A Preferred-Habitat Model with the Corporate Sector

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Introduction

Motivation: Study relation between corporate and sovereign debt: Prices and quantities.

Investment and credit supply decisions made by firms and intermediaries.

▶ These entities cannot usually borrow at the Treasury rate: Credit spreads.
Credit risk factors explain modest fraction of variation in credit spreads.

Idea: Building on Chen, Collin-Dufresne & Goldstein (2008); He, Khorrami & Song (2022).

▶ Variation in credit spreads driven by risk premia rather than default probabilities.

▶ Intermediary factors explain substantial fraction of variation in credit spreads.

Contribution: Defaultable bonds in a preferred-habitat model. Endogenous habitat demand. Richer state dynamics. Arbitrageurs' portfolio choice across markets.

Environment

Arbitrageurs: Arbitrageurs choose holdings $x_{j,t}^{(\tau)}$, $j \in \{c, g\}$, $\tau \in (0, \infty)$ such that

$$\max \left[\mathbb{E}_t(dW_t) - \frac{a}{2}\mathbb{V}_t(dW_t)\right]$$

where wealth W_t evolves as

$$dW_t = \underbrace{\left(W_t - \int_0^\infty x_{g,t}^{(\tau)} d\tau - \int_0^\infty x_{c,t}^{(\tau)} d\tau\right) r_t dt}_{\text{Risk-free}} + \underbrace{\int_0^\infty x_{g,t}^{(\tau)} \frac{dP_{g,t}^{(\tau)}}{P_{g,t}^{(\tau)}} d\tau}_{\text{Government}} + \underbrace{\int_0^\infty x_{c,t}^{(\tau)} \left(\frac{dP_{c,t}^{(\tau)}}{P_{c,t}^{(\tau)}} - \lambda_t dt\right) d\tau}_{\text{Corporate}}$$

Habitat Investors: Demand for corporate and government bonds is

$$Z_{j,t}^{(\tau)} = -\alpha^j(\tau) \log P_{j,t}^{(\tau)} - \theta_0^j(\tau) - \sum_{k=1}^K \theta_k^j(\tau)\beta_{k,t}$$

Dynamics: Short term rate r_t, default intensity λ_t, demand shocks β_t. Stack in s_t such that

$$ds_t = -\Gamma\left(s_t - \bar{s}\right) dt + \Sigma dB_t$$

Prices and Risk Premia

Equilibrium Yields: Prices are exponentially-affine in s_t, $P_{j,t}^{(\tau)} = e^{-\left[A(\tau)^T s_t + C(\tau)\right]}$.

▶ Government bonds load on λ_t, as movements in default intensity affect risk premia.

Risk Prices: $K+2$ risk prices $\boldsymbol{\eta}_t$ driven by quantities of corporate **and** government bonds.

$$\boldsymbol{\eta}_t = a\Sigma^T \left[\sum_j \int_0^\infty x_{j,t}^{(\tau)} A_j(\tau) d\tau\right]$$

▶ Pricing kernel $\pi_t = u'(W_t)$ inherits dynamics dW_t. Arbitrageurs' portfolio prices all bonds.

Risk-neutral Dynamics: The (endogenous) risk-neutral dynamics of s_t are

$$ds_t = -\boldsymbol{M}^T \left(s_t - \bar{s}^{\mathbb{Q}}\right) dt + \Sigma dB_t^{\mathbb{Q}}$$

▶ The matrix $\boldsymbol{M}$ describes where risk adjustments come from.

$$\boldsymbol{M} = \Gamma^T - a \sum_j \int_0^\infty \Theta_j^T(\tau) A_j(\tau)^T - \alpha^j(\tau) A_j(\tau) A_j(\tau)^T d\tau \Sigma\Sigma^T$$

▶ Risk premia vary with λ_t and r_t if $a \neq 0$ and $\alpha^j(\tau) \neq 0$, as arbitrageurs' portfolio changes.

Summary and Main Results

Mechanism: Preferred-habitat model with a government and corporate sector.
▶ The same marginal investor prices Treasuries and defaultable bonds.

Proposition: Duration and credit risk prima jointly determined by the arbitrageurs' pricing kernel. Arbitrageurs induce dependence (under $\mathbb{Q}$) between the risk factors.

▶ Risk premia vary with corporate and Treasury quantities. Concentration of risks.

▶ Credit spreads move due to (i) changes in **credit quality** of corporate issuers (ii) **monetary policy** shocks and (iii) local and global **demand effects**.

