Did the U.S. really grow out of its World War II debt?

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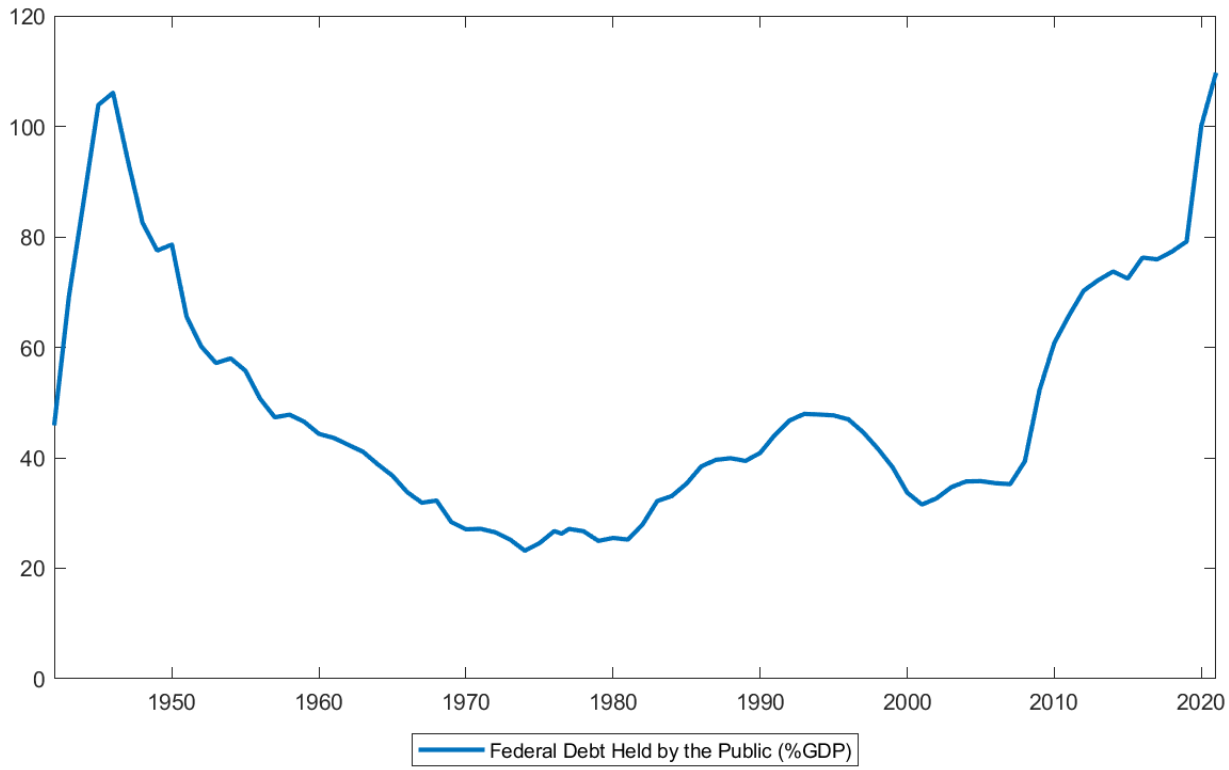
International Macro History Online Seminar
February 8, 2023

High Public Debt Levels Today

Figure: Federal Debt Held by the Public as a Percent of GDP: D_t



Note. The line represents the ratio of the par value of outstanding Treasury securities held by the public to GDP.
Source: OMB.

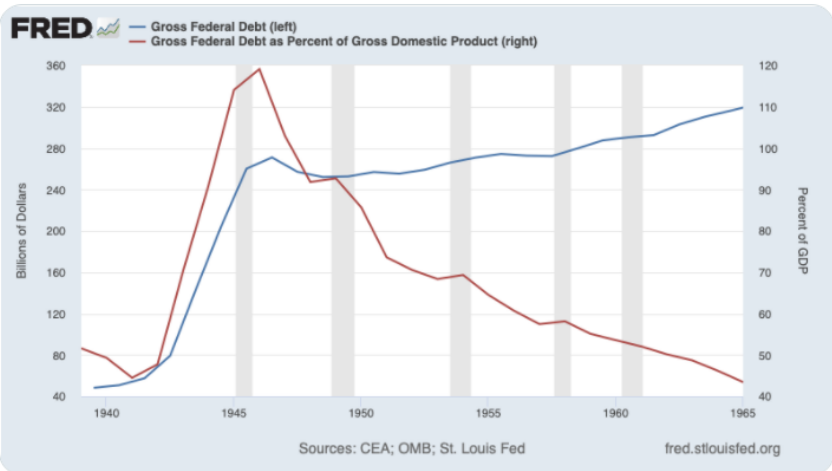
Motivation

- High public debt levels today: The debt held by the public reached 110% GDP in 2021, a level higher than the peak reached during WWII.
- Following Blanchard's AEA influential presidential address, sentiment that negative (ex-post) $r - g$ would allow to grow out of debt over time.
- U.S. public debt history after WWII: increase from 46% in 1942 to 106% in 1946 (peak), then drop to 23% in 1974 (trough).
- *Bis repetita*?

Krugman's View

Paul Krugman ✓
@paulkrugman

Still getting anxious mail from people who worry about how America will pay down its debt. Folks, we don't have to pay it down. Here's what happened after WWII: 1/



8:04 AM · Jan 19, 2021 · Twitter Web App

Paul Krugman ✓ @paulkrugman · Jan 19, 2021
Replying to @paulkrugman
America never repaid its war debt. It just issued new debt as the old debt came due. But because of inflation and growth, debt as a share of GDP declined steadily, so that by the 60s the war debt was negligible in economic terms 2/

59 309 1,453

Paul Krugman ✓ @paulkrugman · Jan 19, 2021
Today, we have an economy where dollar GDP can be expected to grow 3-4% a year, while the feds can borrow at ~1%. This means that debt tends to melt away as a share of GDP unless we run really huge deficits 3/

55 295 1,542

Paul Krugman ✓ @paulkrugman · Jan 19, 2021
The usual suspects try to shout down this arithmetic by playing Dr. Evil: We have 24 TRILLION DOLLARS in debt. But if you analyze the numbers instead of hyping them, there isn't any visible problem 4/

112 230 1,446

Our View

The period following WWII was **very different** from the current environment:

- Distorted real interest rates:
  - The Fed was not independent: Nominal interest rates were pegged between April 1942 and the Fed-Treasury Accord in March 1951. The term structure of rates was ranging from 3/8% on bills to 2.5% for LT bonds.
  - Rapid post-war inflationary episode caused by the elimination of price controls in 1946 and Korean war, and high inflation in 60s and 70s.
- The U.S. government was running primary surpluses.

Primary Balance

This Paper

- Counter-factual analysis to estimate what public debt would have been if:
  - Real interest rates had been non-distorted
  - Primary balances were equal to zero
- Use granular information regarding debt securities (date of issue, maturity, yield) and provide measures of ST and LT inflation expectations back to 1951.

Results:

- The public debt-to-GDP ratio would only have declined from 106% in 1946 to 73% (instead of 23%) in 1974 if primary balances had been equal to zero and there were no interest rate distortions.
- Effect: 27 pp from interest rate distortions and 17 pp from primary surpluses.
- On average, $r^\star - g > 0$ after 1980.

Literature (non-exhaustive review)

- Erosion of public debt by inflation after WWII
  - Reinhart and Sbrancia (2011): ex post real interest rate were negative half of the time in AEs between 1945 and 1980 (financial repression).
  - Hall and Sargent (2011): 15.8% of the 80.3% drop in the debt-to-GDP ratio was due to negative real returns via inflation.
  - Aizenman and Marion (2009): Inflation reduced debt/ratio about 40 percent within a decade after WWII.
  - Friedman and Schwartz (1963), Evans (1982), Hetzel and Leach (2001) for a historical perspective.

- Debt rollovers and $r - g$
  - Blanchard (2019): Higher debt has no fiscal cost, may have welfare cost.
  - Ball et al. (1998): Debt rollover is a gamble, may fail.
  - Hilscher et al. (2021): Inflation unlikely to significantly lower the U.S fiscal burden because debt is concentrated at short maturities and perceived inflation shocks have little short-run persistence and are small.

Conceptual Framework

Debt Dynamics - Aggregate

The actual debt dynamics is given by:

$$D_t = (1 + i_t)D_{t-1} - P_t \tag{1}$$

Our counterfactual debt dynamics is given by:

$$\hat{D}_t = (1 + \hat{i}_t)\hat{D}_{t-1} - \hat{P}_t \tag{2}$$

with either $\hat{P}_t = P_t$ or $\hat{P}_t = 0 \; \forall t$.

We define the **average effective interest rate adjustment** as:

$$x_t \equiv \hat{i}_t - i_t \tag{3}$$

Debt Dynamics - Decomposition

The average effective interest rate at time t can be written as:

$$i_t = \sum_{j=0}^{M} i_t^{j+1} \underbrace{\frac{D_{t-1}^j}{D_{t-1}}}_{\equiv w_{t-1}^j} \tag{4}$$

where w_{t-1}^j is the **reverse maturity structure of the debt** and indicates the share of outstanding debt at time $t-1$ which was first issued at time $t-j-1$.

Assumption: $\hat{w}_{t-1}^j = w_{t-1}^j$. This gives us:

$$\hat{i}_t = i_t + \underbrace{\sum_{j=0}^{M} x_t^{j+1} w_{t-1}^j}_{=x_t} \tag{5}$$

where $x_t^{j+1} \equiv \hat{i}_t - i_t$ is the **interest rate adjustment by year of first issuance**.

Other Assumptions | Reverse Maturity - Marketable | Reverse Maturity - Non-Marketable | Share Marketable

Interest Rate Adjustment

The interest rate adjustment x_t^{j+1}, which is adjustment on the interest rate paid at time t on securities which were issued in fiscal year $t-1-j$ is given by:

$$x_t^{j+1} = \begin{cases} 0 & \text{for } t-1-j \leq 1942 \\ r_t^{\star\, j+1} - \left(i_t^{j+1} - \pi_t\right) & \text{for } 1943 \leq t-1-j \leq 1951 \\ \pi_t - \mathbb{E}_{t-1-j}[\pi_t] & \text{for } 1952 \leq t-1-j \end{cases} \tag{6}$$

where $\mathbb{E}_{t-1-j}[\pi_t]$ is the expectation at $t-1-j$ of the inflation rate at t.

Undistorted real interest rate $r_t^{\star\, j+1}$ estimated by assuming that *ex ante* real interest rate on securities issued under the peg was equal to average *ex ante* real rate for securities with similar maturity issued between 1951 - 1961.

Yield curve: 1.4% at 1-year; 2.1% at 5-year; and 2.5% at 10-year horizon.

Share Bills s_{t-1} and TIPS z_{t-1}^{j} Ex ante real rate - Peg

Variables

Data - Sources

- Fiscal: OMB, Hall, Payne and Sargent database, MSPD, CRSP.
  - Pre-1960 period: Hall, Payne, and Sargent (2018) provides quantities and description of **all securities** issued by the U.S. Treasury before 1960.
  - Post-1960 period: CRSP provides quantities and descriptions of **marketable securities held by the public, excluding Treasury bills**.

- Inflation: Livingston survey, SPF, Fed.
  - ST expectations: Livingston - CPI (1951-1969) and SPF - GDP (1969-)
  - LT expectations: FRB/US (1968-). We extend series back to 1951.

