The US Treasury Funding Advantage Since 1860

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Measuring Funding Advantage ...since 1860

- **Funding Advantage**: US gov borrows at lower interest rates than the private sector

  ...even for bonds with identical cash flows and credit risk

  ⇒ US government can issue debt not fully backed by future surpluses

Yield spread between j-period "plain vanilla", like-for-like bonds:

$$\underbrace{\chi_t^{(j)}}_{\text{Funding advantage}} := \underbrace{\tilde{y}_t^{(j)}}_{\text{Highest-grade private debt}} - \underbrace{y_t^{(j)}}_{\text{US Treasury debt}} > 0$$

- **Data challenge:** observed bonds are heterogeneous (tax advantages, options, etc.)
- **This paper:** first *term structure* of tax- and option-adjusted Aaa-Treasury spreads
  - χ_t has been mismeasured and exaggerated during key episodes of 20th century
  - Build asset pricing model for χ_t: explained by usual bond price risk factors

Literature

Historical Bond Samples

New Data:

- **New Corporate Bond Data:** prices & features for highest-grade bonds (1860-)
  - Pre-1974: CFC, NYT, Moody's Barron's; Post-1974: Lehman Warga, & Merrill Lynch
- **Treasury Bond Data:** prices & features for all treasuries (1790-)
  - Combines Hall-Payne-Sargent-Szőke data (1790-1940) with CRSP (1926-2024)

Key contribution:

- Identify institutional details that matter for historical bond pricing
- Find relevant bond characteristics and orgnize bonds accordingly

Historical Samples Exhibit Substantial Bond Heterogeneity

Tax Advantages

- **Tax Exemptions** (1917-1941): from federal income taxes on government bonds
- Capital Gains Tax Advantage on low coupon bonds

Tax Exemptions | Bonds Trading Below Par

Embedded Options

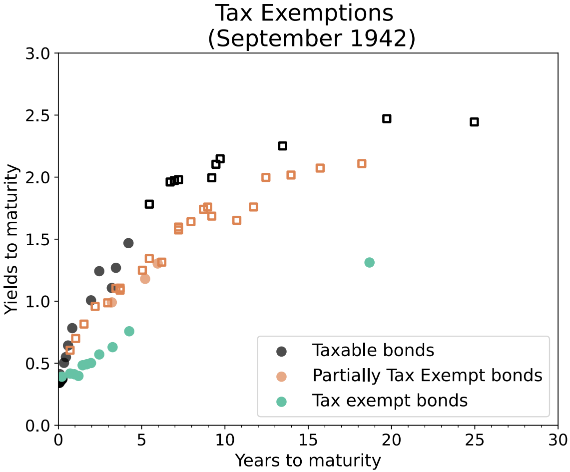
- Call options, Exchange privilege

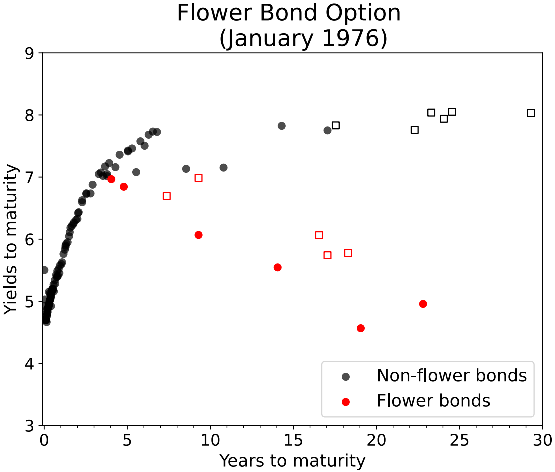
Composition of callable bonds

- **Flower Bonds** (1917-1971): Could be redeemed at par to pay the bondholder's federal estate taxes upon their death
  – Tax provision is valuable when market prices are below par ($\approx$ inflation put):

