Inflation and Regulation of Government Debt: US Historical Evidence*

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Abstract

Governments have often used two policy instruments to lower financing costs: the money supply to generate seigniorage and regulation of the financial system to increase demand for their interest bearing bonds. Both involve trade-offs. This article marshals historical evidence and economic theories about how the US federal government has arranged monetary, financial, and fiscal systems since 1800 to lower its financing costs. In doing so, we infer evolving priorities of different US administrations.

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1 Introduction

Between 1800 to 1900, the US went from struggling to raise war-time financing to enjoying the lowest sovereign borrowing costs in the world. Long-term real US treasury yields dropped from approximately 8% in 1800 to 2% in 1900 and stayed there for most of the 20th century. These outcomes reflect a sequence of policy changes to US monetary, financial, and fiscal systems that transformed domestic and international roles of US treasuries. In this article, we focus on two government policies aimed at lowering funding costs: control of the money supply and regulation of the financial sector. The former enables an inflation tax while exploiting the latter enables a financial tax. We bring together developments in several fields: collection and synthesis of new historical asset pricing data, financial economics and intermediary asset pricing theories for exploring public finance questions, and studies of how monetary-financial institutions shape financial sector outcomes.

Our history of US financing costs brings a number of lessons and tradeoffs:

1. Monetary flexibility promotes financial and business cycle stability but makes it harder to sustain long-run price stability.

2. Financial regulation can open up a government funding advantage and thereby relax the government's intertemporal budget constraint but can impair stability and efficiency of the financial sector.

3. Other aspects of its fiscal policy constrain the government's ability to use its monetary and regulatory tools to raise inflation and financial taxes.

At different times, the US government has held different priorities and accepted different tradeoffs. Throughout the 19th century, the government prioritized decreasing the cost of government financing and keeping trend inflation low. It implemented these priorities by adherening to a gold standard and, after the Civil War, introducing a National Banking System that created captive demand for long-term US debt and thereby acted as a financial tax. During the first half of the 20th century, the government's priorities changed. Concerns about ensuring financial and business cycle stability increased while concerns about ensuring price stability decreased as the government used inflation taxes to lower its borrowing costs, especially during wars. After World War II, the Fed increasingly focused on taming business cycles. We see these changes reflected in the increase in long-run inflation expectations during the 1970s and the relative stability of the financial sector from 1933 through to 2007. Another major shift came with the Global Financial Crisis (GFC) in 2007-09 and the subsequent change in bank regulations, although this episode is beyond the scope of our historical survey.

In Section 2 we discuss historical data collection. In Section 3, we discuss the gold standard from 1800 to 1933. In Section 4, we discuss the period from 1934 to the present day.

2 Historical Data and Evidence

Studying historical time series that span different institutional arrangements offers important lessons about the trade-offs governments face when designing monetary, financial, and fiscal policies. Taking a long-term perspective allows us to infer which “stylized facts” about macroeconomics and finance reflect more enduring economic forces and which reflect outcomes peculiar to today’s prevailing policies. We need reliable historical time series that extend back beyond World War II. Across a collection of papers, we have taken up the challenge of extending the historical asset pricing data available for the United States. In Hall, Payne, Sargent and Szőke (2018) and Payne, Szőke, Hall and Sargent (2025), we collect price, quantity, and bond information for all issues of US federal debt and infer the US Federal yield curve over 1790-2024. In Lehner, Payne and Szőke (2024), we collect a companion data set for all Moody’s rated US corporate debt and construct the first estimate of the US high-grade corporate yield curve from 1860-2024. This work complements the literature aimed at extending historical financial time series further back in time, e.g., Homer and Sylla (2004), Goetzmann, Ibbotson and Peng (2001), Reinhart and Rogoff (2009), Jordà, Knoll, Kuvshinov, Schularick and Taylor (2019), Schmelzing (2020), Officer and Williamson (2021), and Carlson, Correia and Luck (2022).

Estimating historical yield curves pose several technical challenges because institutional differences and changes in recording practices make the underlying data come in an unusual format. In particular, before World War I there were only 5-10 government bonds outstanding at any point in time, which makes efficient information pooling a priority. We address this by adopting a dynamic version of a tightly parameterized Nelson and Siegel (1987) yield curve model similar to the one proposed by Diebold and Li (2006). In addition to acknowledge that our data set includes bonds with peculiar and potentially troublesome features like their denomination, callability and convertibility, we introduce bond-specific idiosyncratic pricing errors to prevent these characteristics from unduly influencing our inferences.[1] In Lehner et al. (2024) we deploy the same technique to infer the first consistent estimates of high-grade corporate bond yield curves. We compare our approach to the relevant alternatives in Payne, Szőke, Hall and Sargent (2023) and discuss the advantages of using high-dimensional statistical models combined with state-of-the-art Bayesian sampling techniques for handling historical data sets. We believe that adopting these technological advances helps to bridge gaps between the history and macroeconomics literatures.

Figure 1 shows a collection of key historical time series for the US that emerge from our analysis and existing series: the market value of government debt relative to GDP (first panel), primary budget surplus, nominal and ex-ante real yields on long-term government debt (second panel), the price level, the inflation process and the corresponding long-term mean inflation (third panel), and the rolling correlation between GDP growth and inflation (fourth panel). The grey shaded time intervals are financial crises and the red shaded areas are wars. Labels on the third subplot indicate the major monetary eras, which we will discuss in the subsequent sections. Evidently, all of these series exhibit low frequency variations.

First, it is unclear whether or not the debt-to-GDP process is stationary throughout the long sample. On the one hand, in the years 1812-15, 1862-65, 1917-20, 1931-33, and 1940-45 major increases in the debt-to-GDP ratio, prompted by wars and major economic crises, seem to be followed

[1] Treasury yield curve estimates in Payne et al. (2025) assume the same parametric representation of zero-coupon yields as the popular estimates from the post-1960 sample, e.g., Gürkaynak, Sack and Wright (2007), so they can be viewed as direct extensions of the modern series.

by subsequent reductions once the crises subsided. On the other hand, some of the shocks in the 20th century appear to lead to permanent increases in the long-run mean of the debt-to-GDP ratio. The question of non-stationarity is a key element of econometric tests of a notion of "debt sustainability". See Trehan and Walsh (1988) for an influential example and Bohn (1995, 2008) for a critical assessment of this literature.

Second, after a slow trend decline in the 19th century, long-term real yields on US government debt were typically low and frequently close to zero throughout the 20th century. Recent papers, such as Schmelzing (2020), have documented a long-term average decline in interest rates around the world. Our estimates suggest that the US contributed to this trend decline during the 19th century, but in the 20th century, US borrowing costs started to follow a different trend. In addition, throughout the 19th century, large positive deviations from this trend decline in US borrowing costs coincided with large (temporary) primary deficits. This pattern changed dramatically during the 20th century when long-term ex-ante real rates became mostly insensitive to large deficits. The 1980s, which witnessed prolonged high ex-ante real rates and large peace-time deficits, stands out as an exception.

Third, we can see that throughout most of the 19th century, the long-run mean of the inflation process was anchored around zero, or actually negative between 1870-1890. However, this did not mean stable inflation: wars, recessions, and panics were associated with sharp increases in inflation volatility. The story started to change in the 1890s when long-run mean inflation started to become positive and inflation volatility dropped. Thus, we see a transition from a period with large but temporary inflation shocks to a period where shocks primarily hit long-run mean inflation, implying an increase in inflation persistence. During the 1960s and 1970s, we see particularly large variations in long-run mean inflation. These patterns are consistent with studies that investigated the changing properties of inflation dynamics, like Benati (2008), Cogley and Sargent (2015), or Cogley, Primiceri and Sargent (2010).

