033	0.118	-1.510	15.773	0.028	0.416	-0.628	0.228
$\Delta \tau_t$	0.029	0.067	-0.086	1.806	0.038	0.231	-0.188	0.226
τv_t	-0.751	0.460	-0.417	-0.516	-0.696	0.038	-1.860	0.958
xv_t	-0.730	0.440	-0.306	-0.278	-0.683	0.010	-1.853	0.971
sv_t ($\rho = 0.99$)	-0.025	0.055	-0.808	3.319	-0.020	0.140	-0.229	0.731
sv_t	-0.009	0.054	-0.61	3.297	-0.005	0.161	-0.201	0.727
S_t/V_t	-0.008	0.060	-0.058	0.375	-0.006	0.149	-0.167	0.651
$\log(1 + S_t/V_t)$	-0.010	0.060	-0.268	0.478	-0.006	0.139	-0.183	0.646
T_t/Y_t	0.168	0.012	-0.314	0.432	0.169	0.198	0.132	0.674
X_t/Y_t	0.173	0.026	0.922	6.816	0.174	0.297	0.093	0.749
S_t/Y_t	-0.005	0.028	-1.580	5.831	-0.002	0.059	-0.133	0.716
V_t/Y_t	0.391	0.186	1.302	1.400	0.340	1.052	0.164	0.966
τy_t	-1.787	0.074	-0.571	0.795	-1.781	-1.622	-2.028	0.671
xy_t	-1.765	0.154	-0.602	4.887	-1.751	-1.214	-2.379	0.779
vy_t	-1.036	0.433	0.379	-0.392	-1.079	0.051	-1.808	0.973
T_t/C_t	0.307	0.030	-0.548	-0.181	0.312	0.364	0.235	0.807
X_t/C_t	0.315	0.042	0.226	5.755	0.316	0.499	0.169	0.702
S_t/C_t	-0.008	0.049	-1.371	5.218	-0.003	0.107	-0.224	0.704
V_t/C_t	0.699	0.294	1.229	1.424	0.622	1.768	0.317	0.961
τc_t	-1.187	0.101	-0.774	0.155	-1.164	-1.01	-1.449	0.816
xc_t	-1.166	0.141	-1.139	5.768	-1.151	-0.695	-1.778	0.749
vc_t	-0.436	0.390	0.347	-0.390	-0.475	0.570	-1.149	0.970

Table A.2: ADF tests (lag = AIC) for US data, 1947–2020

All tests include a free constant term. Number of lags are chosen to minimize the corresponding AIC information criterion. sv_t is computed with parameters $\rho = 0.999$, $\beta = 0.997$. The last column ("p-value*") reports the p-value of a constrained ADF test in which the time series is demeaned by the theoretical average and no constant term is included in the test.

Variable	test-stat	90%	95%	99%	p-value	p-value*
r_t	−7.62	−2.59	−2.91	−3.52	0.000	0.000
Δx_t	−9.47	−2.59	−2.91	−3.52	0.000	0.000
$\Delta \tau_t$	−5.51	−2.59	−2.91	−3.53	0.000	0.000
τv_t	−0.80	−2.59	−2.91	−3.53	0.820	—
xv_t	−1.95	−2.59	−2.91	−3.53	0.306	—
sv_t	−3.15	−2.59	−2.91	−3.52	0.022	0.024
S_t/V_t	−3.62	−2.59	−2.91	−3.52	0.005	—
$\log(1 + S_t/V_t)$	−3.63	−2.59	−2.91	−3.52	0.005	0.000
T_t/Y_t	−4.63	−2.59	−2.91	−3.52	0.000	—
X_t/Y_t	−1.37	−2.59	−2.91	−3.52	0.595	—
S_t/Y_t	−1.71	−2.59	−2.91	−3.52	0.425	—
V_t/Y_t	1.50	−2.59	−2.91	−3.53	0.997	—
τy_t	−4.67	−2.59	−2.91	−3.52	0.000	0.000
xy_t	−2.16	−2.59	−2.91	−3.52	0.219	—
vy_t	−0.23	−2.59	−2.91	−3.52	0.934	—
T_t/C_t	−2.75	−2.59	−2.91	−3.52	0.065	—
X_t/C_t	−2.25	−2.59	−2.91	−3.52	0.189	—
S_t/C_t	−1.90	−2.59	−2.91	−3.52	0.331	—
V_t/C_t	1.24	−2.59	−2.91	−3.53	0.996	—
τc_t	−1.37	−2.59	−2.91	−3.53	0.597	—
xc_t	−2.75	−2.59	−2.91	−3.52	0.065	—
vc_t	−0.38	−2.59	−2.91	−3.52	0.913	—