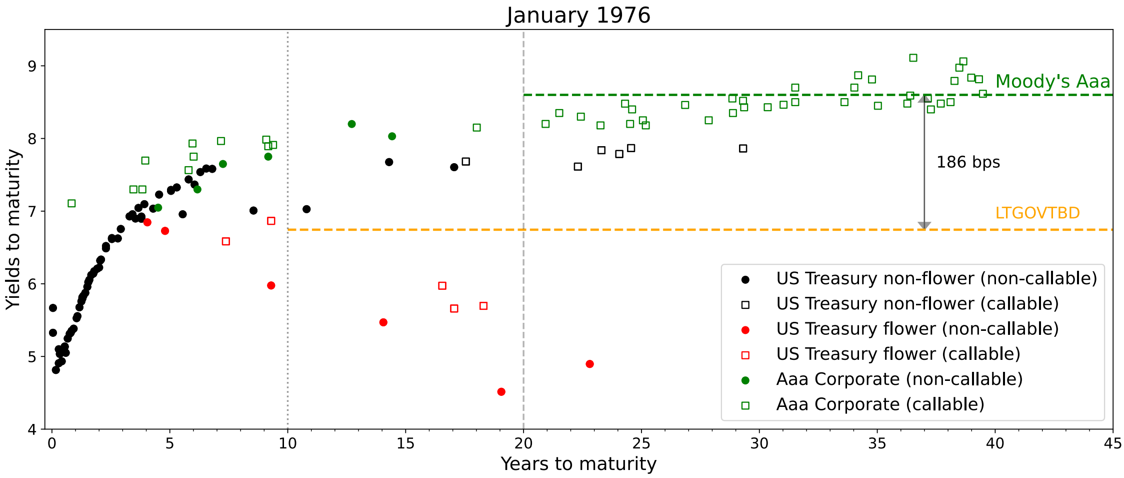
$$\uparrow \text{Inflation} \quad \Rightarrow \quad \uparrow \text{Interest rates} \quad \Rightarrow \quad \downarrow (\text{Price} - \text{Par}) \quad \Rightarrow \quad \uparrow \text{Put Moneyness}$$

Price Effect of Taxation and Flower Bonds

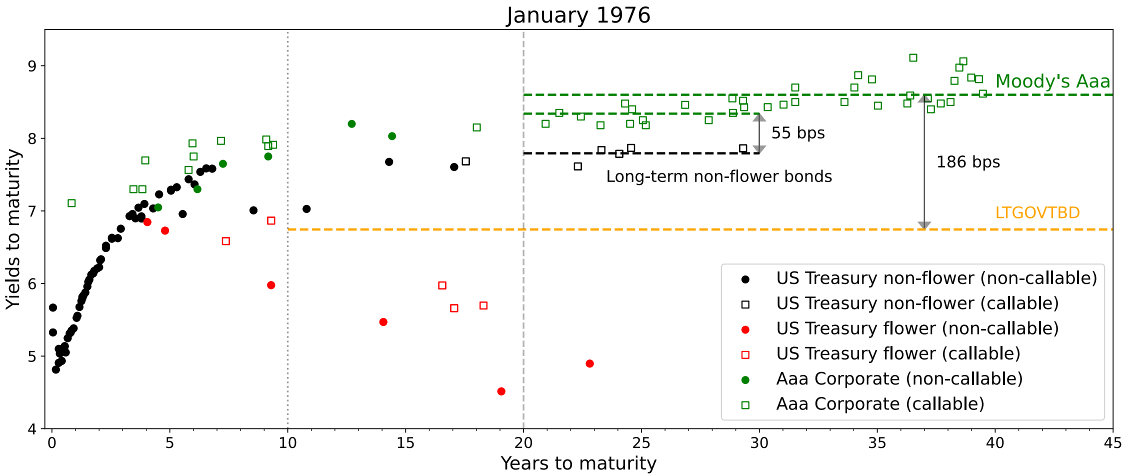




Commonly Used Measure of Long-Maturity Funding Advantage



“Inflation Put” in Government Bonds ⇒ Mismeasured Spread



How can we make progress?

