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A HISTORY OF U.S. DEBT LIMITS

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ABSTRACT

Congress first imposed an aggregate debt limit in 1939 when it delegated decisions about designing US debt instruments to the Treasury. Before World War I, Congress designed each bond and specified a maximum amount of each bond that the Treasury could issue. It usually specified purposes for which proceeds could be spent. We construct and interpret a Federal debt limit before 1939.

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1 Before 1939 and after

US Congresses choose whether to raise limits that earlier Congresses imposed on the Federal Government's borrowing. Sophisticated observers regard these debt limits as side shows:

In my brief time in Washington, I've found the worst myth to be the belief that the debt ceiling imposes any control on government spending. The plain truth is that the debt limit does not affect the deficits or surpluses.

Assistant Secretary for Financial Markets, U.S. Treasury, Brian C. Roseboro, June 26, 2003¹

We investigate whether Secretary Roseboro's portrayal was always accurate.

As part of a broader study of the fiscal history of the United States, we have constructed limits that Congress placed on total Federal debt from 1776 until today. We say "constructed" because Congress began imposing an explicit limit on total debt only in 1939. Before that, Congress placed limits on quantities of every security, so we infer an aggregate debt ceiling by summing these limits. We compare and contrast the behavior of our pre-1939 aggregate debt limit with that of the post-1939 debt limit. We discuss how and why the meaning of a "debt limit" might have changed over the last 240 years.

Article 1, Section 8 of the U.S. Constitution grants Congress exclusive authority to manage Federal debt: "The Congress shall have Power To lay and collect Taxes, Duties, Imposts and Excises, to pay the Debts . . . of the United States; . . . and . . . To borrow Money on the credit of the United States." Our story is about how Congress performed these duties and about which powers Congress chose to keep and which it chose to delegate to the Treasury.

Between 1776 and 1920 Congress authorized the Secretary of the Treasury to issue approximately 200 different securities. In a typical year, there were between 0 and 8 authorized securities. For each security, Congress set coupons, a principal or par value, a term to maturity, a unit of account, tax exemptions, and call features. Congress also specified purposes for which the proceeds of a bond sale could be spent, e.g., to finance a war, to redeem an outstanding bond, or to pay for infrastructure such as the Panama Canal.

Congress usually restricted the amount of each security that could be *issued*; after a security had been redeemed, it could not be re-issued. Occasionally, especially during wars, Congress allowed the Treasury to roll over its short-term debt by placing limits on quantities of short-term notes *outstanding*. But longstanding misgivings about fiat currency usually caused Congress to keep a tight rein on the Treasury's authority to create short-term money-like liabilities.

Congress gradually abandoned these ways of doing things during the two decades after World War I. Acceding to requests from successive Secretaries of the Treasury, Congress delegated more

¹Bond Market Association Inflation-Linked Securities Conference Remarks, June 26, 2003, New York, NY. <http://web.archive.org/web/20080709100455/http://www.treas.gov/press/releases/js506.htm>

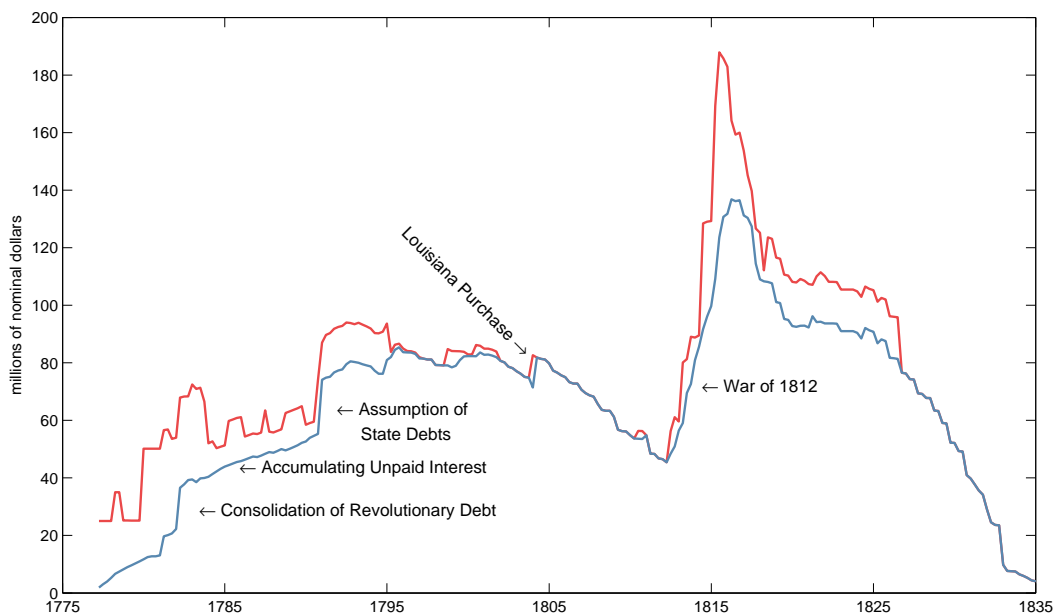


Figure 1: Total Debt and the Limit: Nominal, 1776-1835

Nominal debt is the blue line. The red line is the nominal debt limit constructed by summing limits on individual securities.

and more authority to design securities and manage the composition of the debt to the Treasury.² By 1939, Congress had delegated nearly all decisions about security design and debt management to the Treasury. After 1939, Congress confined itself to limiting the aggregate quantity of debt outstanding.³

To infer an aggregate Federal debt limit before 1939, we summed the bond-by-bond limits stated in the authorizing legislation and kept track of quantities of each bond that were issued and retired.⁴ We plot our aggregate debt limit series (blue line), along with the outstanding gross Federal debt (red line), in the first three of four graphs. In the fourth graph, from 1939-2014, we plot the official debt limit and the Federal debt subject to this limit. These graphs shape our answers to the following questions:

1. Has the debt limit risen monotonically?

Before 1939, no, it declined about as often as it rose. After 1939, yes.

²See Garbade (2012, ch.21), Cooke and Katzen (1954), and Robinson (1959). For discussion of the more recent debates about the wisdom of the having an aggregate debt limit, see Brite (1968), Krishnakumar (2005), and Austin and Levit (2013).

³A second, rarely binding, constraint did exist. In the Second Liberty Bond Act, Congress imposed a $4\frac{1}{4}$ percent interest rate cap on Treasury bonds that remained in effect until March 1971.

⁴We provide details of the construction of the pre-1939 aggregate limit in Appendix A.

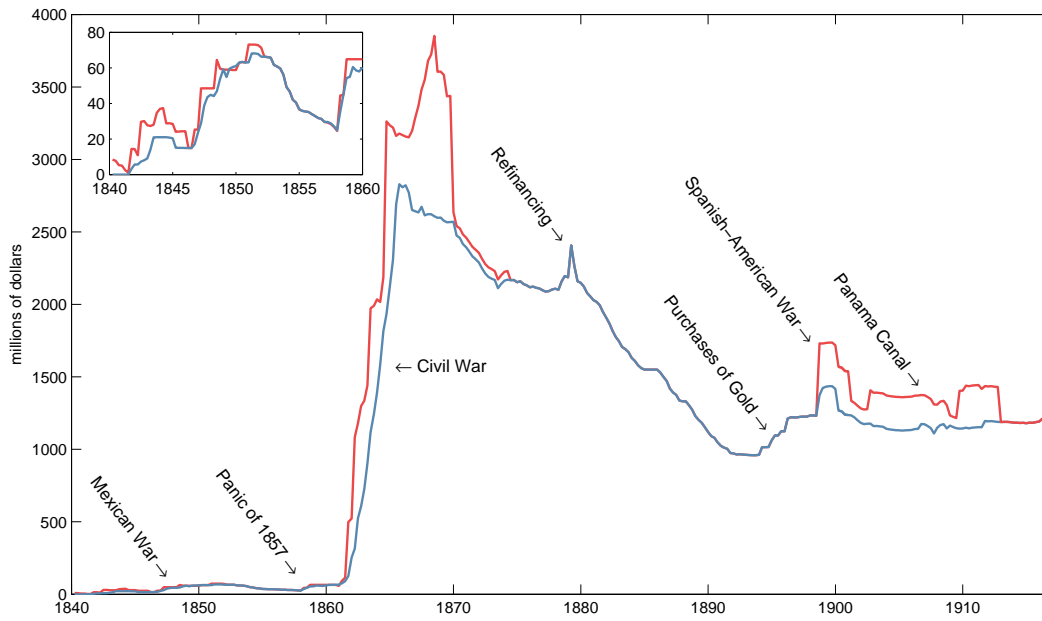


Figure 2: Total Debt and the Limit: Nominal, 1840-1916

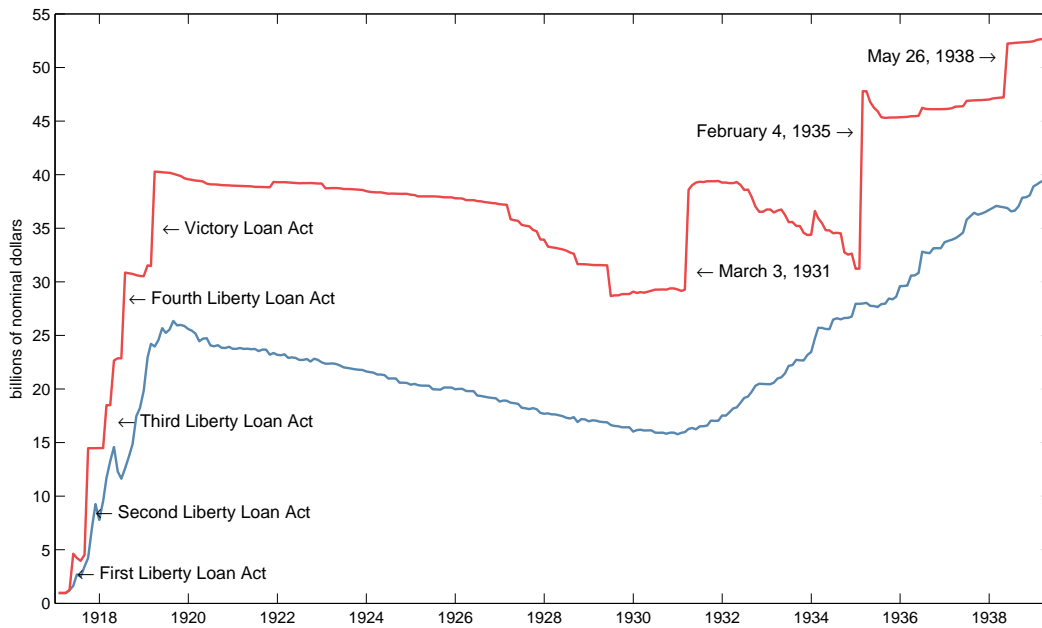


Figure 3: Total Debt and the Limit: Nominal, 1917-1939

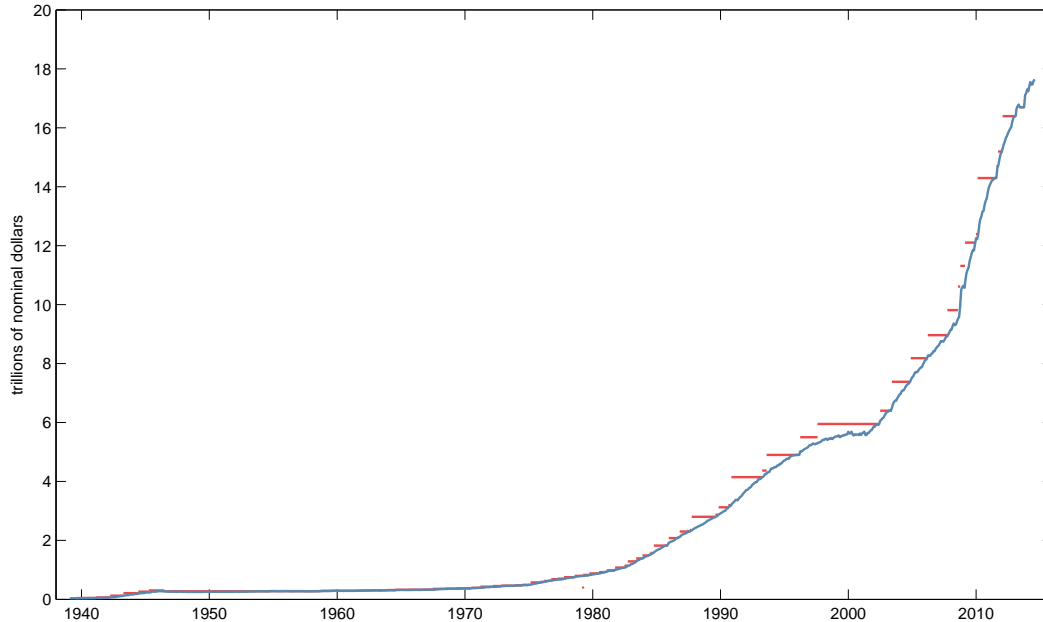


Figure 4: Total Debt and the Limit: Nominal, 1939-2014

Nominal debt is the blue line. The red line is the statutory debt ceiling.

Prior to 1939, Congress confined most bond sale authorizations to predetermined time spans. Furthermore, after a security had been redeemed (either by maturing or by being refinanced), it could not be re-issued. For that reason, when the government gradually repaid debt after the War of 1812 or the Civil War, the overall limit declined in step.

During the War of 1812 and the Civil War, Congress granted the Treasury wide latitude to issue debt. However, after those wars, Congress reasserted its control over the size and design of the debt. Congress did not resume control after World War I or World War II.

2. Has the debt limit been an upper bound on total debt to be anticipated over medium to long horizons during peacetimes? Equivalently, has the debt limit been a reliable signal about prospective surpluses of federal revenues over net-of-interest expenditures?

Before 1939, mostly yes and yes. After 1939, as lamented by Secretary Roseboro in the quotation above, no and unequivocally no.

3. Has the debt limit actually constrained government officials?

Before 1939, evidently yes. In some famous episodes, it tied the hands of the

Secretary of Treasury. For example, in the 1890s, it almost forced the Secretary of Treasury to take the U.S. off gold and maybe onto silver, which Milton Friedman (1990a) said was the objective of a substantial bloc, at times a majority, of the Congress.

After 1939, we don't know.

4. Why did Congress ultimately delegate security design and debt management to the Treasury?

During the 1920s, Congress accepted Secretary of the Treasury Andrew Mellon's reasoning that:

While it is impossible to forecast at this time what form future refunding operations will take, it is obvious that the orderly and economical management of the public debt requires that the Treasury Department should have complete freedom in determining the character of securities to be issued and should not be confronted with any arbitrary limitation which was not intended to apply to these circumstances. Moreover, it is highly desirable that the authority be provided well in advance of actual needs.⁵

Secretary Mellon reckoned that 'complete freedom' would help the Treasury develop thick and liquid markets in Treasury bonds, notes, and bills.⁶

5. Why had earlier Congresses rejected advice from Mellon's predecessors to delegate security design authority to the Treasury?

For them maintaining direct tight controls over debt design and debt quantities outweighed any prospective gains in market liquidity. Long memories of the rapid depreciation of Continental dollars issued during the War of Independence made Congresses reluctant to issue short-term Treasury securities that were good substitutes for currency. Furthermore, early Congresses intended that the Federal government not maintain a permanent debt.

6. Have the units of account in which the US federal debt limit has been stated been unambiguous?

⁵See page 39 of United States Department of the Treasury (1930).

⁶This is a theme of Garbade (2012).

Over some long periods of time, yes. Over other long periods of time, no; it was ambiguous in terms of gold versus silver or gold and silver versus greenbacks.⁷

7. How is the debt limit measured? Is it “marked to market” or expressed in terms of “face value”?

It has been measured in terms of face values ever since Alexander Hamilton started reporting Treasury accounts in 1790. Fluctuating interest rates have driven market values away from face values.⁸ Market interest rates have occasionally included premia for default risk and exchange rate risk.⁹

2 Accounting Systems

The Congress and Treasury measure government debt and interest payments differently than do macroeconomists. In a nutshell, the official accounts measure government debt by the total par value of outstanding promises, while the macroeconomist’s budget constraint is cast in terms of market values. Official accounts aren’t marked to market, while macroeconomists’ are.

To understand how the Treasury’s measure of government debt is related to the market value of debt, we bring in information about bonds’ coupons and prices of (presumably risk-free) promises to future dollars. Let the market price q_{t+j}^t be the number of dollars at time t that it takes to buy a risk-free claim to a dollar at time $t + j$. Thus, the superscript t denotes the date at which the price is quoted, while the subscript $t + j$ refers to which the date at which a promise is to be fulfilled. At any date t , let there be a list of prices $\{q_{t+j}^t\}_{j=1}^{n_t}$, where n_t is the maximum horizon over which the government has promised payments.¹⁰ The price q_{t+j}^t is linked to the yield to maturity ρ_{jt} for j -period risk-free zero-coupon bonds by

$$q_{t+j}^t = \frac{1}{(1 + \rho_{jt})^j}.$$

⁷Footnote 3 of Garber and Grilli (1986) notes that “The U.S. government never circulated bonds payable only in gold in the 19th century.” Except during and after the War of 1812 and the Civil War, bonds were usually payable in “coin” that could mean either gold or silver. Before 1871 when France and other European countries abandoned bimetallism, the exchange rate between gold and silver fluctuated within narrow bounds. After the 1870s, silver depreciated significantly, putting ambiguity into whether U.S. bonds were payable in gold or silver. Before 1900, Secretaries of Treasury had an option to pay in silver that they chose not to exercise.

⁸Gaps between market and par values of both directions have attracted Congresses attention. Prior to the introduction of zero-coupon Treasury Bills in 1929, Congress prohibited the Treasury from selling securities for less than their par values. Recent experiences in which market values of bonds issued during the Mexican War were above par values prompted the Congress to make the famous 5-20’s issued during the Civil War callable at par values at the government’s discretion after 5 years.