Table A.3: Johansen test for $(\tau v_t, x v_t)$, US (NIPA) data 1947–2020

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	29.76	13.43	15.49	19.93
$r = 1$	$r \geq 2$	1.24	2.71	3.84	6.63
$r = 0$	$r \geq 1$	28.53	12.3	14.26	18.52
$r = 1$	$r \geq 2$	1.24	2.71	3.84	6.63

Table A.4: Johansen test for $(r_t, \Delta\tau_t, sv_t, \tau y_t)$, US (NIPA) data 1947–2020

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	111.26	37.03	40.17	46.57
$r = 1$	$r \geq 2$	49.75	21.78	24.28	29.51
$r = 2$	$r \geq 3$	22.15	10.47	12.32	16.36
$r = 3$	$r \geq 4$	2.54	2.98	4.13	6.94
$r = 0$	$r \geq 1$	61.51	21.84	24.16	29.06
$r = 1$	$r \geq 2$	27.6	15.72	17.8	22.25
$r = 2$	$r \geq 3$	19.61	9.47	11.22	15.09
$r = 3$	$r \geq 4$	2.54	2.98	4.13	6.94

Table A.5: Johansen test for $(r_t, \Delta\tau_t, sv_t)$, US (NIPA) data 1947–2020

Top panel is the trace test, bottom panel is the eigenvalue test.'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	77.75	21.78	24.28	29.51
$r = 1$	$r \geq 2$	26.5	10.47	12.32	16.36
$r = 2$	$r \geq 3$	5.01	2.98	4.13	6.94
$r = 0$	$r \geq 1$	51.24	15.72	17.8	22.25
$r = 1$	$r \geq 2$	21.49	9.47	11.22	15.09
$r = 2$	$r \geq 3$	5.01	2.98	4.13	6.94

Table A.6: VAR coefficient estimates. US (NIPA) data, 1947–2020.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	sv_{t+1}
r_t	0.204	−0.468	−0.219
	[0.107]	[0.119]	[0.073]
$\Delta\tau_t$	0.021	0.219	−0.036
	[0.093]	[0.102]	[0.063]
sv_t	0.043	−0.347	0.764
	[0.127]	[0.140]	[0.086]
R^2	4.93%	25.14%	60.86%

Table A.7: Variance decomposition for sv_t based on the system $(r_t, \Delta\tau_t, sv_t)$.

Panel A: Variance decomposition				
Horizon	return	tax	spending	future sv
1	-0.0%	4.6%	14.1%	82.7%
3	0.0%	25.2%	27.0%	49.2%
10	0.0%	56.3%	36.8%	8.3%
30	0.0%	62.6%	38.7%	0.1%
∞	0.0%	62.7%	38.7%	0.0%

Panel B: Bootstrap intervals				
Horizon	return	tax	spending	future sv
1	[-0.0%, 0.1%]	[-4.1%, 32.7%]	[-0.4%, 43.4%]	[38.5%, 92.3%]
3	[-0.1%, 0.1%]	[-3.1%, 65.7%]	[-11.0%, 61.0%]	[8.8%, 81.2%]
10	[-0.2%, 0.1%]	[-0.6%, 115.8%]	[-40.6%, 85.1%]	[-0.8%, 56.4%]
30	[-0.3%, 0.2%]	[0.0%, 160.3%]	[-64.3%, 97.0%]	[-0.0%, 20.6%]
∞	[-0.3%, 0.2%]	[0.0%, 179.4%]	[-78.2%, 101.3%]	[-0.0%, 0.0%]

Table A.8: Variance decomposition for short-run tax news based on the system $(r_t, \Delta\tau_t, sv_t)$.