Law of one price: common discount function, $\mathsf{q}_t := \{q_t^{(j)}\}_{j\geq 1}$, to price all bonds

$$p_{i,t} = \sum_{j=1}^{\infty} q_t^{(j)} c_i^{(j)} + \underbrace{\varepsilon_{i,t}}_{\text{price error}}$$

Identification: simultaneously observe bonds with different maturities and coupons

Yield Curve Estimation With Bond Heterogeneity

Law of one price: common discount function, $\mathsf{q}_t := \{q_t^{(j)}\}_{j\geq 1}$, to price all bonds

$$p_{i,t} = \sum_{j=1}^{\infty} q_t^{(j)} \underbrace{z_i^{(j)}(\eta_t, p_{i,t})}_{\text{tax advantages}} c_i^{(j)} + \underbrace{v_i(\theta_t, p_{i,t})}_{\text{option value}} + \underbrace{\varepsilon_{i,t}}_{\text{price error}}$$

…time-varying wedges $(z_{t,i}, v_{t,i})$ with theory-consistent forms:

$$z_i^{(j)}(\eta_t, p_{i,t}) := f\Big(\text{determinants of tax advantage}\Big)$$

$$= \exp\left(\eta_{t,0}\mathbb{1}\begin{Bmatrix}\text{Partial}\\\text{tax}\\\text{exempt}\end{Bmatrix} + \eta_{t,1}\mathbb{1}\begin{Bmatrix}\text{Fully}\\\text{tax}\\\text{exempt}\end{Bmatrix} + \eta_{t,2}\sum_{s=0}^{j}\max\left\{\overline{y}_{t,i} - cp_i/\widehat{E}_t[p_{t+s,i}],\ 0\right\}\right)$$

Tax Exemptions | Low Coupons | Flower | Kernel Ridge | Price Errors

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...time-varying wedges $(z_{t,i}, v_{t,i})$ with theory-consistent forms:

$$\begin{aligned} v_i^f(\theta_t, p_{i,t}) &:= f\Big(\text{moneyness, exercise period, interest rate volatility}\Big) \\ &= \exp\Big(\theta_{t,0} + \theta_{t,1} \max\{\overline{y}_{i,t} - \overline{y}_{i,t}^p, 0\}\Big) M_{i,t}^{\theta_{t,2}} \end{aligned}$$

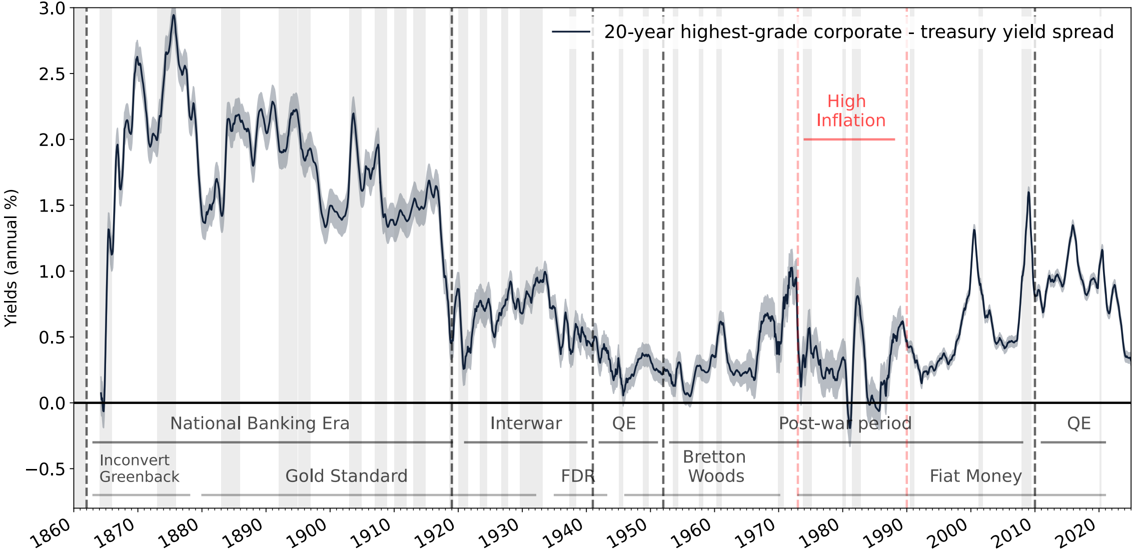
Identification: observe bonds with/without options + with/without tax advantages