⁹For the period after 1945, Hall and Sargent (2011) present measures of the marketable U.S. Treasury marked to market and in terms of face value. We have extended these series back to 1776.

¹⁰When the government has issued perpetual *consols*, $n_t = \infty$.

At time t the government promises to pay s_{t+j}^t dollars at times $t+j, j = 1, 2, \dots, n_t$. Promised payments consist of coupons c_{t+j}^t and principal repayments (also known as par values) b_{t+j}^t :

$$s_{t+j}^t \equiv c_{t+j}^t + b_{t+j}^t. \quad (1)$$

These are sums of the corresponding components associated with each bond.

The market value of government debt at time t is

$$\sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t, \quad (2)$$

which states that the total value of government debt is the sum of a collection of prices times quantities.

The US Congress and Treasury define the total government debt at time t as the outstanding total par value

$$\sum_{j=1}^{n_t} b_{t+j}^t, \quad (3)$$

which differs from the market value of government debt

$$\sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t = \sum_{j=1}^{n_t} q_{t+j}^t (c_{t+j}^t + b_{t+j}^t)$$

for two reasons:

- It neglects the government's outstanding promises to pay coupons that are economically indistinguishable from promises to pay principal

$$\sum_{j=1}^{n_t} c_{t+j}^t; \quad (4)$$

and

- The book value given by equation (3) fails to discount future payments of principal b_{t+j}^t by multiplying them by the market prices, or "discount factors", q_{t+j}^t .

The first omission causes the official Treasury concept (3) to understate the market value of debt, while the second omission tends to make it overstate it. This means that it is possible for the official government debt $\sum_{j=1}^{n_t} b_{t+j}^t$ either to exceed or to fall short of the market value of government debt $\sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t$. In figure 5, we plot the par value of the debt in blue and market value of the debt in red from 1776 to 2014. In figure 6 we plot the ratio of market value to the

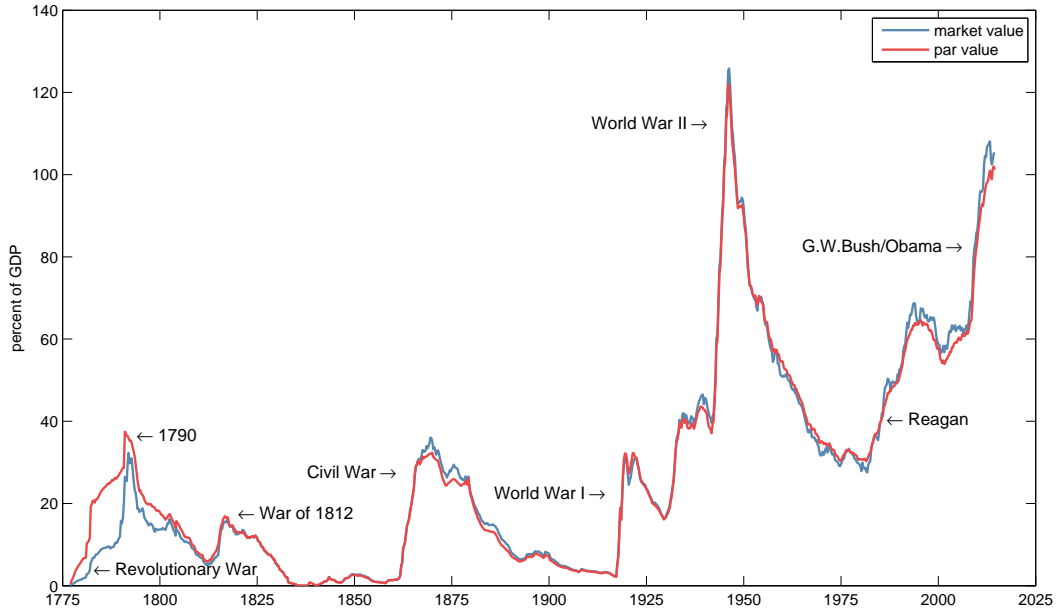


Figure 5: Market and Par Value of Gross Debt, as a Share of GDP

par value. As is apparent in these two graphs, inequalities in both directions have occurred in the U.S. data.

Figure 7 plots the sum of the future promised principal payments, $\sum_{j=1}^{n_t} b_{t+j}^t$, in blue. This is just the par or face value of the debt. In red the same figure plots the sum of the promised coupon and principal payments $\sum_{j=1}^{n_t} b_{t+j}^t + \sum_{j=1}^{n_t} c_{t+j}^t$.

2.1 Macroeconomists' government budget constraint

An instance of the government budget constraint appearing in macroeconomic models (for example equation (3) of Hall and Sargent (2011))¹¹ is

$$\sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t = \sum_{j=1}^{n_{t-1}} q_{t+j-1}^t s_{t+j-1}^{t-1} - \sigma_t^t, \quad (5)$$

where G_t^t are net-of-interest government purchases at t , T_t^t are taxes net of transfers at t , and $\sigma_t^t = T_t^t - G_t^t$ is the government's net of interest surplus at t .¹² The left side of (5) is the value

¹¹This version ignores the TIPS that Hall and Sargent (2011) include. It also in nominal terms and ignores the price level and inflation adjustments that can convert it to real terms. See Hall and Sargent (2011).

¹²In subsection 2.4, we will make use of the following notation and vision. At each date t , we will think of the government as having a fiscal plan consisting of a pair of sequences, namely, a sequence $\{G_{t+j}^t\}_{j=0}^{\infty}$ of government purchases planned at t for period $t+j$ and a sequence $\{T_{t+j}^t\}_{j=0}^{\infty}$ of tax collections net of transfers planned at t for period $t+j$. These two sequences imply an associated net-of-interest surplus sequence $\{\sigma_{t+j}^t\}_{j=0}^{\infty}$ whose j th component equals $T_{t+j}^t - G_{t+j}^t$.

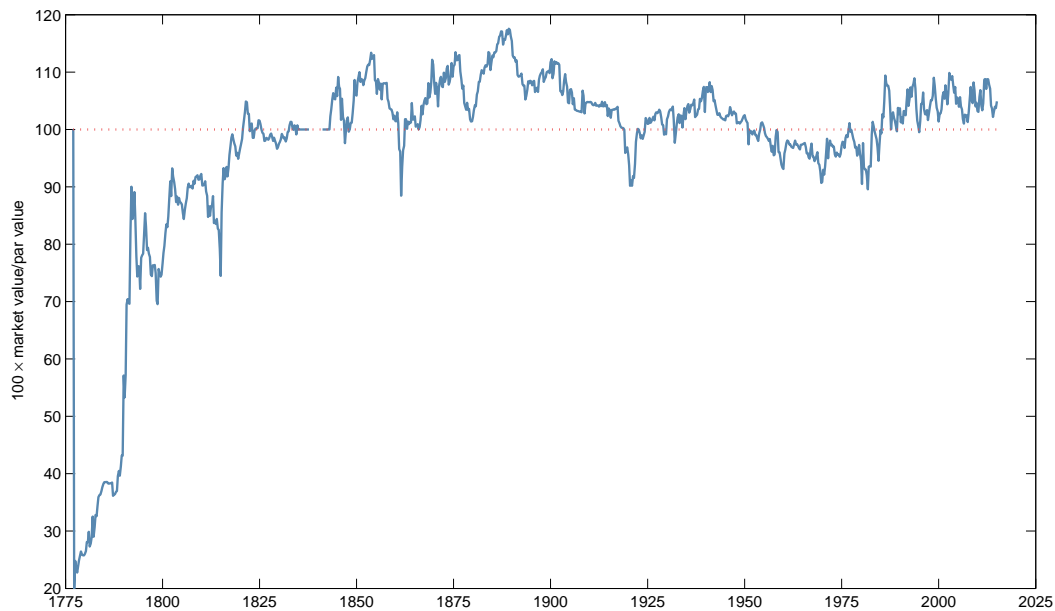


Figure 6: Ratio of Market Value to Par Value of Debt

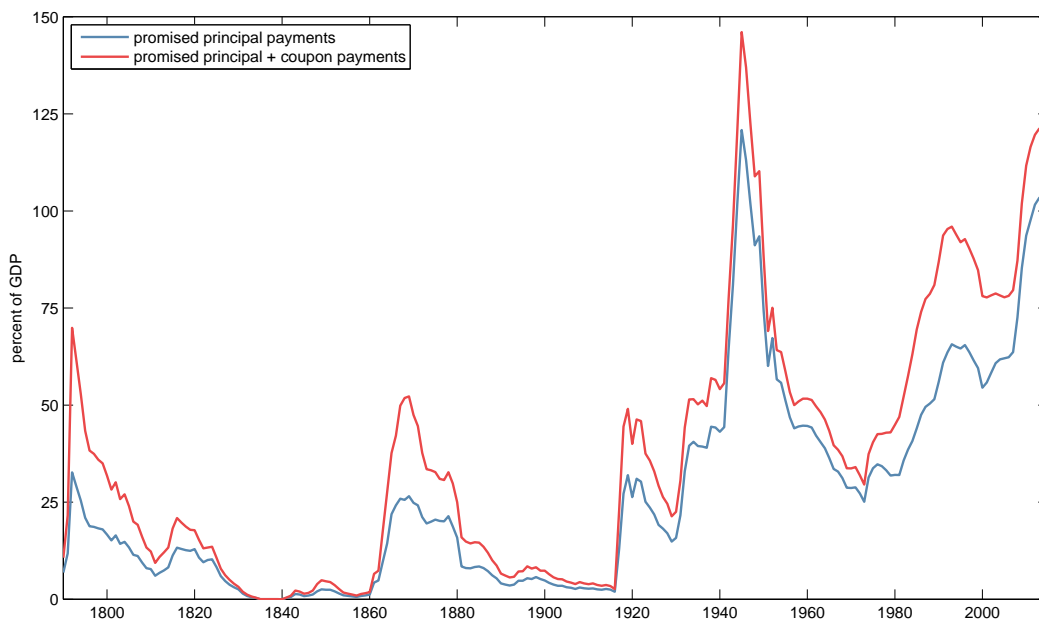


Figure 7: Total Principal $\sum_{j=1}^{n_t} b_{t+j}^t$ + Coupons $\sum_{j=1}^{n_t} c_{t+j}^t$ as Share of GDP

of government debt in period t , while the first term on the right side is the value of promised future payments that the government had made at time $t - 1$ evaluated at time t prices q_{t+j}^t . Equation (5) states that the value of the government debt changes between times t and $t + 1$ because

1. Prices of time $t + j$ promises s_{t+j}^{t-1} to time $t + j$ dollars change from q_{t+j}^{t-1} to q_{t+j}^t .
2. The government alters its promised payments so that $s_{t+j}^t \neq s_{t+j}^{t-1}$ for some j 's.
3. The government runs a deficit or surplus at date t .

It is enlightening to rewrite equation (5) as

$$\begin{aligned} \sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t &= \sum_{j=1}^{n_{t-1}} \left(\frac{q_{t+j-1}^t}{q_{t+j-1}^{t-1}} \right) q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} - \sigma_t^t \\ &= \sum_{j=1}^{n_{t-1}} q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} + \sum_{j=1}^{n_{t-1}} r_{t-1,t}^j q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} - \sigma_t^t \end{aligned} \quad (6)$$

where $\left(\frac{q_{t+j-1}^t}{q_{t+j-1}^{t-1}} \right) = (1 + r_{t-1,t}^j)$ is the one period gross nominal rate of return on a j -period pure discount bond and $r_{t-1,t}^j$ is the net nominal rate of return. The second term on the right side of the second line of equation (6) measures time t nominal interest rate payments on the time $t - 1$ nominal government debt:

$$\underbrace{\sum_{j=1}^{n_t}}_{\text{sum over}} \underbrace{r_{t-1,t}^j}_{\text{net}} \underbrace{\left(q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} \right)}_{\text{values}} \quad (7)$$

maturities returns values

So equation (6) expresses the nominal value of government debt in period t as the sum of the value of government debt yesterday, net interest payments on last period's debt, and the government deficit $-\sigma_t^t$.

2.2 Interest reported by the government

The nominal interest payments defined in expression (7) are not what the US government reports now or has ever reported. Instead, the government reports a different notion of interest on the government debt, namely:

1. Before 1929:

$$c_t^{t-1}$$

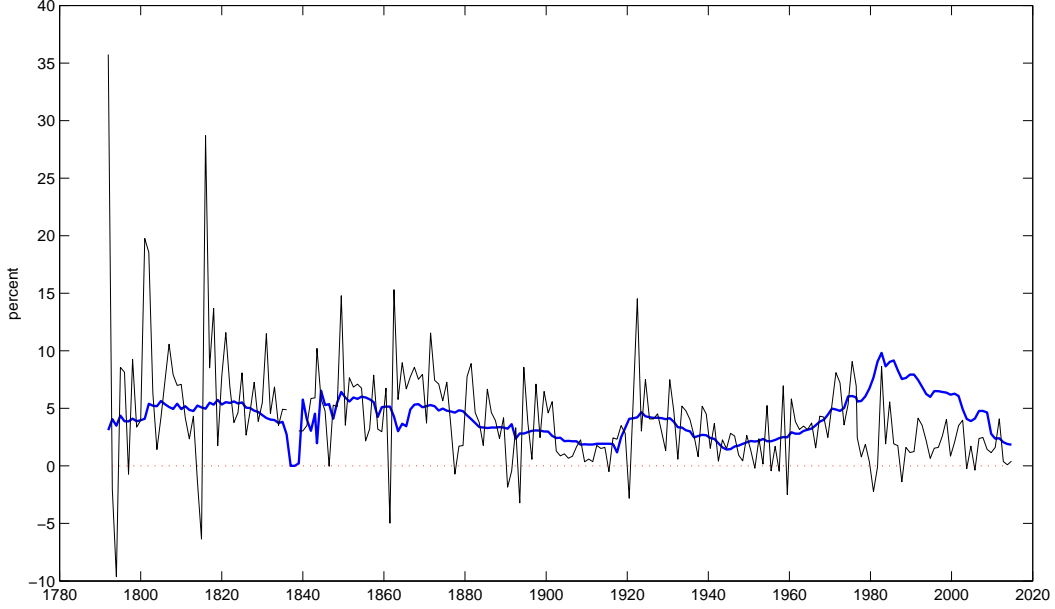


Figure 8: Nominal Holding Period Returns (thin black) and Official Net Interest Payments (thick blue) as a Percentage of the Debt, Annual by Fiscal Year

2. After 1929:

$$c_t^{t-1} + r_{t-1,t}^1 b_{1,t}^{t-1}$$

where $b_{1,t}^{t-1}$ is the par value of pure discount one-period treasury bills issued at $t - 1$. So what the government reports as interest payments consists of coupon payments on longer maturity bonds plus the net yield on one-period zero-coupon Treasury bills (these have existed only since 1929).

To understand how the government's post 1929 definition of nominal interest payments on government debt relates to the theoretical concepts underlying a standard macroeconomic formulation like (5), first introduce the decomposition $b_t^{t-1} = b_{1,t}^{t-1} + b_{-1,t}^{t-1}$ where $b_{-1,t}^{t-1}$ is the par (or principal) values of bonds with initial maturities exceeding one period falling due at time t . (Here we follow game theorists in using the subscript -1 to mean "not 1" meaning "not a treasury bill".) Then note that $q_t^t = 1$ and rewrite the standard macroeconomic government budget constraint (6) as

$$\begin{aligned} \sum_{j=1}^{n_t} q_{t+j}^t s_{t+j}^t &= c_t^{t-1} + b_t^{t-1} + \sum_{j=2}^{n_{t-1}} \left(\frac{q_{t+j-1}^t}{q_{t+j-1}^{t-1}} \right) q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} - \sigma_t^t \\ &= c_t^{t-1} + b_{1,t}^{t-1} + b_{-1,t}^{t-1} + \sum_{j=2}^{n_{t-1}} (1 + r_{t-1,t}^j) q_{t+j-1}^{t-1} s_{t+j-1}^{t-1} - \sigma_t^t. \end{aligned} \quad (8)$$

The second and third terms on the second line of the right side of equation (8) decompose principal payments into those attributable to maturing one-period pure discount bonds $b_{1,t}^{t-1}$ and to maturing longer term bonds $b_{-1,t}^{t-1}$. Rewrite the right side of equation (8) as $\sum_{j=2}^{n_{t-1}} q_{t+j-1}^{t-1} s_{t+j-1}^{t-1}$ plus

$$\underbrace{c_t^{t-1} + r_{t-1,t}^1 b_{1,t}^{t-1}}_{\substack{\text{official} \\ \text{interest}}} + \underbrace{\sum_{j=2}^{n_{t-1}} r_{t-1,t}^j q_{t+j-1}^{t-1} s_{t+j-1}^{t-1}}_{\text{capital gains}} + \underbrace{(1 - r_{t-1,t}^1) b_{1,t}^{t-1} + b_{-1,t}^{t-1} - \sigma_t^t}_{\substack{\text{cash to pay} \\ \text{principal}}}$$

The first term is what the government records as interest payments. The second term measures capital gains or losses of holders of longer term government debt held from $t-1$ to t . These capital gains are included in the macroeconomic concept of interest earnings on the government debt but are neglected in the official concept. The third term constitutes repayments of principal at time t . We can interpret the sum of the first and third components of the above sum as expressing cash t that the government must come up with at time t in order to “service” its debt, meaning pay coupons plus principal that fall due at time t .¹³

Figure 8 reports (in thin black) the nominal one-period holding period return paid by the government debt, namely,¹⁴

$$\frac{\sum_{j=1}^{n_{t-1}} r_{t-1,t}^j q_{t+j-1}^{t-1} s_{t+j-1}^{t-1}}{\sum_{j=1}^{n_{t-1}} q_{t+j-1}^{t-1} s_{t+j-1}^{t-1}}$$

and (in blue) official net interest payments as a percentage of the debt, namely, before 1929

$$\frac{c_t^{t-1}}{\sum_{j=1}^{n_{t-1}} b_{t+j-1}^{t-1}}$$

and after 1929

$$\frac{c_t^{t-1} + r_{t-1,t}^1 b_{1,t}^{t-1}}{\sum_{j=1}^{n_{t-1}} b_{t+j-1}^{t-1}}.$$

The official nominal interest payments series is much less volatile than is the macroeconomist’s definition of nominal interest. This reflects volatility in capital gains on the government debt $\sum_{j=2}^{n_{t-1}} (1 + r_{t-1,t}^j) q_{t+j-1}^{t-1} s_{t+j-1}^{t-1}$.