Panel A: Variance decomposition for short-run tax news				
T	return	LR tax	spending	future sv
1	-0.1%	—	-6.0%	107.6%
3	-0.1%	-17.7%	52.4%	66.8%
10	-0.1%	21.2%	69.5%	10.8%
30	-0.1%	29.4%	72.1%	0.1%
∞	-0.07%	29.4%	72.1%	—
Panel B: Bootstrap intervals				
T	return	LR tax	spending	future sv
1	[-0.1%, -0.1%]	[-0.0%, 0.0%]	[-12.9%, 0.4%]	[101.1%, 114.5%]
3	[-0.2%, -0.0%]	[-54.1%, 9.5%]	[14.9%, 91.2%]	[28.6%, 116.5%]
10	[-0.2%, 0.0%]	[-39.6%, 66.7%]	[10.4%, 120.5%]	[-1.6%, 58.2%]
30	[-0.3%, 0.1%]	[-36.6%, 105.8%]	[-12.4%, 134.8%]	[-0.0%, 19.2%]
∞	[-0.3%, 0.1%]	[-36.3%, 119.4%]	[-17.8%, 138.0%]	[-0.0%, 0.0%]

Table A.9: Variance decomposition for short-run spending news based on the system $(r_t, \Delta\tau_t, sv_t)$.

Panel A: Variance decomposition for short-run spending news				
T	return	tax	LR spending	future sv
1	-0.0%	-2.8%	—	104.2%
3	-0.0%	16.4%	19.9%	65.0%
10	-0.0%	56.5%	34.1%	10.8%
30	-0.0%	64.6%	36.7%	0.1%
∞	-0.0%	64.7%	36.7%	—
Panel B: Bootstrap intervals				
T	return	tax	LR spending	future sv
1	[-0.0%, -0.0%]	[-0.0%, 0.0%]	[-0.0%, 0.0%]	[101.1%, 107.5%]
3	[-0.1%, 0.0%]	[-0.8%, 39.3%]	[-4.3%, 42.5%]	[38.7%, 94.1%]
10	[-0.2%, 0.1%]	[2.6%, 115.6%]	[-44.1%, 77.5%]	[-1.7%, 62.1%]
30	[-0.3%, 0.2%]	[3.9%, 169.3%]	[-75.2%, 95.2%]	[-0.0%, 20.1%]
∞	[-0.3%, 0.2%]	[4.6%, 186.8%]	[-83.2%, 100.2%]	[-0.0%, 0.0%]

A.2.1 Robustness when $\rho = 0.99$

This section conducts a sensitivity analysis by reproducing our main results for the parameter choice $\rho = 0.99$. We determine $\beta = 0.971$ using (22), as in the main text. Also as in the text, we set the unconditional mean for tax or spending growth to 0.029, the empirical mean of tax growth. The unconditional expected log return $\mathbb{E}\, r_t$ becomes 0.039.

Table A.10 reports ADF test results for the variables whose definitions are affected by the change in ρ. Only the last column and the row of results for sv_t differs from Table A.2.

Table A.10: ADF tests (lag = AIC) for US data, 1947–2020. When $\rho = 0.99$.

All tests include a free constant term. Number of lags are chosen to minimize the corresponding AIC information criterion. The last column ("p-value*") reports the p-value of a constrained ADF test in which the time series is demeaned by the theoretical average and no constant term is included in the test. sv_t is computed with parameters $\rho = 0.99$, $\beta = 0.971$. The constrained ADF test imposes that the theoretical mean of sv_t is 0.01, consistent with the theory.

