Historical US Funding Cost Advantage: 1860-2024*

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Abstract

We estimate a historical funding cost advantage of the US government, as measured by the spread between yields on high-grade corporate bonds and treasuries. We construct a new dataset with monthly price, cash-flow, and rating information for US corporate bonds over the period 1860-2024. We deploy a Dynamic Nelson-Siegel model to estimate US high-grade corporate and treasury yield curves making adjustments for tax treatment and other features. A high-grade corporate to treasury spread emerged well before Bretton Woods with the introduction of the 1862-65 National Banking Acts. In the 20th century, there are low frequency movements in average spreads that coincide with large changes to financial sector regulation. Inflation risk eroded the funding cost advantage on nominal government debt in the 1970s.

JEL classification: E31, E43, G12, N21, N41

Key words: Corporate Yields, Convenience Yields, Government Debt Capacity, Hamiltonian Monte Carlo.

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1 Introduction

Many researchers have argued that the US government enjoys a funding advantage because it can issue bonds at lower interest rates than the private sector, even when the private sector bonds have the same risk profile, maturity, and tax treatment. In macroeconomic modeling this allows the government to issue debt that is not necessarily backed by future fiscal surpluses (a "seigniorage" of "convenience" benefit source of financing). The magnitude of the government's funding cost advantage is often measured by the spread between yields on high-grade US corporate bonds and the yields on US treasuries (e.g. Krishnamurthy and Vissing-Jorgensen (2012)). In this paper, we revisit and expand the historical evidence on US high-grade corporate to treasury spreads. This involves the compilation of new bond datasets, the estimation of corporate and government yield curves for the period 1860-2024, and corrections to make corporate and government debt comparable (e.g. adjustments for taxes and callability). In doing so, we uncover the statistical properties of US funding advantage and show how it has evolved with major changes in monetary, financial, and fiscal policies.

We construct yield curves for corporate and government bonds that promise consistent pecuniary payouts. This involves constructing a new micro-level dataset with historical bond price, coupon, and maturity information from 1860-2024 to match existing datasets for Treasuries. To ensure we can compare across maturities, we estimate zero coupon yield curves by deploying the techniques from Payne et al. (2025), which fits a dynamic Nelson and Siegel (1987) parametric interpolation model of the yield curve with stochastic volatility and bond specific measurement errors. To ensure we can compare bonds with similar default risk, we limit our corporate bond estimate to Aaa-rated bonds. For the nineteenth century, we construct a synthetic Aaa classification using Macaulay (1938) and error clustering. For the twentieth century, we construct a new ratings database by transcribing Moody's manuals. To ensure our yield curve reflect claims to payouts with the same tax treatment, we exclude tax-advantaged bonds or, where possible, make corrections for tax concessions. In particular, we exclude the so called government "flower-bonds" that traded between 1921-1985 and offered tax concessions that effectively offset inflation risk. After making these adjustments, we compute the spread between Aaa-rated corporate and treasury yield curves. This offers a "like-for-like" comparison between government and corporate yields at all maturities that captures the funding advantage of the US government.

We infer a collection of stylized facts about relative government debt prices and funding cost spreads. First, we identify low frequency movements in average convenience spreads that coincide with large changes to financial sector regulation and the Federal Reserve's large scale bond purchase programs. The funding cost spread on US Treasuries emerged well before Bretton Woods and global dollar dominance with the introduction of the 1862-65 National Banking Acts. It generally stayed high during the gold standard but then dropped sharply after World War I and followed a trend decline after the Great Depression. Quantitative easing during World War II led to an increase in the funding cost spread at the short maturities while quantitative easing after the 2007-09 financial crisis led to an increase at long maturities.

Second, we find that heightened inflation risk during the Great Inflation in the 1970s coincided with an erosion of the funding cost spread on nominal government debt. This is in contrast to conclusions drawn from the series commonly used in the in data (e.g. the spread between the long-term treasury yield and Aaa corporate yield indices used by Krishnamurthy and Vissing-Jorgensen (2012), Cieslak et al. (2024) and other papers), which document the Aaa Corporate-Treasury spread reaching its highest level during the Great Inflation. The reason for the discrepancy is that the commonly used indices do not take into account the differential tax treatments of a certain subclass of government bonds, the so called "flower bonds". Holders of flower bonds could use the par value of their debt to off-set estate taxes, which meant that the bonds acted as a good inflation hedge. As a result, flower bonds traded like "real-bonds" and saw low yields during the Great Inflation in the 1970-80s. We conclude that a large portion of the 1970's variation in existing AAA Corporate-Treasury series is attributable to the (negative) inflation risk premia on flower bonds instead of a heightened funding advantage on regular US Treasuries.

Related literature: The empirical section extends existing studies on the convenience yield (e.g. Krishnamurthy and Vissing-Jorgensen (2012), Choi et al. (2022), Cieslak et al. (2024)) back to the mid nineteenth century. This makes us part of a literature attempting to connect historical time series for asset prices to government financing costs (e.g. Payne et al. (2025), Jiang et al. (2022a), Chen et al. (2022), Jiang et al. (2022b), Jiang et al. (2021b), Jiang et al. (2021a), Jiang et al. (2020)).

Technically, our work is related to Svensson (1995), Dahlquist and Svensson (1996), Cecchetti (1988), Annaert et al. (2013), Andreasen et al. (2019), Diebold and Li (2006), Diebold et al. (2006) and Diebold et al. (2008) who, like Gürkaynak et al. (2007) and ourselves, implement versions of the parametric yield curve model of Nelson and Siegel (1987). A "Dynamic Nelson-Siegel Approach", studied in detail in Diebold and Rudebusch (2013), makes assumptions on the yield curve parameters' time-variation in order to improve the model's forecasting ability. We make assumptions about yield curve parameters' time-variations in order to pool information across time periods.

The paper is structured as follows. Section 2 explains our conceptual framework. Section 3 discusses our dataset and provides some historical context on the evolution of US bond markets. Section 4 briefly summarizes our statistical methodology. Section 5 presents our estimate of the high-grade corporate yield curve and the term structure of AAA Corporate-Treasury spreads. Section 6 concludes.

2 Conceptual Framework

In this section, we introduce the notion of a government funding cost advantage using a stylized model. Consider a discrete time, infinite horizon economy with time indexed by $t \in \{0, 1, \ldots\}$. The economy contains a representative private sector investor and a government. The government and the investor both issue bonds that pay a fraction ω of the remaining outstanding balance each period. Neither bond is subject to default risk. The bonds trade in a competitive market at prices q_t^b and q_t^h respectively. The private sector bonds are in zero net supply whereas the government bonds are in positive net supply b_t.

The representative investor receives a non-pecuniary benefit from holding government debt, which means that the government can sell its debt at a higher price than the private sector, $q_t^b > q_t^h$, even though the bonds promise the same cash flow stream. Following the literature, we characterize this funding advantage by imposing investor Euler equations:

$$q_t^b = \mathbb{E}\Big[\xi_{t,t+1}\Omega_{t,t+1}\Big(\omega + (1-\omega)q_{t+1}^b\Big)\Big], \qquad q_t^h = \mathbb{E}\Big[\xi_{t,t+1}\Big(\omega + (1-\omega)q_{t+1}^h\Big)\Big]$$

where $\xi_{t,t+1}$ is the investor's stochastic discount factor and $\Omega_{t,t+1}$ is a government debt specific wedge capturing the non-pecuniary benefit of government debt. The government's funding advantage is given by the corporate-government bond spread:

$$\chi_t := \log(q_t^b) - \log(q_t^h).$$

Each period t, the government raises taxes τ_t, spends g_t, and issues long-term debt b_t. The period t government budget constraint is given by:

$$\omega b_{t-1} + g_t = \tau_t + q_t^b \left(b_t - (1-\omega)b_{t-1}\right).$$

Iterating the budget constraint forward gives the lifetime budget constraint:

$$\Big(\omega + (1-\omega)q_t^b\Big)b_{t-1} = \mathbb{E}_t\left[\sum_{s=0}^{\infty} \xi_{t,t+s}\left(\left(\frac{\tau_{t+s} - g_{t+s}}{y_{t+s}}\right) + \left(\frac{q_{t+s}^b - q_{t+s}^h}{y_{t+s}}\right)b_{t+s}\right)y_{t+s}\right]$$

This equation implies that the value of outstanding debt, $(\omega + (1-\omega)q_t^b)b_{t-1}$, is the present discounted value of future surpluses, $\{\tau_{t+s} - g_{t+s}\}_{s\geq 0}$, and the present discounted value of the "seigniorage" revenue the government earns from being able to issue debt more cheaply than the private sector, $\{(q_{t+s}^b - q_{t+s}^h)b_{t+s}\}_{s\geq 0}$. Following Sargent and Wallace (1981), we can express the seigniorage revenue as:

$$(q_t^b - q_t^h)b_t = q_t^b b_t(1 - \exp(-\chi_t))$$

which can be interpreted as the market value of government debt $q_t^b b_t$ multiplied by the implicit "tax" from the government's funding advantage $1 - \exp(-\chi_t)$.

