For Online Publication

Internet Appendix of "Debt and Deficits: Fiscal Analysis with Stationary Ratios"

John Y. Campbell **Can Gao** **Ian W. R. Martin**[1]

Abstract

This appendix presents supplementary material and results not included in the main body of the paper.

[1]John Campbell: Harvard University and NBER, https://scholar.harvard.edu/campbell/home. Can Gao: University of St. Gallen and Swiss Finance Institute, https://sites.google.com/view/can-gao/home. Ian Martin: London School of Economics, https://personal.lse.ac.uk/martiniw.

Contents

IA.1 Data sources

IA.1.1 US postwar data 1947-2022

For the market value of debt, the Dallas Fed provides the market value of debt, V_t, from the 1930s. More specifically, we use the series of "market value of marketable federal debts" from the spreadsheet on Dallas Fed's website. This includes the debt held by Federal Reserve. We choose this debt series because the government receipts data includes deposits of earnings from the Federal Reserve and we treat the Fed as outside of the government —it is an owner of debt that the government must pay, but it happens to provide revenue to the Treasury to do that. [1] In the longer historical plot, 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 GDP and inflation, we use NIPA data from the FRED website.

For 1 year and 10 years nominal bond yield from 1953, we take from FRED data with variable names GS1 and GS10; pre 1953 data is from Robert Shiller's website. The

[1] See https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_15_concepts_fy2024.pdf for description of government receipt.

[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.

variable $yr_{1,t}$ is constructed by taking difference between the one-year yield and lagged inflation between t-1 and t. The variable $spr_{1\rightarrow 10,t}$ is the difference between 10 and 1 year yield.

IA.1.2 UK postwar data 1947-2022

For tax and spending, we use the dataset from website of office for budget responsibility https://obr.uk/data/.

For GDP, we take the nominal GDP data from Johnston and Williamson (2023). For inflation, we take CPI inflation from BOE (pre 2017) and world bank (after 2017) from FRED website.

For the market value of debt, we use the results in Ellison and Scott (2020) for 1947-2017. And we update the last 5 data points till 2022 using the same source files the authors used from David Wilkie and Andrew Cairns's webpage https://www.macs.hw.ac.uk/~andrewc/gilts/. We thank the authors of Ellison and Scott (2020) for sharing with us the public source of UK gilt price and quantity data.

For short term yield, we take the Bank of England dataset's short and long term yield data before 1970: section A.31 column E and S. Post 1970, we take the monthly yield curve data from BoE and take January observations as our annual observation.

IA.1.3 Data from Canada, Japan, Switzerland, and the eurozone

We merge BIS government debt market value to GDP data and IMF public finance data to construct a panel dataset.[5] Debt to GDP ratio series are from BIS website; expenditure and revenue to GDP data, real GDP growth, and inflation data is from IMF; short and long term interest rates data are from FRED's website (source is OECD), monthly series.

Most countries' fiscal year ends in December, so we take December observations as our annual observations if higher frequency data are available. For Canada and Japan, we take the N+1 year's March/June observations as the year N observation because the fiscal years of those countries do not align with calendar years. We first compute real return minus GDP growth, then back out the real debt return by adding back the real GDP growth. Similar approaches used to compute tax, spending, or debt growth rates.

The table below summarizes the starting years for which data are available for Canada, Japan, Switzerland, and the 11 eurozone countries.

[5] We exclude a number of smaller countries for which data are available (CHL, KOR, LUX, ISR, NOR, and TUR), and five EU countries that are not in the eurozone (CZE, DNK, HUN, POL, SWE) that are not in the eurozone.

Table IA.1: Panel data, starting year by country

Year	Countries
1989	CAN
1997	JPN
1999	CHE
1999	AUT, BEL, DEU, ESP, FIN
	FRA, GRC, IRL, ITA, NLD, PRT

