American War Finance

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Sins and Sophistries

. . . the study of the past with one eye, so to speak, upon the present is the source of all sins and sophistries in history.

Herbert Butterfield, *The Whig Interpretation of History (1931)*

Beware

- We present a whig history of US tax and debt management policies for nine wars
- (Or do we?)

Our whig approach

- When you see an outcome, ask who wants it?
- We imagine that a benevolent planner chooses debt management-taxation strategies.

Two Theories of War Finance

1. Barro (1979)
2. Lucas and Stokey (1983)

Please see https://python.quantecon.org/smoothing.html

Barro Tax Smoothing

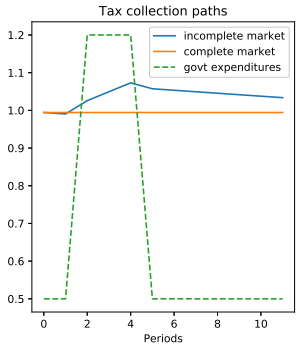
- Exogenous stochastic process for government expenditures (Markov)
- Objective: minimize expected discounted value of a loss function quadratic in total tax collections T_t
- $\beta = 1$
- Opportunities: One-period risk-free debt only, gross risk-free interest rate $R = \beta^{-1}$
  - Government can only "self-insure" via government saving and dissaving
- Outcomes: Tax collections a random walk; government debt has a unit root and is co-integrated with tax collections

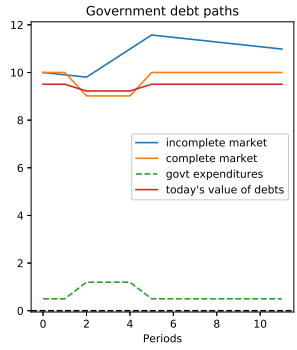
Lucas-Stokey Tax Smoothing (our version)

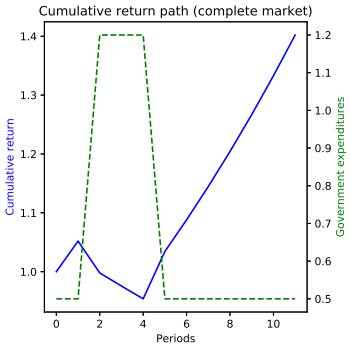
Same as Barro's model *except*

- Opportunities: there exists a complete array of one-period Arrow securities with state-contingent prices equal conditional probabilities times β
  - Government can insure via Arrow securities
- Outcomes:
  - Taxes are constant across time and across Markov states
  - Government debt is a fixed function of the Markov state
  - Expost returns on government debt are low during war, high when war switches to peace

Responses of Taxes and Debt to a Temporary Increase in Government Spending







Nine Wars (1.5 of Which are Revolutions)

Wars

1. War of 1812
2. Mexican War
3. Civil War (Union)
4. Spanish American War
5. World War I
6. World War II
7. Korean War
8. Vietnam War

Revolutions

1. American War of Independence (Succeeded)
2. Confederate States of America (CSA) – the Civil War (Failed)

The Government Budget Constraint

$$B_t = B_{t-1} + r_{t-1,t} B_{t-1} + G_t - T_t - (M_t - M_{t-1})$$

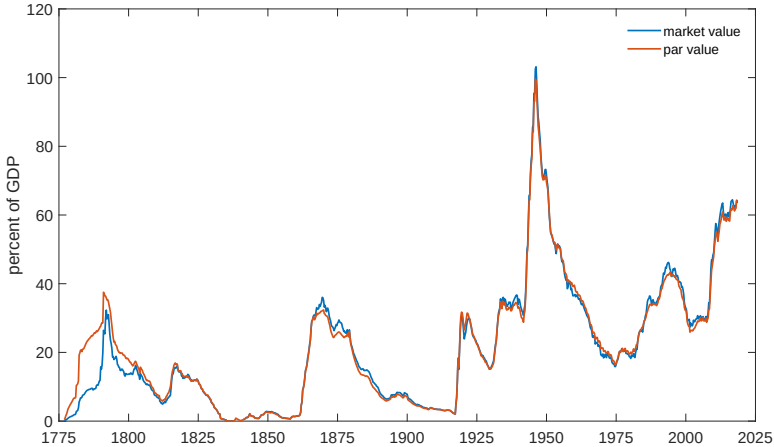
where

$$\begin{aligned}
B_{t-1} &= \text{the total nominal value of interest bearing government debt at } t-1 \\
r_{t-1,t} &= \text{nominal holding period return between } t-1 \text{ and } t \\
G_t &= \text{government purchases} \\
T_t &= \text{taxes} \\
M_t &= \text{stock of non-interest bearing government debt (base money)}
\end{aligned}$$