This paper attempts to provide an empirical counterpart for the high-grade corporate to treasury yield spread, χ_t, that can be used to inform macroeconomic modeling. This means that we need to measure the spread between high-grade corporate and treasury bonds that have the same payout risk, maturity, and tax-treatment. As discussed in the subsequent sections, this requires both original data collection and statistical work.

3 Data and Historical Context

3.1 Context

To help interpret the historical data, we outline some key historical features of bond markets and government policy that present challenges for measuring the funding advantage of the US government.

Market structure

The US corporate bond market traces its origins to the early 19th century, driven by the need to finance large infrastructure projects. The first corporate bonds were issued by banks and canal companies, but the market truly expanded with the rise of the railroad industry in the 1830s and 1840s. Railroads needed large capital investments, that far exceeded the lending capacity of the localized and fragmented banking sector at the time, leading them to issue bonds to investors. As Sylla et al. (2006) notes, this created what is considered the world's first corporate bond market. By the late 19th and early 20th centuries, the market matured, with securities becoming more standardized and industrial corporations and utilities also issuing bonds.

Concurrently, the federal government initially issued bonds infrequently, as Congress was responsible for debt management, leading to long-maturity issuances with significant variations in coupon rates, denominations, maturities, units of account, tax exemptions, and call features. The expansion and standardization of federal debt issuance occurred gradually over time, with Congress delegating more autonomy in designing and issuing securities to the Treasury Department between 1917 and 1939. Both markets continued to expand throughout the 20th century and by the mid-20th century, US Treasury securities had become the world's largest and most liquid debt market, with a standardized set of securities at various maturities. Treasuries dominated in scale but both corporate and Treasury bonds traded actively on major exchanges like the New York Stock Exchange (NYSE) and were held by similar investors, including banks, insurers, and wealthy individuals. Both corporate and government bonds shared similar features, such as fixed coupon payments and typically long maturities and exhibited relatively high liquidity compared to other asset classes. On the corporate side, railroad bonds declined in importance as industrials and utilities became the dominant issuers in the 20th century, increasingly offering high-grade bonds.

Denomination

The denomination of both Treasury and corporate bonds has evolved similarly throughout American financial history. From 1800 to 1933, the US adhered to a gold standard except from 1861 to 1878 when it temporarily suspended gold convertibility and issued a paper currency known as "greenbacks". During this period, both federal and corporate bonds were typically denominated in gold (or greenbacks during the suspension). Following the Gold Reserve Act of 1933, which prohibited private US citizens from holding gold coins, both markets transitioned to nominal dollar denomination. The Bretton Woods Agreement (1944-1971) reintroduced a type of gold standard by establishing an international system of fixed exchange rates with the US dollar convertible to gold until its collapse in 1971 when the dollar was floated. Since then, both Treasury and corporate bonds have been issued exclusively in nominal terms until the introduction of Treasury Inflation-Protected Securities (TIPS) in 1997, which provide explicit inflation protection.

Taxation

Before the introduction of US income taxation in 1913, neither corporate nor government bonds faced federal income tax. From 1913 to 1941, an unusual situation existed where proceeds from US federal government bonds were taxed while corporate bond proceeds were exempt, creating a tax advantage for corporate securities. A notable tax policy between 1921 and 1971 was the issuance of a subclass of government bonds known as "flower bonds", which could be used to pay the bondholder's federal estate taxes upon their death at *at par value* (not market value) plus accrued interest (see Cook (1977), Mayers and Clifford (1987)). In addition, before 1976, flower bonds were *valued as inherited property at their par value* on the date of the decedent's death, effectively exempting them from capital gains tax and creating an inflation hedge.

Credit ratings

The rise of corporate bonds was accompanied by the development of credit ratings. Beginning in 1832, the "American Railroad Journal" published detailed assessments of railroad companies, covering physical descriptions of the railroads, their assets, liabilities, and earnings. In 1868, its former editor Henry V. Poor published the first volume of "Poor's Manual of the Railroads of the United States", a comprehensive resource detailing financial statements, operational statistics, and the capital structure of their securities. In 1909, John Moody in his "Moody's Manual of Railroads and Corporation Securities" first introduced a structured rating system for these securities that established the foundation for modern credit ratings.

Policy interventions

Corporate and government bond markets have historically been subject to different regulatory frameworks, evolving in response to financial and economic pressures. In the decades before the Civil War, only state-chartered banks existed, which were not incentivized to hold Treasuries.[1] This changed with the National Banking Acts of 1863–1866, which established a system of nationally chartered single-branch banks. These banks were permitted to issue banknotes up to 90% of the lower of the par or market value of qualifying US federal bonds, effectively tying their balance sheets to government debt. However, national banks were prohibited from using railroad bonds as backing for their notes and faced strict limitations on the types of loans they could issue.

World War II brought further regulatory intervention, as concerns over war financing led to the government "fixing" the yield curve from 1942 to 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 policy 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 predominantly holding government debt. The arrangement ended with the 1951 Treasury-Fed Accord, establishing official Fed independence from the Treasury.

The 2007–2009 financial crisis triggered extensive regulatory reforms, including the Dodd-Frank Wall Street Reform and Consumer Protection Act, which introduced new oversight for financial institutions. Additionally, the Basel III regulations imposed stricter capital requirements and portfolio constraints on banks, penalizing excessive leverage and encouraging the holding of government debt over assets like corporate bonds. In response to the crisis, the Federal Reserve also launched a quanti-

[1] These banks, chartered by state legislatures, could issue their own banknotes and were subject to diverse balance sheet regulations, often requiring them to hold gold and state bonds. However, no state banks could operate nationally.

tative easing (QE) program, purchasing long-term government bonds to lower interest rates and stabilize financial markets.

3.2 Data

We construct a new historical dataset of high-grade US corporate bonds, providing monthly data on trading prices and cash-flows as well as bond characteristics and credit ratings from 1860-2024. Monthly prices and cash-flows date back to 1860, along with detailed bond characteristics such as maturity, denomination and callability. Annual Moody's credit ratings date back to their earliest availability: 1909 for railroads and 1914 for public utilities and industrials. Our dataset integrates existing databases with hand-collected prices and bond characteristics from historical newspapers, business magazines, and financial releases by companies.

3.2.1 Bond Prices

To compile end-of-month trading prices from 1860-2024 we rely on five main data sources: *Global Financial Data (GFD)*, the *Commercial & Financial Chronicle (CFC)*, *Barron's Magazine*, the *Lehman Brothers Fixed Income Database*, and the *Merrill Lynch Bond Index Database*. From 1860-1884 we take bond price data from *Global Financial Data (GFD)*. The GFD dataset covers nearly 800 corporate bonds from 1791 to 1884, almost all of which are railroad bonds, reflecting their dominance in the bond market during that period. The price data is particularly rich between 1870-1884, featuring both daily time series of trading prices and bond characteristics such as the bonds name, coupon, and company information. The data does not include further bond characteristics such as maturity date or denomination. From 1884 to 1963, we collect end-of-month trading prices from the *Commercial & Financial Chronicle*. The *Commercial & Financial Chronicle* was a weekly business newspaper published from 1865 to 1987.[2] We use bond quotations from the New York Stock Exchange, focusing on actual sale prices, as reported in the "Stock Exchange Quotation / Bond Record" section. From 1884 to 1918, we collect only railroad bond prices. Beginning in January 1918, we expand the collection to include all corpo-

[2]Scanned digital copies of the Chronicle are available from the Federal Reserve Archival System for Economic Research (FRASER) from July 1865 to December 1963.