Finally, the 30-year (centered) rolling correlation between per capita output growth and inflation was positive on average up until the middle of the 20th century. This relationship changed abruptly after World War II when the correlation became significantly negative due to a series of low inflation booms and the "stagflation" of the 1970s.[2] The relationship between inflation and output growth changed again in the 1980s, when the rolling correlation started to increase and eventually become positive again in the early decades of the twenty-first century. This confirms and puts into a broader historical perspective a recent finding by Campbell, Pflueger and Viceira (2020) on the changing cyclicality of inflation.

Figure 2 shows the 10-year nominal yields on US Treasuries and high-grade corporate bonds (top panel), the spread between the two yields (middle panel), and the scatter plot between spreads and the market value of government debt to GDP (bottom panel). We interpret the spread between the two long-term yields as the US government's funding advantage because it reflects the equilibrium substitutability between government bonds and similarly risky private debt securities. We will refer to this spread as the "convenience yield" following Krishnamurthy and Vissing-Jorgensen (2012).

[2]The figure shows the irony that a "Phillips curve" prevailed for approximately 150 years but then abruptly broke down just when economists discovered it in the late 1950s.

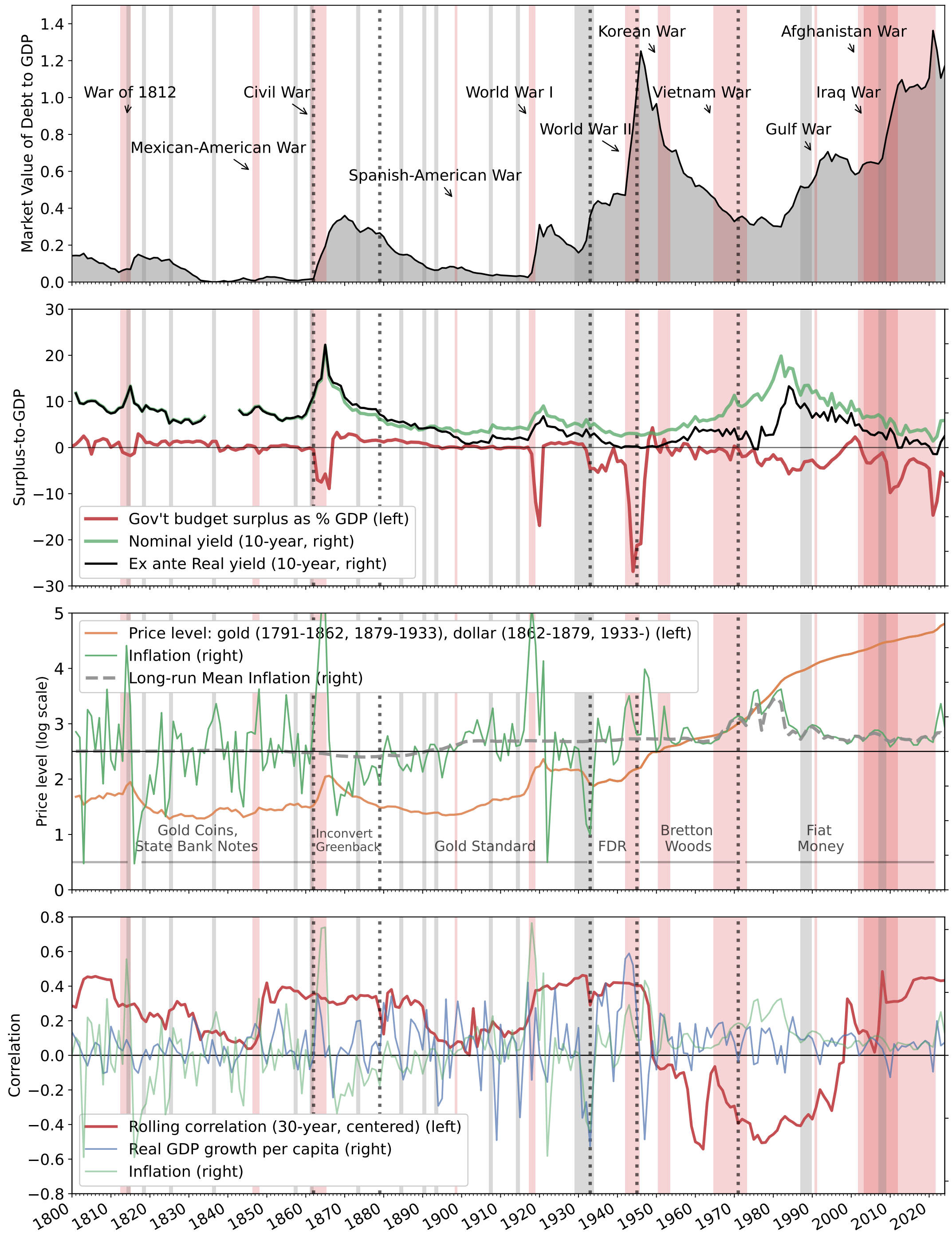

Figure 1: *First panel:* Market value of outstanding debt to GDP ratio. *Second panel:* Primary surplus to GDP ratio and yields on US treasuries. Ex ante real yield equals nominal yield minus expected inflation. *Third panel:* The price level and inflation. The long-run mean inflation and the conditional inflation expectation in the second panel are estimates from a univariate model of inflation as in Cogley et al. (2010). *Fourth plot:* Rolling correlation between inflation and GDP growth. The gray shaded time intervals are financial crisis from Reinhart and Rogoff (2009). The red shaded time intervals are wars.

Labels on the middle panel of Figure 2 indicate major banking regulations and monetary eras, which we will discuss in the subsequent sections. Evidently, the convenience yield also exhibits large low frequency variations with its long-run mean value ranging between 0-2 % over the last 160 years. On average, the convenience yield peaked during the National Banking Era (1862-1913) and generally stayed high during the gold standard. Its long-run mean dropped sharply after World War I and followed a trend decline after the Great Depression before reaching its lowest levels during the high inflation of the 1970s and 1980s.

The scatter plot in the bottom panel of Figure 2 looks different to the plot documented by Krishnamurthy and Vissing-Jorgensen (2012) for two main reasons: we use our estimates of the term structure of zero-coupon yields to calculate the convenience yield at the 10 year horizon and we extend the sample back to 1860. The longer sample highlights some new patterns in the relationship between the convenience yield and the debt-to-GDP ratio. In particular, the relationship appears mostly flat (with period specific intercepts) during the National Banking Era (1865-1913), during the era of yield curve control (1942-1951), and the quantitative easing period (post 2008). In this paper, we focus on the spread between corporate bond yields and treasuries because that is a convenience yield measure that can be viewed as a proxy of the US government's long-term funding advantage and it can be extended back in time to get a sense of its variation across different regulatory eras. There exist other high-quality estimates of the convenience yield on US government debt for the modern period, e.g., see van Binsbergen, Diamond and Grotteria (2022), Nagel (2016), Koijen and Yogo (2020), however, data limitations render them less appropriate for historical studies.

In Payne and Szőke (2024) and Lehner et al. (2024) we discuss possible explanations for the historical equilibrium relationship between convenience yields and the government debt-to-GDP ratio. We argue that changes to the aggregate state of the economy (e.g. recessions, financial crises, aggregate volatility) and to government policies (e.g. financial regulation, monetary policy, and government spending) all shift or rotate the equilibrium relationship. In particular, if the government increases debt issuance in states of the world where financial regulations create captive demand for government debt, then the relationship can be high and flat, as we observe during the National Banking Era. This emphasizes that these historical relationships are policy variant outcomes of market equilibria not policy invariant demand functions.