Regression

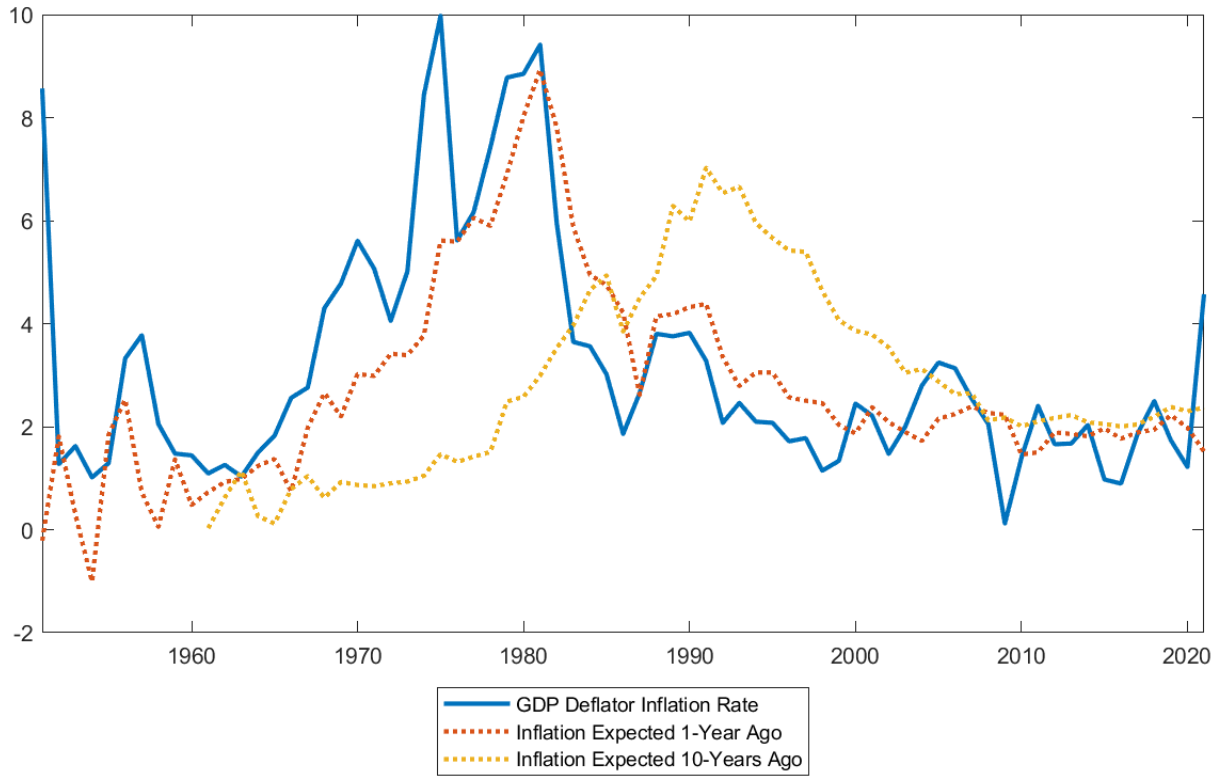
Reversed Maturity Structure

Figure: Reversed Maturity Structure of All Debt: w_{t-1}^{j}

Note. This chart represents the reverse maturity structure of the debt held by the public. The different shades represent the share of the outstanding debt held by the public at the end of fiscal year t which was issued in the same year, last year, 2 to 5 years ago, 6 to 10 years ago, and more than 10 years ago. Source: Authors' calculations.

Inflation

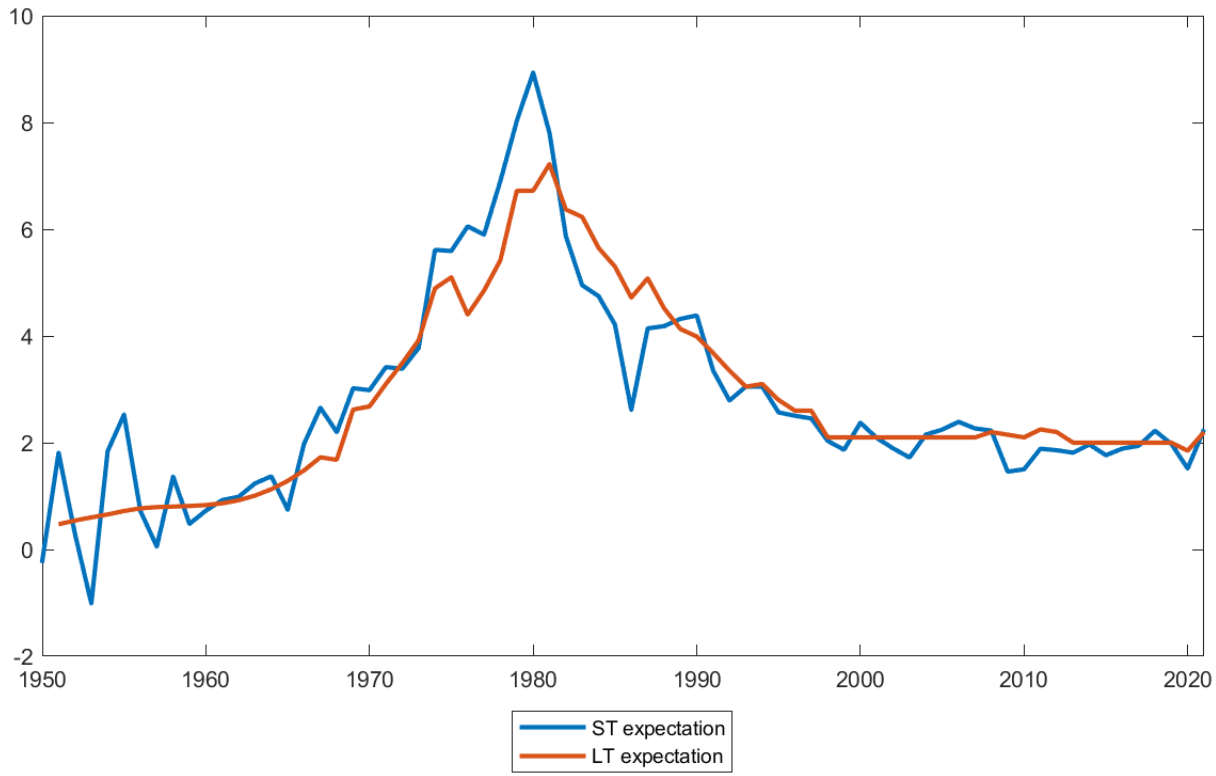
Figure: Inflation π_t and Expected Inflation $\mathbb{E}_{t-1}[\pi_t]$, $\mathbb{E}_{t-10}[\pi_t]$



Note. The lines represent the GDP deflator inflation rate, and its forecast values made 1 year and 10 years ago.
Source: Authors' calculations.

Inflation Expectations

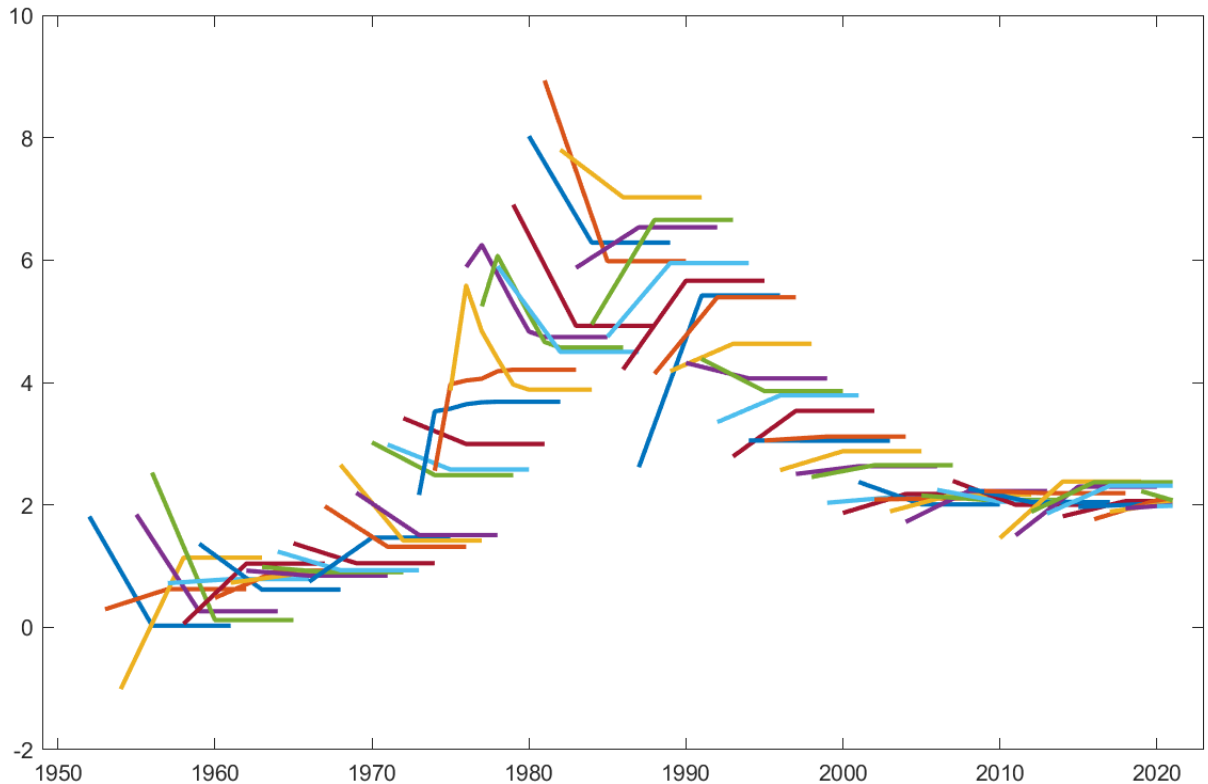
Figure: ST and LT Inflation Expectations: $\mathbb{E}_t[\pi_{t+1}]$ and $\mathbb{E}_t[\pi_t^{10}]$



Note. Sources: Livingston Survey, Survey of Professional Forecasters, Federal Reserve Bank of New York FRB/US Model, authors' calculations.

Inflation Expectations - Term Structure

Figure: Term Structure of Inflation Expectations: $\mathbb{E}_{t-1-j}[\pi_t]$

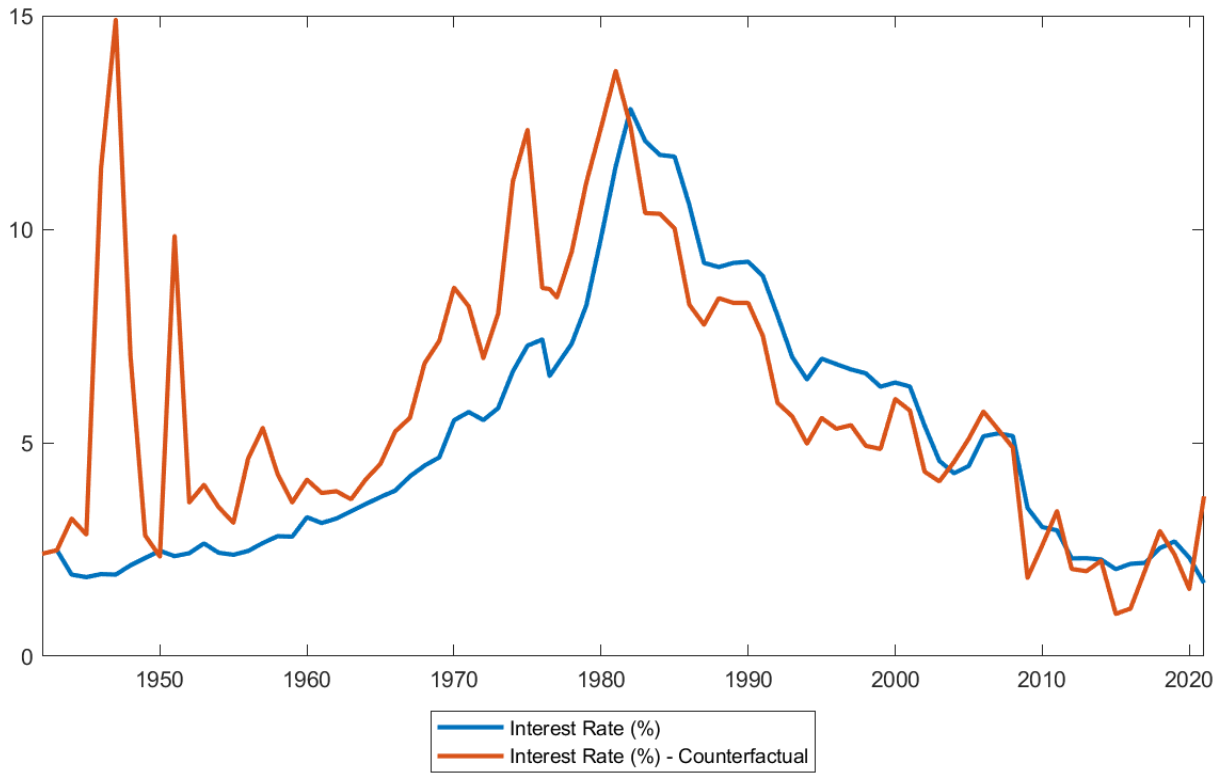


Note. Each line indicates inflation expectations made in the year previous to the beginning of the line. Sources: Livingston Survey, SPF, Federal Reserve Bank of New York FRB/US Model, authors' calculations.