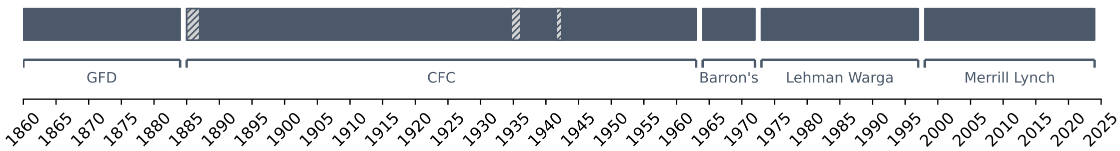

Figure 1: Corporate Bond Price Data Sources

Data sources for bond prices from 1860-2024. GFD, Lehman Warga, and Merrill Lynch are existing datasets, while bond price data from the CFC and Barron's was manually collected using scans from digital archives. Light gray areas indicate gaps in the current sample.

rate bonds, reflecting the growing importance of utility and industrial securities in the corporate bond market during the early 20th century. From 1964 to 1972, we collect bond closing prices from *Barron's Magazine*. *Barron's* is a weekly financial newspaper founded in 1921, providing coverage of closing prices for actively traded corporate bonds in their "Listed Bond Quotations" section. From 1973 to 1997 we rely on the *Lehman Brothers Fixed Income Database* distributed by Hong and Warga (2000) which provides comprehensive monthly bond-specific information from January 1973 to December 1997, including bond price, ratings and coupons. After 1997 we use the *Merill Lynch Bond Index Database* which provides a similar level of detail. We use daily closing prices from the New York Stock Exchange as reported in *The New York Times (NYT)* to fill in any gaps in our sample between 1884 and 1972.

3.2.2 Bond Characteristics

A major challenge with computing yield curves is that we need accurate information about bond maturity and coupon payments. For the period after 1972, we are able to rely on detailed bond information from the *Lehman Brothers Fixed Income Database* and the *Merrill Lynch Bond Index Database*. For bonds maturing between 1900 to 1972, we extract the maturity, coupon and coupon schedule from various *Moody's Manuals* which were first published in 1900. Initially titled *Moody's Manual of Industrial and Miscellaneous Securities*, it was later replaced by *Moody's Manual of Railroads and Corporation Securities*, and subsequently by *Moody's Analyses of Investments*. These manuals provide comprehensive information on outstanding bonds, including the issue and maturity dates, coupon rates and schedules. For the pre-1900 period, we draw maturity and coupon information from a variety of sources. These

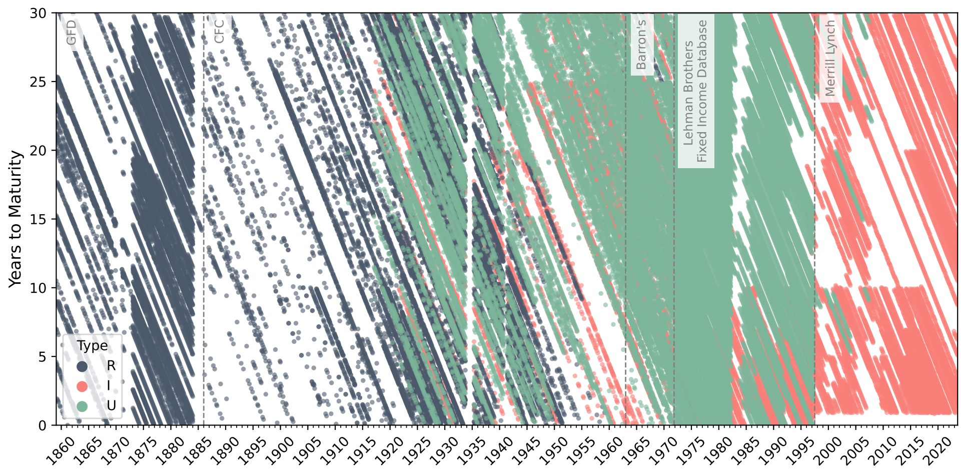

Figure 2: Maturities of observed high-grade corporate bonds

Years-to-maturity of high-grade corporate bonds, defined as those rated at least A by Moody's. R (gray) stands for "railroad companies", I (red) stands for "industrials", U (green) stands for "utilities".

include the *Investors' Supplement of the Commercial and Financial Chronicle*, the *American Railroad Journal*, *Poor's Manual of Railroads*, the *Catalogue of Railroad Mortgages*, various publications by Joseph G. Martins on the Boston stock market, and annual reports to stockholders of various railroad companies.

3.2.3 Credit Ratings

To classify high-grade bonds, we mainly rely on Moody's credit ratings which are readily available from the *Lehman Brothers Fixed Income Database* and the *Merrill Lynch Bond Index Database*. Prior to the availability of these datasets, we collect annual bond ratings from the *Moody's Manuals*. Moody's first issued credit ratings in 1909 for railroads, expanding to public utilities and industrial companies in 1914.[3] Further details on how we identify high-grade bonds prior to 1909 are provided in Section 4.2.

[3]We focus on Moody's ratings since they are the earliest available, whereas Poor's ratings began in 1922 and Fitch's in 1924.

4 Constructing Yield Curves and Spreads

Our goal is to compute the spread between yields on bonds issued by the corporate and government sectors that offer the same cash flows. This means we need to calculate zero coupon yield curves for corporate and US federal bonds (to match maturity), restrict the corporate sample to bonds with comparable default probability (to match payout risk), restrict to the sample to nominal bonds with similar tax treatment (to match after tax real pecuniary benefits), and adjust for the callability of corporate debt (to match effective duration).

4.1 Computing Zero-Coupon Yield Curves

To infer term structures of zero-coupon yields on high-grade corporate bonds, we adopt the estimation approach from Payne et al. (2025). This entails using the popular Dynamic Nelson-Siegel (DNS) model of Diebold and Li (2006) extended with stochastic volatility. This model allows for a dynamic relationship between three factors (that can be thought of as levels, slopes, and curvatures of yield curves), which enables us to learn about yields at all dates simultaneously by pooling information across time periods. We briefly summarize the approach here, for further details see our companion papers Payne et al. (2023) and Payne et al. (2025).

Let $q_t^{(j)}$ denote the dollar price of a government promise to one dollar at time $t+j$. We call the sequence $\mathsf{q}_t := \{q_t^{(j)}\}_{j=0}^{\infty}$ a *discount function*. Suppose that at time t bond i promises a sequence of dollar coupon and principal payments $\mathsf{m}_t^{(i)} := \{m_{t+j}^{(i)}\}_{j=1}^{\infty}$. We let $p_t^{(i)}$ denote the price of such a coupon-bearing bond in terms of dollar. We parameterize the discount function q_t by parameterizing the corresponding j-period zero-coupon yields defined as $y_t^{(j)} := -\log q_t^{(j)}/j$.

Assumption 1. The j-period zero-coupon yield takes the form

$$y_t^{(j)} = L_t + S_t\left(\frac{1-\exp(-j\tau)}{j\tau}\right) + C_t\left(\frac{1-\exp(-j\tau)}{j\tau} - \exp(-j\tau)\right)$$

where L_t, S_t, and C_t are hidden factors that characterize the level, slope, and curvature of the yield curve at time t. The vector $\lambda_t := [L_t, S_t, C_t]'$ follows a drift-less random walk:

$$\lambda_{t+1} = \lambda_t + \Sigma_t^{\frac{1}{2}} \varepsilon_{\lambda,t+1} \tag{4.1}$$

where Σ_t is a covariance matrix with $\Sigma_t = \Xi_t \Omega \Xi_t$. Here, Ω is the time-invariant correlation matrix and Ξ_t is a diagonal matrix with marginal standard deviations σ_t that follow:

$$\log \sigma_{t+1} = \log \sigma_t + \Xi_\sigma \varepsilon_{\sigma,t+1} \tag{4.2}$$

where Ξ_σ is a positive definite diagonal matrix. Shocks $\{\varepsilon_{\lambda,t}, \varepsilon_{\sigma,t}\}_{t\geq 1}$ are Standard Normal.

This is the yield curve model of Diebold and Li (2006) and Diebold et al. (2006) except for the law of motion of the yield curve factors (4.1). Different from these papers, we assume that the yield curve factors are random walks and the corresponding shock volatilities are time-varying to help the model accommodate consequences of wars and important institutional changes for high-grade corporate zero-coupon yield curves.

We assume that the discount function q_t can price high-grade coupon-bearing corporate bonds well.

Assumption 2. The law of one price holds for high-grade corporate bonds and for each $t \geq 0$. That is, the price of bond i with promised payments $\mathsf{m}_t^{(i)}$ is given by:

$$p_t^{(i)} = \sum_{j=1}^{\infty} q_t^{(j)} m_{t+j}^{(i)}.$$

Assumption 2 expresses our key identifying restriction: within each time period, a common discount function prices all high-grade corporate bonds that we include in our sample, i.e., there is no cross-sectional variation in how corporate promises of bond repayment are priced. In principle, q_t implicitly includes compensations for default risks, convenience benefits, and inflation risk, so it should be thought of as the price of a *risky* promise. Our specification allows these components to vary with maturity j and time t, but not by individual bond. Effectively, we assume that the cross-sectional heterogeneity in the class of high-grade corporate bonds (Aaa rated bonds from 1900 onward) is relatively small. To be robust to this assumption and limit the extent to which heterogeneous bond characteristics distort our estimates we introduce *bond specific* pricing errors.