Researchers have often interpreted the low frequency asset pricing movements in Figures 1 and 2 as motivation for narrowing macroeconomic analysis to the post-war period. However, incorporating time-varying institutional constraints into macroeconomic modeling can allow researchers to work with longer datasets and investigate macroeconomic theories that attempt to capture economic forces that are invariant to changes in institutional arrangements. Our research attempts to develop theories that explain these low frequency movements by linking monetary, financial, and fiscal policies to asset prices and aggregate shocks. In subsequent sections, we provide a framework for understanding two key periods in the US historical data: the period 1800-1933 when the US was usually on a gold standard and the period 1934-2024 when the US government gradually decoupled its currency from gold and emerged as provider of the global reserve asset.

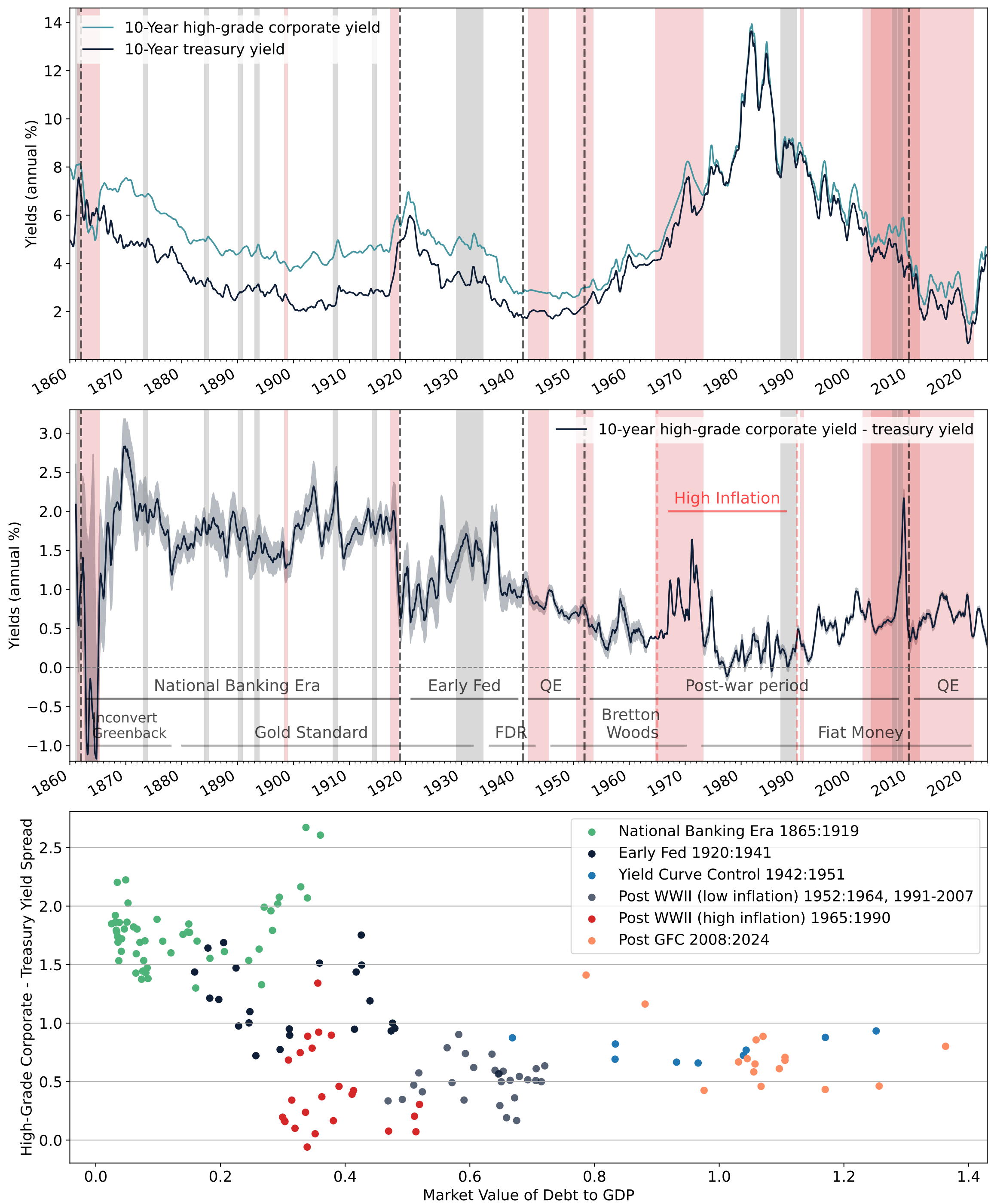

Figure 2: *Top panel:* The black line is the posterior median estimate of the 10-year nominal zero-coupon yield on US treasuries. The blue line is the posterior median estimate of the 10-year nominal zero-coupon yield on high grade corporate bonds. *Middle panel:* The black line is the posterior median estimate of the spread between the 10 year high-grade corporate and treasury yields. The shaded bands around the line is 95% posterior intervals. The gray shaded time intervals are financial crisis from Reinhart and Rogoff (2009). The red shaded time intervals are wars. *Bottom panel:* Scatter plot of the spread between the 10-year high-grade corporate and treasury yields against the market value of US debt to GDP.

3 1800-1933: Gold Standard

Until the early 20th century, the US operated on a gold and/or silver standard that established a long-run "nominal anchor" but limited the government's control of the money supply. This left the government with two main tools available for managing financing costs: temporary deviations from convertibility and restrictions on the financial sector that created captive demand. In this section, we examine how the US government used these tools. We start by summarizing relevant institutions, then construct a simple analytical framework, and finally discuss trade-offs the government faced.

3.1 Institutional Context

From April 1792 to February 1862, the US operated on a bimetallic standard in which the US dollar was defined in terms of gold and silver. The federal government minted gold and silver coins but did not issue paper notes. Instead, state legislatures chartered state banks, that issued bank notes. The outbreak of the Civil War in 1861 strained government resources and provoked a sequence of policies that increased the government's involvement in the monetary and financial system and ultimately reduced its financing costs.

Money creation and portfolio restrictions: On February 25, 1862, Congress passed a Legal Tender Act that authorized the Treasury to issue 150 million dollars of a paper currency that the government did not promise immediately to exchange for gold dollars. From 1862 to 1878 paper notes ("greenbacks" or "lawful money") traded at discounts relative to gold dollars ("gold" or "coin"). The greenback depreciated substantially during the Civil War and did not attain parity with gold until January 1, 1879, when the US Treasury started converting greenbacks into gold dollars one-for-one. In addition, between 1863-6, Congress passed four National Banking Acts, which established a system of nationally charted banks and the Office of the Comptroller of the Currency. National banks faced restrictions on the loans they could make[3] and were allowed to issue bank notes up to 90% of the minimum of par and market value of qualifying US federal bonds.[4] These national bank notes were intended to replace state bank notes as a standardized currency that could be used throughout the nation. To achieve this, Congress imposed a 10% annual tax on state bank notes, which was much higher than the 1% annual tax on national bank notes.[5]

Financial stability and the discount window: Bank runs and stock market crashes were a common feature of monetary and banking policy arrangements during the 19th century. There were country-wide bank panics in 1819, 1827, 1857, 1873, 1893, and 1907 as well as many other local bank panics in

[3]National banks could operate only one branch. They were restricted from buying mortgages unless they operated in rural areas, where they could make a limited range of loans collateralized by agricultural land.

[4]Technically, national banks could issue bank notes for circulation according to the following rules. Banks had to deposit certain classes of US Treasury bonds as collateral for note issuance. Permissible bonds were US federal registered bonds bearing coupons of 5% or more. Deposited bonds had to be at least one-third of the bank's capital (not less than $30,000). Banks could issue bank notes up to an amount of 90% of the maximum of the market value of the bonds and the par value of the bonds. The 90% value was changed to 100% in 1900.

[5]Before 1900, the banks had to pay 1.0% tax on the notes they had issued. After 1900, they had to pay a 0.5% tax.