¹³Tables 1.5 and 1.7 of International Monetary Fund (2014) report what they call Gross Financing Needs of all member countries for the coming years. This is the sum of our first and third terms.

¹⁴To avoid big spikes in years where the debt increases dramatically (e.g. 1917, 1940), we actually plotted $\frac{c_t^{t-1} + r_{t-1,t}^1 b_{1,t}^{t-1}}{\frac{1}{2} \sum_{j=1}^{n_{t-1}} b_{t+j-1}^{t-1} + \frac{1}{2} \sum_{j=1}^{n_{t-1}} b_{t+j-1}^t}$, using interest payments reported by the government as the numerator. These are close to what we calculate by summing coupon payments.

2.3 Market versus par values

The official debt limit after 1939 and the one that we infer before 1939 both apply to the government’s measure of total debt, $\sum_{j=1}^{n_t} b_{t+j}^t$, rather than the market value of the debt, $\sum_{j=1}^{n_t} q_{t+j}^t (b_{t+j}^t + c_{t+j}^t)$. It is easy to devise debt management operations that can raise or lower the government’s measure of outstanding debt while leaving its market value unaltered: just raise or lower b_{t+j}^t and accompany it with an offsetting change in c_{t+j}^t .

A practical illustration of such an operation involves the U.S. Treasury’s STRIPS Program.¹⁵ Since 1985, Treasury notes and bonds with a maturity of 10 years or longer are eligible to be “stripped”, meaning that the Treasury can unbundle coupon and principal payments and then allow them to be bought and sold as separate securities. For example, a 20 year Treasury bond comprises a single principal payment, due at maturity, bundled together with 40 coupon payments, one every six months over the intervening 20 years. When this bond is converted to STRIPS form, the components, (i.e., the 40 interest payments and the principal payment) becomes separate “zero-coupon” securities.

Of course, since the price of the original bond is just the sum of the prices of the 41 individual zero coupon securities, unbundling should have no impact on the market value of the bundle of promises that comprise the bond. From an economic standpoint, each of these 41 securities is just a promise to pay a dollar at a date in the future, and thus the labels “coupon payment” and “principal payment” are irrelevant from the standpoint of what the government owes its creditors. However, from the perspective of the statutory debt limit, these labels matter. Promises labeled principal payments count against the debt limit. Promises labeled coupon or interest payments do not. The U.S. Treasury can lower the par value of outstanding debt by replacing bonds with lower coupons with other bonds having larger coupons.¹⁶

2.4 Reinterpretation of the flow budget constraint

An implication of the “flow” government budget constraint (5) or its equivalent form (6) is an inter-temporal budget constraint constructed by integrating flow constraints forward in time and imposing a boundary condition on government debt “at infinity”. Thus, at each t , an intertemporal version of the government budget constraint is

$$\sum_j q_{t+j}^t s_{t+j}^t = \sum_j q_{t+j}^t (T_{t+j}^t - G_{t+j}^t)$$

¹⁵STRIPS is an acronym for Separate Trading of Registered Interest and Principal of Securities.

¹⁶Some state governments engage in this practice. As noted by The Volcker Alliance (2015), in 2011 and 2012 the State of New Jersey sold securities bearing coupons above market levels. The State recorded the increase in debt at the par value and the premium above par as revenue.

or

$$\sum_j q_{t+j}^t s_{t+j}^t = \sum_j q_{t+j}^t \sigma_{t+j}^t \quad (9)$$

where G_{t+j}^t are government purchases planned at t for period $t+j$, T_{t+j}^t are tax collections net of transfers planned at t for period $t+j$, and $\sigma_{t+j}^t = T_{t+j}^t - G_{t+j}^t$ is the net-of-interest government surplus at $t+j$ planned at t .¹⁷ Equation (9) asserts that the market value of government debt at t on the left side equals the present value of government surpluses at t on the right side. Large government debts signal large prospective net-of-interest surpluses.

In light of the equality (9), the government budget constraint (6) can also be written

$$\sum_{j=1}^{n_t} q_{t+j}^t \sigma_{t+j}^t = \sum_{j=1}^{n_{t-1}} q_{t+j-1}^{t-1} \sigma_{t+j-1}^{t-1} + \sum_{j=1}^{n_{t-1}} r_{t-1,t}^j q_{t+j-1}^{t-1} \sigma_{t+j-1}^{t-1} - \sigma_t^t \quad (10)$$

Equation (10) is the other side of the coin of equation (6). It says that the present value of the government surplus at t is equal to the present value of the government surplus at time $t-1$ plus a time t capital gain on the present value of the time $t-1$ surplus plus the time t net-of-interest deficit $-\sigma_t^t$.

We shall eventually use equation (10) to interpret the fiscal consequences of various alterations of Federal tax and expenditure policies that, by setting $G_{t+j}^t \neq G_{t+j}^{t-1}$ and $T_{t+j}^t \neq T_{t+j}^{t-1}$, often altered present value of government surpluses and therefore market values of government debt.

3 Delegation and Reassertion

We have constructed a new time series, an implied pre-1939 aggregate debt limit (i.e., the red lines in figures 1-3). In this section, we describe notable movements in this time series and an associated par value of the debt subject to the aggregate limit depicted in the blue lines in figures 1-3. A story emerges about a process of slow and uneven concessions of Congressional authority over debt management to the Treasury. In the process of telling this story, we answer the question posed in section 1: why had earlier Congresses rejected advice from Mellon's predecessors to delegate security design *and debt management* authority to the Treasury?

Laws authorizing debt by the Continental Congress and then by the US Congress resembled earlier British laws regulating borrowing by the Crown and by the American colonies. After the Glorious Revolution of 1688, Parliament placed issue-by-issue limits on sovereign borrowing.¹⁸ The power to issue (or really, power to not issue) debt meant Parliament must approve big projects like wars. Because the framers of the Constitution liked this division of authority, they assigned Congress power to issue and manage the debt.

¹⁷Please see footnote 12 above.

¹⁸For example, see William III (1697-8).

3.1 The American Revolution

US debt limits are nearly as old as the Declaration of Independence. The Continental Congress's first authorizations to borrow at the start of the War of Independence included debt limits. However those early debt limits did not bind. For example, although in 1779 the Continental Congress authorized its representatives to borrow \$10 million from France, France eventually lent only \$1.8 million.

The Continental Congress ran up a large debt to finance the war. Despite Article VI of the US constitution,¹⁹ the U.S. eventually defaulted on much of this debt and did so in ways that discriminated heavily across different classes of U.S. government creditors. Hall and Sargent (2014) document this in detail. For many years, bitter memories of those discriminatory defaults motivated successive Congresses strictly to limit the Treasury's authority to issue debts that resembled currency.

Between 1775 and 1781, the Continental Government spent 85 million Spanish dollars. It collected \$7 million in taxes, raised 40 million Spanish dollars by issuing over 200 million Continental dollars that promised to pay Spanish dollars, and incurred \$41 million in interest bearing debt and unpaid interest. The Continental Congress placed limits on most types of borrowing, but the credit of the United States was so poor that these limits were rarely binding.

On October 3, 1776 the Continental Congress authorized its first issue of interest-bearing bonds, called *Loan Office Certificates*. These promised to pay 4 percent per annum. Congress initially authorized up to \$5 million of these. The Congress soon authorized an additional \$15 million to be issued and raised the coupon rate to 6 percent.²⁰ When the Continental Congress authorized Benjamin Franklin and Silas Deane to negotiate its first foreign loan from the Farmers-General of France, on December 23, 1776, it limited the amount the two could borrow:²¹

Resolved that the commissioners of Congress at the court of France be authorized to borrow, on the faith of the thirteen United States, a sum not exceeding two million sterling, for a term not less than ten years.

In addition to Loan Office Certificates, the Continental Congress authorized a second domestic class of interest-bearing evidences of its indebtedness: Army quartermasters and commissaries could issue various types of certificates of indebtedness to pay civilians for supplies requisitioned or otherwise gathered for the army. We know of no statutory limits that Congress placed on

¹⁹“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.”

²⁰On January 14, 1777 Congress authorized an additional \$2 million; on February 22, it authorized \$13 million. On February 26, 1777 Congress raised the coupon rate to 6 percent on all Loan Office Certificates including those already issued. See *Journals of the Continental Congress, 1774-1789* (1904-37). Also see accounts of these decisions in Rappleye (2010).

²¹See Bayley (1882, pp. 10-11, 99).

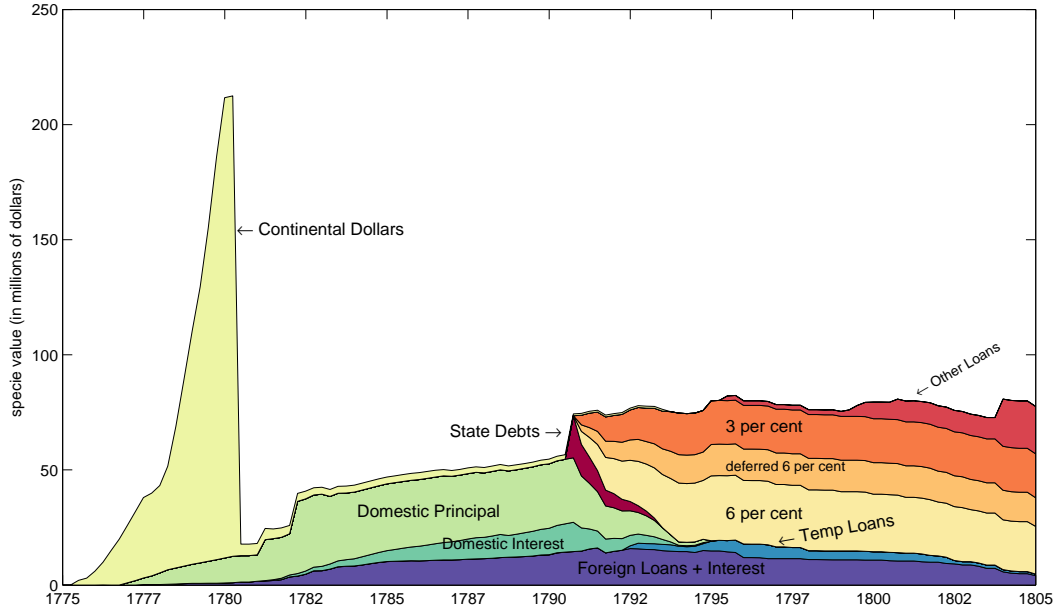


Figure 9: Federal Debt by Type of Loan from 1775 to 1805

the issuance of these certificates.²² In February 1782 authorized the Superintendent of Finance Robert Morris to record these IOUs and consolidate them into final settlement certificates. Until this time, Congress had no record of the quantity of these certificates outstanding.

In June 1775, the Continental Congress first issued *bills of credit* that came to be known as continental dollars. These were small denomination, non interest bearing promises to pay Spanish dollars. For each of eleven separate authorizations, called ‘emissions’, Congress set a maximum additional quantity to be issued. At their peak in 1780, nearly \$200 million bills of credit were outstanding. Over the following decade roughly \$120 million were redeemed. Spanish dollars and British pounds not continental dollars served as units of account for both government and private transactions during and after the war.

By late 1776, markets valued continental dollars far less than the Spanish dollars for which the Continental Congress had promised to redeem them. In 1780, the Continental Congress rescinded its earlier promise to repay one continental dollar with one Spanish dollars and stated a new promise to repay 40 continental dollars with one Spanish dollar, despite what was still written on the faces of outstanding continental dollars. That revised promise continued between 1780 and 1790, when the US Congress reset the ratio to the 100 continental dollars for 1 Spanish dollar that Alexander Hamilton (1790) had recommended in his First Report on Public Credit. Figure 9 reveals these “haircuts”, particularly the one in 1780.

²²See Ferguson (1961, chapter 4). The British troops also had a policy, complete with set prices, of paying local civilians with promissory notes for supplies. See Fischer (2004, p. 173) for information about this.

The continental dollar financed a lion's share of war expenditures. Despite that, the Continental Congress and then the US Congress proceeded to poison its reputation first with those substantial haircuts and then with public promises never again to use a Federal currency like that. While the framers of the U.S. Constitution did not explicitly prohibit the Congress from issuing bills of credit, James Madison's account of their debates on August 16, 1787 made it clear that they detested bills of credit and their effects on US credit.²³

In 1781, what by then had become the Confederation Congress adopted Robert Morris's proposal to establish a Bank of North America as fiscal agent of the Continental Congress as an arrangement to restore US credit by delegating the authority to issue bank notes to private bankers.²⁴ Congress ended Morris's experiment by withdrawing the charter of the Bank of North America in 1787, but the first Congress under the US constitution accepted Secretary of the Treasury Alexander Hamilton's proposal to revive what was essentially Morris's 1781 plan. In his December 13, 1790 report on National Bank, Alexander Hamilton wrote

The emitting of paper money by the authority of Government is wisely prohibited to the individual States by the national constitution; and the spirit of that prohibition ought not to be disregarded by the Government of the United States. Though paper emissions, under a general authority, might have some advantages not applicable, and be free from some disadvantages which are applicable, to the like emissions by the States separately, yet they are of nature so liable to abuse – and, it may even be affirmed, so certain of being abused – that the wisdom of the Government will be shown by never trusting itself with the use of so seducing and dangerous an expedient.

In 1791, the US Congress chartered a Bank of the United States and assigned to it exclusive authority to issue low denomination non-interest bearing legal tender bank notes backed partly by Federal interest bearing debt (then called "stock"). In doing that, the Congress effectively delegated debt management to the Bank of the United States: from 1791 to 1811, the Bank, not the Congress, decided the division of US debt outside that bank between interest bearing and non-interest bearing form. Another term for such debt management is monetary policy.

3.2 Treasury Notes Issued during the War of 1812

In 1811, Congress declined to renew the charter of the Bank of the United States, ending a 20 year period when the Bank of the United States had been the only Federal agency issuing non-interest bearing small denomination notes. Since Congress had granted the Treasury no authority to issue the easily transferable, small denomination, non-interest bearing notes that we often call "money", that meant that the only bank notes circulating after 1811 would be those issued by

²³Dewey (1912, pp. 67-68) and Hall and Sargent (2014, Sec. 3.2) discuss the August 16 debate and its legacy.

²⁴See the May 21 and May 26, 1781 entries of the *Journals of the Continental Congress, 1774-1789* (1904-37).

state-chartered banks. But war came. In a pattern that would repeat itself during wars over the next century, Congress relaxed its reins on the Treasury in several ways, including allowing it to issue limited quantities of currency. When war ended, Congress reasserted tight control.

For us, key points about this period are:

1. During the War of 1812, Congress relaxed constraints it had imposed on the Treasury's authority to borrow money. While it still imposed limits on each loan that it authorized, these limits did not bind, as they had not during the Revolution. Creditors did not lend as much as Congress authorized. (This is why the red line rises above the blue in figure 1 during those years.)
2. Congress authorized the Treasury to issue short-term Treasury notes. Because it placed limits on amounts of these short term loans to be issued, Congress renewed authorizations for these each year during the war.²⁵
3. At the end of the war, the Treasury Secretary asked for authority to re-issue Treasury notes. Congress denied that request and authorized no new issues of Treasury notes.
4. Immediately after the war, Congress re-asserted control and tightened limits on the Treasury's authority to borrow. See the diminished gap between the aggregate debt limit (red line) and the face value of the debt in figure 10 after 1816 and especially after 1825.

Partly as a consequence of the monetary, fiscal, and military preparedness policies of the two Jefferson and first Madison administrations, when Congress declared war on Britain in June of 1812, the US was poorly prepared equipped to fight. A decade earlier, Secretary of the Treasury Albert Gallatin had dismantled much of the Federalist machinery for collecting internal revenue. Ignoring Gallatin's warnings, the Jefferson administration's embargo of trade with Britain caused customs revenues to plunge from \$16.4 million in 1808 to \$7.3 and \$8.5 million in 1809 and 1810 respectively. In his 1807 Annual Report, Gallatin (1837, p. 360) advanced what we now call a 'tax smoothing theory' advocating that a government finance a war by issuing longer-term risk free evidences of indebtedness at low market interest interest free of the default premia that had inhibited borrowing during the War of Independence. The US borrowed to finance much of the

²⁵During the war, multiple currencies coexisted: specie (meaning gold and silver coins), bank notes issued by banks chartered by various states, and U.S. Treasury Notes. Between August 1814 and early 1817, many state banks in the south and mid-Atlantic suspended convertibility of their notes into specie. During that period, various state bank notes traded at diverse discounts vis a vis specie. Then in terms of what units of account, specie, treasury notes, or state bank notes, are the different lines in figure 10 stated? Treasury was compelled to accept payment in the local currencies at par. The laws authorizing debt issues are simply stated in dollars without distinguishing between bank notes, treasury notes, and specie, and the debts issued also promised to pay such dollars. So they are affected symmetrically by any divergences of bank notes and treasury notes from specie. However, the different lines of figure 5 comparing market and par values are differentially affected, since market values during the suspension period stated in terms of New York bank notes.

