

For Online Publication

Online Appendix to “Debt and Deficits: Fiscal Analysis with Stationary Ratios”

John Y. Campbell Can Gao Ian W. R. Martin¹

Abstract

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

¹John 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

OA.1	The primary surplus-debt ratio in steady state	OA-1
OA.2	Additional derivations	OA-3
OA.3	Convergence issues	OA-4
OA.4	Data sources and descriptions	OA-8
OA.4.1	The US 1841-2022	OA-8
OA.4.2	The UK 1727-2022	OA-9
OA.4.3	Canada, Switzerland, and the eurozone	OA-10
OA.5	Data plots	OA-11
OA.6	Measurement of real debt returns post WWII	OA-26
OA.7	Theoretical values	OA-31
OA.8	Summary statistics for US and UK	OA-32
OA.9	Unit root tests and autocorrelation coefficients	OA-36
OA.10	Results for US and UK	OA-45
OA.10.1	VAR coefficient estimates	OA-45
OA.10.2	Local projection and cumulative figures, post-war sample . . .	OA-46
OA.10.3	Local projections, post-war sample	OA-50
OA.10.4	Variance decomposition for fp_t , post-war sample	OA-52
OA.10.5	Sensitivity analysis for ρ and a	OA-54
OA.10.6	More state variables for US post-war sample	OA-62
OA.10.7	Variance decomposition of unexpected tax, spending and re- turns	OA-68
OA.11	Results for Canada, Switzerland and 11 Eurozone countries . . .	OA-87
OA.11.1	VAR estimates	OA-87
OA.11.2	Variance decomposition of fp_t	OA-99

OA.1 The primary surplus-debt ratio in steady state

By definition, the gross return on government debt is

$$R_{t+1} = \frac{V_{t+1} + T_{t+1} - X_{t+1}}{V_t}. \quad (\text{OA.1})$$

Here R_{t+1} is the return on debt from time t to $t + 1$, V_t is the total market value of the debt in period t , T_{t+1} is tax revenue and X_{t+1} is expenditure. All variables are defined in real terms. This formula takes the perspective of a representative investor who holds all government debt and receives all resources devoted to servicing it, while buying all new issues so as to continue to hold all the debt.

We define the primary surplus as $S_t = T_t - X_t$ and assume throughout that the gross return R_{t+1} is strictly positive: this rules out the possibility of a total default on all government debt obligations with zero recovery. Note that the debt return R_{t+1} should only be interpreted as a riskless interest rate in the special case in which all government debt is short-term real debt. We allow debt to be risky: the realized return on debt is low if, for example, real yields rise, or if there is an explicit default. Inflation can also resolve fiscal difficulties by driving down real returns. It can do so in two ways: either via an unexpected inflation, which reduces the value of all nominal debt, or via increases in expected inflation that reduce the value of long-dated nominal debt by driving up nominal yields.

As a first step toward a simple benchmark, let us suppose that the conditional expectations of growth in tax revenue, spending, and the debt are all equal to some constant, G .¹ Similarly, let us suppose that the conditionally expected return on the debt equals R . Equation (OA.1) then implies

$$R = \mathbb{E}_t \frac{V_{t+1}}{V_t} + \mathbb{E}_t \frac{T_{t+1}}{T_t} \frac{T_t}{V_t} - \mathbb{E}_t \frac{X_{t+1}}{X_t} \frac{X_t}{V_t} = G \left(1 + \frac{S_t}{V_t} \right). \quad (\text{OA.2})$$

It follows that the primary surplus-debt ratio is a constant:

$$\frac{S_t}{V_t} = \frac{R - G}{G}. \quad (\text{OA.3})$$

This expression resembles the classic Gordon formula for the value of a stock paying

¹This assumption is not unreasonable for unconditional expectations. Table OA.20 shows that we cannot reject equality of mean growth rates for tax, spending, debt and GDP in either the US or the UK. But of course conditional expectations vary in the data, which is why our empirical work relies on the loglinear model rather than the exact steady-state model of this subsection.

dividends that grow at a constant rate G . Importantly, however, there is no presumption in this context that S is positive or that R exceeds G . When R is lower than G , the government runs a primary deficit (a negative S_t) in steady state.

Within this steady-state model, any increase in debt V_t must change S_t in the same proportion. Equivalently, the impact of an extra dollar of debt V_t is to change the surplus S_t by $(R - G)/G$ dollars. In the case where R exceeds G , additional debt requires taxes to increase relative to spending; but in the case where R is lower than G , additional debt allows taxes to fall relative to spending because the steady-state primary deficit increases in proportion to the value of the debt.

It is illuminating to calculate the ratio of spending to taxes in this steady-state model. We have

$$\frac{X_t}{T_t} = 1 - \frac{S_t}{T_t} = 1 - \frac{S_t/V_t}{T_t/V_t} = 1 - \frac{(R - G)/G}{T_t/V_t}. \quad (\text{OA.4})$$

The ratio of spending to taxes depends both on the primary surplus-debt ratio (or equivalently the difference between R and G), and on the size of the government relative to the size of the debt as captured by the tax-debt ratio T_t/V_t . If R exceeds G , the government runs a primary surplus so the spending-tax ratio is less than one; if R is less than G the government runs a primary deficit so the spending-tax ratio exceeds one. But when the government uses taxes to finance a large quantity of current spending as well as to service its debt, both tax revenue and spending are large relative to the debt so the spending-tax ratio need not vary far from one to generate the required primary surplus-debt ratio.

The steady-state model allows shocks to move taxes, but if debt is held constant any shock to the level of taxes must be offset by an equal shock to the level of spending so that the primary surplus remains unchanged. In proportional terms, at a constant level of debt any proportional change in taxes must equal the spending-tax ratio times the proportional change in spending. In the case where R exceeds G , the spending-tax ratio is less than one so the proportional change in spending must be greater than the proportional change in taxes; the reverse is true in the case where R is less than G .

Things are particularly simple in the special case where $R = G$. In this case, the primary surplus-debt ratio is zero in steady state and taxes and spending are equal, so the ratio X_t/T_t in equation (OA.4) equals one. To understand fiscal dynamics away from steady state, we will develop a loglinear approximation first in the general case, and then return to this special case.

OA.2 Additional derivations

Derivation of equation (9). We have

$$\log(1 + e^{\tau v_t} - e^{xv_t}) = k + \frac{1}{1 + a - b} (a\tau v_t - bxv_t) \quad (\text{OA.5})$$

up to higher order terms in τv_t and xv_t , where

$$k = \log(1 + a - b) + \frac{b \log b - a \log a}{1 + a - b}. \quad (\text{OA.6})$$

After rearranging and writing $\rho = 1/(1 + a - b)$, we have equation (9).

Taking limits as $T \rightarrow \infty$; and the derivation of equation (22). Throughout, we exploit the maintained assumption of Section 1.3 that conditional expectations of hatted quantities—that is, conditional expectations of deviations of quantities from their unconditional means—converge to zero faster than ρ^T tends to infinity. In our VAR implementation this assumption is satisfied if the maximal eigenvalue λ of the coefficient matrix satisfies $\rho\lambda < 1$ (as is the case in our empirical work).

The assumption has two important implications. First, sums of the form

$$\sum_{j=0}^{T-1} \rho^j \mathbb{E}_t(\hat{z}_{t+1+j})$$

are bounded uniformly in T , because their terms decay geometrically at rate $\rho\lambda < 1$. Second, $\mathbb{E}_t(vy_{t+T} - vy_t) = \sum_{j=0}^{T-1} \mathbb{E}_t \Delta vy_{t+1+j}$. As $\Delta v_{t+1} = r_{t+1} - fp_{t+1}$ by equation (11), it follows that $\Delta vy_{t+1} = r_{t+1} - \Delta y_{t+1} - fp_{t+1}$ is a linear combination of variables in the VAR. Moreover, its unconditional mean is zero. Hence $\mathbb{E}_t \Delta vy_{t+1}$ decays geometrically at rate $\lambda < 1$. Therefore $\mathbb{E}_t(vy_{t+T} - vy_t)$ converges as $T \rightarrow \infty$, so $\lim_{T \rightarrow \infty} \mathbb{E}_t(vy_{t+T})$ exists.

The case $r > g$, $\rho < 1$. Here we take the limit of (19) as $T \rightarrow \infty$. Note that (i) $(1 - \rho)\rho^j / (1 - \rho^T) \rightarrow (1 - \rho)\rho^j$; (ii) $(\rho^{j+1} - \rho^{T+1}) / (1 - \rho^T) \rightarrow \rho^{j+1}$; (iii) $(1 - \rho)\rho^T / (1 - \rho^T) \rightarrow 0$; and (iv) as shown above, $\mathbb{E}_t(vy_{t+T} - vy_t)$ converges so that (in view of (iii)) the final term in equation (19) vanishes. Hence we have

$$fp_t = \sum_{j=0}^{\infty} (1 - \rho)\rho^j \mathbb{E}_t(r_{t+1+j} - \Delta y_{t+1+j}) - \sum_{j=0}^{\infty} \rho^{j+1} \mathbb{E}_t(a\Delta \tau y_{t+1+j} - b\Delta xy_{t+1+j}).$$

This is equivalent to equation (15). (Recall from footnote 6 that equation (15) holds without hats when $\rho < 1$.)

The case $r = g$, $\rho = 1$. Here we take the limit of (20) as $T \rightarrow \infty$. Note that

$\frac{1}{T} \sum_{j=0}^{T-1} \mathbb{E}_t(r_{t+1+j} - \Delta y_{t+1+j}) = \frac{1}{T} \sum_{j=0}^{T-1} \mathbb{E}_t(\widehat{r}_{t+1+j} - \widehat{\Delta y}_{t+1+j})$, because $r = g$. The sum converges as $T \rightarrow \infty$ because the conditional expectation declines geometrically with horizon; hence the sum divided by T converges to zero. The third term also tends to zero because $\mathbb{E}_t(vy_{t+T} - vy_t)$ converges, as shown above. For the second term, write

$$a \sum_{j=0}^{T-1} \left(1 - \frac{j}{T}\right) \mathbb{E}_t(\Delta \tau y_{t+1+j} - \Delta x y_{t+1+j}) = a \sum_{j=0}^{T-1} \mathbb{E}_t(\cdots) - \frac{a}{T} \sum_{j=0}^{T-1} j \mathbb{E}_t(\cdots).$$

The first sum converges because its terms decay geometrically. The second sum converges for the same reason, and so tends to zero after being divided by T . Hence

$$fp_t = -a \sum_{j=0}^{\infty} \mathbb{E}_t(\Delta \tau y_{t+1+j} - \Delta x y_{t+1+j}),$$

which is equivalent to equation (15) in the case $\rho = 1$.

The case $r < g$, $\rho > 1$. We consider the three terms of (19) in turn.

The first term can be rewritten as

$$(r - g) + \frac{1 - \rho}{1 - \rho^T} \sum_{j=0}^{T-1} \rho^j \mathbb{E}_t(\widehat{r}_{t+1+j} - \widehat{\Delta y}_{t+1+j}).$$

The sum is bounded uniformly in T , as shown above, and $(1 - \rho)/(1 - \rho^T) \rightarrow 0$. As a result, the first term converges to $r - g$.

The second term can be rewritten as

$$\sum_{j=0}^{T-1} \frac{\rho^{j+1} - \rho^{T+1}}{1 - \rho^T} \mathbb{E}_t[\cdots] = \frac{1}{1 - \rho^T} \sum_{j=0}^{T-1} \rho^{j+1} \mathbb{E}_t[\cdots] - \frac{\rho^{T+1}}{1 - \rho^T} \sum_{j=0}^{T-1} \mathbb{E}_t[\cdots]. \quad (\text{OA.7})$$

As for the third term, $(1 - \rho)\rho^T/(1 - \rho^T) \rightarrow \rho - 1$ and $\mathbb{E}_t(vy_{t+T} - vy_t)$ has a limit $\lim_{T \rightarrow \infty} \mathbb{E}_t(vy_{t+T} - vy_t)$ as shown above.

Combining the limits of the three terms, we have equation (22).

OA.3 Convergence issues

The present-value identity (15) is written in deviations from unconditional means and discounts at the fixed factor ρ ; it converges under the condition that the maximal eigenvalue of the VAR is smaller than $1/\rho$. This condition becomes harder to satisfy as ρ increases (that is, as $r - g$ decreases), but it is always satisfied in our empirical applications.

Importantly, the condition can hold even if the market value of the debt does not equal the expected present value of future surpluses. Specifically, if we iterate equation (OA.1) forward, we can write

$$V_t = \sum_{j=1}^T \frac{S_{t+j}}{\prod_{i=1}^j R_{t+i}} + \frac{V_{t+T}}{\prod_{i=1}^T R_{t+i}}, \quad (\text{OA.8})$$

and it may not be the case that

$$\mathbb{E}_t \left[\frac{V_{t+T}}{\prod_{i=1}^T R_{t+i}} \right] \rightarrow 0 \quad \text{as } T \rightarrow \infty. \quad (\text{OA.9})$$

When (OA.9) fails to hold, the value of debt is not the expected present value of future surpluses: the influence of the second term on the right-hand side of equation (OA.8) cannot be neglected in the limit as $T \rightarrow \infty$. But equation (OA.8) continues to hold at any finite horizon T by definition of the return on government debt (OA.1) (and, as noted, our approach continues to be valid so long as the maximal eigenvalue of the VAR is smaller than $1/\rho$).

We use a lognormal example to illustrate how (OA.9) can fail to hold. By (4), the log return satisfies $r_{t+1} = \Delta v_{t+1} + \log(1 + S_{t+1}/V_{t+1})$, so

$$r_{t+1} - \Delta v_{t+1} = \log\left(1 + \frac{S_{t+1}}{V_{t+1}}\right) \quad (\text{OA.10})$$

is the log surplus–debt ratio, which by (11) equals the fiscal position fp_{t+1} up to our loglinearization.

We temporarily suppose, as an illustrative example for the duration of this subsection, that $\log(1 + S_{t+1}/V_{t+1})$ —and hence $r_{t+1} - \Delta v_{t+1}$ —follows an AR(1),

$$(r_{t+1} - \Delta v_{t+1}) - (r - g) = \phi[(r_t - \Delta v_t) - (r - g)] + \varepsilon_{t+1}, \quad \varepsilon_{t+1} \sim \text{i.i.d. } N(0, \sigma^2), \quad (\text{OA.11})$$

with unconditional mean $r - g$, autocorrelation ϕ , and long-run variance

$$\omega^2 \equiv \lim_{T \rightarrow \infty} \frac{1}{T} \text{var}_t \left(\sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) \right) = \frac{\sigma^2}{(1 - \phi)^2}. \quad (\text{OA.12})$$

The market value of the debt equals the expected discounted present value of future

surpluses if and only if

$$\mathbb{E}_t \left[\frac{V_{t+T}}{V_t \prod_{i=1}^T R_{t+i}} \right] = \mathbb{E}_t \exp \left(- \sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) \right) \quad (\text{OA.13})$$

tends to zero as $T \rightarrow \infty$. This is an expectation of a lognormal random variable, so

$$\begin{aligned} \mathbb{E}_t \exp \left(- \sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) \right) &= \exp \left(- \mathbb{E}_t \sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) + \frac{1}{2} \text{var}_t \sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) \right) \\ &= \exp \left(- T[(r - g) - \frac{1}{2}\omega^2] + O(1) \right). \end{aligned} \quad (\text{OA.14})$$

The value of the debt equals the expected present value of future surpluses precisely when the final term vanishes, and this happens if and only if

$$r - g > \frac{1}{2}\omega^2. \quad (\text{OA.15})$$

In particular, we therefore require that $r - g > 0$; but this is not sufficient, as the expected present value does not converge if $r - g < \frac{1}{2}\omega^2$. Notice that as ω^2 is increasing in ϕ , a more persistent surplus–debt ratio raises the threshold that $r - g$ must exceed for the value of debt to equal the expected present value of future surpluses.

The above identities are framed in terms of ex ante conditional expectations. It is also instructive to ask whether the value of debt equals the discounted present value of surpluses *ex post*. Perhaps surprisingly, this question has a subtly different answer. By equation (OA.8), this holds if and only if $\exp \left(- \sum_{i=1}^T (r_{t+i} - \Delta v_{t+i}) \right) \rightarrow 0$ as $T \rightarrow \infty$. (Note that we are not taking an expectation here.) Given stationarity and ergodicity, this holds almost surely under the weaker assumption that $\mathbb{E}(r_{t+i} - \Delta v_{t+i}) = r - g > 0$. It may therefore be the case that the value of debt almost surely equals the discounted present value of surpluses ex post, but does not equal the ex ante conditionally expected present value of surpluses.

The gap between the ex ante and ex post conditions reflects a Jensen’s inequality effect arising from the convexity of the exponential. Under lognormality, the expectation (OA.13) is governed by the drift, $-T(r - g)$, and by half the variance, $\frac{1}{2}\omega^2 T$.² The variance term captures the fact that the expectation is inflated by the right tail of $-\sum(r_{t+i} - \Delta v_{t+i})$: paths on which there are very large cumulative deficits. Such paths are unlikely, but the exponential weights them so heavily that they can dominate the expectation

²Without the lognormality assumption, the expectation would also depend on higher cumulants of accumulated $r_{t+i} - \Delta v_{t+i}$.

even as they become vanishingly rare, as in [Martin \(2012\)](#). Taking expectations therefore makes convergence harder to achieve, which is why the ex post condition $r - g > 0$ is weaker than the ex ante condition given in [\(OA.15\)](#), $r - g > \frac{1}{2}\omega^2$.

The analog of [\(OA.8\)](#) in our loglinear framework is the identity [\(13\)](#), whose final term is $\rho^T \hat{f}p_{t+T}$. This vanishes as $T \rightarrow \infty$ when $\rho < 1$ but not when $\rho \geq 1$; as a result, we work with the conditionally expected deviations of [\(14\)](#), whose final term is $\rho^T \mathbb{E}_t \hat{f}p_{t+T}$. To understand how this quantity behaves in our running example, note that $\hat{f}p$ inherits (under our loglinearization) the AR(1) dynamics of $r - \Delta v$ in [\(OA.11\)](#), so that

$$\rho^T \mathbb{E}_t \hat{f}p_{t+T} = (\rho\phi)^T \hat{f}p_t. \quad (\text{OA.16})$$

This vanishes as $T \rightarrow \infty$ if

$$\rho\phi < 1. \quad (\text{OA.17})$$

This holds whenever $\rho < 1$ (that is, whenever $r > g$); and it also holds if $\rho \geq 1$, so long as the surplus–debt ratio is not too persistent (specifically, if $\phi < 1/\rho$). The analogous condition in our more general VAR setup is that the largest eigenvalue of the VAR coefficient matrix should be less than $1/\rho$.

It may seem puzzling that the loglinear present value can converge even when $r \leq g$, given that the exact present value then converges neither ex ante nor ex post.³ It may seem particularly puzzling that we choose to write down ex ante identities: in light of the discussion earlier in this subsection, one might expect doing so to make the situation worse rather than better. The reason is that our loglinear approximation delivers the identity [\(13\)](#) in which terms appear additively, and with deterministic discount weights: expectations can be taken term by term, and the final term involves the fiscal position at the single date $t + T$ rather than a product of terms compounded over the whole horizon. This in turn makes it possible to write the identity in terms of conditionally expected deviations from unconditional means, as in [\(14\)](#). Moreover, there is no costly Jensen’s inequality effect when we take expectations, because the relevant terms are linear in the underlying variables. Taking expectations also makes the final term, $\rho^T \mathbb{E}_t \hat{f}p_{t+T}$, well behaved even if $\rho \geq 1$, under our maintained assumption that the conditional expectation converges to its unconditional mean sufficiently fast.

³Recall, however, that *finite-horizon* identities are always well defined, ex ante and ex post, whether $r < g$ or $r \geq g$.

OA.4 Data sources and descriptions

OA.4.1 The US 1841-2022

Nominal GDP and GDP deflator data is from the website of Louis Johnston and Samuel H. Williamson.⁴

The **spending, tax and interest payment** data is taken from OMB. We use the most recent observations from OMB. We use total receipts as T_t , and the difference between total outlays and interest payments as X_t .⁵

For interest payment data after 1940 and tax and spending data after 1901, we download directly from FRED website (series named FYFR, FYOINT and FYONET).

We hand collect interest payment data before 1940 (or 1901 for tax and spending) from the most recent digitized archive, the *Annual Report of 1980* (pages 4–14). Data are available from 1791 (end of December). In 1842, Congress changed the beginning of the fiscal year from January 1 to July 1. In 1977, it was changed again from July 1 to October 1 where it remains today. We interpolate the spending and tax data before 1842 to match the change from January to July. We do not make any adjustment for the change in 1977, which means the one-period length between 1976-1977 is effectively 1.25 years. Later, we match the observations of debt market values with fiscal years by taking end of June observations until 1976 and end of September observations thereafter.

As we treat social security taxes as taxes and social security benefit payments as outlays, we are consolidating the Social Security trust fund with the federal government, and as a result we do *not* include the nonmarketable debt held by the Social Security trust fund in our measure of government debt. Conversely, as our measures of tax receipts and expenditures do include transfers between the Federal Reserve and Treasury, we are treating the Federal Reserve as being outside the federal government. We therefore include the marketable debt held by the Federal Reserve in our measure of the debt.

For the **market value of debt**, there are two main data sources. The Dallas Fed provides the market value of marketable debt, V_t , from 1942. The suitable series according to our definition of debt is the *market value of gross federal debts* from the spreadsheet

⁴See <https://www.measuringworth.com/> for details.

⁵Receipts include taxes and other collections from the public. See table 17.1 in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_17_receipts_fy2024.pdf for details. Outlays are payments that liquidate obligations. Details are given in the chapter on outlays in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_15_concepts_fy2024.pdf. The US federal government also collects income from the public through market-oriented activities. Collections from these activities are subtracted from gross outlays, rather than being added to taxes and other governmental receipts. See table 18.1 in https://www.whitehouse.gov/wp-content/uploads/2023/03/ap_18_offsetting_fy2024.pdf for details.

on the Dallas Fed’s website. For long sample data, the calculation of privately held debt from Robert Hall’s website (as used in Hall and Sargent (2021)) is available.

The two sources are similar to each other (see Figure OA.1). We use Dallas Fed’s data from 1942 and combine it with Hall and Sargent’s data before 1942.

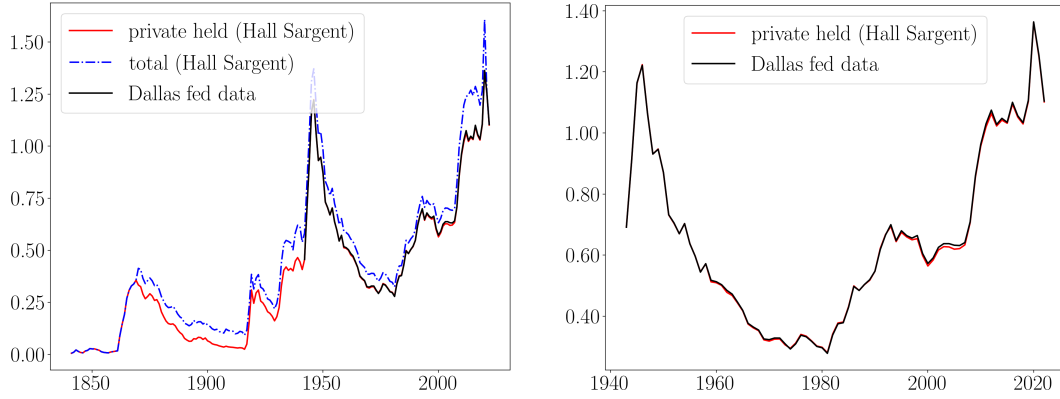


Figure OA.1: Hall–Sargent data compared to the Dallas Fed’s time series of the debt-to-GDP ratio (i.e., the market value of gross federal debt, scaled by GDP).

The US full sample range is 1790s to 2022. As there are three missing data points for the market value of debt from 1838 to 1840, we start from 1841. We match the observations of debt market values with fiscal years. To do so, we use end of June observations until 1976 and end of September observations thereafter.

We take 1 year and 10 year nominal bond yields from FRED after 1953, using variable names GS1 and GS10. Pre-1953 data is from Robert Shiller’s website. The 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 the 10 and 1 year yield.

OA.4.2 The UK 1727-2022

The public sector in UK includes central government, local government, the Bank of England and other public corporations. Our measures are of **the central government**.

The **market value of debt** data has two parts: i) For 1727-2016, we use the time series of the market value of central government gross debt from the Bank of England’s macro dataset;⁶ ii) For 2017-2022, we infer the market value of debt using the BIS’s

⁶See <https://www.bankofengland.co.uk/statistics/research-datasets>.

government debt dataset, which reports (market value of) debt to GDP ratios from 2017 to 2022, and nominal GDP and deflator data from the website of Johnston and Williamson.

The spending (central government expenditure), tax (central government receipts), and interest payment data is taken from website of the UK's Office for Budget Responsibility (historical public finances database).

OA.4.3 Canada, Switzerland, and the eurozone

We merge BIS government debt market value to GDP data and IMF public finance data to construct a panel dataset.⁷ 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, we use March/June observations from year $N + 1$ as the year N observation, because its fiscal year does not align with the calendar year. We first compute real return minus GDP growth, then back out the real debt return by adding back the real GDP growth. Similar approaches are used to compute tax, spending, or debt growth rates.