New York and other financial hubs. In response, the Federal Reserve Act was passed in 1913 to create a Federal Reserve System (FRS) to act as a reserve money creator of last resort to prevent bank runs. The primary tool in this regard was the discount window—i.e, lending reserve money to member banks against good collateral—which initially appeared effective to fulfill its intended purpose, but then was quickly called upon to achieve other goals, namely to help finance the government's war deficit and to create a liquid market for bills.[6] This was implemented through changes to which collateral was eligible at the discount window and the relative discount rates on different securities. In the original Federal Reserve Act, government securities were not eligible collateral. Nevertheless, during World War I and World War II, the Fed accepted government bonds at "preferential discount rates". The Fed's failure to prevent bank failures during the depression prompted President Franklin D. Roosevelt to preside on reorganization of the financial sector. The 1933 Banking Act introduced deposit insurance for retail banks, established the Federal Deposit Insurance Corporation (FDIC), and separated commercial and investment banking. The 1933 Gold Reserve Act prohibited private US citizens from holding gold coins and increased the price of gold. We treat this as the end of the "true" gold standard in the United States.

3.2 Conceptual Framework

We now outline a theoretical model of the gold standard for understanding the tradeoffs the government faced between lowering their financing costs and maintaining price and financial stability. This model can be thought of a dynamic version of Diamond and Dybvig (1983) with money and a government budget constraint, drawing on Freeman (1985), Allen and Gale (2007), and Bassetto and Sargent (2020). A maturity mismatch is the heart of the model: long-term investment is necessary for growth but lenders are subject to liquidity shocks. The maturity mismatch between long-term investments and short-term liquidity needs is intermediated by the financial system through the creation of liquid "money-like" assets, an activity that exposes them to default. A government funds itself through taxation and issuing long-term nominal debt. Historically, it has used three main policies to influence its borrowing costs: (i) temporary deviations from the gold standard during crises, (ii) portfolio restrictions on the financial sector, and (iii) setting up a "discount window" to make long-term government debt more liquid. All of these policies have implications for price and financial stability.

3.2.1 Environment

Time is discrete with infinite horizon $t = 0, 1, 2, \ldots$. There is one consumption good. The economy has an exogenous stock of gold, denoted N_t at time t. The government issues money and 2-period nominal zero coupon bonds that promise to pay 1 unit of money at maturity. The economy is populated by overlapping generations of households each with mass 1.[7]

[6] Gorton and Metrick (2013) argue that the confusion of multiple objectives throughout the 1920s eroded the effectiveness of the discount window to prevent bank failures.

[7] In Payne and Szőke (2024) we use a Lucas (1990) family structure to provide more flexibility for modeling asset prices. In this article, we use an OLG model to keep the exposition simple.

Households: Each period t, a new generation of households is born. At age 0, each household is endowed with one unit of labor. With probability λ_t a household becomes an "early consumer" who gets utility $u(c_{t,1}) = \frac{1}{1-\gamma} c_{t,1}^{1-\gamma}$ from consuming $c_{t,1}$ goods at age 1 and then dies at the end of age 1. Otherwise, with probability $1 - \lambda_t$, a household becomes a "late consumer" who gets utility $u(c_{t,2}) = \frac{1}{1-\gamma} c_{t,2}^{1-\gamma}$ from $c_{t,2}$ goods and then dies at end of age 2. Here we use the notation $x_{t,a}$ to refer to variable x for the generation born at t when they are at age a. Aggregate liquidity needs are determined by an i.i.d. aggregate stochastic process. With probability ϕ the good aggregate state $s_t = s_G$ occurs and the fraction of early consumers is $\lambda_t = \lambda \in (0, 1)$. Otherwise, with probability $1 - \phi$ the bad state $s_t = s_B$ occurs and all households withdraw so $\lambda_t = 1$.

Production: The economy has a production technology that transforms k_t unit of goods at time t into $(1 - \delta^k)k_t$ units of goods in period $t + 1$ (if liquidated early) and $z k_t^{\alpha} l_{t+2}^{1-\alpha}$ units of goods in period $t+2$ if the investment is run to maturity, where $\delta^k > 0$, $z > 0$, and l_{t+2} is labor hired at time $t+2$.

Banks: Each generation, a new bank forms to manage liquidity needs. On the liability side of its balance sheet, each bank offers a deposit contract that transforms d units of money at t into d units of money if withdrawn at $t + 1$ and a proportionate share of residual resources in the bank if withdrawn at $t + 2$. If the bank becomes insolvent at time $t + 1$, it liquidates and pays out its assets. We let d_t denote total deposits in a bank. On the asset side, the bank can create capital, k_t, purchase money, m_t, and purchase government bonds, b_t.

Markets: We use goods as the numeraire. Gold and money can be traded in a competitive market at prices q_t^n and q_t^m respectively. Bonds are issued in a competitive primary market at $q_t^{b,2}$ and trade in a secondary market at price $q_t^{b,1}$; agents lose a fraction δ^b of bond value that disappears when they sell the bonds. There is no private secondary market for capital. We refer to capital and bonds as "illiquid" assets. Gold is the only asset that is traded internationally. Foreign gold demand follows a stochastic process $\{N_t^f\}_{t\geq 0}$.

Government: The government finances an exogenous spending process $\{g_t\}_{t\geq 0}$ by raising lump-sum taxes on household wages, τ_t, issuing money, M_t^g, and issuing 2-period nominal bonds, B_t^g. Money supplied by the government, M_t^g, is subject to a gold reserve requirement that the government uses to back a fraction φ of outstanding notes: $N_t^g = \varphi M_t^g$, where $\varphi \in [0, 1]$. Motivated by the historical evidence, the government imposes that banks formed at time t face the portfolio restriction:

$$\kappa d_t \leq q_t^{b,2} b_t \tag{3.1}$$

where κ is a regulatory parameter capturing a bond to deposit ratio that the bank must satisfy. A larger κ implies that a bank must hold a larger fraction of its portfolio in government debt. We start without an explicit discount window and then introduce one in the next section when we discuss the historical policies. Given these policies, the government faces the budget constraint:

$$g_t + q_t^m B_{t-2}^g + q_t^n (N_t^g - N_{t-1}^g) = \tau_t + q_t^{b,2} B_t^g + q_t^m (M_t^g - M_{t-1}^g)$$

The left-hand side of the budget constraint is the sum of government spending, repayments of outstanding maturing debt, and purchases of gold required to back the money issuance. The right-hand side is the sum of taxes and the real values of newly issued debt and money. For the special case that money consists of gold coins and (fully backed) gold certificates, i.e., $\varphi = 1$, $M_t^g = N_t^g$ and $q_t^m = q_t^n$, the government budget constraint simplifies to:

$$g_t + q_t^m B_{t-2}^g = \tau_t + q_t^{b,2} B_t^g, \tag{3.2}$$

in which case the government collects no seigniorage revenue.

3.2.2 Equilibrium

Bank's problem: In equilibrium, banks are indifferent between holding money and nominal government bonds with one-period to maturity, which implies that $q_t^{b,1} = q_t^m$. So, for convenience, we let $\hat{m}_t := m_t + b_t^1$ denote total bank holdings of money plus debt with one-period to maturity (i.e., the bank's total liquid assets). Consider a bank that forms at time t. The bank chooses an asset portfolio $(\hat{m}_t, b_t, k_t)$ in order to manage the liquidity of the household generation born at time t. Taking prices as given, the bank solves:

$$\max_{\substack{c_{t,1}, c_{t,2}, l_{t+2}, \\ \hat{m}_t, b_t, k_t}} \left\{ \mathbb{E}_t \left[\lambda_{t+1} u(c_{t,1}) + (1 - \lambda_{t+1}) u(c_{t,2}) \right] \right\} \tag{3.3}$$

subject to the regulatory constraint (3.1) and the following budget constraints. At formation time t, new banks take in the after tax wage income of the new households as deposits:

$$q_t^m \hat{m}_t + k_t - q_t^{b,2} b_t \leq w_t - \tau_t$$

If the bank can cover withdrawals at $t+1$ (which will occur in the good state of the world, when $\lambda_{t+1} = \lambda < 1$), then the bank's budget constraints become:

$$\lambda \leq \hat{m}_t$$
$$(1 - \lambda) c_{t,2} \leq z k_t^\alpha l_{t+2}^{1-\alpha} - w_{t+2} l_{t+2} + q_{t+2}^m (\hat{m}_t - \lambda)$$

where we refer to $\hat{m}_t - \lambda$ as the excess reserves held by the banking sector.[8] If the bank cannot cover withdrawals (which will occur in the bad state of the world when $\lambda_{t+1} = 1$), then it becomes insolvent and pays out its available resources to depositors who withdraw at $t+1$:

$$c_{t,1} \leq q_{t+1}^m \hat{m}_t + q_{t+1}^{b,1} (1 - \delta^b) b_t + (1 - \delta^k) k_t$$

[8]For convenience, here we have used the result that the bank always chooses $\hat{m}_t \geq \lambda$.