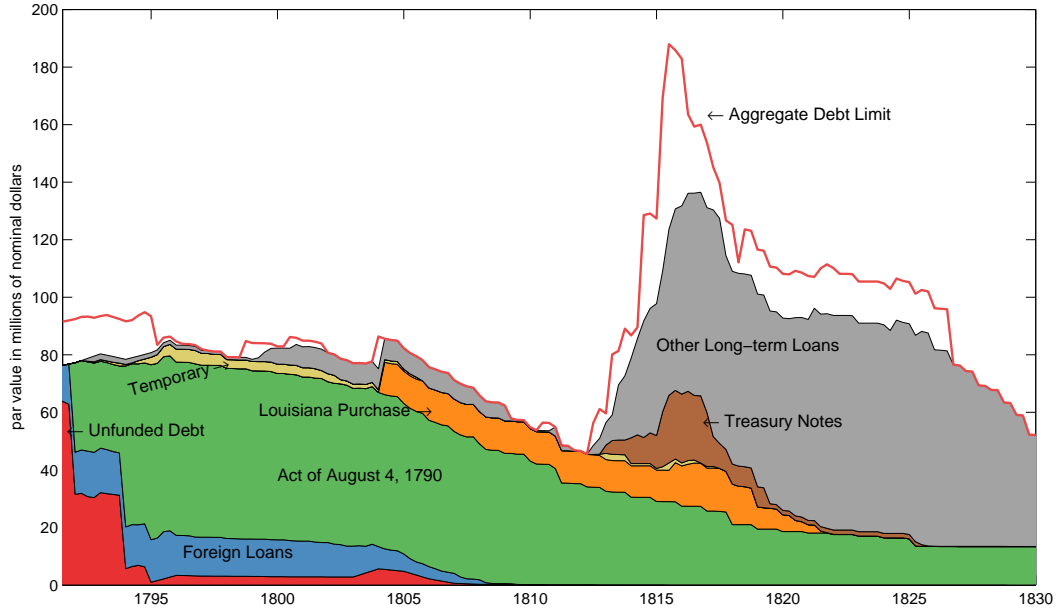


Figure 10: Federal Debt by Type of Loan from 1791 to 1830

war of 1812, but with a more diverse package of IOUs than contemplated in Gallatin’s 1807 report, and at what *ex post* turned out to be very high returns because of the *ex ante* default premiums required to attract creditors during the war. As documented by Hall and Sargent (2014), in real terms, U.S. creditors received real returns of -13.5% in 1814, but then 45.1%, 20.7% and 20.9% in 1815, 1816 and 1817, respectively.

Against Gallatin’s recommendation, the Congress liquidated the Bank of the United States, which had been the Federal government’s fiscal agent since 1811. That forced the Treasury to improvise a network of state banks and tax collectors to act as its fiscal agent, and it had either to rely on state banks or itself to issue short term low denomination evidences of indebtedness backed by longer term Federal debt.

When state banks suspended specie payments, banks stopped honoring each other’s notes, rendering the Treasury unable to use those banks to transfer funds from one part of the country to another. Therefore, between June 1812 and February 1815 Congress authorized five separate issues of Treasury notes to pay federal obligations where local currency could not be obtained. Figure 11 shows amounts issued and retired under the various authorizations, as well as sums authorized and cumulative sums issued. At first, the Treasury was not authorized to reissue these notes, but legislation on February 24, 1815 did authorize the Treasury to reissue notes. Congress permanently rescinded that authority on March 3, 1817.

In the first of these acts, passed in June 1812, Congress authorized the President to issue up to \$5,000,000 in Treasury notes. Nothing in the law regulated the denomination of these notes,

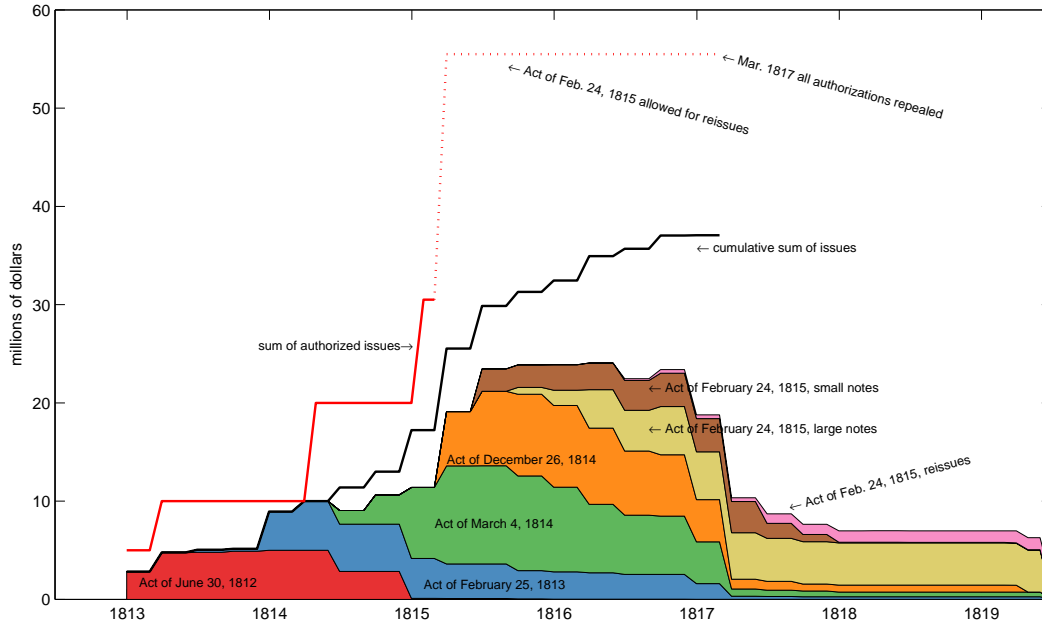


Figure 11: Treasury Notes of 1812 to 1815: Quantities Outstanding, the Cumulative Sum of Issues, and Authorizations

Source: Bayley (1882).

but none were issued in denominations less than \$100. All \$5 million of the authorized notes were issued by the end of 1813. The first four acts authorized one-year loans paying a coupon rate of $5\frac{2}{5}\%$, which amounted to $1\frac{1}{2}$ cents per day for every \$100 of principal. Though not a legal tender, these Treasury notes were transferable and were accepted by the federal government in payment of all duties and taxes. the Treasury and Congress expected these notes to circulate as currency. In a letter to Congress in January 1812, Gallatin stated²⁶

Treasury notes, bearing interest, might to a certain extent be issued, and to that extent diminish the amount to be directly borrowed. The advantage they would have would result from their becoming a part of the circulating medium, and taking, to a certain degree, the place of bank-notes.

The fifth law, passed on February 24, 1815, authorized notes in denominations of \$3, \$5, \$10, \$20 and \$50. These paid no interest and were payable to the bearer. Congress intended that they would circulate like bank notes as currency.

Despite the significant fiscal authority that the US Constitution had awarded to the Federal Congress, memories of those Continental bills of credit cast a dark shadow during this episode. To redeem those discredited bills of credit, the Continental and then the Confederation Congress

²⁶Also see Kagin (1984).

could only hope that the thirteen states would comply with its requests for fiscal contributions from the states. Those hopes had always been disappointed. Although the Federal Congresses that met during the War of 1812 knew that future Federal Congress would have the authority to levy taxes for repaying Federal debt, they had to live down the fact that the first Federal Congress in 1790 had chosen to give owners of Continental dollars a 100-1 haircut. But somehow, they made decisions that made things different this time. Owners of the Treasury Notes issued during the War of 1812 ended up earning high real rates of return on the credit they had granted to the United States, not the haircuts that those owners of Continental bills of credit had suffered.²⁷ These outcomes emerged from decisions deliberately taken in view of theories about good ways to manage fiscal and monetary affairs. For example, before Congress passed the authorization for the March 1814 Treasury notes, the Secretary of the Navy and Acting Secretary of the Treasury William Jones wrote to Congress²⁸

... although the interest paid on treasury notes is considerably less than that paid for the moneys obtained by the United States on funded stock, yet the certainty of their reimbursement at the end of one year, and the facilities they afford for remittances and other commercial operations, have obtained for them a currency which leaves little reason to doubt that they may be extended considerably beyond the sum of \$5,000,000, **hitherto authorized to be annually issued.** It will, perhaps, be eligible to leave to the executive, as was done last year, a discretion as to the amount to be borrowed upon stock or upon treasury notes, that one or the other may be resorted to, within prescribed limits, as shall be found most advantageous to the United States.

Congress declined to grant continuing annual authorizations.

As soon as the state banks returned to paying specie, Congress stopped issuing a federal currency. On March 3, 1817 Congress repealed all previous acts authorizing the issuing of Treasury Notes as well as the Secretary's authority to re-issue any existing notes.

3.3 Treasury Notes of the late 1830s and early 1940s

Andrew Jackson's extermination of the Second Bank of the United States and the immediate absence of an acceptable set of alternatives forced Congresses to micro-manage a sequence of short-term near-money issues. Significantly for us, during these years Congress moved from regulating amounts of short-term securities *issued* to amounts *outstanding*. Members of Congress debated whether re-issuing short-term Treasury notes amounted to issuing bills of credit permanently. During this period, the Treasury Secretary requested permission to re-issue redeemed Treasury

²⁷They earned real returns of 45.1%, 20.7% and 20.9% in 1815, 1816 and 1817, respectively. See Hall and Sargent (2014) for more details and the legacy of this episode.

²⁸See Jones (1829).

notes. Noting their resemblance to bills of credit and having in mind the August 16, 1787 debate at the Constitutional Convention recorded by James Madison, some members of Congress argued that it was unconstitutional to allow the reissuance of short term debt. After much debate, Congress granted permission. While Congress continued to limit the quantity issued of long term securities, from then on, Congress regulated the quantity of short-term securities outstanding.

These outcomes were responses to the following conditions. In 1835, all outstanding Federal debt had been repaid. Between 1835 and 1841, longer term Federal debt was zero. See figure 5. The charter of Second Bank of the United States expired on March 4, 1836. Even before then, Andrew Jackson had caused Federal deposits to be withdrawn from the Second Bank and transferred to a list of state chartered banks (derisively called “pet banks”). But on May 1, 1837, many of these and other state banks suspended convertibility of their notes into specie (something the Second Bank had never done). In 1837, the Treasury anticipated that revenues would fall between \$6 and \$10 million short of expenditures, prompting Congress to authorize the first of what would be 8 issues of Treasury notes between 1837 and 1843. Table 1 provides some information about the structure of these notes. Figure 12 displays quantities of these notes in a way that illustrates both the short durations of the periods over which they were authorized, issued, and redeemed. They were redeemed partly by being used to pay taxes or to purchase the longer term bonds sold in 1841, 1842, and 1843, and then not being reissued. Continuing a theme of this paper, figure 13 displays limits on the individual notes issues as well as quantities outstanding. The minimum denomination was set at \$50 on Treasury notes. The coupon rate capped at 6%; but there was no floor on it. In 1843, the Treasury issued some Treasury notes with coupons of 1/1000 of 1%. The decision to issue those notes was preceded by a debate in Congress about whether such notes were really bills of credit.

At least after the election of 1840, these Treasury Notes were issued in lieu of the success of Whig plans to charter a third Bank of the United States, frustrated by the death of President Harrison and the succession to the presidency of John Tyler, who vetoed them. Congress put limits on the amounts of the notes of 1837, 1838, and 1839 that could be issued. After 1840, it placed limits on quantities outstanding. From this period until 1935, Congress drew a distinction between long-term debt and short-term debt: long-term bonds were used to finance particular projects, such as wars, while short-term securities were used to facilitate cash management. Hence for the next 95 years, Congress continued to restrict the issuance of long-term debt but regulated the quantity outstanding of short-term debt.

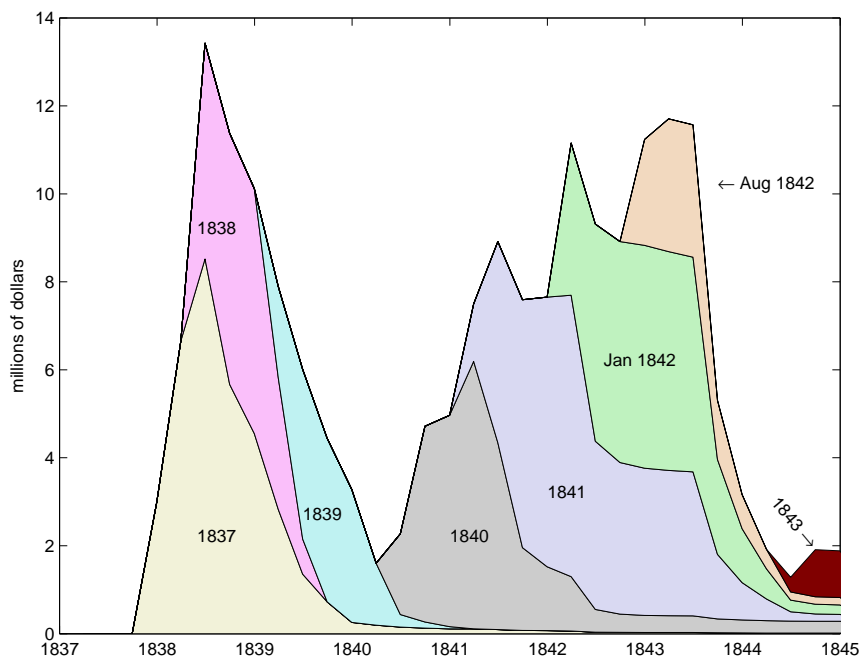


Figure 12: Treasury Notes of 1837 to 1843: Quantities Outstanding.

Issue	amount	authorization	reissues	total issued
Treasury Notes of	(millions)	type	allowed?	(in millions)
1837	\$10	issued	no	\$10.0
1838	10	issued	no	5.7
1839	remainder of 1838	authorization	no	3.9
1840	5	outstanding	yes	7.1
1841	5	outstanding	yes	7.5
January, 1842	5	outstanding	yes	8.0
August, 1842	6	outstanding	yes	3.0
1843	reissue 1842 notes		yes	1.8

Table 1: Treasury Notes of 1837 to 1843

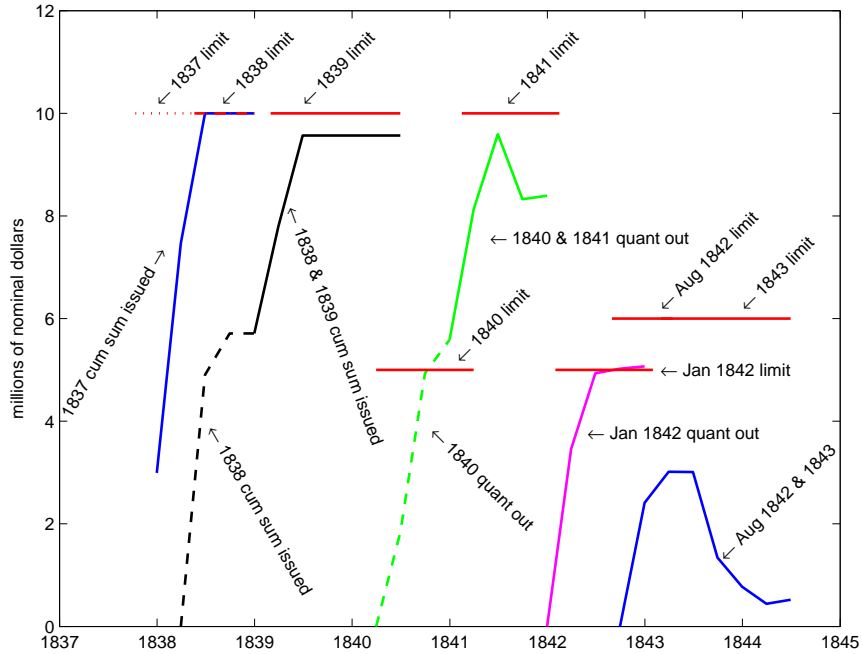


Figure 13: Treasury Notes of 1837 to 1843: Authorizations, Quantities Issued, and Outstanding

3.4 The Civil War

During and after the Civil War, Congress again allowed the Treasury to low denomination non-interest bearing notes. And it authorized the Treasury to issue large amounts of interest-bearing securities designed by Congress. See figure 14. The non-interest bearing debt was largely comprised of greenbacks (i.e., the Legal Tender Notes authorized on February 25, 1862). As in the War of 1812, Congress authorized Treasury to borrow more than it ended up borrowing. For example, the Loan of February 1861, authorized one day before the Confederate States of America was formed, Congress authorized a loan of \$25 million. Only \$18.4 million were sold at an average price of \$89.03 per \$100 face value.

But by 1862, partly because of a sleight of hand by which it altered the unit of account by declaring (what 17 years later turned out to be a temporarily) inconvertible paper currency the legal tender unit of account, the market's demand for Federal securities was strong. The first issue of the 5-20s was so strong that the Treasury sold \$11 million more than they were authorized, causing the Treasury to return to Congress to ask for *ex post* authorization for the additional amount. See the left hand panel of figure 15.