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

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

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

⁷We 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).

OA.5 Data plots

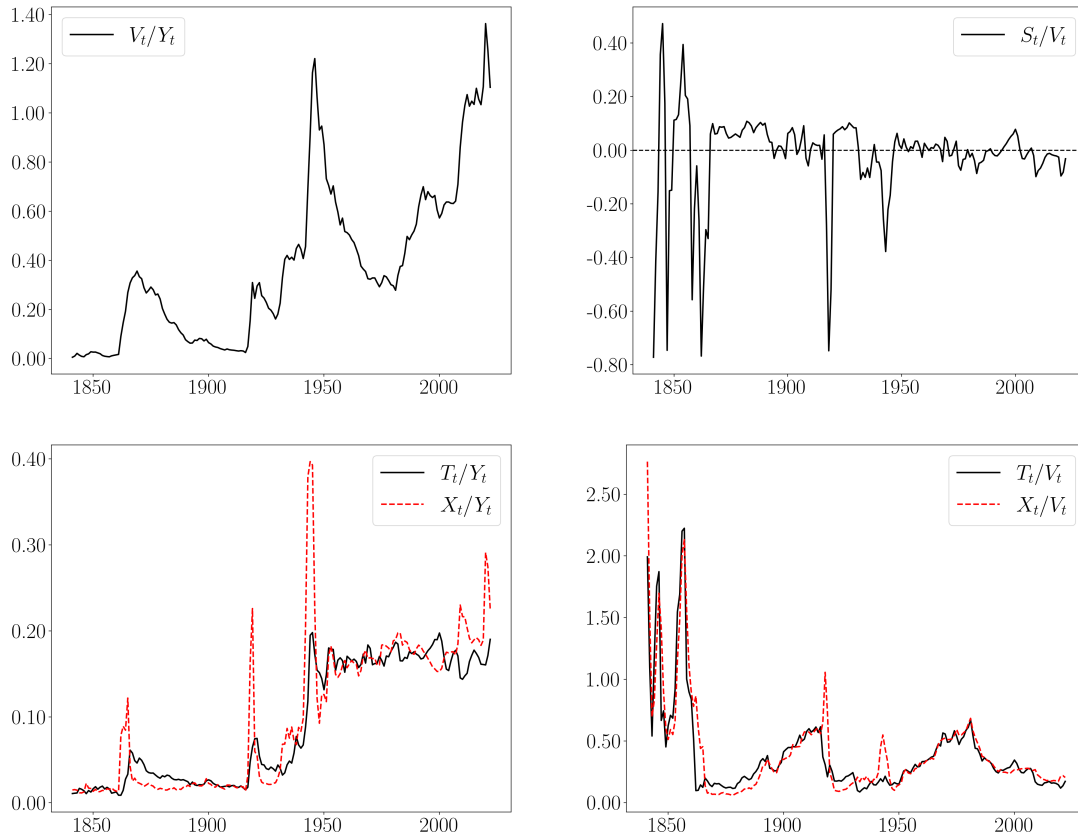


Figure OA.2: USA

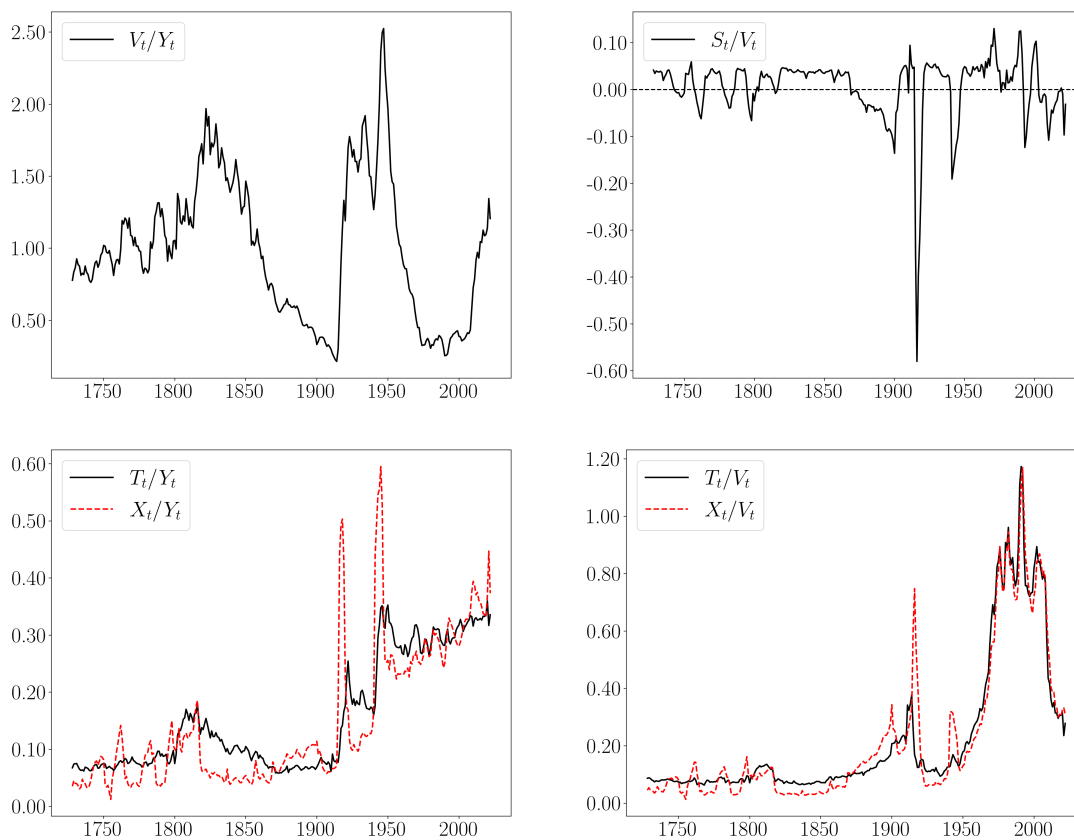


Figure OA.3: GBR

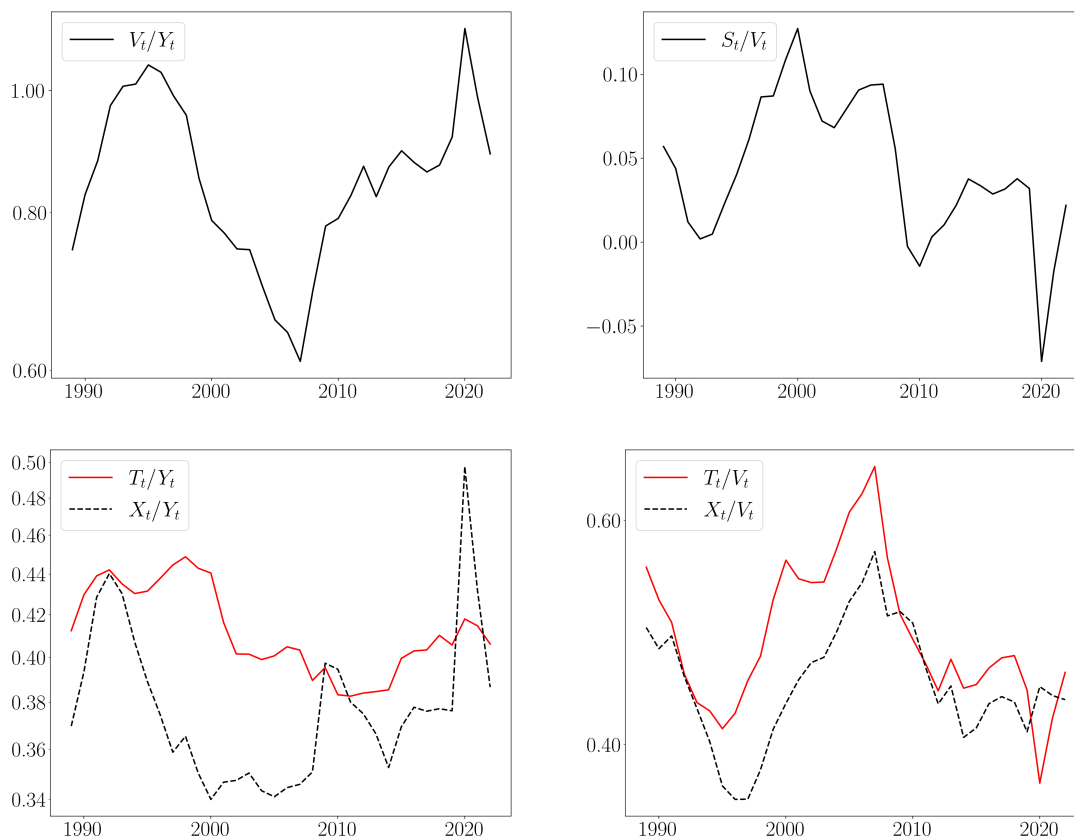


Figure OA.4: CAN

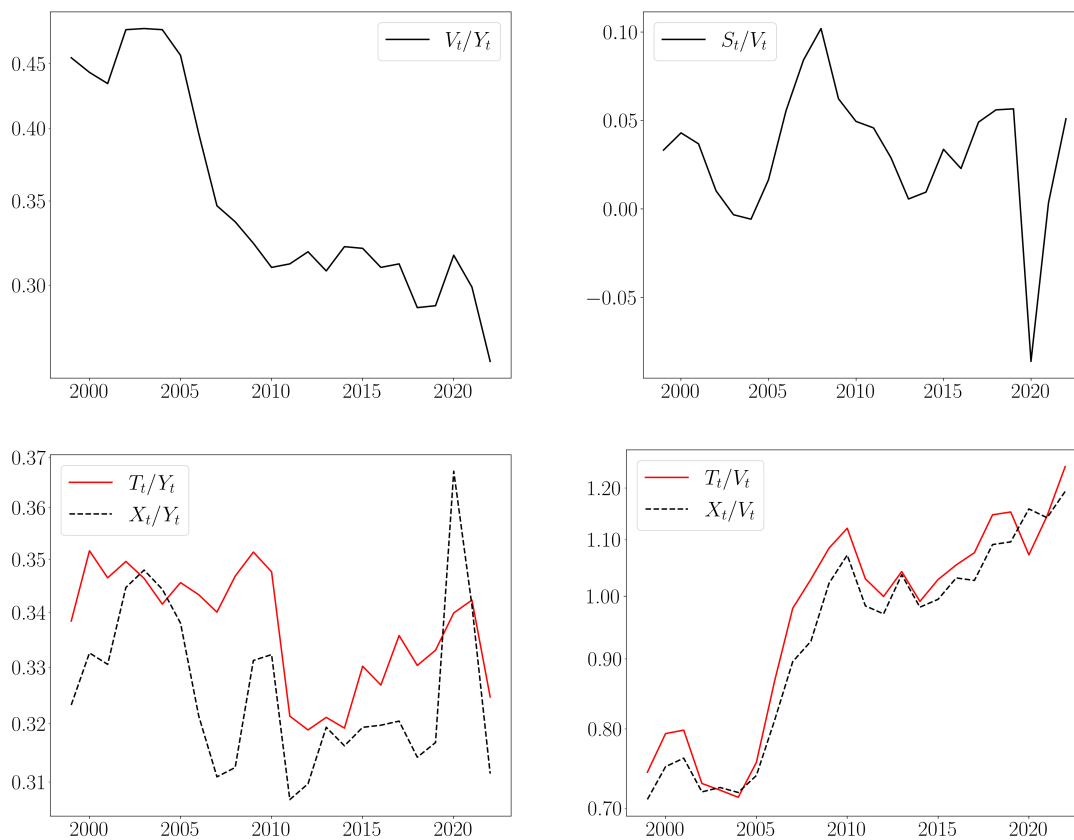


Figure OA.5: CHE

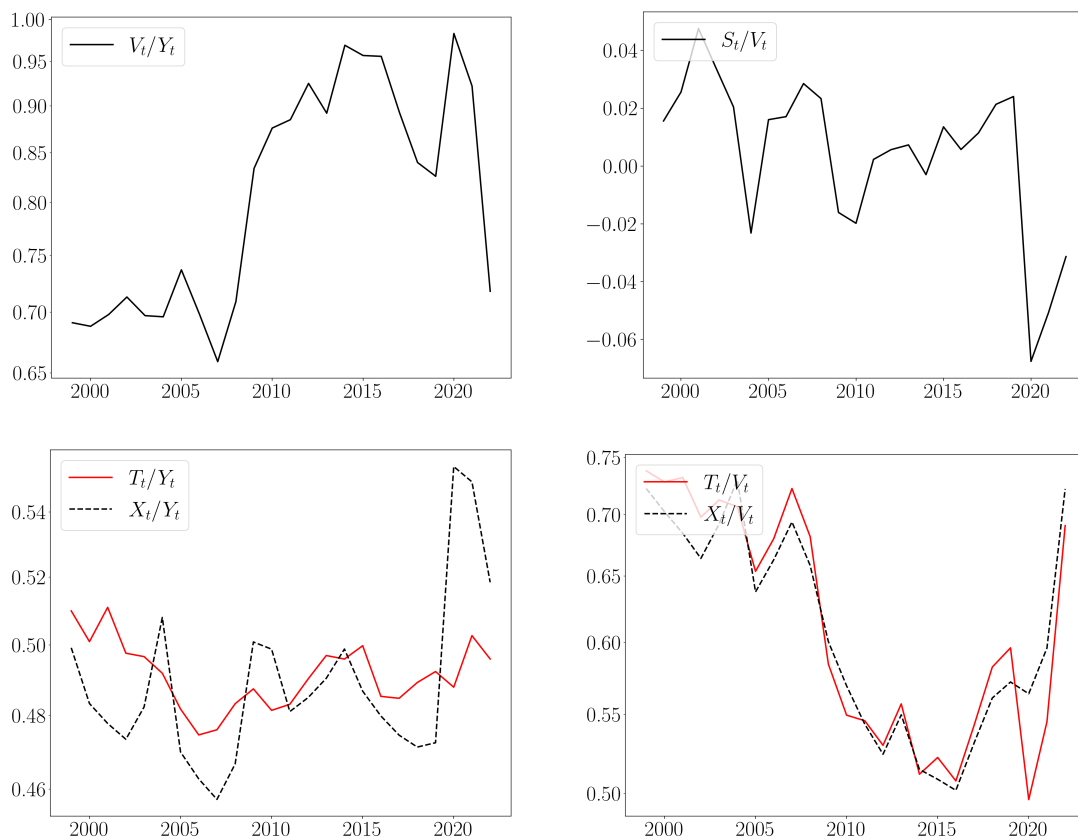


Figure OA.6: AUT



Figure OA.7: BEL



Figure OA.8: DEU

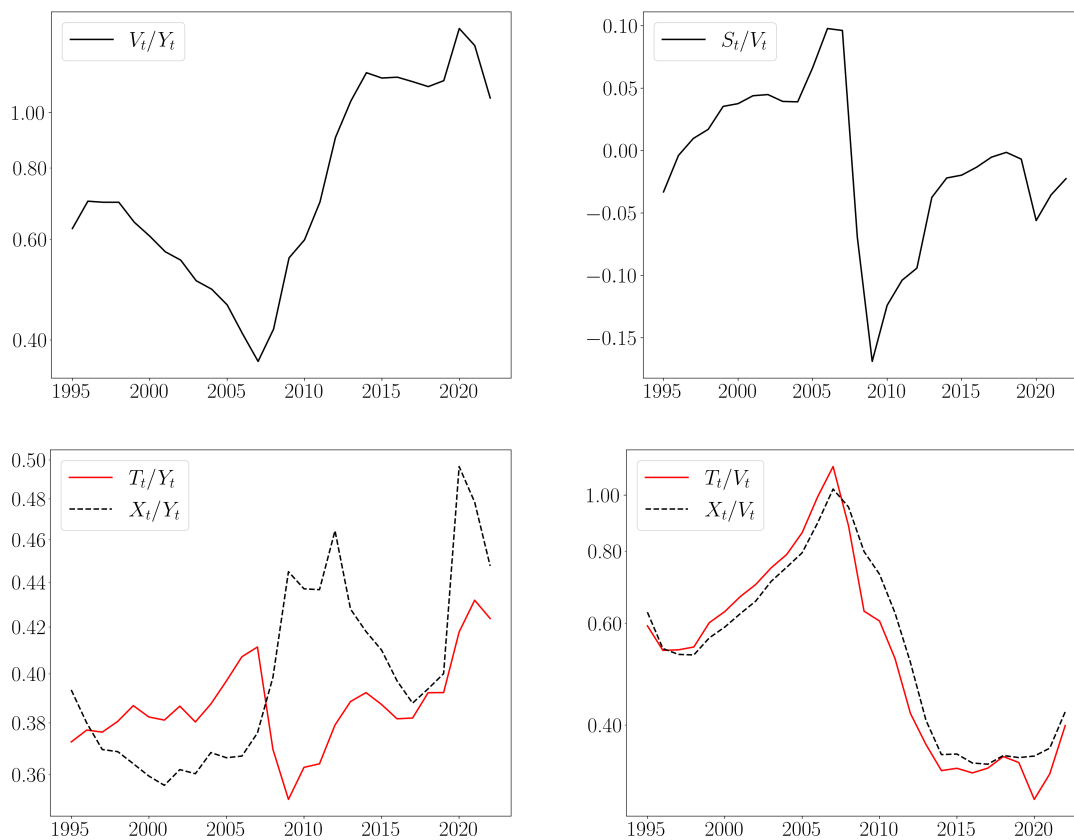


Figure OA.9: ESP

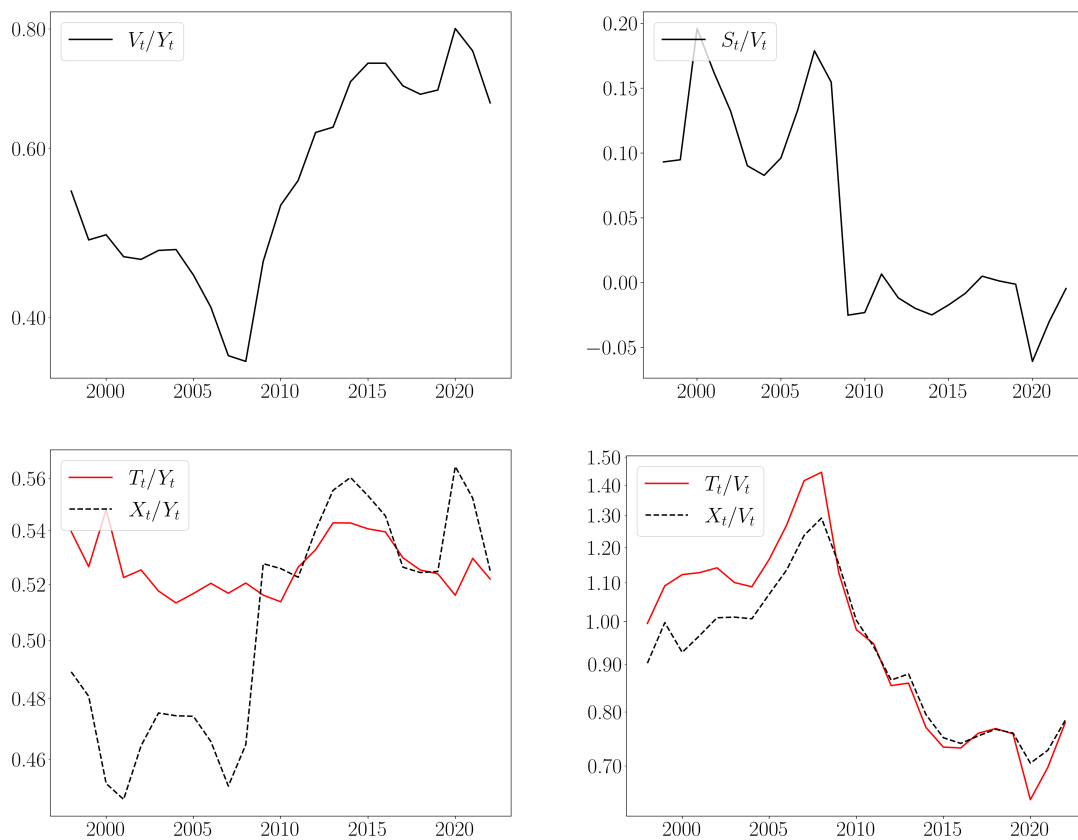


Figure OA.10: FIN

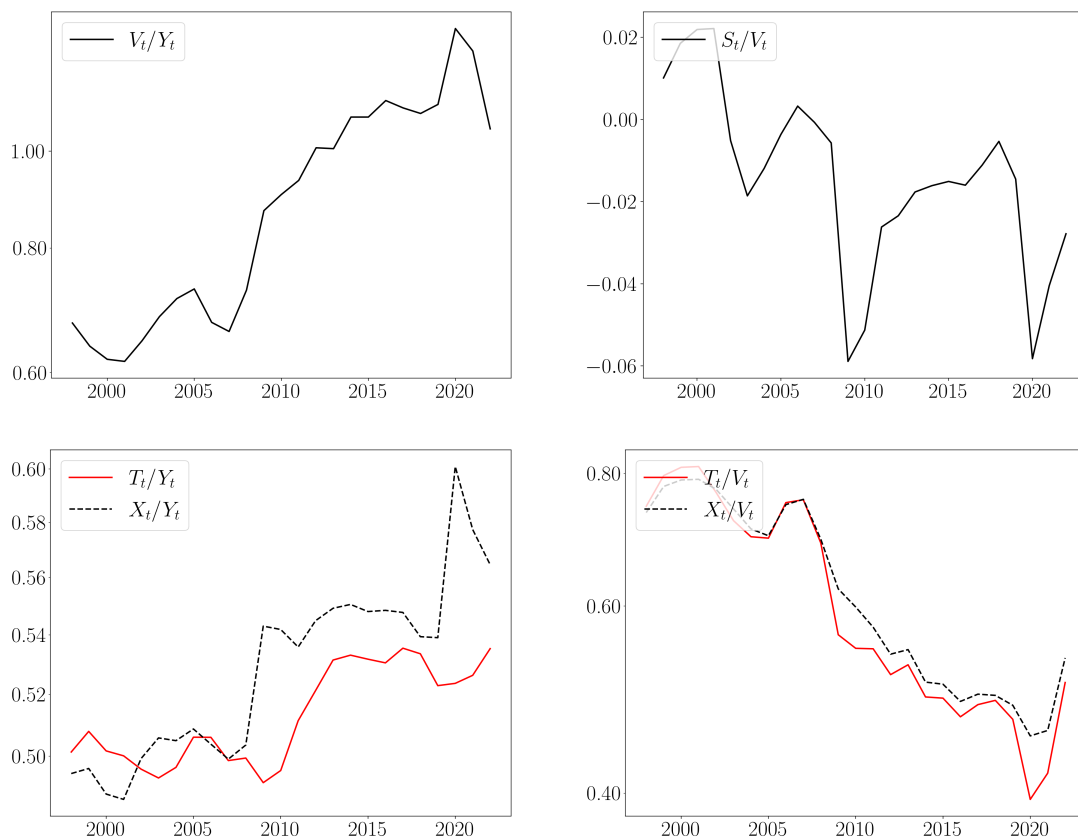


Figure OA.11: FRA

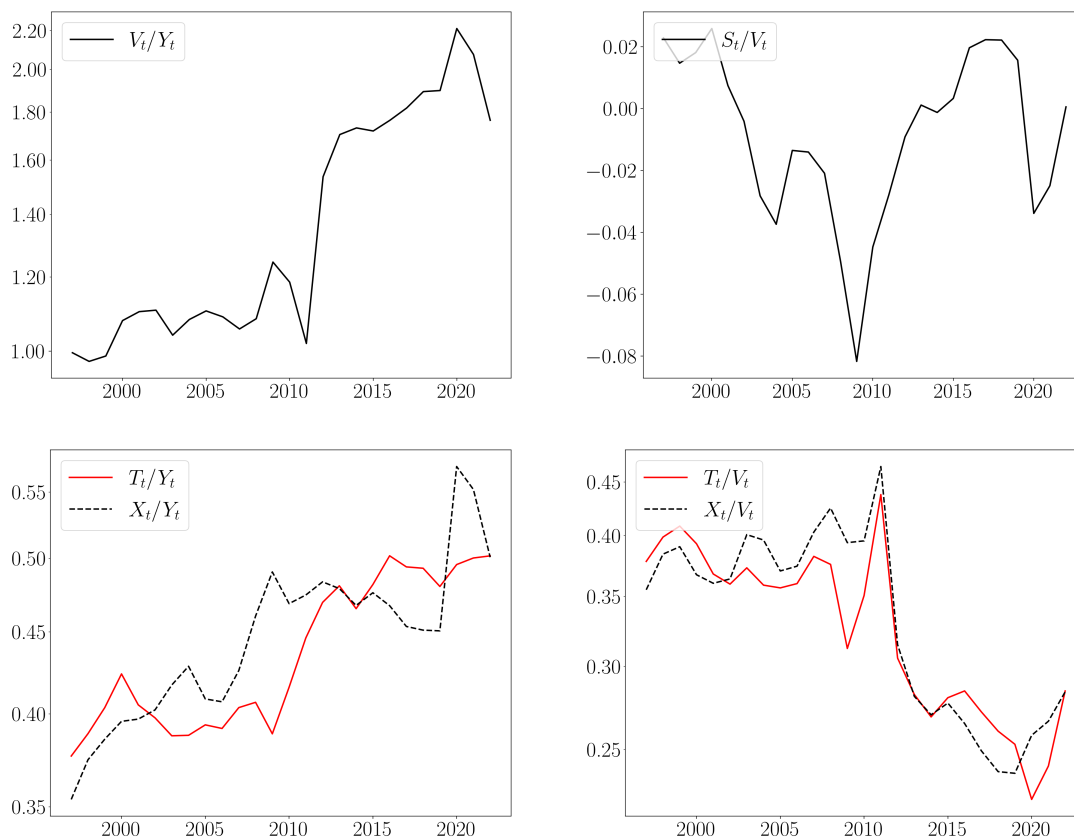


Figure OA.12: GRC

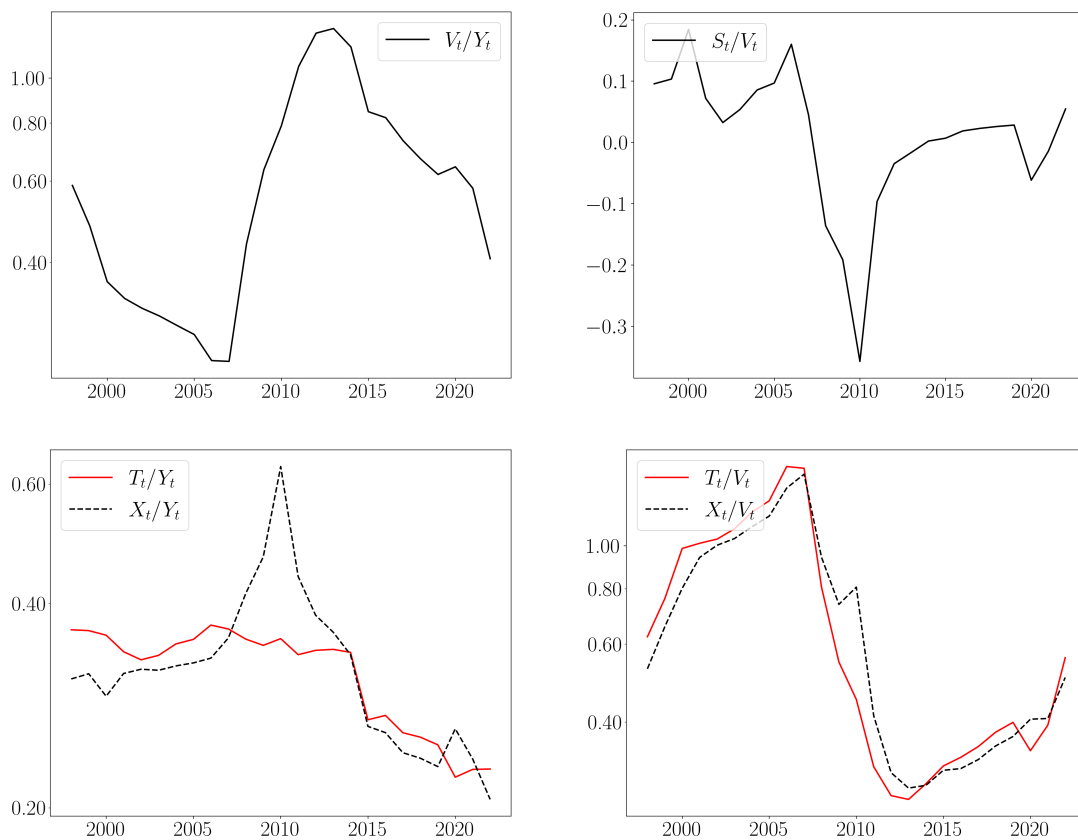


Figure OA.13: IRL

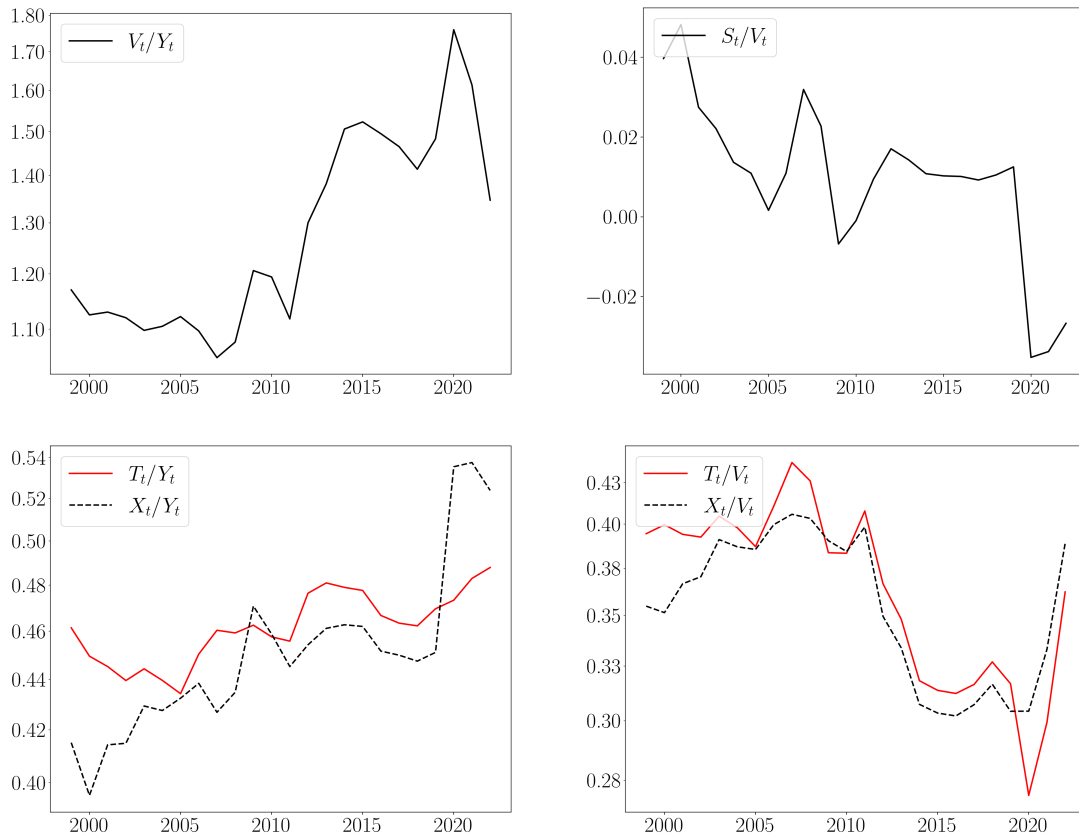


Figure OA.14: ITA

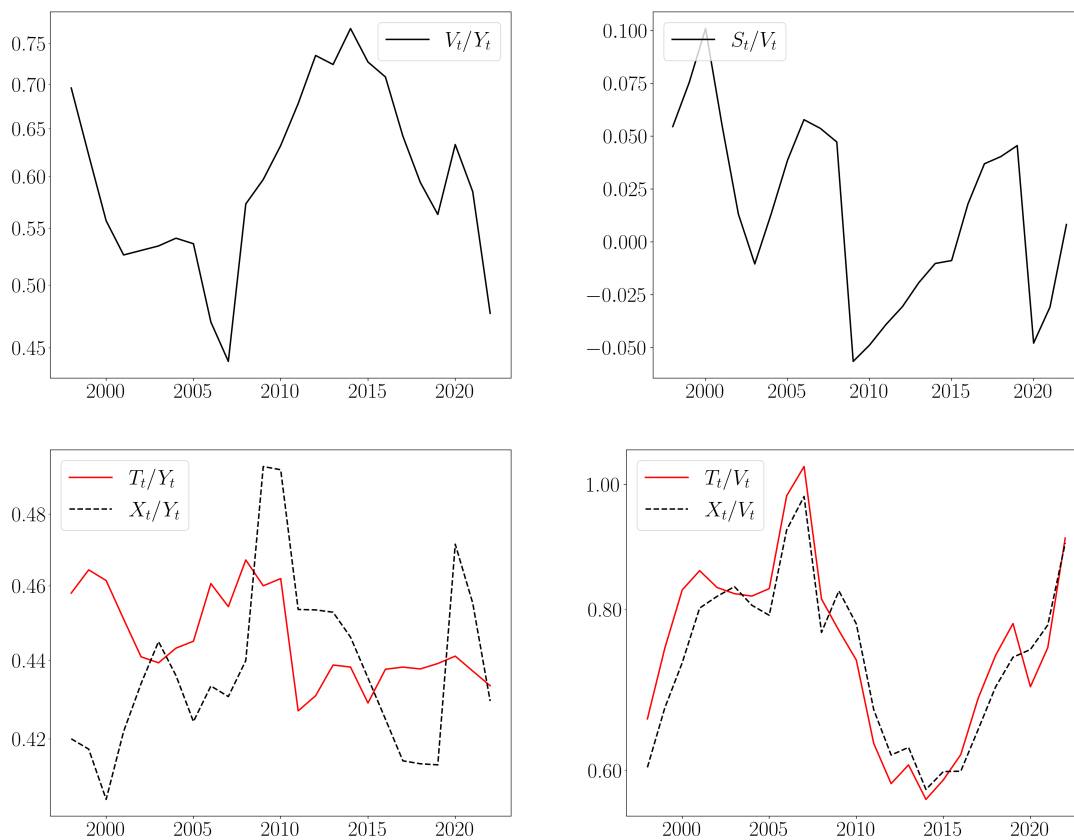


Figure OA.15: NLD

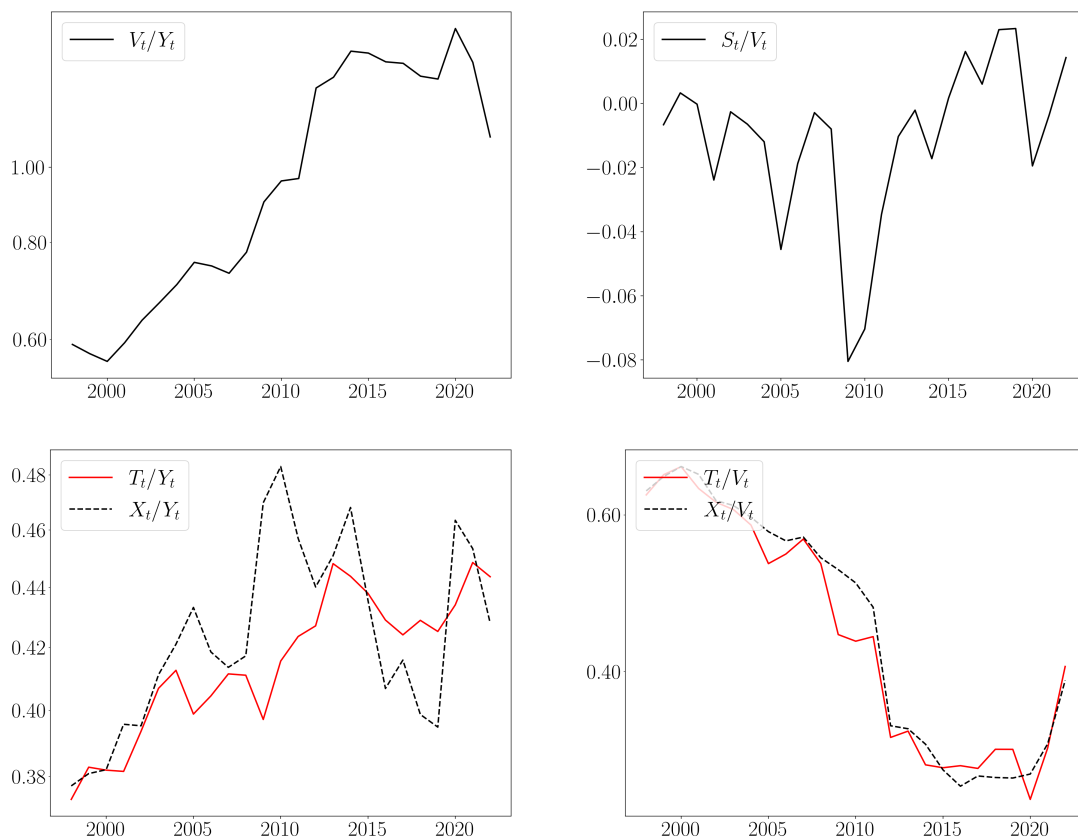


Figure OA.16: PRT

OA.6 Measurement of real debt returns post WWII

Table OA.2: US, UK, Canada, 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:

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

country	α	NW _{se}	β	NW _{se}	γ	NW _{se}	R^2	obs.
USA	0.01	[0.00]	1.42	[0.15]	—	—	55.3%	76
	0.02	[0.00]	—	—	-4.09	[0.47]	60.2%	76
	0.01	[0.00]	1.01	[0.11]	-3.05	[0.36]	84.1%	76
GBR	0.03	[0.01]	1.80	[0.36]	—	—	23.5%	76
	0.03	[0.01]	—	—	-10.27	[1.12]	40.8%	76
	0.03	[0.01]	0.97	[0.34]	-8.49	[1.20]	46.4%	76
CAN	0.05	[0.01]	1.06	[0.32]	—	—	35.1%	33
	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
CHE	0.03	[0.01]	1.50	[0.52]	—	—	20.5%	23
	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 OA.3: US, UK, Canada, 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	0.012 [0.007]	1.051 [0.096]	-1.269 [0.123]	-2.759 [0.347]	0.587 [0.270]	86.6%	76
GBR	0.016 [0.013]	1.451 [0.412]	-1.277 [0.450]	-8.089 [1.097]	2.067 [1.164]	47.9%	76
CAN	0.096 [0.015]	0.394 [0.180]	-1.977 [0.422]	-4.115 [0.771]	-0.904 [0.497]	64.5%	33
CHE	0.030 [0.008]	0.151 [0.322]	1.128 [0.586]	-7.314 [0.842]	-1.653 [0.627]	71.7%	23

Table OA.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:

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

country	α	NW _{se}	β	NW _{se}	γ	NW _{se}	R^2	obs.
AUT	0.04	[0.01]	2.18	[0.29]	—	—	74.4%	23
	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
BEL	0.03	[0.01]	1.70	[0.34]	—	—	60.9%	24
	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
DEU	0.03	[0.01]	1.63	[0.40]	—	—	54.5%	24
	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
ESP	0.03	[0.01]	1.48	[0.38]	—	—	42.9%	27
	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
FIN	0.08	[0.01]	2.18	[0.24]	—	—	47.7%	24
	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 OA.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:

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

country	α	NW _{se}	β	NW _{se}	γ	NW _{se}	R^2	obs.
FRA	0.02	[0.01]	1.80	[0.45]	—	—	57.0%	24
	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
GRC	0.01	[0.02]	1.04	[0.44]	—	—	14.2%	25
	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
IRL	0.04	[0.02]	2.16	[0.74]	—	—	23.4%	24
	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
ITA	0.03	[0.01]	1.53	[0.14]	—	—	58.6%	23
	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
NLD	0.03	[0.01]	1.58	[0.43]	—	—	31.8%	24
	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
PRT	0.03	[0.01]	1.39	[0.33]	—	—	33.8%	24
	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 OA.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 [0.012]	1.483 [0.234]	-1.324 [0.323]	-4.608 [0.783]	0.100 [0.817]	88.5%	23
BEL	0.021 [0.009]	1.007 [0.235]	-0.972 [0.305]	-4.344 [1.000]	0.065 [0.869]	86.8%	24
DEU	0.029 [0.018]	0.849 [0.493]	-1.545 [0.436]	-2.828 [1.463]	1.220 [1.450]	71.5%	24
ESP	-0.008 [0.016]	0.867 [0.268]	-0.580 [0.297]	-3.234 [0.747]	1.333 [0.659]	76.1%	27
FIN	-0.020 [0.020]	3.090 [0.316]	0.177 [0.416]	-4.392 [0.897]	3.206 [1.009]	82.9%	24
FRA	0.017 [0.009]	1.076 [0.199]	-0.961 [0.326]	-4.655 [0.659]	-0.232 [0.351]	87.5%	24
GRC	-0.008 [0.020]	0.163 [0.427]	0.431 [0.437]	-3.418 [0.409]	0.160 [0.224]	80.4%	25
IRL	-0.001 [0.032]	3.614 [1.310]	-0.954 [0.635]	-3.476 [1.386]	-0.114 [1.346]	46.6%	24
ITA	-0.009 [0.006]	1.151 [0.147]	-0.804 [0.144]	-2.864 [0.359]	1.303 [0.195]	95.8%	23
NLD	0.008 [0.023]	1.768 [0.682]	-0.120 [0.545]	-6.161 [1.993]	-2.421 [2.273]	55.1%	24
PRT	-0.007 [0.012]	1.506 [0.269]	-0.812 [0.297]	-1.470 [0.228]	1.007 [0.263]	84.5%	24

OA.7 Theoretical values

Table OA.7: Parameter choices

Country	period	r	g	ρ	a	b	$\mathbb{E} r_t$	$\mathbb{E} \Delta y_t$	$\mathbb{E} \Delta v$