IA.2 Data plots

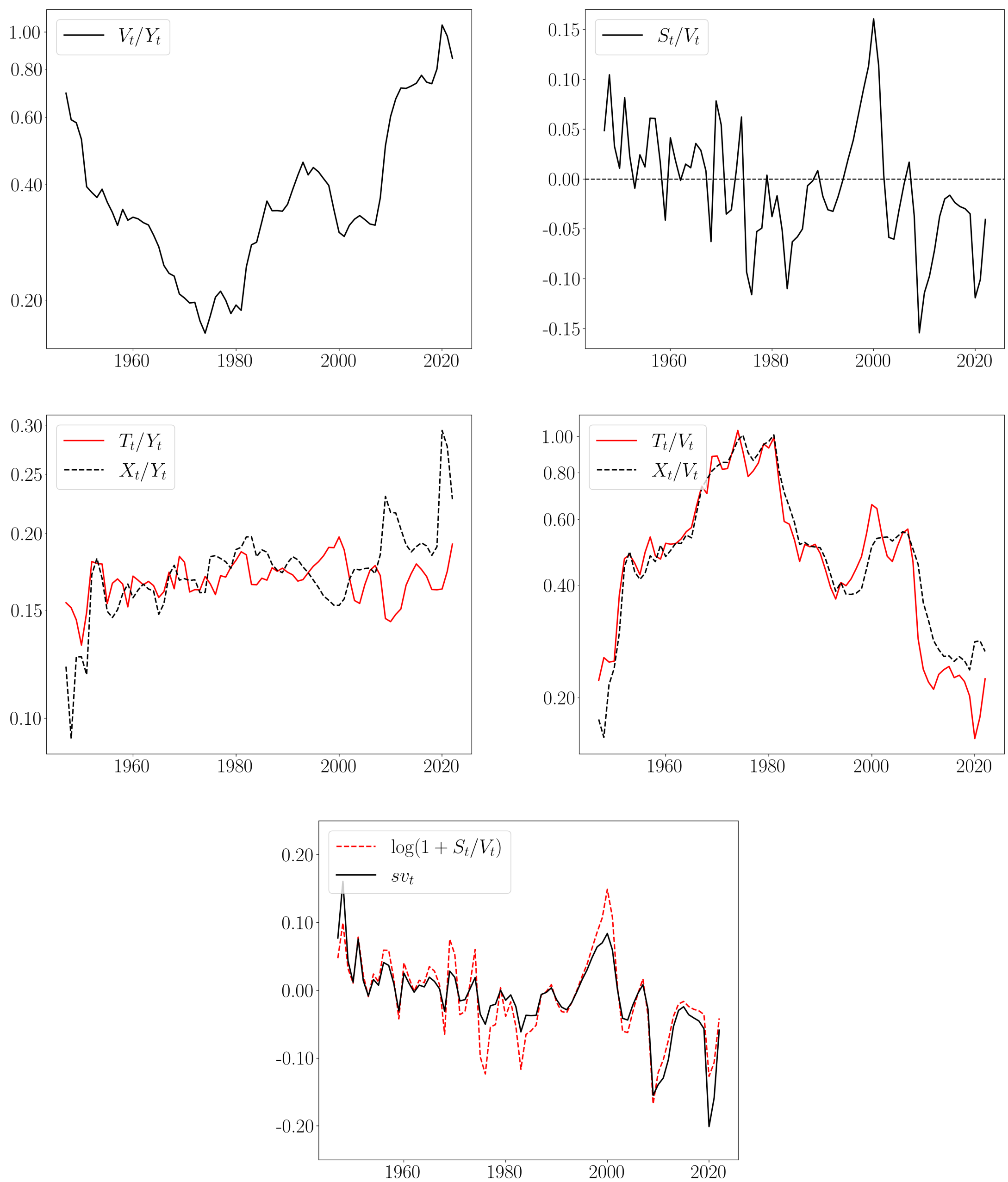


Figure IA.1: USA

Figure IA.2: GBR

Figure IA.3: CAN

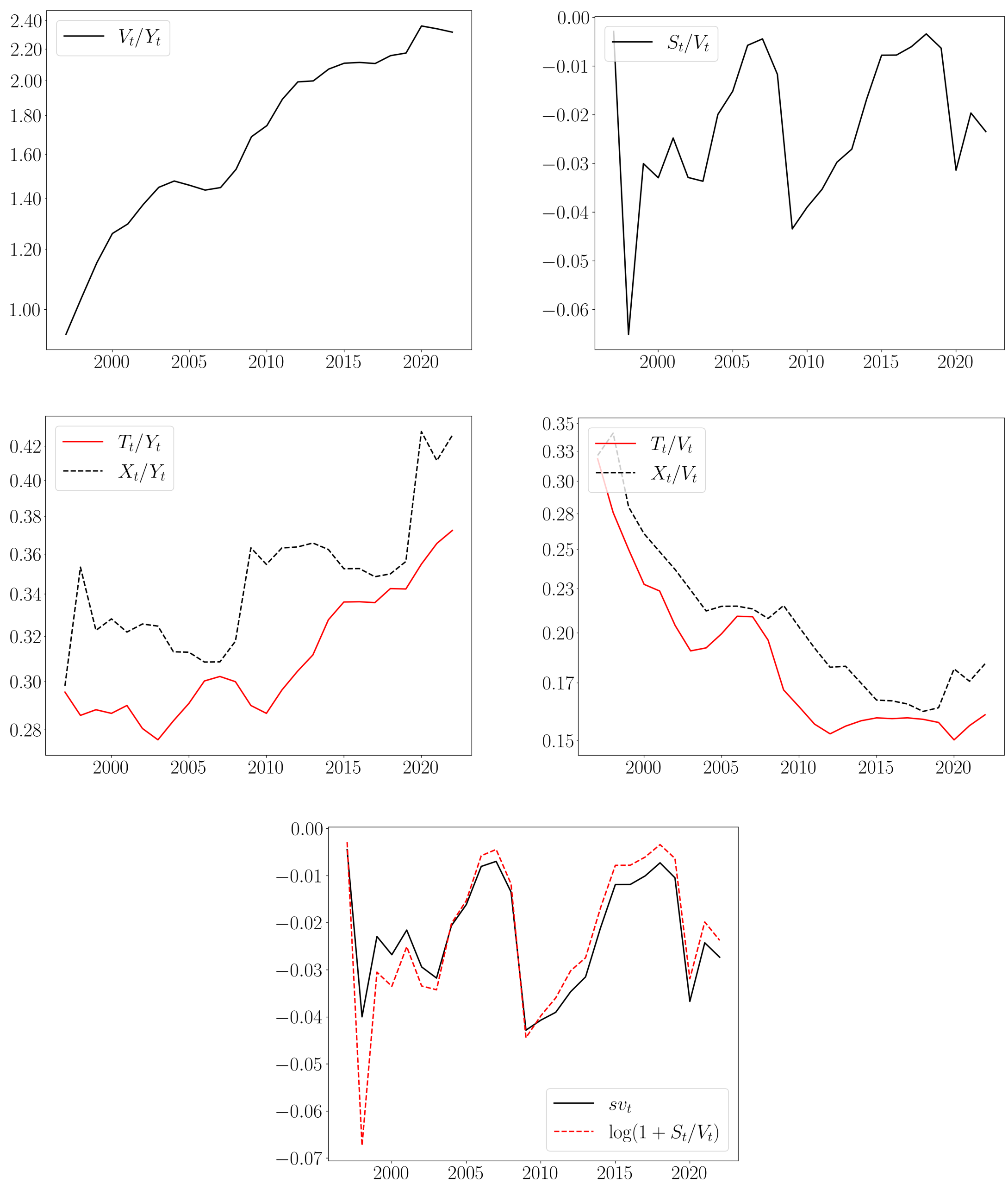


Figure IA.4: JPN

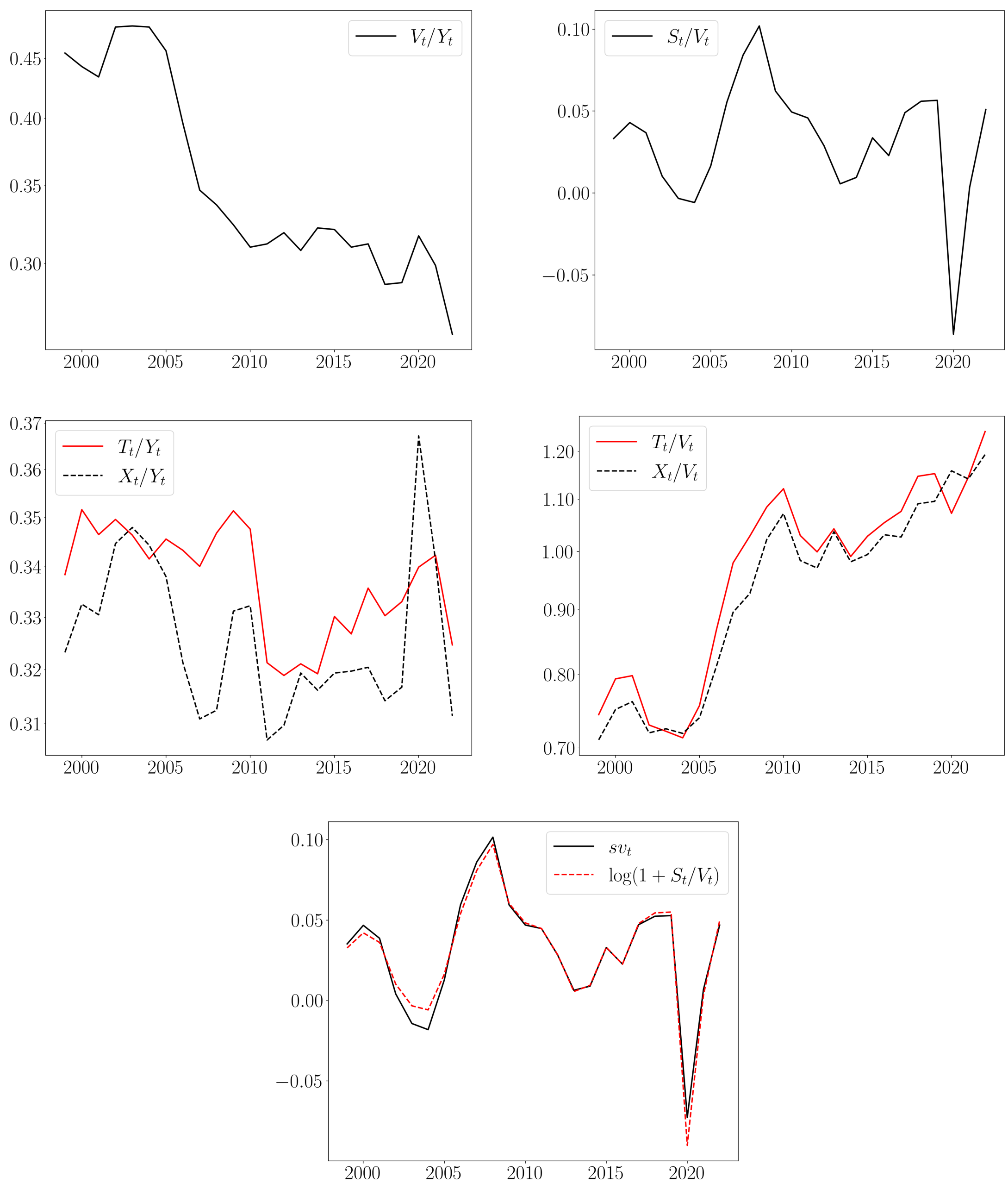


Figure IA.5: CHE

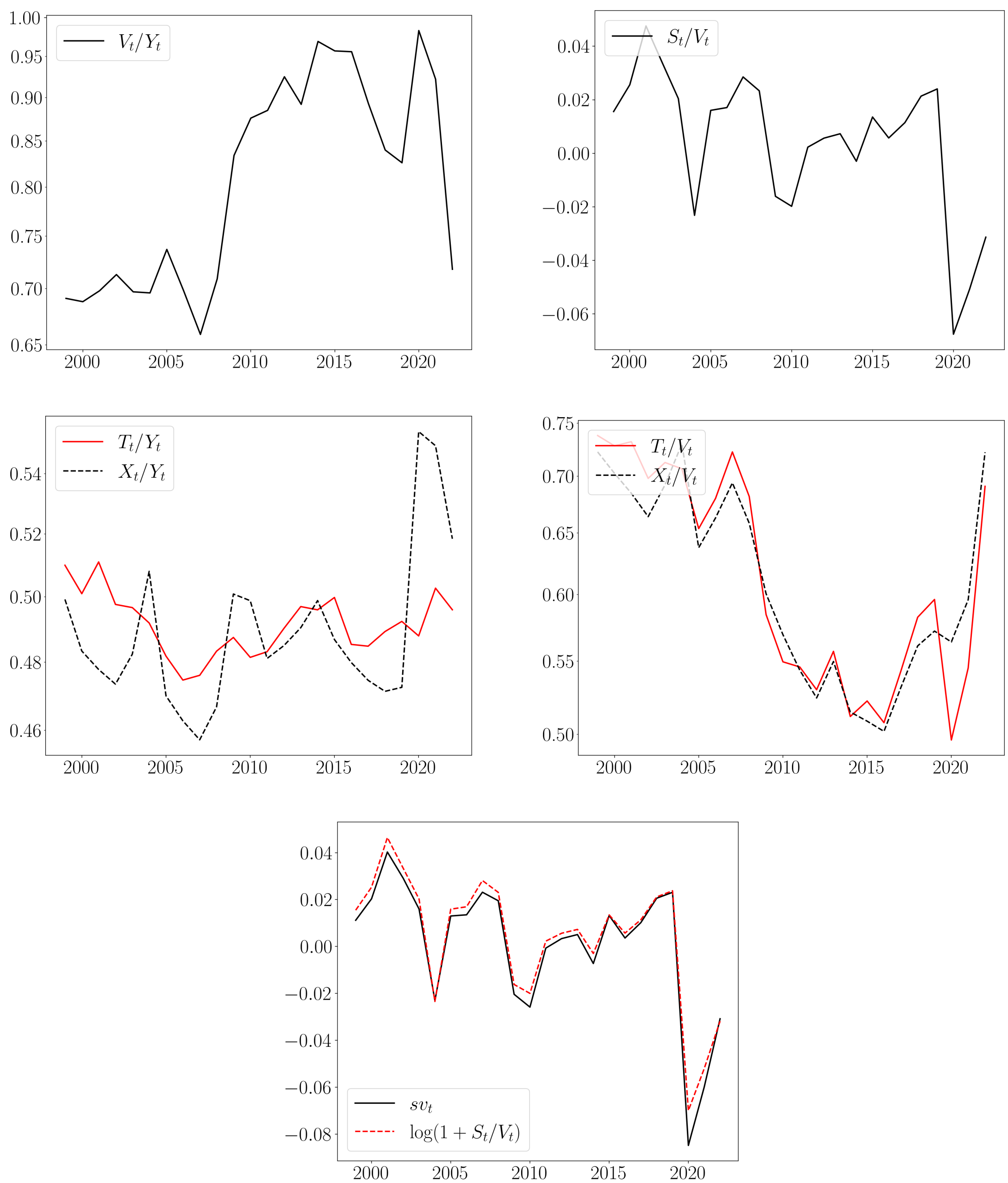


Figure IA.6: AUT

Figure IA.7: BEL

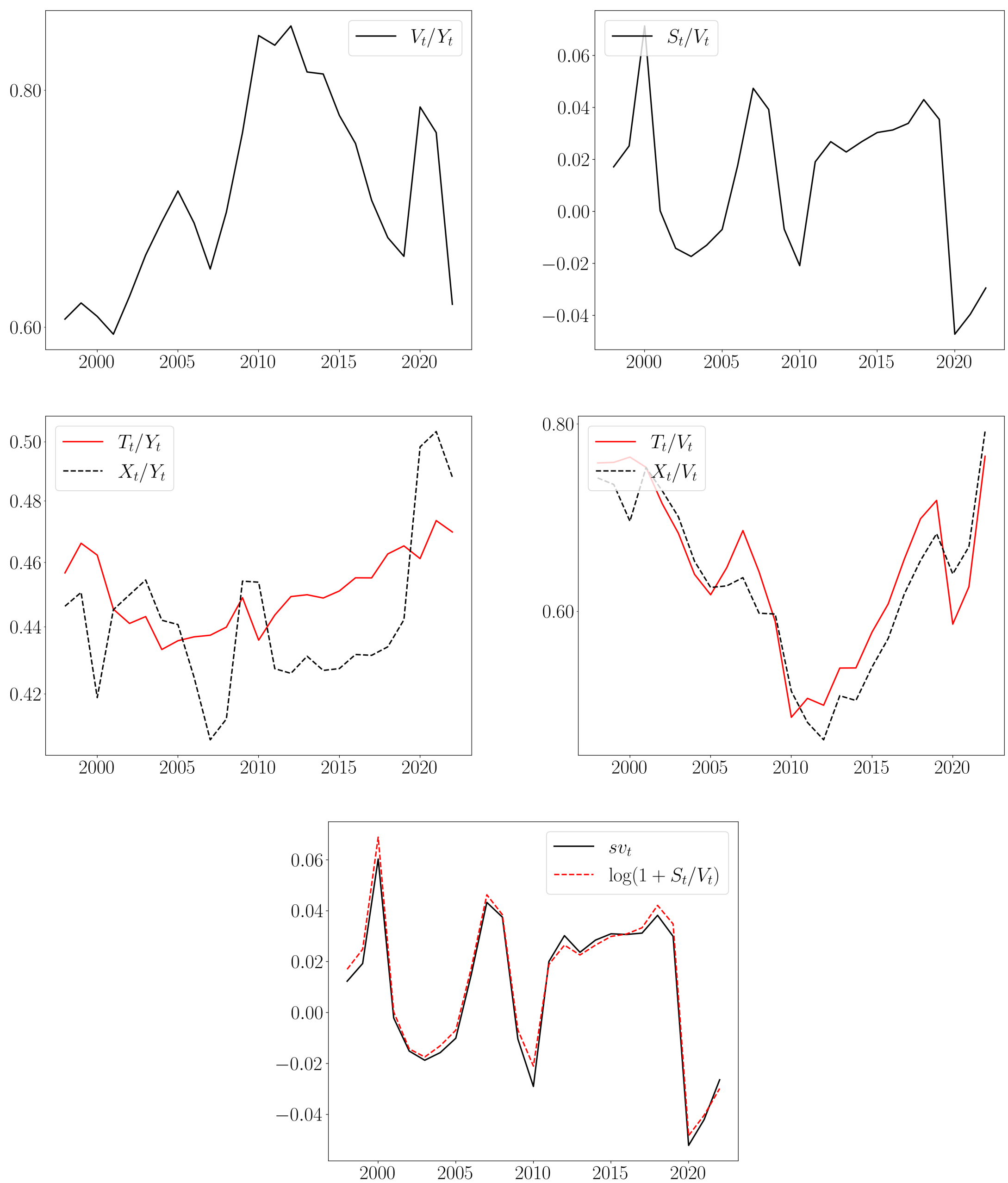


Figure IA.8: DEU

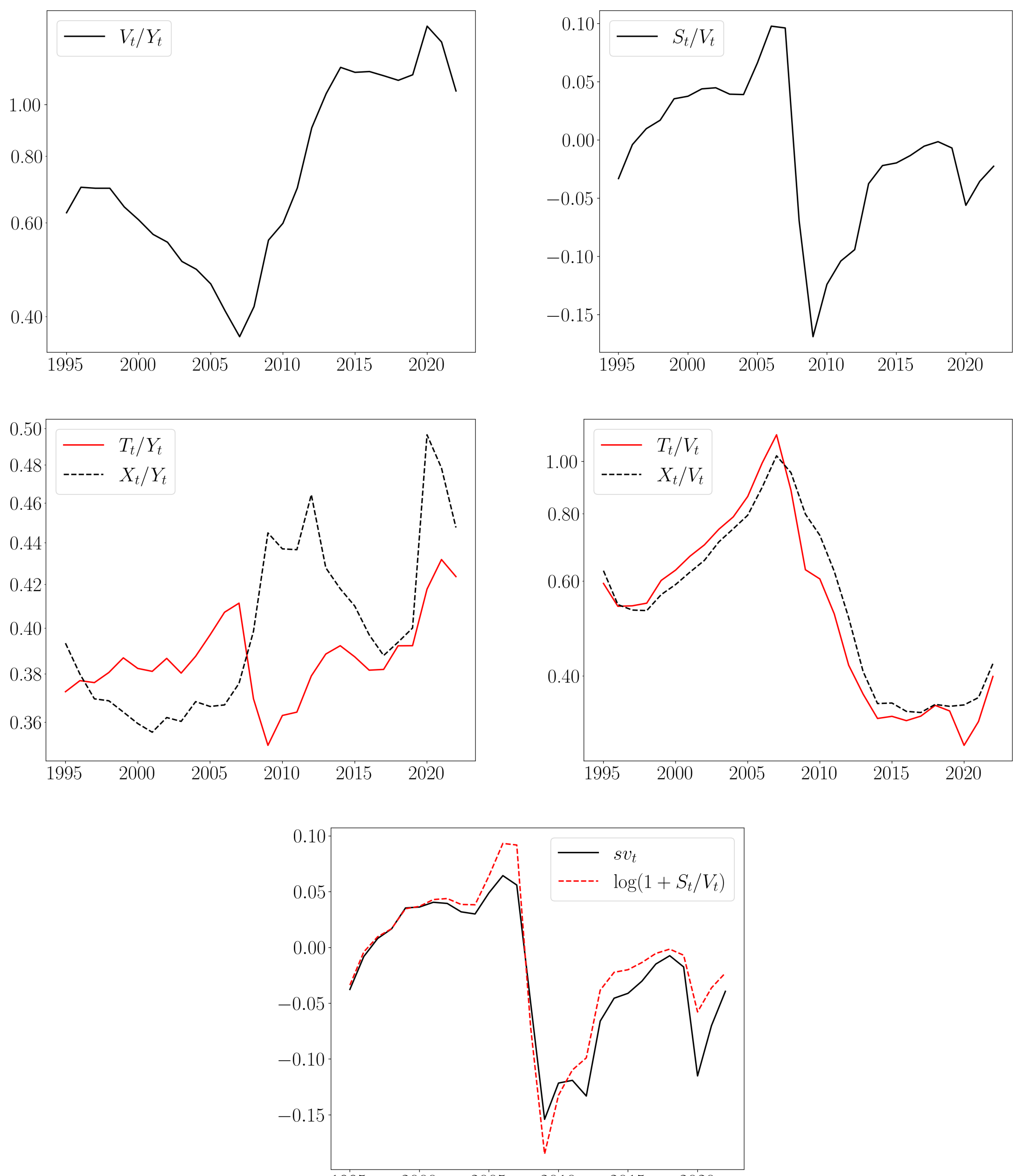


Figure IA.9: ESP

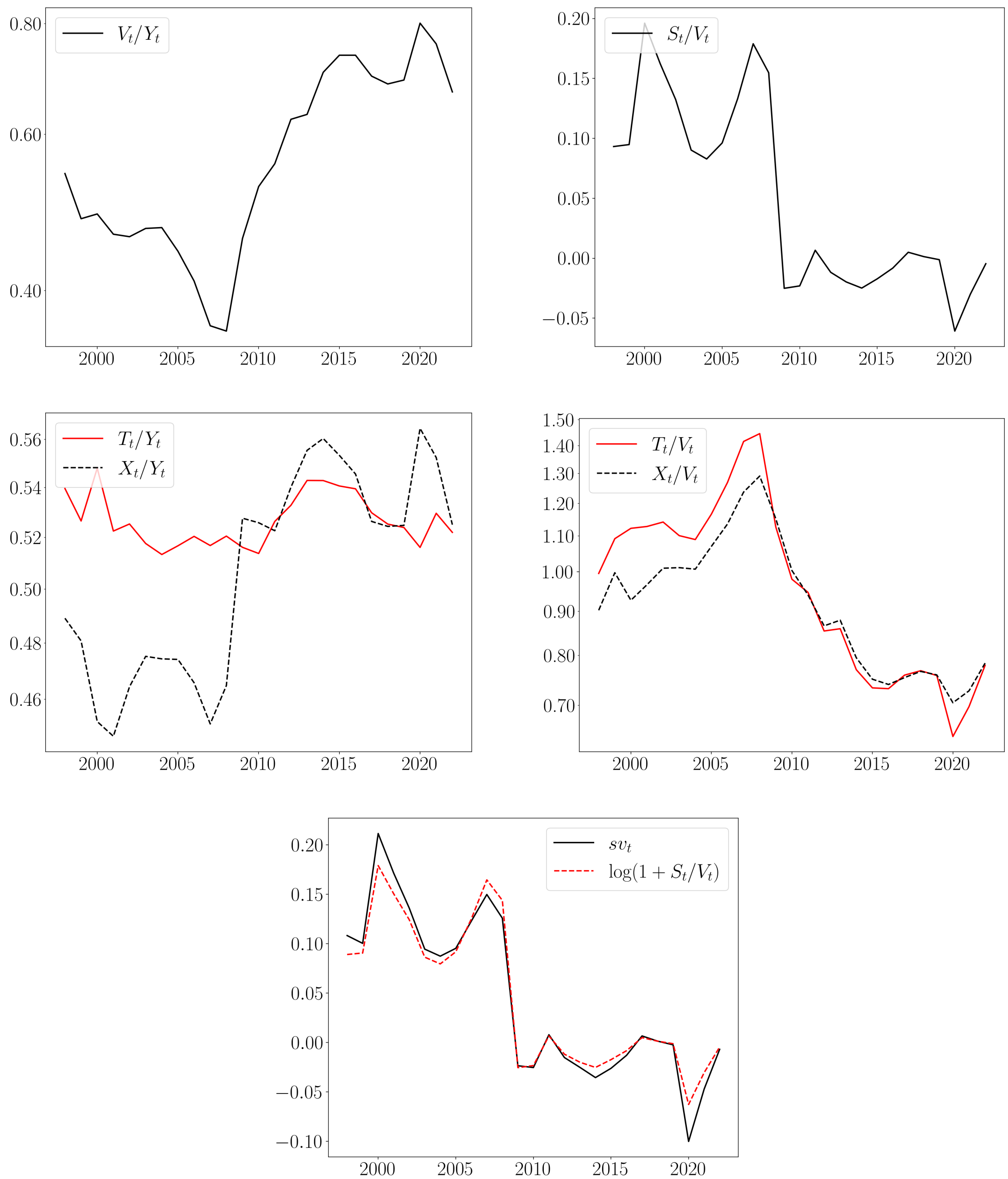


Figure IA.10: FIN

Figure IA.11: FRA

Figure IA.12: GRC

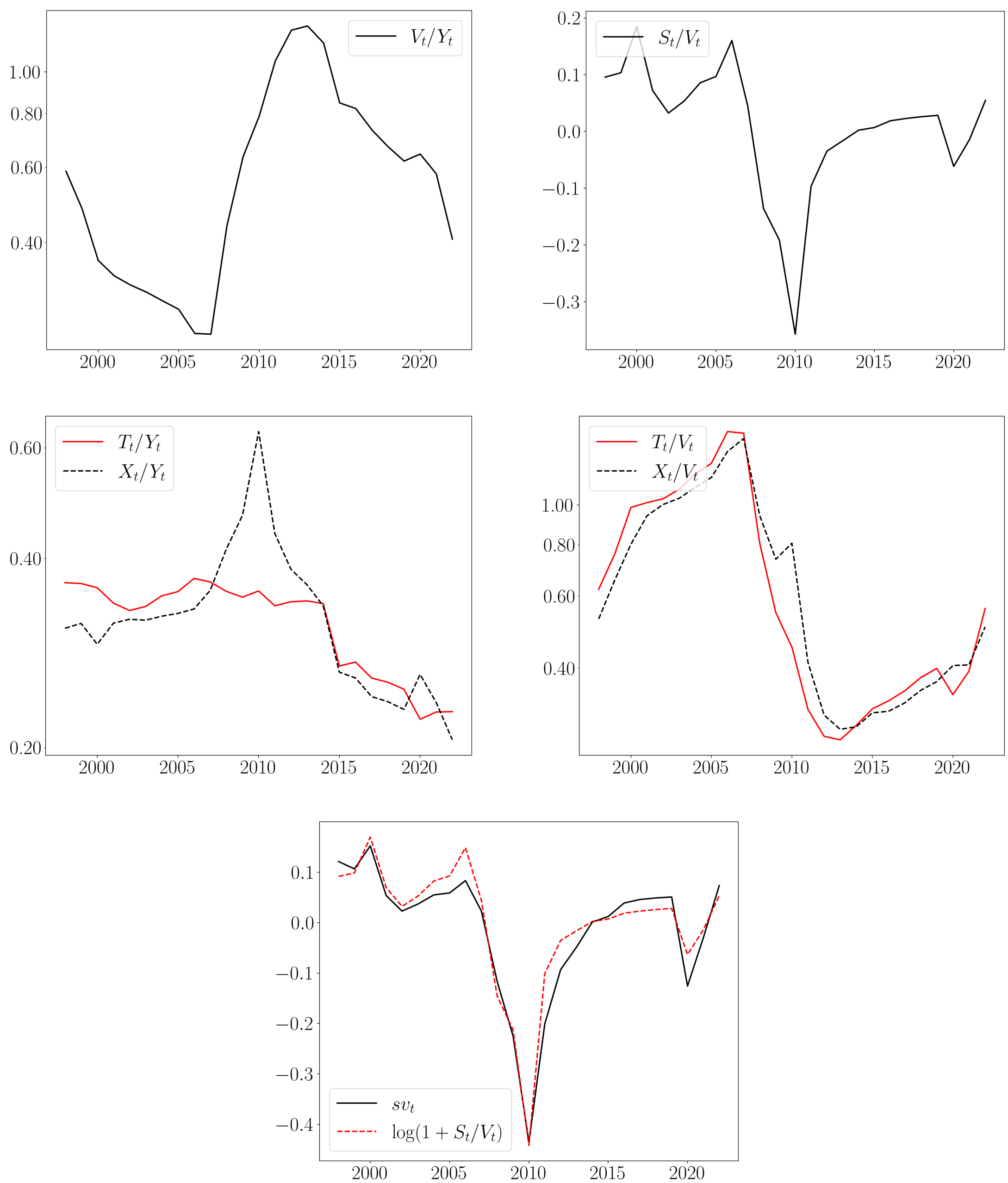


Figure IA.13: IRL

Figure IA.14: ITA

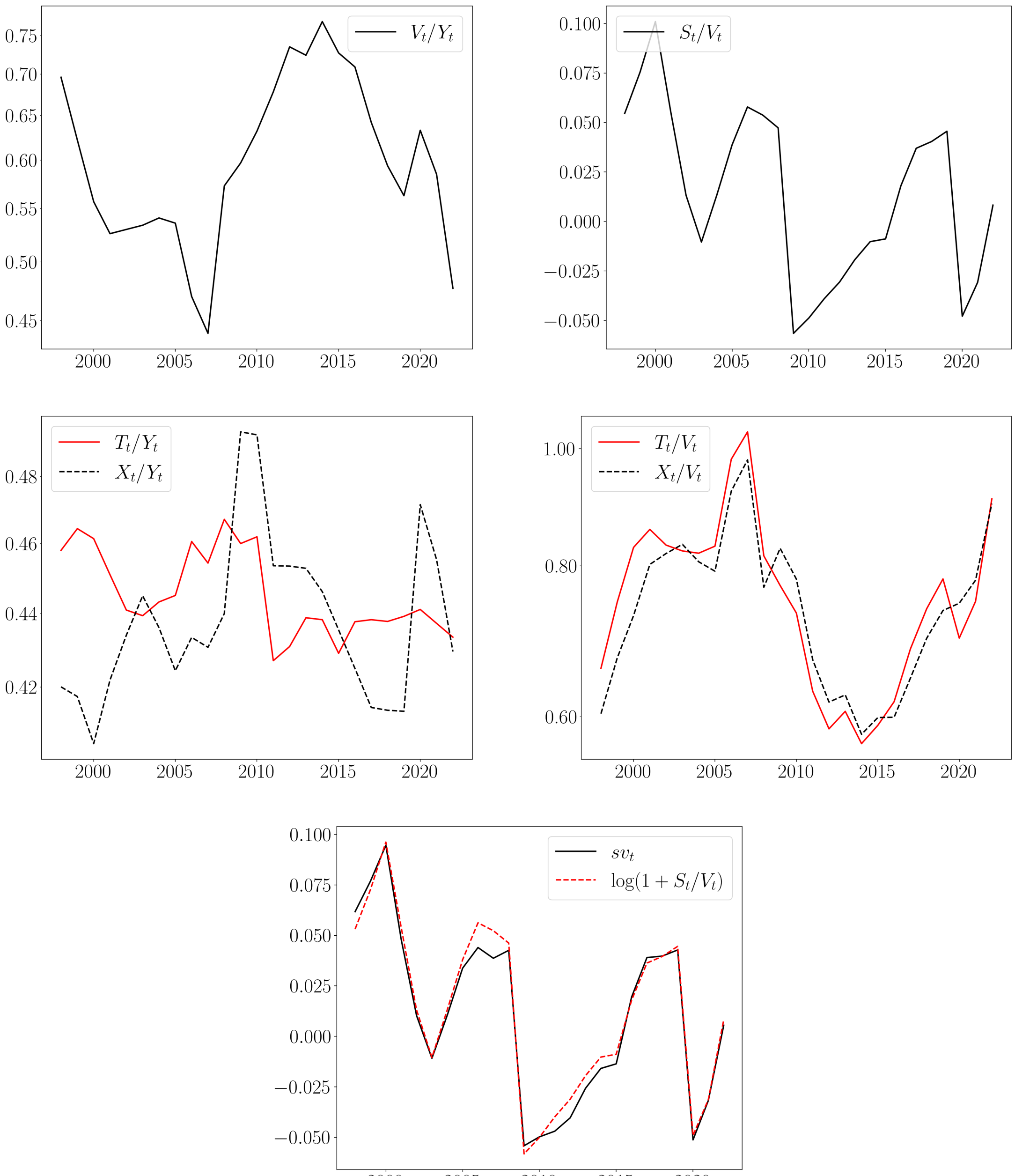


Figure IA.15: NLD

Figure IA.16: PRT

IA.3 Measurement of real debt returns

Table IA.2: US, UK, Canada, Japan, and Switzerland (1)

The imputed real debt return is regressed on the realized short-term real interest rate, the change in the long-term nominal bond yield, or both. Standard errors are computed using a Newey-West correction with a single lag. The multiple regression equation is the following:

$$r_t = \alpha + \beta \left(\text{short yield}_{t-1\to t} - \text{realised inflation}_t\right) + \gamma \, \Delta\text{long yield}_t + \varepsilon_t$$

country	α	NW_{se}	β	NW_{se}	γ	NW_{se}	R^2	obs.
	0.00	[0.01]	1.56	[0.17]	—	—	52.8%	76
USA	0.02	[0.00]	—	—	−4.17	[0.50]	49.8%	76
	0.01	[0.00]	1.56	[0.19]	−2.98	[0.39]	74.6%	76
	0.08	[0.01]	1.53	[0.59]	—	—	7.3%	76
GBR	0.08	[0.01]	—	—	−16.32	[1.69]	44.4%	76
	0.08	[0.01]	−0.08	[0.58]	−16.46	[2.18]	44.4%	76
	0.05	[0.01]	1.06	[0.32]	—	—	35.1%	33
CAN	0.06	[0.01]	—	—	−4.43	[1.28]	34.4%	33
	0.05	[0.01]	0.78	[0.26]	−3.23	[0.82]	51.0%	33
	0.02	[0.00]	0.73	[0.44]	—	—	13.5%	25
JPN	0.02	[0.01]	—	—	−3.62	[1.94]	20.4%	25
	0.02	[0.00]	0.68	[0.37]	−3.47	[1.85]	32.3%	25
	0.03	[0.01]	1.50	[0.52]	—	—	20.5%	23
CHE	0.02	[0.01]	—	—	−5.85	[0.57]	65.8%	23
	0.02	[0.01]	0.02	[0.37]	−5.83	[0.74]	65.8%	23

Table IA.3: US, UK, Canada, Japan, and Switzerland (2)

The imputed real debt return is regressed on the nominal short rate, the realized inflation rate, the change in the long-term nominal bond yield, and the slope of the term structure (the yield spread between the long-term and short-term interest rate). Standard errors are computed using a Newey-West correction with a single lag.

country	α	nominal short yield	inflation	Δ long yield	slope	R^2	obs.
USA	0.030	1.040	−1.650	−2.742	−0.258	78.5%	76
	[0.010]	[0.167]	[0.206]	[0.354]	[0.458]		
GBR	0.004	2.054	0.853	−16.697	3.676	60.2%	76
	[0.015]	[0.549]	[0.640]	[2.053]	[1.788]		
CAN	0.096	0.394	−1.977	−4.115	−0.904	64.5%	33
	[0.015]	[0.180]	[0.422]	[0.771]	[0.497]		
JPN	0.008	0.930	−0.440	−2.868	1.176	38.3%	25
	[0.004]	[1.163]	[0.360]	[1.825]	[1.070]		
CHE	0.030	0.151	1.128	−7.314	−1.653	71.7%	23
	[0.008]	[0.322]	[0.586]	[0.842]	[0.627]		

Table IA.4: Eurozone countries (1)

The imputed real debt return is regressed on the realized short-term real interest rate, the change in the long-term nominal bond yield, or both. Standard errors are computed using a Newey-West correction with a single lag. The multiple regression equation is the following:

$$r_t = \alpha + \beta \left(\text{short yield}_{t-1\to t} - \text{realised inflation}_t\right) + \gamma\,\Delta\text{long yield}_t + \varepsilon_t$$

country	α	NW$_{se}$	β	NW$_{se}$	γ	NW$_{se}$	R^2	obs.