Variable	test-stat	90%	95%	99%	p-value	p-value*
r_t	−7.62	−2.59	−2.91	−3.52	0.000	0.000
sv_t	−3.15	−2.59	−2.91	−3.52	0.041	0.152
$\log(1 + S_t/V_t)$	−3.63	−2.59	−2.91	−3.52	0.005	0.000

Table A.11: Johansen test for $(r_t, \Delta\tau_t, sv_t, \tau y_t)$, US (NIPA) data 1947–2020, when $\rho = 0.99$

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	98.83	37.03	40.17	46.57
$r = 1$	$r \geq 2$	43.4	21.78	24.28	29.51
$r = 2$	$r \geq 3$	18.23	10.47	12.32	16.36
$r = 3$	$r \geq 4$	0.30	2.98	4.13	6.94
$r = 0$	$r \geq 1$	55.42	21.84	24.16	29.06
$r = 1$	$r \geq 2$	25.18	15.72	17.8	22.25
$r = 2$	$r \geq 3$	17.93	9.47	11.22	15.09
$r = 3$	$r \geq 4$	0.30	2.98	4.13	6.94

Table A.12: Johansen test for $(r_t, \Delta\tau_t, sv_t)$, US (NIPA) data 1947–2020, when $\rho = 0.99$.

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	74.08	21.78	24.28	29.51
$r = 1$	$r \geq 2$	22.07	10.47	12.32	16.36
$r = 2$	$r \geq 3$	1.47	2.98	4.13	6.94
$r = 0$	$r \geq 1$	52.01	15.72	17.8	22.25
$r = 1$	$r \geq 2$	20.6	9.47	11.22	15.09
$r = 2$	$r \geq 3$	1.47	2.98	4.13	6.94

Table A.13: VAR coefficient estimates. US (NIPA) data, 1947–2020. When $\rho = 0.99$

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	sv_{t+1}	τy_{t+1}	Δy_{t+1}
r_t	0.150	−0.217	−0.149	−0.257	0.039
	[0.105]	[0.107]	[0.079]	[0.097]	[0.050]
$\Delta\tau_t$	−0.071	0.356	−0.032	0.367	−0.011
	[0.094]	[0.096]	[0.071]	[0.087]	[0.045]
sv_t	0.052	−0.057	0.918	−0.095	0.038
	[0.102]	[0.104]	[0.077]	[0.094]	[0.048]
τy_t	0.232	−0.444	−0.052	0.636	−0.080
	[0.09]	[0.092]	[0.067]	[0.083]	[0.043]
R^2	19.37%	40.18%	70.49%	62.76%	6.20%

Table A.14: VAR coefficient estimates. US (NIPA) data, 1947–2020. , When $\rho = 0.99$ OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	sv_{t+1}
r_t	0.24	-0.391	-0.169
	[0.103]	[0.116]	[0.074]
$\Delta\tau_t$	0.01	0.201	-0.05
	[0.093]	[0.105]	[0.067]
sv_t	0.121	-0.187	0.903
	[0.103]	[0.116]	[0.074]
R^2	9.68%	23.5%	70.62%

Table A.15: A variance decomposition for sv_t based on system $(r_t, \Delta\tau_t, sv_t, \tau y_t)$. When $\rho = 0.99$

Panel A: Variance decomposition for sv_t				
Horizon	return	tax	spending	future sv
1	0.1%	2.8%	5.5%	92.9%
3	0.4%	20.1%	8.9%	72.0%
10	0.3%	9.2%	51.0%	40.9%
30	0.3%	-0.2%	93.8%	7.5%
∞	0.3%	-2.5%	103.6%	0.0%
Panel B: Bootstrap intervals				
Horizon	return	tax	spending	future sv
1	[-0.1%, 0.7%]	[-0.3%, 25.2%]	[-7.8%, 26.9%]	[55.9%, 99.6%]
3	[-0.3%, 1.2%]	[6.1%, 40.8%]	[-11.6%, 42.2%]	[29.1%, 93.5%]
10	[-1.3%, 2.0%]	[-15.8%, 28.7%]	[14.9%, 85.8%]	[4.1%, 80.4%]
30	[-3.0%, 3.3%]	[-58.2%, 28.8%]	[52.4%, 127.8%]	[0.0%, 57.3%]
∞	[-5.3%, 4.7%]	[-150.0%, 29.1%]	[71.0%, 253.4%]	[0.0%, 0.0%]