USA	1841-2022	0.029	0.035	1.006	0.394	0.399	0.029	0.035	0.064
	1947-2022	0.020	0.030	1.010	0.262	0.272	0.020	0.030	0.029
GBR	1727-2022	0.021	0.018	0.997	0.128	0.125	0.021	0.018	0.019
	1947-2022	0.032	0.024	0.991	0.428	0.419	0.032	0.024	0.014
CAN	1989-2022	0.067	0.021	0.955	0.833	0.786	0.067	0.021	0.026
CHE	1999-2022	0.025	0.019	0.994	0.972	0.966	0.025	0.019	-0.005
AUT	1999-2022	0.020	0.016	0.996	0.637	0.632	0.020	0.016	0.017
BEL	1999-2022	0.016	0.017	1.001	0.400	0.401	0.016	0.017	0.004
DEU	1999-2022	0.024	0.012	0.988	0.752	0.740	0.024	0.012	0.013
ESP	1999-2022	0.020	0.017	0.997	0.611	0.608	0.020	0.017	0.034
FIN	1999-2022	0.067	0.016	0.950	1.081	1.028	0.067	0.016	0.025
FRA	1999-2022	0.017	0.014	0.997	0.476	0.473	0.017	0.014	0.032
GRC	1999-2022	0.019	0.005	0.986	0.391	0.377	0.019	0.005	0.030
IRL	1999-2022	0.037	0.055	1.019	0.706	0.724	0.037	0.055	0.040
ITA	1999-2022	0.018	0.004	0.986	0.594	0.581	0.018	0.004	0.010
NLD	1999-2022	0.013	0.017	1.004	0.738	0.742	0.013	0.017	0.002
PRT	1999-2022	0.024	0.010	0.986	0.514	0.500	0.024	0.010	0.036

OA.8 Summary statistics for US and UK

Table OA.8: Summary statistics of US data, 1841 to 2022

variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.029	0.102	-0.009	11.502	0.029	0.612	-0.543	0.048
Δx_t	0.049	0.293	1.644	17.469	0.024	1.886	-1.339	0.216
$\Delta \tau_t$	0.048	0.168	1.809	8.414	0.036	1.044	-0.367	0.325
Δv_t	0.064	0.232	3.633	20.421	0.017	1.783	-0.422	0.422
Δy_t	0.035	0.046	-0.473	2.452	0.034	0.169	-0.142	0.284
τv_t	-1.215	0.677	0.715	0.394	-1.286	0.799	-2.448	0.934
xv_t	-1.223	0.790	0.150	-0.104	-1.284	1.017	-2.817	0.958
$\log(1 + S_t/V_t)$	-0.043	0.255	-3.923	17.987	0.007	0.387	-1.479	0.475
S_t/V_t	-0.019	0.169	-2.209	8.142	0.007	0.472	-0.772	0.590
T_t/V_t	0.387	0.366	3.055	10.756	0.276	2.224	0.086	0.865
X_t/V_t	0.405	0.389	2.905	11.097	0.277	2.765	0.060	0.899
fp_t	0.015	0.181	-1.273	4.151	0.020	0.356	-0.859	0.784
τy_t	-2.811	0.997	-0.189	-1.542	-2.881	-1.619	-4.728	0.988
xy_t	-2.820	1.108	-0.077	-1.747	-2.515	-0.924	-4.463	0.967
vy_t	-1.596	1.362	-0.859	-0.267	-1.173	0.310	-5.215	0.985
T_t/Y_t	0.091	0.070	0.203	-1.816	0.056	0.198	0.009	0.989
X_t/Y_t	0.100	0.086	0.723	0.173	0.081	0.397	0.012	0.936
S_t/Y_t	-0.009	0.041	-3.183	13.193	0.001	0.059	-0.261	0.736
V_t/Y_t	0.374	0.325	0.937	0.198	0.309	1.364	0.005	0.985

Table OA.9: Summary statistics of US data, 1947 to 2022

variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.020	0.055	-0.339	0.597	0.019	0.144	-0.140	0.304
Δx_t	0.030	0.119	-1.476	14.762	0.028	0.412	-0.630	0.195
$\Delta \tau_t$	0.031	0.068	-0.133	1.543	0.038	0.227	-0.188	0.227
Δv_t	0.029	0.069	0.230	0.226	0.021	0.186	-0.153	0.443
Δy_t	0.030	0.024	-0.194	0.077	0.030	0.086	-0.027	0.068
τv_t	-1.242	0.450	-0.105	-0.917	-1.261	-0.398	-2.140	0.968
xv_t	-1.213	0.433	-0.035	-0.431	-1.293	-0.381	-2.308	0.975
$\log(1 + S_t/V_t)$	-0.008	0.038	-0.374	0.167	-0.005	0.075	-0.104	0.671
S_t/V_t	-0.008	0.037	-0.262	0.086	-0.005	0.078	-0.098	0.674
T_t/V_t	0.318	0.139	0.612	-0.507	0.283	0.672	0.118	0.963
X_t/V_t	0.326	0.141	0.746	-0.469	0.274	0.683	0.100	0.979
fp_t	0.017	0.045	-0.362	2.727	0.019	0.165	-0.130	0.746
τy_t	-1.785	0.074	-0.532	0.723	-1.778	-1.622	-2.028	0.661
xy_t	-1.756	0.163	-0.330	3.992	-1.746	-1.234	-2.379	0.812
vy_t	-0.544	0.425	0.032	-0.958	-0.492	0.310	-1.280	0.983
T_t/Y_t	0.168	0.012	-0.277	0.363	0.169	0.198	0.132	0.663
X_t/Y_t	0.175	0.029	1.021	4.938	0.174	0.291	0.093	0.799
S_t/Y_t	-0.007	0.030	-1.522	4.525	-0.003	0.059	-0.131	0.744
V_t/Y_t	0.634	0.270	0.707	-0.341	0.612	1.364	0.278	0.975

Table OA.10: Summary statistics of UK data, 1727 to 2022

variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.021	0.074	-0.080	2.220	0.024	0.346	-0.306	0.252
Δx_t	0.026	0.204	1.117	12.107	0.027	1.337	-0.754	0.307
$\Delta \tau_t$	0.023	0.070	1.349	7.672	0.022	0.437	-0.225	0.120
Δv_t	0.019	0.091	2.151	11.892	0.011	0.689	-0.216	0.402
Δy_t	0.018	0.031	-0.555	1.378	0.021	0.101	-0.109	-0.002
τv_t	-1.900	0.826	1.078	-0.124	-2.207	0.160	-2.763	0.994
xv_t	-2.082	1.063	0.374	-0.904	-2.243	0.157	-4.327	0.982
$\log(1 + S_t/V_t)$	0.002	0.084	-5.470	45.001	0.028	0.123	-0.867	0.806
S_t/V_t	0.005	0.070	-3.727	22.722	0.029	0.130	-0.580	0.837
T_t/V_t	0.227	0.254	1.907	2.459	0.110	1.173	0.063	0.989
X_t/V_t	0.222	0.257	1.683	1.772	0.106	1.170	0.013	0.985
fp_t	0.010	0.055	-0.324	0.719	0.009	0.197	-0.199	0.899
τy_t	-2.052	0.612	0.410	-1.442	-2.305	-1.023	-2.845	0.992
xy_t	-2.234	0.796	0.253	-1.002	-2.360	-0.519	-4.398	0.968
vy_t	-0.152	0.559	-0.484	-0.713	-0.039	0.926	-1.538	0.986
T_t/Y_t	0.156	0.099	0.744	-1.106	0.100	0.360	0.058	0.993
X_t/Y_t	0.147	0.122	1.278	0.972	0.094	0.595	0.012	0.962
S_t/Y_t	0.009	0.066	-3.032	12.445	0.020	0.101	-0.361	0.877
V_t/Y_t	0.988	0.487	0.461	-0.284	0.962	2.525	0.215	0.982