Assumption 3. The observed price of bond i with promised payments $\mathsf{m}_t^{(i)}$ differs from the price in Assumption 2 by an independent pricing error that has a time-invariant Gaussian distribution with mean 0 and standard deviation $\sigma_m^{(i)}$. That is, we have:

$$\tilde{p}_t^{(i)} = \sum_{j=1}^{\infty} q_t^{(j)} m_{t+j}^{(i)} + d_t^{(i)} \sigma_m^{(i)} \varepsilon_t^{(i)} \tag{4.3}$$

where $\tilde{p}_t^{(i)}$ denotes the *observed* period-t dollar price of bond i and $d_t^{(i)}$ is the Macaulay duration of bond i in period t.[4]

Assumptions 1-3 give rise to a non-linear state space model with state equations (4.1)-(4.2) and observation equation (4.3). We estimate this model with Bayesian Markov Chain Monte Carlo (MCMC) methods assuming the weakly informative priors detailed in Appendix B.

4.2 Sample Restrictions

We apply several sample restrictions to ensure that we are comparing bonds with the same pecuniary payouts.

Restriction to Aaa corporate bonds. We limit our sample to high-grade corporate bonds to minimize default risk. To classify bonds, we primarily rely on Moody's credit ratings, which became available in 1909, and restrict our sample to Aaa-rated bonds. For bonds maturing before 1909, we follow Macaulay (1938) in identifying high-quality issuers, relying on the selection of railroad companies included in his high-grade railroad bond yield index. Specifically, we include companies from which Macaulay selected at least one bond for his index. Macaulay carefully selected companies based on their financial strength and excluded them before they encountered financial trouble, to ensure that his index reflected only the most creditworthy issuers. However, as pointed out in Homer and Sylla (2004), constructing an index equivalent

[4] We adjust the price error by the inverse duration to ensure that the error in yield terms does not become unbounded as the bond nears maturity.

to a modern Aaa bond index prior to 1900 presents challenges due to the limited number of true high-grade issuers and even Macaulay's "high-grade" sample exhibits some variation in credit quality.

Restriction to nominal treasuries with analogous tax treatments. We exclude the flower bond treasuries and TIPS from our sample. Since all corporate bonds in our sample are nominal, we restrict to nominal Treasury bonds to ensure that we are comparing yield curves on bonds with similar exposure to inflation risk.

Adjustment of maturity for callable corporate debt. For callable corporate bonds, we assume perfect foresight of the call date. Specifically, we treat these bonds as priced with a maturity corresponding to the date the bonds were called. Our bond-specific measurement errors help to mitigate potential issues with this assumption.

5 Corporate Bond Yields and Convenience Spreads

In this section, we describe the key outputs from our estimation: the high-grade corporate bond yield curve, the treasury yield curve, and the AAA Corporate-Treasury spread curve for the period 1860-2024. We show that our spread estimate differs significantly from existing series during the Great Inflation period (1965-1980) due to the implicit inflation hedge in a subset of Treasuries (the so called "flower-bonds").

5.1 High-Grade Corporate Bond Yield Curves

The top panel of Figure 3 depicts selected long term nominal yields on high-grade US corporate bonds. The solid black line represents the median of our 20-year zero coupon yield estimates. Bands around the posterior median depict the 90% interquantile range. Between 1860-1900, long term high-grade corporate yields trended downward from around 8% to around 4% (the "great bond bull market"), then climbed slowly back to 5% by World War I. During the war and the subsequent 1920 recession long term corporate yields reached more than 7% before they began their renewed downward decline (interrupted briefly by the Great Depression). During World War II and the 1950s, the 20-year high-grade corporate yield exhibited surprising stability up until the late 1960s when, in tandem with increasing inflation, it reached its peak of 18% during the 1981-1982 recession.

The blue dashed line in the top panel of Figure 6 depicts the high-grade railroad bond index from Macaulay (1938) computed as the average yield-to-maturity on selected long term bonds issued by reputable railroad companies between 1857-1937. The red solid line is Moody's Seasoned Aaa Corporate Bond Yield index computed as the average yield-to-maturity on bonds with maturity 20 years and above. This index is available from 1919 onward. While yields-to-maturity are different from the notion of a zero-coupon yield, we find it reassuring that our estimates broadly align with Macaulay's high-grade railroad and Moody's Aaa indexes.[5]

One of the main advantages of estimating the whole yield curve is to observe shorter maturity private borrowing costs. The middle panel of Figure 6 depicts our posterior median estimates of the 10-year and 2-year zero-coupon yields on high-grade corporate bonds. The bottom panel shows the corresponding spread. Evidently, short- and medium-term yields follow the same trend as the 20-year yield, but they are more volatile, especially in the post WWII period. Before the 1980s, the spread between the 10-year and 2-year zero-coupon yields is close to zero, suggesting that for about 100 years, the average yield curve on high-grade corporate bonds was flat on average.

5.2 Treasury Yield Curves

In previous work, we estimated the historical yield curve on US Treasuries from 1790-1933 (see Payne et al. (2025)). For this paper, we extend our estimation to 1934-2024 to provide a consistent comparison to the corporate yield curve. An important deviation from the literature is that we restrict attention to nominal bonds by excluding flower bonds and other bonds that effectively traded as real debt. In the first subsection, we highlight why eliminating flower bonds has a large impact on the Treasury yield curve. We then discuss the overall time series for the Treasury yield curve.

[5] Yield-to-maturity is computed under the assumption of a flat yield curve. In this sense, yield-to-maturity of a particular bond can be considered as the weighted average of zero-coupon yields with the bond's cash-flows acting as weights.

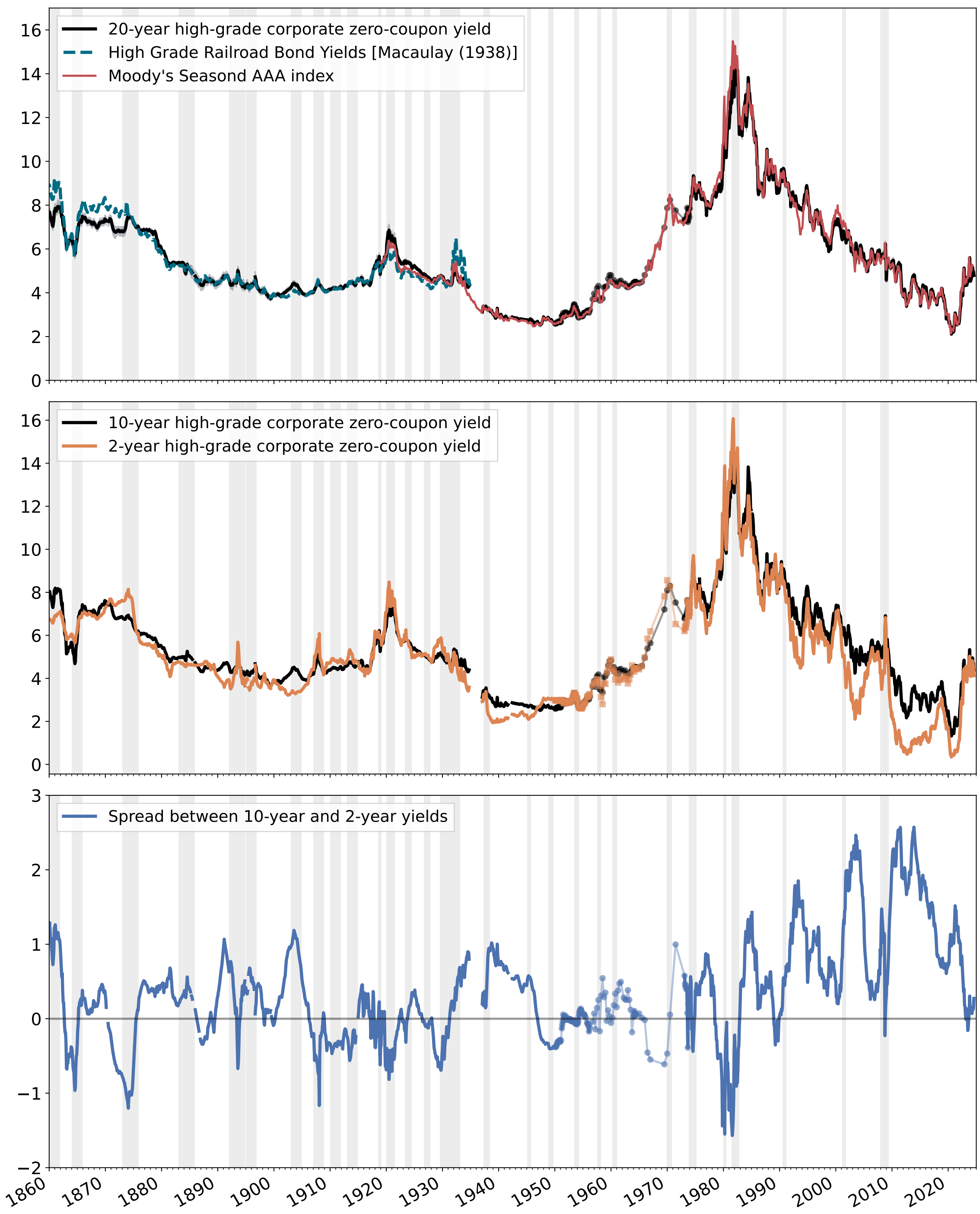

Figure 3: High-grade Nominal Corporate Zero-Coupon Yields 1860-2024

Top panel depicts our posterior median estimate of the 20-year high-grade corporate zero-coupon yield (black). The blue dashed line depicts the High Grade Railroad Bond Index from Macaulay (1938). The red solid line is Moody's Seasoned Aaa bond index. Middle panel depicts posterior median estimates of the 10- (black) and 2-year (orange) high-grade corporate yields. Bottom panel depicts the spread between the 10-year and 2-year yields. The light gray intervals depict NBER recessions.