	0.04	[0.01]	2.18	[0.29]	—	—	74.4%	23
AUT	0.01	[0.01]	—	—	−7.76	[1.06]	69.2%	23
	0.03	[0.01]	1.42	[0.19]	−4.49	[0.54]	88.5%	23
	0.03	[0.01]	1.70	[0.34]	—	—	60.9%	24
BEL	0.01	[0.01]	—	—	−6.11	[1.39]	72.3%	24
	0.02	[0.00]	0.99	[0.15]	−4.34	[0.60]	86.8%	24
	0.03	[0.01]	1.63	[0.40]	—	—	54.5%	24
DEU	0.02	[0.01]	—	—	−6.29	[2.11]	50.7%	24
	0.03	[0.01]	1.10	[0.34]	−3.91	[1.31]	68.4%	24
	0.03	[0.01]	1.48	[0.38]	—	—	42.9%	27
ESP	0.02	[0.01]	—	—	−4.68	[0.81]	68.2%	27
	0.02	[0.01]	0.42	[0.30]	−3.97	[0.72]	70.2%	27
	0.08	[0.01]	2.18	[0.24]	—	—	47.7%	24
FIN	0.06	[0.02]	—	—	−5.98	[1.11]	32.6%	24
	0.07	[0.01]	1.71	[0.35]	−3.15	[1.19]	54.4%	24

Table IA.5: Eurozone countries (2)

The imputed real debt return is regressed on the realized short-term real interest rate, the change in the long-term nominal bond yield, or both. Standard errors are computed using a Newey-West correction with a single lag. The multiple regression equation is the following:

$$r_t = \alpha + \beta\,\left(\text{short yield}_{t-1\to t} - \text{realised inflation}_t\right) + \gamma\,\Delta\text{long yield}_t + \varepsilon_t$$

country	α	NW_{se}	β	NW_{se}	γ	NW_{se}	R^2	obs.
	0.02	[0.01]	1.80	[0.45]	—	—	57.0%	24
FRA	0.01	[0.01]	—	—	−5.98	[1.12]	71.6%	24
	0.02	[0.00]	1.08	[0.21]	−4.44	[0.52]	87.4%	24
	0.01	[0.02]	1.04	[0.44]	—	—	14.2%	25
GRC	0.01	[0.01]	—	—	−3.35	[0.40]	79.6%	25
	0.01	[0.01]	0.01	[0.35]	−3.35	[0.46]	79.6%	25
	0.04	[0.02]	2.16	[0.74]	—	—	23.4%	24
IRL	0.03	[0.02]	—	—	−3.69	[1.56]	17.4%	24
	0.04	[0.02]	1.90	[0.80]	−3.05	[1.66]	35.0%	24
	0.03	[0.01]	1.53	[0.14]	—	—	58.6%	23
ITA	0.02	[0.01]	—	—	−4.67	[0.58]	85.2%	23
	0.02	[0.00]	0.62	[0.16]	−3.69	[0.53]	91.1%	23
	0.03	[0.01]	1.58	[0.43]	—	—	31.8%	24
NLD	0.01	[0.01]	—	—	−5.95	[1.27]	33.2%	24
	0.02	[0.01]	1.00	[0.47]	−3.98	[0.90]	42.5%	24
	0.03	[0.01]	1.39	[0.33]	—	—	33.8%	24
PRT	0.02	[0.01]	—	—	−2.30	[0.56]	60.3%	24
	0.03	[0.01]	0.87	[0.31]	−1.94	[0.55]	71.9%	24

Table IA.6: Eurozone countries (3)

The imputed real debt return is regressed on the nominal short rate, the realized inflation rate, the change in the long-term nominal bond yield, and the slope of the term structure (the yield spread between the long-term and short-term interest rate). Standard errors are computed using a Newey-West correction with a single lag.

country	α	nominal short yield	inflation	Δ long yield	slope	R^2	obs.
AUT	0.023	1.483	−1.324	−4.608	0.100	88.5%	23
	[0.012]	[0.234]	[0.323]	[0.783]	[0.817]		
BEL	0.021	1.007	−0.972	−4.344	0.065	86.8%	24
	[0.009]	[0.235]	[0.305]	[1.000]	[0.869]		
DEU	0.029	0.849	−1.545	−2.828	1.220	71.5%	24
	[0.018]	[0.493]	[0.436]	[1.463]	[1.450]		
ESP	−0.008	0.867	−0.580	−3.234	1.333	76.1%	27
	[0.016]	[0.268]	[0.297]	[0.747]	[0.659]		
FIN	−0.020	3.090	0.177	−4.392	3.206	82.9%	24
	[0.020]	[0.316]	[0.416]	[0.897]	[1.009]		
FRA	0.017	1.076	−0.961	−4.655	−0.232	87.5%	24
	[0.009]	[0.199]	[0.326]	[0.659]	[0.351]		
GRC	−0.008	0.163	0.431	−3.418	0.160	80.4%	25
	[0.020]	[0.427]	[0.437]	[0.409]	[0.224]		
IRL	−0.001	3.614	−0.954	−3.476	−0.114	46.6%	24
	[0.032]	[1.310]	[0.635]	[1.386]	[1.346]		
ITA	−0.009	1.151	−0.804	−2.864	1.303	95.8%	23
	[0.006]	[0.147]	[0.144]	[0.359]	[0.195]		
NLD	0.008	1.768	−0.120	−6.161	−2.421	55.1%	24
	[0.023]	[0.682]	[0.545]	[1.993]	[2.273]		
PRT	−0.007	1.506	−0.812	−1.470	1.007	84.5%	24
	[0.012]	[0.269]	[0.297]	[0.228]	[0.263]		