Results

Counterfactual Interest Rate

Figure: Effective Interest Rate: Actual i_t versus Counterfactual $\hat{i}_t$

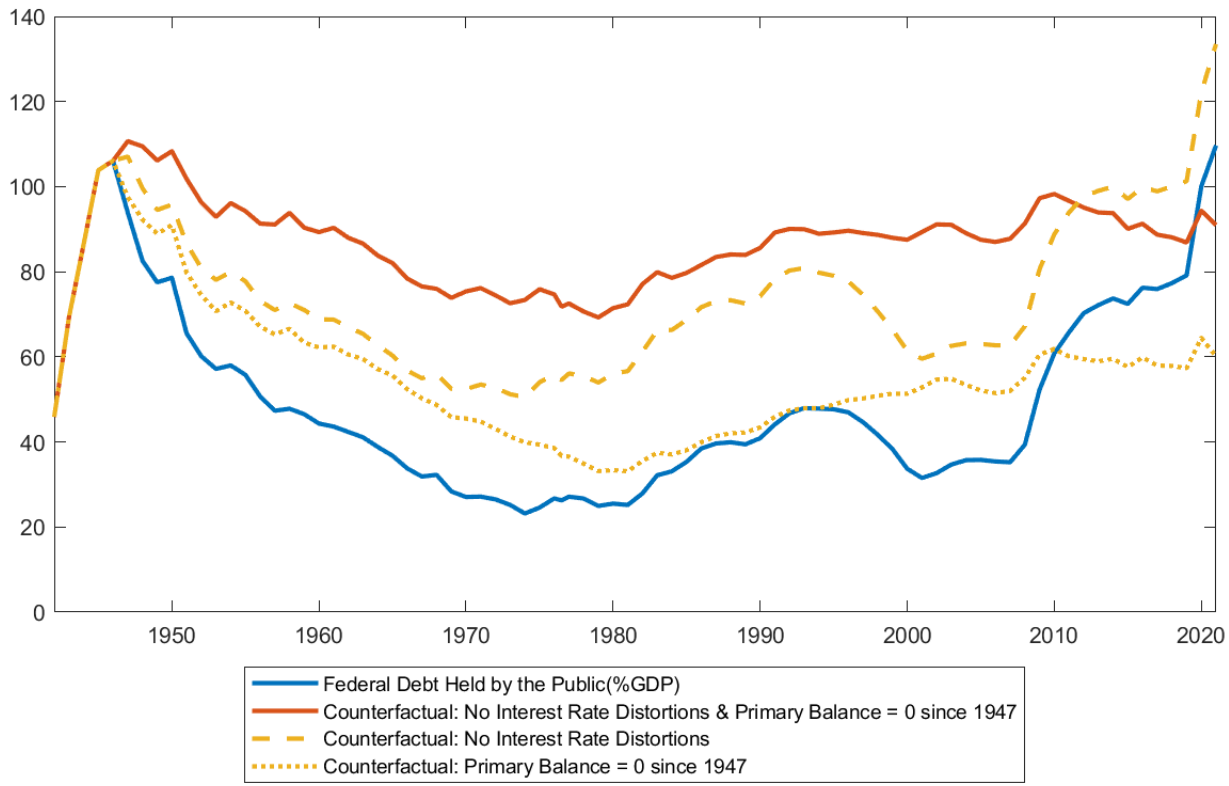


Note. The lines represent the average effective interest rate on debt held by the public and its counterfactual.

Source: Authors' calculations. Details

Counterfactual Debt Dynamics

Figure: Actual D_t and Counterfactual $\hat{D}_t$ Debt Dynamics

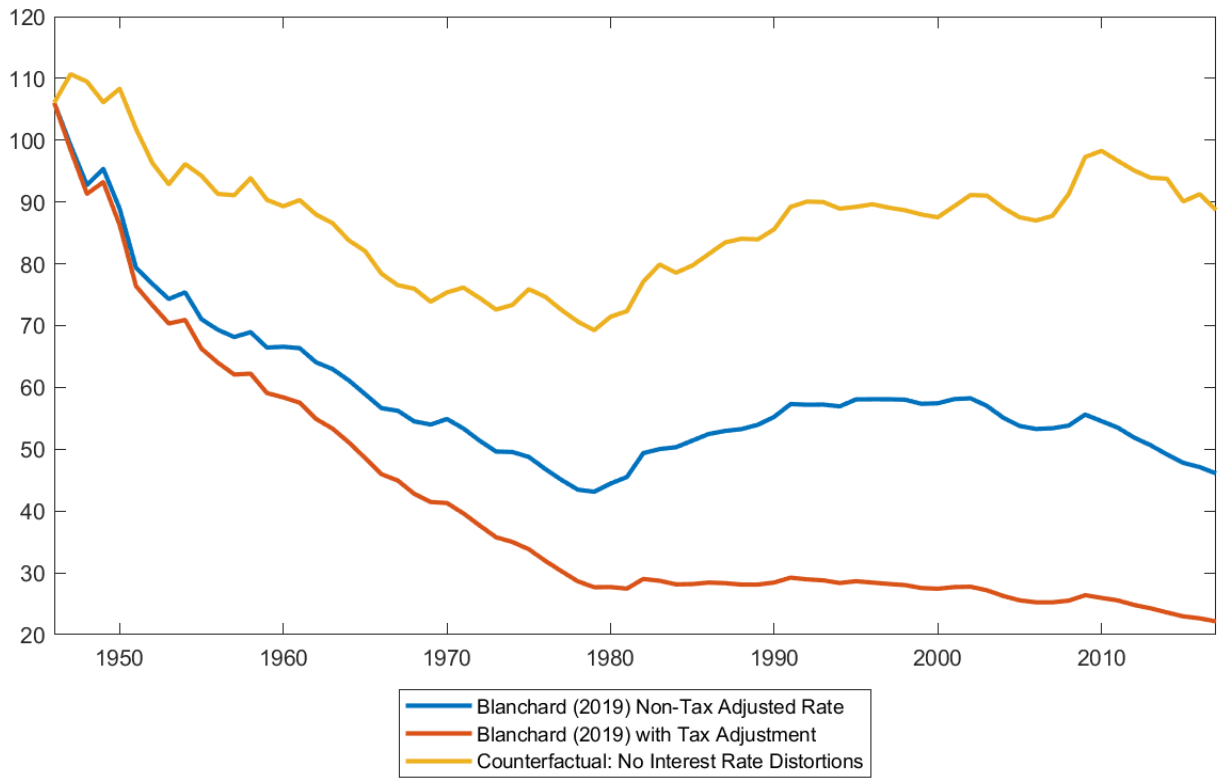


Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactuals for every fiscal year starting from 1947. Source: Authors' calculations.

Robustness

Revisiting Blanchard (2019)

Figure: Debt Dynamics, with Zero Primary Balance, starting in 1947



Note. The lines represent our baseline counterfactual debt dynamics and the debt dynamics in Figures 5 and 6 from Blanchard (2019) Source: Authors' calculations.

Conclusions

- Under our baseline calibration, we estimate that the public debt-to-GDP ratio would only have declined from 106% in 1946 to 73% in 1974 if primary balances had been equal to zero and there were no interest rate distortions.
- We find that the debt-to-GDP ratio would have persistently remained above its pre-war level and reached 91% in 2021.
- Put differently, the U.S. would not have grown its way out of its WWII debt without interest rate distortions and primary surpluses.
- The economy *could* grow its way out its current debt, but History should not make us optimistic about the prospects for growing out of debt.

CBO Forecast

Thank you!

Assumptions

Assumption 1:

$$\hat{w}_{t-1}^{j,nm} = w_{t-1}^{j,nm},\ \hat{w}_{t-1}^{j,m} = w_{t-1}^{j,m} \text{ and } \hat{m}_{t-1} = m_{t-1}.$$

Assumption 2:

$$w_{t-1}^{j,nm} = w_{1960}^{j,nm}\ \forall t > 1961 \text{ and } \forall j \geq 0.$$

Assumption 3: *ex ante* real interest rate on securities issued during the peg period

(1942-1951) before the Fed-Treasury Accord of March 1951 was equal to average ex ante real rate for securities with similar maturity issued between 1951 - 1961.

Assumption 4: debt securities issued during year $t - j$ are all issued at the end of year $t - j$. We also assume that debt securities maturing during year t all mature at the end of year t, except for Treasury bills which are constantly rolled over.

Assumption 5:

$$\hat{D}_{1946} = D_{1946}$$

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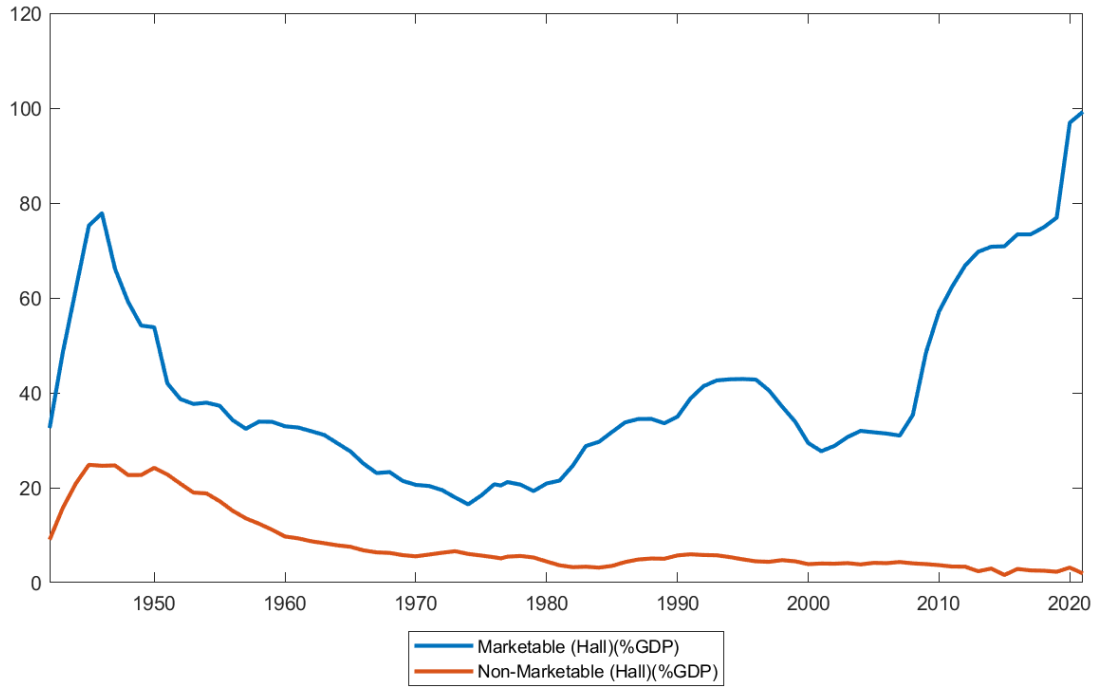
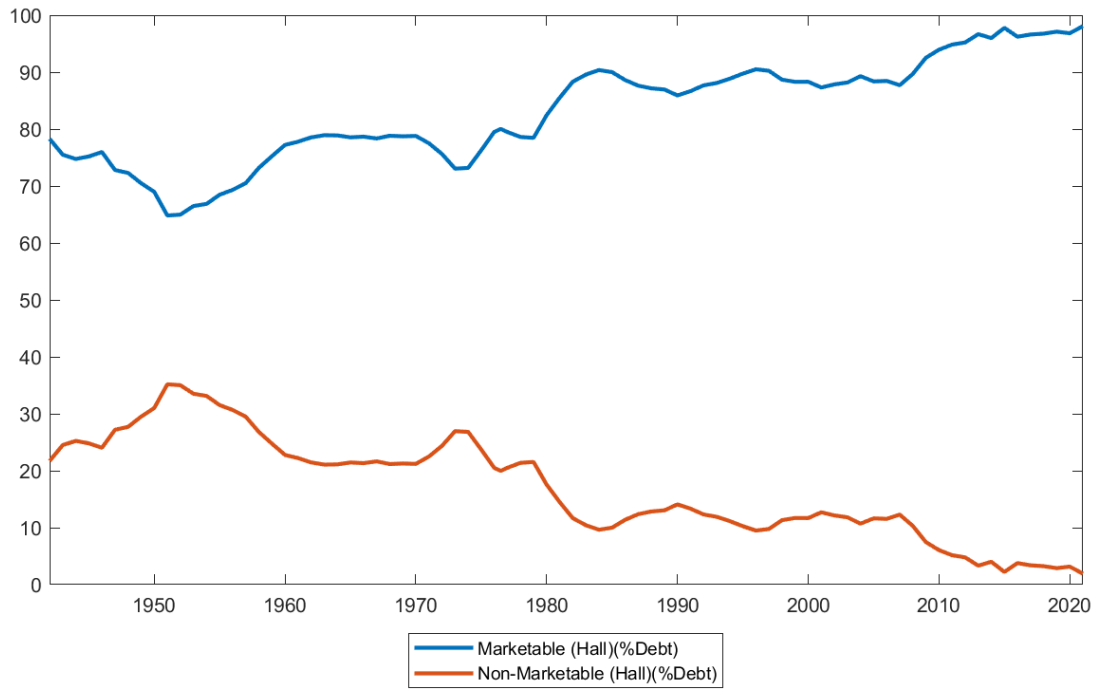
Figure: Marketable and Non-Marketable Federal Debt Held by the Public