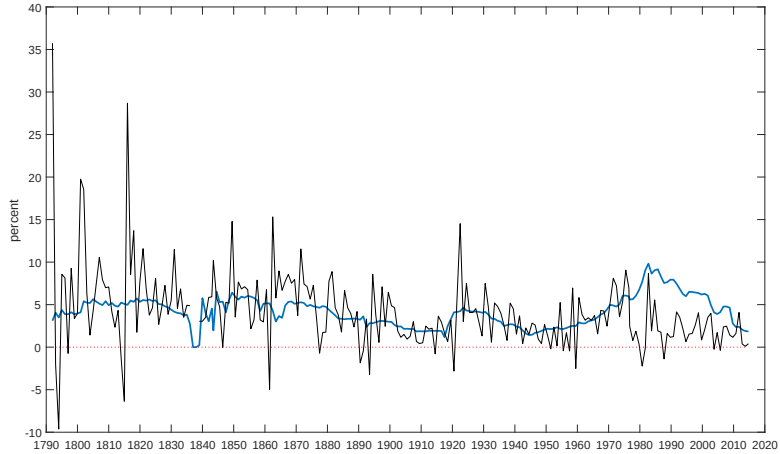
Accounting and Data

- US Treasury Accounts
  - Debt is measured at its *face value*
  - Interest payments are the coupon payments plus capital gains on T-bills
- Our Two Theories
  - Debt is measured at its *market value*
  - Interest payments are ex post holding period returns
- Hall, Payne and Sargent, 2018, *US Federal Debt 1776-1960: Prices and Quantities*
  - data available from https://github.com/jepayne/US-Federal-Debt-Public

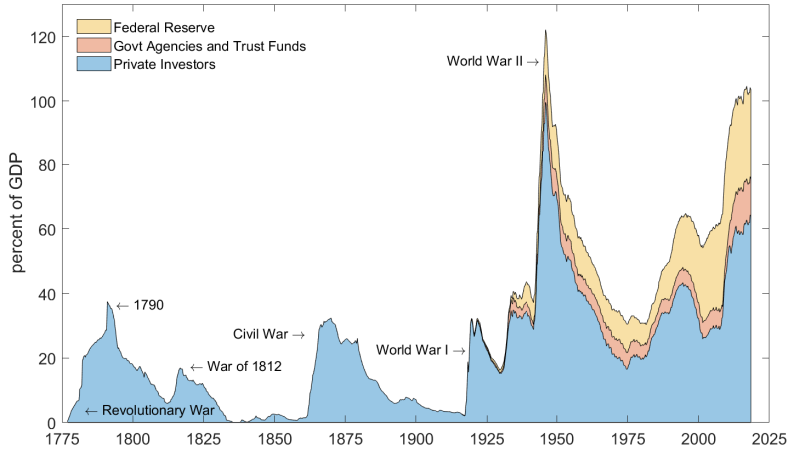
Par Value and Market Value of US Treasury Debt Held by Private Investors



Official Interest Payments and Holding Period Returns to Bondholders



Par Value of US Treasury Debt by Ownership as a Percent of GDP



The Debt/GDP Ratio

Dividing each term by nominal GDP, Y_t, and rearranging terms yields

$$\frac{G_t}{Y_t} + r_{t-1,t}\frac{B_{t-1}}{Y_{t-1}} = \frac{T_t}{Y_t} + \left(\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}}\right) + \frac{M_t - M_{t-1}}{Y_t} + g_{t-1,t}\frac{B_{t-1}}{Y_{t-1}} + \pi_{t-1,t}\frac{B_{t-1}}{Y_{t-1}} + r_{t-1,t}(\pi_{t-1,t} + g_{t-1,t})\frac{B_{t-1}}{Y_{t-1}}$$

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Consider a "peacetime baseline"

$$\left(\frac{G}{Y}\right)^{base} + \left(r_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base} = \left(\frac{T}{Y}\right)^{base} + \left(\frac{B}{Y} - \frac{B_{-1}}{Y_{-1}}\right)^{base} + \left(\frac{M - M_{-1}}{Y_{-1}}\right)^{base} + \left(g_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base} + \left(\pi_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base} + \left(r_{-1,0}(\pi_{-1,0} + g_{-1,0})\frac{B_{-1}}{Y_{-1}}\right)^{base}.$$