Table OA.11: Summary statistics of UK data, 1947 to 2022

variable	mean	std	skew	kurt	median	max	min	auto-corr
r_t	0.032	0.067	-0.178	-0.217	0.036	0.169	-0.121	0.058
Δx_t	0.019	0.085	-2.973	19.385	0.020	0.275	-0.502	0.213
$\Delta \tau_t$	0.023	0.039	-0.304	1.118	0.024	0.133	-0.102	0.222
Δv_t	0.014	0.094	0.349	0.560	0.012	0.248	-0.216	0.389
Δy_t	0.024	0.026	-2.025	8.793	0.026	0.083	-0.109	0.053
τv_t	-0.706	0.586	-0.480	-1.029	-0.437	0.160	-2.060	0.984
xv_t	-0.758	0.630	-0.623	-0.770	-0.576	0.157	-2.175	0.989
$\log(1 + S_t/V_t)$	0.018	0.054	-0.619	0.470	0.031	0.123	-0.132	0.815
S_t/V_t	0.020	0.054	-0.457	0.279	0.031	0.130	-0.123	0.820
T_t/V_t	0.574	0.285	0.076	-1.294	0.646	1.173	0.127	0.971
X_t/V_t	0.554	0.283	0.043	-1.275	0.562	1.170	0.114	0.975
fp_t	0.008	0.050	-0.589	0.753	0.012	0.111	-0.163	0.825
τy_t	-1.192	0.075	-0.108	-0.832	-1.173	-1.023	-1.338	0.847
xy_t	-1.244	0.160	0.451	-0.544	-1.256	-0.805	-1.501	0.922
vy_t	-0.486	0.605	0.512	-0.918	-0.746	0.926	-1.370	0.988
T_t/Y_t	0.305	0.023	0.025	-0.766	0.310	0.360	0.262	0.842
X_t/Y_t	0.292	0.048	0.771	0.164	0.285	0.447	0.223	0.913
S_t/Y_t	0.013	0.038	-0.742	1.840	0.015	0.097	-0.130	0.806
V_t/Y_t	0.746	0.508	1.495	2.075	0.475	2.525	0.254	0.990

OA.9 Unit root tests and autocorrelation coefficients

sample	variable	r_t	Δx_t	$\Delta \tau_t$	Δv_t	Δy_t
1841-2022	t-stat	-3.70	-9.06	-5.73	-8.76	-7.77
	p-value	0.004	0.000	0.000	0.000	0.000
	auto-corr	0.05	0.22	0.32	0.42	0.28
1947-2022	t-stat	-6.12	-10.95	-5.88	-5.51	-8.18
	p-value	0.000	0.000	0.000	0.000	0.000
	auto-corr	0.30	0.19	0.23	0.44	0.07

Table OA.12: ADF tests for US samples (1)

sample	variable	τv_t	xv_t	τy_t	xy_t	vy_t
1841-2022	t-stat	-3.04	-3.10	-1.59	-1.35	-2.12
	p-value	0.032	0.027	0.488	0.604	0.238
	auto-corr	0.93	0.96	0.99	0.97	0.99
1947-2022	t-stat	-1.64	-2.67	-4.68	-2.22	-0.87
	p-value	0.462	0.079	0.000	0.199	0.797
	auto-corr	0.97	0.98	0.66	0.81	0.98

Table OA.13: ADF tests for US samples (2)

sample	variable	S_t/V_t	$\log(1 + S_t/V_t)$	fp_t
1841-2022	t-stat	-4.19	-2.95	-5.02
	p-value	0.001	0.040	0.000
	auto-corr	0.59	0.47	0.78
1947-2022	t-stat	-3.82	-3.84	-4.46
	p-value	0.003	0.002	0.000
	auto-corr	0.67	0.67	0.75

Table OA.14: ADF tests for US samples (3)

sample	variable	T_t/V_t	X_t/V_t	T_t/Y_t	X_t/Y_t	S_t/Y_t	V_t/Y_t
1841-2022	t-stat	-5.62	-4.47	-0.61	-1.79	-6.46	-1.13
	p-value	0.000	0.000	0.869	0.384	0.000	0.704
	auto-corr	0.87	0.90	0.99	0.94	0.74	0.99
1947-2022	t-stat	-1.53	-1.68	-4.63	-1.80	-4.02	-0.90
	p-value	0.519	0.439	0.000	0.380	0.001	0.787
	auto-corr	0.96	0.98	0.66	0.80	0.74	0.98

Table OA.15: ADF tests for US samples (4)

sample	variable	r_t	Δx_t	$\Delta \tau_t$	Δv_t	Δy_t
1727-2022	t-stat	-4.63	-8.17	-15.11	-11.15	-17.10
	p-value	0.000	0.000	0.000	0.000	0.000
	auto-corr	0.25	0.31	0.12	0.40	-0.00
1947-2022	t-stat	-7.85	-10.28	-4.61	-5.62	-8.19
	p-value	0.000	0.000	0.000	0.000	0.000
	auto-corr	0.06	0.21	0.22	0.39	0.05

Table OA.16: ADF tests for UK samples (1)

sample	variable	τv_t	xv_t	τy_t	xy_t	vy_t
1727-2022	t-stat	-1.09	-1.54	-1.04	-1.27	-2.26
	p-value	0.719	0.512	0.739	0.642	0.184
	auto-corr	0.99	0.98	0.99	0.97	0.99
1947-2022	t-stat	-2.07	-2.47	-2.33	-1.03	-1.91
	p-value	0.257	0.123	0.163	0.741	0.326
	auto-corr	0.98	0.99	0.85	0.92	0.99

Table OA.17: ADF tests for UK samples (2)

sample	variable	S_t/V_t	$\log(1 + S_t/V_t)$	fp_t
1727-2022	t-stat	-5.71	-5.96	-6.00
	p-value	0.000	0.000	0.000
	auto-corr	0.84	0.81	0.90
1947-2022	t-stat	-3.60	-3.60	-2.50
	p-value	0.006	0.006	0.116
	auto-corr	0.82	0.82	0.82

Table OA.18: ADF tests for UK samples (3)

sample	variable	T_t/V_t	X_t/V_t	T_t/Y_t	X_t/Y_t	S_t/Y_t	V_t/Y_t
1727-2022	t-stat	-2.85	-2.25	-0.50	-2.03	-7.08	-2.56
	p-value	0.052	0.189	0.893	0.274	0.000	0.101
	auto-corr	0.99	0.99	0.99	0.96	0.88	0.98
1947-2022	t-stat	-1.81	-1.83	-2.36	-1.49	-2.65	-0.79
	p-value	0.375	0.364	0.153	0.540	0.084	0.821
	auto-corr	0.97	0.98	0.84	0.91	0.81	0.99

Table OA.19: ADF tests for UK samples (4)

Table OA.20: t-tests for difference between mean growth rates, various samples

The table reports tests of differences in means of time series. The difference between two series is regressed against a constant. The test statistics are reported under the null of the intercept being zero. Standard error is Newey-West with 1 lag.

start year		$\Delta\tau_t - \Delta y_t$	$\Delta x_t - \Delta y_t$	$\Delta\tau_t - \Delta v_t$	$\Delta x_t - \Delta v_t$	$\Delta v_t - \Delta y_t$	$\Delta\tau_t - \Delta x_t$
USA 1841	t-stat	1.205	0.650	-0.704	-0.718	1.437	0.038
	p-value	0.228	0.515	0.481	0.473	0.151	0.969
	1947						
	t-stat	0.384	0.769	0.154	0.630	0.051	-0.412
	p-value	0.701	0.442	0.878	0.529	0.959	0.680
GBR 1727	t-stat	1.171	0.610	0.679	0.490	0.228	-0.202
	p-value	0.242	0.542	0.497	0.624	0.820	0.840
	1947						
	t-stat	0.117	0.251	0.753	0.899	-0.744	-0.166
	p-value	0.907	0.802	0.451	0.369	0.457	0.868

null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	40.15	13.43	15.49	19.93
$r = 1$	$r \geq 2$	8.72	2.71	3.84	6.63
$r = 0$	$r \geq 1$	31.42	12.30	14.26	18.52
$r = 1$	$r \geq 2$	8.72	2.71	3.84	6.63

Table OA.21: Johansen test for $(\tau v_t, x v_t)$, US 1841-2022
Top panel is trace test and bottom panel is eigenvalue test

null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	30.03	13.43	15.49	19.93
$r = 1$	$r \geq 2$	3.57	2.71	3.84	6.63
$r = 0$	$r \geq 1$	26.46	12.30	14.26	18.52
$r = 1$	$r \geq 2$	3.57	2.71	3.84	6.63

Table OA.22: Johansen test for $(\tau v_t, x v_t)$, US 1947-2022
Top panel is trace test and bottom panel is eigenvalue test

null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	32.11	13.43	15.49	19.93
$r = 1$	$r \geq 2$	1.24	2.71	3.84	6.63
$r = 0$	$r \geq 1$	30.87	12.3	14.26	18.52
$r = 1$	$r \geq 2$	1.24	2.71	3.84	6.63

Table OA.23: Johansen test for $(\tau v_t, x v_t)$, UK 1727-2022
Top panel is trace test and bottom panel is eigenvalue test

null	alternative	test-stat	90%	95%	99%
$r = 0$	$r \geq 1$	27.24	13.43	15.49	19.93
$r = 1$	$r \geq 2$	3.62	2.71	3.84	6.63
$r = 0$	$r \geq 1$	23.62	12.3	14.26	18.52
$r = 1$	$r \geq 2$	3.62	2.71	3.84	6.63

Table OA.24: Johansen test for $(\tau v_t, x v_t)$, UK 1947-2022
Top panel is trace test and bottom panel is eigenvalue test

Table OA.25: Other 13 countries: unit-root tests for returns and growth rates

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
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
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
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 OA.26: Other 13 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
CAN	0.154	0.271	-0.079	0.263	0.109
CHE	-0.061	-0.187	-0.073	0.194	-0.110
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 OA.27: Other 13 countries: unit-root tests for ratios

country		vy_t	τy_t	xy_t	τv_t	xv_t	fp_t
AUT	t-stat	-1.840	-1.936	-2.948	-1.790	-1.276	-2.634
	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	-1.600
	p-value	0.201	0.328	0.509	0.062	0.393	0.484
CAN	t-stat	-1.92	-1.546	-2.405	-2.195	-1.766	-2.294
	p-value	0.323	0.511	0.14	0.208	0.397	0.174
CHE	t-stat	-0.669	-1.899	-3.338	-0.786	-0.574	-3.012
	p-value	0.855	0.333	0.013	0.823	0.877	0.034
DEU	t-stat	-2.063	-0.913	-2.037	-1.965	-0.695	-3.508
	p-value	0.259	0.784	0.271	0.302	0.848	0.008
ESP	t-stat	-1.461	-2.423	-1.650	-1.461	-2.123	-2.138
	p-value	0.553	0.135	0.457	0.553	0.235	0.230
FIN	t-stat	-1.365	-2.062	-1.855	-1.316	-1.331	-2.101
	p-value	0.599	0.260	0.354	0.622	0.615	0.244
FRA	t-stat	-1.521	-1.143	-1.313	-1.688	-1.588	-2.810
	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	-3.072
	p-value	0.787	0.915	0.375	0.494	0.719	0.029
IRL	t-stat	-1.893	0.189	-0.833	-1.870	-1.269	-2.447
	p-value	0.335	0.972	0.809	0.346	0.643	0.129
ITA	t-stat	-1.545	-1.121	-1.176	-1.781	-1.541	-2.267
	p-value	0.511	0.707	0.684	0.390	0.513	0.183
NLD	t-stat	-1.491	-2.244	-3.145	-1.639	-1.317	-3.342
	p-value	0.538	0.191	0.023	0.463	0.621	0.013
PRT	t-stat	-1.765	-1.667	-2.891	-1.634	-1.529	-2.828
	p-value	0.398	0.448	0.046	0.465	0.519	0.054

Table OA.28: Other 13 countries: autocorrelations of ratios

country	vy_t	τy_t	xy_t	τv_t	xv_t	fp_t
AUT	0.807	0.675	0.534	0.806	0.851	0.469
BEL	0.670	0.778	0.847	0.573	0.804	0.814
CAN	0.879	0.916	0.687	0.860	0.882	0.748
CHE	0.946	0.678	0.407	0.938	0.959	0.435
DEU	0.774	0.819	0.662	0.772	0.861	0.498
ESP	0.956	0.743	0.812	0.950	0.961	0.792
FIN	0.935	0.578	0.874	0.929	0.936	0.833
FRA	0.954	0.913	0.846	0.939	0.962	0.635
GRC	0.914	0.944	0.804	0.803	0.877	0.619
IRL	0.920	0.943	0.858	0.937	0.932	0.697
ITA	0.878	0.855	0.822	0.838	0.869	0.697
NLD	0.788	0.639	0.583	0.819	0.798	0.649
PRT	0.963	0.889	0.662	0.948	0.968	0.454

OA.10 Results for US and UK

OA.10.1 VAR coefficient estimates

We report the estimated VAR(1) coefficients for the post-war samples beginning in 1947, using the same five-variable system $(r_t, \Delta\tau_t, \Delta y_t, fp_t, fp_{t-1})$ and the same conventions as Tables 3 and 4 in the main text. The first four columns report the directly estimated coefficients; the last two columns show the imputed coefficients for spending growth and spending growth minus tax growth, $\Delta x_{t+1} - \Delta\tau_{t+1}$.

Table OA.29: VAR coefficient estimates. US data, 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.313 [0.123]	−0.103 [0.119]	0.091 [0.054]	−0.040 [0.062]	0.060 [0.202]	0.163 [0.241]
$\Delta\tau_t$	−0.105 [0.115]	0.177 [0.110]	0.019 [0.050]	0.005 [0.058]	0.150 [0.188]	−0.027 [0.224]
Δy_t	0.056 [0.279]	1.918 [0.268]	0.267 [0.122]	0.588 [0.141]	−0.314 [0.457]	−2.232 [0.545]
fp_t	0.502 [0.253]	−0.941 [0.243]	−0.284 [0.111]	0.583 [0.128]	0.612 [0.414]	1.553 [0.494]
fp_{t-1}	−0.274 [0.243]	0.591 [0.233]	0.297 [0.106]	0.112 [0.123]	0.148 [0.398]	−0.443 [0.474]
R^2	16.07%	52.13%	16.84%	73.75%	20.93%	37.10%

Table OA.30: VAR coefficient estimates. UK data, 1947–2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

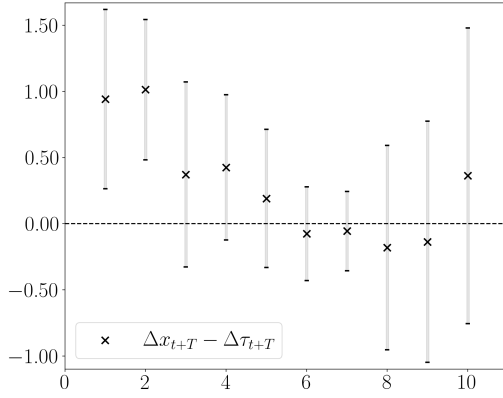
	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.097 [0.110]	-0.134 [0.066]	0.132 [0.048]	-0.092 [0.035]	0.081 [0.071]	0.215 [0.087]
$\Delta\tau_t$	0.731 [0.216]	0.241 [0.130]	0.026 [0.095]	0.122 [0.070]	-0.060 [0.140]	-0.302 [0.170]
Δy_t	-1.147 [0.266]	0.371 [0.161]	-0.075 [0.117]	0.818 [0.086]	-1.550 [0.173]	-1.921 [0.210]
fp_t	-0.127 [0.285]	-0.097 [0.172]	0.045 [0.126]	0.780 [0.092]	0.450 [0.185]	0.547 [0.225]
fp_{t-1}	-0.070 [0.289]	-0.123 [0.174]	0.093 [0.127]	-0.056 [0.093]	0.010 [0.187]	0.133 [0.228]
R^2	32.28%	15.89%	12.26%	87.67%	59.22%	60.46%

OA.10.2 Local projection and cumulative figures, post-war sample

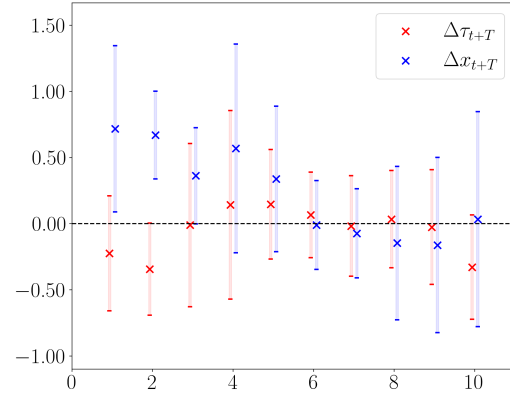
For the post-war samples beginning in 1947, the following figures reproduce, for the US and the UK, the two figure styles used for the long samples in the main text: the period-specific local-projection coefficients and the cumulative fiscal-position plots.

Figure OA.17: What does the US fiscal position predict? US data 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

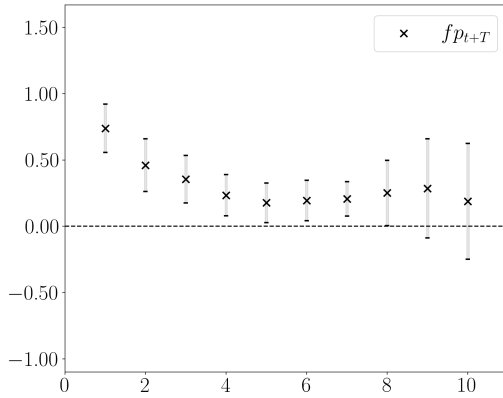
This figure plots estimated slope coefficients (with ± 2 Newey–West standard error bands) from regressions $\theta_{t+j} = \alpha + \beta_{\theta,j} fp_t + \varepsilon_{\theta,t+j}$, for $j = 1, \dots, 10$, where the variables θ_{t+j} are indicated in the legend of each subfigure. US data 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.



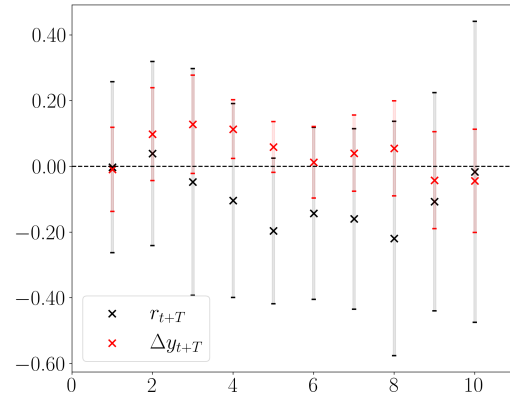
(a) Spending minus tax growth



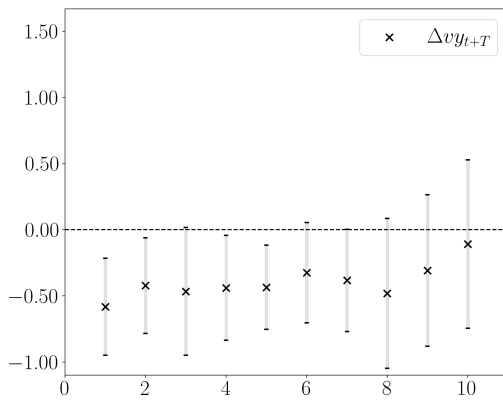
(b) Tax and Spending Growth



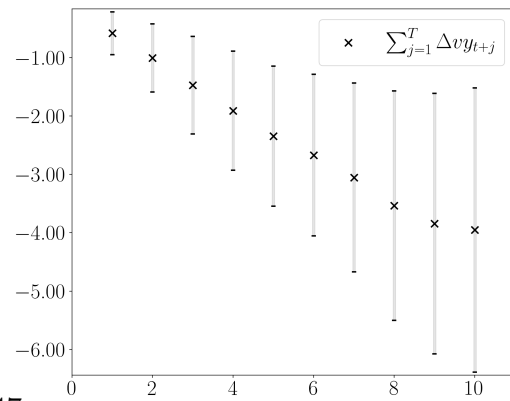
(c) Future fp



(d) Return and GDP Growth



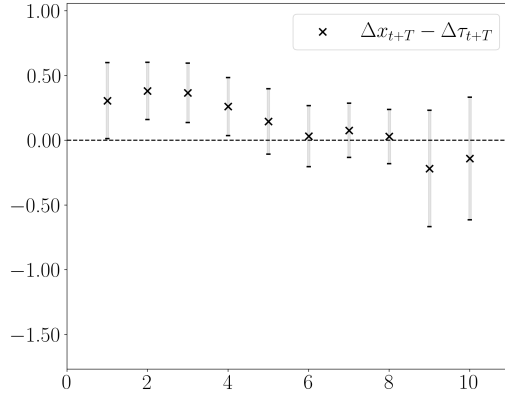
(e) Debt-GDP Growth



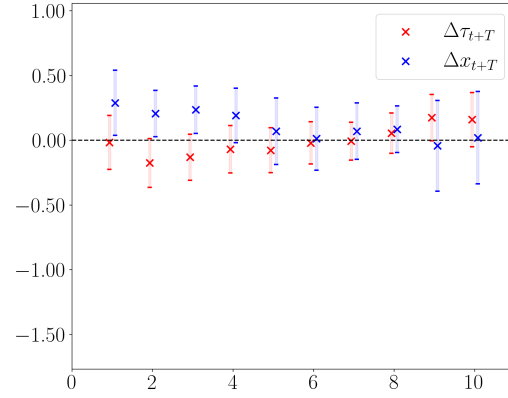
(f) Cumulative Debt-GDP Growth

Figure OA.18: What does the UK fiscal position predict? UK data 1947–2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

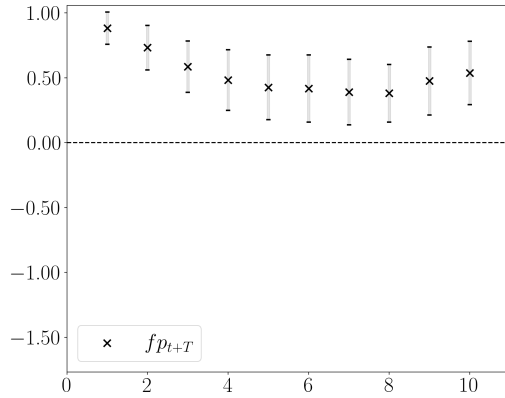
This figure plots estimated slope coefficients (with ± 2 Newey–West standard error bands) from regressions $\theta_{t+j} = \alpha + \beta_{\theta,j} fp_t + \varepsilon_{\theta,t+j}$, for $j = 1, \dots, 10$, where the variables θ_{t+j} are indicated in the legend of each subfigure. UK data 1947–2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.



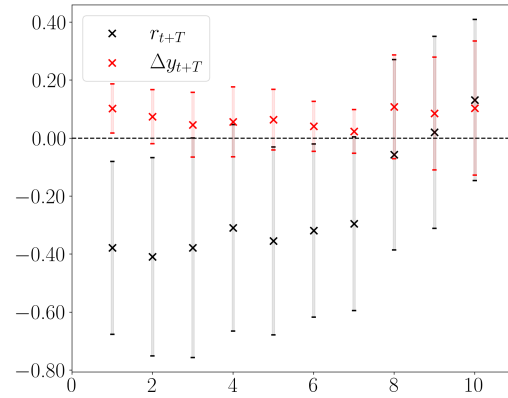
(a) Spending minus Tax Growth



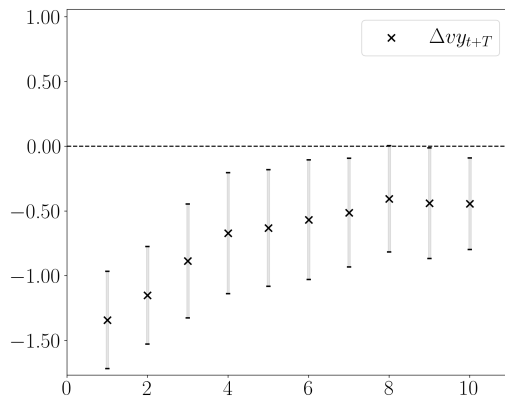
(b) Tax and Spending Growth



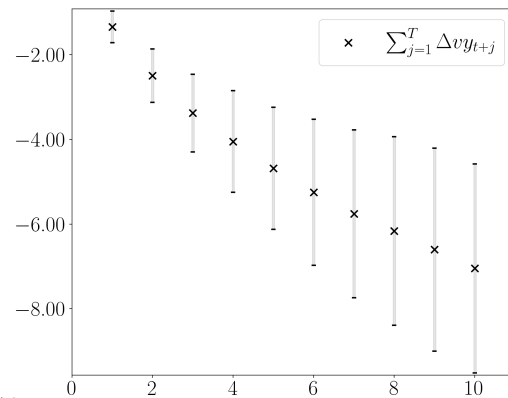
(c) Future fp



(d) Return and GDP Growth



(e) Debt-GDP Growth



(f) Cumulative Debt-GDP Growth

Figure OA.19: The fiscal position and subsequent fiscal adjustment and returns. US data 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

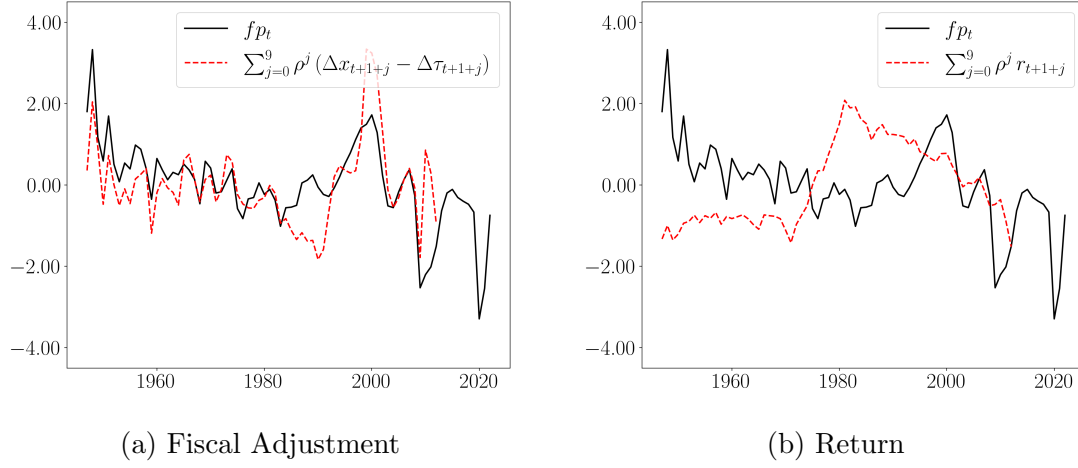
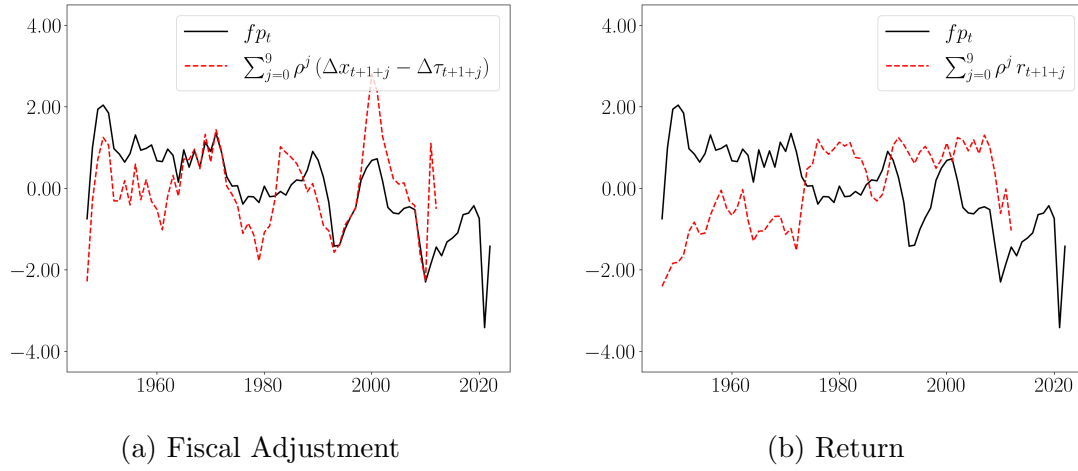


Figure OA.20: The fiscal position and subsequent fiscal adjustment and returns. UK data 1947–2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.