- estimate $(\mathsf{q}_t, \eta_t, \theta_t)$ via non-parametric Kernel Ridge (Filipovic, Pelger, and Ye (2025))

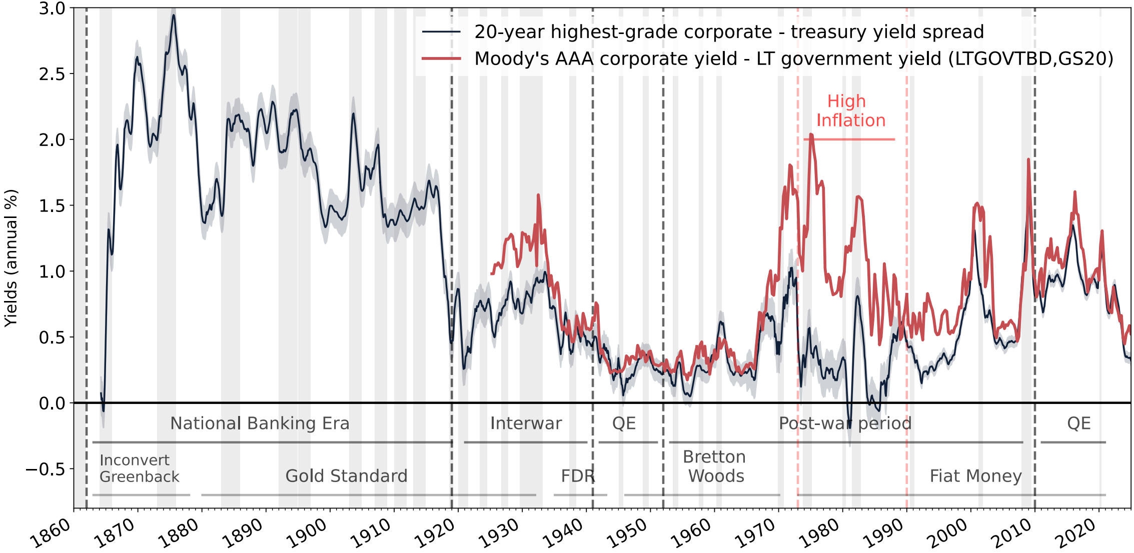
Tax Exemptions | Low Coupons | Flower | Kernel Ridge | Price Errors

What do we find?