The bank's first order conditions (FOC) for money and bond holdings become:

$$[\hat{m}_t]: \quad q_t^m = \phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}q_{t+2}^m\right] + (1-\phi)\frac{u'(c_{t,1}(s_B))}{\mu_t^e}q_{t+1}^m(s_B)$$

$$[b_t]: \quad q_t^{b,2} = \left(\phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}q_{t+2}^m\right] + (1-\phi)\frac{u'(c_{t,1}(s_B))}{\mu_t^e}q_{t+1}^{b,1}(s_B)(1-\delta^b)\right)\left(1-\kappa\frac{\mu_t^r}{\mu_t^e}\right)^{-1}$$

$$[k_t]: \quad q_t^k = \phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}\alpha z\left(\frac{l_{t+2}}{k_t}\right)^{1-\alpha}\right] + (1-\phi)\frac{u'(c_{t,1}(s_B))}{\mu_t^e}(1-\delta^k)$$

$$[l_{t+2}] \qquad 0 = z(1-\alpha)\left(\frac{k_t}{l_{t+2}}\right)^{\alpha} - w_{t+2}$$

where $\mathbb{E}_{t+1}[\cdot]$ is the expectation conditional on $s_{t+1} = s_B$, $x_{t+1}(s_B)$ is the value of variable x at $t+1$ if s_B occurs, μ_t^r is the Lagrange multiplier on the time t regulatory constraint, μ_t^e is the Lagrange multiplier on the time t budget constraint (or initial equity raising constraint), and $\xi_{t+2} := u'(c_{t,2})/\mu_t^e$ is the bank's "stochastic discount factor". Implicitly, these FOCs characterize the bank's portfolio choice, which can be approximated:

$$\theta_t \approx \frac{1}{\gamma}\left(\Sigma + \Psi_t\right)^{-1}\left(\mathbb{E}\left[R_{t,t+2}\right] - \mathbb{E}[R_{t,t+2}^k]\right)$$

when $\mathbb{E}\left[R_{t,t+2}\right] - \mathbb{E}[R_{t,t+2}^k]$ is small; and here $\theta_t = [\theta_t^m, \theta_t^b]$ is the share of wealth that the bank invests in liquid assets and 2-period bonds respectively, $R_{t,t+2} = [q_{t+2}^m/q_t^m, q_{t+2}^m/q_t^{b,2}]$ is the return on liquid assets and 2-period bonds, R_{t+2}^k is the return on capital under an optimal labor choice, Σ is the covariance matrix, and Ψ_t is a wedge that reflects liquidity and regulatory terms.

Consider the FOC for $\hat{m}_t$. The first term $\phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}q_{t+2}^m\right]$ looks like a "standard" asset pricing equation that says that the price today is the expected payoff at maturity after weighting by the bank's stochastic discount factor. The second term $(1-\phi)\frac{u'(c_{t,1}(s_B))}{\mu_t^e}q_{t+1}^m(s_B)$ reflects the "liquidity value" of money and short-term debt for managing liquidity needs. This is often expressed as the spread between the yield on money and a yield on a synthetic illiquid asset that pays one unit of money at $t=2$:

$$\begin{aligned}\nu_t :=& -\left(\log\left(\phi(1-\lambda)\mathbb{E}_{t+1}[\xi_{t+2}q_{t+2}^m]\right) - \log(q_t^m)\right)\\ =& \log\left(1 + \frac{(1-\phi)u'(c_{t,1}(s_B))q_{t+1}^m(s_B)(1-\delta^b)/\mu_t^e}{\phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}q_{t+2}^m\right]}\right),\end{aligned}$$

which is sometimes labeled as a "liquidity spread". When the government can create assets that are more liquid than those created in the private sector, it is able to earn this spread. Our model here is just one of many ways of generating a liquidity spread. For other examples in the literature, see, e.g., Lucas (1990), Bewley (1980, 1983), and Lagos and Wright (2005).

The FOC for government debt b_t has two differences when compared to the FOC for money. The first is that government debt earns only $(1-\delta^b)$ of the liquidity value because trading it incurs transaction costs. The second is that a regulatory benefit from holding government debt is captured by the $\left(1-\kappa^b\mu_t^r/\mu_t^e\right)^{-1}$ term.[9] Evidently, an increase in the regulatory constraint $\mu_t^r\kappa$ forces the financial sector to allocate a greater share of its wealth into government debt, which increases the price of government debt. The FOC for government debt is also often re-expressed as the spread between a yield on a nominal bond that doesn't carry liquidity or regulatory benefits and the yield on government debt:

$$\begin{aligned}\chi_t :=& -\left(\log\left(\phi(1-\lambda)\mathbb{E}_{t+1}[\xi_{t+2}q^m_{t+2}]\right)-\log(q_t^{b,2})\right)\\ =& \log\left(\frac{1}{1-\kappa\mu_t^r/\mu_t^e}\right)+\log\left(1+\frac{(1-\phi)u'(c_{t,1}(s_B))q^{b,1}_{t+1}(1-\delta^b)/\mu_t^e}{\phi(1-\lambda)\mathbb{E}_{t+1}\left[\xi_{t+2}q^m_{t+2}\right]}\right)\end{aligned}$$

This spread is sometimes referred to as the "convenience yield", the "inflation risk adjusted convenience yield", or the "regulatory and liquidity spread". Ultimately, this spread reflects how much lower the yield on government debt is when compared to an illiquid asset with the same risk profile. As is true the liquidity premium, there are many ways of modeling the convenience yield and financing frictions (e.g. see Krishnamurthy and Vissing-Jorgensen (2012), Reis (2021a), Kekre and Lenel (2024), Choi, Kirpalani and Perez (2024b), Cieslak, Li and Pflueger (2024) and Di Tella, Hébert and Kurlat (2024), Gertler and Kiyotaki (2010), Brunnermeier and Sannikov (2014)). For simplicity, we have focused on modeling banks rather than the entire financial sector, but pension and insurance companies currently face restrictions that encourage them to hold government and corporate debts (e.g. Koijen and Yogo (2023)).

The FOCs indicate that in the good state of the world a fraction λ of households request deposits so the bank can cover withdrawal needs provided that they have $\hat{m}_t \geq \lambda$. However, in the bad state, all depositors withdraw and the bank is forced to liquidate its asset position. The more excess reserves they hold, the lower the withdrawal risk that they face but so is the return on their overall portfolio. Thus, the economy confronts a trade-off between financial stability and economic growth. Evidently, regulatory constraints and liquidity frictions distort a bank's portfolio decisions. A higher κ and a lower δ^b increase demand for government bonds because they increase how much they help manage regulatory and liquidity needs.