IA.4 Unit root tests and autocorrelation coefficients

Table IA.7: US, UK, Canada, Japan, and Switzerland: unit-root tests for returns and growth rates

ADF tests, with AIC lag length for USA and GBR, single lag for other countries.

country		r_t	$\Delta\tau_t$	Δx_t	Δv_t	Δy_t
USA	t-stat	−6.976	−5.873	−10.954	−5.067	−8.072
	p-value	0.000	0.000	0.000	0.000	0.000
GBR	t-stat	−9.001	−5.688	−7.595	−7.432	−2.101
	p-value	0.000	0.000	0.000	0.000	0.244
CAN	t-stat	−2.878	−3.553	−4.720	−2.832	−3.956
	p-value	0.048	0.007	0.000	0.054	0.002
JPN	t-stat	−3.021	−3.624	−3.031	−2.418	−3.995
	p-value	0.033	0.005	0.032	0.137	0.001
CHE	t-stat	−2.302	−2.715	−4.779	−2.605	−4.389
	p-value	0.171	0.071	0.000	0.092	0.000

Table IA.8: US, UK, Canada, Japan, and Switzerland: autocorrelations of returns and growth rates

country	r_t	$\Delta\tau_t$	Δx_t	Δv_t	Δy_t
USA	0.223	0.226	0.191	0.493	0.079
GBR	−0.065	0.410	0.348	0.135	0.591
CAN	0.154	0.271	−0.079	0.263	0.109
JPN	0.381	0.302	−0.513	0.635	−0.122
CHE	−0.061	−0.187	−0.073	0.194	−0.110

Table IA.9: US, UK, Canada, Japan, and Switzerland: unit-root tests for ratios

country		vy_t	τy_t	xy_t	τv_t	xv_t	sv_t
USA	t-stat	-1.086	-4.642	-2.152	-1.469	-2.565	-4.271
	p-value	0.720	0.000	0.224	0.549	0.100	0.000
GBR	t-stat	-1.218	-2.291	-1.018	-1.449	-1.765	-2.399
	p-value	0.666	0.175	0.747	0.559	0.398	0.142
CAN	t-stat	-1.920	-1.546	-2.405	-2.195	-1.766	-2.293
	p-value	0.323	0.511	0.140	0.208	0.397	0.174
JPN	t-stat	-1.786	0.136	0.110	-2.068	-4.892	-2.406
	p-value	0.387	0.968	0.967	0.257	0.000	0.140
CHE	t-stat	-0.669	-1.899	-3.338	-0.786	-0.574	-3.023
	p-value	0.855	0.333	0.013	0.823	0.877	0.033

Table IA.10: US, UK, Canada, Japan, and Switzerland: autocorrelations of ratios

country	vy_t	τy_t	xy_t	τv_t	xv_t	sv_t
USA	0.976	0.662	0.814	0.960	0.972	0.747
GBR	0.977	0.848	0.921	0.972	0.976	0.834
CAN	0.879	0.916	0.687	0.860	0.882	0.748
JPN	0.991	0.969	0.766	0.973	0.964	0.434
CHE	0.946	0.678	0.407	0.938	0.959	0.436

Table IA.11: Eurozone countries: unit-root tests for returns and growth rates (1)

country		r_t	$\Delta\tau_t$	Δx_t	Δv_t	Δy_t
AUT	t-stat	−0.954	−6.306	−4.009	−2.804	−4.772
	p-value	0.770	0.000	0.001	0.058	0.000
BEL	t-stat	−1.406	−4.154	−3.017	−2.744	−4.723
	p-value	0.580	0.001	0.033	0.067	0.000
DEU	t-stat	−1.309	−4.202	−3.719	−2.726	−4.875
	p-value	0.625	0.001	0.004	0.070	0.000
ESP	t-stat	−1.853	−3.384	−2.469	−1.982	−3.125
	p-value	0.355	0.012	0.123	0.295	0.025
FIN	t-stat	−0.516	−4.657	−2.667	−2.420	−3.919
	p-value	0.889	0.000	0.080	0.136	0.002
FRA	t-stat	−1.774	−4.267	−3.674	−2.893	−4.479
	p-value	0.393	0.001	0.004	0.046	0.000
GRC	t-stat	−3.952	−3.326	−2.817	−5.092	−1.837
	p-value	0.002	0.014	0.056	0.000	0.362
IRL	t-stat	−3.531	−2.897	−3.012	−2.228	−2.427
	p-value	0.007	0.046	0.034	0.196	0.134
ITA	t-stat	−1.858	−4.191	−2.434	−3.205	−4.212
	p-value	0.352	0.001	0.132	0.020	0.001
NLD	t-stat	−3.281	−2.691	−3.077	−3.077	−3.946
	p-value	0.016	0.076	0.028	0.028	0.002
PRT	t-stat	−2.257	−5.469	−4.445	−1.723	−3.730
	p-value	0.186	0.000	0.000	0.419	0.004

Table IA.12: Eurozone countries: autocorrelations of returns and growth rates

country	r_t	$\Delta\tau_t$	Δx_t	Δv_t	Δy_t
AUT	0.399	−0.293	−0.104	0.159	−0.034
BEL	0.153	−0.044	−0.240	0.103	−0.239
DEU	0.214	−0.024	−0.076	0.131	−0.108
ESP	0.375	0.199	0.266	0.579	0.100
FIN	0.504	−0.170	0.380	0.324	0.145
FRA	0.264	−0.009	−0.027	0.240	−0.225
GRC	−0.007	0.185	0.511	−0.175	0.458
IRL	0.089	0.190	−0.021	0.577	0.326
ITA	0.260	−0.182	0.212	0.081	−0.103
NLD	−0.110	0.002	0.274	0.085	0.061
PRT	−0.003	−0.224	0.197	0.093	0.031

Table IA.13: Eurozone countries: unit-root tests for ratios

country		vy_t	τy_t	xy_t	τv_t	xv_t	sv_t
AUT	t-stat	−1.840	−1.936	−2.948	−1.790	−1.276	−2.632
	p-value	0.361	0.315	0.040	0.386	0.640	0.086
BEL	t-stat	−2.214	−1.908	−1.549	−2.777	−1.775	−1.610
	p-value	0.201	0.328	0.509	0.062	0.393	0.479
DEU	t-stat	−2.063	−0.913	−2.037	−1.965	−0.695	−3.388
	p-value	0.259	0.784	0.271	0.302	0.848	0.011
ESP	t-stat	−1.461	−2.423	−1.650	−1.461	−2.123	−2.140
	p-value	0.553	0.135	0.457	0.553	0.235	0.229
FIN	t-stat	−1.365	−2.062	−1.855	−1.316	−1.331	−2.270
	p-value	0.599	0.260	0.354	0.622	0.615	0.182
FRA	t-stat	−1.521	−1.143	−1.313	−1.688	−1.588	−2.812
	p-value	0.523	0.697	0.623	0.437	0.490	0.057
GRC	t-stat	−0.903	−0.37	−1.811	−1.580	−1.091	−2.926
	p-value	0.787	0.915	0.375	0.494	0.719	0.042
IRL	t-stat	−1.893	0.189	−0.833	−1.870	−1.269	−2.466
	p-value	0.335	0.972	0.809	0.346	0.643	0.124
ITA	t-stat	−1.545	−1.121	−1.176	−1.781	−1.541	−2.270
	p-value	0.511	0.707	0.684	0.390	0.513	0.182
NLD	t-stat	−1.491	−2.244	−3.145	−1.639	−1.317	−3.322
	p-value	0.538	0.191	0.023	0.463	0.621	0.014
PRT	t-stat	−1.765	−1.667	−2.891	−1.634	−1.529	−2.654
	p-value	0.398	0.448	0.046	0.465	0.519	0.082

Table IA.14: Eurozone countries: autocorrelations of ratios

country	vy_t	τy_t	xy_t	τv_t	xv_t	sv_t
AUT	0.807	0.675	0.534	0.806	0.851	0.468
BEL	0.670	0.778	0.847	0.573	0.804	0.811
DEU	0.774	0.819	0.662	0.772	0.861	0.506
ESP	0.956	0.743	0.812	0.950	0.961	0.792
FIN	0.935	0.578	0.874	0.929	0.936	0.814
FRA	0.954	0.913	0.846	0.939	0.962	0.635
GRC	0.914	0.944	0.804	0.803	0.877	0.638
IRL	0.920	0.943	0.858	0.937	0.932	0.708
ITA	0.878	0.855	0.822	0.838	0.869	0.695
NLD	0.788	0.639	0.583	0.819	0.798	0.653
PRT	0.963	0.889	0.662	0.948	0.968	0.485

IA.5 Theoretical choices of means

Table IA.15: Theoretical choices of means for US, UK, Canada, Japan, and Switzerland

country	start	ρ	β	sv	sv (data)	r	r (data)	g (data)	$r-g$ (data)
USA	1947	0.999	0.997	0.001	−0.011	0.031	0.018	0.030	−0.012
GBR	1947	0.967	0.952	0.034	0.034	0.088	0.083	0.054	0.030
CAN	1989	0.960	0.947	0.041	0.041	0.062	0.067	0.021	0.046
JPN	1997	0.999	0.994	0.001	−0.023	0.007	0.019	0.006	0.013
CHE	1999	0.970	0.970	0.031	0.031	0.050	0.025	0.019	0.006

Table IA.16: Theoretical choices of means for a panel of 11 eurozone countries

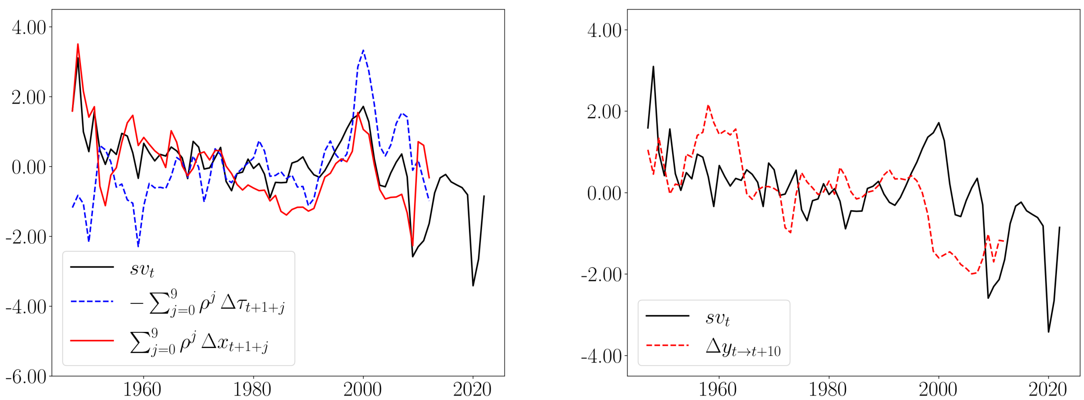
country	start	ρ	β	sv	sv (data)	r	r (data)	g (data)	$r-g$ (data)
AUT	1999	0.997	0.995	0.003	0.004	0.019	0.020	0.016	0.004
BEL	1999	0.997	0.993	0.003	0.012	0.020	0.016	0.017	−0.001
DEU	1999	0.997	0.995	0.003	0.011	0.016	0.024	0.012	0.012
ESP	1999	0.997	0.995	0.003	−0.014	0.020	0.020	0.017	0.003
FIN	1999	0.997	0.997	0.003	0.042	0.019	0.067	0.016	0.051
FRA	1999	0.997	0.994	0.003	−0.015	0.017	0.017	0.014	0.003
GRC	1999	0.997	0.990	0.003	−0.011	0.008	0.019	0.005	0.014
IRL	1999	0.997	0.996	0.003	−0.003	0.059	0.037	0.055	−0.019
ITA	1999	0.997	0.992	0.003	0.009	0.008	0.018	0.004	0.014
NLD	1999	0.997	0.996	0.003	0.012	0.021	0.013	0.017	−0.004
PRT	1999	0.997	0.993	0.003	−0.012	0.013	0.024	0.010	0.014

IA.6 Results for the US

Table IA.17: Summary statistics for US, 1947-2022

horizon	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.018	0.062	−0.536	1.663	0.018	0.188	−0.180	0.223
$yr_{1,t}$	0.011	0.026	−0.923	2.753	0.011	0.068	−0.094	0.723
$spr_{1\to 10,t}$	0.009	0.010	−0.011	0.093	0.007	0.031	−0.019	0.593
Δx_t	0.030	0.119	−1.429	14.620	0.028	0.416	−0.628	0.191
$\Delta \tau_t$	0.031	0.068	−0.119	1.553	0.038	0.231	−0.188	0.226
Δy_t	0.030	0.024	−0.254	0.040	0.030	0.084	−0.028	0.079
Δv_t	0.030	0.091	0.186	1.166	0.015	0.288	−0.226	0.493
τv_t	−0.773	0.475	−0.393	−0.640	−0.717	0.038	−1.860	0.960
xv_t	−0.744	0.443	−0.244	−0.408	−0.689	0.010	−1.853	0.972
$\log(1 + S_t/V_t)$	−0.011	0.061	−0.232	0.359	−0.008	0.139	−0.183	0.660
sv_t	−0.012	0.056	−0.653	2.772	−0.006	0.161	−0.201	0.747
S_t/V_t	−0.010	0.060	−0.029	0.288	−0.008	0.149	−0.167	0.664
T_t/Y_t	0.168	0.012	−0.280	0.385	0.169	0.198	0.132	0.664
X_t/Y_t	0.175	0.029	1.103	5.184	0.174	0.295	0.093	0.801
S_t/Y_t	−0.007	0.030	−1.549	4.654	−0.003	0.059	−0.132	0.744
V_t/Y_t	0.405	0.202	1.263	0.996	0.342	1.044	0.164	0.969
τy_t	−1.784	0.075	−0.539	0.745	−1.778	−1.622	−2.028	0.662
xy_t	−1.755	0.165	−0.272	4.002	−1.746	−1.222	−2.379	0.814
vy_t	−1.011	0.454	0.400	−0.478	−1.074	0.043	−1.808	0.976

IA.6.1 Local projections



(a) Tax and Spending Growth

(b) GDP Growth

Figure IA.17: US data

Newey–West standard errors reported in the main text set lags equal to 2, 5, and 15, respectively, for $T = 1, 3$ and 10. The standard error for the spending ratio is computed via the delta method using the Newey–West standard errors of $\beta_{\tau,T}$ and $\beta_{x,T}$:

$$\text{s.e. of spending ratio} = \left| \frac{\beta_{\tau,T} \times \text{s.e. of spending}}{(\beta_{x,T} + \beta_{\tau,T})^2} \right| + \left| \frac{\beta_{x,T} \times \text{s.e. of tax}}{(\beta_{x,T} + \beta_{\tau,T})^2} \right|$$

Table IA.18: More details of covariance between sv_t and returns, US data

This table reports the components of the product

$$\frac{\text{cov}(\sum_{j=0}^{T-1} \rho^j r_{t+1+j}, sv_t)}{\text{var}\, sv_t} = \underbrace{\frac{std(r_{t)}}{std(sv_t)}}_{(1)} \times \underbrace{\frac{std(\sum_{j=0}^{T-1} \rho^j r_{t+1+j})}{std(r_t)}}_{(2)} \times \underbrace{\text{corr}\left(\sum_{j=0}^{T-1} \rho^j r_{t+1+j}, sv_t\right)}_{(3)} .$$

horizon	(1)	(2)	(3)
1	1.036	1.000	0.222
3	1.036	2.114	-0.016
10	1.036	3.929	-0.062

IA.6.2 VAR estimates

Table IA.19: VAR coefficient estimates for a system that includes the tax-GDP ratio, τy_t. US data, 1947–2022.