From 1860 to 1870, the Treasury enjoyed large statutory balances of unused authorizations. A main source of these balances was Congressional authorizations associated with rescheduling of debts, in particular, the time lags involved in issuing and marketing new securities and to redeem

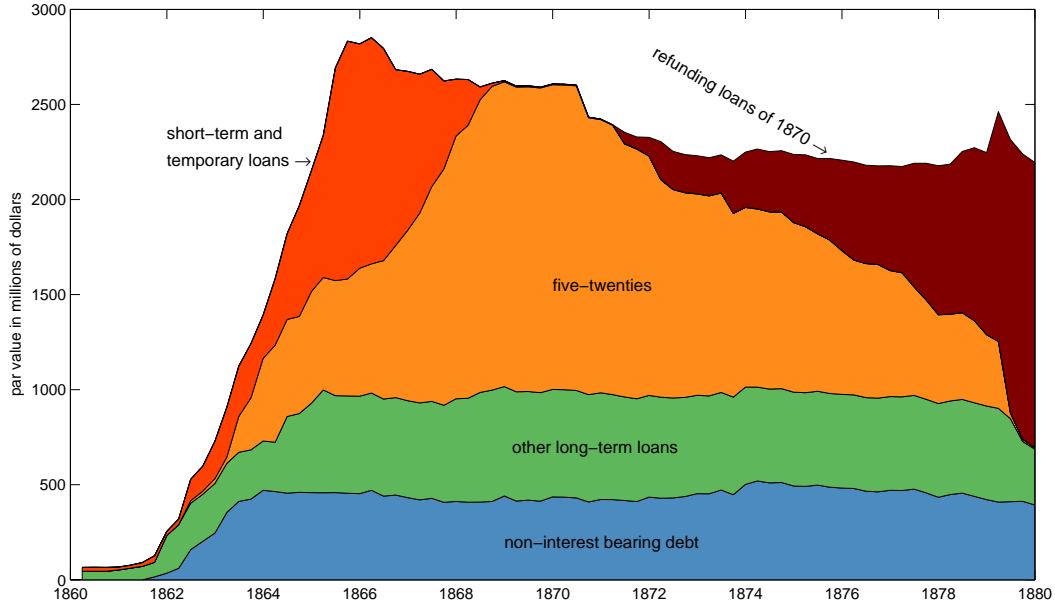


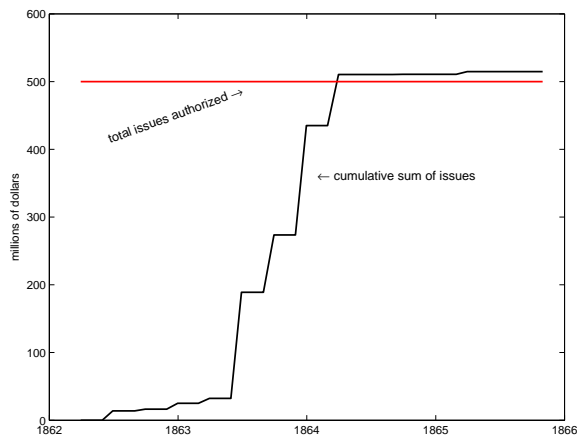
Figure 14: Federal Debt by Type of Loan from 1860 to 1880

outstanding ones. For example, although the 5-20s of 1862 were authorized on February 25, 1862, they were first sold in the fourth quarter of 1862; \$321 million were sold in 1864. Even though they were eventually oversold, for a couple of years the statutory balance on this security alone was a couple hundred million. See figure 15.

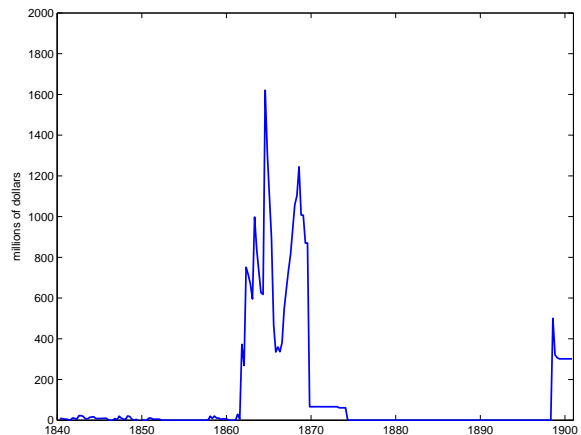
The Treasury issued a lot of short term debt during the war and in the early post war period. Much of that short-term debt paid relatively high interest coupons. For example, the loan act of July 17, 1861 authorized the Treasury to issue \$250 million in three-year 7-30 Treasury notes and also twenty-year bonds paying a coupon rate of 6 percent.²⁹ That short term debt was then refinanced into 5-20 loans during the mid 1860s intended to extend the maturity of the debt. In the 1870s, Treasury Secretary George Boutwell refinanced the 5-20s into three bonds paying lower coupon rates: the Five Percent Loan of 1881, the Four and One-Half Percent Loan of 1891, and the Four Percent Loan of 1907. See figures 14 and 31.

After the War, Congress reasserted tighter control over debt management and monetary policy. See figure 2.

²⁹The 7.3 percent coupon rate was chosen because it made it easy to compute the nominal return: 2 cents per day for \$100. While the 7-30s were never legal tender, they were used to pay government employees, including soldiers. George Hall's great-great-grandfather, who fought for the Union, was paid in 7-30s. See the letter dated Jan. 24, 1865 in Clark (2014). Also see Bayley (1882, p. 78).



Authorization and Issuance
of the 5-20s of 1862



Statutory Balance 1840-1900

Figure 15: Statutory Balance During the Civil War

4 Units of Account

From 1790 to 1873, the US was on a bimetallic standard, which meant that the US mint freely sold silver and gold dollars at set prices in terms of silver and gold bullion, respectively. The Mint Act of April 2 1792 defines the \$10 eagle to contain 247.5 grains of gold and the \$1 as 371.25 grains of pure silver, so $371.25/24.75 = 15$. The Act of June 28, 1834 redefines the eagle to contain 232 grains of gold, leaving the silver dollar unchanged, so $371.25/23.2 = 16$. In 1873, the US stopped free coinage of silver and exclusively coined gold. From 1790 to 1933, with the exception of from 1862 to 1879, only US “coin” meaning gold or silver, was legal tender. Federally and state chartered banks issued bank notes promising to pay coin. Widespread suspensions of convertibility occurred between 1812 and 1816, when state bank notes traded at substantial discounts relative to coin; again in a briefer suspension from 1837 to 1838, briefly in 1857, and from 1862 to 1878 when greenbacks were legal tender. These suspensions of convertibility obscure our statistics on debt and the debt limit.³⁰

Figure 16 traces the evolution of four measures of Federal debt from 1860 to 1885:

1. In solid blue, the par value of the debt in dollars as a fraction of nominal GDP. The units of the par value of the debt are “dollars”, but this is misleading because the Treasury added up dollars of different types. Some securities, such as the One- and Two-Year Notes of 1863, promised greenbacks at par; others, such as the Loan of 1863, promised gold; it was ambiguous whether the 5-20s promised greenbacks or gold.
2. In dotted green, the market value of the debt in “lawful money”, which from February 1862

³⁰See Elwell and Woodward (2011).

to December 1878 meant greenbacks.

3. In dashed gray, the market value of the debt measured in silver dollars. To calculate this series, we multiplied the market value in greenbacks by the price of greenbacks in terms of silver dollars, whose units are silver dollars per greenback dollar.
4. In dot-dashed orange, the market value of the debt measured in gold dollars. To calculate this series, we multiplied the market value in greenbacks by the price of greenbacks in terms of gold dollars, whose units are gold dollars per greenback dollar.

The graph reveals these patterns:

1. That market values in gold and silver dollars depicted in the dot-dashed orange and dashed gray lines nearly coincide before 1872. That reflects the success of France and Germany in stabilizing the relative price of gold and silver when they maintained bimetallic standard.³¹ A popular explanation for their divergence after 1873 was the myth of the Crime of '73.³²
2. That the dotted green line depicting the market value in green backs lies above the dashed gray and dot-dashed orange lines depicting the value in silver and gold dollars between 1862 and 1878 indicates that silver and gold traded at premiums over greenbacks.
3. That the green and orange lines coincide after 1879 reflects the December 1878 implementation of the Resumption Act of 1875.³³
4. The government had the option to redeem 5-20's at their par value 5 years after they were issued. That the green line (the market value in lawful money) lies above the blue line (par value) between 1865 and 1879 indicates that the government's options to call the 5-20's were in the money. The 5-20s were called in 96 separate calls stretching most of a decade from December 1, 1871 to July 4, 1879.³⁴

Comparisons among the green, gray, and orange lines in figure 16 answer the questions: if someone had wanted to purchase the entire stock of debt at market prices using greenbacks, silver, or gold dollars, respectively, then what would it cost in terms of that type of dollars? During the suspension of convertibility from 1862 to 1878, it would have taken fewer gold or silver dollars than greenbacks. This reflects the premium on gold and silver from 1862 to 1878. The figure confirms that during the Civil War, the market value of the debt in terms of gold dollars was substantially less than its face value despite the fact that the debt traded at a premium in terms of greenback.

³¹See Friedman (1990a) and Velde and Weber (2000).

³²See Friedman (1990b).

³³See Dewey (1912, ch. 159, page 372).

³⁴Each 5-20 bond had a serial number. Numbers of the particular bonds being called were listed in the call notice.

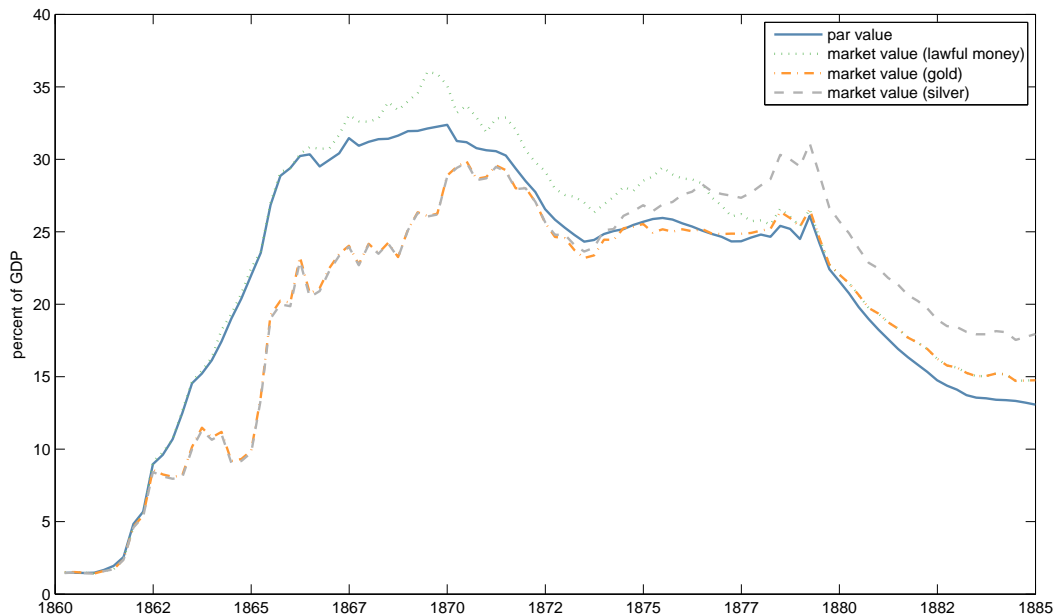


Figure 16: Par and Market Value of the Debt By Unit of Account: 1860 - 1885

Figure 17 transforms the information in figure 16 for the purpose of answering a different set of questions; namely, if the Treasury had repaid the debt in a X type dollar rather than greenbacks, what would bond owners have received in terms of lawful money?

1. The blue line is again the par or face value of the debt
2. The green line is the market value of the debt in lawful money (greenbacks between 1862 and 1878)
3. The gray line is the market value of the debt in silver, meaning that it is the cost, measured in lawful money, of repurchasing the entire debt if you generously paid market values in silver dollars, which from 1862 to 1878 were at a premium relative to greenbacks. To get this series, we divided the market value in greenbacks by the price of silver dollars in greenbacks, whose units are greenback dollar per silver dollar.
4. The orange line is the market value of the debt in gold, meaning that it is the cost, measured in lawful money, if the government paid debt holders gold dollars rather than greenbacks. To get this series, we divided the market value in greenbacks by the price of gold dollars in greenbacks.

Figure 18 is a counterpart of figure 17 for the period 1885-1890. Now

1. The blue line is the par or face value of the debt

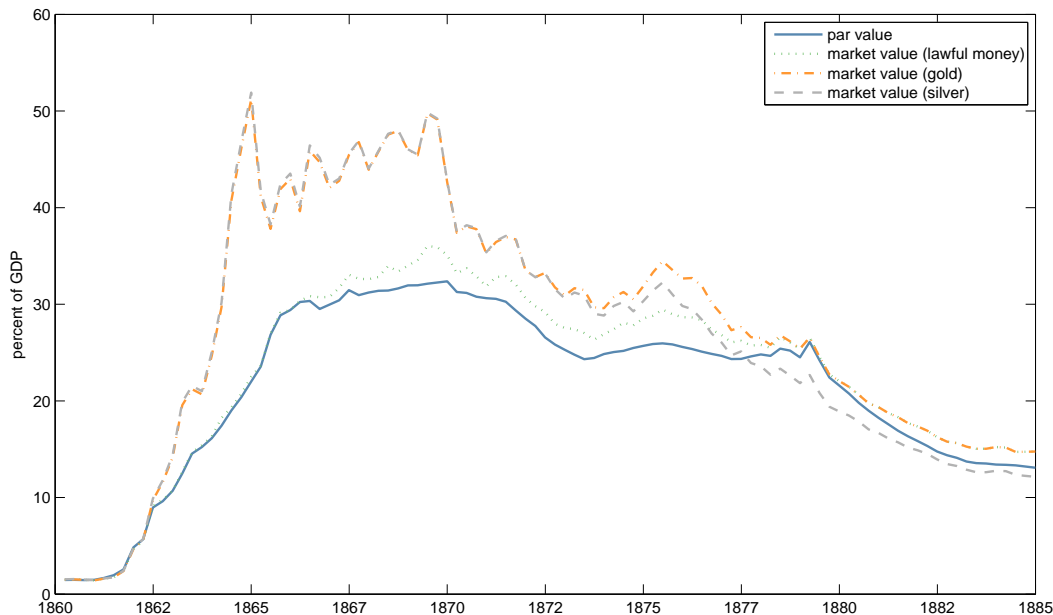


Figure 17: Par and Market Value of the Debt By Unit of Account: 1860 - 1885

2. The orange line is the market value of the debt in gold, which in this period was *de facto*, but not *de jure*, the unit of account.³⁵
3. The gray line is the market value of the debt in terms of gold if the government were to repay it with silver dollars, which during this period were worth less than gold dollars in terms of their metal content. To construct this series, we multiplied the market value in terms of gold by the market price of silver in terms of gold at each date.

We regard the gray line in figure 18 as providing a lower bound on the value of the US debt had the US resumed free coinage of silver at a ratio of 16:1 as William Jennings Bryan and his allies advocated. The reason is that by the 1890s the US was a big enough economy that if it had begun freely coining silver, the relative price of silver would have risen for the same reason that it fell when Germany and France abandoned silver in 1871.³⁶ Figure 18 indicates that despite the 1890s agitation to replace gold with silver dollars, Federal debt continued to sell above par throughout the period 1884-1900.³⁷

³⁵See footnote 7 above. Until 1900, ‘coin’ meant either gold or silver according to US law.

³⁶See Friedman (1990b,a), Velde and Weber (2000), and Fisher (1911).

³⁷The silver/gold prices were provided to us by François Velde. The original source of the data is United States Department of the Treasury (1914). These data are annual. We interpolated to a quarterly frequency.

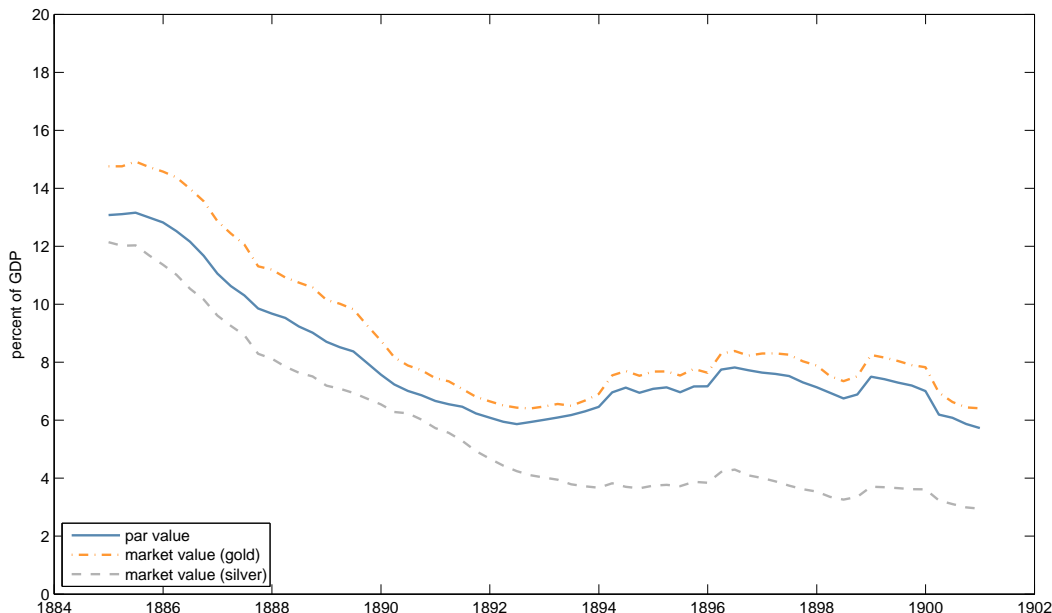


Figure 18: Par and Market Value of the Debt By Unit of Account: 1885 - 1900

5 From Project to Aggregated Finance

Prior to World War I, Congress issued debt to finance projects specified in the authorizing legislation. Big issues to finance major expenditures created echoes by requiring future Congresses and Treasury Secretaries to refinance large principal payments destined to come due at a few discrete dates. Therefore, future Congresses and Treasury Secretaries confronted both liquidity and rollover risks. It usually was not feasible to repay the debt as it came due out of tax revenue, and often the Congress had to pass new legislation in order to issue new debt to redeem maturing debt.

In the Second Liberty Bond Act of 1917 and thereafter, Congress allowed debt to be issued without being tied to a specific project. Consequently, during the 1920s and 30s the Treasury acquired, in Andrew Mellon’s words, “freedom in determining the character of securities to be issued” and thus could offer several securities for sale simultaneously. The Treasury could market securities that were, according to Henry Morgenthau, “best suited to the needs of the investors to who they are sold.” That also suited the needs of the Treasury by providing it greater control over the maturity structure of the debt. This decoupling of debt issuance and spending coincides with the shortening of the average maturity of the debt and smoothing of the Treasury’s debt service profile. In this section, we describe this evolution from project finance to aggregated finance, and in doing so, address the question asked in the introduction: Why did Congress ultimately delegate security design and debt management to the Treasury?