Equilibrium: Given government policies for $(B_t^g, M_t^g, \varphi, \tau_t, \kappa)$, a competitive equilibrium is a collection of prices $(q_t^m, q_t^n, q_t^{b,2}, w_t)$ and allocations $(c_{t,1}, c_{t,2})$ such that (i) banks solve problem (3.3), (ii) the government budget constraint (3.2) holds, and (iii) the money, gold, government bond, and labor markets clear[10]:

$$\theta_t^m w_t = q_t^m \mathcal{M}_t, \qquad N_t^g + N_t^f = N_t, \qquad \theta_t^b w_t = B^g_{t,2}, \qquad L_t = 1,$$

where $\mathcal{M}_t := \min\{\lambda_t, \hat{m}_{t-1}\} + (\hat{m}_{t-2} - \min\{\lambda_{t-1}, \hat{m}_{t-2}\}) + (M_t^g - M_{t-1}^g)$ is the total money and short-term nominal debt supplied to the market at time t net of money and short-term debt held

[9] In many periods of US history, money holdings have also been part of the regulatory constraint, in which case the FOC for money holdings would also have this term. We abstract from this here for simplicity.

[10] In this definition, we have imposed that $q_t^{b,1} = q_t^m$ and are using Walras's Law to eliminate the goods market clearing condition.

within the financial sector. The first term in $\mathcal{M}_t$ is total money withdrawn from generation $t-1$ banks at time t, the second term is total money withdrawn from generation $t-2$ banks at time t, and the final term is new money created by the government.

3.2.3 Equilibrium Relationships

Long-run price anchor: a gold standard leads to long-run price level stability because the long-run supply of gold is not controlled by the government. The money market clearing condition shows that, the gold standard, if no liquidity shocks occur and the government is not raising taxes to purchase gold, then $\mathcal{M}_t$ converges to a constant $\overline{\mathcal{M}}$. Likewise, (θ_t^m, w_t) converge to constants ($\bar{\theta}$, $\bar{w}$) and so the long-run price level converges to

$$\bar{q}^m = \frac{\bar{\theta}\bar{w}}{\overline{\mathcal{M}}}.$$

This is reflected by the third panel in Figure 1. Throughout the 19th century, the price level seemed anchored, with the long-run mean of inflation always staying close to zero, particularly when compared to the post World War II period.

Nevertheless, Figure 1 also highlights at least two qualifications about price stability under the gold standard. First, a constant long-run price level is not necessarily associated with short-term price stability. Under the gold standard, a government adjusts the money supply in response to shocks by adjusting its gold reserve holdings. Notice that inflation volatility before 1933 manifested as temporary deviations from long-term mean inflation that were much larger than those observed during the post World War II period. Second, under the gold standard, there is guarantee that the supply of gold will grow at the same rate as the economy's production capacity. Figure 1 indicates the period 1870-1890 saw long-run deflation indicated that increases in productivity brought by the Industrial Revolution were not accompanied by appropriate increases in the money supply. Major gold discoveries during the 1890s probably accompanied the increase in trend inflation after 1900.

Inflation and financial stability. In our framework, the inflation process determines costs of holding excess reserves and so financial stability. Because the two nominal assets—reserves and government debt—are exposed to price level risk, persistent shocks to inflation (e.g, a fall in foreign money demand) can lead to a portfolio reallocation toward capital, while a persistent deflation shock can lead to hoarding of nominal assets. Such a relationship between the inflation process and private sector capital investment was emphasized by Mundell (1963), Tobin (1963), and Gertler and Grinols (1982) and possibly contributed to the procyclical relationship between inflation and output growth observed during the gold standard era in the bottom panel of Figure 1. Whether the bank's asset holdings are tilted toward short-term reserves or long-term government debt hinges on the volatility and persistence of the price level shocks. Long-term price level stability helps to anchor the demand for long-term nominal debt (through q_{t+2}^m in the bond FOC), but short-term price instability discourages reserve holdings and leads to lower average reserves and more severe financial crises.

3.3 Gold Standard Policy Options and Constraints

A gold standard commits the government to long-run price stability by limiting its ability to adjust the money supply. In this section, we explore how this restricts the government's choice set and induces trade-offs between fiscal and financial policies.

1. Emergency financing through temporary deviations from the gold standard. In practice, the gold standard did not involve completely rigid convertibility. In fact, countries made temporary deviations from the gold standard during times of emergency while maintaining a commitment to a long-term price (a so-called "long-run" nominal price anchor).[11] Formally, consider a government that, at time t, suspends convertibility, prints $M_t^g - M_{t-1}^g$ without increasing gold reserves (i.e. by decreasing the degree of backing φ) and then restores convertibility T periods later. Then the time t budget constraint is:

$$g_t + q_t^m B_{t-2,0} = \tau_t + q_t^b B_{t,2} + q_t^m (M_t^g - M_{t-1}^g)$$

So, the suspension of convertibility temporarily provides seigniorage resources to the government. During this time, it is possible that the price of money, q_t^m, deviates from the price of gold, q_t^n, because the government is no longer promising convertibility. At time T (or before), the government must purchase gold at price q_t^n in order to back the additional money that has been created (or buy back the outstanding money). So, their time $t + T$ budget constraint is:

$$g_{t+T} + q_{t+T}^m B_{t+T-2}^g + q_{t+T}^n (M_{t+T}^g - M_{t+T-1}^g) = \tau_{t+T} + q_{t+T}^b B_{t+T}^g$$

This means that temporary deviations from the gold standard create (i) a future tax burden and (ii) potentially create expected future appreciation of the money when convertibility is restored.

Issues of non-convertible greenbacks during the Civil War offers a particularly interesting case study for understanding the effectiveness of temporary deviations as a "policy tool". During the Civil War, with Congress authorizing the issue of non-convertible paper currency, greenbacks depreciated to approximately one third of their initial value. In Payne et al. (2025), we use the relative prices of greenback and gold denominated government bonds to infer how investors' expectations about the greenback-dollar exchange rate evolved during and after the Civil War. We find that throughout the greenback era investors anticipated that greenback dollars would eventually exchange for gold dollars one-for-one (long-run expectations remained "well anchored"). This was true even during the large drops in the value of the greenback that occurred in 1863 and 1864 in response to bad news from the war front. Ultimately, this meant that investors anticipated an appreciation of the greenback notes during the war and so were willing to accept low yields on greenback denominated bonds during the war. This provided the government a low yield source of financing during the war, as discussed by Friedman and Schwartz (1963) and Roll (1972). However, it also implied a high tax burden after the war.

[11] The view that the gold standard can be considered as a commitment device that facilitates emergency financing through *termporary* suspensions was entertained by Bordo and Kydland (1995), Thompson (1997), Glasner (1989) and Hendrickson (2024).

2. Financial repression to reduce borrowing costs. The National Banking Era offers a stark example of how portfolio constraints on the financial sector can be used to lower the cost government financing. In the language of our model, the National Banking Era restriction can be expressed as:

$$\kappa x_t^b \le \min\left\{b_t, (q_t^{b,2}/q_t^m)b_t\right\}$$

where x_t is National Bank Note issuance, b_t is bank holdings of long-term government bonds, and $\kappa = 0.9$. The redemption of National Bank Notes created a captive market for purchasing government debt. This is reflected in Figure 2, where during the National Banking Era our proxy for convenience yield is highest and least responsive to the Debt-to-GDP ratio. In Payne et al. (2025), we also show that the National Banking Era is the only period where there is no premium on short-term government debt relative to long-term debt.