OLS standard errors are reported in square brackets. The last two columns show imputed coefficients for spending growth and for $f_{t+1} = \Delta\tau_{t+1} - \beta\Delta x_{t+1}$.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	τy_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.221	−0.205	0.033	−0.164	−0.239	0.288	−0.492
	[0.123]	[0.101]	[0.050]	[0.074]	[0.088]	[0.185]	[0.232]
$\Delta\tau_t$	−0.147	0.164	−0.002	−0.161	0.166	0.650	−0.483
	[0.119]	[0.097]	[0.049]	[0.072]	[0.085]	[0.178]	[0.224]
Δy_t	0.221	1.313	0.105	0.619	1.208	−0.544	1.855
	[0.318]	[0.260]	[0.130]	[0.192]	[0.228]	[0.476]	[0.599]
sv_t	0.272	−0.424	−0.074	0.804	−0.350	0.165	−0.589
	[0.183]	[0.150]	[0.075]	[0.111]	[0.132]	[0.275]	[0.346]
τy_t	0.218	−0.268	−0.074	0.080	0.806	−0.501	0.241
	[0.103]	[0.084]	[0.042]	[0.062]	[0.074]	[0.154]	[0.193]
sv_{t-1}	−0.082	0.135	0.138	−0.166	−0.004	0.634	−0.498
	[0.186]	[0.152]	[0.076]	[0.112]	[0.134]	[0.279]	[0.351]
R^2	19.69%	57.10%	12.91%	70.35%	74.41%	31.37%	34.99%

Table IA.20: VAR coefficient estimates. US data, 1947–2022

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	$yr_{1,t+1}$	$spr_{1\to 10,t+1}$	Δx_{t+1}	f_{t+1}
r_t	−0.019	−0.209	−0.040	−0.202	0.005	0.020	0.397	−0.605
	[0.140]	[0.129]	[0.061]	[0.090]	[0.041]	[0.020]	[0.234]	[0.284]
$\Delta\tau_t$	−0.033	0.048	−0.003	−0.125	0.010	−0.002	0.424	−0.375
	[0.108]	[0.099]	[0.047]	[0.070]	[0.032]	[0.016]	[0.180]	[0.219]
Δy_t	−0.505	1.742	0.149	0.428	−0.038	−0.132	0.463	1.280
	[0.309]	[0.284]	[0.135]	[0.199]	[0.091]	[0.045]	[0.516]	[0.627]
sv_t	0.473	−0.576	−0.108	0.863	0.166	0.017	−0.165	−0.412
	[0.169]	[0.156]	[0.074]	[0.109]	[0.050]	[0.025]	[0.283]	[0.343]
$yr_{1,t}$	1.195	−0.400	0.035	0.265	0.710	0.041	−1.203	0.799
	[0.299]	[0.276]	[0.131]	[0.193]	[0.089]	[0.044]	[0.500]	[0.608]
$spr_{1\to 10,t}$	1.592	−0.219	0.673	0.263	0.293	0.535	−1.018	0.796
	[0.780]	[0.718]	[0.340]	[0.504]	[0.231]	[0.114]	[1.303]	[1.584]
sv_{t-1}	−0.177	0.198	0.186	−0.195	−0.108	−0.006	0.786	−0.586
	[0.184]	[0.169]	[0.080]	[0.119]	[0.054]	[0.027]	[0.307]	[0.373]
R^2	30.85%	52.70%	13.99%	70.60%	60.43%	48.11%	26.67%	35.17%

Table IA.21: VAR coefficient estimates. US data, 1947–2022

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	τy_{t+1}	$yr_{1,t+1}$	$spr_{1\to10,t+1}$	Δx_{t+1}	f_{t+1}
r_t	−0.025	−0.186	−0.033	−0.206	−0.153	0.003	0.020	0.434	−0.618
	[0.140]	[0.123]	[0.060]	[0.090]	[0.106]	[0.041]	[0.020]	[0.226]	[0.286]
$\Delta\tau_t$	−0.060	0.154	0.028	−0.146	0.126	0.002	−0.001	0.594	−0.438
	[0.116]	[0.102]	[0.050]	[0.075]	[0.088]	[0.034]	[0.017]	[0.187]	[0.236]
Δy_t	−0.396	1.312	0.023	0.514	1.289	−0.006	−0.135	−0.227	1.539
	[0.354]	[0.310]	[0.152]	[0.228]	[0.268]	[0.105]	[0.052]	[0.572]	[0.722]
sv_t	0.433	−0.419	−0.062	0.831	−0.356	0.154	0.018	0.088	−0.506
	[0.180]	[0.158]	[0.077]	[0.116]	[0.137]	[0.053]	[0.026]	[0.291]	[0.368]
τy_t	0.070	−0.275	−0.081	0.055	0.806	0.021	−0.002	−0.442	0.165
	[0.111]	[0.098]	[0.048]	[0.072]	[0.084]	[0.033]	[0.016]	[0.180]	[0.228]
$yr_{1,t}$	1.094	−0.003	0.152	0.186	−0.155	0.680	0.043	−0.565	0.561
	[0.339]	[0.297]	[0.145]	[0.219]	[0.257]	[0.100]	[0.050]	[0.548]	[0.693]
$spr_{1\to10,t}$	1.604	−0.262	0.660	0.272	−0.922	0.296	0.534	−1.087	0.822
	[0.778]	[0.683]	[0.334]	[0.502]	[0.590]	[0.230]	[0.114]	[1.258]	[1.590]
sv_{t-1}	−0.156	0.115	0.161	−0.179	−0.046	−0.101	−0.006	0.653	−0.536
	[0.186]	[0.163]	[0.080]	[0.120]	[0.141]	[0.055]	[0.027]	[0.301]	[0.380]
R^2	31.26%	57.19%	17.20%	70.88%	75.14%	60.62%	48.11%	32.72%	35.68%

IA.6.3 Variance decomposition

Table IA.22: Variance decomposition of fiscal position sv_t, US 1947-2022, based on system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, yr_{1,t}, spr_{1\to 10,t})$

Quantities in square brackets indicate the 95% confidence intervals due to a bootstrap exercise. In this bootstrap procedure we i) draw a new VAR(1) coefficient matrix using the covariance matrix of the estimated coefficients around the point estimates; ii) given this VAR matrix and the data, generate the news series and do the variance decomposition; iii) repeat i) and ii) 2,000 times and report the 95% quantiles.

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.0	24.2	77.1	65.4
	$[0.0, 0.0]$	$[11.3, 36.8]$	$[64.5, 90.0]$	$[36.9, 87.5]$
3	0.1	71.6	29.7	68.3
	$[0.0, 0.1]$	$[35.8, 103.0]$	$[-1.8, 65.5]$	$[38.9, 98.7]$
10	0.1	100.1	1.1	81.6
	$[-0.1, 0.2]$	$[70.0, 106.6]$	$[-5.2, 31.1]$	$[40.5, 127.2]$
∞	0.1	101.3	0.0	82.4
	$[-0.2, 0.4]$	$[100.9, 101.5]$	$[-0.0, 0.0]$	$[31.9, 142.4]$

Table IA.23: Variance decomposition of fiscal position sv_t, US 1947-2022, based on system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t, yr_{1,t}, spr_{1\rightarrow 10,t})$

Quantities in square brackets indicate the 95% confidence intervals due to a bootstrap exercise. In this bootstrap procedure we i) draw a new VAR(1) coefficient matrix using the covariance matrix of the estimated coefficients around the point estimates; ii) given this VAR matrix and the data, generate the news series and do the variance decomposition; iii) repeat i) and ii) 2,000 times and report the 95% quantiles.

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.0	24.3	77.0	66.4
	$[0.0, 0.0]$	$[11.1, 36.6]$	$[64.7, 90.2]$	$[42.8, 87.9]$
3	0.1	73.2	28.1	74.5
	$[0.0, 0.1]$	$[39.7, 104.0]$	$[-2.8, 61.6]$	$[56.3, 97.2]$
10	0.0	101.2	0.1	103.1
	$[-0.1, 0.2]$	$[78.0, 111.0]$	$[-9.6, 23.5]$	$[91.1, 129.8]$
∞	0.0	101.3	0.0	100.7
	$[-0.1, 0.2]$	$[101.1, 101.5]$	$[-0.0, 0.0]$	$[88.6, 135.6]$

IA.6.4 Sensitivity analysis for ρ and β

Table IA.24: Sensitivity analysis for variance decomposition of sv_t, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.1	101.2	74.3
0.995	0.035	0.985	0.059	0.726	0.7	100.6	69.6
0.990	0.040	0.970	0.079	0.810	2.1	99.2	63.6
0.980	0.050	0.945	0.160	0.895	6.6	94.7	55.4
0.970	0.060	0.927	0.284	0.926	11.6	89.7	53.0
0.960	0.071	0.914	0.439	0.941	16.0	85.3	54.2
0.950	0.081	0.904	0.614	0.949	19.6	81.8	56.8
0.900	0.135	0.871	1.630	0.969	27.8	73.5	71.1

Table IA.25: Sensitivity analysis for variance decomposition of sv_t, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.1	101.2	74.3
		0.991	0.154	0.704	0.4	101.0	71.1
		0.999	0.319	0.634	0.1	101.3	75.0
0.995	0.035	0.985	0.059	0.726	0.7	100.6	69.6
		0.954	0.158	0.91	4.1	97.2	50.1
		0.993	0.325	0.664	0.3	101.0	73.2
0.990	0.040	0.970	0.079	0.810	2.1	99.2	63.6
		0.908	0.194	0.974	15.3	86.0	23.9
		0.985	0.338	0.705	0.7	100.6	70.9
0.980	0.050	0.945	0.160	0.895	6.6	94.7	55.4
		0.814	0.381	0.996	32.3	69.1	39.6
		0.97	0.381	0.783	2.3	99.0	66.3
0.970	0.060	0.927	0.284	0.926	11.6	89.7	53.0
		0.719	0.734	0.999	32.5	68.8	72.1
		0.955	0.45	0.845	5.1	96.2	62.5
0.960	0.071	0.914	0.439	0.941	16.0	85.3	54.2
		0.621	1.278	0.999	30.7	70.7	85.9
		0.939	0.544	0.89	9.2	92.1	59.8
0.950	0.081	0.904	0.614	0.949	19.6	81.8	56.8
		0.522	2.04	0.999	29.1	72.2	91.9
		0.923	0.667	0.922	14.2	87.1	59.0

Table IA.26: Sensitivity analysis for variance decomposition of sv_t, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.1	101.3	101.1
0.995	0.035	0.985	0.059	0.683	0.4	100.9	101.2
0.990	0.040	0.970	0.079	0.784	1.3	100.0	101.0
0.980	0.050	0.945	0.160	0.891	5.2	96.1	99.6
0.970	0.060	0.927	0.284	0.928	10.3	91.0	96.8
0.960	0.071	0.914	0.439	0.943	14.9	86.4	93.8
0.950	0.081	0.904	0.614	0.952	18.8	82.5	91.2
0.900	0.135	0.871	1.630	0.971	27.7	73.6	84.5

Table IA.27: Sensitivity analysis for variance decomposition of sv_t, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.1	101.3	101.1
		0.991	0.154	0.664	0.2	101.2	101.4
		0.999	0.319	0.605	0.0	101.3	101.1
0.995	0.035	0.985	0.059	0.683	0.4	100.9	101.2
		0.954	0.158	0.914	2.6	98.7	102.9
		0.993	0.325	0.624	0.1	101.2	100.9
0.990	0.040	0.970	0.079	0.784	1.3	100.0	101.0
		0.908	0.194	0.981	13.3	88.1	101.8
		0.985	0.338	0.654	0.4	100.9	100.7
0.980	0.050	0.945	0.160	0.891	5.2	96.1	99.6
		0.814	0.381	1.001	32.4	68.9	83.8
		0.970	0.381	0.732	1.6	99.8	99.9
0.970	0.060	0.927	0.284	0.928	10.3	91.0	96.8
		0.719	0.734	1.002	32.4	68.9	79.7
		0.955	0.450	0.815	4.0	97.3	98.5
0.960	0.071	0.914	0.439	0.943	14.9	86.4	93.8
		0.621	1.278	1.002	30.8	70.5	81.5
		0.939	0.544	0.876	7.9	93.4	96.5
0.950	0.081	0.904	0.614	0.952	18.8	82.5	91.2
		0.522	2.040	1.002	29.7	71.7	84.1
		0.923	0.667	0.917	13.1	88.2	93.8

Table IA.28: Sensitivity analysis for variance decomposition of short term tax news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.0	101.4	106.6
0.995	0.035	0.985	0.059	0.726	0.0	101.6	99.8
0.990	0.040	0.970	0.079	0.810	0.9	101.2	89.1
0.980	0.050	0.945	0.160	0.895	5.4	97.7	72.5
0.970	0.060	0.927	0.284	0.926	11.0	92.8	66.3
0.960	0.071	0.914	0.439	0.941	16.0	88.2	65.9
0.950	0.081	0.904	0.614	0.949	20.0	84.3	67.8
0.900	0.135	0.871	1.630	0.969	30.2	72.6	82.7

Table IA.29: Sensitivity analysis for variance decomposition of short term tax news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.0	101.4	106.6
		0.991	0.154	0.704	0.0	101.8	102.1
		0.999	0.319	0.634	0.0	101.3	107.5
0.995	0.035	0.985	0.059	0.726	0.0	101.6	99.8
		0.954	0.158	0.910	2.9	100.4	65.5
		0.993	0.325	0.664	-0.1	101.3	105.2
0.990	0.040	0.970	0.079	0.810	0.9	101.2	89.1
		0.908	0.194	0.974	15.9	89.7	25.4
		0.985	0.338	0.705	0.0	101.1	101.7
0.980	0.050	0.945	0.160	0.895	5.4	97.7	72.5
		0.814	0.381	0.996	36.3	73.5	44.1
		0.970	0.381	0.783	1.0	100.1	92.8
0.970	0.060	0.927	0.284	0.926	11.0	92.8	66.3
		0.719	0.734	0.999	34.1	79.7	85.8
		0.955	0.450	0.845	3.7	97.9	83.7
0.960	0.071	0.914	0.439	0.941	16.0	88.2	65.9
		0.621	1.278	0.999	28.7	88.9	101.0
		0.939	0.544	0.890	8.1	94.0	76.7
0.950	0.081	0.904	0.614	0.949	20.0	84.3	67.8
		0.522	2.040	0.999	24.0	97.5	106.0
		0.923	0.667	0.922	13.8	88.9	72.7

Table IA.30: Sensitivity analysis for variance decomposition of short term tax news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.2	101.3	26.6
0.995	0.035	0.985	0.059	0.683	1.0	101.1	27.6
0.990	0.040	0.970	0.079	0.784	2.7	100.2	27.9
0.980	0.050	0.945	0.160	0.891	8.5	95.9	24.5
0.970	0.060	0.927	0.284	0.928	15.5	89.8	17.7
0.960	0.071	0.914	0.439	0.943	21.8	83.9	10.3
0.950	0.081	0.904	0.614	0.952	26.8	78.9	3.6
0.900	0.135	0.871	1.630	0.971	38.5	64.6	-11.7