Note. The lines represent the ratio of the par value of marketable and non-marketable outstanding Treasury securities held by the public to GDP. Source: OMB, Hall.

Figure: Marketable and Non-Marketable Federal Debt Held by the Public



Note. The lines represent the ratio of the par value of marketable and non-marketable outstanding Treasury securities held by the public to Federal Debt. Source: Hall.

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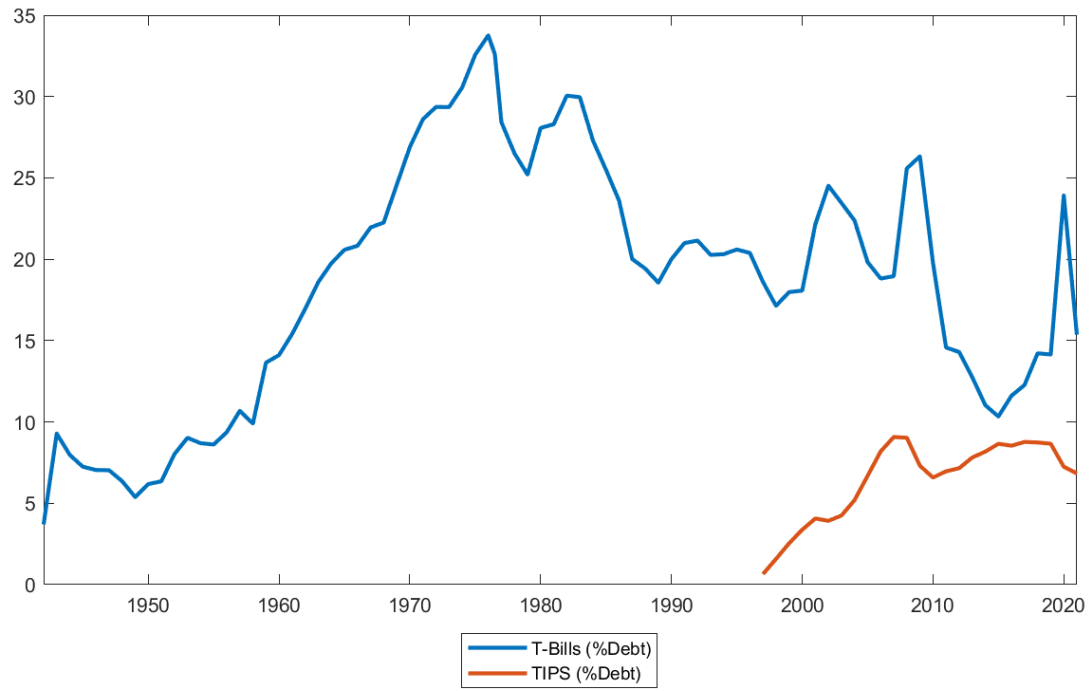
Figure: Share of Treasury Bills and TIPS in Outstanding Public Debt



Note. This chart represents the share of Treasury bills and TIPS in total outstanding debt held by the public. Source: Treasury Bulletin.

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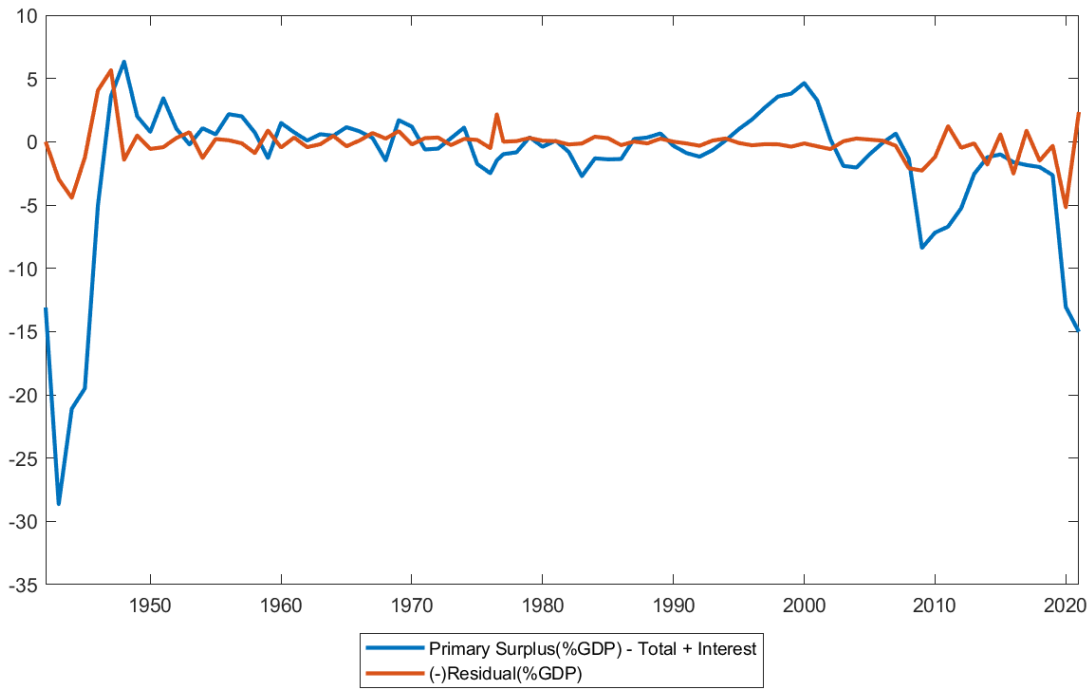
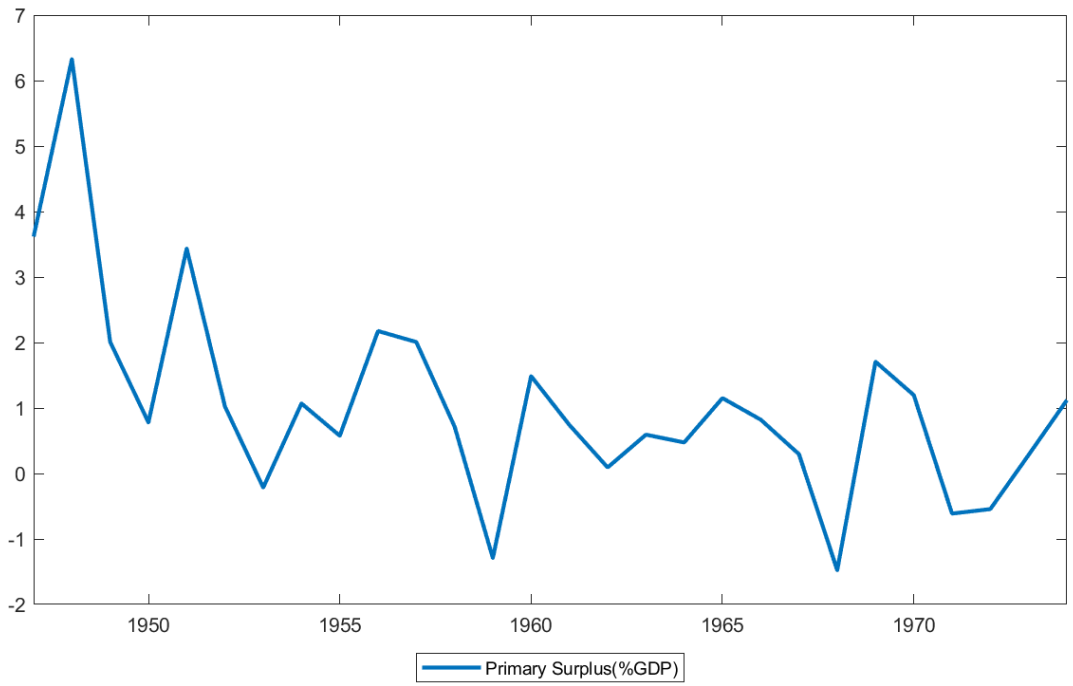
Figure: Primary Balance and Residual as a Percent of GDP



Note. The lines represent the ratio of the primary balance to GDP and the residual ϵ to GDP. The blue line is computed as the ratio of the sum of the total fiscal balance plus interest payment to GDP. The second line is computed using the debt dynamics equation. Source: OMB, authors' calculations.

Primary Balance

Figure: Primary Balance as a Percent of GDP: P_t



Note. The line represents the ratio of the primary balance to GDP. It is computed as the ratio of the sum of the total fiscal balance plus interest payment to GDP. Source: OMB, authors' calculations.

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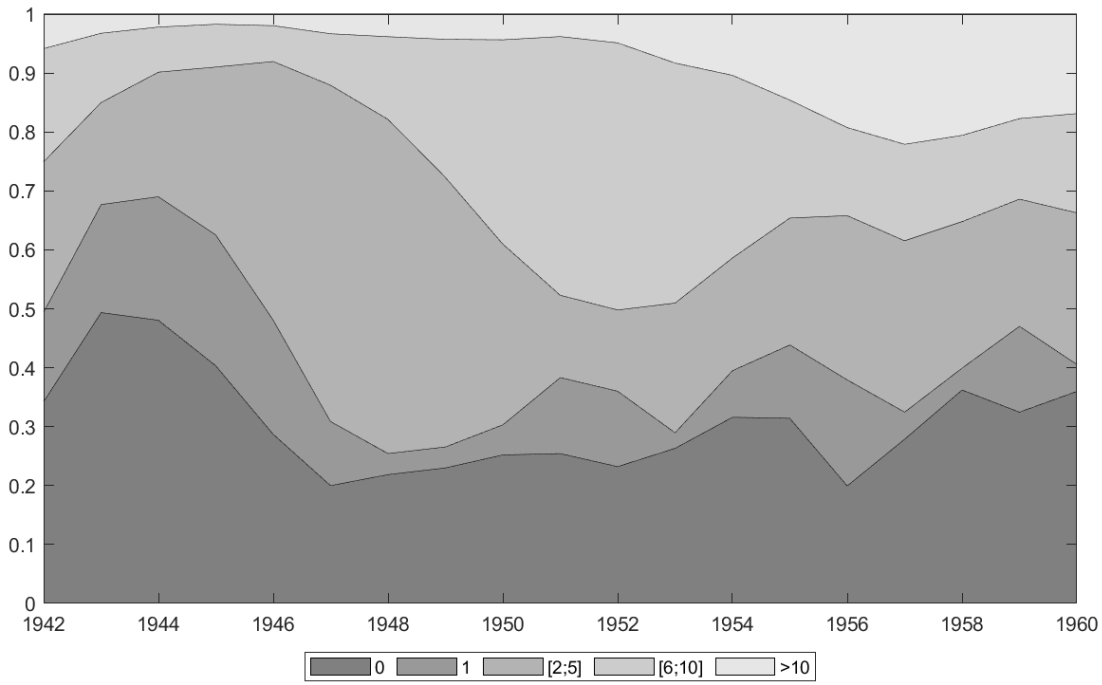
Figure: Reversed Maturity Structure of Public Debt Pre-1960



Note. This chart represents the reverse maturity structure of the total debt held by the public between 1942 and 1960. The different shades represent the share of the outstanding debt held by the public at the end of fiscal year t which was issued in the same year, last year, 2 to 5 years ago, 6 to 10 years ago, and more than 10 years ago. Lighter shades are associated with longer reverse maturity. Source: Authors' calculations.