Following Shaw (1973) and McKinnon (1973), a large literature has argued that financial repression is an important tool that both emerging and advanced economy governments use to reduce borrowing costs (e.g. Allen (2014), Acharya and Steffen (2015), Bai, Li, Qian and Wang (2001), Chari, Dovis and Kehoe (2020), De Marco and Macchiavelli (2016), Horvath, Huizinga and Ioannidou (2015), Ongena, Popov and Van Horen (2019), Reinhart and Sbrancia (2015), Reis (2021b), and others). Reinhart and Sbrancia (2015) summarizes many ways that financial repression has been introduced around the world including interest rate caps, forced "home-bias" in bond holdings, reserve requirements, prudential policy that sets portfolio restrictions, government ownership of financial services, and restrictions on entry into the financial sector. They refer to the overall tax from financial repression and inflation as the "liquidation" of government debt. Chari et al. (2020) show that, when a government lacks commitment, financial repression is a helpful tool because it disincentivizes ex-post government default.

A major cost of financial repression is the distortion of financial sector portfolios. In our illustrative model, like Chari et al. (2020) and other papers, this shows up as a decrease in capital investment because banks need to hold a larger share of wealth in government bonds. Reis (2021b) studies the fiscal implications of macro-prudential policies that increase increase demand for government bonds. Payne and Szőke (2024) shows that financial repression can cause financial instability and is effective in generating a convenience yield only if the government runs a fiscal policy that avoids real devaluations of government debt.

3. Stabilizing the financial sector through the discount window has direct fiscal implications. Our environment has financial instability because age-1 banks have insufficient money to be able to meet withdrawals during periods with high aggregate liquidity needs ($\lambda_t = 1$). In principle, the government could resolve this problem by setting up a discount window where banks can exchange bonds for money at real price $\tilde{q}_t^b$. Given these policies, the government faces the budget constraint:

$$g_t + q_t^m(B_{t-2}^g - \tilde{b}_{t-1}) + \tilde{q}_t^b \tilde{b}_t + q_t^n(N_t^g - N_{t-1}^g) = \tau_t + q_t^{b,2} B_t^g + q_t^m(M_t^g - M_{t-1}^g)$$

where $\tilde{b}_t$ is the number of bonds that the banks sell at the discount window at time t. The left-hand-side of the budget constraint is now government spending, plus the repayment of outstanding maturing debt, plus the repurchase of (non-maturing) government debt in the discount window, plus the purchase of gold. If the government bonds are accepted at the discount window and the discount window price is sufficiently low, then the government budget constraint shows this is profitable for the government because they are essentially retiring their debt at a discount while increasing the "liquidity" spread on government bond issuance. However, under the gold standard, the government needs to have sufficient gold to be able to repurchase the government bonds. It can do so by holding excess gold reserves for use during financial crises, borrowing during the financial crisis to raise gold, or suspending convertibility and issuing "unbacked" money. The first two options incur fiscal costs while the last option leads to short-term price instability and potentially the loss of long-run credibility.

At the end of World War I, the US held approximately 40% of the world's gold reserves and so was well placed to be able to act as lender of last resort at a relatively low cost while maintaining the gold standard. In fact, many researchers (and contemporary observers) have argued that the existence of the Fed's discount window prevented a banking crisis in 1920. See, e.g., Willis (1923), Board of Governors of the Federal Reserve System (1922), Gorton (1988), and Gorton and Metrick (2013).

4 US Debt: 1934-2024: International Dollar Dominance and the End of Gold Backing

The first half of the 20th century brought large changes to the US financial and monetary systems. Internationally, the US dollar emerged as the "global" currency and US dollar dominated debt emerged as the global reserve asset. Domestically, the US gradually removed gold backing of the currency, which opened up the choice set for the government but also brought new challenges. In this section, we examine how the US learnt the privileges and limitations that accompanied their new role in the international financial system.

4.1 Institutional Context

World War II financing and treasury-Fed coordination: Concerns about financing World War II led to the government "fixing" the yield curve from 1942-1951, with the T-Bill rate set to 3/8% and the long-term bond yield capped at 2.5% (see Garbade (2020) and Rose (2021)). this was implemented through coordination between the Treasury and the Federal Reserve, with the Fed agreeing to absorb excess bond supply at the fixed price, and implicit coordination with the banking system, which ended up predominately holding government debt. This coordination ended in 1951 with a Treasury-Fed Accord that established official Fed independence from the Treasury.

Bretton Woods and international dollar dominance: The interwar period was marked by competitive currency devaluations and the complications of the Great Depression. In response, the 1944

Bretton Woods Agreement set up an international system of fixed exchange rates to the US dollar, convertibility of the US dollar to gold, and international capital controls. In the following decades, the US dollar emerged as global currency and US dollar denominated debt became a key reserve asset for the global financial system. The Bretton Woods system lasted until 1971 when the US converting dollars to gold.

Business cycle management and fiat money: Throughout the postwar period, the Fed moved towards a system of nominal interest rate targeting that attempted to balance maintaining low inflation with reducing the output gap. In practice, this involved the Fed intervening in the money market in order to "set" the cash rate. The unwinding of the Bretton Woods gold reserve system and the floating of the US dollar in 1973 gave the US government much greater freedom to set independent monetary policy than it had enjoyed historically.

The financial crisis and quantitative easing: The 2007-9 financial crisis spurred another set of major reforms. The Fed embarked on an extensive program of quantitative easing to purchase mortgage backed securities and long-term treasuries with the intention of bringing down long-term treasury rates, reminiscent of the yield curve control period 1942-1951. Policy makers enacted extensive new regulation on the banking sector through the Dodd-Frank Wall Street Reform and the Consumer Protection Act. In addition, the Basel-III regulation introduced portfolio restrictions. Ultimately, the regulations encouraged banks to hold assets with low "risk-weights" such as US treasuries.

4.2 Conceptual Framework

In order to relate more directly to the literature, we generalize the framework from Section 4.2 and abstract from a particular model of liquidity premia and convenience yields. Following Sargent and Wallace (1981), Bassetto and Sargent (2020), Cochrane (2023), and Jiang, Lustig, Nieuwerburgh and Xiaolan (2024), iterating the government budget constraint and imposing the asset pricing equations leads to the following expression for the market value of government liabilities:

$$\mathcal{D}_t + q_t^m M_t = \mathbb{E}_t\left[\sum_{j=0}^{\infty} \tilde{\xi}_{t,t+j}\Big((\tau_{t+j} - g_{t+j}) + \omega_{t+j}^{\chi} + \omega_{t+j}^{\nu}\Big)\right] + \lim_{j\to\infty} \mathbb{E}_t[\tilde{\xi}_{t+j}\mathcal{D}_{t+j}] \tag{4.1}$$

where $\mathcal{D}_t = \sum_{h=0}^{2} q_t^{b,h} B_t^h$ denotes the market value of all government debt at t, $q_t^{b,h}$ is the price of a government bond maturing in h periods, B_t^h is the quantity of bonds outstanding that mature in h periods, $\tilde{\xi}_{t,t+j}$ is the appropriate stochastic discount factor from t to $t+j$, $\tau_{t+j} - g_{t+j}$ is the government surplus at time $t+j$, ω_{t+j}^{χ} is contribution from the convenience yield, ω_{t+j}^{π} is the contribution from seigniorage revenue at $t+j$, and $\lim_{j\to\infty} \mathbb{E}_t[\xi_{t+j}\mathcal{D}_{t+j}]$ is the limiting "bubble" term that equals zero if a no-bubble condition holds. The present value of future surpluses is sometimes referred to as "fiscal backing" of government debt while the other terms capture the funding advantage of the government compared to a private sector that is unable to create assets that have convenience yields, liquidity premia, or bubbles.

Fiscal backing: Equation (4.1) emphasises that the market value of government liabilities is intimately related to fiscal policy. As has been much discussed in the literature, this has significant implications for how the price level and inflation are determined and places important restrictions on monetary-fiscal policy interactions. This includes (but is not limited to) Sargent and Wallace (1981) and Bassetto and Sargent (2020) and the "fiscal theory of the price level" literature, e.g., Leeper (1991), Sims (1994), Woodford (1995), Bassetto (2002), Cochrane (2023), Bianchi, Faccini and Melosi (2023) and many others. For our purposes here, there are two important differences between equation (4.1) and the gold standard era budget constraints. The first is that the government has an additional source of financing through seigniorage revenue. The second is that the value of government debt and money are now jointly backed by the present discounted value of surpluses and the other terms on the right hand side of (4.1). This is in contrast to the fully backed gold standard ($\varphi = 1$) where the government has no access to seigniorage revenue and the value of money is related to gold holdings.