A Revenue Decomposition

For each war,

$$\underbrace{\sum_{t=T_1}^{T_2}\left[\frac{G_t}{Y_t}-\left(\frac{G}{Y}\right)^{base}\right]}_{\text{government spending}}+\underbrace{\sum_{t=T_1}^{T_2}\left[r_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}-\left(r_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{nominal return on debt}}=\underbrace{\sum_{t=T_1}^{T_2}\left[\frac{T_t}{Y_t}-\left(\frac{T}{Y}\right)^{base}\right]}_{\text{explicit tax revenue}}$$

$$+\underbrace{\sum_{t=T_1}^{T_2}\left[\left(\frac{B_t}{Y_t}-\frac{B_{t-1}}{Y_{t-1}}\right)-\left(\frac{B}{Y}-\frac{B_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{interest-bearing debt growth}}+\underbrace{\sum_{t=T_1}^{T_2}\left[\frac{M_t-M_{t-1}}{Y_t}-\left(\frac{M-M_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{money growth}}$$

$$+\underbrace{\sum_{t=T_1}^{T_2}\left[g_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}-\left(g_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{debt dilution via real GDP growth}}+\underbrace{\sum_{t=T_1}^{T_2}\left[\pi_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}-\left(\pi_{-1,0}\frac{B_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{debt default via inflation}}$$

$$+\underbrace{\sum_{t=T_1}^{T_2}\left[r_{t-1,t}(\pi_{t-1,t}+g_{t-1,t})\frac{B_{t-1}}{Y_{t-1}}-\left(r_{-1,0}(\pi_{-1,0}+g_{-1,0})\frac{B_{-1}}{Y_{-1}}\right)^{base}\right]}_{\text{cross-term}}$$

where T_1 is the first year of the war or the first year of US involvement, and T_2 is the final year of the war.

Decomposition of Wartime Revenue

Start - End	government spending	return on debt	total spending	tax revenue	debt growth	money growth	GDP growth	inflation	cross term	residual
War of 1812										
1812:6 - 1815:2	7.34	-0.20	7.14	-2.35	10.60	0.00	-0.16	0.06	-0.39	-0.62
				-32.9	148.5	0.0	-2.2	0.8	-5.5	-8.7
Mexican War										
1846:5 - 1848:2	2.26	0.20	2.47	-0.06	2.72	0.00	-0.06	-0.01	-0.00	-0.12
				-2.4	110.4	0.0	-2.5	-0.5	-0.1	-4.8
Civil War (Union)										
1861:4 - 1865:4	31.04	2.10	33.14	2.26	19.74	6.49	1.08	3.95	0.40	-0.77
				6.8	59.6	19.6	3.2	11.9	1.2	-2.3
World War I										
1917:4 - 1918:11	36.93	0.30	37.23	7.76	27.79	2.59	0.05	0.76	0.00	-1.73
				20.8	74.6	7.0	0.1	2.1	0.0	-4.6
World War II										
1941:12 - 1945:8	116.48	2.00	118.48	35.80	54.53	11.96	8.99	6.05	0.43	0.71
				30.2	46.0	10.1	7.6	5.1	0.4	0.6
Korean War										
1950:6 - 1953:6	15.43	-0.71	14.73	5.42	4.17	2.53	10.99	-10.12	0.05	1.70
				36.8	28.3	17.2	74.6	-68.7	0.3	11.5
Vietnam War										
1964:8 - 1973:6	5.53	-2.13	3.41	1.39	0.44	-0.60	-5.55	3.91	0.19	3.63
				40.8	12.9	-17.8	-163.0	114.9	5.7	106.5

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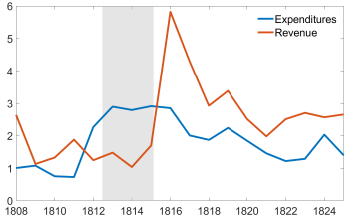
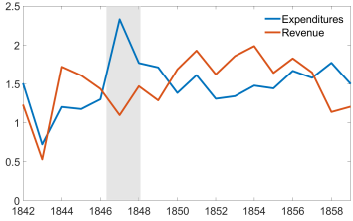
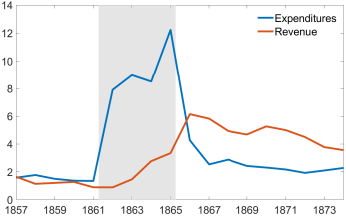
Federal Government Expenditures and Revenues