Table IA.31: Sensitivity analysis for variance decomposition of short term tax news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.2	101.3	26.6
		0.991	0.154	0.664	0.5	101.5	27.2
		0.999	0.319	0.605	0.1	101.3	26.4
0.995	0.035	0.985	0.059	0.683	1.0	101.1	27.6
		0.954	0.158	0.914	4.9	100.2	28.9
		0.993	0.325	0.624	0.4	100.9	27.0
0.990	0.040	0.970	0.079	0.784	2.7	100.2	27.9
		0.908	0.194	0.981	19.7	89.3	19.2
		0.985	0.338	0.654	1.0	100.3	27.5
0.980	0.050	0.945	0.160	0.891	8.5	95.9	24.5
		0.814	0.381	1.001	44.1	71.9	-20.7
		0.970	0.381	0.732	3.1	98.6	27.4
0.970	0.060	0.927	0.284	0.928	15.5	89.8	17.7
		0.719	0.734	1.002	43.5	78.5	-13.7
		0.955	0.450	0.815	6.8	95.4	25.0
0.960	0.071	0.914	0.439	0.943	21.8	83.9	10.3
		0.621	1.278	1.002	41.6	85.8	-1.9
		0.939	0.544	0.876	12.5	90.3	20.0
0.950	0.081	0.904	0.614	0.952	26.8	78.9	3.6
		0.522	2.040	1.002	40.7	91.5	7.4
		0.923	0.667	0.917	19.6	83.9	12.4

Table IA.32: Sensitivity analysis for variance decomposition of short term spending news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.1	101.2	69.1
0.995	0.035	0.985	0.059	0.726	0.8	100.6	63.6
0.990	0.040	0.970	0.079	0.810	2.3	99.1	57.1
0.980	0.050	0.945	0.160	0.895	7.5	93.8	48.2
0.970	0.060	0.927	0.284	0.926	13.4	87.6	45.4
0.960	0.071	0.914	0.439	0.941	18.7	81.9	46.5
0.950	0.081	0.904	0.614	0.949	23.1	76.9	49.4
0.900	0.135	0.871	1.630	0.969	34.2	60.4	68.2

Table IA.33: Sensitivity analysis for variance decomposition of short term spending news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.646	0.1	101.2	69.1
		0.991	0.154	0.704	0.4	101.2	65.5
		0.999	0.319	0.634	0.1	101.2	69.9
0.995	0.035	0.985	0.059	0.726	0.8	100.6	63.6
		0.954	0.158	0.910	4.4	97.6	43.2
		0.993	0.325	0.664	0.3	100.8	67.6
0.990	0.040	0.970	0.079	0.810	2.3	99.1	57.1
		0.908	0.194	0.974	16.9	85.6	13.3
		0.985	0.338	0.705	0.8	100.1	64.8
0.980	0.050	0.945	0.160	0.895	7.5	93.8	48.2
		0.814	0.381	0.996	36.1	67.6	28.6
		0.970	0.381	0.783	2.6	97.8	59.6
0.970	0.060	0.927	0.284	0.926	13.4	87.6	45.4
		0.719	0.734	0.999	35.9	68.9	64.3
		0.955	0.450	0.845	6.0	94.0	55.1
0.960	0.071	0.914	0.439	0.941	18.7	81.9	46.5
		0.621	1.278	0.999	33.1	71.7	74.9
		0.939	0.544	0.890	11.1	88.6	52.2
0.950	0.081	0.904	0.614	0.949	23.1	76.9	49.4
		0.522	2.040	0.999	30.0	71.1	71.7
		0.923	0.667	0.922	17.2	82.0	51.3

Table IA.34: Sensitivity analysis for variance decomposition of short term spending news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.0	101.4	126.3
0.995	0.035	0.985	0.059	0.683	0.1	101.2	126.3
0.990	0.040	0.970	0.079	0.784	1.0	100.4	125.6
0.980	0.050	0.945	0.160	0.891	5.6	95.8	123.8
0.970	0.060	0.927	0.284	0.928	11.8	89.3	121.9
0.960	0.071	0.914	0.439	0.943	17.8	82.9	120.0
0.950	0.081	0.904	0.614	0.952	23.0	77.2	118.3
0.900	0.135	0.871	1.630	0.971	36.2	58.6	115.9

Table IA.35: Sensitivity analysis for variance decomposition of short term spending news, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. Two boundary values of β are considered by setting $a = 0.11$ or 0.68 (reflecting the maximum and minimum of T_t/V_t in our dataset) and imputing the value of b given ρ using $b = 1 + a - \rho^{-1}$; then computing $\beta = b/a$. We stop at $\rho = 0.950$ because for some boundary value of β, the maximum eigenvalue of the VAR(1) coefficient matrix exceeds one.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment	spending ratio
0.999	0.031	0.997	0.052	0.614	0.0	101.4	126.3
		0.991	0.154	0.664	0.0	101.5	126.5
		0.999	0.319	0.605	0.0	101.3	126.1
0.995	0.035	0.985	0.059	0.683	0.1	101.2	126.3
		0.954	0.158	0.914	2.3	99.6	126.5
		0.993	0.325	0.624	0.0	101.1	126.1
0.990	0.040	0.970	0.079	0.784	1.0	100.4	125.6
		0.908	0.194	0.981	14.7	87.7	128.2
		0.985	0.338	0.654	0.2	100.7	125.8
0.980	0.050	0.945	0.160	0.891	5.6	95.8	123.8
		0.814	0.381	1.001	38.2	65.2	114.2
		0.970	0.381	0.732	1.4	99.0	124.6
0.970	0.060	0.927	0.284	0.928	11.8	89.3	121.9
		0.719	0.734	1.002	37.4	67.0	107.3
		0.955	0.45	0.815	4.4	95.7	123.1
0.960	0.071	0.914	0.439	0.943	17.8	82.9	120.0
		0.621	1.278	1.002	34.1	70.6	107.4
		0.939	0.544	0.876	9.5	90.3	121.6
0.950	0.081	0.904	0.614	0.952	23.0	77.2	118.3
		0.522	2.040	1.002	30.0	71.3	109.6
		0.923	0.667	0.917	16.2	83.2	119.8

IA.6.5 Unexpected tax and spending news

Table IA.36: A variance decomposition for short-run tax news. US 1947-2022, based on system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$.

horizon	return	fiscal adjustment	future sv	spending ratio
1	-0.1	-9.8	111.4	100.0
	$[-0.2, -0.1]$	$[-20.4, 0.6]$	$[100.9, 121.9]$	$[100.0, 100.0]$
3	-0.1	43.2	58.3	137.3
	$[-0.2, -0.0]$	$[-16.5, 91.8]$	$[9.7, 118.2]$	$[-327.3, 663.4]$
10	-0.1	98.7	2.8	107.1
	$[-0.3, 0.2]$	$[64.0, 103.9]$	$[-2.6, 37.4]$	$[68.6, 183.2]$
∞	-0.1	101.4	0.0	106.6
	$[-0.3, 0.2]$	$[101.2, 101.6]$	$[0.0, 0.0]$	$[66.7, 174.3]$

Table IA.37: A variance decomposition for short-run spending news. US 1947-2022, based on system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$.

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.0	-3.3	104.6	0.0
	$[-0.1, 0.0]$	$[-6.7, 0.1]$	$[101.3, 108.1]$	$[0.0, 0.0]$
3	0.0	38.9	62.4	50.2
	$[-0.1, 0.1]$	$[3.8, 66.8]$	$[34.4, 97.6]$	$[-55.6, 110.9]$
10	0.1	98.1	3.2	68.4
	$[-0.1, 0.3]$	$[65.6, 103.8]$	$[-2.6, 35.6]$	$[15.0, 114.8]$
∞	0.1	101.2	0.0	69.1
	$[-0.1, 0.4]$	$[101.0, 101.4]$	$[0.0, 0.0]$	$[17.3, 119.4]$

IA.6.6 Unexpected return news

Table IA.38: Variance decomposition of news on return, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment
0.999	0.031	0.997	0.052	0.646	-0.5	102.7
0.995	0.035	0.985	0.059	0.726	8.2	93.6
0.990	0.040	0.970	0.079	0.810	24.1	77.0
0.980	0.050	0.945	0.160	0.895	58.6	39.6
0.970	0.060	0.927	0.284	0.926	77.7	15.9
0.960	0.071	0.914	0.439	0.941	78.5	9.5
0.950	0.081	0.904	0.614	0.949	66.8	15.0
0.900	0.135	0.871	1.630	0.969	-51.8	106.9

Table IA.39: Variance decomposition of news on return, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, yr_{1,t}, spr_{1\to 10,t})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment
0.999	0.031	0.997	0.052	0.905	25.7	75.8
0.995	0.035	0.985	0.059	0.909	31.8	68.7
0.990	0.040	0.970	0.079	0.919	44.3	54.6
0.980	0.050	0.945	0.160	0.939	71.7	21.8
0.970	0.060	0.927	0.284	0.952	83.5	3.2
0.960	0.071	0.914	0.439	0.959	77.5	2.4
0.950	0.081	0.904	0.614	0.964	60.8	12.9
0.900	0.135	0.871	1.630	0.975	-58.4	110.8

Table IA.40: Variance decomposition of news on return, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t)$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment
0.999	0.031	0.997	0.052	0.614	18.9	83.7
0.995	0.035	0.985	0.059	0.683	24.7	77.4
0.990	0.040	0.970	0.079	0.784	37.0	64.0
0.980	0.050	0.945	0.160	0.891	67.7	29.3
0.970	0.060	0.927	0.284	0.928	86.1	5.2
0.960	0.071	0.914	0.439	0.943	86.0	-1.1
0.950	0.081	0.904	0.614	0.952	73.0	5.6
0.900	0.135	0.871	1.630	0.971	-51.1	104.8

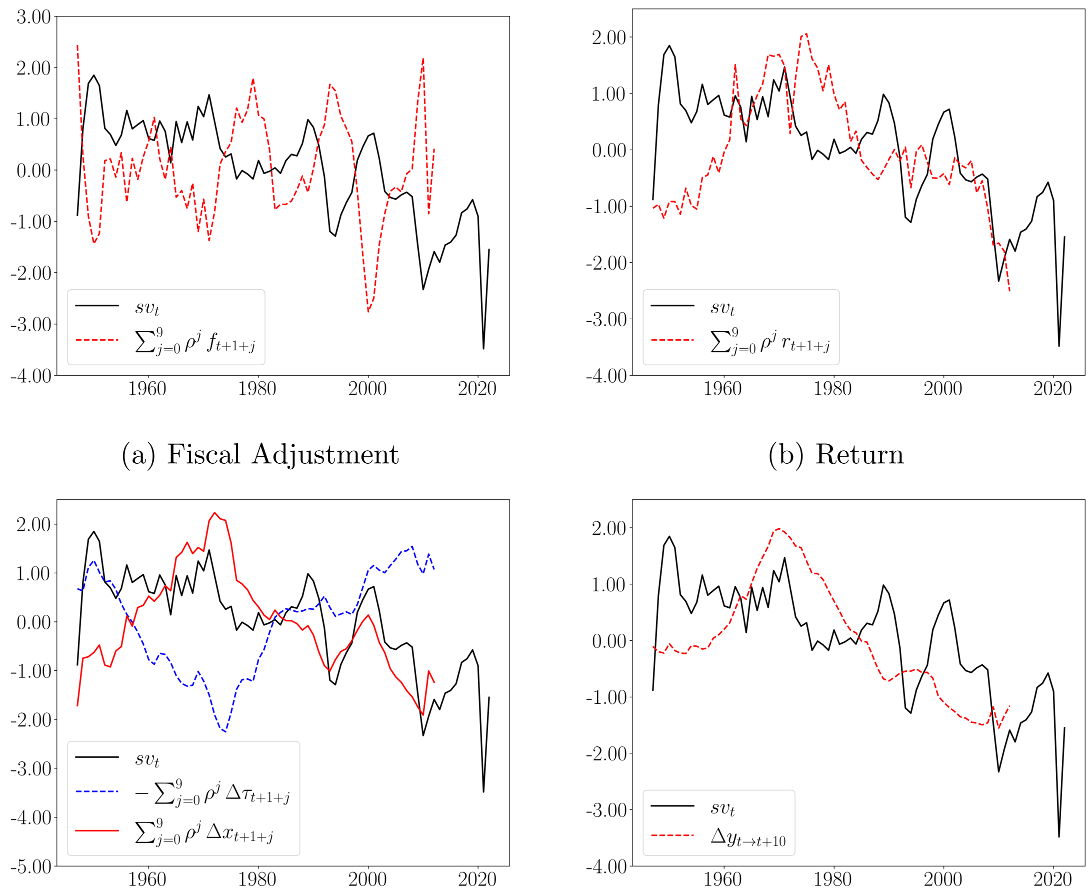
Table IA.41: Variance decomposition of news on return, using system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1}, \tau y_t, yr_{1,t}, spr_{1\to 10,t})$

Infinite horizon results using different values of ρ. We report the sum of squared approximation errors, maximum eigenvalue of the VAR(1) coefficient matrix and implied theoretical mean of return. We stop at $\rho = 0.900$ base on the following observations: the theoretical mean of return already exceeds 13.5% and linear approximation error is significant; the coefficient matrix of corresponding VAR(1) model has maximum eigenvalue close to 1.

ρ	r	β	approx. error	λ_{max}	return	fiscal adjustment
0.999	0.031	0.997	0.052	0.900	30.2	71.7
0.995	0.035	0.985	0.059	0.906	33.7	67.2
0.990	0.040	0.970	0.079	0.917	43.2	56.1
0.980	0.050	0.945	0.160	0.940	67.5	26.1
0.970	0.060	0.927	0.284	0.953	79.6	7.2
0.960	0.071	0.914	0.439	0.961	74.8	5.1
0.950	0.081	0.904	0.614	0.966	59.0	14.7
0.900	0.135	0.871	1.630	0.977	-58.9	111.2

IA.7 Results for the UK, Canada, Japan, Switzerland and 11 eurozone countries

IA.7.1 Local projections for the UK



(a) Fiscal Adjustment

(b) Return

(c) Tax and Spending Growth

(d) GDP Growth

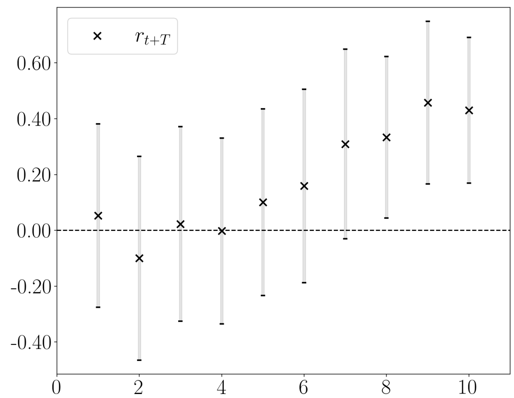
Figure IA.18: UK data

Figure IA.19: Slope coefficients of uni-variable regressions: UK data

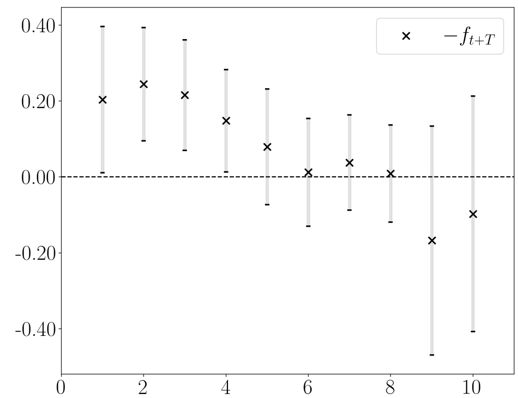
This figure plots estimated slope coefficients (with ±2 Newey–West standard error bands) from regressions

$$\theta_{t+T} = \alpha + \beta_{\theta,T}\, sv_t + \varepsilon_{\theta,t+T}\,,$$

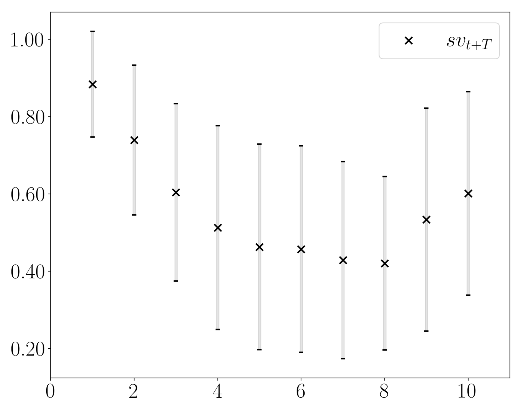
where the variables θ_{t+T} are indicated in the legends of each subfigure.