OA.10.3 Local projections, post-war sample

horizon	return	tax	spending	future fp
1	-0.2 [0.2]	8.1 [4.9]	18.4 [7.0]	73.9 [7.2]
3	-0.1 [0.4]	14.6 [13.3]	42.7 [10.9]	43.1 [10.7]
10	1.0 [1.6]	15.3 [23.7]	63.5 [21.5]	20.7 [27.5]

Table OA.31: Local projections for the fiscal position, US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

Standard error is using Newey-West (HAC) with lags $T + 1$.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	25.3 [21.3]	0.6 [4.8]	7.9 [4.2]	18.6 [6.9]	30.5 [24.8]	30.2 [24.6]
3	2.6 [15.0]	-8.6 [4.1]	14.7 [6.9]	27.0 [9.2]	51.8 [16.0]	152.5 [47.0]
10	-9.7 [15.4]	-4.0 [3.1]	18.0 [13.2]	49.0 [12.0]	41.7 [18.8]	395.4 [178.1]

Table OA.32: Local projections for debt growth, US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

The last column reports the contribution of cumulative change $vy_{t+T} - vy_t$. Standard errors are computed using Newey-West (HAC) with lags $T + 1$.

horizon	return	tax	spending	future fp
1	-0.1 [0.2]	2.6 [3.7]	14.8 [4.7]	82.6 [6.4]
3	-0.8 [0.3]	9.0 [9.2]	30.6 [7.3]	61.0 [9.9]
10	-2.0 [0.8]	5.1 [24.7]	46.5 [17.7]	49.3 [11.5]

Table OA.33: Local projections for the fiscal position, UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

Standard error is using Newey-West (HAC) with lags $T + 1$.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	-13.0 [17.5]	-6.3 [4.5]	5.3 [3.3]	12.2 [5.8]	94.4 [26.2]	95.2 [26.4]
3	-30.0 [9.9]	-9.1 [4.0]	13.2 [6.0]	13.4 [7.0]	103.0 [14.2]	314.4 [43.2]
10	-23.9 [9.4]	-7.0 [4.1]	29.1 [12.0]	21.6 [14.4]	67.2 [15.1]	704.8 [158.3]

Table OA.34: Local projections for debt growth, UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

The last column reports the contribution of cumulative change $vy_{t+T} - vy_t$. Standard errors are computed using Newey-West (HAC) with lags $T + 1$.

OA.10.4 Variance decomposition for fp_t , post-war sample

horizon	return	tax	spending	future fp
1	-0.2 [0.1]	4.7 [2.8]	20.2 [4.8]	75.3 [5.7]
3	-0.6 [0.3]	8.0 [9.9]	47.4 [10.5]	45.1 [12.2]
10	-1.1 [0.9]	-1.3 [24.4]	89.7 [19.9]	12.7 [12.2]
∞	-1.3 [8.5]	-4.4 [412.7]	105.7 [420.8]	—

Table OA.35: VAR-implied decomposition (24) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	25.6 [11.3]	1.9 [4.9]	4.2 [2.5]	20.7 [5.3]	47.5 [16.9]	47.1 [16.8]
3	20.0 [11.9]	-6.5 [4.4]	9.9 [5.0]	32.4 [8.1]	44.2 [18.6]	130.1 [54.6]
10	10.8 [8.7]	-5.0 [3.5]	11.6 [11.4]	54.3 [12.9]	28.2 [16.5]	268.0 [156.5]
∞	—	—	12.5 [30.7]	84.5 [28.5]	3.0 [3.9]	315.3 [402.4]

Table OA.36: VAR-implied decomposition (26) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$.

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	-0.1 [0.1]	3.9 [3.3]	13.9 [3.4]	82.3 [4.0]
3	-0.8 [0.3]	16.5 [11.4]	29.8 [9.7]	54.5 [13.8]
10	-1.8 [0.7]	33.2 [21.2]	57.2 [16.6]	11.4 [16.3]
∞	-2.0 [8.5]	37.7 [116.6]	64.3 [118.7]	—

Table OA.37: VAR-implied decomposition (24) of the fiscal position, fp_t , UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	-16.2 [13.1]	-7.7 [5.7]	7.2 [3.6]	10.7 [3.8]	106.0 [13.5]	106.9 [13.6]
3	-30.8 [12.6]	-7.6 [5.6]	17.4 [7.1]	16.1 [9.0]	104.9 [16.4]	320.1 [50.0]
10	-21.4 [8.4]	-3.6 [4.5]	34.2 [14.0]	30.2 [19.1]	60.6 [22.3]	636.2 [234.4]
∞	-2.0 [2.1]	-0.3 [1.2]	54.1 [53.6]	48.3 [51.2]	—	725.6 [5621.5]

Table OA.38: VAR-implied decomposition (26) of the fiscal position, fp_t , UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$.

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

OA.10.5 Sensitivity analysis for ρ and a

ρ	r	a	approx. error	λ_{max}	return	tax	spending
1.010	0.025	0.392	6.696	0.652	-0.1	47.5	52.6
		2.224	134.207	0.604	-0.0	50.6	49.4
		0.086	10.419	0.894	-1.0	32.9	68.2
1.005	0.030	0.394	6.455	0.623	-0.0	48.8	51.3
		2.224	132.017	0.602	-0.0	50.3	49.7
		0.086	10.073	0.790	-0.2	40.4	59.8
0.999	0.036	0.398	6.228	0.596	0.0	50.4	49.6
		2.224	129.421	0.599	0.0	50.0	50.0
		0.086	9.813	0.597	0.0	52.2	47.7
0.995	0.040	0.402	6.114	0.591	0.1	51.5	48.5
		2.224	127.708	0.597	0.0	49.9	50.1
		0.086	9.740	0.765	0.6	61.1	38.4
0.990	0.045	0.408	6.013	0.601	0.1	52.8	47.1
		2.224	125.588	0.595	0.0	49.6	50.3
		0.086	9.765	0.905	2.6	70.2	27.2
0.980	0.055	0.425	5.945	0.654	0.5	55.0	44.5
		2.224	121.419	0.588	0.0	49.2	50.7
		0.086	10.235	0.978	11.5	66.2	22.2
0.970	0.065	0.446	6.050	0.713	1.2	56.5	42.3
		2.224	117.344	0.579	0.0	48.9	51.1
		0.086	11.323	0.993	18.4	45.4	36.3
0.960	0.076	0.472	6.312	0.761	2.3	57.0	40.7
		2.224	113.364	0.565	0.1	48.5	51.4
		0.086	13.121	0.997	20.7	30.2	49.2

Table OA.39: Sensitivity of the infinite-horizon VAR-implied decomposition (24) of the fiscal position, fp_t , to ρ and a , US data, 1841 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample.

ρ	r	a	approx. error	λ_{max}	return	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1.010	0.025	0.392	6.696	0.652	—	—	51.1	46.4	2.5	246.5
		2.224	134.207	0.604	—	—	54.3	43.5	2.2	224.5
		0.086	10.419	0.894	—	—	35.4	56.9	7.7	774.5
1.005	0.030	0.394	6.455	0.623	—	—	52.8	46.0	1.2	233.7
		2.224	132.017	0.602	—	—	54.4	44.5	1.1	223.8
		0.086	10.073	0.790	—	—	44.3	53.7	2.1	410.6
0.999	0.036	0.398	6.228	0.596	0.0	-0.0	54.8	45.2	—	224.0
		2.224	129.421	0.599	0.0	-0.0	54.4	45.6	—	223.1
		0.086	9.813	0.597	0.0	-0.1	56.6	43.4	—	225.4
0.995	0.040	0.402	6.114	0.591	0.1	-0.1	55.8	44.2	—	221.2
		2.224	127.708	0.597	0.0	-0.0	54.2	45.8	—	222.6
		0.086	9.740	0.765	0.6	-0.3	65.4	34.3	—	303.4
0.990	0.045	0.408	6.013	0.601	0.1	-0.1	57.0	42.9	—	221.9
		2.224	125.588	0.595	0.0	-0.0	53.9	46.1	—	222.0
		0.086	9.765	0.905	2.6	-0.5	74.2	23.7	—	706.0
0.980	0.055	0.425	5.945	0.654	0.5	-0.2	59.1	40.6	—	236.0
		2.224	121.419	0.588	0.0	-0.0	53.4	46.6	—	220.8
		0.086	10.235	0.978	11.5	-0.6	68.7	20.3	—	3100.1
0.970	0.065	0.446	6.050	0.713	1.2	-0.3	60.4	38.7	—	263.5
		2.224	117.344	0.579	0.0	-0.1	52.9	47.1	—	219.7
		0.086	11.323	0.993	18.4	-0.4	46.5	35.5	—	9795.4
0.960	0.076	0.472	6.312	0.761	2.3	-0.3	60.6	37.4	—	299.0
		2.224	113.364	0.565	0.1	-0.1	52.4	47.6	—	218.5
		0.086	13.121	0.997	20.7	-0.3	30.7	48.9	—	28871.6

Table OA.40: Sensitivity of the infinite-horizon VAR-implied decomposition (26) of the fiscal position, fp_t , to ρ and a , US data, 1841 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The columns from return to $-\Delta vy$ sum to 100; — marks a component that is zero by construction; n.a. marks an entry whose infinite sum does not converge because $\lambda_{max} \geq 1$.

ρ	r	a	approx. error	λ_{max}	return	tax	spending
1.010	0.020	0.264	0.074	0.825	-1.3	-4.6	105.9
		0.672	0.488	0.789	-0.6	0.8	99.8
		0.118	0.141	0.929	-2.6	-12.8	115.4
1.005	0.025	0.233	0.034	0.796	-0.7	-1.0	101.7
		0.672	0.478	0.796	-0.3	3.0	97.3
		0.118	0.068	0.857	-1.0	-5.9	106.9
0.999	0.031	0.208	0.018	0.827	0.3	7.2	92.5
		0.672	0.481	0.816	0.1	5.9	94.0
		0.118	0.035	0.844	0.5	9.0	90.5
0.995	0.035	0.208	0.029	0.900	2.2	15.9	81.9
		0.672	0.491	0.833	0.4	8.1	91.5
		0.118	0.048	0.958	6.5	30.4	63.1
0.990	0.040	0.228	0.071	0.952	7.0	26.6	66.4
		0.672	0.513	0.858	1.1	10.9	88.0
		0.118	0.104	0.995	29.2	60.4	10.4
0.980	0.050	0.295	0.228	0.980	17.3	32.7	50.0
		0.672	0.590	0.907	3.8	16.7	79.6
		0.118	0.361	1.004	39.6	27.8	32.6
0.970	0.061	0.372	0.455	0.987	23.0	28.9	48.1
		0.672	0.713	0.943	8.7	21.3	70.0
		0.118	0.825	1.003	32.1	10.8	57.1
0.960	0.071	0.450	0.728	0.991	25.9	24.6	49.5
		0.672	0.885	0.967	15.2	23.2	61.6
		0.118	1.521	1.002	28.4	5.5	66.1

Table OA.41: Sensitivity of the infinite-horizon VAR-implied decomposition (24) of the fiscal position, fp_t , to ρ and a , US data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample.

ρ	r	a	approx.	error	λ_{max}	return	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1.010	0.020	0.264	0.074	0.825	—	—	12.2	84.6	3.2	320.8	
		0.672	0.488	0.789	—	—	20.8	76.7	2.5	253.0	
		0.118	0.141	0.929	—	—	0.3	88.4	11.2	1123.6	
1.005	0.025	0.233	0.034	0.796	—	—	17.4	81.4	1.2	239.7	
		0.672	0.478	0.796	—	—	23.7	75.0	1.3	268.3	
		0.118	0.068	0.857	—	—	9.4	88.3	2.3	466.7	
0.999	0.031	0.208	0.018	0.827	0.3	-0.1	29.8	70.1	—	233.9	
		0.672	0.481	0.816	0.1	-0.0	27.7	72.2	—	304.3	
		0.118	0.035	0.844	0.5	-0.2	32.5	67.2	—	141.6	
0.995	0.035	0.208	0.029	0.900	2.2	-0.6	42.5	56.0	—	467.6	
		0.672	0.491	0.833	0.4	-0.2	30.5	69.3	—	341.6	
		0.118	0.048	0.958	6.5	-1.4	63.8	31.1	—	1017.4	
0.990	0.040	0.228	0.071	0.952	7.0	-1.3	56.2	38.1	—	1143.9	
		0.672	0.513	0.858	1.1	-0.3	34.0	65.3	—	407.3	
		0.118	0.104	0.995	29.2	-3.2	98.0	-24.1	—	11555.9	
0.980	0.050	0.295	0.228	0.980	17.3	-1.8	58.3	26.2	—	3044.4	
		0.672	0.590	0.907	3.8	-0.7	40.2	56.7	—	626.6	
		0.118	0.361	1.004	39.6	-1.4	35.9	25.8	—	n.a.	
0.970	0.061	0.372	0.455	0.987	23.0	-1.6	47.7	30.9	—	4971.9	
		0.672	0.713	0.943	8.7	-1.0	43.3	49.0	—	1031.6	
		0.118	0.825	1.003	32.1	-0.3	12.1	56.1	—	n.a.	
0.960	0.071	0.450	0.728	0.991	25.9	-1.3	38.3	37.0	—	6913.8	
		0.672	0.885	0.967	15.2	-1.1	41.6	44.4	—	1779.6	
		0.118	1.521	1.002	28.4	0.0	5.5	66.1	—	n.a.	

Table OA.42: Sensitivity of the infinite-horizon VAR-implied decomposition (26) of the fiscal position, fp_t , to ρ and a , US data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The columns from return to $-\Delta vy$ sum to 100; — marks a component that is zero by construction; n.a. marks an entry whose infinite sum does not converge because $\lambda_{max} \geq 1$.

ρ	r	a	approx. error	λ_{max}	return	tax	spending
1.010	0.008	0.091	2.251	0.950	-5.7	3.8	101.9
		1.173	84.793	0.822	-0.3	12.0	88.2
		0.063	2.316	0.968	-10.8	-0.7	111.5
1.005	0.013	0.097	1.592	0.905	-1.6	7.9	93.8
		1.173	81.555	0.816	-0.1	12.0	88.1
		0.063	1.676	0.936	-2.7	5.3	97.5
0.999	0.019	0.118	1.156	0.788	0.2	12.8	87.0
		1.173	77.792	0.808	0.0	12.0	88.0
		0.063	1.367	0.764	0.4	13.7	86.0
0.995	0.023	0.137	1.043	0.732	0.8	15.4	83.8
		1.173	75.359	0.803	0.1	12.0	87.9
		0.063	1.452	0.854	2.1	21.2	76.7
0.990	0.028	0.163	1.062	0.763	1.6	17.5	80.9
		1.173	72.401	0.796	0.1	12.1	87.7
		0.063	1.904	0.967	6.6	28.2	65.2
0.980	0.038	0.219	1.507	0.837	3.5	19.4	77.1
		1.173	66.773	0.781	0.2	12.3	87.5
		0.063	4.048	0.995	15.4	18.3	66.3
0.970	0.048	0.274	2.364	0.871	5.7	19.4	74.9
		1.173	61.531	0.764	0.3	12.5	87.2
		0.063	8.051	0.998	16.5	8.5	75.0
0.960	0.058	0.329	3.535	0.889	7.8	18.7	73.5
		1.173	56.684	0.745	0.4	12.8	86.8
		0.063	14.281	0.999	15.8	3.9	80.2

Table OA.43: Sensitivity of the infinite-horizon VAR-implied decomposition (24) of the fiscal position, fp_t , to ρ and a , UK data, 1727 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample.

ρ	r	a	approx. error	λ_{max}	return	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1.010	0.008	0.091	2.251	0.950	—	—	10.3	73.7	16.0	1596.4
		1.173	84.793	0.822	—	—	19.8	74.7	5.5	551.7
		0.063	2.316	0.968	—	—	6.4	68.4	25.2	2518.3
1.005	0.013	0.097	1.592	0.905	—	—	15.1	80.8	4.1	825.6
		1.173	81.555	0.816	—	—	20.0	77.3	2.7	538.4
		0.063	1.676	0.936	—	—	12.2	81.9	5.9	1171.9
0.999	0.019	0.118	1.156	0.788	0.2	-0.1	21.1	78.8	—	367.8
		1.173	77.792	0.808	0.0	-0.0	20.2	79.8	—	522.6
		0.063	1.367	0.764	0.4	-0.1	22.1	77.6	—	224.3
0.995	0.023	0.137	1.043	0.732	0.8	-0.3	24.0	75.5	—	306.9
		1.173	75.359	0.803	0.1	-0.0	20.2	79.8	—	512.3
		0.063	1.452	0.854	2.1	-0.7	30.6	68.1	—	426.5
0.990	0.028	0.163	1.062	0.763	1.6	-0.6	26.5	72.5	—	340.1
		1.173	72.401	0.796	0.1	-0.1	20.1	79.8	—	499.6
		0.063	1.904	0.967	6.6	-1.4	36.9	57.8	—	2415.7
0.980	0.038	0.219	1.507	0.837	3.5	-0.8	28.2	69.1	—	478.6
		1.173	66.773	0.781	0.2	-0.1	20.1	79.8	—	475.0
		0.063	4.048	0.995	15.4	-1.0	21.5	64.1	—	17333.4
0.970	0.048	0.274	2.364	0.871	5.7	-0.9	27.7	67.5	—	595.4
		1.173	61.531	0.764	0.3	-0.2	20.2	79.7	—	451.7
		0.063	8.051	0.998	16.5	-0.5	9.5	74.5	—	52511.0
0.960	0.058	0.329	3.535	0.889	7.8	-1.0	26.4	66.8	—	679.6
		1.173	56.684	0.745	0.4	-0.3	20.4	79.5	—	430.2
		0.063	14.281	0.999	15.8	-0.2	4.2	80.1	—	89992.7

Table OA.44: Sensitivity of the infinite-horizon VAR-implied decomposition (26) of the fiscal position, fp_t , to ρ and a , UK data, 1727 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The columns from return to $-\Delta vy$ sum to 100; — marks a component that is zero by construction; n.a. marks an entry whose infinite sum does not converge because $\lambda_{max} \geq 1$.

ρ	r	a	approx. error	λ_{max}	return	tax	spending
1.010	0.014	0.308	0.108	0.925	-0.6	18.9	81.7
		1.173	1.111	0.865	0.4	29.0	70.6
		0.127	0.154	0.971	-11.9	2.5	109.4
1.005	0.019	0.324	0.082	0.892	0.6	23.6	75.8
		1.173	1.045	0.857	0.3	29.1	70.7
		0.127	0.131	0.946	-0.8	12.4	88.4
0.999	0.025	0.363	0.067	0.842	-0.2	30.4	69.8
		1.173	0.970	0.848	-0.1	29.4	70.7
		0.127	0.145	0.821	-0.7	34.2	66.5
0.995	0.029	0.396	0.065	0.816	-1.2	34.6	66.6
		1.173	0.923	0.842	-0.4	29.7	70.7
		0.127	0.180	0.907	-5.6	57.7	47.9
0.990	0.034	0.440	0.070	0.804	-2.3	38.8	63.5
		1.173	0.867	0.834	-0.8	30.2	70.6
		0.127	0.254	0.982	-6.8	68.7	38.1
0.980	0.044	0.529	0.095	0.821	-3.0	43.5	59.5
		1.173	0.765	0.818	-1.8	31.5	70.3
		0.127	0.510	0.997	10.7	24.0	65.3
0.970	0.054	0.616	0.132	0.849	-1.6	44.5	57.1
		1.173	0.678	0.802	-2.8	33.2	69.5
		0.127	0.924	0.998	17.2	9.2	73.7
0.960	0.065	0.698	0.176	0.871	1.2	43.3	55.5
		1.173	0.604	0.790	-3.2	35.0	68.3
		0.127	1.512	0.998	19.4	4.9	75.7

Table OA.45: Sensitivity of the infinite-horizon VAR-implied decomposition (24) of the fiscal position, fp_t , to ρ and a , UK data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample.

ρ	r	a	approx.	error	λ_{max}	return	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1.010	0.014	0.308	0.108	0.925	—	—	—	35.1	52.4	12.5	1253.5
		1.173	1.111	0.865	—	—	—	45.5	47.5	7.1	708.1
		0.127	0.154	0.971	—	—	—	18.6	54.0	27.4	2742.8
1.005	0.019	0.324	0.082	0.892	—	—	—	41.2	53.8	5.1	1014.8
		1.173	1.045	0.857	—	—	—	46.4	50.1	3.4	687.3
		0.127	0.131	0.946	—	—	—	29.6	61.4	9.0	1798.2
0.999	0.025	0.363	0.067	0.842	-0.2	-0.0	-0.0	48.3	51.9	—	824.6
		1.173	0.970	0.848	-0.1	-0.0	-0.0	47.4	52.7	—	662.4
		0.127	0.145	0.821	-0.7	-0.1	-0.1	51.9	49.0	—	1347.6
0.995	0.029	0.396	0.065	0.816	-1.2	-0.2	-0.2	51.6	49.8	—	758.4
		1.173	0.923	0.842	-0.4	-0.1	-0.1	47.1	53.3	—	646.0
		0.127	0.180	0.907	-5.6	-0.6	-0.6	71.7	34.5	—	2331.7
0.990	0.034	0.440	0.070	0.804	-2.3	-0.4	-0.4	54.8	47.9	—	717.5
		1.173	0.867	0.834	-0.8	-0.1	-0.1	47.1	53.9	—	625.7
		0.127	0.254	0.982	-6.8	-0.3	-0.3	72.0	35.1	—	6848.0
0.980	0.044	0.529	0.095	0.821	-3.0	-0.5	-0.5	57.4	46.1	—	697.1
		1.173	0.765	0.818	-1.8	-0.3	-0.3	47.4	54.7	—	587.0
		0.127	0.510	0.997	10.7	0.6	0.6	20.5	68.3	—	27715.8
0.970	0.054	0.616	0.132	0.849	-1.6	-0.6	-0.6	56.3	45.9	—	699.8
		1.173	0.678	0.802	-2.8	-0.4	-0.4	48.1	55.1	—	551.6
		0.127	0.924	0.998	17.2	0.4	0.4	7.4	75.0	—	36400.2
0.960	0.065	0.698	0.176	0.871	1.2	-0.6	-0.6	53.0	46.4	—	704.5
		1.173	0.604	0.790	-3.2	-0.5	-0.5	48.8	54.9	—	521.3
		0.127	1.512	0.998	19.4	0.3	0.3	4.0	76.3	—	34164.9

Table OA.46: Sensitivity of the infinite-horizon VAR-implied decomposition (26) of the fiscal position, fp_t , to ρ and a , UK data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The columns from return to $-\Delta vy$ sum to 100; — marks a component that is zero by construction; n.a. marks an entry whose infinite sum does not converge because $\lambda_{max} \geq 1$.