5.2.1 Treasury Yields in the 1960-80 Inflation Episode

As discussed, before 1971, the US Federal government issued "flower bonds" which bondholders could use to pay federal estate taxes upon their death at *at par value* plus accrued interest (see Cook (1977), Mayers and Clifford (1987)). In addition, before 1976, flower bonds were *valued as inherited property at their par value* on the date of the decedent's death, effectively exempting them from capital gains tax. This meant that flower bonds effectively acted as an inflation hedge: rising inflation led to higher interest rates, which decreased the bond's market price relative to its par value, thereby increasing the tax advantage of holding flower bonds. In this sense, the flower bonds functioned similarly to inflation bonds. Flower bonds constitute an important subset of treasury securities during the early decades of the post-WWII period.[6] The first recorded flower bond in CRSP was issued in 1922 and the last flower bond matured (or was redeemed) in 1985. Importantly, from 1955-1971, (almost) all outstanding treasuries with maturity greater that 10 years were flower bonds. This uneven distribution across the maturity spectrum is reflected on the yield-to-maturity plots in Figure 4. Each subplot depicts yields-to-maturity against corresponding maturities (in years) for all bonds outstanding in a given month. Black dots and squares represent non-callable and callable non-flower bonds, respectively. Red dots and squares represent non-callable and callable flower bonds, respectively. Evidently, prior to 1971 all bonds beyond 10 years to maturity are flower bonds, implying that the commonly used average long-term government debt series (e.g. LTGOVTBD in FRED) is completely made up of flower bonds over this period. We can also see that the red flower bond dots and regular bond black dots move differently once inflation takes off. Prior to 1965, the red and black dots form a consistent shape. However, by 1975, the red and black dots have dramatically departed.

To get a sense of the magnitude of the "flower bond effect", we estimate our yield curve model from Section 4 using a sample that includes only flower bonds and a sample that excludes all flower bonds. The results are depicted in Figure 5. The black line shows the posterior median estimate of the 20-year zero-coupon yield without flower bonds. The green line shows the posterior median estimate of the 20-year zero-coupon yield using only flower bonds. Evidently, before the end of 1965, the

[6] See McCulloch (1975), Cook (1977), Cook and Hendershott (1978), and Mayers and Clifford (1987).

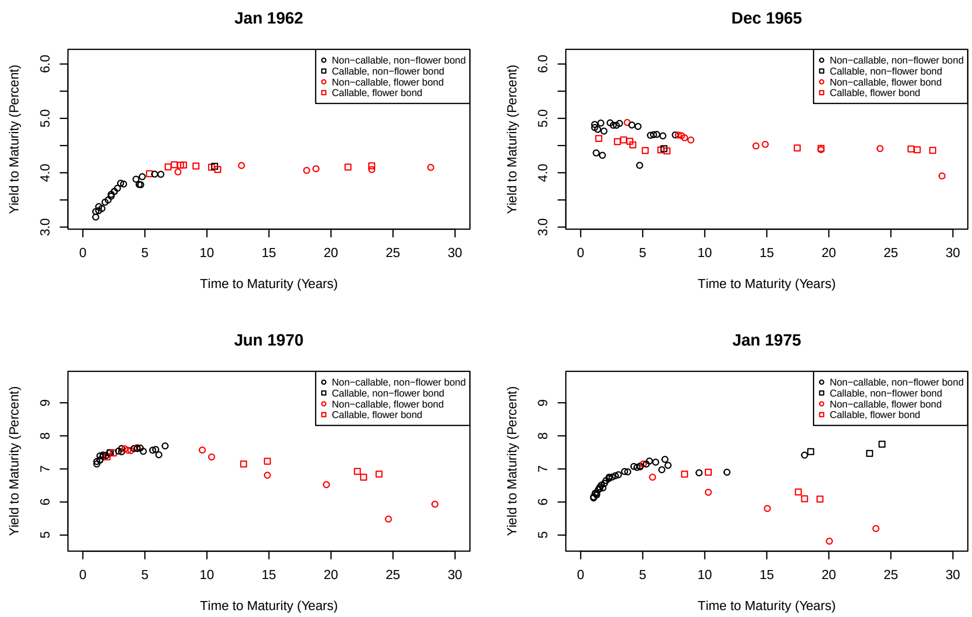

Figure 4: US Treasuries Yields Before and During the Great Inflation

Panels depict yields-to-maturity (y-axes) against years-to-maturity (x-axes) for different dates (panel title). Each circle/square corresponds to a separate bond outstanding in the given month. Red color represents "flower bonds", black color is for regular bonds. Circles show non-callable bonds, squares represent callable bonds. If a callable bond is traded at a premium in the given month Yield-to-Call and Years-to-Call is shown on the vertical and horizonatal axes, respectively.

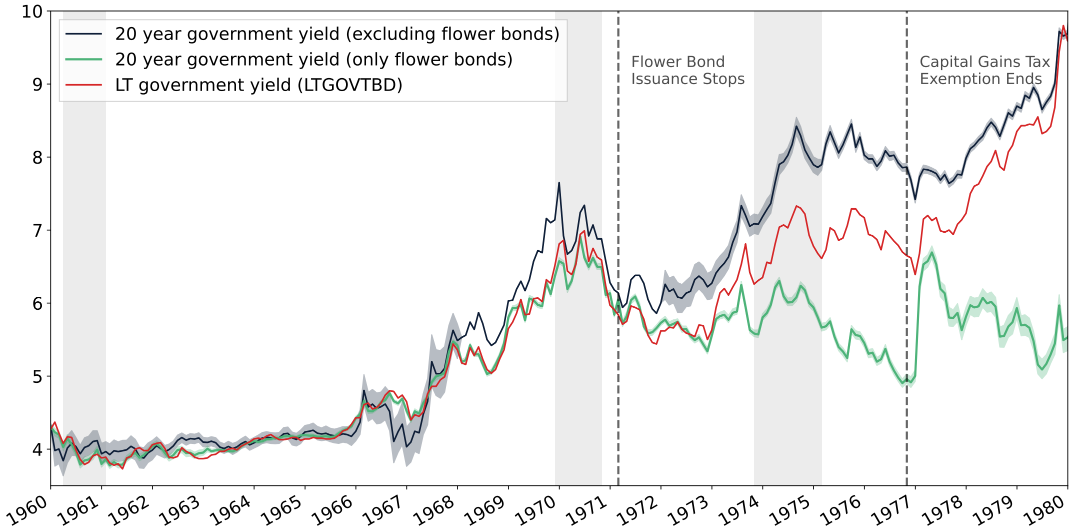

Figure 5: Long Term Government Yields With and Without Flower Bonds

Black solid line is the posterior median estimate of the 20-year zero-coupon yield on US Treasuries excluding all flower bonds from the sample. Green solid line is the posterior median estimate of the 20-year zero-coupon yield on flower bonds only. Bands denote 90% posterior interquantile ranges. Red solid line is the average long-term government yield index (LTGOVBD).

two yields are indistinguishable. This implies that the average long-term government yield index, represented by the red line in Figure 5, is a good approximation of long-term treasury yields.