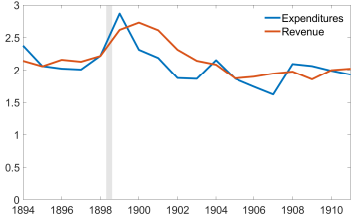
(a) War of 1812



(b) Mexican War

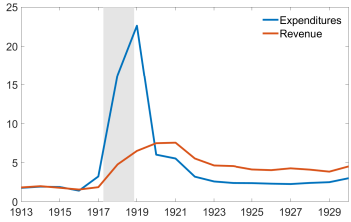


(c) Civil War

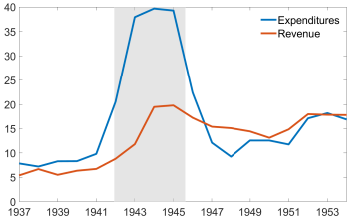


(d) Spanish-American War

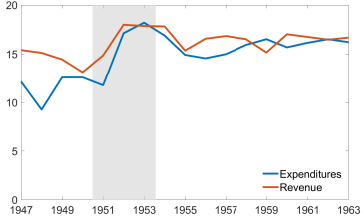
Federal Government Expenditures and Revenues (con't)



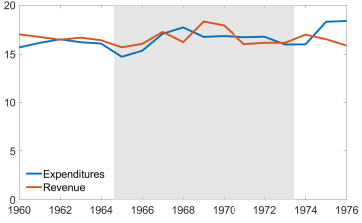
(e) World War I



(f) World War II



(g) Korean War



(h) Vietnam War

Wartime and Post-War Real Returns

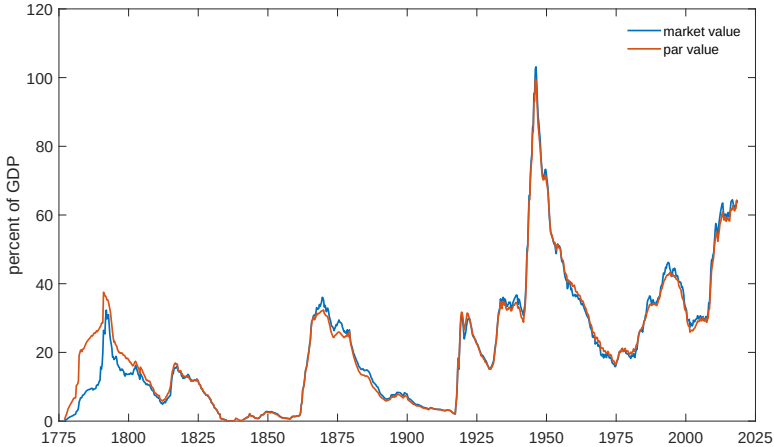
- Under Lucas-Stokey, bondholder receive
  - negative returns during the war
  - positive returns during peace
- Use adjustments in the price level to deliver positive and negative returns to US bondholders
- Gold standard as a state-contingent rule.
- We look for this pattern two ways
  1. decompose changes in the debt/GDP ratio for each post-war period
  2. cumulative returns to bondholders during and after each war

Decomposing Postwar Changes in the Debt-GDP Ratio

$$\underbrace{\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}}}_{\text{change in debt/GDP ratio}} = \underbrace{r_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}}_{\text{nominal returns}} - \underbrace{g_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}}_{\text{GDP growth}} - \underbrace{\pi_{t-1,t}\frac{B_{t-1}}{Y_{t-1}}}_{\text{inflation}}$$

$$- \underbrace{r_{t-1,t}(\pi_{t-1,t} + g_{t-1,t})\frac{B_{t-1}}{Y_{t-1}}}_{\text{cross term}} + \underbrace{\frac{G_t - T_t}{Y_t}}_{\text{primary deficit}} - \underbrace{\frac{M_t - M_{t-1}}{Y_t}}_{\text{money creation}}$$