OA.10.6 More state variables for US post-war sample

Table OA.47: VAR coefficient estimates. US data, 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$; system including the tax-GDP ratio τy_t .

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	τy_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.269 [0.124]	-0.043 [0.112]	0.118 [0.054]	-0.084 [0.063]	-0.161 [0.102]	0.276 [0.190]	0.318 [0.244]
$\Delta\tau_t$	-0.204 [0.119]	0.297 [0.107]	0.050 [0.052]	-0.028 [0.060]	0.246 [0.098]	0.383 [0.182]	0.086 [0.235]
Δy_t	0.333 [0.292]	1.554 [0.264]	0.190 [0.128]	0.655 [0.148]	1.364 [0.241]	-0.906 [0.448]	-2.460 [0.577]
fp_t	0.351 [0.254]	-0.755 [0.229]	-0.239 [0.111]	0.539 [0.129]	-0.516 [0.209]	0.954 [0.389]	1.709 [0.502]
fp_{t-1}	-0.273 [0.239]	0.495 [0.215]	0.285 [0.105]	0.128 [0.121]	0.210 [0.197]	0.004 [0.366]	-0.491 [0.471]
τy_t	0.222 [0.091]	-0.296 [0.082]	-0.068 [0.040]	0.067 [0.046]	0.772 [0.075]	-0.525 [0.140]	-0.229 [0.181]
R^2	21.98%	58.89%	20.18%	74.73%	72.88%	35.09%	39.46%

horizon	return	tax	spending	future fp
1	-0.2 [0.1]	5.6 [2.5]	19.5 [4.4]	75.2 [5.6]
3	-0.4 [0.3]	10.3 [7.4]	45.4 [9.1]	44.8 [12.4]
10	-0.6 [0.9]	-2.3 [10.2]	90.6 [7.6]	12.3 [12.2]
∞	-0.7 [2.1]	-4.6 [29.8]	105.3 [31.4]	—

Table OA.48: VAR-implied decomposition (24) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with τy_t added as a state variable in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	21.2 [11.1]	1.5 [4.7]	5.2 [2.3]	19.9 [5.1]	52.3 [16.9]	51.8 [16.8]
3	14.8 [11.1]	-6.7 [4.2]	11.7 [3.9]	30.6 [7.6]	49.6 [17.6]	146.0 [51.9]
10	5.9 [8.4]	-5.1 [3.2]	11.5 [3.4]	54.4 [10.2]	33.2 [15.4]	315.5 [145.8]
∞	—	—	12.5 [0.0]	84.0 [3.4]	3.5 [3.4]	366.3 [347.7]

Table OA.49: VAR-implied decomposition (26) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with τy_t added as a state variable in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction. With τy_t in the state vector, the infinite-horizon $-\Delta \tau y$ contribution depends only on the sample covariance of τy_t with fp_t , not on the VAR coefficients, so its bootstrap standard error is zero.

Table OA.50: VAR coefficient estimates. US data, 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$; system including the real short rate $yr_{1,t}$ and the 1–10yr yield spread $spr_{1 \rightarrow 10,t}$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	$yr_{1,t+1}$	$spr_{1 \rightarrow 10,t+1}$	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.029 [0.128]	−0.094 [0.137]	0.057 [0.062]	−0.157 [0.070]	−0.002 [0.043]	0.033 [0.021]	0.481 [0.220]	0.575 [0.274]
$\Delta\tau_t$	−0.053 [0.106]	0.181 [0.113]	0.046 [0.051]	0.020 [0.058]	0.005 [0.036]	−0.000 [0.018]	0.101 [0.182]	−0.081 [0.226]
Δy_t	−0.280 [0.256]	1.991 [0.275]	0.259 [0.125]	0.475 [0.140]	−0.071 [0.086]	−0.129 [0.043]	0.158 [0.441]	−1.834 [0.550]
fp_t	0.490 [0.223]	−0.950 [0.239]	−0.289 [0.108]	0.580 [0.122]	0.211 [0.075]	0.017 [0.037]	0.618 [0.383]	1.568 [0.478]
fp_{t-1}	−0.363 [0.216]	0.617 [0.232]	0.329 [0.105]	0.105 [0.118]	−0.146 [0.073]	−0.005 [0.036]	0.206 [0.372]	−0.411 [0.464]
$yr_{1,t}$	1.313 [0.268]	−0.330 [0.288]	0.052 [0.131]	0.383 [0.146]	0.722 [0.090]	0.031 [0.045]	−1.669 [0.462]	−1.339 [0.576]
$spr_{1 \rightarrow 10,t}$	1.708 [0.643]	0.091 [0.689]	0.529 [0.313]	0.564 [0.350]	0.271 [0.217]	0.509 [0.108]	−1.885 [1.105]	−1.975 [1.378]
R^2	40.19%	53.41%	20.54%	75.79%	57.64%	48.55%	34.49%	42.87%

horizon	return	tax	spending	future fp
1	-0.1 [0.1]	5.1 [2.8]	21.8 [4.4]	73.3 [5.6]
3	-0.4 [0.3]	8.8 [9.6]	46.6 [9.8]	44.9 [12.3]
10	-0.7 [0.9]	-3.3 [23.3]	90.4 [20.9]	13.6 [13.5]
∞	-0.7 [10.3]	-7.7 [329.7]	108.5 [332.9]	—

Table OA.51: VAR-implied decomposition (24) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with the short rate and yield spread added as state variables in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	15.3 [9.9]	2.2 [4.9]	4.5 [2.5]	22.4 [5.0]	55.6 [16.9]	55.1 [16.7]
3	12.7 [8.8]	-6.6 [4.2]	10.4 [4.7]	32.6 [7.5]	50.8 [17.7]	149.5 [52.2]
10	6.5 [8.8]	-5.5 [3.2]	11.8 [10.6]	53.7 [12.7]	33.5 [17.3]	317.6 [164.0]
∞	—	—	11.3 [34.4]	85.0 [33.2]	3.7 [5.6]	381.3 [584.5]

Table OA.52: VAR-implied decomposition (26) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with the short rate and yield spread added as state variables in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

Table OA.53: VAR coefficient estimates. US data, 1947–2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$; system including the tax-GDP ratio τy_t , the real short rate $yr_{1,t}$, and the 1–10yr yield spread $spr_{1 \rightarrow 10,t}$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	τy_{t+1}	$yr_{1,t+1}$	$spr_{1 \rightarrow 10,t+1}$	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.019 [0.128]	-0.054 [0.128]	0.066 [0.061]	-0.161 [0.070]	-0.120 [0.117]	-0.005 [0.043]	0.033 [0.022]	0.533 [0.212]	0.587 [0.277]
$\Delta\tau_t$	-0.082 [0.111]	0.302 [0.111]	0.076 [0.053]	0.009 [0.061]	0.227 [0.101]	-0.004 [0.037]	-0.000 [0.019]	0.258 [0.184]	-0.045 [0.241]
Δy_t	-0.157 [0.297]	1.483 [0.298]	0.136 [0.142]	0.520 [0.162]	1.347 [0.271]	-0.031 [0.100]	-0.130 [0.050]	-0.501 [0.492]	-1.984 [0.643]
fp_t	0.438 [0.231]	-0.735 [0.232]	-0.237 [0.111]	0.561 [0.126]	-0.498 [0.211]	0.194 [0.078]	0.017 [0.039]	0.897 [0.383]	1.632 [0.501]
fp_{t-1}	-0.328 [0.220]	0.471 [0.220]	0.294 [0.105]	0.118 [0.120]	0.177 [0.200]	-0.135 [0.074]	-0.006 [0.037]	0.017 [0.364]	-0.454 [0.476]
τy_t	0.078 [0.096]	-0.323 [0.097]	-0.078 [0.046]	0.029 [0.053]	0.755 [0.088]	0.025 [0.032]	-0.001 [0.016]	-0.419 [0.159]	-0.096 [0.209]
$yr_{1,t}$	1.199 [0.302]	0.141 [0.303]	0.165 [0.145]	0.341 [0.165]	-0.024 [0.275]	0.685 [0.102]	0.032 [0.051]	-1.059 [0.500]	-1.200 [0.654]
$spr_{1 \rightarrow 10,t}$	1.744 [0.641]	-0.059 [0.643]	0.492 [0.307]	0.577 [0.350]	-0.551 [0.585]	0.282 [0.216]	0.509 [0.108]	-2.078 [1.062]	-2.019 [1.390]
R^2	40.34%	59.01%	23.87%	75.95%	73.50%	57.95%	48.55%	40.69%	43.05%

horizon	return	tax	spending	future fp
1	-0.2 [0.1]	5.6 [2.6]	21.1 [4.3]	73.4 [5.4]
3	-0.4 [0.2]	10.8 [7.3]	45.0 [9.1]	44.6 [12.1]
10	-0.6 [0.8]	-3.4 [8.9]	90.6 [8.3]	13.4 [13.0]
∞	-0.8 [3.7]	-6.2 [41.3]	107.0 [44.2]	—

Table OA.54: VAR-implied decomposition (24) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with τy_t , the short rate and yield spread added as state variables in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	15.8 [9.8]	2.7 [4.8]	4.9 [2.4]	21.9 [4.9]	54.8 [16.5]	54.3 [16.4]
3	13.5 [8.5]	-6.1 [3.7]	11.5 [3.7]	31.7 [7.4]	49.5 [16.7]	145.5 [49.0]
10	6.4 [8.2]	-5.5 [2.8]	11.6 [3.3]	53.8 [10.3]	33.6 [15.3]	319.2 [145.4]
∞	—	—	12.5 [0.0]	83.9 [3.7]	3.6 [3.7]	377.7 [380.6]

Table OA.55: VAR-implied decomposition (26) of the fiscal position, fp_t , US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$, with τy_t , the short rate and yield spread added as state variables in the VAR(1).

All quantities are measured in percent. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction. With τy_t in the state vector, the infinite-horizon $-\Delta \tau y$ contribution depends only on the sample covariance of τy_t with fp_t , not on the VAR coefficients, so its bootstrap standard error is zero.

In the last row of Tables OA.49 and OA.55, the contribution of the tax-GDP ratio, $-\Delta\tau y$, is reported with a bootstrapped standard error of zero. This is a mechanical consequence of two features of these systems. First, because $\rho > 1$ in postwar US data, the weights on tax-GDP growth in the identity (19), $(\rho^{j+1} - \rho^{T+1})/(1 - \rho^T)$, converge to ρ for every j as $T \rightarrow \infty$ (see equation (22)). The infinite-horizon tax-GDP term is therefore an unweighted sum:

$$-a\rho \sum_{j=0}^{\infty} \mathbb{E}_t \Delta\tau y_{t+1+j} = -a\rho \left(\lim_{T \rightarrow \infty} \mathbb{E}_t \tau y_{t+T} - \tau y_t \right).$$

Second, when the tax-GDP ratio is a stationary state variable in the VAR, its conditional expectation converges to its unconditional mean. So the right-hand side reduces to $a\rho \widehat{\tau y}_t$. The infinite-horizon contribution of tax-GDP growth is then $a\rho \text{cov}(fp_t, \tau y_t) / \text{var}(fp_t)$, which does not depend on the estimated VAR coefficient matrix.

OA.10.7 Variance decomposition of unexpected tax, spending and returns

horizon	return	tax	spending	future fp	tax + spending
1	-0.2 [0.1]	—	56.1 [16.3]	44.0 [16.3]	56.1 [16.3]
3	-0.2 [0.1]	-15.3 [13.8]	85.5 [29.6]	30.0 [21.4]	70.2 [21.4]
10	-0.2 [0.2]	-5.8 [23.0]	104.7 [24.7]	1.3 [3.4]	98.9 [3.4]
∞	-0.2 [0.2]	-5.5 [24.0]	105.7 [24.0]	—	100.2 [0.2]

Table OA.56: Variance decomposition of unexpected tax news, US data, 1841 to 2022, $\rho = 1.006$, $a = 0.394$, $b = 0.399$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	0.1 [0.0]	10.8 [3.2]	—	89.1 [3.2]	10.8 [3.2]
3	-0.1 [0.1]	54.3 [6.4]	-16.2 [11.8]	61.9 [10.0]	38.2 [10.0]
10	-0.1 [0.1]	75.6 [14.9]	21.6 [17.9]	2.9 [5.1]	97.1 [5.1]
∞	-0.1 [0.1]	76.3 [17.5]	23.8 [17.5]	—	100.1 [0.1]

Table OA.57: Variance decomposition of unexpected spending news, US data, 1841 to 2022, $\rho = 1.006$, $a = 0.394$, $b = 0.399$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	—	-1303.0 [670.0]	2270.4 [1521.9]	-867.4 [1492.1]	967.4 [1492.1]
3	-3.5 [8.7]	-3337.5 [1418.5]	3292.3 [2678.0]	148.7 [1887.3]	-45.2 [1884.7]
10	-3.5 [9.5]	-3361.3 [1952.8]	3453.7 [2063.0]	11.1 [211.5]	92.3 [209.3]
∞	-3.5 [9.6]	-3358.6 [2011.3]	3462.0 [2010.3]	—	103.5 [9.6]

Table OA.58: Variance decomposition of unexpected return news, US data, 1841 to 2022, $\rho = 1.006$, $a = 0.394$, $b = 0.399$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	1.3 [0.4]	—	-7.2 [20.0]	105.9 [20.0]	-7.2 [20.0]
3	1.5 [0.9]	-21.1 [22.0]	47.3 [24.0]	72.3 [27.8]	26.2 [28.0]
10	0.8 [1.4]	-27.0 [36.7]	107.9 [30.6]	18.2 [17.5]	80.9 [17.5]
∞	0.6 [195.5]	-31.4 [2417.9]	130.8 [2613.2]	—	99.4 [195.5]

Table OA.59: Variance decomposition of unexpected tax news, US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	0.2 [0.3]	-2.5 [6.9]	—	102.3 [6.8]	-2.5 [6.9]
3	-0.5 [0.5]	28.2 [15.8]	32.9 [12.1]	39.4 [17.0]	61.1 [17.1]
10	-1.1 [0.8]	17.6 [23.7]	70.9 [19.8]	12.6 [11.2]	88.4 [11.1]
∞	-1.2 [128.1]	14.5 [1584.7]	86.7 [1712.7]	—	101.2 [128.1]

Table OA.60: Variance decomposition of unexpected spending news, US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	—	894.7 [291.3]	384.4 [522.8]	-1179.2 [592.1]	1279.2 [592.1]
3	-34.6 [20.6]	1410.1 [775.8]	-219.9 [773.2]	-1055.5 [918.3]	1190.2 [922.9]
10	-31.0 [35.6]	1188.2 [1051.1]	-870.7 [885.9]	-186.4 [361.0]	317.5 [358.7]
∞	-28.3 [368.9]	1233.1 [4879.1]	-1104.8 [5215.8]	—	128.3 [368.9]

Table OA.61: Variance decomposition of unexpected return news, US data, 1947 to 2022, $\rho = 1.010$, $a = 0.262$, $b = 0.272$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	0.7 [0.1]	—	67.4 [16.0]	31.9 [16.0]	67.4 [16.0]
3	1.2 [0.3]	-3.6 [7.3]	102.0 [29.9]	0.4 [26.1]	98.5 [26.2]
10	1.1 [0.3]	-4.3 [9.8]	104.1 [15.3]	-0.9 [6.6]	99.8 [6.9]
∞	1.1 [0.4]	-4.3 [10.3]	103.2 [10.5]	—	98.9 [0.4]

Table OA.62: Variance decomposition of unexpected tax news, UK data, 1727 to 2022, $\rho = 0.997$, $a = 0.128$, $b = 0.125$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	0.1 [0.1]	8.6 [2.0]	—	91.4 [2.0]	8.6 [2.0]
3	0.4 [0.1]	24.5 [3.5]	-27.3 [9.0]	102.3 [8.2]	-2.7 [8.2]
10	0.8 [0.2]	35.5 [7.3]	44.7 [15.6]	19.0 [10.7]	80.2 [10.8]
∞	0.9 [0.3]	36.5 [9.9]	62.6 [10.0]	—	99.1 [0.3]

Table OA.63: Variance decomposition of unexpected spending news, UK data, 1727 to 2022, $\rho = 0.997$, $a = 0.128$, $b = 0.125$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	—	1041.3 [212.4]	608.1 [631.8]	-1549.4 [616.2]	1649.4 [616.2]
3	-22.3 [8.7]	91.8 [379.2]	2444.7 [1197.8]	-2414.2 [1038.7]	2536.4 [1042.4]
10	-32.5 [12.9]	-215.5 [480.7]	848.0 [743.7]	-500.0 [362.9]	632.5 [371.1]
∞	-34.4 [14.9]	-243.2 [520.5]	377.5 [526.5]	—	134.4 [14.9]

Table OA.64: Variance decomposition of unexpected return news, UK data, 1727 to 2022, $\rho = 0.997$, $a = 0.128$, $b = 0.125$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	0.0 [0.4]	—	24.0 [11.8]	76.0 [11.9]	24.0 [11.8]
3	1.3 [0.6]	-19.3 [19.8]	27.0 [21.6]	91.0 [29.8]	7.8 [29.8]
10	-0.8 [1.0]	12.7 [28.8]	64.5 [23.3]	23.6 [25.1]	77.1 [24.9]
∞	-1.3 [3.0]	22.1 [52.1]	79.3 [53.3]	—	101.3 [3.0]

Table OA.65: Variance decomposition of unexpected tax news, UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	-0.2 [0.4]	23.2 [11.6]	—	76.9 [11.6]	23.2 [11.6]
3	-0.6 [0.5]	41.8 [18.0]	37.5 [15.1]	21.4 [23.8]	79.2 [23.9]
10	-1.1 [0.6]	48.5 [15.8]	48.2 [12.6]	4.4 [10.3]	96.7 [10.1]
∞	-1.2 [1.2]	50.3 [19.4]	50.9 [19.8]	—	101.2 [1.2]

Table OA.66: Variance decomposition of unexpected spending news, UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp	tax + spending
1	—	15.9 [350.6]	-139.9 [356.3]	224.0 [427.8]	-124.0 [427.8]
3	25.1 [14.4]	-214.4 [638.2]	1391.1 [558.9]	-1101.8 [827.4]	1176.7 [825.7]
10	33.1 [18.2]	-413.7 [523.4]	672.0 [429.6]	-191.3 [315.6]	258.2 [308.9]
∞	37.5 [32.6]	-488.3 [656.5]	550.8 [665.6]	—	62.5 [32.6]

Table OA.67: Variance decomposition of unexpected return news, UK data, 1947 to 2022, $\rho = 0.991$, $a = 0.428$, $b = 0.419$. The first four columns sum to 100 at every horizon; the last repeats the total of tax and spending. Bootstrapped standard errors (from 2,000 draws) are reported in square brackets; — marks a component that is zero by construction.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.025	0.392	6.70	0.652	-0.3	-5.4	105.7	100.3
		2.224	134.21	0.604	-0.1	-5.3	105.4	100.1
		0.086	10.42	0.894	-2.0	-7.1	109.1	102.0
1.005	0.030	0.394	6.46	0.623	-0.1	-5.5	105.6	100.1
		2.224	132.02	0.602	-0.0	-5.3	105.4	100.0
		0.086	10.07	0.790	-0.6	-4.6	105.2	100.6
0.999	0.036	0.398	6.23	0.596	0.0	-5.3	105.3	100.0
		2.224	129.42	0.599	0.0	-5.4	105.4	100.0
		0.086	9.81	0.597	0.1	-4.3	104.2	99.9
0.995	0.040	0.402	6.11	0.591	0.1	-4.9	104.7	99.9
		2.224	127.71	0.597	0.0	-5.4	105.4	100.0
		0.086	9.74	0.765	1.0	10.4	88.6	99.0
0.990	0.045	0.408	6.01	0.601	0.3	-3.9	103.6	99.7
		2.224	125.59	0.595	0.0	-5.4	105.4	100.0
		0.086	9.77	0.905	3.7	28.7	67.7	96.3
0.980	0.055	0.425	5.95	0.654	0.8	-0.8	100.0	99.2
		2.224	121.42	0.588	0.0	-5.5	105.5	100.0
		0.086	10.24	0.978	14.5	26.5	59.0	85.5
0.970	0.065	0.446	6.05	0.713	1.8	2.5	95.7	98.2
		2.224	117.34	0.579	0.0	-5.6	105.6	100.0
		0.086	11.32	0.993	22.5	2.7	74.7	77.5
0.960	0.076	0.472	6.31	0.761	3.2	4.9	91.9	96.8
		2.224	113.36	0.565	0.0	-5.7	105.7	100.0
		0.086	13.12	0.997	25.3	-12.1	86.9	74.7

Table OA.68: Sensitivity of the infinite-horizon decomposition of unexpected tax news to ρ and a , US data, 1841 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.025	0.392	6.70	0.652	-0.2	75.2	24.9	100.2
		2.224	134.21	0.604	-0.0	78.1	21.9	100.0
		0.086	10.42	0.894	-1.2	60.7	40.4	101.2
1.005	0.030	0.394	6.46	0.623	-0.1	76.4	23.7	100.1
		2.224	132.02	0.602	-0.0	77.8	22.2	100.0
		0.086	10.07	0.790	-0.3	68.5	31.8	100.3
0.999	0.036	0.398	6.23	0.596	0.0	77.8	22.2	100.0
		2.224	129.42	0.599	0.0	77.5	22.5	100.0
		0.086	9.81	0.597	0.1	79.4	20.5	99.9
0.995	0.040	0.402	6.11	0.591	0.1	78.7	21.2	99.9
		2.224	127.71	0.597	0.0	77.4	22.6	100.0
		0.086	9.74	0.765	0.7	86.2	13.1	99.3
0.990	0.045	0.408	6.01	0.601	0.2	79.7	20.1	99.8
		2.224	125.59	0.595	0.0	77.1	22.8	100.0
		0.086	9.77	0.905	2.6	93.6	3.8	97.4
0.980	0.055	0.425	5.95	0.654	0.6	81.4	18.0	99.4
		2.224	121.42	0.588	0.1	76.7	23.2	99.9
		0.086	10.24	0.978	10.2	91.6	-1.9	89.8
0.970	0.065	0.446	6.05	0.713	1.3	82.2	16.4	98.7
		2.224	117.34	0.579	0.1	76.4	23.5	99.9
		0.086	11.32	0.993	16.1	78.9	5.0	83.9
0.960	0.076	0.472	6.31	0.761	2.4	82.4	15.3	97.6
		2.224	113.36	0.565	0.1	76.0	23.8	99.9
		0.086	13.12	0.997	19.1	73.2	7.7	80.9

Table OA.69: Sensitivity of the infinite-horizon decomposition of unexpected spending news to ρ and a , US data, 1841 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.025	0.392	6.70	0.652	-3.8	-1921.2	2024.9	103.8
		2.224	134.21	0.604	-3.8	-10956.8	11060.6	103.8
		0.086	10.42	0.894	-3.0	-410.4	513.3	103.0
1.005	0.030	0.394	6.46	0.623	-3.4	-3731.6	3835.1	103.4
		2.224	132.02	0.602	-3.5	-21121.4	21224.9	103.5
		0.086	10.07	0.790	-3.2	-803.3	906.5	103.2
0.999	0.036	0.398	6.23	0.596	-3.8	17975.3	-17871.5	103.8
		2.224	129.42	0.599	-3.8	100283.3	-100179.5	103.8
		0.086	9.81	0.597	-3.8	3920.8	-3817.0	103.8
0.995	0.040	0.402	6.11	0.591	-4.4	3503.3	-3398.9	104.4
		2.224	127.71	0.597	-4.4	19288.3	-19183.9	104.4
		0.086	9.74	0.765	-4.4	774.9	-670.5	104.4
0.990	0.045	0.408	6.01	0.601	-5.7	1696.2	-1590.5	105.7
		2.224	125.59	0.595	-5.7	9138.7	-9033.1	105.7
		0.086	9.77	0.905	-4.9	383.7	-278.8	104.9
0.980	0.055	0.425	5.95	0.654	-10.0	800.7	-690.7	110.0
		2.224	121.42	0.588	-9.8	4040.4	-3930.6	109.8
		0.086	10.24	0.978	-4.3	187.5	-83.2	104.3
0.970	0.065	0.446	6.05	0.713	-16.7	513.7	-397.1	116.7
		2.224	117.34	0.579	-16.0	2341.1	-2225.0	116.0
		0.086	11.32	0.993	-3.2	116.4	-13.2	103.2
0.960	0.076	0.472	6.31	0.761	-25.5	381.0	-255.6	125.5
		2.224	113.36	0.565	-24.2	1506.5	-1382.3	124.2
		0.086	13.12	0.997	-3.0	77.5	25.5	103.0