Table A.16: A variance decomposition for sv_t based on system $(r_t, \Delta\tau_t, sv_t)$. When $\rho = 0.99$

Panel A: Variance decomposition for sv_t				
Horizon	return	tax	spending	future sv
1	0.1%	0.4%	7.2%	93.7%
3	0.3%	15.7%	12.3%	73.0%
10	0.9%	56.9%	13.1%	30.4%
30	1.3%	84.2%	13.3%	2.5%
∞	1.3%	86.7%	13.4%	0.0%
Panel B: Bootstrap intervals				
Horizon	return	tax	spending	future sv
1	[-0.2%, 0.6%]	[-8.5%, 23.8%]	[-7.3%, 31.2%]	[57.8%, 102.8%]
3	[-0.4%, 1.3%]	[-7.0%, 54.8%]	[-23.0%, 46.4%]	[27.6%, 96.8%]
10	[-0.8%, 2.8%]	[-4.1%, 124.8%]	[-74.3%, 70.4%]	[0.5%, 82.3%]
30	[-1.3%, 5.0%]	[-0.7%, 227.2%]	[-159.8%, 92.2%]	[-0.0%, 54.9%]
∞	[-1.9%, 8.0%]	[-3.1%, 406.3%]	[-310.6%, 104.0%]	[-0.0%, 0.0%]

A.3 Tables and figures: UK

Table A.17: Summary statistics of UK data, 1947–2016

sv_t is computed with parameters $\rho = 0.958$, $\beta = 0.944$.

Variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.066	0.103	0.281	0.511	0.069	0.394	-0.155	-0.164
Δx_t	0.019	0.079	-4.051	23.84	0.027	0.140	-0.483	0.466
$\Delta \tau_t$	0.025	0.038	-0.268	0.354	0.027	0.131	-0.065	0.350
τv_t	-0.294	0.526	-0.392	-1.134	-0.159	0.531	-1.321	0.969
xv_t	-0.367	0.561	-0.436	-1.026	-0.208	0.503	-1.527	0.974
sv_t	0.026	0.085	-0.612	-0.107	0.041	0.185	-0.193	0.887
S_t/V_t	0.047	0.078	-0.435	0.817	0.061	0.244	-0.195	0.829
$\log(1 + S_t/V_t)$	0.043	0.076	-0.730	1.303	0.059	0.218	-0.217	0.826
T_t/Y_t	0.304	0.021	-0.005	-0.851	0.304	0.354	0.265	0.845
X_t/Y_t	0.285	0.044	0.598	-0.458	0.280	0.390	0.220	0.933
S_t/Y_t	0.019	0.036	-0.213	0.040	0.019	0.102	-0.074	0.900
V_t/Y_t	0.476	0.286	1.077	-0.053	0.360	1.226	0.170	0.976
τy_t	-1.194	0.070	-0.120	-0.903	-1.191	-1.038	-1.327	0.845
xy_t	-1.266	0.149	0.350	-0.786	-1.274	-0.941	-1.514	0.928
vy_t	-0.899	0.552	0.445	-0.961	-1.021	0.204	-1.775	0.973

Table A.18: ADF tests (lag = AIC) for UK data, 1947–2016

All tests include a free constant term. Number of lags are chosen to minimize the corresponding AIC information criterion. sv_t is computed with parameters $\rho = 0.958$, $\beta = 0.944$. The last column ("p-value*") reports the p-value of a constrained ADF test in which the time series is demeaned by the theoretical average and no constant term is included in the ADF test.