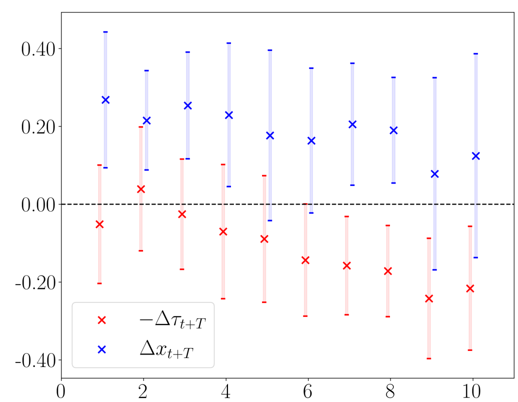
(a) Return



(b) Fiscal Adjustment



(c) Future sv



(d) Tax and spending growth

Table IA.42: Local projections, UK data 1947-2022.

Newey–West standard errors reported set lags equal to 2, 5, and 15, respectively, for $T = 1, 3$ and 10. The standard error for the spending ratio is computed via the delta method using the Newey–West standard errors of $\beta_{\tau,T}$ and $\beta_{x,T}$:

$$\text{s.e. of spending ratio} = \left| \frac{\beta_{\tau,T} \times \text{s.e. of spending}}{(\beta_{x,T} + \beta_{\tau,T})^2} \right| + \left| \frac{\beta_{x,T} \times \text{s.e. of tax}}{(\beta_{x,T} + \beta_{\tau,T})^2} \right|$$

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.9	17.0	81.6	118.3
	[0.4]	[4.3]	[6.2]	[34.4]
3	1.4	37.0	59.8	130.3
	[1.2]	[14.2]	[10.4]	[58.6]
10	4.6	47.6	43.0	231.5
	[3.7]	[45.8]	[8.5]	[339.6]

Table IA.43: More details of covariance between sv_t and returns, UK data

This table reports the components of the product

$$\frac{\text{cov}(\sum_{j=0}^{T-1} \rho^j r_{t+1+j}, sv_t)}{\text{var}\, sv_t} = \underbrace{\frac{std(r_t)}{std(sv_t)}}_{(1)} \times \underbrace{\frac{std(\sum_{j=0}^{T-1} \rho^j r_{t+1+j})}{std(r_t)}}_{(2)} \times \underbrace{\text{corr}\left(\sum_{j=0}^{T-1} \rho^j r_{t+1+j}, sv_t\right)}_{(3)} .$$

horizon	(1)	(2)	(3)
1	1.231	1.000	0.210
3	1.231	1.836	0.212
10	1.231	3.060	0.314

IA.7.2 VAR estimates for the UK, Canada, Japan, and Switzerland

Table IA.44: VAR coefficient estimates. GBR data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.175	−0.110	0.040	−0.065	−0.009	−0.101
	[0.111]	[0.036]	[0.030]	[0.045]	[0.064]	[0.065]
$\Delta\tau_t$	0.807	0.285	−0.005	−0.222	0.592	−0.279
	[0.291]	[0.095]	[0.078]	[0.118]	[0.169]	[0.171]
Δy_t	0.316	0.889	0.527	0.902	−0.419	1.287
	[0.391]	[0.127]	[0.104]	[0.158]	[0.227]	[0.230]
sv_t	0.155	−0.110	0.018	0.998	−0.086	−0.029
	[0.231]	[0.075]	[0.062]	[0.093]	[0.134]	[0.136]
sv_{t-1}	−0.112	−0.007	0.025	−0.239	0.354	−0.344
	[0.214]	[0.070]	[0.057]	[0.086]	[0.124]	[0.126]
R^2	18.21%	52.37%	37.97%	81.67%	32.20%	40.23%

Table IA.45: VAR coefficient estimates. CAN data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.184	−0.120	−0.280	−0.474	0.504	−0.598
	[0.172]	[0.087]	[0.073]	[0.164]	[0.188]	[0.227]
$\Delta\tau_t$	−0.626	0.388	0.328	0.760	−0.576	0.934
	[0.461]	[0.232]	[0.194]	[0.438]	[0.502]	[0.606]
Δy_t	0.023	0.021	0.428	0.444	−0.560	0.552
	[0.681]	[0.343]	[0.287]	[0.649]	[0.743]	[0.896]
sv_t	0.711	−0.135	−0.366	0.330	0.745	−0.841
	[0.383]	[0.193]	[0.161]	[0.365]	[0.418]	[0.504]
sv_{t-1}	−0.423	0.085	0.378	0.452	−0.488	0.548
	[0.346]	[0.174]	[0.146]	[0.329]	[0.377]	[0.455]
R^2	34.75%	17.95%	38.80%	70.27%	37.22%	37.05%

Table IA.46: VAR coefficient estimates. JPN data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.273	−0.313	−0.102	−0.006	−0.283	−0.033
	[0.192]	[0.260]	[0.191]	[0.088]	[0.369]	[0.563]
$\Delta\tau_t$	−0.525	0.434	−0.044	0.182	−0.601	1.032
	[0.233]	[0.315]	[0.231]	[0.106]	[0.446]	[0.680]
Δy_t	0.214	−0.040	−0.231	0.079	−0.495	0.453
	[0.313]	[0.423]	[0.310]	[0.143]	[0.599]	[0.915]
sv_t	0.161	−0.999	0.293	0.340	2.784	−3.767
	[0.535]	[0.724]	[0.531]	[0.244]	[1.026]	[1.565]
sv_{t-1}	−0.691	0.289	−0.557	0.646	−3.408	3.677
	[0.613]	[0.829]	[0.607]	[0.280]	[1.174]	[1.792]
R^2	48.16%	41.89%	13.11%	88.72%	32.22%	25.93%

Table IA.47: VAR coefficient estimates. CHE data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.145	−0.132	−0.204	−0.310	0.171	−0.297
	[0.199]	[0.119]	[0.060]	[0.132]	[0.161]	[0.147]
$\Delta\tau_t$	−0.661	−0.054	0.042	0.091	−0.128	0.070
	[0.381]	[0.227]	[0.114]	[0.252]	[0.308]	[0.281]
Δy_t	1.887	−0.213	−0.150	0.724	−1.007	0.763
	[0.903]	[0.539]	[0.271]	[0.597]	[0.729]	[0.666]
sv_t	−0.440	−0.148	−0.122	0.305	0.589	−0.720
	[0.442]	[0.264]	[0.132]	[0.292]	[0.356]	[0.326]
sv_{t-1}	1.030	0.017	−0.087	0.121	−0.137	0.150
	[0.456]	[0.272]	[0.137]	[0.302]	[0.368]	[0.337]
R^2	55.69%	24.11%	60.20%	48.64%	37.23%	51.77%

IA.7.3 VAR estimates for eurozone countries

Table IA.48: VAR coefficient estimates. AUT data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.406	−0.153	−0.165	0.022	−0.19	0.036
	[0.27]	[0.115]	[0.1]	[0.125]	[0.15]	[0.221]
$\Delta\tau_t$	0.81	−0.883	−0.785	−0.553	−0.024	−0.859
	[0.842]	[0.36]	[0.314]	[0.389]	[0.47]	[0.691]
Δy_t	0.038	0.659	0.446	0.927	−0.792	1.447
	[0.91]	[0.389]	[0.339]	[0.42]	[0.507]	[0.747]
sv_t	0.402	−0.3	−0.066	0.355	0.712	−1.009
	[0.718]	[0.307]	[0.268]	[0.332]	[0.4]	[0.59]
sv_{t-1}	1.66	−0.273	−0.471	−0.142	−0.059	−0.214
	[0.77]	[0.329]	[0.287]	[0.356]	[0.429]	[0.632]
R^2	53.52%	44.47%	43.43%	40.4%	31.41%	41.57%

Table IA.49: VAR coefficient estimates. BEL data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.033	−0.215	−0.28	−0.18	0.186	−0.4
	[0.309]	[0.136]	[0.105]	[0.094]	[0.18]	[0.234]
$\Delta\tau_t$	0.269	0.235	0.118	0.292	−0.416	0.648
	[0.653]	[0.287]	[0.222]	[0.198]	[0.381]	[0.494]
Δy_t	−1.603	−0.407	−0.527	−0.337	0.352	−0.757
	[0.925]	[0.407]	[0.315]	[0.28]	[0.54]	[0.7]
sv_t	1.663	−0.275	−0.024	0.625	0.554	−0.825
	[1.041]	[0.458]	[0.354]	[0.315]	[0.607]	[0.787]
sv_{t-1}	−0.454	0.237	0.104	0.235	−0.281	0.516
	[0.947]	[0.417]	[0.322]	[0.287]	[0.552]	[0.716]
R^2	33.73%	16.3%	28.6%	73.33%	21.48%	30.94%

Table IA.50: VAR coefficient estimates. DEU data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.199	0.052	−0.024	0.033	−0.001	0.053
	[0.247]	[0.106]	[0.099]	[0.105]	[0.111]	[0.185]
$\Delta\tau_t$	−1.666	0.252	0.085	0.428	−0.409	0.659
	[0.948]	[0.409]	[0.379]	[0.403]	[0.427]	[0.711]
Δy_t	−0.159	0.073	−0.153	0.218	−0.268	0.34
	[0.828]	[0.357]	[0.331]	[0.352]	[0.373]	[0.622]
sv_t	1.736	−0.494	−0.18	0.275	0.637	−1.128
	[0.703]	[0.303]	[0.281]	[0.298]	[0.317]	[0.527]
sv_{t-1}	−0.614	0.13	−0.124	0.063	0.035	0.095
	[0.709]	[0.306]	[0.283]	[0.301]	[0.319]	[0.532]
R^2	37.13%	18.02%	14.49%	44.88%	46.0%	40.49%

Table IA.51: VAR coefficient estimates. ESP data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.397	0.036	0.005	0.049	-0.043	0.078
	[0.213]	[0.171]	[0.145]	[0.15]	[0.147]	[0.259]
$\Delta\tau_t$	-0.865	0.677	0.531	0.392	0.071	0.606
	[0.442]	[0.355]	[0.3]	[0.31]	[0.305]	[0.537]
Δy_t	-0.14	-0.701	-0.361	-0.615	0.259	-0.959
	[0.427]	[0.342]	[0.29]	[0.299]	[0.294]	[0.519]
sv_t	1.168	-0.025	-0.023	1.119	-0.213	0.187
	[0.492]	[0.395]	[0.334]	[0.345]	[0.339]	[0.598]
sv_{t-1}	-0.923	0.063	0.147	-0.234	0.436	-0.37
	[0.424]	[0.34]	[0.288]	[0.297]	[0.292]	[0.515]
R^2	31.8%	22.5%	20.49%	76.92%	34.85%	30.46%

Table IA.52: VAR coefficient estimates. FIN data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.154	0.025	0.014	0.0	0.024	0.001
	[0.204]	[0.12]	[0.108]	[0.173]	[0.066]	[0.177]
$\Delta\tau_t$	−0.179	−0.272	−0.28	−0.117	−0.166	−0.106
	[1.066]	[0.625]	[0.564]	[0.905]	[0.345]	[0.926]
Δy_t	0.065	1.349	0.719	1.369	0.11	1.239
	[0.877]	[0.515]	[0.464]	[0.744]	[0.284]	[0.762]
sv_t	0.238	−0.701	−0.197	0.223	0.004	−0.705
	[0.73]	[0.429]	[0.386]	[0.62]	[0.237]	[0.635]
sv_{t-1}	0.494	0.531	0.137	0.456	0.118	0.414
	[0.678]	[0.398]	[0.359]	[0.576]	[0.22]	[0.59]
R^2	70.0%	29.73%	10.81%	76.56%	47.92%	25.03%

Table IA.53: VAR coefficient estimates. FRA data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.503	−0.271	−0.326	−0.223	0.173	−0.442
	[0.326]	[0.161]	[0.14]	[0.099]	[0.074]	[0.223]
$\Delta\tau_t$	−0.802	1.609	1.528	0.816	−0.015	1.624
	[1.386]	[0.686]	[0.597]	[0.422]	[0.313]	[0.949]
Δy_t	−0.144	−1.206	−1.114	−0.618	0.029	−1.235
	[0.998]	[0.494]	[0.429]	[0.304]	[0.225]	[0.683]
sv_t	1.939	−1.538	−1.543	0.222	0.008	−1.546
	[1.884]	[0.933]	[0.811]	[0.574]	[0.425]	[1.29]
sv_{t-1}	−1.239	1.451	1.719	0.739	−0.015	1.467
	[2.046]	[1.013]	[0.881]	[0.623]	[0.462]	[1.401]
R^2	33.89%	38.06%	34.95%	79.81%	28.87%	31.9%

Table IA.54: VAR coefficient estimates. GRC data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.092	0.025	0.070	0.011	−0.007	0.032
	[0.19]	[0.081]	[0.076]	[0.04]	[0.104]	[0.138]
$\Delta\tau_t$	1.341	0.459	0.475	−0.037	0.567	−0.103
	[0.703]	[0.300]	[0.280]	[0.147]	[0.382]	[0.510]
Δy_t	−1.449	−0.036	0.086	−0.048	0.128	−0.163
	[0.638]	[0.272]	[0.254]	[0.134]	[0.347]	[0.463]
sv_t	0.074	−0.999	−0.883	1.037	−1.117	0.107
	[1.067]	[0.456]	[0.425]	[0.224]	[0.581]	[0.775]
sv_{t-1}	1.781	0.873	1.235	−0.313	1.843	−0.952
	[1.212]	[0.518]	[0.482]	[0.254]	[0.660]	[0.881]
R^2	33.72%	24.84%	44.25%	66.2%	46.88%	19.76%

Table IA.55: VAR coefficient estimates. IRL data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	0.14	0.03	−0.218	−0.069	0.122	−0.091
	[0.313]	[0.157]	[0.129]	[0.181]	[0.246]	[0.275]
$\Delta\tau_t$	0.247	0.218	0.097	0.585	−0.569	0.785
	[0.523]	[0.262]	[0.215]	[0.303]	[0.411]	[0.46]
Δy_t	−0.224	0.155	−0.071	0.588	−0.636	0.788
	[0.631]	[0.316]	[0.26]	[0.366]	[0.496]	[0.555]
sv_t	−0.253	0.015	0.151	0.59	0.573	−0.555
	[0.38]	[0.19]	[0.156]	[0.22]	[0.299]	[0.334]
sv_{t-1}	0.277	0.015	−0.052	−0.179	0.255	−0.239
	[0.295]	[0.148]	[0.122]	[0.171]	[0.232]	[0.26]
R^2	7.53%	17.51%	25.68%	72.27%	56.49%	51.13%

Table IA.56: VAR coefficient estimates. ITA data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.211	−0.147	−0.072	−0.128	0.169	−0.314
	[0.218]	[0.167]	[0.162]	[0.098]	[0.179]	[0.272]
$\Delta\tau_t$	−0.011	−0.073	−0.234	−0.012	−0.044	−0.03
	[0.543]	[0.416]	[0.405]	[0.245]	[0.447]	[0.678]
Δy_t	−1.394	0.159	0.429	−0.086	0.382	−0.221
	[0.549]	[0.421]	[0.41]	[0.248]	[0.453]	[0.686]
sv_t	3.106	−1.193	−1.166	0.857	−0.871	−0.329
	[0.637]	[0.488]	[0.475]	[0.287]	[0.525]	[0.795]
sv_{t-1}	−0.946	0.549	0.669	−0.195	1.041	−0.484
	[0.803]	[0.614]	[0.599]	[0.362]	[0.661]	[1.002]
R^2	72.3%	41.74%	34.98%	49.38%	27.28%	30.01%

Table IA.57: VAR coefficient estimates. NLD data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.152	−0.206	−0.156	−0.233	0.108	−0.313
	[0.229]	[0.082]	[0.051]	[0.067]	[0.068]	[0.102]
$\Delta\tau_t$	−0.868	0.101	0.417	0.131	−0.071	0.173
	[0.847]	[0.304]	[0.188]	[0.249]	[0.25]	[0.378]
Δy_t	0.198	−0.25	0.04	0.116	−0.408	0.156
	[1.347]	[0.483]	[0.299]	[0.396]	[0.398]	[0.601]
sv_t	0.829	0.136	−0.376	0.693	0.551	−0.412
	[1.108]	[0.398]	[0.246]	[0.326]	[0.327]	[0.495]
sv_{t-1}	−0.121	−0.073	0.24	−0.154	0.135	−0.207
	[0.798]	[0.286]	[0.177]	[0.235]	[0.236]	[0.357]
R^2	12.75%	23.53%	40.66%	66.5%	62.3%	55.11%

Table IA.58: VAR coefficient estimates. PRT data.