Table OA.70: Sensitivity of the infinite-horizon decomposition of unexpected return news to ρ and a , US data, 1841 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.020	0.264	0.07	0.825	0.6	-31.3	130.7	99.4
		0.672	0.49	0.789	0.1	-33.0	132.9	99.9
		0.118	0.14	0.929	1.7	-29.7	128.0	98.3
1.005	0.025	0.233	0.03	0.796	0.4	-33.1	132.7	99.6
		0.672	0.48	0.796	0.1	-30.3	130.3	99.9
		0.118	0.07	0.857	1.4	-29.2	127.9	98.6
0.999	0.031	0.208	0.02	0.827	0.0	-21.9	121.9	100.0
		0.672	0.48	0.816	0.0	-25.0	125.0	100.0
		0.118	0.04	0.844	0.2	-17.4	117.3	99.8
0.995	0.035	0.208	0.03	0.900	1.5	-1.8	100.3	98.5
		0.672	0.49	0.833	0.1	-20.5	120.4	99.9
		0.118	0.05	0.958	6.2	23.7	70.2	93.8
0.990	0.040	0.228	0.07	0.952	6.7	17.7	75.6	93.3
		0.672	0.51	0.858	0.6	-14.3	113.8	99.4
		0.118	0.10	0.995	33.5	67.0	-0.5	66.5
0.980	0.050	0.295	0.23	0.980	18.3	28.5	53.2	81.7
		0.672	0.59	0.907	3.1	-2.1	98.9	96.9
		0.118	0.36	1.004	43.5	26.4	30.0	56.5
0.970	0.061	0.372	0.45	0.987	24.6	24.3	51.1	75.4
		0.672	0.71	0.943	8.4	7.4	84.3	91.6
		0.118	0.83	1.003	30.0	3.6	66.4	70.0
0.960	0.071	0.450	0.73	0.991	27.6	18.9	53.5	72.4
		0.672	0.88	0.967	15.5	12.2	72.3	84.5
		0.118	1.52	1.002	21.3	-4.0	82.7	78.7

Table OA.71: Sensitivity of the infinite-horizon decomposition of unexpected tax news to ρ and a , US data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.020	0.264	0.07	0.825	-1.3	14.3	87.0	101.3
		0.672	0.49	0.789	-0.6	20.3	80.3	100.6
		0.118	0.14	0.929	-2.2	3.9	98.3	102.2
1.005	0.025	0.233	0.03	0.796	-0.7	18.7	82.0	100.7
		0.672	0.48	0.796	-0.3	22.3	78.0	100.3
		0.118	0.07	0.857	-0.9	12.3	88.6	100.9
0.999	0.031	0.208	0.02	0.827	0.3	25.6	74.2	99.7
		0.672	0.48	0.816	0.1	24.8	75.2	99.9
		0.118	0.04	0.844	0.5	26.7	72.8	99.5
0.995	0.035	0.208	0.03	0.900	2.0	31.7	66.2	98.0
		0.672	0.49	0.833	0.4	26.4	73.1	99.6
		0.118	0.05	0.958	5.7	43.0	51.3	94.3
0.990	0.040	0.228	0.07	0.952	6.2	40.0	53.8	93.8
		0.672	0.51	0.858	1.1	28.6	70.2	98.9
		0.118	0.10	0.995	24.5	67.5	8.0	75.5
0.980	0.050	0.295	0.23	0.980	15.0	44.7	40.3	85.0
		0.672	0.59	0.907	3.7	33.2	63.1	96.3
		0.118	0.36	1.004	31.7	40.7	27.6	68.3
0.970	0.061	0.372	0.45	0.987	19.8	41.6	38.6	80.2
		0.672	0.71	0.943	8.2	36.8	54.9	91.8
		0.118	0.83	1.003	24.6	29.3	46.2	75.4
0.960	0.071	0.450	0.73	0.991	22.4	38.2	39.4	77.6
		0.672	0.88	0.967	14.0	38.3	47.7	86.0
		0.118	1.52	1.002	21.1	28.8	50.1	78.9

Table OA.72: Sensitivity of the infinite-horizon decomposition of unexpected spending news to ρ and a , US data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.020	0.264	0.07	0.825	-28.1	1202.7	-1074.6	128.1
		0.672	0.49	0.789	-24.3	2769.6	-2645.4	124.3
		0.118	0.14	0.929	-29.7	593.0	-463.3	129.7
1.005	0.025	0.233	0.03	0.796	-29.9	2048.1	-1918.2	129.9
		0.672	0.48	0.796	-23.9	5521.3	-5397.3	123.9
		0.118	0.07	0.857	-35.1	1101.3	-966.2	135.1
0.999	0.031	0.208	0.02	0.827	-21.5	-8282.2	8403.7	121.5
		0.672	0.48	0.816	-24.9	-27389.6	27514.5	124.9
		0.118	0.04	0.844	-16.6	-4517.3	4633.8	116.6
0.995	0.035	0.208	0.03	0.900	0.5	-1429.6	1529.0	99.5
		0.672	0.49	0.833	-26.4	-5438.4	5564.8	126.4
		0.118	0.05	0.958	53.9	-513.4	559.5	46.1
0.990	0.040	0.228	0.07	0.952	39.8	-624.0	684.1	60.2
		0.672	0.51	0.858	-29.2	-2690.3	2819.4	129.2
		0.118	0.10	0.995	210.2	49.8	-160.0	-110.2
0.980	0.050	0.295	0.23	0.980	82.6	-353.8	371.3	17.4
		0.672	0.59	0.907	-37.0	-1309.8	1446.8	137.0
		0.118	0.36	1.004	157.4	-91.3	33.9	-57.4
0.970	0.061	0.372	0.45	0.987	75.8	-330.0	354.2	24.2
		0.672	0.71	0.943	-44.6	-840.9	985.5	144.6
		0.118	0.83	1.003	78.0	-111.6	133.6	22.0
0.960	0.071	0.450	0.73	0.991	52.0	-324.8	372.8	48.0
		0.672	0.88	0.967	-47.3	-598.0	745.3	147.3
		0.118	1.52	1.002	45.1	-95.0	149.9	54.9

Table OA.73: Sensitivity of the infinite-horizon decomposition of unexpected return news to ρ and a , US data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.008	0.091	2.25	0.950	-6.8	-6.0	112.9	106.8
		1.173	84.79	0.822	-0.4	-3.9	104.3	100.4
		0.063	2.32	0.968	-11.2	-8.1	119.3	111.2
1.005	0.013	0.097	1.59	0.905	-2.6	-4.7	107.3	102.6
		1.173	81.56	0.816	-0.2	-4.1	104.3	100.2
		0.063	1.68	0.936	-4.1	-5.6	109.7	104.1
0.999	0.019	0.118	1.16	0.788	0.4	-4.3	103.9	99.6
		1.173	77.79	0.808	0.0	-4.3	104.2	100.0
		0.063	1.37	0.764	0.7	-4.3	103.6	99.3
0.995	0.023	0.137	1.04	0.732	1.7	-4.2	102.6	98.3
		1.173	75.36	0.803	0.2	-4.4	104.2	99.8
		0.063	1.45	0.854	3.8	-1.8	98.0	96.2
0.990	0.028	0.163	1.06	0.763	2.9	-3.4	100.5	97.1
		1.173	72.40	0.796	0.4	-4.4	104.1	99.6
		0.063	1.90	0.967	8.5	3.1	88.3	91.5
0.980	0.038	0.219	1.51	0.837	4.9	-1.1	96.2	95.1
		1.173	66.77	0.781	0.7	-4.4	103.6	99.3
		0.063	4.05	0.995	18.4	0.1	81.5	81.6
0.970	0.048	0.274	2.36	0.871	6.8	0.3	92.9	93.2
		1.173	61.53	0.764	1.1	-4.0	102.9	98.9
		0.063	8.05	0.998	25.9	-2.5	76.6	74.1
0.960	0.058	0.329	3.53	0.889	8.7	1.1	90.2	91.3
		1.173	56.68	0.745	1.6	-3.4	101.8	98.4
		0.063	14.28	0.999	34.9	-2.1	67.2	65.1

Table OA.74: Sensitivity of the infinite-horizon decomposition of unexpected tax news to ρ and a , UK data, 1727 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.008	0.091	2.25	0.950	-7.7	20.1	87.7	107.7
		1.173	84.79	0.822	-0.4	32.9	67.4	100.4
		0.063	2.32	0.968	-14.3	13.6	100.7	114.3
1.005	0.013	0.097	1.59	0.905	-2.3	26.3	76.0	102.3
		1.173	81.56	0.816	-0.2	32.9	67.2	100.2
		0.063	1.68	0.936	-3.8	22.4	81.4	103.8
0.999	0.019	0.118	1.16	0.788	0.3	34.2	65.5	99.7
		1.173	77.79	0.808	0.0	33.0	67.0	100.0
		0.063	1.37	0.764	0.6	35.6	63.9	99.4
0.995	0.023	0.137	1.04	0.732	1.3	38.1	60.6	98.7
		1.173	75.36	0.803	0.1	33.0	66.8	99.9
		0.063	1.45	0.854	3.1	44.8	52.1	96.9
0.990	0.028	0.163	1.06	0.763	2.4	40.9	56.6	97.6
		1.173	72.40	0.796	0.2	33.1	66.6	99.8
		0.063	1.90	0.967	9.1	53.2	37.7	90.9
0.980	0.038	0.219	1.51	0.837	5.0	43.1	51.9	95.0
		1.173	66.77	0.781	0.4	33.4	66.2	99.6
		0.063	4.05	0.995	21.7	48.2	30.1	78.3
0.970	0.048	0.274	2.36	0.871	7.7	43.2	49.1	92.3
		1.173	61.53	0.764	0.5	33.8	65.7	99.5
		0.063	8.05	0.998	29.7	51.4	18.9	70.3
0.960	0.058	0.329	3.53	0.889	10.4	42.5	47.1	89.6
		1.173	56.68	0.745	0.6	34.3	65.1	99.4
		0.063	14.28	0.999	46.2	69.0	-15.2	53.8

Table OA.75: Sensitivity of the infinite-horizon decomposition of unexpected spending news to ρ and a , UK data, 1727 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.008	0.091	2.25	0.950	-42.7	44.6	98.1	142.7
		1.173	84.79	0.822	-42.5	529.8	-387.2	142.5
		0.063	2.32	0.968	-45.4	28.9	116.5	145.4
1.005	0.013	0.097	1.59	0.905	-35.5	108.4	27.1	135.5
		1.173	81.56	0.816	-37.4	1221.7	-1084.2	137.4
		0.063	1.68	0.936	-34.7	71.4	63.3	134.7
0.999	0.019	0.118	1.16	0.788	-34.1	-705.5	839.6	134.1
		1.173	77.79	0.808	-33.6	-7099.5	7233.1	133.6
		0.063	1.37	0.764	-34.6	-370.1	504.7	134.6
0.995	0.023	0.137	1.04	0.732	-34.6	-169.2	303.9	134.6
		1.173	75.36	0.803	-32.3	-1549.0	1681.3	132.3
		0.063	1.45	0.854	-31.4	-62.4	193.7	131.4
0.990	0.028	0.163	1.06	0.763	-36.0	-104.3	240.3	136.0
		1.173	72.40	0.796	-32.1	-850.9	983.0	132.1
		0.063	1.90	0.967	-25.0	-17.8	142.8	125.0
0.980	0.038	0.219	1.51	0.837	-42.3	-72.7	215.0	142.3
		1.173	66.77	0.781	-36.2	-490.3	626.5	136.2
		0.063	4.05	0.995	-17.3	-3.5	120.8	117.3
0.970	0.048	0.274	2.36	0.871	-52.9	-59.9	212.8	152.9
		1.173	61.53	0.764	-45.9	-356.5	502.4	145.9
		0.063	8.05	0.998	-16.0	-1.5	117.5	116.0
0.960	0.058	0.329	3.53	0.889	-66.4	-49.6	216.0	166.4
		1.173	56.68	0.745	-60.5	-278.0	438.5	160.5
		0.063	14.28	0.999	-16.2	2.0	114.2	116.2

Table OA.76: Sensitivity of the infinite-horizon decomposition of unexpected return news to ρ and a , UK data, 1727 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.014	0.308	0.11	0.925	-3.6	2.3	101.3	103.6
		1.173	1.11	0.865	-0.2	14.2	86.0	100.2
		0.127	0.15	0.971	-22.8	-19.5	142.2	122.8
1.005	0.019	0.324	0.08	0.892	-0.5	7.6	92.8	100.5
		1.173	1.05	0.857	0.0	13.7	86.3	100.0
		0.127	0.13	0.946	-4.1	-6.1	110.2	104.1
0.999	0.025	0.363	0.07	0.842	-0.1	14.6	85.5	100.1
		1.173	0.97	0.848	-0.0	13.4	86.6	100.0
		0.127	0.14	0.821	-0.4	18.5	81.8	100.4
0.995	0.029	0.396	0.07	0.816	-0.7	18.6	82.1	100.7
		1.173	0.92	0.842	-0.2	13.4	86.8	100.2
		0.127	0.18	0.907	-4.9	50.9	54.0	104.9
0.990	0.034	0.440	0.07	0.804	-1.5	23.3	78.2	101.5
		1.173	0.87	0.834	-0.5	13.4	87.1	100.5
		0.127	0.25	0.982	-3.7	67.0	36.7	103.7
0.980	0.044	0.529	0.09	0.821	-1.3	30.4	70.9	101.3
		1.173	0.77	0.818	-1.2	14.2	87.1	101.2
		0.127	0.51	0.997	24.0	8.0	68.0	76.0
0.970	0.054	0.616	0.13	0.849	1.7	32.7	65.6	98.3
		1.173	0.68	0.802	-1.7	16.1	85.6	101.7
		0.127	0.92	0.998	37.1	-12.0	74.8	62.9
0.960	0.065	0.698	0.18	0.871	6.7	31.4	61.9	93.3
		1.173	0.60	0.790	-1.2	18.8	82.3	101.2
		0.127	1.51	0.998	44.6	-17.4	72.8	55.4

Table OA.77: Sensitivity of the infinite-horizon decomposition of unexpected tax news to ρ and a , UK data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.014	0.308	0.11	0.925	-0.8	30.2	70.6	100.8
		1.173	1.11	0.865	0.2	40.0	59.8	99.8
		0.127	0.15	0.971	-9.0	16.6	92.4	109.0
1.005	0.019	0.324	0.08	0.892	0.2	35.8	64.0	99.8
		1.173	1.05	0.857	0.1	41.2	58.6	99.9
		0.127	0.13	0.946	-1.0	25.3	75.6	101.0
0.999	0.025	0.363	0.07	0.842	-0.1	44.0	56.2	100.1
		1.173	0.97	0.848	-0.0	42.9	57.1	100.0
		0.127	0.14	0.821	-0.5	47.2	53.2	100.5
0.995	0.029	0.396	0.07	0.816	-0.7	48.2	52.5	100.7
		1.173	0.92	0.842	-0.2	44.2	56.0	100.2
		0.127	0.18	0.907	-3.0	52.6	50.4	103.0
0.990	0.034	0.440	0.07	0.804	-1.3	50.7	50.7	101.3
		1.173	0.87	0.834	-0.5	45.8	54.7	100.5
		0.127	0.25	0.982	-2.9	55.5	47.5	102.9
0.980	0.044	0.529	0.09	0.821	-1.2	50.8	50.4	101.2
		1.173	0.77	0.818	-1.0	48.9	52.1	101.0
		0.127	0.51	0.997	7.3	30.7	62.0	92.7
0.970	0.054	0.616	0.13	0.849	0.5	49.9	49.6	99.5
		1.173	0.68	0.802	-1.2	51.1	50.1	101.2
		0.127	0.92	0.998	10.6	23.5	65.9	89.4
0.960	0.065	0.698	0.18	0.871	3.3	48.8	47.8	96.7
		1.173	0.60	0.790	-0.7	52.3	48.3	100.7
		0.127	1.51	0.998	11.1	21.7	67.2	88.9

Table OA.78: Sensitivity of the infinite-horizon decomposition of unexpected spending news to ρ and a , UK data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

ρ	r	a	approx. error	λ_{max}	return	tax	spending	tax + spending
1.010	0.014	0.308	0.11	0.925	-7.5	105.6	1.8	107.5
		1.173	1.11	0.865	11.2	638.6	-549.9	88.8
		0.127	0.15	0.971	-62.4	-18.7	181.1	162.4
1.005	0.019	0.324	0.08	0.892	15.1	318.1	-233.1	84.9
		1.173	1.05	0.857	21.2	1418.6	-1339.8	78.8
		0.127	0.13	0.946	-2.6	52.9	49.7	102.6
0.999	0.025	0.363	0.07	0.842	30.9	-2602.9	2672.0	69.1
		1.173	0.97	0.848	30.3	-8138.4	8208.1	69.7
		0.127	0.14	0.821	33.3	-1025.1	1091.9	66.7
0.995	0.029	0.396	0.07	0.816	35.9	-687.6	751.8	64.1
		1.173	0.92	0.842	34.5	-1783.3	1848.7	65.5
		0.127	0.18	0.907	44.3	-337.2	392.9	55.7
0.990	0.034	0.440	0.07	0.804	37.5	-448.7	511.2	62.5
		1.173	0.87	0.834	37.8	-991.2	1053.4	62.2
		0.127	0.25	0.982	29.4	-164.5	235.1	70.6
0.980	0.044	0.529	0.09	0.821	28.4	-302.1	373.7	71.6
		1.173	0.77	0.818	37.2	-579.7	642.6	62.8
		0.127	0.51	0.997	5.6	-9.4	103.8	94.4
0.970	0.054	0.616	0.13	0.849	6.9	-224.7	317.8	93.1
		1.173	0.68	0.802	26.9	-411.9	485.0	73.1
		0.127	0.92	0.998	13.0	3.3	83.8	87.0
0.960	0.065	0.698	0.18	0.871	-21.6	-166.9	288.5	121.6
		1.173	0.60	0.790	7.2	-305.5	398.3	92.8
		0.127	1.51	0.998	20.1	2.1	77.8	79.9

Table OA.79: Sensitivity of the infinite-horizon decomposition of unexpected return news to ρ and a , UK data, 1947 to 2022. For each ρ the three rows use the fitted a , then a set to the largest and smallest values of T_t/V_t in the sample. The return, tax and spending columns sum to 100; future fp is zero at this horizon and is not reported.

OA.11 Results for Canada, Switzerland and 11 Eurozone countries

OA.11.1 VAR estimates

Table OA.80: VAR coefficient estimates. AUT data, 1999–2022, $\rho = 0.996$, $a = 0.637$, $b = 0.632$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.435 [0.268]	-0.164 [0.116]	-0.176 [0.101]	0.007 [0.125]	-0.180 [0.133]	-0.016 [0.198]
$\Delta\tau_t$	0.834 [0.840]	-0.882 [0.364]	-0.788 [0.316]	-0.546 [0.392]	-0.031 [0.417]	0.852 [0.619]
Δy_t	0.050 [0.904]	0.648 [0.392]	0.437 [0.341]	0.906 [0.422]	-0.780 [0.449]	-1.429 [0.667]
fp_t	0.364 [0.719]	-0.283 [0.312]	-0.048 [0.271]	0.380 [0.336]	0.701 [0.357]	0.984 [0.531]
fp_{t-1}	1.699 [0.776]	-0.270 [0.336]	-0.474 [0.292]	-0.132 [0.362]	-0.075 [0.385]	0.195 [0.572]
R^2	53.62%	44.31%	43.20%	42.15%	32.64%	42.37%

Table OA.81: VAR coefficient estimates. BEL data, 1999–2022, $\rho = 1.001$, $a = 0.400$, $b = 0.401$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	−0.066 [0.335]	−0.201 [0.142]	−0.257 [0.108]	−0.148 [0.085]	0.169 [0.164]	0.369 [0.214]
$\Delta\tau_t$	0.270 [0.696]	0.225 [0.296]	0.092 [0.225]	0.260 [0.177]	−0.423 [0.340]	−0.649 [0.444]
Δy_t	−1.472 [0.981]	−0.419 [0.417]	−0.544 [0.317]	−0.300 [0.250]	0.327 [0.479]	0.746 [0.625]
fp_t	1.666 [1.258]	−0.290 [0.535]	0.011 [0.407]	0.605 [0.321]	0.698 [0.615]	0.987 [0.802]
fp_{t-1}	−0.525 [1.167]	0.240 [0.496]	0.035 [0.377]	0.241 [0.298]	−0.363 [0.570]	−0.604 [0.744]
R^2	31.25%	16.29%	28.72%	74.00%	25.33%	33.59%

Table OA.82: VAR coefficient estimates. CAN data, 1989–2022, $\rho = 0.955$, $a = 0.833$, $b = 0.786$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.157 [0.174]	-0.121 [0.089]	-0.291 [0.074]	-0.505 [0.176]	0.505 [0.173]	0.626 [0.218]
$\Delta\tau_t$	-0.639 [0.455]	0.382 [0.233]	0.322 [0.193]	0.770 [0.459]	-0.537 [0.452]	-0.919 [0.569]
Δy_t	-0.028 [0.669]	0.002 [0.342]	0.403 [0.283]	0.380 [0.675]	-0.480 [0.664]	-0.481 [0.837]
fp_t	0.709 [0.361]	-0.117 [0.184]	-0.339 [0.152]	0.379 [0.364]	0.683 [0.358]	0.800 [0.451]
fp_{t-1}	-0.417 [0.328]	0.075 [0.168]	0.359 [0.139]	0.429 [0.331]	-0.441 [0.326]	-0.516 [0.410]
R^2	35.10%	17.91%	38.94%	71.20%	39.10%	38.69%

Table OA.83: VAR coefficient estimates. CHE data, 1999–2022, $\rho = 0.994$, $a = 0.972$, $b = 0.966$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	−0.101 [0.191]	−0.226 [0.126]	−0.279 [0.063]	−0.403 [0.149]	0.190 [0.171]	0.416 [0.154]
$\Delta\tau_t$	−0.677 [0.325]	−0.043 [0.214]	0.063 [0.107]	0.112 [0.253]	−0.155 [0.291]	−0.112 [0.261]
Δy_t	1.729 [0.773]	−0.252 [0.510]	−0.155 [0.254]	0.770 [0.602]	−1.061 [0.693]	−0.810 [0.622]
fp_t	−0.507 [0.387]	−0.134 [0.255]	−0.085 [0.127]	0.373 [0.301]	0.524 [0.347]	0.658 [0.311]
fp_{t-1}	0.887 [0.380]	0.021 [0.251]	−0.024 [0.125]	0.311 [0.296]	−0.307 [0.341]	−0.327 [0.306]
R^2	43.96%	25.61%	60.31%	62.20%	33.26%	52.64%

Table OA.84: VAR coefficient estimates. DEU data, 1999–2022, $\rho = 0.988$, $a = 0.752$, $b = 0.740$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.117 [0.265]	0.008 [0.121]	-0.100 [0.108]	-0.111 [0.131]	0.157 [0.095]	0.149 [0.176]
$\Delta\tau_t$	-2.263 [1.021]	0.099 [0.467]	-0.227 [0.417]	-0.125 [0.504]	0.305 [0.365]	0.207 [0.677]
Δy_t	0.131 [0.823]	0.139 [0.377]	-0.013 [0.336]	0.542 [0.406]	-0.593 [0.294]	-0.732 [0.545]
fp_t	1.667 [0.586]	-0.371 [0.268]	-0.058 [0.239]	0.496 [0.289]	0.293 [0.209]	0.664 [0.388]
fp_{t-1}	-0.738 [0.640]	0.034 [0.293]	-0.257 [0.262]	-0.201 [0.316]	0.317 [0.229]	0.284 [0.424]
R^2	42.41%	18.99%	18.50%	49.32%	59.61%	46.84%

Table OA.85: VAR coefficient estimates. ESP data, 1999–2022, $\rho = 0.997$, $a = 0.611$, $b = 0.608$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.467 [0.275]	-0.102 [0.215]	-0.116 [0.185]	0.010 [0.188]	-0.121 [0.172]	-0.019 [0.308]
$\Delta\tau_t$	-0.898 [0.496]	0.512 [0.387]	0.407 [0.332]	0.315 [0.339]	0.002 [0.309]	-0.510 [0.554]
Δy_t	-0.161 [0.460]	-0.822 [0.359]	-0.449 [0.308]	-0.627 [0.314]	0.206 [0.286]	1.028 [0.514]
fp_t	1.279 [0.566]	0.130 [0.442]	0.077 [0.379]	1.184 [0.387]	-0.174 [0.353]	-0.304 [0.633]
fp_{t-1}	-1.018 [0.489]	-0.054 [0.382]	0.079 [0.328]	-0.284 [0.334]	0.418 [0.305]	0.472 [0.547]
R^2	33.54%	24.05%	19.99%	77.44%	49.42%	34.06%

Table OA.86: VAR coefficient estimates. FIN data, 1999–2022, $\rho = 0.950$, $a = 1.081$, $b = 1.028$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.222 [0.172]	0.024 [0.138]	0.038 [0.128]	−0.036 [0.186]	0.048 [0.057]	0.024 [0.172]
$\Delta\tau_t$	−0.116 [0.769]	−0.327 [0.616]	−0.311 [0.573]	−0.188 [0.831]	−0.155 [0.255]	0.172 [0.770]
Δy_t	−0.577 [0.620]	0.926 [0.497]	0.547 [0.463]	0.689 [0.671]	0.333 [0.205]	−0.593 [0.621]
fp_t	0.522 [0.532]	−0.437 [0.426]	−0.085 [0.397]	0.692 [0.575]	−0.135 [0.176]	0.301 [0.532]
fp_{t-1}	0.115 [0.536]	0.318 [0.429]	0.033 [0.400]	0.064 [0.579]	0.267 [0.177]	−0.051 [0.536]
R^2	72.05%	26.26%	8.18%	78.58%	67.61%	30.43%