Figure: Reversed Maturity Structure of Marketable Public Debt Pre-1960

Note. This chart represents the reverse maturity structure of the total debt held by the public between 1942 and 1960, computed using equation (4). The different shades represent the share of the outstanding debt held by the public at the end of fiscal year t which was issued in the same year, last year, 2 to 5 years ago, 6 to 10 years ago, and more than 10 years ago. Lighter shades are associated with longer reverse maturity. Source: Authors' calculations.

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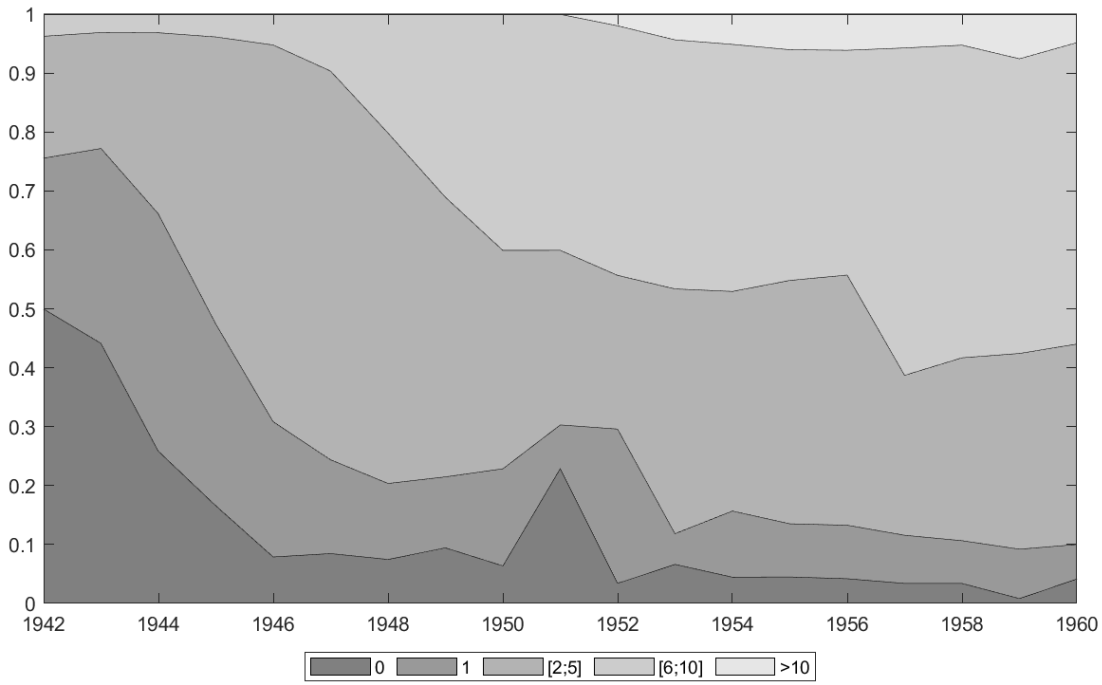
Figure: Reversed Maturity Structure of Non-Marketable Public Debt



Note. This chart represents the reverse maturity structure of the non-marketable debt held by the public between 1942 and 1960, computed using equation (4). The different shades represent the share of the outstanding debt held by the public at the end of fiscal year t which was issued in the same year, last year, 2 to 5 years ago, 6 to 10 years ago, and more than 10 years ago. Lighter shades are associated with longer reverse maturity. Source: Authors' calculations.

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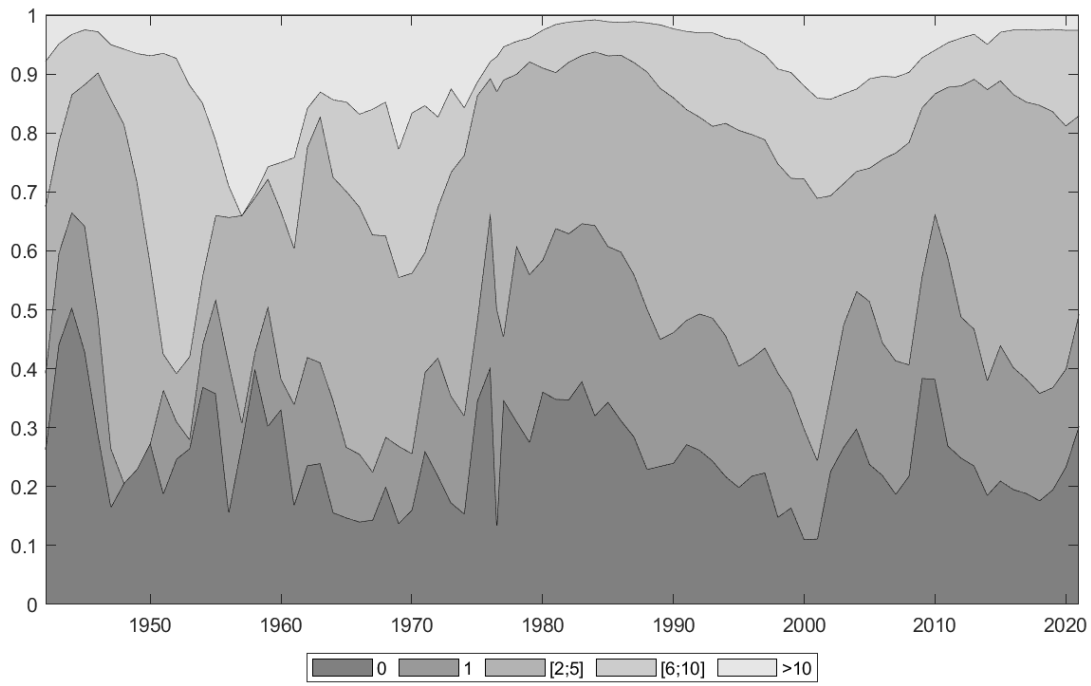
Reversed Maturity Structure - Marketable

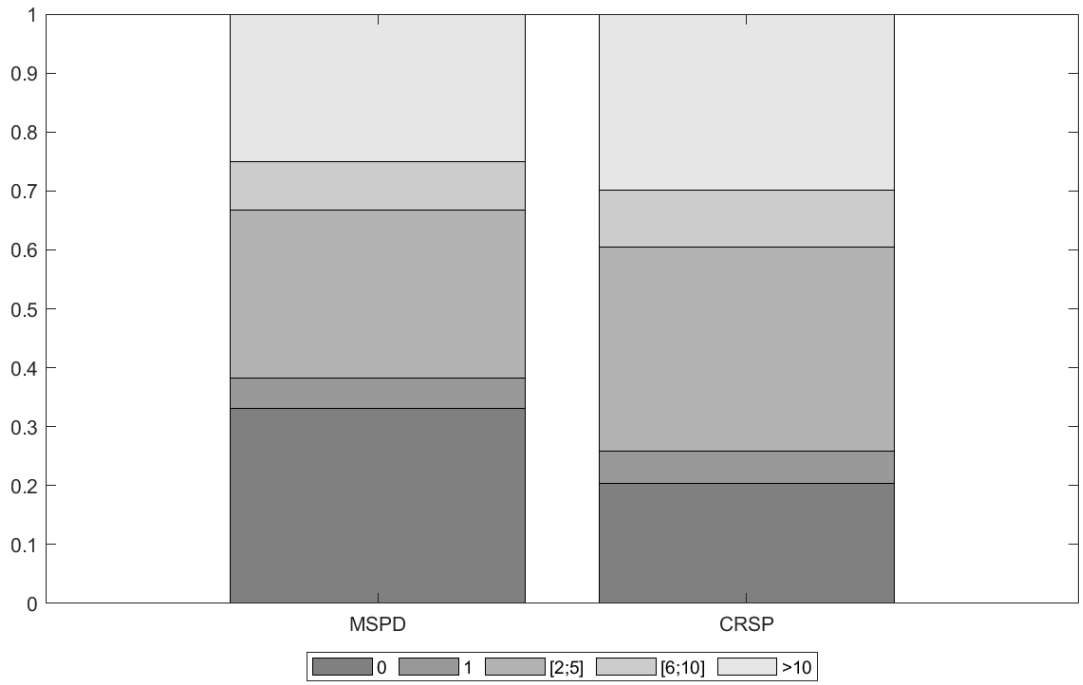
Figure: Reversed Maturity Structure of Marketable Debt: $w_{t-1}^{j,m}$



Note. This chart represents the reverse maturity structure of the marketable debt excluding Treasury bills held by the public. Source: Authors' calculations.

Compare MSPD and CRSP

Figure: Reverse Maturity Structure of Marketable Non-Bills in 1960: MSPD and CRSP



Note. This chart represents the reverse maturity structure of the marketable non-bills debt held by the public in 1960, both according to MSPD (left bar) and CRSP (right bar) datasets. The different shades represent the share of the outstanding debt held by the public at the end of fiscal year t which was issued in the same year, last year, 2 to 5 years ago, 6 to 10 years ago, and more than 10 years ago. Source: Authors' calculations.