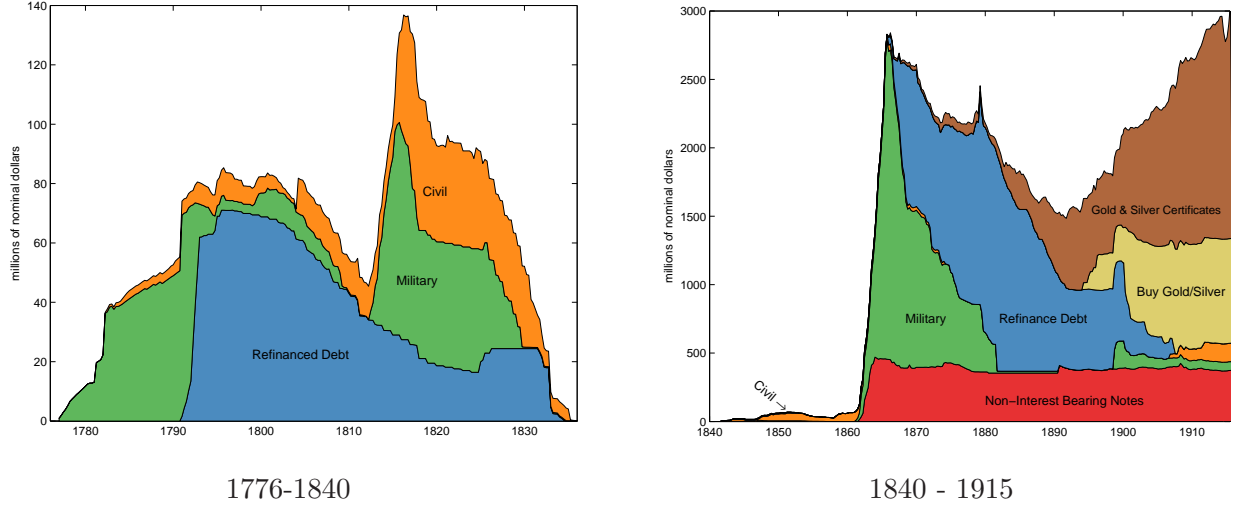


Figure 19: Debt Decomposed by Statutory Purpose

Before World War I, Congress authorized the Treasury to sell particular securities sequentially, one issue at a time, for particular purposes. Figure 19 decomposes the outstanding interest-bearing debt (measured at its par value) prior to 1915 according to statutory purposes. These have been aggregated into five categories of purposes: to finance military spending; to purchase non-military goods and services (labeled civil); to refinance existing debt; to buy gold or silver; to issue gold or silver certificates. This figure also includes non-interest bearing debt (i.e., currency). Prior to 1880, most debt had been issued to finance the Revolutionary War, the War of 1812, and the Civil War. Much of this debt was ultimately refinanced – meaning issuing new loans to repay old ones. After 1890, most Treasury borrowing was for the purpose of acquiring stock piles of gold and silver as part of open market operations associated with issuing currency in the form gold and silver certificates. Before 1915, relatively little debt was incurred to finance non-military spending. The increase of \$11.25 million in 1803 was to finance the Louisiana Purchase. Much of the debt labeled “civil” incurred after the War of 1812 was to replace lost customs revenue due to the war and to rebuild Washington DC.

Two consequences of tying debt to particular projects were:

1. When long term debt was issued, it generated a lumpy maturity structure and associated echo effects in the ‘debt service’ profile,³⁸
2. Heterogeneity in security design reduced liquidity.³⁹

These consequences confronted Congresses with rollover risks and liquidity risks. How Congress instructed Secretaries of Treasury to manage these risks changed over time. To see this consider

³⁸The IMF focuses on ‘debt service requirements.’ Please see footnote 13.

³⁹Figures 30 and 31 in the Appendix illustrate the variety of different loans authorized by Congress prior to World War I.

the funding of three wars during the “project finance” era: the Revolutionary War, the Civil War, and World War I.

As discussed in section 3.1, the American Revolution was financed by a jumble of domestic IOUs, foreign loans, state loans, and paper money. In 1790, Treasury Secretary Alexander Hamilton refinanced the state and domestic continental debt into three consols⁴⁰: the 6 percent stock, the deferred 6 percent stock, and the 3 percent stock. See figure 9. In his *Report on Public Credit* Hamilton (1790) argued that by replacing the numerous old securities with three new securities liquidity would increase both for investors and the nation. He wished to create “stock” that “passes current as specie.” He succeeded. As Sylla (1998) documents, trade in these three securities helped to foster nascent stock exchanges in New York, Philadelphia, and Boston. Hamilton also wished to lengthened the payment schedule in order to provide the young nation breathing room to grow.

This strategy of restricting the set of securities and extending the maturity of the debt was repeated after the Civil War. To finance the preservation of the Union during the Civil War, the US Treasury issued 19 unique interest-bearing securities and five different forms of currency.

- Of the interest bearing securities, 10 promised payment in gold; 4 promised payment in “lawful money” (greenbacks); but for 5 of them, the currency in which the principal payment was promised was ambiguous.
- Securities differed in call features and exchange privileges. Because several allowed for partial calls, the likelihood and timing of call depended on the individual bond’s serial number.
- One currency, Compound Interest Notes, paid interest; the other four did not.

It was so difficult to deduce the precise nature of the Government’s promises that Senator John Sherman of Ohio decried

Eight-ninths of [the debt] consisted of transient forms issued under laws made up to a great extent of incomprehensible verbiage giving unlimited direction over the mass to one man and expressing in the aggregate nearly one hundred contingencies of duration, option, conversion, extension, renewal, etc.⁴¹

Although a large variety of different securities were issued, at the end of 1868, five issues comprised over 78 percent of the interest-bearing debt generating large principal payments due in 1868, 1881, 1882, and 1885. The left panel of figure 20 plots the Treasury’s debt service profile, i.e., the s_{t+j}^t , at the end of 1866. Repayment of the \$676 million in principal for the 7-30s owed in 1868 and of the \$515 million in principal for the 5-20’s of 1862 owed in 1882 is readily apparent. Total federal

⁴⁰A consol is a bond with no maturity date.

⁴¹See Dewey (1912), page 333.

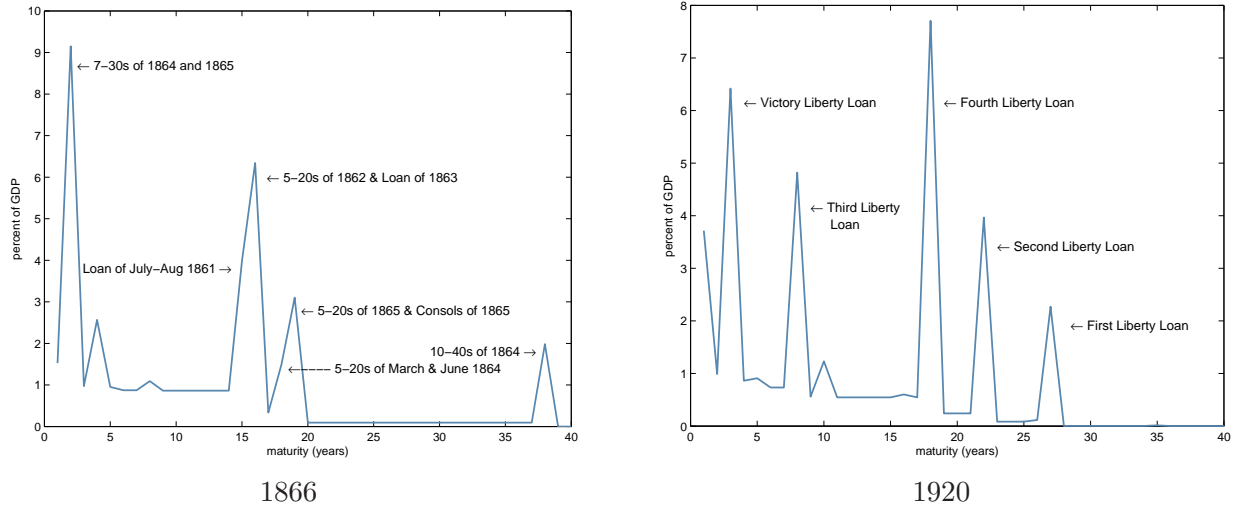


Figure 20: Debt Service Profile as a Share of GDP after the Civil War and World War I

The blue line is the government’s promised payments, both coupon and principal payments, across maturities measured in years as of December 31.

tax revenues averaged a little over \$350 million per year during the two decades after the war, so repaying all debt as it came due was out of the question.

Through three refundings, Congress authorized the Treasury to issue new securities for the sole purpose of refunding existing debt with bonds bearing lower coupons; the statutes prohibited using this debt to finance increased government spending. See the right panel of figure 19. These new bonds lengthened the average maturity of the debt. The Treasury retired roughly 2/3 of the debt over the following 25 years using primary surpluses steadily to repurchase the debt via a sinking fund. Further, refundings in 1870 and 1880 also consolidated the federal debt into a smaller number of more easily understood securities.

To finance World War I, Woodrow Wilson’s Treasury Secretary, William Gibbs McAdoo, wanted to borrow in a more orderly way than the Union had during the Civil War. As described in his memoir *McAdoo* (1931, p. 373), he “did not get much in the way of inspiration or suggestion from a study of the Civil War, except a pretty clear idea of what not to do.” Therefore, rather than issuing 19 separate securities improvised along the way, McAdoo convinced Congress to finance the war effort (mostly) with five securities that the Treasury issued and marketed sequentially. That conveyed to the Congress and its agent Treasury Secretary Andrew Mellon who assumed office in January 1921 with the responsibility for managing a Federal debt comprised of the

- First Liberty Loan, with \$2.0 billion due June 1947,
- Second Liberty Loan, with \$3.3 billion due November 15, 1942,
- Third Liberty Loan, with \$3.6 billion due September 15, 1928,

- Fourth Liberty Loan, with \$6.3 billion due October 15, 1938,
- Victory Loan, with \$4.5 billion due May 20, 1923,

along with 7 pre-war bonds with an outstanding face value of \$800 million dollars and \$3.3 billion in short term debt. In the debt service profile displayed in the right panel of figure 20, the large spikes in the Treasury’s payment schedule associated with the five major war bond issues are readily apparent.

Secretary Mellon faced a different set of Congressional constraints than had his predecessors.⁴² The Second Liberty Bond Act of 1917 granted the Secretary of the Treasury the authority

to borrow from time to time, on the credit of the United States for the purposes of this Act, and to meet expenditures authorized for the national security and defense and other public purposes authorized by law not to exceed \$7,538,945,460

By including the phrase “and other public purposes authorized by law,” this Act differed from all previous statutes. That broad language broke the tight connection between borrowing and spending on a specific purpose that had been a characteristic of Treasury debt since 1776.

The Second Liberty Bond Act and subsequent amendments to it continued the Congressional practice of limiting the quantity of long term securities that could be *issued* while also placing limits on the quantity *outstanding* of short-term debt. Congress no longer constrained the Treasury to issue securities sequentially. Now the limits were placed on classes of securities rather than on specific issues. Consequently, Secretary Mellon had more flexibility to manage the debt than any of his predecessors. In 1920 Mellon faced the following sub-limits:

1. \$10 billion in certificates of indebtedness outstanding⁴³
2. \$7.0 billion in notes issued
3. \$20 billion in bonds that could be issued

Figures 21, 22, and 23 portray the evolution of the debt and these limits from 1917 to 1939.

While Secretary Mellon recognized the need to refinance the debt, his first priority was to lower tax rates from their extraordinary wartime rates. He accepted that repayment of the debt would be accomplished gradually. During his tenure from 1921 to 1932 Mellon smoothed and shortened the maturity structure of the debt by replacing long term bonds with issues of a new set of standardized short-term securities: term notes, certificates of indebtedness, and (beginning in 1929) bills. In the early 1920s, the quantity of bonds outstanding declined while the quantity of

⁴²Our understanding of the details of Treasury’s debt management after 1920 is shaped by the work of Gaines (1962) and Garbade (2012).

⁴³Certificates of indebtedness, the precursors of Treasury bills, had a maturity of one year or less. Because the Treasury could not sell its debt below par, unlike the zero-coupon Treasury bills, these certificates paid a coupon.

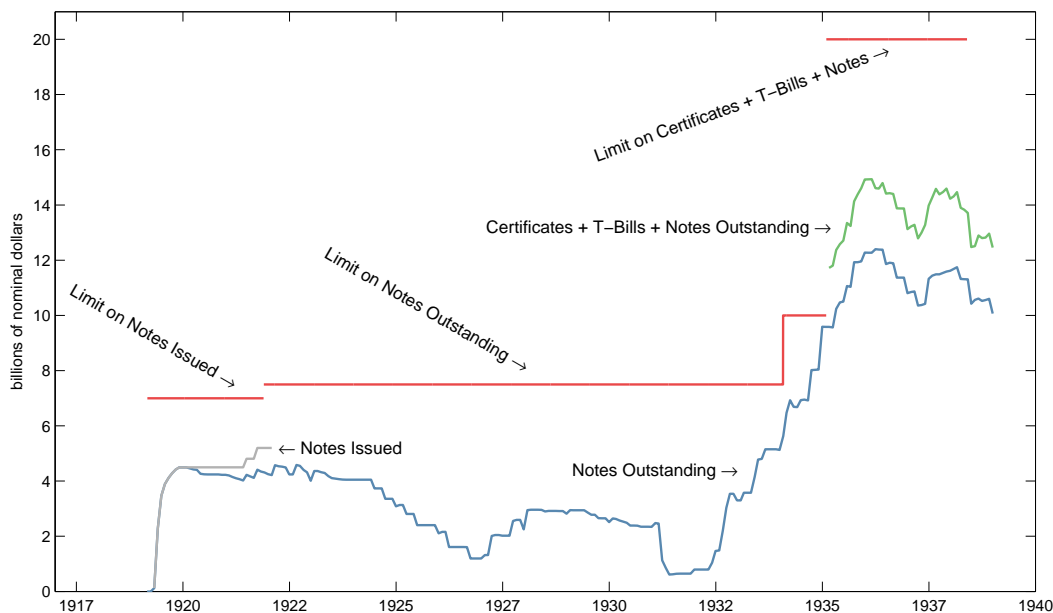


Figure 21: Limits on Notes Outstanding: 1917 to 1939

notes grew to more than \$4 billion dollars. Thus, Andrew Mellon’s post World War I refinancing was unprecedented in *shortening* the average maturity of the debt. Earlier postwar refinancings of US debt were designed to *lengthen* the average maturity of the debt.

Throughout most of the 1920s, Congress’s limits on these classes of securities did not constrain Secretary Mellon’s way of refinancing and restructuring the federal debt. But the class sub-limits began to bind him in 1929. When Secretary Mellon wanted to issue \$8 billion in new bonds to refinance existing debt, an operation that would have violated the Congress’s limit on bonds issued, he wrote to Congress:

[I]t is obvious that the orderly and economical management of the public debt requires that the Treasury Department have complete freedom in determining the character of securities to be issued and should not be confronted with any arbitrary limitation which was not intended to apply to these circumstances.⁴⁴

As illustrated in figure 23, Congress responded by raising the limit on bonds issued to \$28 billion.

In 1935, Congress eliminated the distinction between short and long term debt it had made nearly a century earlier⁴⁵ and redefined the limit on bonds from \$28 billion issued to \$25 billion bonds outstanding.

In 1938, the Treasury, then led by Secretary Henry Morgenthau, once again approached the bond sub-limit. Again see figure 23. Secretary Morgenthau requested an increase in the limit.

⁴⁴See United States Department of the Treasury (1930, p. 39).

⁴⁵See Section 3.3.

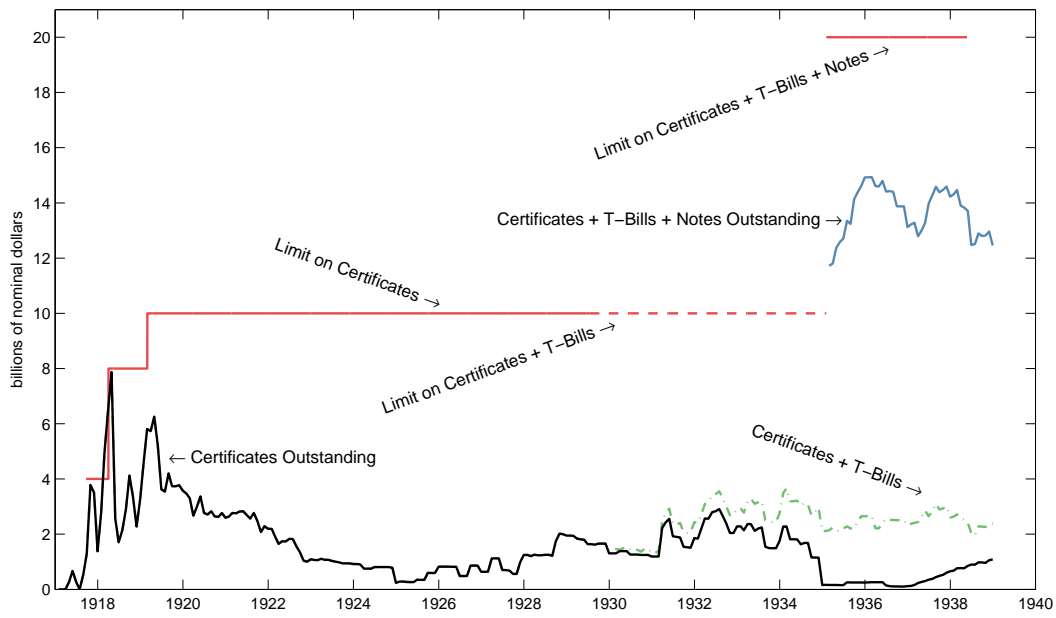


Figure 22: Limits on Certificates of Indebtedness, Treasury Bills, and Treasury Notes Outstanding: 1917 to 1939



Figure 23: Limits on Bond Issuance and Outstanding: 1917 to 1939

Congress raised the limit on bonds from \$25 to \$30 billion and set an aggregate limit of the debt to \$45 billion. In 1939, Congress removed the \$30 billion cap on bonds, leaving the total limit unchanged.