Par Value and Market Value of US Treasury Debt Held by Private Investors



Decomposition of Post-War Changes to the Debt/GDP Ratio

	100 × Debt/GDP			Contributions						
post-war period	(1) end of war	(2) 15 years postwar	(3) change	(4) nominal returns	(5) real gdp growth	(6) inflation	(7) primary deficit	(8) cross term	(9) seignorage	(10) residual
War for Independence										
1791-1806	33.3	9.6	-23.8	11.3	-15.4	-7.6	-17.3	-1.0	–	6.3
War of 1812										
1815-1830	11.6	3.4	-8.2	10.5	-5.6	4.9	-19.4	0.1	–	1.3
Mexican War										
1848-1860	2.7	1.2	-1.5	0.8	-0.9	-0.1	-1.5	-0.1	–	0.3
Civil War (Union)										
1865-1880	22.1	15.6	-6.5	21.4	-14.5	13.5	-29.5	0.1	1.2	1.3
Spanish-American War										
1898-1913†	4.6	2.2	-2.4	0.9	-1.2	-1.1	-1.9	-0.1	0.8	0.1
World War I										
1919-1929†	28.6	20.2	-8.4	12.5	-6.4	2.4	-20.3	0.3	2.0	1.0
World War II										
1945-1960	90.1	35.7	-54.4	14.3	-15.8	-38.9	-13.0	-0.6	-0.3	-0.2
Korean War										
1953-1968	49.9	21.8	-28.1	14.0	-20.3	-10.8	4.0	-0.8	-5.8	-8.5
Vietnam War										
1973-1988	16.4	34.7	+18.3	32.3	-12.2	-19.2	19.7	-2.7	-6.0	6.3

Decomposition of Post-War Changes to the Debt/GDP Ratio

post-war period	100 × Debt/GDP (1) end of war	(2) 15 years postwar	(3) change	Contributions (4) nominal returns	(5) real gdp growth	(6) inflation	(7) primary deficit	(8) cross term	(9) seignorage	(10) residual
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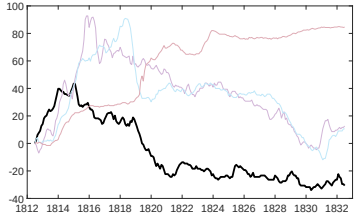
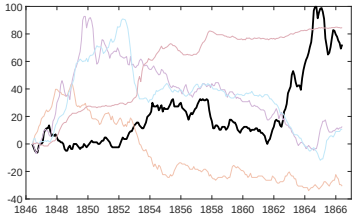
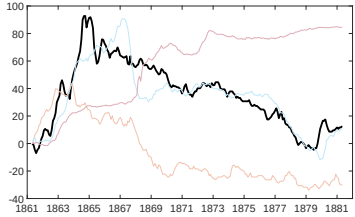
The Natural Log of the Price Level



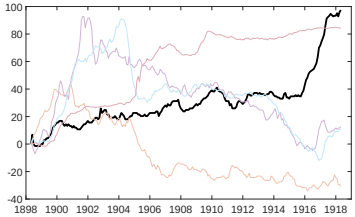
(a) War of 1812



(b) Mexican War

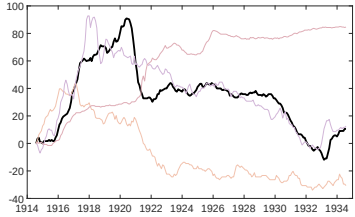


(c) Civil War

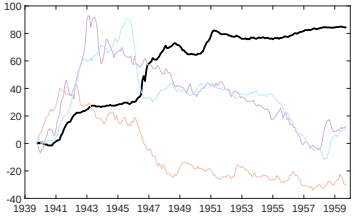


(d) Spanish-American War

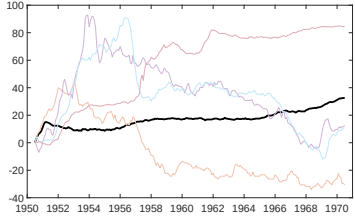
The Natural Log of the Price Level (con't)



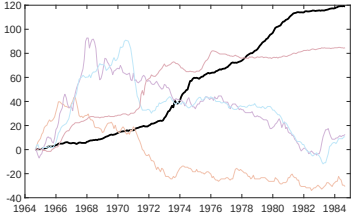
(e) World War I



(f) World War II

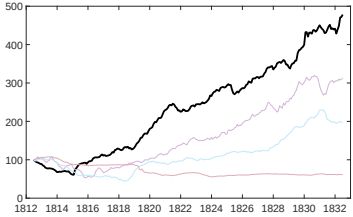


(g) Korean War

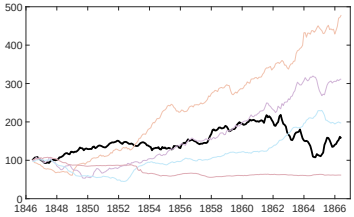


(h) Vietnam War

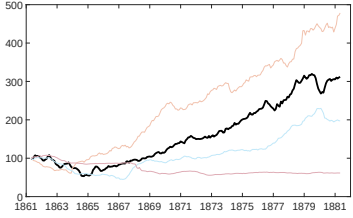
Real Value of a $100 Portfolio of US Treasury Securities