Variable	test-stat	90%	95%	99%	p-value	p-value*
r_t	−9.78	−2.59	−2.91	−3.53	0.000	0.000
Δx_t	−5.42	−2.59	−2.91	−3.53	0.000	0.000
$\Delta \tau_t$	−5.92	−2.59	−2.91	−3.53	0.000	0.000
τv_t	−1.41	−2.59	−2.91	−3.53	0.579	—
xv_t	−1.89	−2.59	−2.91	−3.53	0.335	—
sv_t	−1.6	−2.59	−2.91	−3.53	0.481	0.129
S_t/V_t	−3.3	−2.59	−2.91	−3.53	0.014	—
$\log(1 + S_t/V_t)$	−2.97	−2.59	−2.91	−3.53	0.037	0.003
T_t/Y_t	−2.56	−2.59	−2.91	−3.53	0.101	—
X_t/Y_t	−0.94	−2.59	−2.91	−3.54	0.772	—
S_t/Y_t	−2.77	−2.59	−2.91	−3.53	0.062	—
V_t/Y_t	−1.09	−2.59	−2.91	−3.54	0.720	—
τy_t	−2.51	−2.59	−2.91	−3.53	0.114	0.012
xy_t	−0.98	−2.59	−2.91	−3.54	0.759	—
vy_t	−1.44	−2.59	−2.91	−3.53	0.562	—

Table A.19: Johansen test for $(\tau v_t, xv_t)$, UK data 1947–2016

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	28.20	13.43	15.49	19.93
$r = 1$	$r \geq 2$	2.11	2.71	3.84	6.63
$r = 0$	$r \geq 1$	26.09	12.30	14.26	18.52
$r = 1$	$r \geq 2$	2.11	2.71	3.84	6.63

Table A.20: Johansen test for $(r_t, \Delta\tau_t, sv_t, \tau y_t)$, UK data 1947–2016

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	101.24	37.03	40.17	46.57
$r = 1$	$r \geq 2$	51.09	21.78	24.28	29.51
$r = 2$	$r \geq 3$	17.3	10.47	12.32	16.36
$r = 3$	$r \geq 4$	1.49	2.98	4.13	6.94
$r = 0$	$r \geq 1$	50.15	21.84	24.16	29.06
$r = 1$	$r \geq 2$	33.79	15.72	17.8	22.25
$r = 2$	$r \geq 3$	15.81	9.47	11.22	15.09
$r = 3$	$r \geq 4$	1.49	2.98	4.13	6.94

Table A.21: Johansen test for $(r_t, \Delta\tau_t, sv_t)$, UK data 1947–2016

Top panel is the trace test, bottom panel is the eigenvalue test. 'r' is short for 'rank'. When the test statistic is higher than the x% confidence criteria, there is x% confidence that the 'alternative' is true. All the time series are demeaned by the theoretical average, and no constant term is included in the test.

Null	alternative	test-stat	90%	95%	99%
$r=0$	$r \geq 1$	80.03	21.78	24.28	29.51
$r=1$	$r \geq 2$	36.09	10.47	12.32	16.36
$r=2$	$r \geq 3$	4.62	2.98	4.13	6.94
$r=0$	$r \geq 1$	43.94	15.72	17.8	22.25
$r=1$	$r \geq 2$	31.47	9.47	11.22	15.09
$r=2$	$r \geq 3$	4.62	2.98	4.13	6.94

Table A.22: VAR coefficient estimates. UK data, 1947–2016.

Demeaned using $\mathbb{E}\, r_t = 0.066$, $\mathbb{E}\,\Delta\tau_t = 0.025$ (sample means for period 1947–2016); $\mathbb{E}\, sv_t = 0.043$. Standard errors from three different methods are reported in brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	sv_{t+1}
r_t	−0.216	−0.078	−0.042
	[0.119]	[0.040]	[0.047]
$\Delta\tau_t$	0.632	0.408	0.088
	[0.328]	[0.112]	[0.129]
sv_t	−0.009	−0.044	0.888
	[0.143]	[0.049]	[0.056]
R^2	7.85%	17.50%	79.61%

Table A.23: Variance decomposition for sv_t based on the system $(r_t, \Delta\tau_t, sv_t)$, UK data 1947–2016.