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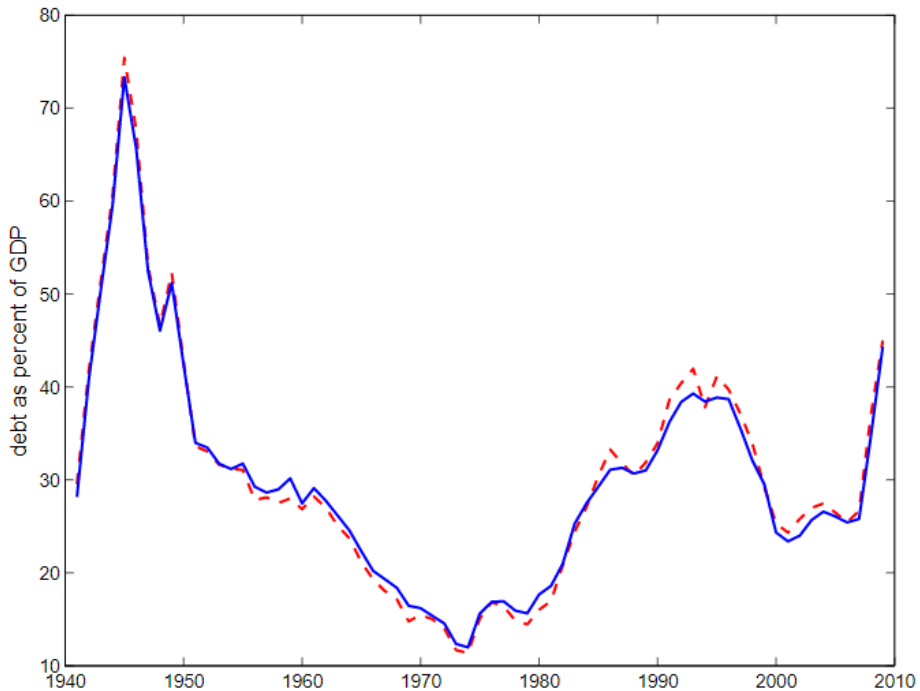
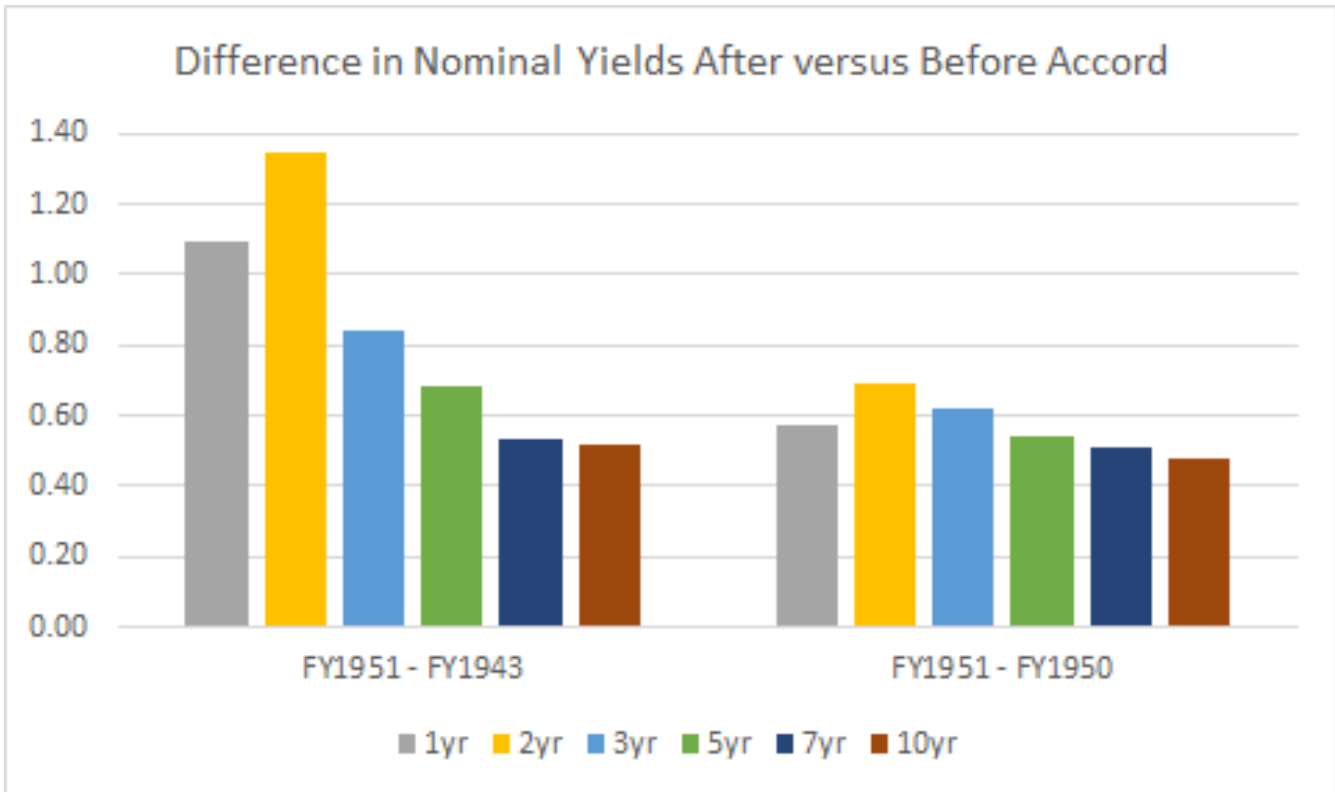
Figure: Par Value and Market Value of Marketable Debt Held by the Public as a Percent of GDP



Note. The solid blue line is the ratio of the par value of marketable Treasury securities held by the public to GDP. The dashed red line is ratio of the market value of marketable Treasury securities held by the public to GDP. Source: Borrowed from Hall and Sargent (2011).

Figure: Historical Background



Note. The chart shows the difference between the average nominal yields in FY1951 and FY1943 (left) and FY1951 and FY1950 (right) for different maturities.

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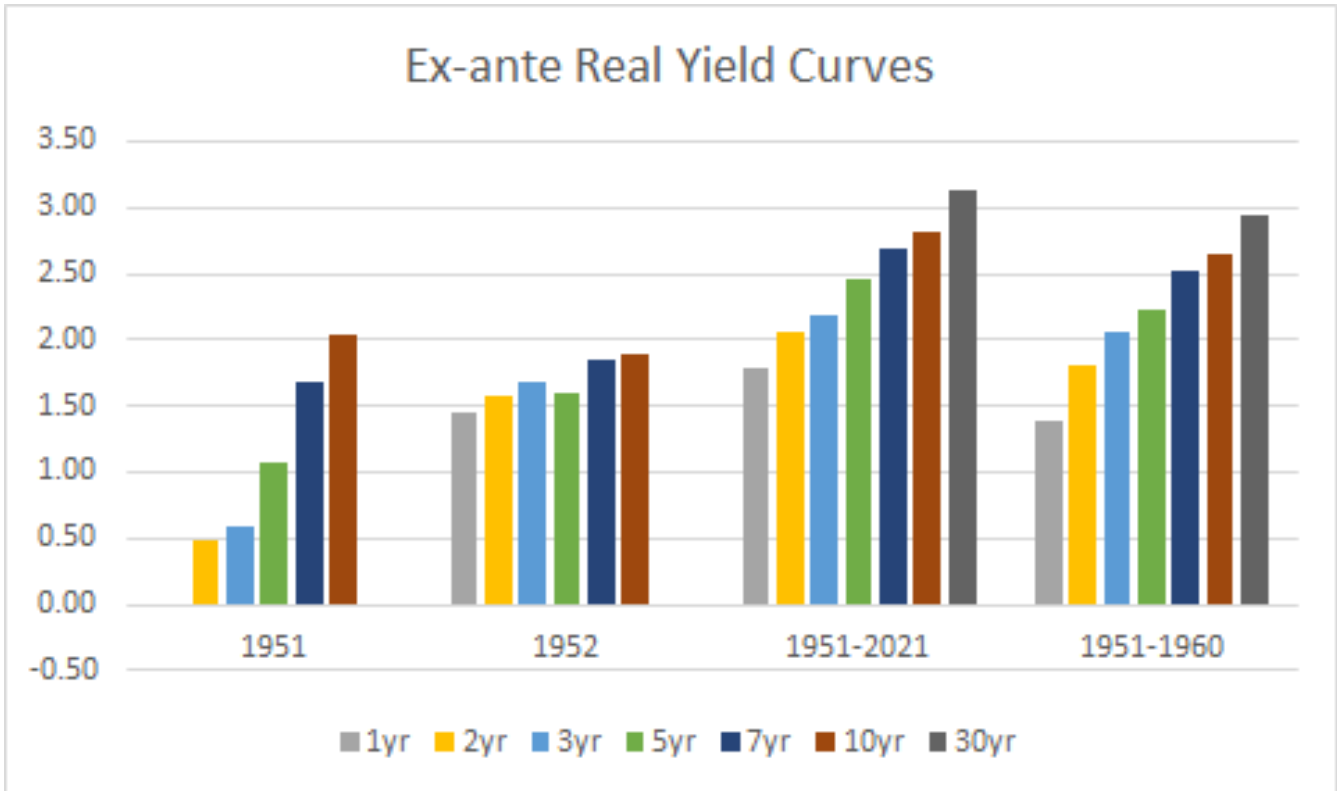
Figure: Ex ante real rate



Note. The chart shows the average ex ante real yield for different maturities and different time periods.

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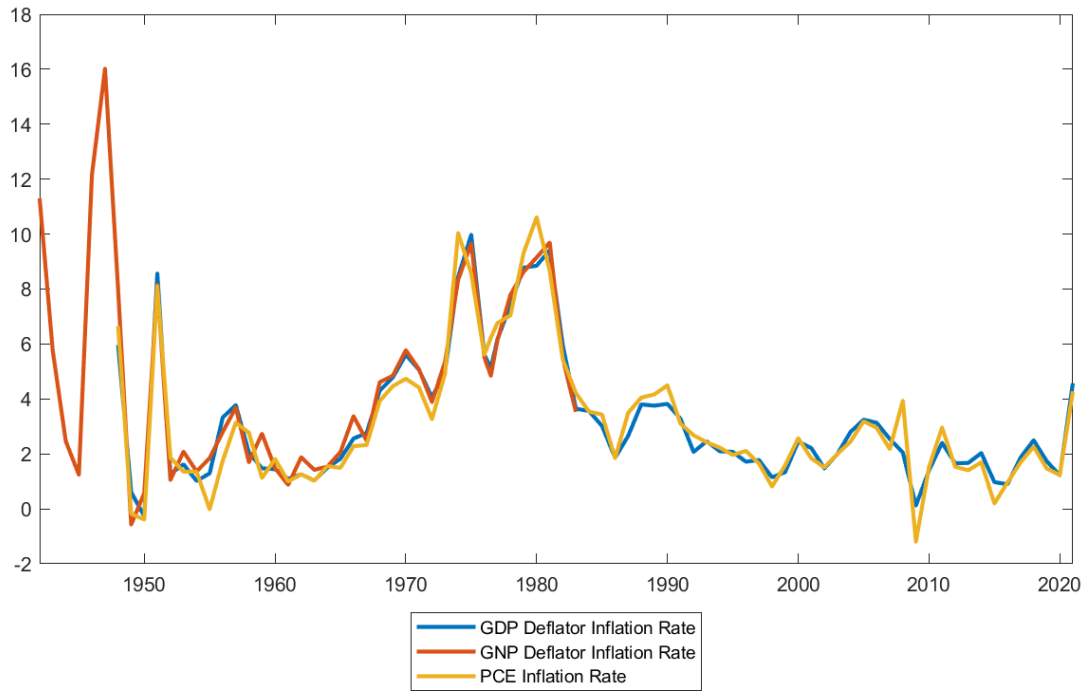
Figure: GDP Deflator (1948-2021) and GNP Inflation Rate (1942-1983)



Note. The blue, orange, and yellow lines represent, respectively, the GDP deflator inflation rate, the GNP deflator inflation rate, and the PCE inflation rate. Sources: Bureau of Economic Analysis, NBER "The American Business Cycle" Database.

Long-term Inflation Expectations Before 1968

Table: Long-term and HP Filtered Short-term Expectations

VARIABLES	$\pi_t^{GDP,eL} - \tilde{\pi}_t^{GDP,eS}$
$\Delta\tilde{\pi}_t^{GDP,eS}$	-1.549***
	[0.217]
Observations	30
R-squared	0.637