Table OA.87: VAR coefficient estimates. FRA data, 1999–2022, $\rho = 0.997$, $a = 0.476$, $b = 0.473$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.604 [0.335]	-0.298 [0.169]	-0.325 [0.148]	-0.241 [0.097]	0.205 [0.063]	0.503 [0.203]
$\Delta\tau_t$	-1.917 [1.677]	1.907 [0.846]	1.516 [0.741]	1.091 [0.486]	-0.373 [0.317]	-2.279 [1.017]
Δy_t	0.162 [1.023]	-1.287 [0.516]	-1.110 [0.452]	-0.673 [0.296]	0.124 [0.194]	1.412 [0.620]
fp_t	3.528 [2.360]	-2.016 [1.191]	-1.608 [1.043]	-0.201 [0.684]	0.493 [0.447]	2.509 [1.431]
fp_{t-1}	-2.988 [2.582]	1.977 [1.303]	1.790 [1.141]	1.215 [0.748]	-0.557 [0.489]	-2.534 [1.566]
R^2	36.05%	37.95%	31.61%	81.09%	42.88%	39.45%

Table OA.88: VAR coefficient estimates. GRC data, 1999–2022, $\rho = 0.986$, $a = 0.391$, $b = 0.377$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	−0.052 [0.204]	0.010 [0.079]	0.075 [0.079]	0.002 [0.052]	0.007 [0.102]	−0.004 [0.134]
$\Delta\tau_t$	0.850 [0.902]	0.161 [0.350]	0.609 [0.347]	−0.097 [0.230]	0.393 [0.451]	0.232 [0.593]
Δy_t	−1.058 [0.725]	0.110 [0.281]	0.033 [0.279]	−0.057 [0.185]	0.304 [0.362]	0.195 [0.476]
fp_t	−0.004 [1.023]	−0.626 [0.397]	−0.916 [0.394]	1.154 [0.261]	−1.020 [0.511]	−0.395 [0.672]
fp_{t-1}	0.748 [1.149]	0.539 [0.446]	1.105 [0.442]	−0.254 [0.293]	1.204 [0.574]	0.665 [0.755]
R^2	21.18%	16.83%	43.26%	84.98%	39.55%	17.46%

Table OA.89: VAR coefficient estimates. IRL data, 1999–2022, $\rho = 1.019$, $a = 0.706$, $b = 0.724$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.127 [0.318]	0.001 [0.162]	-0.225 [0.131]	-0.135 [0.187]	0.191 [0.249]	0.190 [0.258]
$\Delta\tau_t$	0.131 [0.508]	0.233 [0.259]	0.088 [0.209]	0.261 [0.298]	-0.130 [0.398]	-0.362 [0.412]
Δy_t	-0.130 [0.642]	0.160 [0.327]	-0.109 [0.264]	0.570 [0.377]	-0.635 [0.502]	-0.795 [0.521]
fp_t	-0.283 [0.377]	-0.011 [0.192]	0.174 [0.155]	0.675 [0.221]	0.406 [0.295]	0.417 [0.306]
fp_{t-1}	0.268 [0.306]	-0.008 [0.156]	-0.043 [0.126]	-0.246 [0.180]	0.339 [0.239]	0.347 [0.248]
R^2	5.42%	17.44%	26.47%	68.07%	55.15%	50.43%

Table OA.90: VAR coefficient estimates. ITA data, 1999–2022, $\rho = 0.986$, $a = 0.594$, $b = 0.581$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	0.027 [0.238]	-0.282 [0.158]	-0.171 [0.159]	-0.288 [0.139]	0.208 [0.149]	0.489 [0.235]
$\Delta\tau_t$	-0.631 [0.637]	-0.046 [0.422]	-0.079 [0.424]	0.107 [0.371]	-0.216 [0.398]	-0.170 [0.628]
Δy_t	-0.891 [0.610]	-0.011 [0.404]	0.259 [0.406]	-0.285 [0.355]	0.502 [0.381]	0.513 [0.601]
fp_t	2.064 [0.544]	-0.631 [0.361]	-0.730 [0.363]	0.962 [0.317]	-0.605 [0.340]	0.026 [0.536]
fp_{t-1}	-1.408 [0.704]	0.339 [0.467]	0.634 [0.469]	-0.073 [0.410]	0.507 [0.440]	0.167 [0.694]
R^2	64.97%	40.79%	32.26%	68.78%	27.08%	26.50%

Table OA.91: VAR coefficient estimates. NLD data, 1999–2022, $\rho = 1.004$, $a = 0.738$, $b = 0.742$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	−0.154 [0.236]	−0.204 [0.084]	−0.150 [0.051]	−0.225 [0.066]	0.100 [0.065]	0.304 [0.089]
$\Delta\tau_t$	−0.759 [0.849]	0.101 [0.301]	0.364 [0.185]	−0.012 [0.237]	0.112 [0.232]	0.011 [0.321]
Δy_t	0.398 [1.364]	−0.237 [0.483]	−0.020 [0.297]	−0.042 [0.381]	−0.177 [0.373]	0.060 [0.515]
fp_t	0.581 [1.074]	0.084 [0.380]	−0.326 [0.234]	0.838 [0.300]	0.300 [0.294]	0.216 [0.406]
fp_{t-1}	−0.005 [0.815]	−0.076 [0.289]	0.200 [0.177]	−0.255 [0.228]	0.268 [0.223]	0.344 [0.308]
R^2	10.89%	23.65%	40.29%	64.38%	66.80%	60.36%

Table OA.92: VAR coefficient estimates. PRT data, 1999–2022, $\rho = 0.986$, $a = 0.514$, $b = 0.500$.

OLS standard errors are reported in square brackets. The last two columns show the imputed coefficients for spending growth and spending growth minus tax growth.

	r_{t+1}	$\Delta\tau_{t+1}$	Δy_{t+1}	fp_{t+1}	Δx_{t+1}	$\Delta x_{t+1} - \Delta\tau_{t+1}$
r_t	−0.134 [0.260]	−0.044 [0.155]	−0.145 [0.138]	−0.136 [0.131]	0.231 [0.185]	0.275 [0.256]
$\Delta\tau_t$	−0.764 [0.633]	0.168 [0.376]	0.139 [0.336]	−0.090 [0.318]	0.374 [0.451]	0.206 [0.622]
Δy_t	−0.224 [0.686]	−0.317 [0.407]	−0.102 [0.365]	−0.092 [0.345]	−0.136 [0.488]	0.181 [0.674]
fp_t	1.197 [0.551]	−0.507 [0.327]	−0.284 [0.293]	0.895 [0.277]	−0.318 [0.392]	0.190 [0.541]
fp_{t-1}	−1.206 [0.571]	0.443 [0.339]	0.342 [0.303]	−0.047 [0.287]	0.583 [0.406]	0.139 [0.561]
R^2	19.87%	19.79%	10.84%	74.83%	23.43%	17.49%

OA.11.2 Variance decomposition of fp_t

Variance decomposition of fp_t based on the system $(r_t, \Delta\tau_t, \Delta y_t, fp_t, fp_{t-1})$ of different countries are reported below. Throughout this section, quantities in square brackets are bootstrapped standard errors, and — marks a component that is zero by construction. 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 compute the standard deviation across draws.

Table OA.93: VAR-implied decomposition (24) of the fiscal position, fp_t , AUT data, 1999 to 2022, $\rho = 0.996$, $a = 0.637$, $b = 0.632$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.8 [0.2]	37.5 [10.2]	17.1 [11.6]	44.7 [17.1]
3	2.2 [0.7]	91.6 [21.5]	36.7 [29.6]	-30.5 [32.2]
10	1.8 [1.9]	75.1 [38.7]	26.2 [43.9]	-3.1 [18.5]
∞	1.7 [5.7]	73.7 [99.1]	24.6 [104.2]	—

Table OA.94: VAR-implied decomposition (26) of the fiscal position, fp_t , AUT data, 1999 to 2022, $\rho = 0.996$, $a = 0.637$, $b = 0.632$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	173.7 [38.4]	49.7 [14.4]	5.9 [6.7]	48.4 [18.0]	-177.8 [48.0]	-178.6 [48.2]
3	168.6 [56.1]	49.6 [12.4]	1.7 [12.3]	94.2 [27.2]	-214.1 [58.6]	-648.0 [177.4]
10	40.1 [46.3]	12.3 [7.1]	-0.5 [22.5]	99.1 [26.8]	-51.0 [44.6]	-522.4 [456.8]
∞	1.7 [6.3]	0.5 [0.9]	-1.1 [57.6]	98.8 [56.9]	—	-512.7 [2103.7]

Table OA.95: VAR-implied decomposition (24) of the fiscal position, fp_t , BEL data, 1999 to 2022, $\rho = 1.001$, $a = 0.400$, $b = 0.401$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	-0.1 [0.0]	10.7 [6.8]	19.4 [7.8]	69.9 [9.9]
3	-0.2 [0.1]	20.5 [18.4]	43.0 [15.8]	36.7 [22.2]
10	-0.3 [0.2]	30.5 [30.8]	66.2 [25.7]	3.6 [17.2]
∞	-0.3 [0.8]	31.7 [131.7]	68.6 [132.2]	—

Table OA.96: VAR-implied decomposition (26) of the fiscal position, fp_t , BEL data, 1999 to 2022, $\rho = 1.001$, $a = 0.400$, $b = 0.401$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	84.3 [39.7]	23.4 [12.6]	1.3 [5.2]	28.8 [11.3]	-37.9 [53.3]	-37.9 [53.3]
3	75.2 [36.1]	15.5 [11.7]	1.8 [9.6]	44.8 [18.3]	-37.3 [54.9]	-111.7 [164.6]
10	36.9 [22.1]	7.1 [6.6]	2.0 [21.0]	73.7 [28.8]	-19.6 [34.8]	-195.3 [346.3]
∞	—	—	2.0 [199.3]	98.2 [200.6]	-0.2 [2.1]	-203.9 [2785.0]

Table OA.97: VAR-implied decomposition (24) of the fiscal position, fp_t , CAN data, 1989 to 2022, $\rho = 0.955$, $a = 0.833$, $b = 0.786$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	1.5 [0.4]	3.0 [3.8]	22.2 [7.2]	73.2 [9.2]
3	2.9 [1.2]	12.2 [11.7]	53.7 [13.8]	31.1 [20.4]
10	4.0 [1.9]	20.3 [18.3]	74.0 [13.5]	1.7 [10.9]
∞	4.1 [2.7]	20.8 [23.0]	75.1 [21.7]	—

Table OA.98: VAR-implied decomposition (26) of the fiscal position, fp_t , CAN data, 1989 to 2022, $\rho = 0.955$, $a = 0.833$, $b = 0.786$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	34.6 [9.6]	1.4 [4.1]	1.8 [3.2]	23.3 [9.6]	38.8 [17.1]	40.6 [17.9]
3	22.7 [8.9]	0.8 [4.2]	6.1 [6.3]	41.8 [15.4]	28.6 [20.7]	94.1 [68.2]
10	10.9 [5.0]	-0.1 [2.8]	15.5 [13.0]	62.6 [19.0]	11.1 [14.6]	144.3 [189.0]
∞	4.1 [2.6]	-0.0 [1.5]	21.4 [24.9]	74.6 [24.0]	—	147.9 [16630.6]

Table OA.99: VAR-implied decomposition (24) of the fiscal position, fp_t , CHE data, 1999 to 2022, $\rho = 0.994$, $a = 0.972$, $b = 0.966$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.1 [0.1]	23.2 [11.8]	17.6 [15.7]	59.0 [13.9]
3	0.5 [0.2]	35.5 [24.3]	58.1 [30.9]	5.9 [25.8]
10	0.4 [0.2]	32.7 [30.5]	66.3 [31.8]	0.6 [10.0]
∞	0.4 [0.5]	32.8 [73.8]	66.7 [74.1]	—

Table OA.100: VAR-implied decomposition (26) of the fiscal position, fp_t , CHE data, 1999 to 2022, $\rho = 0.994$, $a = 0.972$, $b = 0.966$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	11.5 [18.5]	18.5 [6.0]	5.3 [12.0]	35.4 [19.5]	29.2 [28.2]	29.4 [28.4]
3	23.8 [12.2]	14.1 [4.2]	-0.3 [17.9]	67.8 [27.3]	-5.5 [27.7]	-16.6 [84.3]
10	7.1 [3.9]	4.5 [0.9]	-7.2 [25.8]	99.0 [27.9]	-3.4 [11.6]	-35.0 [120.5]
∞	0.4 [0.6]	0.3 [0.1]	-9.6 [80.2]	108.9 [79.9]	—	-35.6 [1926.7]

Table OA.101: VAR-implied decomposition (24) of the fiscal position, fp_t , DEU data, 1999 to 2022, $\rho = 0.988$, $a = 0.752$, $b = 0.740$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.7 [0.4]	21.5 [11.2]	33.0 [8.6]	44.7 [16.0]
3	1.4 [1.2]	34.3 [26.1]	100.8 [17.4]	-36.5 [28.8]
10	0.7 [1.5]	25.3 [31.9]	79.3 [28.2]	-5.4 [16.4]
∞	0.7 [3.3]	24.8 [75.0]	74.5 [73.7]	—

Table OA.102: VAR-implied decomposition (26) of the fiscal position, fp_t , DEU data, 1999 to 2022, $\rho = 0.988$, $a = 0.752$, $b = 0.740$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	64.1 [33.3]	28.5 [13.4]	0.3 [6.6]	53.8 [14.2]	-46.7 [39.7]	-47.3 [40.1]
3	41.4 [35.6]	23.1 [10.3]	-7.4 [12.5]	108.5 [19.7]	-65.7 [44.9]	-201.8 [137.8]
10	6.7 [14.3]	5.6 [3.1]	-11.6 [22.4]	111.3 [18.6]	-12.0 [15.9]	-128.2 [169.8]
∞	0.7 [3.5]	0.6 [0.6]	-12.4 [101.6]	111.1 [98.4]	—	-116.4 [1829.3]

Table OA.103: VAR-implied decomposition (24) of the fiscal position, fp_t , ESP data, 1999 to 2022, $\rho = 0.997$, $a = 0.611$, $b = 0.608$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	-0.0 [0.1]	1.7 [7.3]	15.8 [5.8]	82.5 [10.2]
3	0.0 [0.2]	9.9 [22.9]	49.3 [15.3]	40.7 [27.1]
10	-0.1 [0.7]	18.6 [44.1]	82.7 [37.5]	-1.1 [23.2]
∞	-0.1 [3.3]	18.3 [159.0]	81.9 [159.0]	—

Table OA.104: VAR-implied decomposition (26) of the fiscal position, fp_t , ESP data, 1999 to 2022, $\rho = 0.997$, $a = 0.611$, $b = 0.608$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	-1.7 [16.2]	-13.5 [10.9]	9.9 [5.7]	7.7 [10.9]	97.6 [31.7]	98.0 [31.9]
3	0.5 [20.1]	-8.4 [10.5]	18.0 [11.4]	21.1 [18.9]	68.8 [40.1]	207.8 [121.1]
10	-3.2 [19.4]	-3.5 [7.7]	31.0 [22.9]	45.5 [29.7]	30.1 [37.0]	307.1 [377.6]
∞	-0.1 [3.4]	-0.1 [1.3]	39.0 [128.3]	61.3 [127.2]	—	305.4 [6367.1]

Table OA.105: VAR-implied decomposition (24) of the fiscal position, fp_t , FIN data, 1999 to 2022, $\rho = 0.950$, $a = 1.081$, $b = 1.028$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	3.1 [0.5]	5.3 [7.1]	14.3 [3.0]	77.2 [9.0]
3	8.9 [1.4]	4.3 [18.3]	47.4 [8.6]	39.4 [22.0]
10	14.6 [5.1]	1.7 [33.4]	80.7 [20.7]	3.0 [13.8]
∞	15.0 [9.8]	1.5 [51.7]	83.5 [42.7]	—

Table OA.106: VAR-implied decomposition (26) of the fiscal position, fp_t , FIN data, 1999 to 2022, $\rho = 0.950$, $a = 1.081$, $b = 1.028$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	62.3 [9.5]	-0.5 [6.2]	5.8 [3.4]	13.9 [8.0]	18.5 [18.3]	19.5 [19.2]
3	62.3 [10.6]	-0.5 [6.7]	6.0 [5.5]	31.0 [15.5]	1.1 [23.0]	3.7 [76.6]
10	36.3 [13.2]	-0.2 [4.7]	4.4 [11.1]	61.7 [22.8]	-2.3 [13.2]	-30.6 [176.7]
∞	15.0 [10.3]	-0.1 [2.9]	3.1 [19.9]	81.9 [20.6]	—	-35.1 [4225.1]

Table OA.107: VAR-implied decomposition (24) of the fiscal position, fp_t , FRA data, 1999 to 2022, $\rho = 0.997$, $a = 0.476$, $b = 0.473$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.2 [0.1]	26.3 [9.6]	1.6 [3.7]	72.0 [11.8]
3	0.8 [0.4]	59.0 [23.2]	13.5 [12.7]	26.6 [31.1]
10	1.1 [0.8]	72.7 [25.6]	26.0 [22.0]	0.2 [22.5]
∞	1.1 [3.9]	72.9 [61.0]	26.0 [59.2]	—

Table OA.108: VAR-implied decomposition (26) of the fiscal position, fp_t , FRA data, 1999 to 2022, $\rho = 0.997$, $a = 0.476$, $b = 0.473$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	66.8 [40.6]	37.7 [17.7]	8.3 [4.0]	19.3 [10.1]	-32.3 [57.2]	-32.4 [57.4]
3	83.3 [44.5]	22.4 [14.8]	18.4 [7.1]	29.6 [18.3]	-53.7 [67.8]	-162.1 [204.6]
10	35.1 [28.0]	8.4 [6.0]	29.1 [17.0]	53.9 [30.4]	-26.5 [37.1]	-270.1 [377.4]
∞	1.1 [3.2]	0.3 [0.6]	33.4 [114.1]	65.2 [112.3]	—	-270.0 [1715.2]

Table OA.109: VAR-implied decomposition (24) of the fiscal position, fp_t , GRC data, 1999 to 2022, $\rho = 0.986$, $a = 0.391$, $b = 0.377$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.4 [0.6]	5.0 [7.1]	4.4 [8.3]	90.2 [11.2]
3	1.5 [1.2]	5.5 [15.4]	27.3 [22.1]	65.7 [20.9]
10	2.6 [2.8]	-7.6 [46.9]	94.7 [59.1]	10.3 [30.8]
∞	2.6 [6.6]	-12.4 [109.1]	109.7 [108.8]	—

Table OA.110: VAR-implied decomposition (26) of the fiscal position, fp_t , GRC data, 1999 to 2022, $\rho = 0.986$, $a = 0.391$, $b = 0.377$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	31.6 [46.9]	-20.9 [18.0]	13.0 [4.5]	-3.4 [10.5]	79.6 [51.6]	80.6 [52.3]
3	37.2 [30.1]	-24.1 [17.0]	22.9 [6.4]	-1.2 [14.8]	65.1 [35.5]	200.8 [109.4]
10	20.6 [21.9]	-23.2 [17.7]	51.5 [14.9]	5.9 [28.9]	45.2 [30.2]	488.1 [326.3]
∞	2.6 [6.9]	-3.4 [6.3]	84.0 [93.7]	16.8 [93.3]	—	545.2 [242410.3]

Table OA.111: VAR-implied decomposition (24) of the fiscal position, fp_t , IRL data, 1999 to 2022, $\rho = 1.019$, $a = 0.706$, $b = 0.724$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.2 [0.4]	-5.0 [7.4]	34.2 [11.9]	70.6 [12.4]
3	-0.1 [1.1]	-7.7 [22.8]	96.1 [22.7]	11.6 [28.9]
10	-0.3 [1.9]	-6.8 [43.5]	107.1 [38.1]	0.1 [15.1]
∞	-0.3 [20.8]	-6.9 [295.8]	107.2 [281.7]	—

Table OA.112: VAR-implied decomposition (26) of the fiscal position, fp_t , IRL data, 1999 to 2022, $\rho = 1.019$, $a = 0.706$, $b = 0.724$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	-10.1 [19.9]	-15.3 [8.3]	5.9 [7.3]	23.0 [13.4]	96.5 [27.6]	94.7 [27.1]
3	1.3 [18.5]	-8.4 [9.2]	9.1 [13.2]	50.9 [23.5]	47.1 [38.1]	136.1 [110.2]
10	1.6 [9.6]	-1.7 [5.8]	7.8 [24.8]	81.3 [32.4]	10.9 [28.1]	98.9 [253.8]
∞	—	—	6.7 [53.1]	91.4 [58.4]	1.9 [9.2]	100.2 [489.6]

Table OA.113: VAR-implied decomposition (24) of the fiscal position, fp_t , ITA data, 1999 to 2022, $\rho = 0.986$, $a = 0.594$, $b = 0.581$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	1.2 [0.3]	35.8 [9.9]	-1.0 [9.3]	64.1 [14.7]
3	2.1 [1.1]	62.1 [21.6]	29.8 [29.9]	6.1 [33.1]
10	1.5 [1.9]	56.3 [31.6]	41.3 [36.6]	0.8 [18.4]
∞	1.4 [4.0]	55.5 [70.1]	43.1 [72.4]	—

Table OA.114: VAR-implied decomposition (26) of the fiscal position, fp_t , ITA data, 1999 to 2022, $\rho = 0.986$, $a = 0.594$, $b = 0.581$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	88.7 [25.5]	37.3 [16.2]	13.9 [5.6]	20.3 [15.0]	-60.2 [43.1]	-61.1 [43.7]
3	53.0 [29.2]	11.9 [14.1]	28.0 [10.9]	35.6 [26.0]	-28.5 [45.5]	-87.8 [140.2]
10	12.1 [15.3]	0.5 [7.4]	44.2 [24.0]	40.8 [36.1]	2.5 [23.2]	26.6 [249.8]
∞	1.4 [3.8]	0.0 [2.3]	55.4 [113.8]	43.1 [113.1]	—	43.3 [2353.8]

Table OA.115: VAR-implied decomposition (24) of the fiscal position, fp_t , NLD data, 1999 to 2022, $\rho = 1.004$, $a = 0.738$, $b = 0.742$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	-0.1 [0.2]	5.9 [10.6]	38.8 [8.3]	55.5 [11.2]
3	-0.3 [0.3]	18.0 [27.2]	90.5 [19.0]	-8.2 [23.3]
10	-0.2 [0.4]	20.0 [34.7]	79.7 [33.1]	0.6 [9.1]
∞	-0.2 [1.0]	20.2 [169.1]	80.1 [168.2]	—

Table OA.116: VAR-implied decomposition (26) of the fiscal position, fp_t , NLD data, 1999 to 2022, $\rho = 1.004$, $a = 0.738$, $b = 0.742$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	28.8 [40.3]	8.3 [8.9]	-0.2 [8.0]	44.9 [12.0]	18.2 [45.5]	18.1 [45.3]
3	22.0 [27.0]	4.8 [8.1]	2.9 [11.7]	76.5 [16.9]	-6.3 [40.9]	-18.7 [121.8]
10	5.8 [8.9]	1.2 [3.4]	9.1 [15.1]	86.9 [14.7]	-3.0 [17.5]	-29.0 [170.8]
∞	—	—	11.2 [22.4]	89.0 [21.9]	-0.1 [1.2]	-29.5 [282.9]

Table OA.117: VAR-implied decomposition (24) of the fiscal position, fp_t , PRT data, 1999 to 2022, $\rho = 0.986$, $a = 0.514$, $b = 0.500$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	return	tax	spending	future fp
1	0.2 [0.4]	19.5 [8.4]	0.7 [10.2]	79.6 [13.7]
3	0.1 [0.8]	21.0 [13.4]	23.6 [19.7]	55.3 [20.4]
10	-0.6 [1.7]	24.7 [26.6]	58.3 [30.3]	17.6 [20.3]
∞	-0.9 [4.6]	26.8 [60.9]	74.1 [62.8]	—

Table OA.118: VAR-implied decomposition (26) of the fiscal position, fp_t , PRT data, 1999 to 2022, $\rho = 0.986$, $a = 0.514$, $b = 0.500$.

All quantities are measured in percent. Bootstrapped standard errors are reported in square brackets; — marks a component that is zero by construction.

horizon	r	$-\Delta y$	$-\Delta \tau y$	Δxy	$-\Delta vy$	$-(vy_{t+T} - vy_t)$
1	14.3 [27.7]	7.4 [15.0]	15.8 [5.0]	4.3 [12.9]	58.2 [45.0]	59.0 [45.6]
3	1.9 [18.4]	-1.2 [10.1]	19.1 [7.4]	13.1 [16.7]	67.0 [32.6]	206.8 [100.5]
10	-4.5 [13.6]	-3.9 [7.7]	31.5 [17.3]	28.1 [28.4]	48.8 [30.7]	527.3 [331.5]
∞	-0.9 [5.2]	-0.7 [3.1]	52.6 [95.6]	49.0 [89.6]	—	694.9 [145504.9]

References

- 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.
- Martin, Ian W. R.** 2012. “On the Valuation of Long-Dated Assets.” *Journal of Political Economy*, 120(2): 346–358.