From 1966 onward, however, a gap opens up between the black and green lines due to the slow increase in the value of the two tax features mentioned at the beginning of this section. Cook (1977) argues that before 1973, the first "capital gains effect" was the dominant force and the flower bond premium affected mainly the lowest-coupon issues.[7] 1971 brought two important changes in the US treasury market. First, the 4 1/4% ceiling on new US bond issues was lifted and so long-term bonds without flower bond provisions started to reappear (with higher coupons). Second, effective March 1971, Congress eliminated flower bond privileges on new US bond issues, thereby ensuring a steadily declining stock as outstanding issues purchased

[7]Among the outstanding flower bonds, the ones actually purchased because of the estate-tax feature tended to be the lowest coupon bonds, such as the 3's of 1995 and the 3 1/2 of 1998, which were selling at the largest discounts. Evidence of this can be seen in the amount outstanding, with the net decline from year to year measuring the amount redeemed for estate tax purposes. See Cook (1977).

for estate tax purposes were retired over time. The flower bond premium started to increase sharply on all flower bonds, which can be attributed to the combination of (1) the steady decline in the supply of flower bonds and (2) increased demand for flower bonds as rapid inflation drove up the value of estates, but tax laws were not adjusted in a timely manner to correct for the impact on the level of estate taxes. We can see these effects reflected in the decrease in the green line between 1973-1976 in Figure 5.

The next big regulatory change was the Tax Reform Act of 1976, passed in October, which contained two provisions that diminished the attractiveness of flower bonds. First, the Act effectively terminated the flower bonds' exemption from capital gains taxes. Second, the Act extended the holding period necessary to apply the long-term capital gains tax rate from six months to one year with the intention of eliminating "deathbed" purchases of flower bonds. Figure 5 demonstrates that the Tax Reform Act of 1976 had a major impact on the pricing of flower bonds. The 20-year zero-coupon yield on flower bonds jumped from around 5% to almost 7% in the two months following the passage of the Act.

Ultimately, because the value of flower bond provisions was inversely related to market prices of bonds, flower bonds implicitly hedged inflation and/or interest rate risk. As a result, these bonds were not priced as regular nominal bonds but instead like real bonds. In fact, to a first approximation, the spread between the black and green lines in Figure 5 can be interpreted as a compensation for inflation risk, which is highest between 1971-1976. In this sense, the yield on flower bonds is not comparable to the yield on corporate bonds: one uses tax revenue to provide an inflation protected return while the other does not. This reinforces why we take the flower bonds out of our baseline estimate for the Treasury yield curve.

5.2.2 Treasury Yields

Before we turn to the construction of high-grade corporate-Treasury yield spreads, it is instructive to see the extent to which the Treasury and Corporate yield curves co-move with each other. The top panel of Figure 6 depicts the 10-year high-grade corporate yield against the 10-year zero-coupon Treasury yields from Payne et al. (2025) combined with our estimates for the modern period. Evidently, the two yields follow similar trend dynamics, but long term treasury yields are persistently lower than high-grade corporate yields throughout our sample. In addition, despite the similar trend, short- and medium-term fluctuations of the two yield curves around their respective trends are very different in the early part of the sample. We can see this reflected in the middle and bottom panels of Figure 6. The middle panel depicts yield curve slopes defined as the spreads between the 10 year and 2 year zero-coupon yields on high-grade corporate bonds (blue) and on US treasuries (orange). The bottom panel shows the 10 year centered rolling correlation between the long end of the yield curves (blue) and the 2-year yields (orange). The corporate and treasury yield curves are only weakly correlated between 1860-1950 and then became highly synchronized after the late 1950s. Despite this convergence, the two yield curves seemed to decouple during the yield curve control period (1942-1951), the Great Inflation, and the post 2008 period.

5.3 Properties of the AAA Corporate-Treasury Spread

Figure 7 shows our estimates of the 10-year (top) and 20-year (bottom) AAA Corporate-Treasury spread, as measured by our estimate for the high-grade corporate zero-coupon yield minus our estimate for the treasury zero-coupon yield. Evidently, both measures of the spread exhibit large low frequency variations with their long-run mean value ranging between 0-2 % over the last 160 years. On average, the convenience spread 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 reached its lowest levels during the high inflation of the 1970's and 1980's.

The red line in Figure 7 depicts the measure used by Krishnamurthy and Vissing-Jorgensen (2012), Choi et al. (2022), Cieslak et al. (2024) among many others. This measure is computed as the spread between Moody's Seasoned Aaa-rated long-maturity corporate bond index—constructed from a sample of industrial and utility bonds (industrial only after 2002) with more than 20 years to maturity—and the (unweighted) average yield on all outstanding government bonds neither due nor callable in less than 10 years.[8] For brevity, we will call this the *index-based* AAA Corporate-Treasury spread. Our 20-year spread estimate follows this measure fairly

[8]More precisely, the Treasury bonds included are due or callable after 12 years for 1926–41, 15 years for 1941–51, 12 years for 1952, and 10 years for 1953–99. The FRED code of this series is LTGOVTBD. After 2000, the "market yield on US Treasury Securities at 20-year constant maturity" is used (FRED code: GS20).

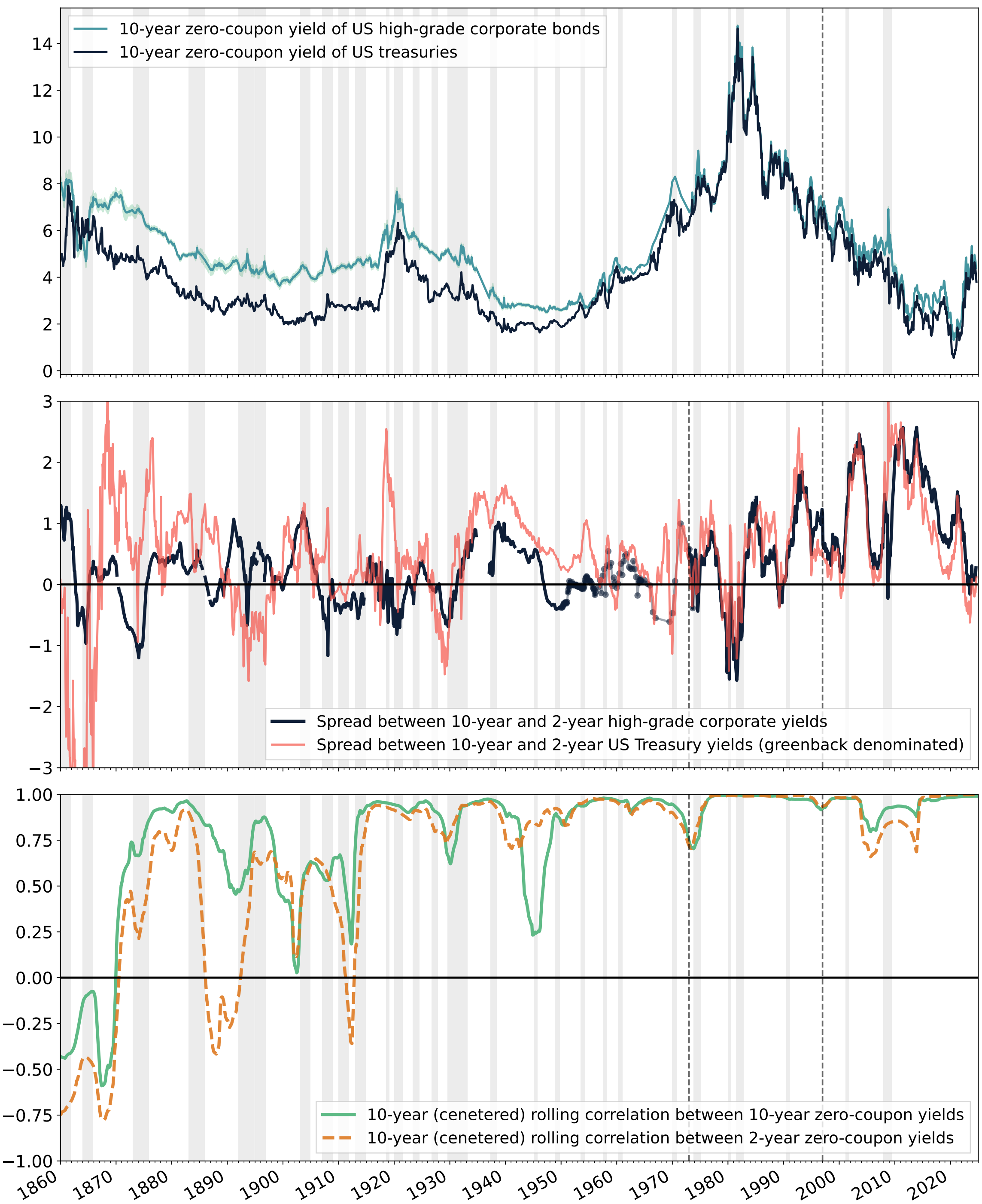

Figure 6: Difference Between Private and Public Borrowing Costs

Top panel depicts posterior median estimates of the 10-year zero-coupon yields on high-grade corporate debt (blue) and US Treasuries (black). Middle panel depicts spreads between 10-year and 2-year yields for high-grade corporate debt (black) and US Treasuries (red). Bottom panel depicts 10-year (centered) rolling correlations computed from the monthly series of posterior median estimates of 10-year (green solid) and 2-year (orange dashed) zero-coupon yields.