Standard errors in brackets
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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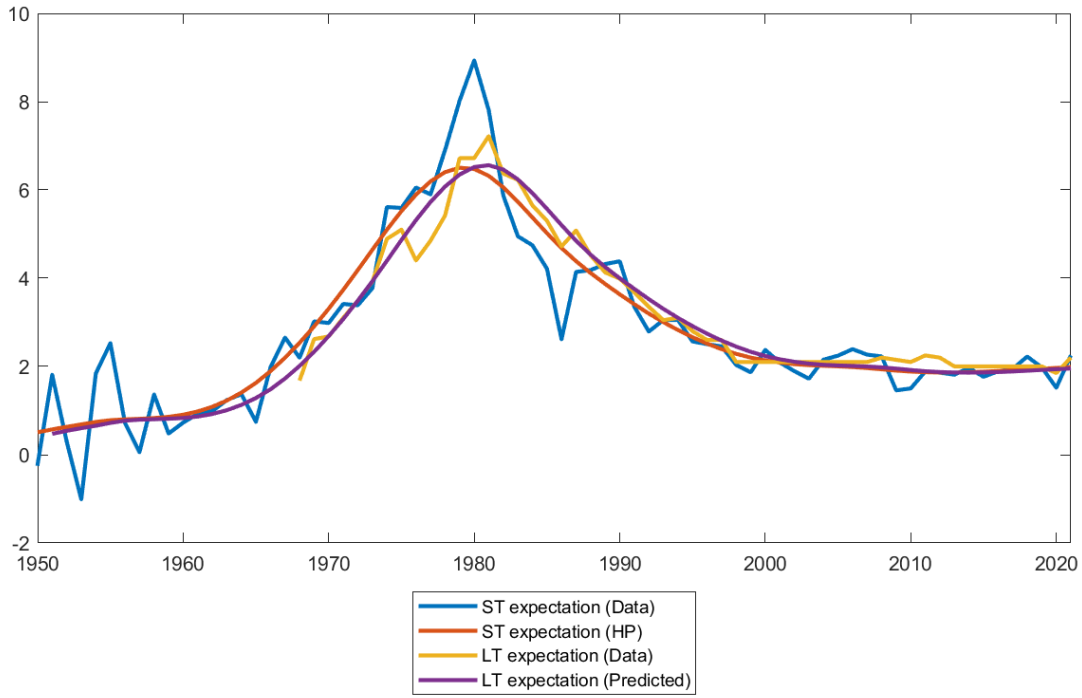
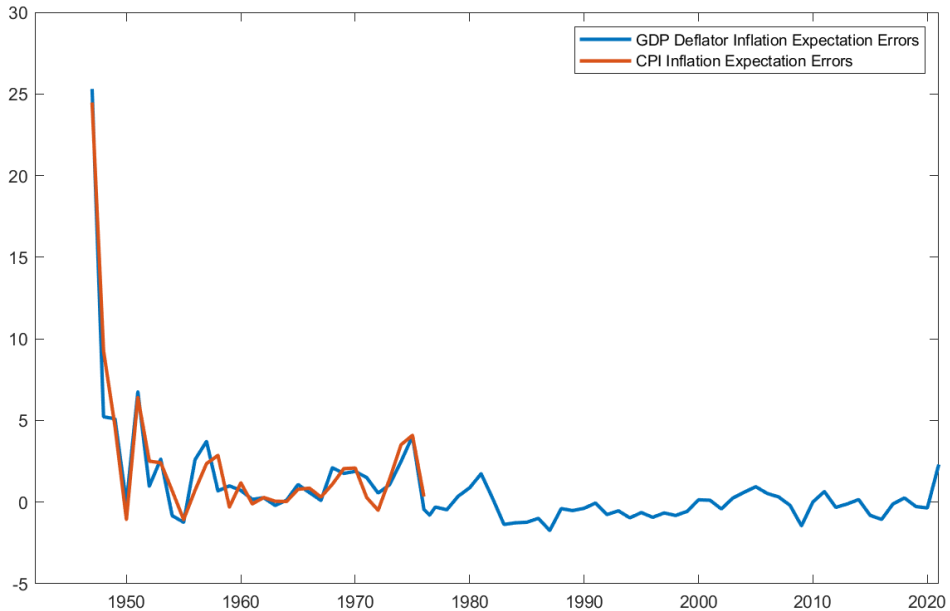
Figure: Inflation Expectations, 1951-2021



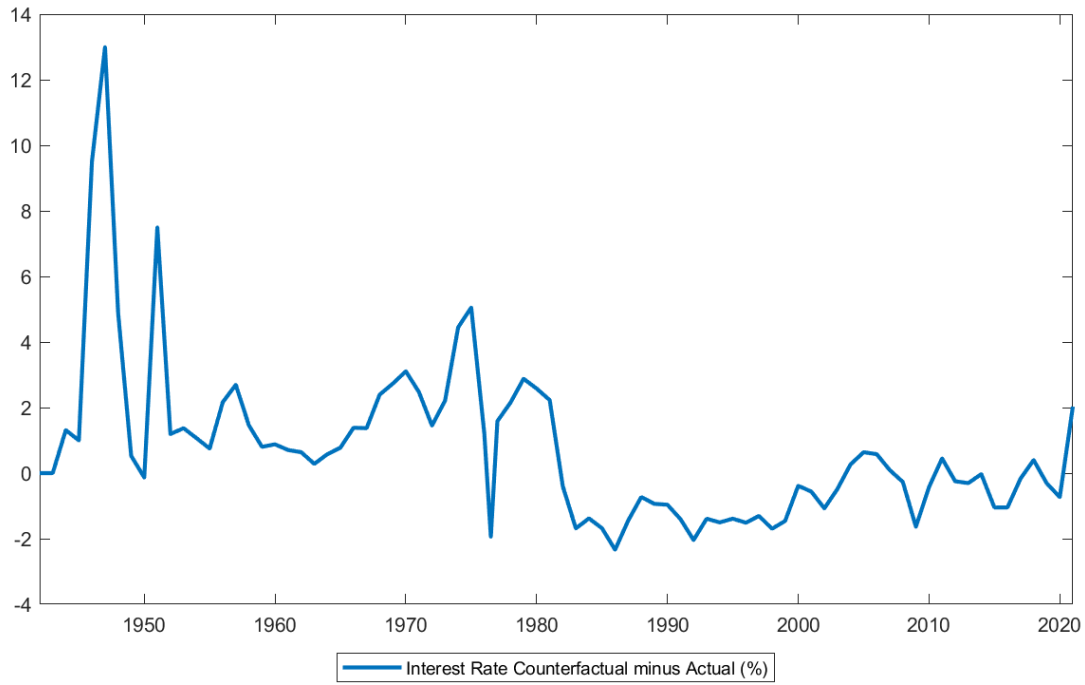
Note. Sources: Livingston Survey, Survey of Professional Forecasters, Federal Reserve Bank of New York FRB/US Model, Authors' calculations.

Figure: GNP Deflator and CPI Inflation Expectations Errors, 1951-2018



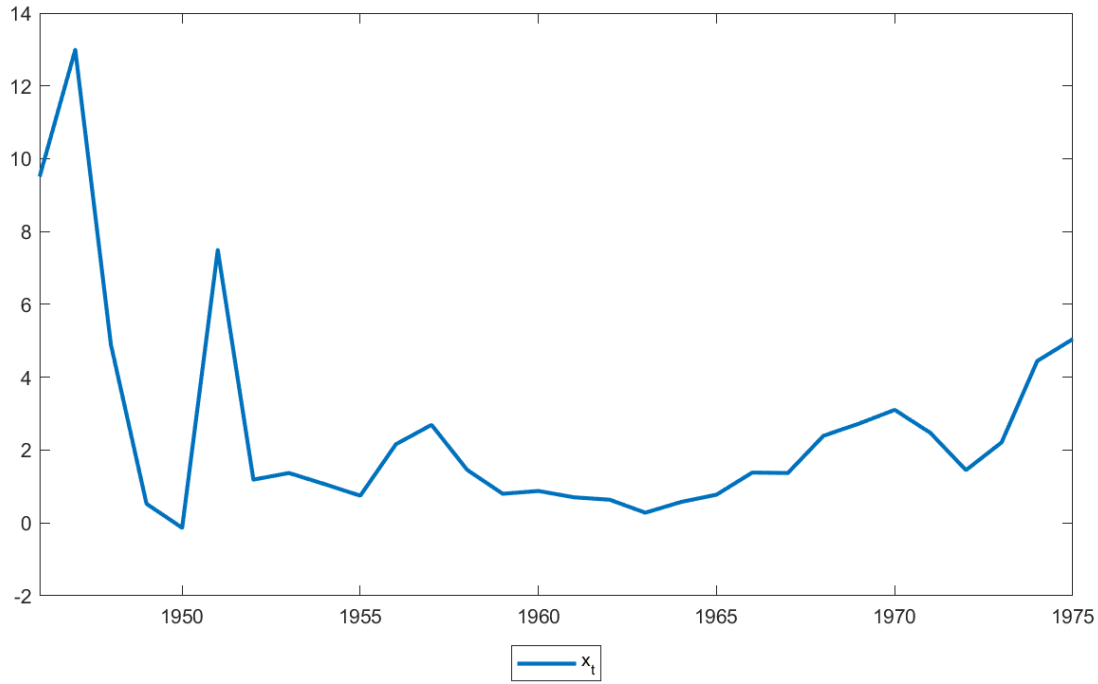
Note. The line for CPI inflation expectation errors is computed as the actual CPI inflation rate minus the expected CPI inflation rate (Livingston Survey), from FY 1947 to FY 1976. The line for the GDP inflation expectation errors is computed as the GDP deflator inflation rate minus the expected GDP deflator inflation rate (Survey of Professional Forecasters). The GDP deflator inflation rate time series, as used in this graph, is composed of the GNP deflator inflation rate (NBER American Business Cycle dataset) from FY 1942 to FY 1947, then the GDP deflator inflation rate (FRED) from FY 1948 to FY 2021. The GDP deflator inflation expectations time series is composed of GNP deflator inflation expectations from FY 1970 to FY 1991 (Survey of Professional Forecasters), then the GDP deflator inflation expectations from FY 1992 to FY 2021 (Survey of Professional Forecasters). Sources: FRED, NBER Ameriacan Business Cycle dataset, Livingston Survey, Survey of Professional Forecasters, Federal Reserve Bank of New York FRB/US Model, authors' calculations.

Figure: Effective Interest Rate Differential



Note. The line represents the difference between the counterfactual and actual average effective interest rate on debt held by the public. Source: Authors' calculations.

Figure: Effective Interest Rate Differential (1951-1975)



Note. The line represents the difference between the counterfactual and the average effective interest rate on debt held by the public. Source: Authors' calculations.

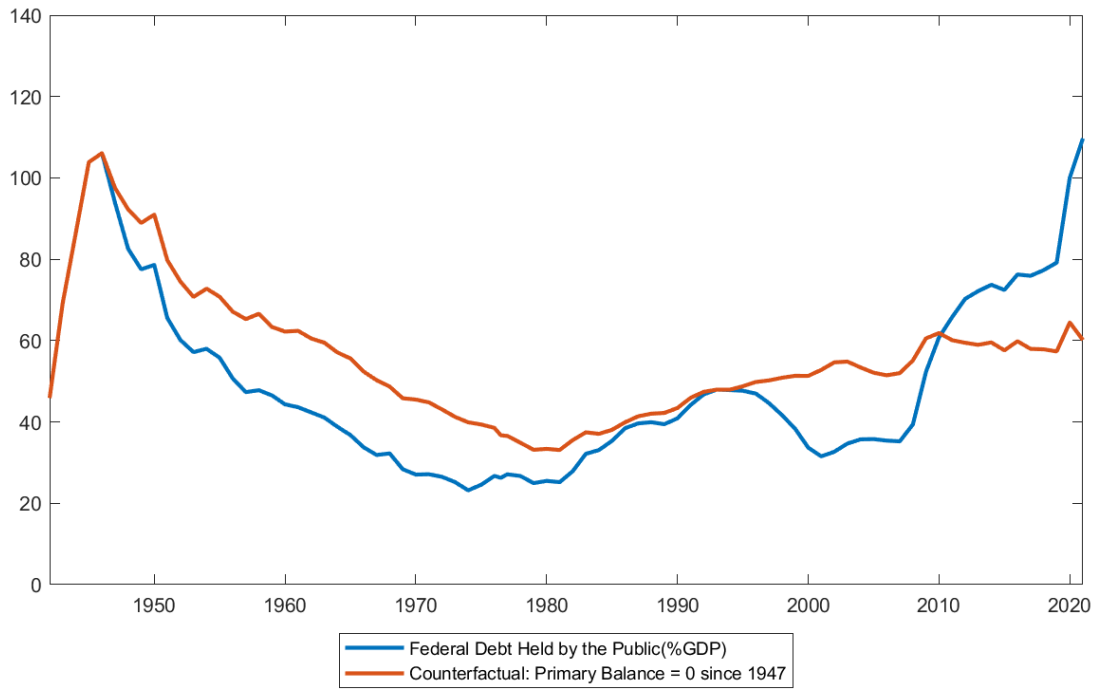
Interest Rate Adjustment - Decomposition

Table: Decomposition of the Average Effective Interest Rate Adjustment x_t Selected Years post WWII

Variable	j	1946	1947	1948	1951	1957	1969	1970	1974	1975
x_t		9.51	12.99	4.90	7.50	2.69	2.73	3.11	4.45	5.05
$x_t^{j+1} w_{t-1}^j$	0	4.99	4.63	1.20	2.27	0.33	0.45	0.35	0.84	0.85
	1	2.76	3.15	0.66	0.44	0.33	0.13	0.27	0.41	0.45
	[2:5]	1.76	5.22	3.05	2.64	0.89	0.88	0.86	1.37	1.71
	> 5	0.00	0.00	0.00	2.14	1.15	1.27	1.62	1.83	2.04
w_{t-1}^j	0	0.29	0.20	0.22	0.25	0.28	0.38	0.42	0.45	0.53
	1	0.19	0.11	0.04	0.13	0.05	0.08	0.06	0.07	0.06
	[2:5]	0.44	0.57	0.57	0.14	0.29	0.21	0.21	0.25	0.22
	> 5	0.08	0.12	0.18	0.48	0.38	0.33	0.32	0.23	0.18
x_t^{j+1}	0	17.34	23.09	5.47	8.92	1.16	1.17	0.83	1.89	1.60
	1	14.25	28.96	18.40	3.43	7.25	1.75	4.88	5.47	6.96
	[2:5]	4.01	9.15	5.37	18.91	3.05	4.16	4.10	5.53	7.73
	> 5	0.00	0.00	0.00	4.49	2.99	3.82	5.15	7.84	11.18