That move to a single aggregate debt limit meant that before World War II Congress had delegated the design and management of the debt almost completely to the Treasury. In contrast to earlier wars, the debt issued to finance World War II was designed by the Treasury, not by a Congressional committee. Secretary Morgenthau took advantage of this new authority and set as one of Treasury's wartime finance goals that "the securities offered should be those best suited to the needs of the investors to whom they are sold." Toward achieving that objective, the Treasury issued a wide range of marketable and nonmarketable securities. The set of interest-bearing marketable securities on December 31, 1946 consisted of:

1. 13 Treasury bills, each maturing on consecutive Thursdays from January 2 to March 27, 1947.
2. 11 Certificates of Indebtedness, each maturing on the first of the month from January to December 1947.
3. 4 Treasury notes, one maturing March 15, 1947, two maturing on September 15, 1947 and one maturing on September 15, 1948
4. 43 Treasury bonds, maturing on staggered dates from December 1947 to December 1972

Relative to previous wars, many more securities were issued, but the the spacing of the maturities were in part designed to ease future refinancings and rollovers. And while there were only four different classes of securities, Treasury's attempt the design securities to meet the "needs of the investors" by varying maturities, call features, and tax exemptions, both facilitated initial sales and limited liquidity in secondary markets.

The left panel of figure 24 plots the Treasury's debt service profile, i.e., the s_{t+j}^t s, at the end of 1946. There are few spikes and lumps in the maturity structure. Further, in contrast to debt service profiles reported after the Civil War and World War I, a large share of the debt was due within one-year.

During the post-war period the tension increased between designing securities

- to meet the specific funding needs of the Treasury and those purchasers interested in holding government debt as an investment, and
- to create a highly liquid store of value.

Echoing John Sherman nearly a century prior, Milton Friedman (1960) stated

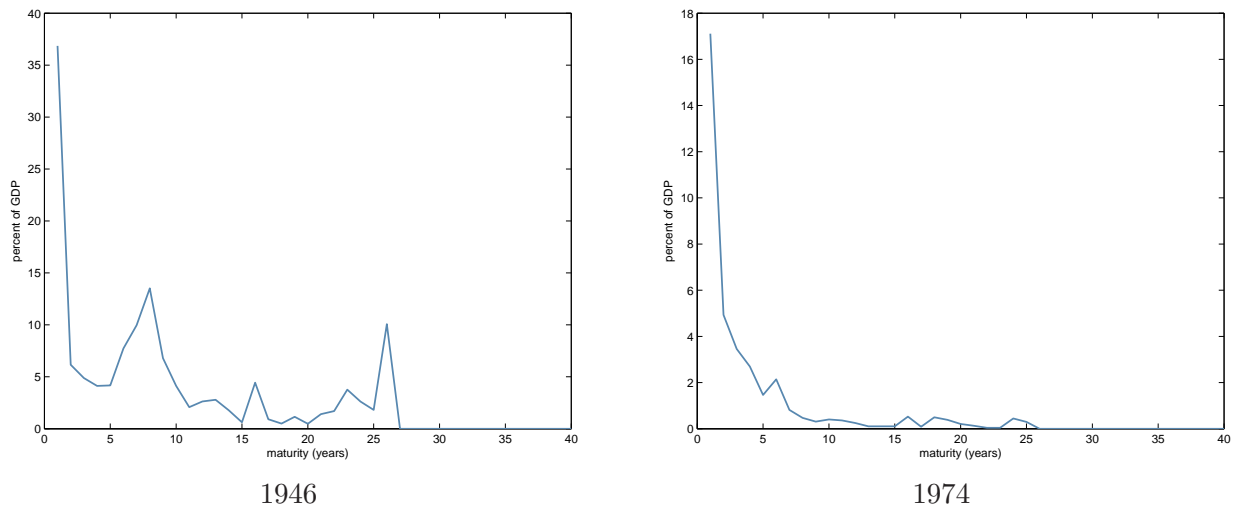


Figure 24: Debt Service Profile as a Share of GDP after World War II and the Vietnam War

The blue line is the government’s promised payments, both coupon and principal payments, across maturities measured in years as of December 31.

In the attempt to keep down the interest cost, and to achieve such other objectives as a wide distribution of securities and lengthen maturities, the Treasury has sought to “tailor” securities to supposed demands of special groups of potential purchasers, and to time the issue of securities to fit into slack periods in the money market. The result has been a bewildering variety of securities of different maturities and terms, and lumpiness and discontinuity in debt operations, and refunding of major magnitude occurring on a few dates in the year.

Friedman advocated issuing just two securities, 3-month T-bills and 10 year bonds at regular intervals.

Since 1950 there has been a trend toward increased standardization, a shorter average maturity, and a more orderly maturity spacing. As an example of increased standardization, the share of long term bonds that are callable has declined sharply.⁴⁶ Near the end of the Vietnam War in December 1974, there remained only three classes of marketable securities outstanding.

1. 41 Treasury bills, with 33 maturing roughly weekly from January 2, 1975 to June 26, 1975 and a remaining 6 maturing roughly once a month thereafter.
2. 45 Treasury notes, with maturities evenly distributed over the next five years
3. 19 Treasury bonds, with maturities between 5 and 28 years.

As can be seen in the right panel of figure 24, there are no spikes or lumps in the debt service schedule.

⁴⁶See figure 14 of Faraglia et al. (2014).

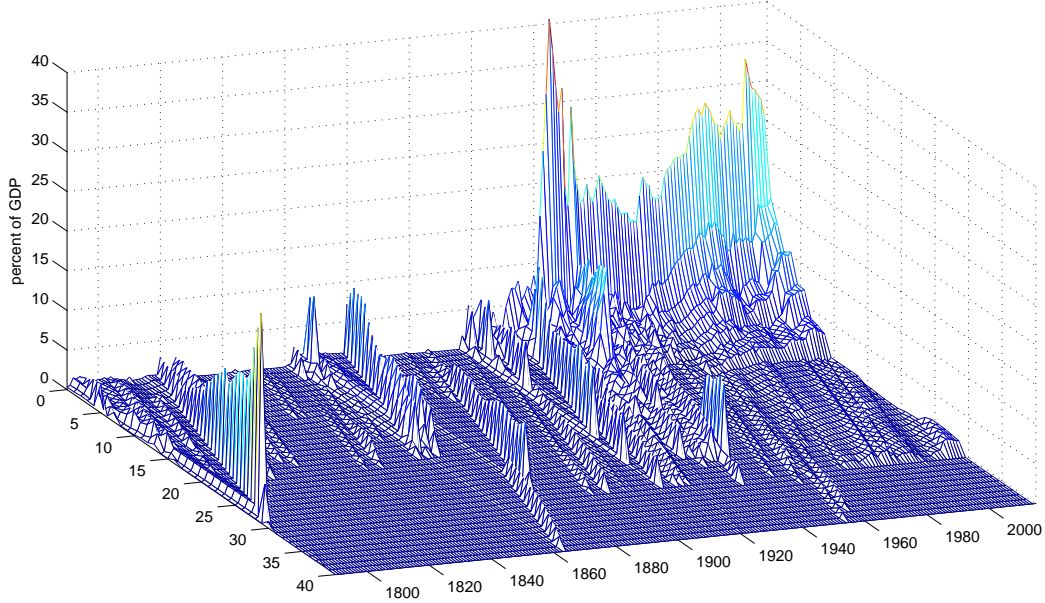


Figure 25: Debt Service Profiles from 1790 to 2014

The surface is the government's promised payments, both coupon and principal payments, as a share of GDP across maturities measured in years as of December 31.

Since, 1974 the Treasury has introduced one more class of marketable securities, the Treasury Inflation Protected Securities, or TIPS as they are known. TIPS are coupon bonds and notes whose interest and principal payments are linked to the CPI.

The transition from project finance to aggregated finance and the coincidental smoothing of the debt service schedule and reduction of the average maturity are summarized in two figures. Figure 25 plots the evolution of the debt service schedule as a share of GDP from 1790 to 2014 in three dimensions. Prior to 1950, much of the debt is long-term, thus the many ridges. In the post-1950 period the maturity structure shortens and becomes much smoother.

Figure 26 plots the average maturity of the debt. From 1840 to 1920 the average maturity of the debt (as measured by the s_{t+j}^t s) often exceeded 10 years. Since 1920, the average maturity has steadily fallen. A shorter maturity structure requires more frequent rollovers. To manage these, it is convenient for Congress to delegate more debt management responsibility to the Treasury. Why did Andrew Mellon and his successors, with the implicit consent of Congress, choose a shorter maturity structure? We don't know.

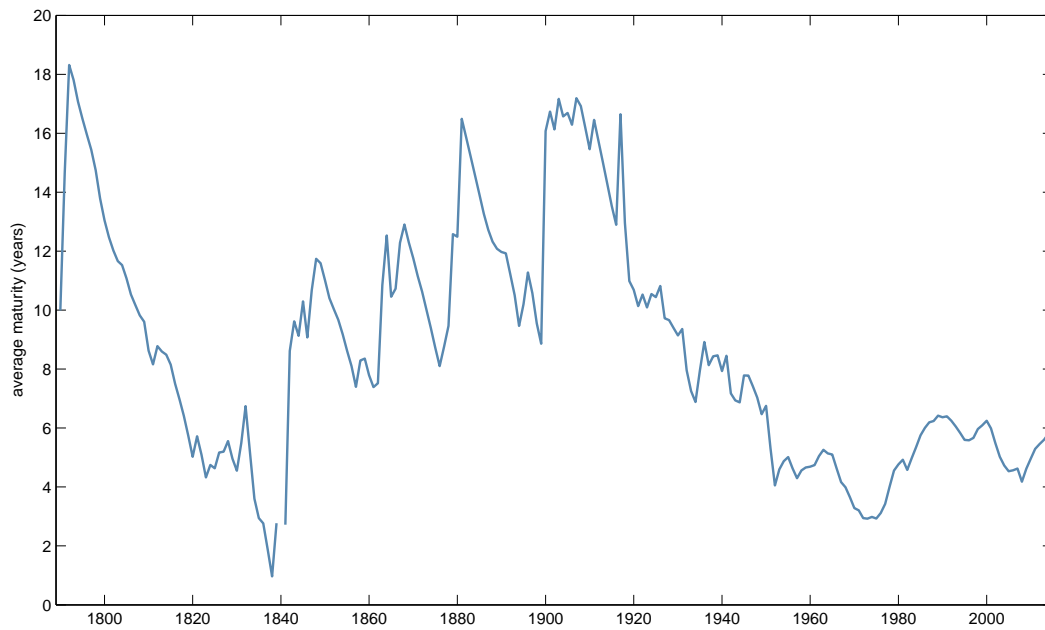


Figure 26: Average Maturity of the Debt: 1790 to 2014

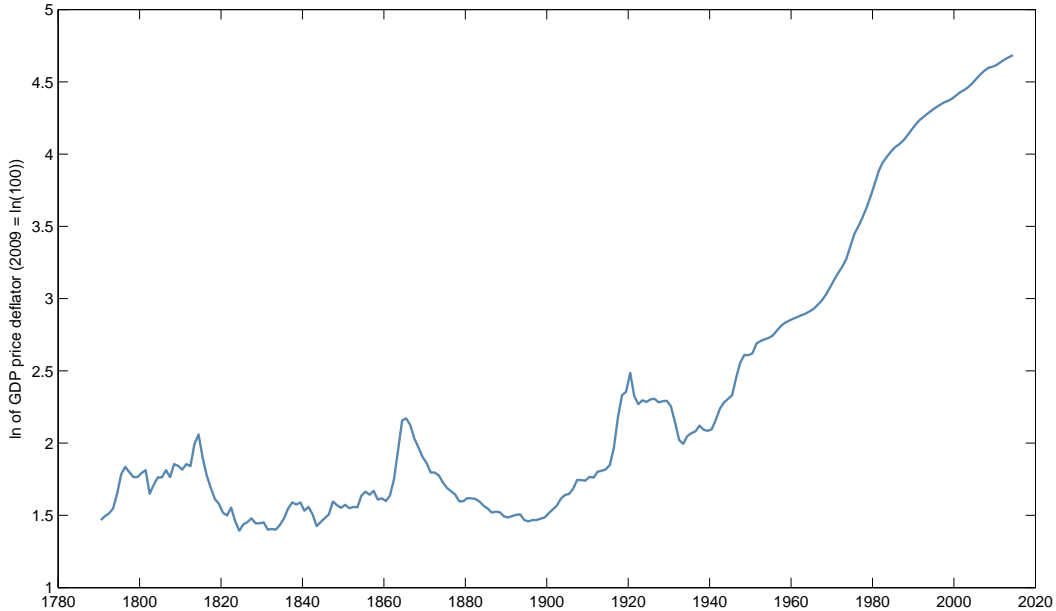


Figure 27: Natural Log of the GDP Deflator

6 Causes and Coincidents

Changes in the joint behavior of the debt limit and U.S. debt as economic time series coincided with Congress’s devolution of authority for designing and managing U.S. Federal debt to the Secretary of Treasury and also with other changes in economic policies and ideas. For us it is especially important to take into account changes in the behavior of the price level that occurred after 1939.

Figure 27, which plots the logarithm of a GDP deflator for the US, shows that a force for increasing the nominal debt limit just to keep up with inflation became much more powerful after 1940 than before. Converting figures 1-3 into a real government debt and a real debt limit by dividing both series by the price level would not alter broad patterns because sustained changes in the price level in one direction were limited before 1939, with the price level sometimes rising for a while, then falling. But adjusting for the price level as we do in figure 28 materially alters patterns emerging from the the post 1939 figure 4. Figure 28 reveals that most of the increases in the debt limit between 1950 and about 1983 were purely nominal adjustments designed to catch up with inflation. But after 1983, increases in the debt limit outpaced inflation and thereby significantly increased the real amount of debt that the Congress authorized. This figure indicates that it was only after about 1983 that the debt limit seems not to have forecast or constrained future real debt levels.

We offer these opinions about two possible causes of the altered joint behavior of debt and

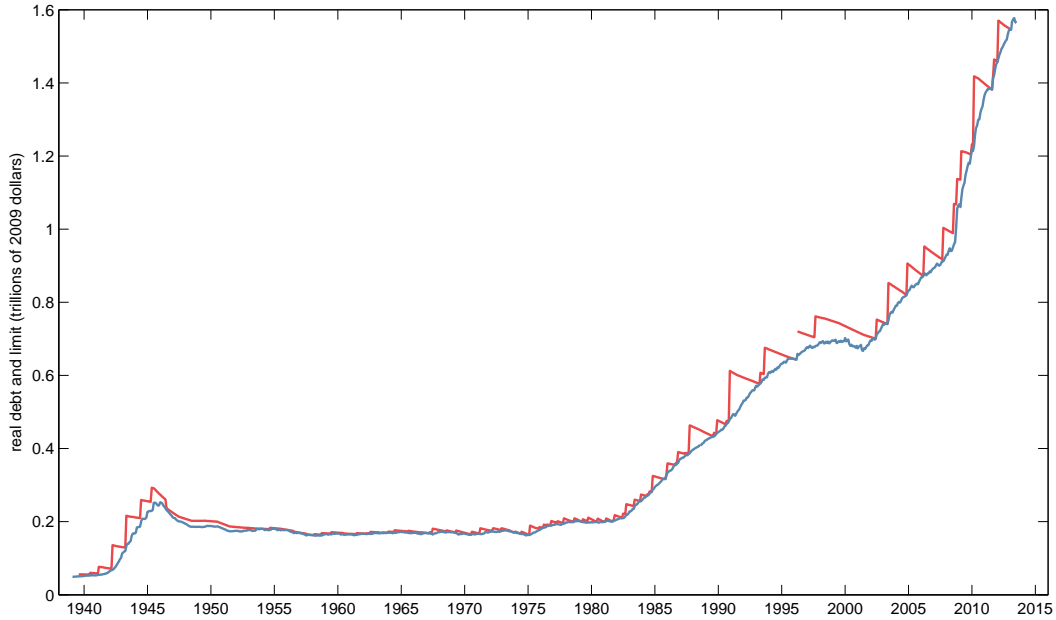


Figure 28: Statutory Debt Limit and Debt Subject to it Divided by Price Level

the debt limit.

1. Advent of Keynesian economics?

Probably not. It is true that in response to economic and intellectual events of the 1930's, macroeconomists advocated countercyclical government budget deficits as a tool to attenuate business fluctuations. Superficially, it might seem that legislated debt limits threaten to obstruct fine tuning of fiscal policy to fight the business cycle. But this objection to a debt limit doesn't seem to bear close scrutiny. Keynes (1978) had advocated a disciplined approach to countercyclical fiscal policy that involved (a) keeping separate capital and current account government budgets, (b) always balancing the current account budget, and (c) timing capital account deficits to arrest the business cycle. Leading Keynesian economists consistently advocated balancing the government's budget over the business cycle. Meaningful debt limits are compatible with that approach to countercyclical fiscal policy.⁴⁷

⁴⁷The break in behavior of trend inflation in 1939 associated with the US leaving the gold standard in steps taken between 1933 and 1972. A gold standard or silver standard requires balanced government budgets in the present value sense and limits "seignorage revenues" from printing money as a source of government revenues. The economic justification for a gold standard is that it forces a government to abstain from money creation. A principal theoretical justification for abandoning a gold standard was to leave macroeconomic economic policy freer to attenuate business cycle fluctuations by exploiting a Phillips curve. A Phillips curve expressing an exploitable

2. Reaganomics gone bipartisan.

More likely. In the 1970s, fiscally conservative economists including Milton Friedman advocated a Federal balanced budget amendment, but that campaign went silent during the Reagan administration. Why?