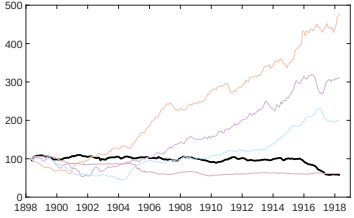
(a) War of 1812



(b) Mexican War

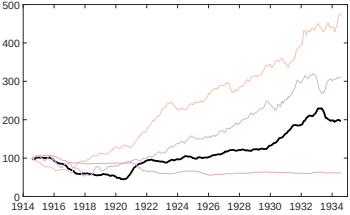


(c) Civil War

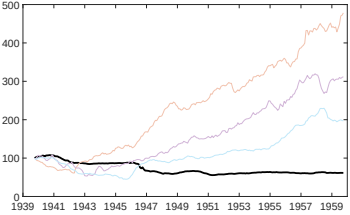


(d) Spanish-American War

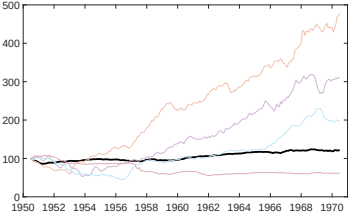
Real Value of a $100 Portfolio of US Treasury Securities (con't)



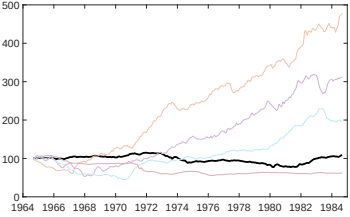
(e) World War I



(f) World War II



(g) Korean War



(h) Vietnam War

Average Annual Returns and Inflation Rates

	war time			post-war		
Start - End	nominal holding period return	inflation rate	real holding period return	nominal holding period return	inflation rate	real holding period return
War of 1812						
1812:6 - 1815:2	4.20	14.70	-10.58	7.05	-4.73	12.01
Mexican War						
1846:5 - 1848:2	3.55	1.36	3.95	5.57	2.59	3.21
Civil War (Union)						
1861:4 - 1865:4	7.64	14.65	-5.69	5.66	-2.68	8.47
Spanish-American War						
1898:4 - 1898:8	8.09	0.00	8.14	1.86	2.10	-0.21
World War I						
1917:4 - 1918:11	2.45	11.05	-8.60	4.12	-1.31	5.52
World War II						
1941:12 - 1945:8	1.78	4.23	-2.50	1.82	3.28	-1.42
Korean War						
1950:6 - 1953:6	0.73	3.96	-3.24	2.85	1.72	1.13
Vietnam War						
1964:8 - 1973:6	4.40	4.02	0.46	8.57	6.55	2.02
Mean	4.24	6.75	-2.26	4.69	0.94	3.84

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Spanish-American War						
1898:4 - 1898:8	8.09	0.00	8.14	1.86	2.10	-0.21
World War I						
1917:4 - 1918:11	2.45	11.05	-8.60	4.12	-1.31	5.52
World War II						
1941:12 - 1945:8	1.78	4.23	-2.50	1.82	3.28	-1.42
Korean War						
1950:6 - 1953:6	0.73	3.96	-3.24	2.85	1.72	1.13
Vietnam War						
1964:8 - 1973:6	4.40	4.02	0.46	8.57	6.55	2.02
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Move from War Bonds to Aggregate Finance

- Prior to World War I, bonds were designed by Congress and issued for specific purposes
  - wars were financed by a small number of bond issues
- The Second Liberty Loan Act of 1917 broke the tight connection between borrowing and spending for specific purposes that had characterized Congress's policy since 1776.
- Prior to that time, Treasury Secretaries faced lumpy post-war debt-service profiles
  - cash-management challenges
  - roll-over risk

Bond Posters

Office of JAY COOKE,
Subscription Agent.

At Jay Cooke & Co. Bankers,
114 South Third Street,
Philadelphia, Nov. 1, 1862.

The undersigned, having been appointed SUBSCRIPTION AGENT by the SECRETARY of the TREASURY, is now prepared to furnish, at once, the

NEW TWENTY YEAR 6 PER CENT. BONDS

of the UNITED STATES, designated as "FIVE-TWENTIES," redeemable at the pleasure of the Government, after five years, and authorized by Act of Congress approved Feb. 25, 1862.