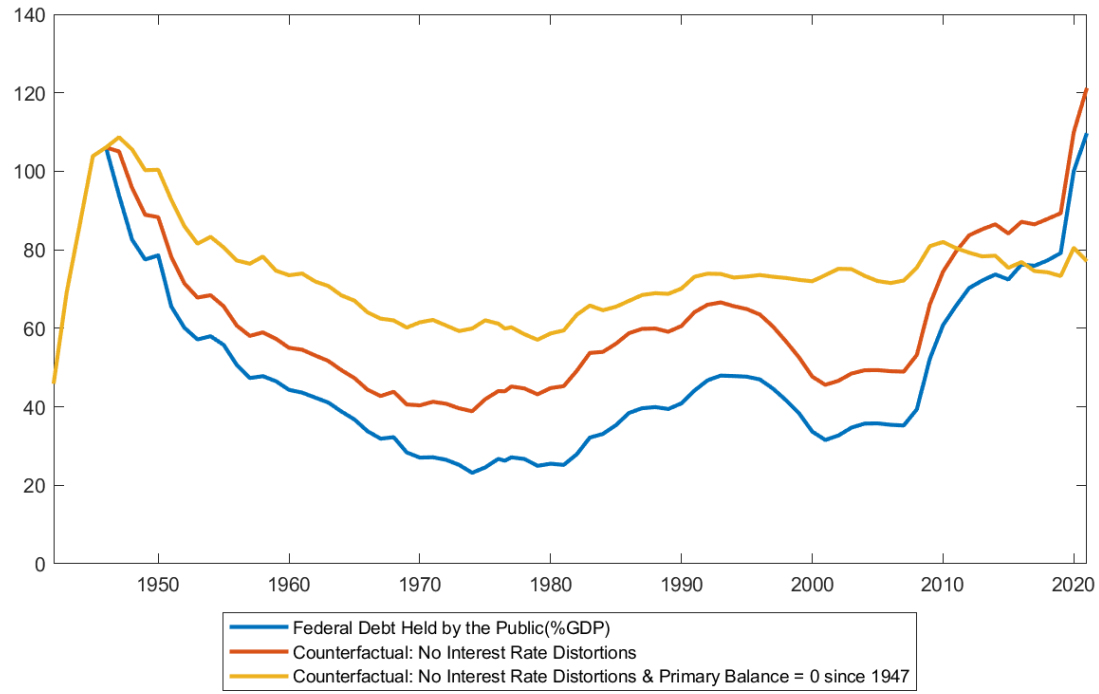
Note. The table provides a decomposition of the average effective interest rate adjustment x_t for selected years. The years shows corresponds to the ones for which the adjustment x_t was above the average adjustment x_t over the period 1946-1975. Source: Authors' calculations. Back

Figure: Counterfactual Debt Dynamics - Primary Balance



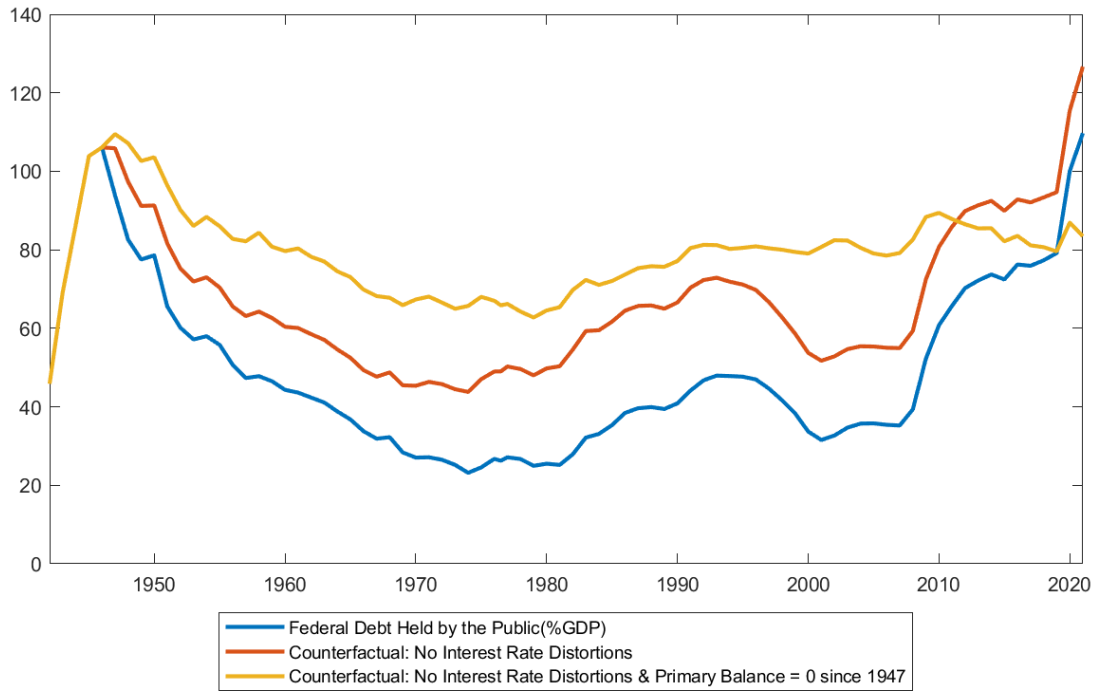
Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactual assuming a primary balance equal to zero for every fiscal year starting from 1947. Source: Authors' calculations.

Figure: Counterfactual Debt Dynamics - Inflation and Primary Balance



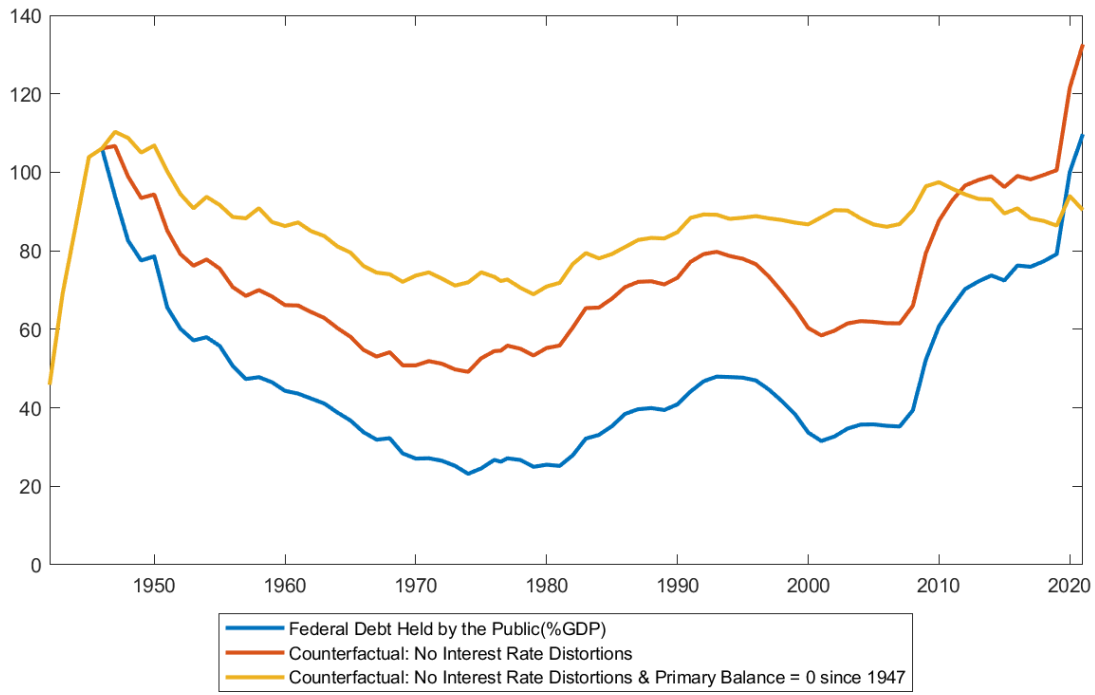
Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactual assuming no interest rate distortions and *ex ante* real rate of 0% during the peg period, and a primary balance equal to zero for every fiscal year starting from 1947. Source: Authors' calculations.

Figure: Counterfactual Debt Dynamics - Inflation and Primary Balance



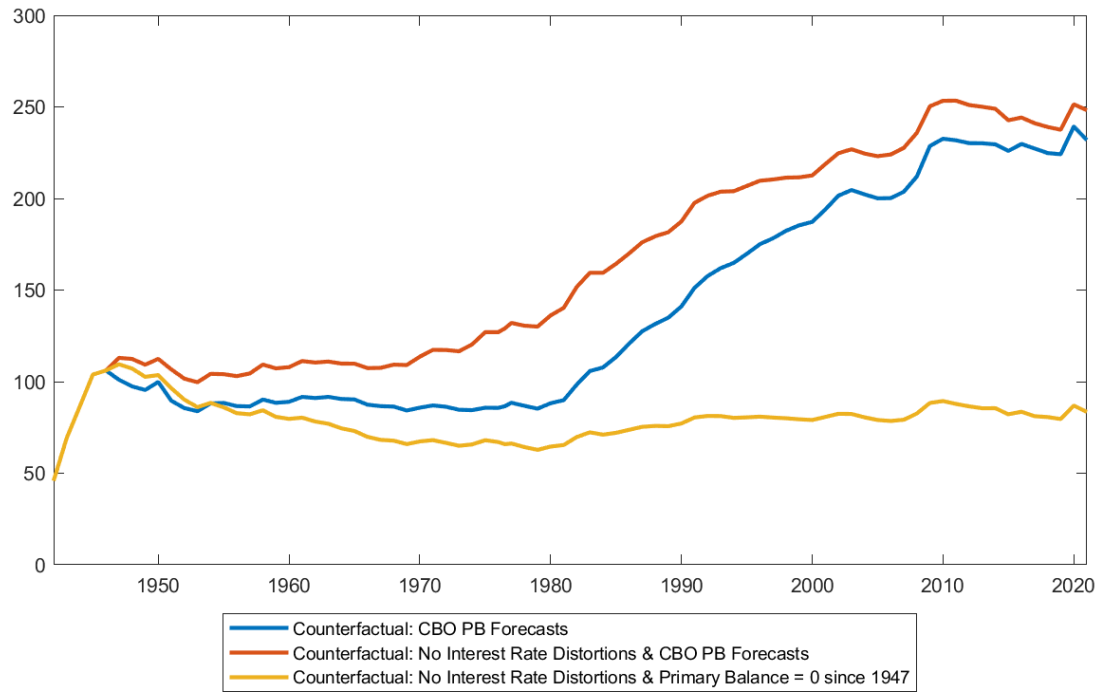
Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactual assuming no interest rate distortions, *ex ante* real rate of 1% during the peg period, and a primary balance equal to zero for every fiscal year starting from 1947. Source: Authors' calculations.

Figure: Counterfactual Debt Dynamics - Inflation and Primary Balance



Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactual assuming no interest rate distortions, *ex ante* real rate of 2% during the peg period, and a primary balance equal to zero for every fiscal year starting from 1947. Source: Authors' calculations. Back

Figure: Counterfactual Debt Dynamics
Inflation and CBO Forecasted Primary Balance



Note. The lines represent the the ratio of the par value of outstanding Treasury securities held by the public to GDP and its counterfactual assuming no interest rate distortions, *ex ante* real rate of 1% during the peg period, and a primary balance equal to zero for every fiscal year starting from 1947. The blue and red lines use primary balances forecasts for the period 2022-2095 instead of actual primary balances. Source: Authors' calculations.

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