OLS standard errors are reported in square brackets.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	sv_{t+1}	Δx_{t+1}	f_{t+1}
r_t	−0.029	−0.015	−0.126	−0.119	0.251	−0.264
	[0.247]	[0.144]	[0.129]	[0.100]	[0.176]	[0.25]
$\Delta\tau_t$	−0.550	0.252	0.227	−0.127	0.541	−0.286
	[0.603]	[0.351]	[0.314]	[0.244]	[0.429]	[0.610]
Δy_t	−0.224	−0.318	−0.124	0.004	−0.329	0.009
	[0.704]	[0.409]	[0.366]	[0.285]	[0.500]	[0.712]
sv_t	1.099	−0.650	−0.357	0.768	−0.139	−0.513
	[0.632]	[0.367]	[0.329]	[0.256]	[0.449]	[0.639]
sv_{t-1}	−1.304	0.527	0.448	−0.174	0.927	−0.394
	[0.651]	[0.378]	[0.338]	[0.264]	[0.463]	[0.658]
R^2	19.53%	19.27%	11.65%	49.43%	32.78%	23.19%

IA.7.4 Variance decomposition for the UK, Canada, Japan, Switzerland, and 11 eurozone countries

Variance decomposition of sv_t based on the system $(r_t, \Delta\tau_t, \Delta y_t, sv_t, sv_{t-1})$ of different countries are reported below.

Throughout this section, quantities in square brackets indicate the 95% confidence intervals due to a bootstrap exercise. In this bootstrap procedure we i) draw a new VAR(1) coefficient matrix using the covariance matrix of the estimated coefficients around the point estimates; ii) given this VAR matrix and the data, generate the news series and do the variance decomposition; iii) repeat i) and ii) 2,000 times and report the 95% quantiles.

Table IA.59: GBR

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.8	17.4	83.2	113.5
	$[-0.0, 1.6]$	$[8.3, 26.5]$	$[73.9, 92.3]$	$[84.3, 175.4]$
3	1.0	46.9	53.4	103.5
	$[-1.1, 2.9]$	$[24.6, 69.3]$	$[31.0, 75.5]$	$[61.6, 171.2]$
10	1.5	86.4	13.4	105.2
	$[-3.1, 6.6]$	$[49.3, 104.8]$	$[-1.9, 48.1]$	$[37.6, 213.1]$
∞	1.7	99.6	0.0	105.5
	$[-4.0, 11.3]$	$[90.1, 105.4]$	$[-0.0, 0.0]$	$[32.0, 237.5]$

Table IA.60: CAN

horizon	return	fiscal adjustment	future sv	spending ratio
1	1.5	27.1	74.6	87.7
	$[0.6, 2.4]$	$[9.0, 45.8]$	$[55.5, 93.0]$	$[65.7, 136.1]$
3	2.7	69.4	31.0	81.0
	$[0.4, 5.1]$	$[26.7, 111.1]$	$[-12.1, 74.3]$	$[57.8, 138.4]$
10	3.7	97.8	1.6	78.1
	$[0.2, 8.4]$	$[50.9, 104.0]$	$[-4.3, 47.0]$	$[51.1, 163.8]$
∞	3.8	99.4	0.0	77.9
	$[0.0, 11.5]$	$[91.6, 103.1]$	$[-0.0, 0.0]$	$[50.3, 170.2]$

Table IA.61: JPN

horizon	return	fiscal adjustment	future sv	spending ratio
1	-0.1	13.7	90.6	59.8
	$[-0.1, -0.0]$	$[-4.3, 33.6]$	$[70.7, 108.6]$	$[-92.8, 183.0]$
3	-0.2	25.2	79.2	-3.9
	$[-0.3, -0.1]$	$[-12.3, 60.5]$	$[43.7, 116.5]$	$[-401.6, 327.2]$
10	-0.2	77.6	26.8	-25.6
	$[-0.8, 0.2]$	$[1.9, 134.9]$	$[-31.0, 102.5]$	$[-461.3, 75.1]$
∞	-0.2	104.4	-0.0	-25.3
	$[-2.9, 1.1]$	$[103.0, 107.0]$	$[-0.0, 0.0]$	$[-684.0, 33.1]$

Table IA.62: CHE

horizon	return	fiscal adjustment	future sv	spending ratio
1	1.0	57.6	45.9	60.3
	$[-0.4, 2.4]$	$[25.8, 88.4]$	$[15.6, 77.3]$	$[3.6, 115.8]$
3	3.5	127.1	-26.1	77.5
	$[0.1, 7.5]$	$[81.8, 168.8]$	$[-68.7, 19.8]$	$[31.0, 130.6]$
10	2.6	104.6	-2.7	78.5
	$[-0.1, 6.4]$	$[84.9, 131.5]$	$[-29.7, 16.5]$	$[34.4, 140.1]$
∞	2.6	102.0	-0.0	78.5
	$[-0.1, 6.4]$	$[98.1, 104.7]$	$[-0.0, 0.0]$	$[34.5, 142.7]$

Table IA.63: AUT

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.6 $[0.3, 0.8]$	58.8 $[22.9, 94.9]$	45.2 $[9.1, 81.2]$	32.2 $[-15.0, 56.6]$
3	1.6 $[0.7, 2.9]$	132.5 $[54.5, 188.7]$	-29.6 $[-85.7, 48.4]$	29.2 $[-50.9, 57.8]$
10	1.3 $[0.4, 6.1]$	106.1 $[62.2, 152.4]$	-2.8 $[-49.2, 39.2]$	26.5 $[-156.5, 57.9]$
∞	1.3 $[0.4, 12.6]$	103.3 $[91.9, 104.1]$	0.0 $[-0.0, 0.0]$	25.9 $[-256.0, 58.0]$

Table IA.64: BEL

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.3 $[0.1, 0.6]$	31.9 $[10.2, 55.1]$	72.3 $[49.0, 94.1]$	62.7 $[17.7, 115.8]$
3	0.9 $[0.2, 1.7]$	74.5 $[22.3, 129.3]$	29.2 $[-25.9, 81.5]$	64.3 $[19.2, 141.4]$
10	1.2 $[0.3, 3.3]$	102.7 $[47.7, 116.6]$	0.7 $[-14.3, 55.1]$	64.3 $[11.7, 179.9]$
∞	1.2 $[0.3, 5.8]$	103.3 $[98.7, 104.2]$	0.0 $[-0.0, 0.0]$	64.3 $[9.9, 198.1]$

Table IA.65: DEU

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.2	54.1	50.2	62.0
	$[-0.0, 0.5]$	$[23.7, 85.6]$	$[18.8, 80.5]$	$[41.3, 108.2]$
3	0.5	123.7	-19.7	76.4
	$[-0.1, 1.3]$	$[58.5, 174.7]$	$[-70.6, 45.7]$	$[54.1, 148.7]$
10	0.3	104.9	-0.7	77.0
	$[-0.3, 1.4]$	$[77.9, 133.4]$	$[-29.1, 26.2]$	$[53.8, 175.5]$
∞	0.3	104.3	0.0	76.8
	$[-0.3, 1.6]$	$[103.0, 104.8]$	$[-0.0, 0.0]$	$[53.3, 187.0]$

Table IA.66: ESP

horizon	return	fiscal adjustment	future sv	spending ratio
1	-0.0	18.5	86.0	90.6
	$[-0.1, 0.1]$	$[-0.6, 40.9]$	$[63.7, 105.1]$	$[-62.3, 361.0]$
3	0.0	62.7	41.8	83.5
	$[-0.4, 0.4]$	$[11.7, 124.1]$	$[-19.5, 93.0]$	$[39.2, 298.2]$
10	-0.1	106.1	-1.5	81.9
	$[-1.4, 1.1]$	$[36.2, 149.3]$	$[-43.9, 68.7]$	$[18.9, 319.8]$
∞	-0.1	104.7	0.0	82.0
	$[-4.3, 3.6]$	$[100.8, 108.8]$	$[-0.0, 0.0]$	$[-8.1, 512.2]$

Table IA.67: FIN

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.2	24.4	79.9	59.1
	$[0.1, 0.3]$	$[8.1, 43.6]$	$[60.8, 96.2]$	$[35.9, 142.0]$
3	0.6	59.8	44.1	81.5
	$[0.4, 0.8]$	$[18.3, 99.5]$	$[4.5, 85.7]$	$[51.0, 240.1]$
10	1.1	97.1	6.3	85.8
	$[0.6, 2.0]$	$[37.3, 112.4]$	$[-8.7, 65.5]$	$[47.7, 321.7]$
∞	1.2	103.3	0.0	86.3
	$[0.6, 6.2]$	$[98.4, 103.9]$	$[-0.0, 0.0]$	$[48.0, 399.5]$

Table IA.68: FRA

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.2	29.3	75.0	5.7
	$[-0.0, 0.5]$	$[7.5, 56.3]$	$[47.9, 96.8]$	$[-44.9, 27.0]$
3	0.8	77.6	26.2	19.0
	$[0.0, 1.7]$	$[19.2, 140.3]$	$[-36.7, 85.0]$	$[-36.1, 46.8]$
10	1.1	103.2	0.3	26.7
	$[-0.0, 3.5]$	$[32.4, 131.8]$	$[-29.3, 71.3]$	$[-28.2, 97.2]$
∞	1.1	103.4	0.0	26.5
	$[-0.0, 7.6]$	$[96.8, 104.7]$	$[-0.0, 0.0]$	$[-29.7, 124.0]$

Table IA.69: GRC

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.3	22.8	81.5	68.6
	$[-0.1, 0.8]$	$[-2.1, 50.7]$	$[53.5, 106.4]$	$[-62.6, 218.7]$
3	0.8	78.7	25.0	97.5
	$[-0.1, 1.7]$	$[13.0, 133.1]$	$[-29.7, 90.7]$	$[22.9, 239.0]$
10	0.5	108.8	-4.7	121.0
	$[-1.0, 2.7]$	$[47.0, 145.9]$	$[-42.1, 56.1]$	$[42.9, 289.8]$
∞	0.5	104.1	0.0	119.1
	$[-1.0, 3.3]$	$[101.2, 105.5]$	$[-0.0, 0.0]$	$[45.7, 322.9]$

Table IA.70: IRL

horizon	return	fiscal adjustment	future sv	spending ratio
1	-0.0	32.2	72.4	124.9
	$[-0.1, 0.1]$	$[10.6, 55.7]$	$[49.1, 93.9]$	$[80.9, 259.8]$
3	0.1	90.3	14.2	118.2
	$[-0.3, 0.4]$	$[32.6, 143.9]$	$[-39.7, 71.6]$	$[78.2, 270.8]$
10	0.1	104.7	-0.3	117.0
	$[-0.5, 0.8]$	$[56.7, 121.2]$	$[-16.9, 47.6]$	$[70.3, 360.6]$
∞	0.1	104.4	-0.0	117.0
	$[-0.8, 0.9]$	$[103.6, 105.3]$	$[-0.0, 0.0]$	$[73.0, 476.1]$

Table IA.71: ITA

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.6	45.7	58.2	12.1
	$[0.4, 0.8]$	$[16.0, 77.1]$	$[26.9, 88.0]$	$[-84.3, 44.4]$
3	1.0	120.2	-16.7	50.1
	$[0.3, 1.9]$	$[51.3, 174.2]$	$[-70.7, 51.5]$	$[-21.2, 89.4]$
10	0.7	106.6	-2.7	60.5
	$[-0.2, 2.4]$	$[68.9, 144.6]$	$[-41.1, 34.3]$	$[-10.8, 125.3]$
∞	0.6	103.9	0.0	61.0
	$[-0.2, 3.0]$	$[101.5, 104.8]$	$[-0.0, 0.0]$	$[-9.7, 127.6]$

Table IA.72: NLD

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.1	50.2	54.2	91.7
	$[-0.1, 0.4]$	$[26.9, 74.0]$	$[30.5, 77.4]$	$[59.9, 158.6]$
3	0.2	120.0	-15.7	85.6
	$[-0.4, 0.8]$	$[67.9, 165.0]$	$[-61.3, 36.8]$	$[52.9, 163.7]$
10	0.2	104.4	-0.0	82.0
	$[-0.5, 0.7]$	$[81.6, 119.8]$	$[-15.5, 22.8]$	$[48.6, 200.5]$
∞	0.2	104.4	-0.0	81.9
	$[-0.6, 0.7]$	$[103.8, 105.1]$	$[-0.0, 0.0]$	$[47.2, 205.4]$

Table IA.73: PRT

horizon	return	fiscal adjustment	future sv	spending ratio
1	0.0	37.0	67.6	42.9
	$[-0.2, 0.3]$	$[4.8, 69.9]$	$[34.5, 99.7]$	$[-45.7, 93.3]$
3	-0.3	82.9	21.9	79.3
	$[-0.8, 0.3]$	$[28.8, 133.6]$	$[-29.0, 76.2]$	$[28.9, 147.1]$
10	-0.5	103.4	1.6	82.4
	$[-2.2, 0.3]$	$[50.7, 110.3]$	$[-5.5, 54.7]$	$[31.6, 200.8]$
∞	-0.5	105.0	0.0	82.6
	$[-6.2, 0.3]$	$[104.3, 110.8]$	$[-0.0, 0.0]$	$[31.8, 237.5]$

References

Ellison, Martin, and Andrew Scott. 2020. "Managing the UK National Debt 1694–2018." *American Economic Journal: Macroeconomics*, 12(3): 227–57.

Hall, George J., and Thomas J. Sargent. 2021. "Debt and Taxes in Eight US Wars and Two Insurrections." *The Handbook of Historical Economics*, 825–880.

Johnston, Louis, and Samuel H. Williamson. 2023. "What Was the US GDP Then?"