Panel A: Variance decomposition for sv_t				
Horizon	return	tax	spending	future sv
1	0.2%	0.3%	13.9%	87.1%
3	0.0%	7.2%	31.8%	62.5%
10	-0.6%	22.5%	60.2%	19.3%
30	-0.8%	29.2%	72.4%	0.7%
∞	-0.8%	29.4%	72.9%	0.0%
Panel B: Bootstrap intervals				
Horizon	return	tax	spending	future sv
1	[-1.9%, 2.1%]	[-11.5%, 19.0%]	[6.5%, 41.6%]	[56.3%, 90.5%]
3	[-3.6%, 3.2%]	[-19.8%, 41.5%]	[5.3%, 67.0%]	[29.2%, 80.1%]
10	[-7.2%, 5.4%]	[-37.5%, 79.9%]	[-1.1%, 111.6%]	[2.0%, 53.0%]
30	[-10.2%, 7.0%]	[-53.0%, 105.0%]	[-5.7%, 147.9%]	[0.0%, 16.2%]
∞	[-10.9%, 7.3%]	[-57.1%, 111.0%]	[-6.3%, 159.3%]	[0.0%, 0.0%]

Table A.24: Variance decompositions for short-run tax news based on the system $(r_t, \Delta\tau_t, sv_t)$. UK data, 1947–2016.

Panel A: Short-run tax news				
T	return	LR tax	spending	future sv
1	1.8%	—	30.6%	67.3%
3	5.4%	-42.3%	79.2%	57.5%
10	5.2%	-32.8%	109.4%	18.1%
30	4.9%	-26.6%	120.8%	0.6%
∞	4.9%	-26.4%	121.2%	—
Panel B: Bootstrap intervals				
T	return	tax	LR spending	future sv
1	[1.0%, 2.6%]	[-0.0%, 0.0%]	[24.6%, 36.4%]	[61.1%, 73.6%]
3	[1.6%, 9.8%]	[-79.9%, -11.4%]	[46.9%, 119.4%]	[23.5%, 100.2%]
10	[-0.1%, 10.8%]	[-101.3%, 6.2%]	[69.7%, 164.8%]	[3.9%, 49.9%]
30	[-1.9%, 11.5%]	[-108.2%, 20.2%]	[72.9%, 194.6%]	[0.0%, 12.2%]
∞	[-2.3%, 11.7%]	[-111.1%, 23.1%]	[73.0%, 205.6%]	[0.0%, 0.0%]

Table A.25: Variance decompositions for short-run spending news based on the system $(r_t, \Delta\tau_t, sv_t)$. UK data, 1947–2016.

Panel A: Short-run spending news				
T	return	tax	LR spending	future sv
1	-1.2%	17.9%	—	84.1%
3	-1.8%	31.1%	11.9%	59.6%
10	-2.4%	46.3%	38.5%	18.4%
30	-2.6%	52.7%	50.1%	0.6%
∞	-2.64%	52.9%	50.5%	—
Panel B: Bootstrap intervals				
T	return	tax	LR spending	future sv
1	[-1.8%, -0.6%]	[-0.0%, 0.0%]	[-0.0%, 0.0%]	[80.5%, 87.6%]
3	[-3.9%, 0.2%]	[-1.4%, 30.6%]	[-6.0%, 28.2%]	[41.9%, 76.7%]
10	[-7.7%, 2.2%]	[-17.6%, 78.2%]	[-13.5%, 72.2%]	[2.4%, 49.1%]
30	[-10.8%, 3.7%]	[-35.3%, 101.9%]	[-18.6%, 113.8%]	[0.0%, 14.6%]
∞	[-11.6%, 4.0%]	[-40.5%, 106.2%]	[-19.2%, 124.6%]	[0.0%, 0.0%]