Building on an analysis in Sargent and Wallace (1981), Sargent (2013, Ch. 6) interpreted the Reagan deficits as outcomes of a strategy of the Reagan administration to use government debt to force successor administrations to lower net-of-interest government spending. What would get the attention of future Presidents and Congresses was not a binding debt limit, but a big government debt. Reaganomics put downward pressure on the present value of net-of-interest government expenditures by⁴⁸

- (a) Permanently cutting the present value of federal tax revenues by front loading tax cuts and then resisting proposals later to increase them.
- (b) Supporting Paul Volcker's Federal Reserve policy of reducing inflation, thereby limiting the present value of prospective federal revenues from levying an inflation tax ("seigniorage").⁴⁹
- (c) Accepting a growing government debt as a device to pressure future administrations and Congresses to lower the present value of government expenditures.

Here growing government debt intermediates a three-way game of chicken among 1) a Central Bank that by controlling an inflation rate controls inflation tax revenues, 2) an Executive Branch capable of preventing increases in other tax rates, and 3) a Congress that controls a stream of net-of-interest government expenditures. Backed by a Central Bank committed to low inflation, Reaganomics used the lever of the present value budget balance constraint to reduce future government spending.

The conservative fiscal policies followed by the Clinton period can be interpreted as responses to the restraints imposed on it by the Reagan administration's runup of Federal debt.

We know big government does not have all the answers. We know there's not a program for every problem. . . . we have worked to give the American people a smaller, less bureaucratic government in Washington. And we

trade-off between higher inflation and lower unemployment became a pillar of Keynesian macroeconomic analysis after 1960.

⁴⁸Neil Wallace called this a game of chicken.

⁴⁹See Silber (2012) for an account of Paul Volcker's understandings about coordinating monetary and fiscal policies.

have to give the American people one that lives within its means. The era of big government is over. . . .

. . . our responsibility begins with balancing the budget in a way that is fair to all Americans. There is now broad bipartisan agreement that permanent deficit spending must come to an end. I compliment the Republican leadership and the membership for the energy and determination you have brought to this task of balancing the budget.

President Bill Clinton, State of the Union Address (January 23, 1996)

Figure 28 shows that things had changed by the time of Barack Obama's administration, partly because of decisions taken during the administration of George W. Bush, and partly in response to the financial crisis, but also because Democrats turned Reaganomics on its head by using the arithmetic of an intertemporal government budget constraint to play chicken more stubbornly in pursuit of their interests.⁵⁰ While the arithmetic of the government budget constraint implies that one way or another, monetary and fiscal policies have to be coordinated, it leaves open the possibility that an administration determined to raise net-of-government expenditures can use a growing government debt as a way to force its successors eventually to raise the present value of taxes enough to arrest further increases in the debt while also financing a permanently bigger government.

⁵⁰This is a theme of White (2014).

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A Constructing an Aggregate Debt Limit Before 1939

To construct a limit on total Federal debt before World War I, we added up limits on outstanding quantities of each security stated in authorizing legislation. During World War I, Congress began to place limits on classes of Treasury securities. When those limits were in place, we summed them to get an aggregate limit. In this section, we discuss these calculations in more detail.

Between 1776 and 1916, the US Congress authorized the Treasury to issue a total of approximately 200 distinct securities, with no more than 8 distinct ones being authorized in any particular year. We list these securities vertically in figures 30 and 31. The span of each line corresponds to the period the security was outstanding. The width is proportional to the size of the issue, and the color denotes the coupon rate.

Authorizing legislation for each security expressed Congress’s reason for borrowing, a sum to be borrowed, a duration of a security, and a coupon rate. Other characteristics, restrictions, and terms, such as tax exemptions and call features, might also be stated. In most cases, Congress expressed a quantity in terms of the par value of the security that could be *issued*. It also restricted the period during which the security could be issued.

Let $b(\ell)^t$ denote the par value of a particular security called ℓ outstanding at date t . Suppose that at time t there are N_t different loans authorized and outstanding. The law of motion of the par value outstanding of security ℓ is

$$b(\ell)^t = b(\ell)^{t-1} + i(\ell)^t - r(\ell)^t$$

where $i(\ell)^t$ denotes the par value of security ℓ issued at t and $r(\ell)^t$ denotes the par value redeemed.⁵¹

When Congress authorized the Treasury to issue at most $i(\ell)^*$ of security ℓ , that meant that it placed the following restriction on cumulative sum of issues:

$$\sum_t i(\ell)^t \leq i(\ell)^*.$$

Let \bar{i}^t denote the time t *statutory balance* on the quantity of bond ℓ that could be issued. This limit satisfies

$$\bar{i}^t = i(\ell)^* - \sum_{j=1}^n i(\ell)^{t-j},$$

where $t - n$ is the date at which the securities were first issued. Let $\tilde{r}(\ell)^t$ be the amount of type ℓ bonds that *must* be redeemed by virtue of the bond contract. The implied limit on the par value

⁵¹The bond contracts made some redemptions mandatory – we’ll call these $\tilde{r}(\ell)^t$; others were “early redemptions”.

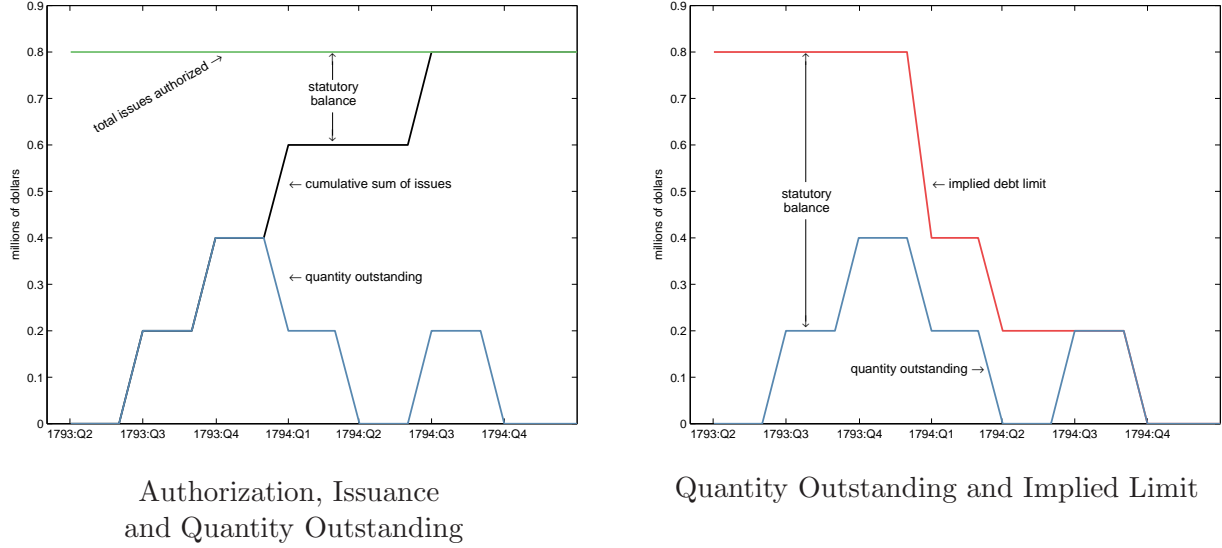


Figure 29: The Temporary Loan of 1793.

of the quantity outstanding of security ℓ at time t is:

$$\bar{b}(\ell)^t = b(\ell)^{t-1} + \bar{i}(\ell)^t - \bar{r}(\ell)^t.$$

The aggregate debt limit \bar{B}_t is the sum of these individual limits over all outstanding securities:

$$\bar{B}_t = \sum_{\ell=1}^{N_t} \bar{b}(\ell)^t.$$

The Temporary Loan of 1793 provides a good example. The Act of February 28, 1793 spelled out federal spending and revenues for the fiscal year. For example, it appropriated \$143,591 to pay members of Congress and their staffs. Section 3 of the act authorized the government to borrow \$800,000 at 5 percent interest to cover several of the expenditures listed in earlier sections of the act. The left panel of figure 29 plots the implied restriction $i(\ell)^*$ as a horizontal green line. Between the second quarter of 1793 and the second quarter of 1794, \$800,000 of loans were issued; we plot the cumulative sum of issues as the black solid line. Due to redemptions, the maximum quantity outstanding on this particular loan at any time was only \$400,000. See the blue line. The statutory balance is the vertical distance between the green line (total issues authorized) and the black line (the cumulative sum of issues).

We computed the limit on the quantity outstanding by adding the statutory balance to the quantity outstanding and netting out redemptions. We plot the implied limit in red in the right hand of figure 29. As bonds issued as part of the Temporary Loan of 1793 were gradually redeemed, they could not be re-issued. Therefore, the debt limit ratcheted down with redemptions. By the

third quarter of 1794, the limit on the quantity issue had been reached, the statutory balance hit zero, and the loan was closed.

When aggregating limits across individual securities, we adhered to the following rules:

- We excluded any loans issued solely for the purpose of refunding existing debt or purchasing gold or silver.
- When authorization dates were not explicitly stated, we assumed that a security could be issued 30 days after the authorizing legislation passed Congress and that issuance “closed” (i.e. authorization expires) 365 days after the final issuance.
- When Congress limited a quantity outstanding for an authorized security, we recorded $\bar{b}(\ell)^t$ directly from the legislation.

The large quantity and variety of different securities issued to finance World War I made placing limits on individual securities impractical. Therefore, as part of the Second Liberty Bond Act of 1917 Congress began placing limits on different classes of Treasury securities. To impute an aggregate debt limit during this period we deduced the statutory balance for each class of securities and then aggregated across the various classes. Over the next two decades, Congress gradually merged and relaxed these sub-limits, and by 1939 all the sub-limits had been removed leaving only the aggregate limit.

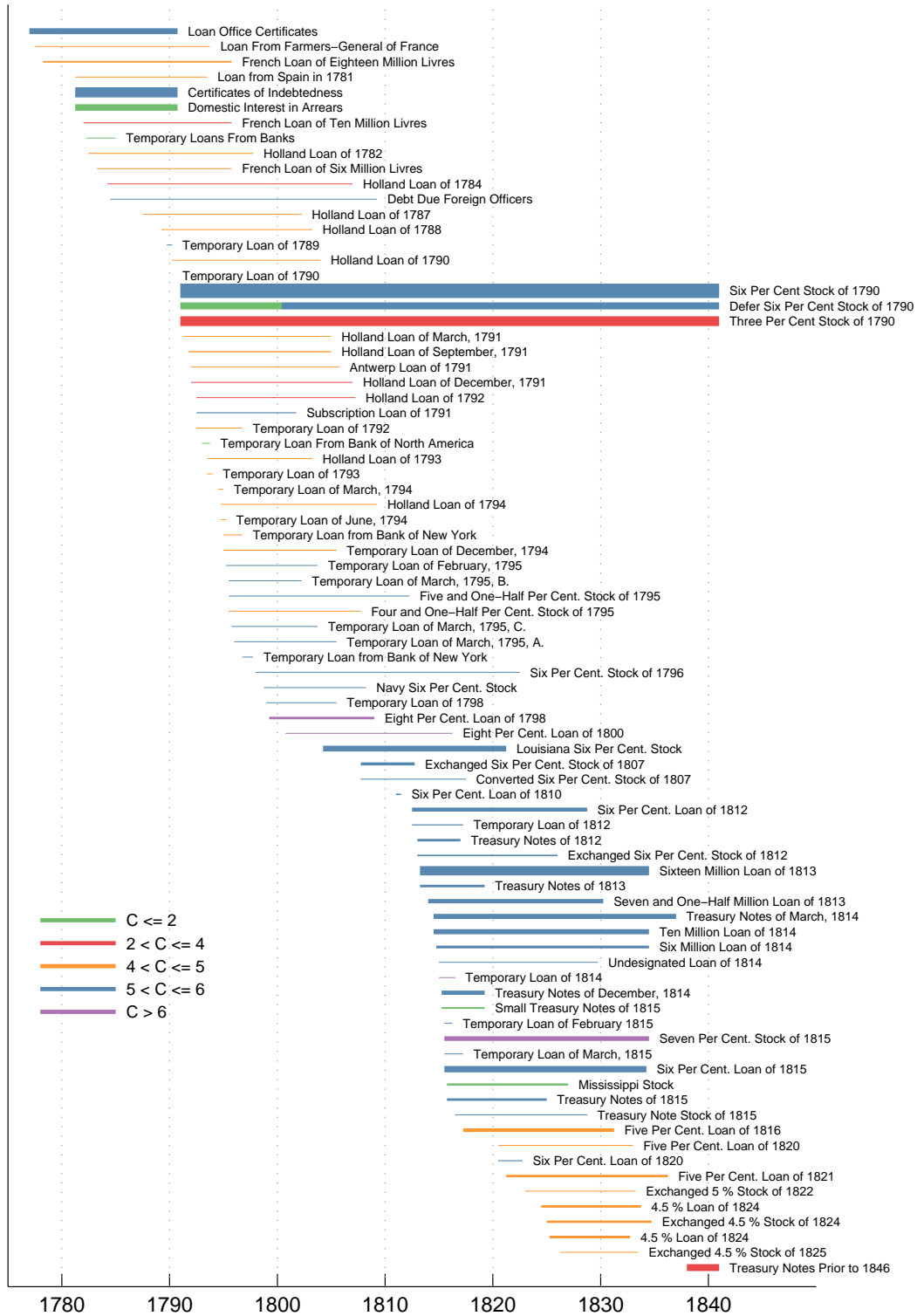


Figure 30: Debt Issues Outstanding: 1775 to 1840

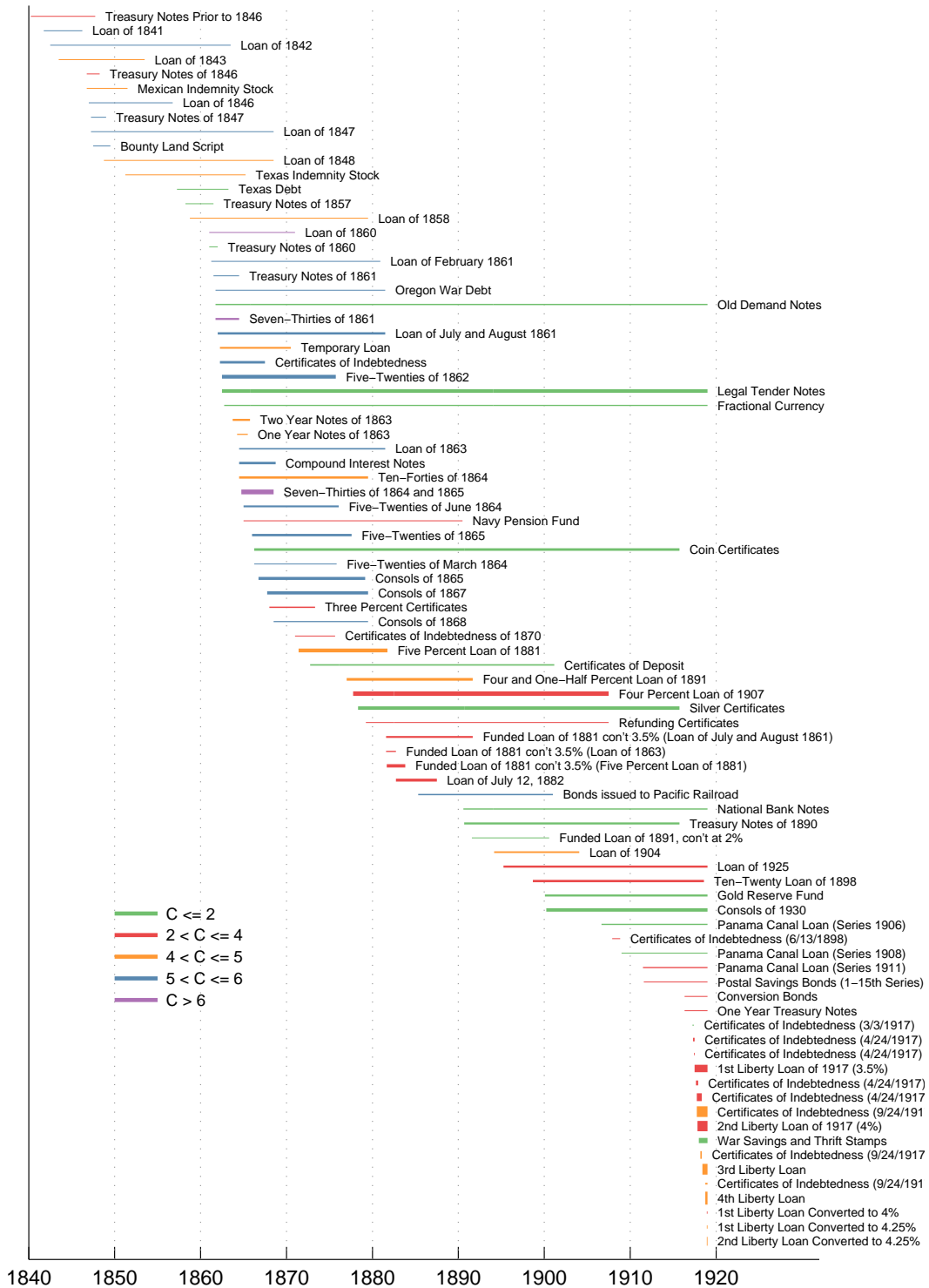


Figure 31: Debt Issues Outstanding: 1840 to 1918