The **COUPON BONDS** are issued in sums of
$50, $100, $500, and $1000,

The **REGISTERED BONDS** in sums of
$50, $100, $500, $1000, and $5000.

Interest will commence from the DATE OF SUBSCRIPTION, and is PAYABLE IN GOLD, at the Mint, or any Sub-Treasury or Depository of the United States, on the first days of May and November of each year. At the present PREMIUM on GOLD, these Bonds yield about EIGHT per cent. per annum. The ample provision made by Customs Duties, Excise Stamps and Internal Revenue, for the payment of Interest and Liquidation of the Principal, makes an investment in this Loan safe, profitable and available at all times. In a word, this being the permanent Loan into which the Legal Tender Notes are convertible, it will become the PRINCIPAL LOAN in the market, and a profitable mode of investment for Trust Funds, the surplus funds of capitalists, as well as the savings of the industrial classes.

Subscriptions received at PAR in Legal Tender Notes, or notes and checks of banks at par in Philadelphia. Subscribers by mail will receive prompt attention, and every facility and explanation will be afforded on application at this office.

A full supply of BONDS will be kept on hand for immediate delivery

JAY COOKE,
Subscription Agent.

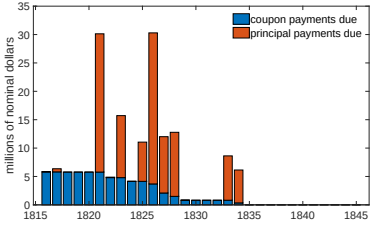
JAY COOKE'S ADVERTISEMENT ANNOUNCING HIS APPOINTMENT TO THE 5-20 AGENCY

(a) Civil War

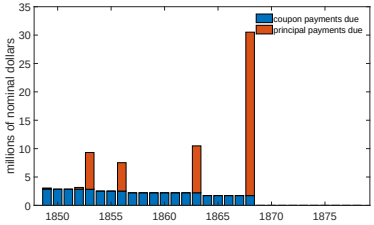
(b) World War I

(c) World War II

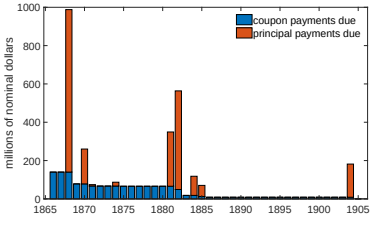
Post-War US Treasury Debt Service Profiles



(a) 1815



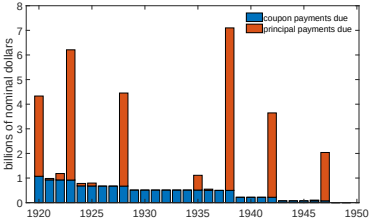
(b) 1848



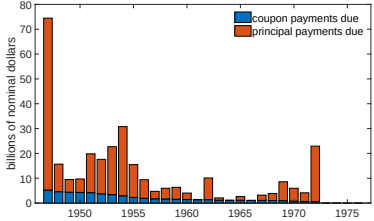
(c) 1865

(d) 1898

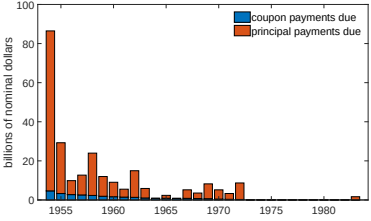
Post-War US Treasury Debt Service Profiles (con't)



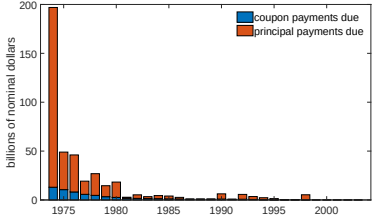
(a) 1919



(b) 1946



(c) 1953



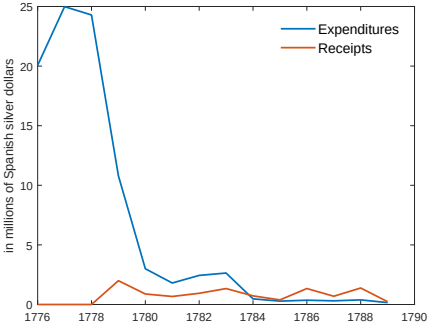
(d) 1973

Two Revolutions: American War of Independence (1775-1790) and the Confederacy (1861-1865)