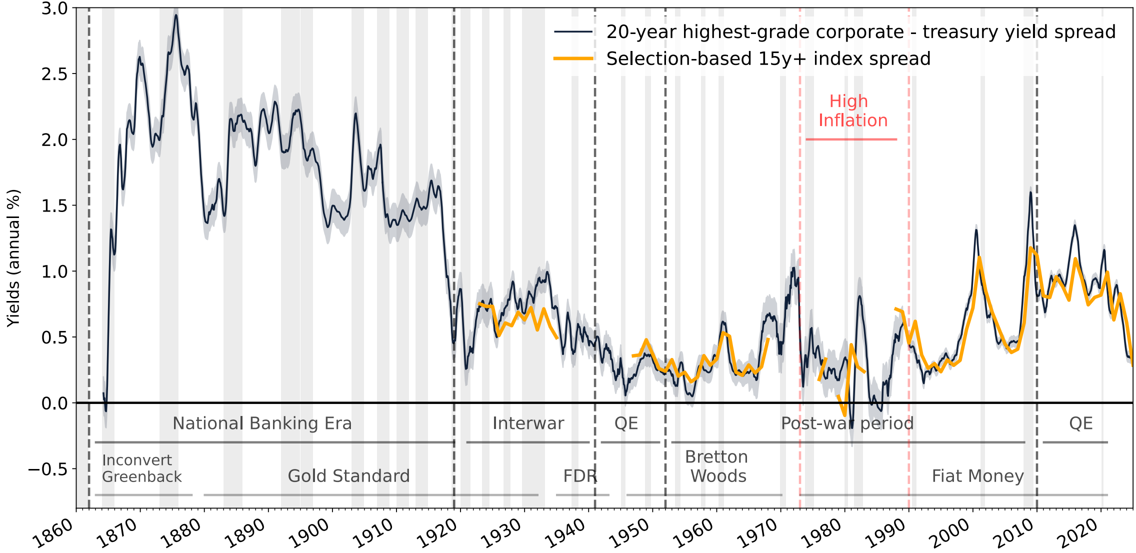
US Funding Advantage 1860-2024



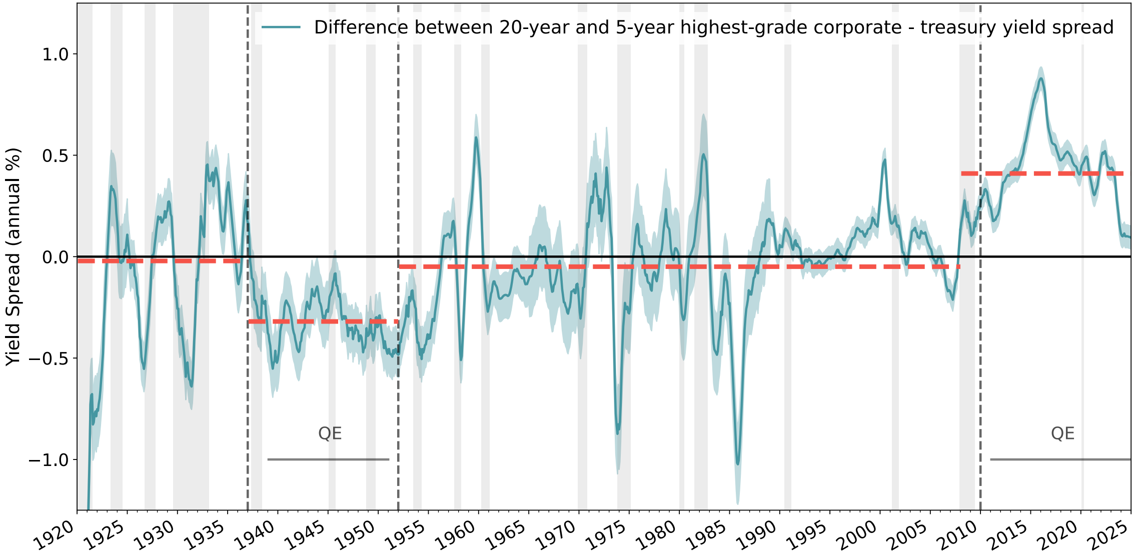
Commonly Used Measure Overestimates US Funding Advantage...



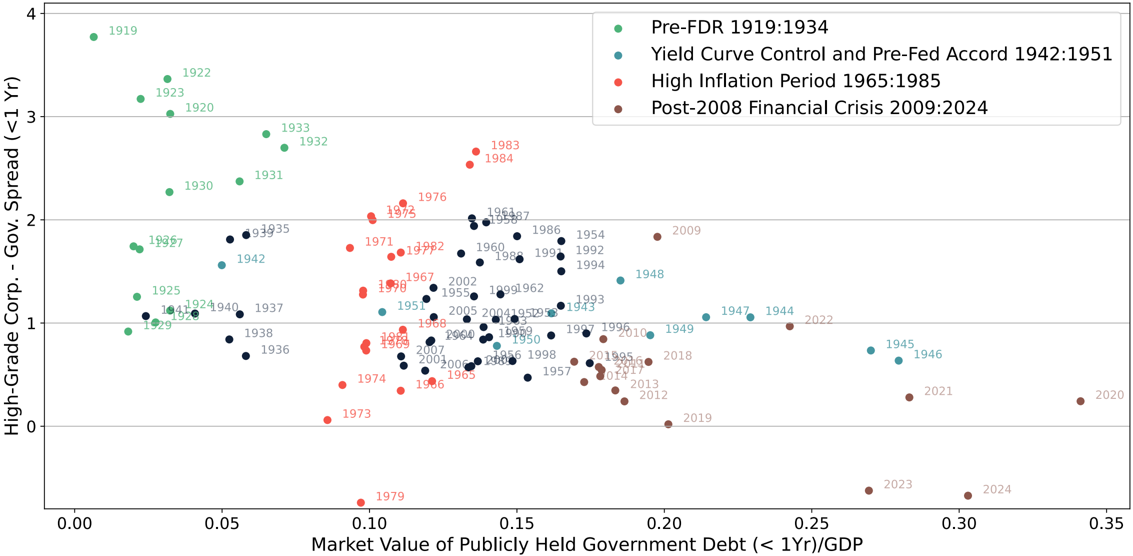
. . . Because It Includes Options and Tax Advantages