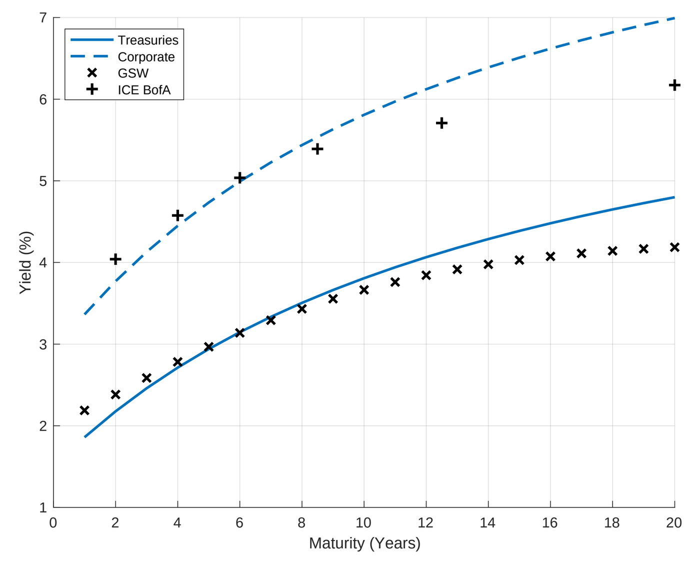
Policy Implications: Intermediaries' portfolio choice (rebalancing) affects monetary policy transmission. State-dependent impact of QE, contingent on assets purchased.

Calibration

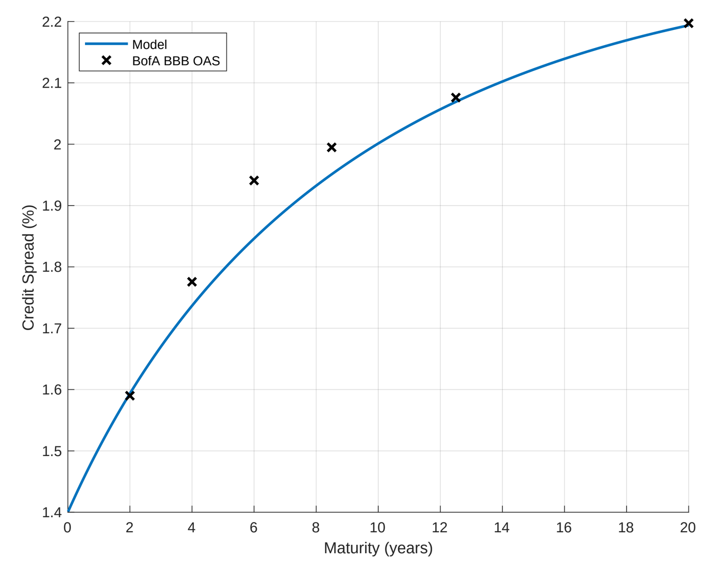
Calibration: $\widehat{\vartheta}$ minimizes squared deviation between model and empirical moments.

$$\widehat{\vartheta} = \arg\min L(\vartheta) \doteq \sum_i \left(\mathcal{M}_i(\vartheta) - m_i\right)^2$$

Fit: Good fit for yields. Replicate upward sloping term structure of credit spreads (BBB).



(a) Model-implied and observed yields $y_{j,t}^{(\tau)}$.



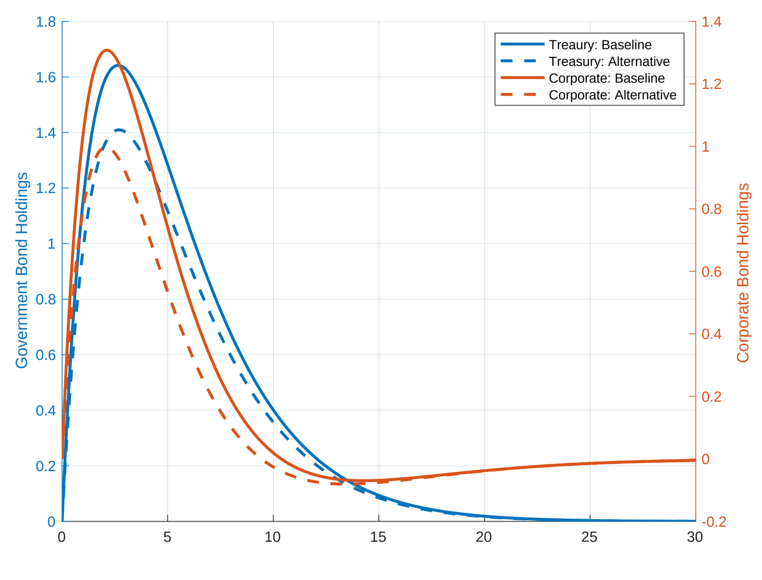
(b) Model-implied and observed BBB credit spreads.