Compare the financing and financial resolution of two revolutions

- For the central governments, these revolutions were existential fights; if the military lost,
  - the central government would cease to exist
  - state and local government would survive
- Both governments faced political and institutional constraints in raising revenue.
  - were dependent on existing and reluctant state governments to collect taxes voluntarily on their behalf;
  - relied heavily on seignorage for revenue
- Data limitations

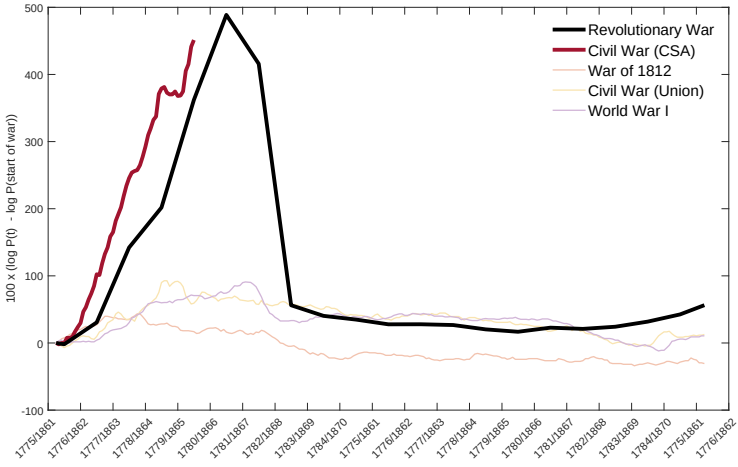
Government Expenditures and Revenues



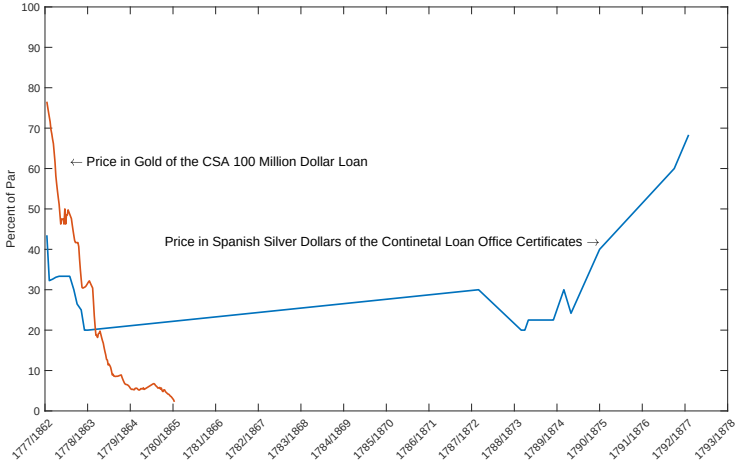
(a) War of Independence

(b) Civil War (CSA)

Natural Log of the Price Level



Bond Prices


Percent of Par
100
90
80
70
60
50
40
30
20
10
0
← Price in Gold of the CSA 100 Million Dollar Loan
Price in Spanish Silver Dollars of the Continetal Loan Office Certificates →
1777/1862
1778/1863
1779/1864
1780/1865
1781/1866
1782/1867
1783/1868
1784/1869
1785/1870
1786/1871
1787/1872
1788/1873
1789/1874
1790/1875
1791/1876
1792/1877
1793/1878

Financial Resolutions

- War of Independence
  - Article VI of the US Constitution, which went into effect in 1789, stated

    All Debts contracted and Engagements entered into, before the Adoption of this Constitution, shall be as valid against the United States under this Constitution, as under the Confederation.
  - In 1790, Hamilton refunded the federal government's debt and nationalized the states' debt.
  - Together the adoption of the new constitution and Hamilton's refunding raised the market value of the federal debt from roughly 18 million to 38 million Spanish dollars.
- Confederacy
  - In 1866, the US Congress passed the 14th Amendment, Section 4

    ... neither the United States nor any state shall assume or pay any debt or obligation incurred in aid of insurrection or rebellion against the United States, or any claim for the loss or emancipation of any slave; but all such debts, obligations and claims shall be held illegal and void.

A Caveat

In 1807, Treasury Secretary Albert Gallatin wrote that in the event of a war, tax rates should be set to ...

> *provide a revenue at least equal to the annual expenses on a peace establishment, the interest on the existing debt, and the interest on the loans which may be raised ... losses and privations caused by war should not be aggravated by taxes beyond what is strictly necessary.*