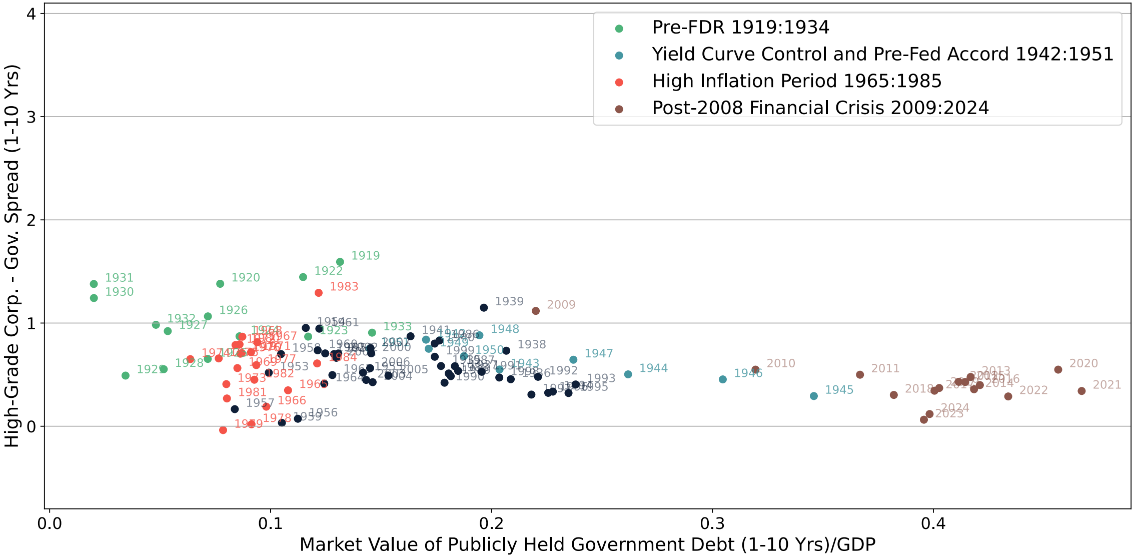
Term Structure Opens Up During QE Episodes



Comovement with Debt-to-GDP



Comovement with Debt-to-GDP . . . Only at the Short End



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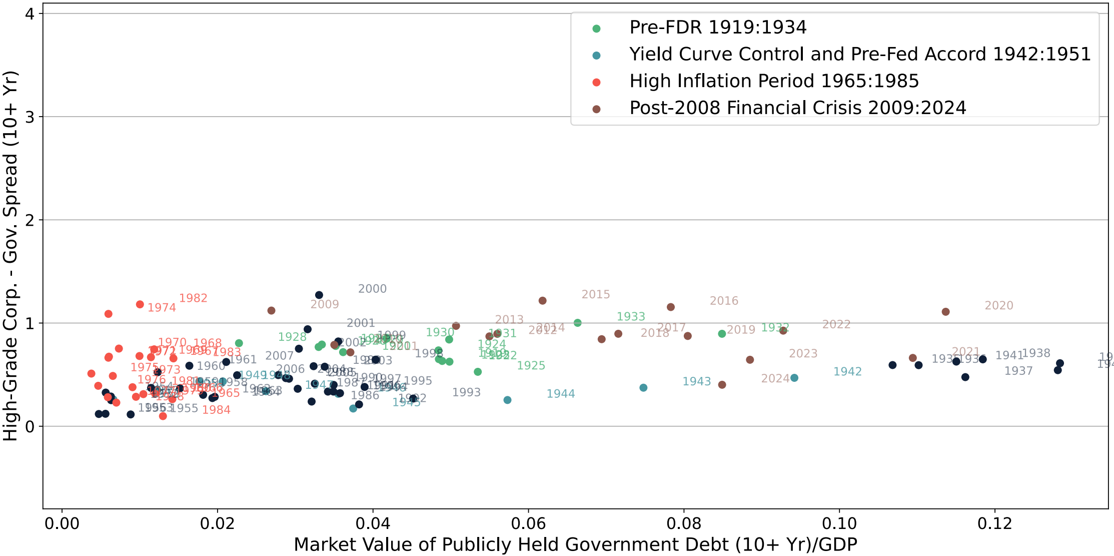