Credit Spreads

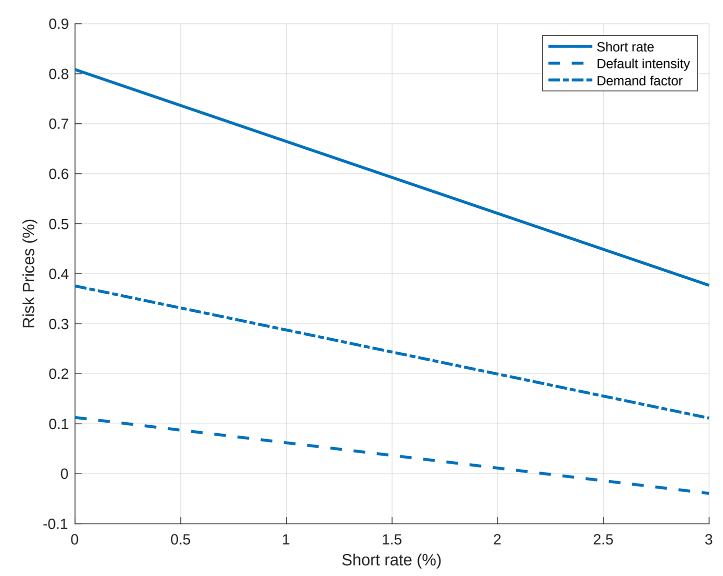
Credit Spreads: The credit spread $\mathcal{S}_t^{(\tau)}$ at maturity τ is

$$\mathcal{S}_t^{(\tau)} = \frac{1}{\tau}\left[A_{\mathcal{S},r}(\tau) r_t + A_{\mathcal{S},\lambda}(\tau)\lambda_t + \sum_{k=1}^K A_{\mathcal{S},k}(\tau)\beta_{k,t} + C_{\mathcal{S}}(\tau)\right]$$

1. Fluctuations in the credit quality of corporate issuers λ_t.
2. Monetary policy, through the short term rate r_t effect on risk premia.
3. Local and global demand effects, within and across markets.



(a) Arbitrageurs' net positions $x_{j,t}^{(\tau)}$.



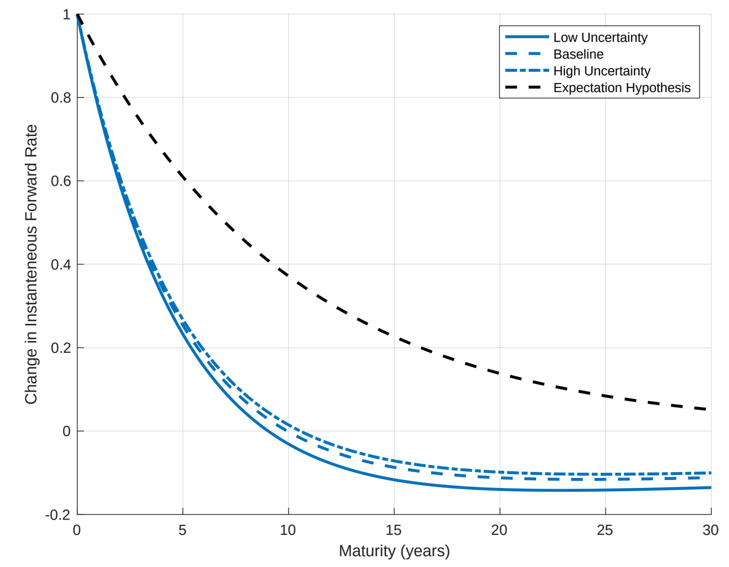
(b) Market prices of aggregate risk.

Policy Intervention

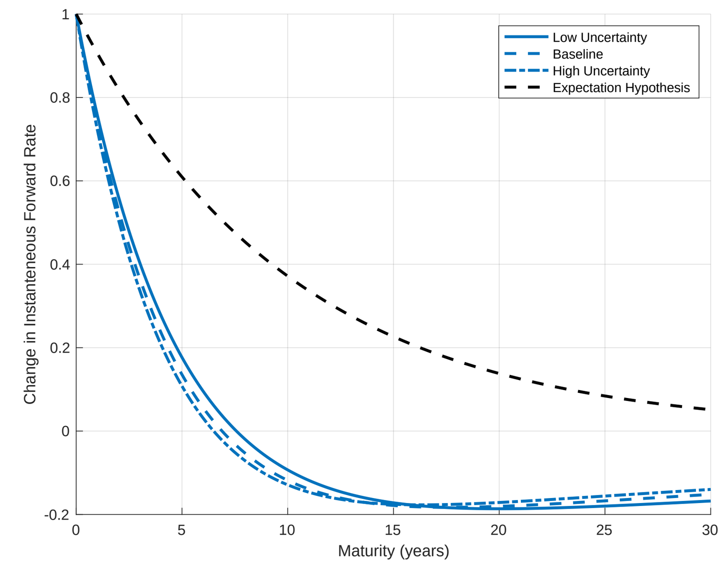
Monetary Policy Transmission: Arbitrageurs transmit shocks to r_t throughout the yield curves, but that requires compensation for exposure to duration and credit risk.