Exorbitant privilege: In our model in Section 3.2, the convenience yield was determined by the restrictions on the domestic financial system. The emergence of US dollars as the international currency and US treasuries as the global reserve asset offer additional sources of a convenience yield or "bubble" component in the debt price. The changing international role of US dollar debt is one of the potential explanations for the profound change in the US government's ability to finance deficits during the 20th century. Panel 2 of Figure 1 indicates that all of the big deficits during the 19th century were accompanied by large increases in the real rate while during the 20th century, this typically reversed. This is consistent with US debt playing the role of a global safe asset that agents want to hold in bad times.

The presence of exorbitant privilege has been much discussed in the literature, both theoretically and empirically. Many researchers have developed theories of safe asset determination (see e.g. Gourinchas and Rey (2007), Maggiori (2017), Gourinchas and Rey (2022), He, Krishnamurthy and Milbradt (2019), Farhi and Maggiori (2018), Brunnermeier, Merkel and Sannikov (2024)) and macroeconomic models that study the global implications of the special role of US debt (Engel and Wu (2022), Valchev (2020), Jiang, Krishnamurthy and Lustig (2023), Kekre and Lenel (2024), Choi, Dang, Kirpalani and Perez (2024a)). From a historical perspective, Chen, Jiang, Lustig, Van Nieuwerburgh and Xiaolan (Forthcoming) argue that in different periods, there have been different countries that have been able to issue government bonds at a "premium": Holland in the 17th and 18th centuries, Great Britain in the 18th and 19th centuries, and the US after World War II.

4.3 Policy Tradeoffs

The end of the gold standard in 1933 and the end the Bretton Woods gold backing system in 1971 ultimately relaxed a key constraint from the previous section: the restriction on printing money. This in turn relaxed related and much studied constraints on the government. One of the constraints is the international finance trilemma that say a government cannot simultaneously run a fixed exchange rate system, have no capital constraints, and run independent monetary policy. By ending Bretton Woods and ultimately floating the US dollar in 1973, the US government could relax capital controls and run more independent interest rate policies. Here, we discuss two trade-offs related to how these changes impacted government financing costs

1. Flexibility vs commitment. Even under the gold standard, governments could, and did, temporarily suspend gold convertibility in order to respond to emergencies such as wars or severe financial crisis. However, the implicit requirement under a gold standard was that soon after the emergency had ended the government would incur the fiscal burden of re-backing the currency to reinstate convertibility. This meant that suspension could not ordinarily be used for business cycle management. Departing from the gold standard relaxed this constraint. At a business cycle frequency, the government became able to create money to engage in open market operations to achieve the target cash rate. Without a commitment to re-back the currency, the government could run sustained trend inflation to collect seigniorage revenue and, if inflation were unanticipated at debt issuance, devalue the debt. Such debt devaluation is similar to a suspension under the gold standard that is reinstated at a lower conversion rate to gold. Of course, under rational expectations, unanticipated devaluation cannot be undertaken as a systematic policy in the same way that suspension and currency re-pegging could not be undertaken as a systematic policy during the gold standard. None-the-less, giving the government the flexibility to create money leads to inflation bias (e.g. Kydland and Prescott (1977), Barro and Gordon (1983), Rogoff (1985), and many others).

These forces unfold in the third panel of Figure 1. For most of the gold standard period, the long-term mean of the inflation process was approximately zero. In the early 20th century and the Bretton Woods era, the long-run inflation mean became positive but remained very stable at approximately 1.5%. Then, throughout the 1970s and 1980s the long-run mean became large and volatile, which is sometimes interpreted as the US losing the "nominal inflation anchor", both in terms of the average level of inflation but also in terms of the volatility of the long-run mean of the inflation process. It was not until the 1990s that trend inflation came back to 2%. This has been interpreted as the government re-establishing a "nominal inflation anchor" through renewed commitment to an inflation target even it the target resulted in business cycle and fiscal costs. Our observations are consistent with the recent work of Hazell, Herreño, Nakamura and Steinsson (2022), which argues that changes to the nominal inflation anchor and resulting shifts in the Philips curve are important for explaining inflation during the 1970s. A number of authors have decomposed the reduction in government debt following World War II and show that at times inflation and low nominal returns played an important, although not solitary, role in bringing down the debt-to-GDP ratio (e.g. Hall and Sargent (2011) and Acalin and Ball (2023)).

2. Fiscal policy and the government funding advantage: Equation (4.1) emphasises that the market value of government liabilities is intimately related to the government surplus process. What is less clear from the equation is how the functional forms for convenience yields, seigniorage revenue, and any asset pricing bubbles are related to fiscal policy. This may make it seem like the government's "funding advantage" is policy invariant and so can be easily "exploited" as a source of financing. However, there are many reasons to believe that these terms are connected to the regulatory system designed by the government and the likelihood that government monetary-fiscal policy leads to real devaluation of the debt. For example, in Payne and Szőke (2024), we extend the model in Section 3.2 to characterize how repression can generate a convenience yield on government debt both directly through forced portfolio choice and also indirectly by changing the price process for government debt and endogenously making it the "safe-asset" for the financial sector.[12] This makes the convenience yield policy variant and fragile. "Irresponsible" fiscal policy that leads to government debt devaluations prevents government debt from effectively playing the safe asset role and ultimately erodes the convenience yield.

The second panel of Figure 2 illustrates these connections. During the 1970s, the US experienced high and volatile long-run mean inflation that coincided with a real devaluation of government debt and a reduction of the convenience yield to zero. Jiang, Lustig, Van Nieuwerburgh and Xiaolan (2020) find additional support for this observation by looking at the Eurozone. They find that countries facing fiscal crises and high CDS spreads (e.g. Ireland, Portugal, Spain, and Italy) experienced much larger decreases in risk-adjusted convenience yields than countries with stronger fiscal positions (e.g. Germany, Netherlands, Finland, and France).

5 Conclusion

Since 1790, the US monetary, financial, and fiscal systems have undergone transformations that have altered government funding costs. This journey is sometimes presented as a narrative of progress. However, the stories and evidence discussed in this review article suggest that this is not entirely true. Instead, we prefer to view the institutional changes as responses to shifting government priorities about how to balance long-run price stability, financial sector stability, and maintaining a government funding advantage.

Although our review article focuses on historical examples, we believe that our analysis suggests new research directions for economists studying recent monetary-fiscal interventions and the impact of increasing debt-to-GDP ratios. Through the lens of this paper, the 2007-9 financial crisis and the 2020 COVID crisis reflect different government responses to financing constraints and policy trade-offs. During the financial crisis, the government increased money and debt issuance while also introducing new regulations (e.g. interest on reserves, liquidity coverage ratios, Dodd-Frank Act) that increased financial sector demand for government liabilities. Consequently, the government could increase the debt-to-GDP ratio while maintaining a high convenience yield and low inflation. However, this came at the cost of low private sector investment and a slow recovery. By contrast, during the COVID crisis, the government increased the debt-to-GDP ratio without increasing pressure on the financial sector to hold its liabilities. The result was a fast recovery but also high inflation. These episodes underline how integrating government fiscal constraints into macro-finance modeling clarifies the choice set of the government. Rising debt service costs and political tensions

[12] Linking the convenience yield on US treasuries to their hedging properties complements the empirical work of Acharya and Laarits (2023).

may well bring future crises that make these government trade-offs even more acute. Studying these issues is beyond the scope of this review but we hope we have offered thought-provoking directions for future research.

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