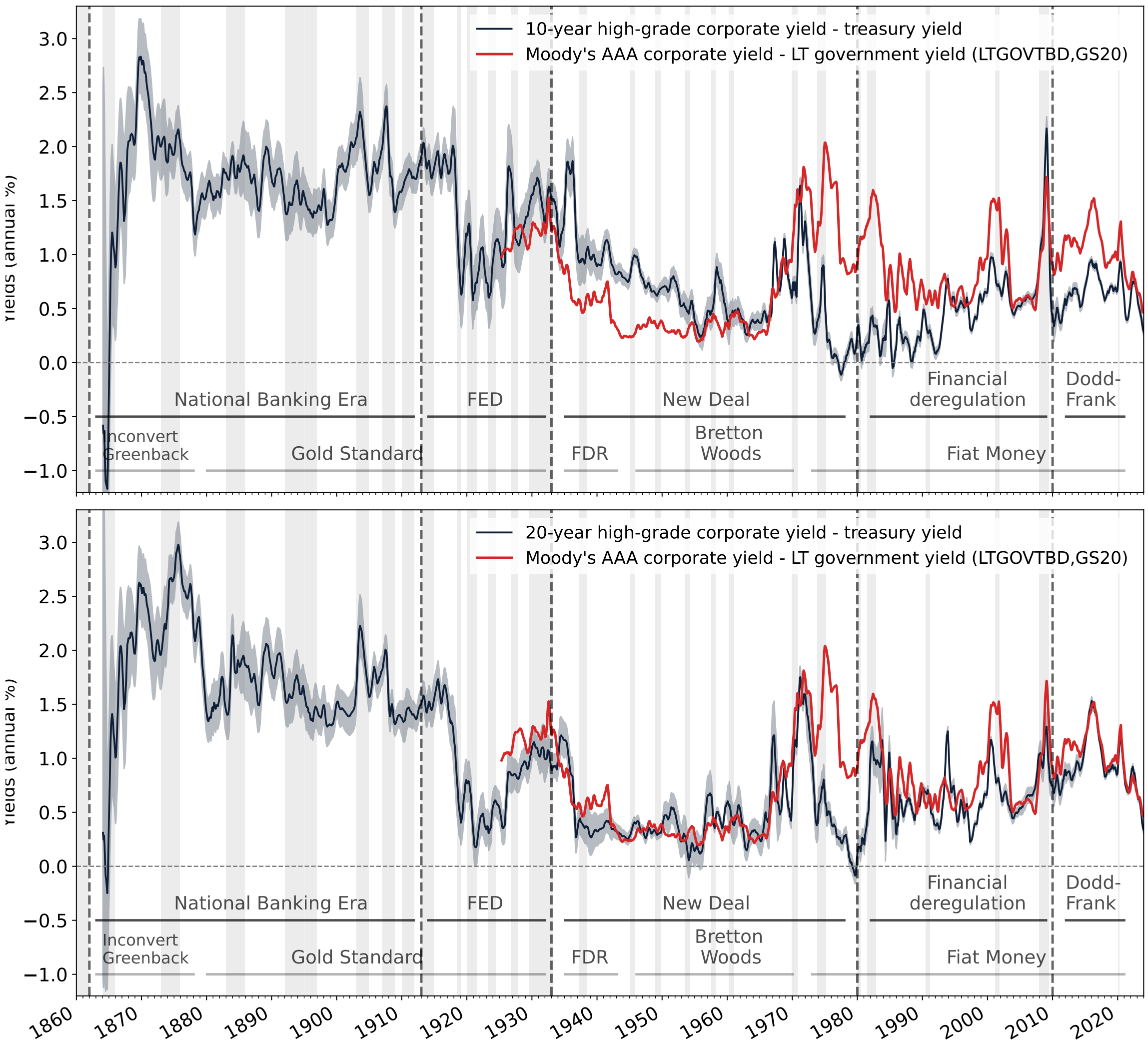

Figure 7: High-Grade Corporate to Treasury Spread Estimates: 1860-2024

Top panel depicts the 12-month centered moving average of the posterior median estimate of the 10-year convenience spread (black solid line) defined as the difference between 10-year zero-coupon yields on high-grade corporate debt and US Treasuries. The gray bands depict 90% posterior interquantile ranges. The red solid line shows the 12-month centered moving average of the index-based AAA Corporate-Treasury spread proposed by Krishnamurthy and Vissing-Jorgensen (2012). Bottom panel depicts the 20-year convenience spread against the index-based measure. Dashed vertical lines denote financial regulatory eras. Bottom labeling shows monetary standards. The light gray intervals depict NBER recessions.

closely except during the high inflation of the 1970's and 1980's. While the index-based measure (the red line) reaches its highest values during this period, our estimate shows the opposite: the high-grade corporate to treasury spread is close to zero. The difference occurs because we exclude the flower bonds from our sample, suggesting that a large portion of the variation in the index-based measure is attributable to an "inflation risk premium" instead of a "specialness premium" on US treasuries.[9]

We find more discrepancies relative to index-based measure (the red line) at shorter maturities, which are arguably more relevant for US government borrowing costs. In particular, at the 10-year horizon, which approximates the average debt maturity of US federal debt between 1860-2024 well, our estimates indicate relatively high spreads during the yield curve control period, and relatively low spreads during the decade after the Global Financial Crisis (GFC). Details of the Fed's Treasury buying programs during these two episodes provide a potential explanation for these patters in the term structure of convenience yields. While during the 1940s and 1950s the Fed purchased predominantly short-term government debt, the post-2008 quantitative easings (QE) focused on the purchase of long-term Treasuries.

5.4 Implications for the Literature

We conclude this section by discussing how our estimate of the high-grade corporate to treasury spread relates to some recent narratives in the literature. In particular, we argue that many of the relationships identified in the current research rely on the behavior of the index-based measure during the high-inflation period of 1965–1985 and lose identification using our series.

5.4.1 Comovement With Inflation

Our estimate of the AAA Corporate-Treasury spread helps to resolve a puzzle with the existing index-based estimate: the correlation between inflation and the AAA Corporate-Treasury spread appears to become positive during the Great Inflation.

To study how the use of our high-grade corporate to treasury spread measure affects the relationship between inflation and the Aaa Corporate-Treasury spread on US treasuries, Figure 8 depicts (annual) CPI inflation from Officer and Williamson

[9]This is consistent with Figure 1 in Cook and Hendershott (1978), which suggests that after adjusting for "tax effects" the convenience spread on US debt stayed below 1% before 1975.

(2021) along with our 10-year spread estimate[10] between 1870-2024. The dashed vertical lines divide the sample into 5 sub-periods. These sub-periods are the: (i) National Banking Era (1868-1919), (ii) Interwar years (1920-1941), (iii) Yield Curve Control (1942-1951), (iv) Post Treasury-Fed Accord (1952-1999), (v) Post 2000 (2000-2024). The numbers at the bottom of Figure 8 show the correlations between the two time series over the respective sub-periods. Evidently, the co-movement between inflation and the convenience spread was remarkably stable over the period of 1870-2024. Except for the yield curve control years, when the correlation is close to zero, the relationship is negative with a correlation coefficient ranging from -0.4 to -0.15. In particular, unlike for the existing index-based measure, we do not find that the correlation became positive during the Post Treasury-Fed Accord (1952-1999) period.

Our results are in contrast to a recent paper Cieslak et al. (2024), which documents and attempts to rationalize a change in the correlation between inflation and the AAA Corporate-Treasury spread during the high inflation period. The difference between our findings and those of Cieslak et al. (2024) stems from our reassessment of how the Treasury yields behaved during the high inflation period. The positive correlation observed in the existing index-based series from 1952-1999 appears to be driven by the inclusion of "real" flower bonds in the index that appreciated during the high-inflation period. This suggests that the pattern is not due to an increase in the non-pecuniary or "convenience" benefits of US Treasuries, as proposed by Cieslak et al. (2024). Instead, it appears because the government effectively used tax incentives to ensure the real return on flower bonds remained high and this distorted the index-based measure of the high-grade corporate to treasury spread.

5.4.2 Treasury Demand and US Government Market Power

There has been recent interest in finding instruments for US Treasury demand and estimating the US government's market power. In this section, we investigate one such instrument that has been used in the literature: foreign volatility shocks as rotators for US debt demand.

Figure (9) depicts the relationship between the AAA Corporate-Treasury spread and debt issuance for maturities less than one year (the left panel) and for maturities greater than one year (the right panel). The red dots depict periods with high foreign

[10] We annualize our monthly estimate by taking the mean convenience spread each year.