What Accounts For Changes in $\chi_t^{(j)}$?

Asset Pricing Model For The Funding Spread

- Let $\xi_{t,t+1}$ be the pricing kernel for corporate bonds satisfying the dynamic recursion:

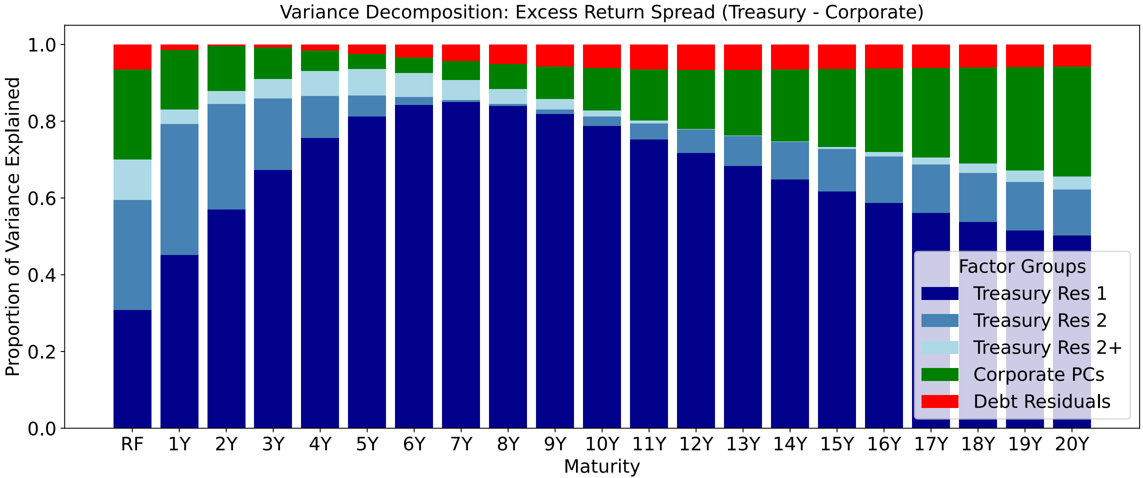
$$\tilde{q}_t^{(j)} = \mathbb{E}_t \left[\xi_{t,t+1} \tilde{q}_{t+1}^{(j-1)} \right], \quad j \geq 1, \quad \tilde{q}_t^{(0)} = 1$$

- Let $\Omega_{t,t+1}^{(j-1)}$ be the non-pecuniary component required to price j-maturity treasuries:

$$q_t^{(j)} = \mathbb{E}_t \left[\xi_{t,t+1} \Omega_{t,t+1}^{(j-1)} q_{t+1}^{(j-1)} \right], \quad j \geq 1, \quad q_t^{(0)} = 1$$

- Exponential Affine Model of $\xi_{t,t+1}$ and $\Omega_{t,t+1}^{(j)}$ with a state space $X_t := [\widetilde{x}_t, b_t, x_t]$:
  - $\widetilde{x}_t$ = Principal components spanning the corporate yield curves,
  - b_t = Principal components of the Treasury's *promised cash-flow matrix* relative to GDP
  - x_t = Residualised principal components of the Treasury yield curves

Treasury Risk Factors Explain a Lot of The Variance in The Spread



Takeaways

1. Tax advantages and embedded options have been misinterpreted as funding advantage

2. It looks like risk pricing matters . . . even for the US funding spread.

Thank You!