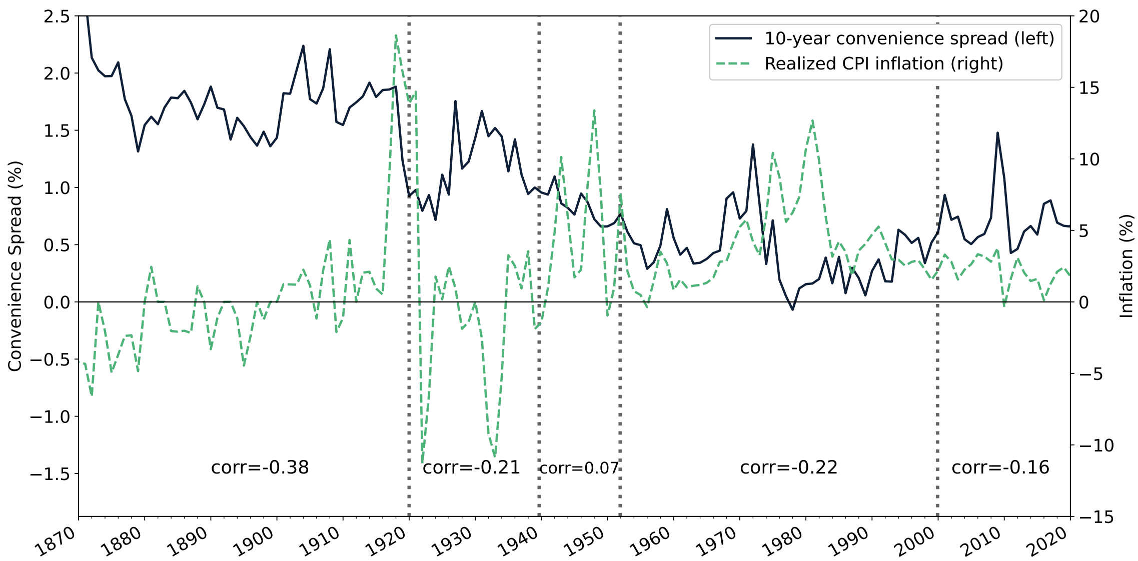

Figure 8: Convenience Spread vs Realized CPI Inflation: 1870-2024, Annual

Black line depicts our annualized 10-year convenience spread (left axis) defined as the yearly average of the monthly series. Green dashed line shows the realized annual CPI inflation between period $t-1$ and period t (right axis). Vertical dashed line divide the sample into five sub-periods. Numbers at the bottom show correlations between the two time series within the respective sub-samples.

volatility while the blue dots depict periods with low volatility in returns on UK equities. Changes to the shape of the equilibrium relationship in periods of high volatility have been interpreted as evidence of rotation in US debt demand (e.g. by Choi et al. (2022)). Contrary to the literature, we find little evidence that the foreign volatility acts as a rotator, except for very short term maturities.

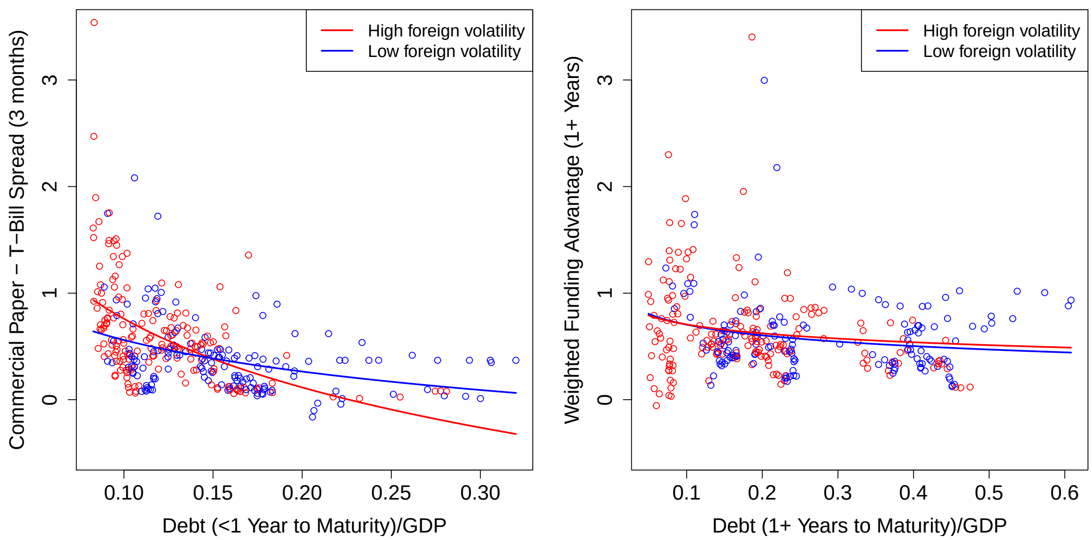

Figure 9: Convenience Spread vs Debt/GDP: 1919-2008, Annual, High and Low Foreign Volatility

Our findings have implications for estimation of US treasury market power. Following Choi et al. (2022), we impose a log linearized government issuance policy rule:

$$\lambda \log(q_t^b B_t / Y_t) = \log(\chi_t) + \log(1 - \xi \epsilon_t^{-1}(\sigma_t)) - \omega_t$$

where $q_t^b B_t / Y_t$ is the market value of debt-to-GDP ratio, χ_t is the AAA Corporate-Treasury spread, ξ is an indicator function whether debt issuance reacts systematically to elasticity, $\epsilon_t^{-1}(\sigma_t)$ is the inverse elasticity, $\sigma_t \in \{\sigma_L, \sigma_H\}$ is foreign volatility, and ω_t is an iid policy shock. We then estimate the price elasticity ϵ_t in high and low foreign volatility periods $\sigma \in \{\sigma_L, \sigma_H\}$. Finally, we test if $\xi = 1$ (debt issuance reacts systematically to elasticity) or $\xi = 0$ (debt issuance does not react systematically to elasticity) is a better fit. The results are shown in Table 1. Contrary to Choi et al. (2022), we find little evidence that US government issuance reacts systematically to elasticity shocks at maturities greater than 1 year. In other words, using the framework of Choi et al. (2022), our results suggest that the US hasn't been exploiting its market power in the bond market for maturities above 1 year. However, we do find evidence for systematic reaction at maturities < 1 year. Since inflation and volatility are correlated, this may reflect monetary policy adjustments rather than exploitation of safe-asset monopoly power.

Cost elasticity	$\lambda = 0$	$\lambda = 1$	$\lambda = 2$
$<$ 1 Year to Maturity	-2.630^{***}	-2.712^{***}	-2.281^{**}
1+ Year to Maturity	0.575	-1.439	-1.585

Table 1: Null hypothesis: US debt issuance does not react to elasticity ($\xi = 0$)

6 Conclusion

In this paper, we construct new estimates for historical high-grade corporate and nominal treasury yield curves and use them to compute a term structure of Aaa-rated corporate to US Treasury spreads. We use our estimates to document how the long-run mean of the US funding cost advantage, as measured by the AAA Corporate-Treasury spread, has fluctuated in response to financial sector regulation and monetary-fiscal policies, thereby challenging prevailing narratives about the existence of an exploitable demand function for US treasuries.

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A Additional Detail on the Dataset

B Priors

Table 2: Prior Distributions of the Dynamic Nelson-Siegel Model

Parameter	Description	Priors	Hyper parameters
L_0	initial level factor	$\mathcal{N}(\mu, \sigma^2)$	$(\mu, \sigma) = (10, 5)$
S_0	initial slope factor	$\mathcal{N}(\mu, \sigma^2)$	$(\mu, \sigma) = (0, 10)$
C_0	initial curvature factor	$\mathcal{N}(\mu, \sigma^2)$	$(\mu, \sigma) = (0, 10)$
τ	location parameter	$\log \mathcal{N}(\mu, \sigma^2)$	$(\mu, \sigma) = (5, 5)$
σ_0	initial shock volatilities	$\log \mathcal{N}(\mu, \sigma^2)$	$(\mu, \sigma) = (0.05, 0.1)$
Ω	correlation of shocks	$\text{LKJ}(\eta)$	$\eta = 5$
Ξ_σ	volatilities of σ_t shocks	$\text{Exp}(\lambda)$	$\lambda = 20$
$\sigma_m^{(i)}$	volatilities of pricing error	$\text{Exp}(\lambda)$	$\lambda = 0.1$

[1] The LKJ distribution is defined by $p(\Omega|\eta) \propto \det(\Omega)^{\eta-1}$. See Lewandowski et al. (2009)