▶ Default uncertainty (σ_λ) affects transmission across both yield curves.

- Higher σ_λ: Corporate carry-trades become riskier $\implies$ **Weaker** transmission.
- Higher σ_λ: Treasuries hedge against default shocks $\implies$ **Stronger** transmission.



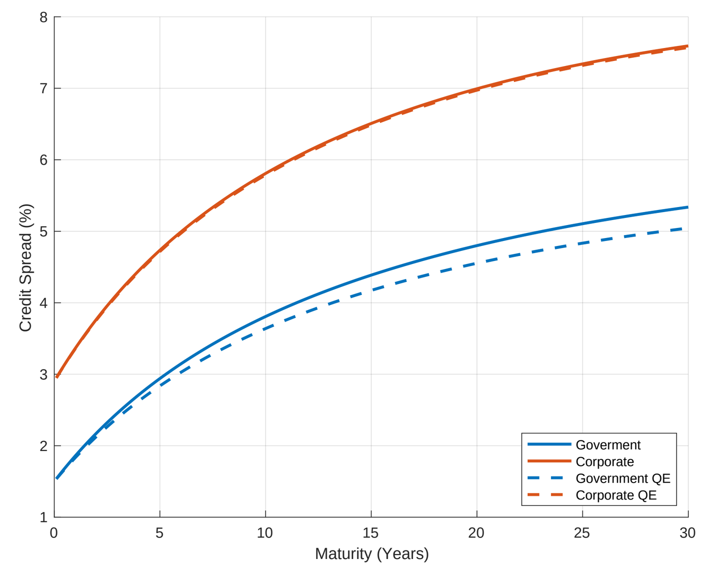
(a) Treasury forward rates response to r_t.



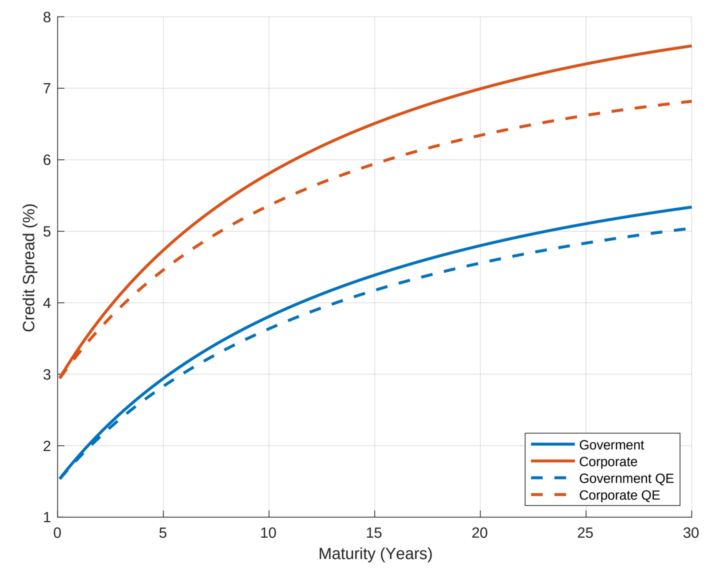
(b) Corporate forward rates response to r_t.

Quantitative Easing: Effect of QE interventions contingent on assets being purchased.

- Treasury-only QE lowers Treasury yields more than corporate yields: $\mathcal{S}_t^{(\tau)} \uparrow$.
- Corporate-only QE lowers corporate yields more than Treasury yields. $\mathcal{S}_t^{(\tau)} \downarrow$.



(a) Yield curves responses to $\Delta\theta_0^g(\tau) < 0$.



(b) Yield curves responses to $\Delta\theta_0^c(\tau) < 0$.

Revisiting Habitat Demand and State Dynamics

Discussion: Specifications of habitat demand and state dynamics have three shortcomings: (i) No guarantee that $\lambda_t > 0$ (ii) habitat demand insensitive to fundamentals (iii) exogenous price elasticity without microfoundation.

Solution: Endow habitat investors with CARA utility. Specify CIR dynamics for r_t and λ_t.

$$dr_t = \kappa_r(\bar{r} - r_t)dt + \sigma_r\sqrt{\lambda_t}dB_{r,t}$$

$$d\lambda_t = \kappa_\lambda(\bar{\lambda} - \lambda_t)dt + \sigma_\lambda\sqrt{\lambda_t}dB_{\lambda,t}$$

$$Z_{c,t}^{(\tau)} = \frac{\alpha(\tau)}{\lambda_t}\left[\mu_t^{(\tau)} - r_t - \lambda_t\right] + \frac{\alpha(\tau)}{\lambda_t}\beta_t + \theta(\tau) \quad : \quad \alpha(\tau) \propto \frac{1}{a^h\left[A_r(\tau)^2\sigma_r^2 + A_\lambda(\tau)^2\sigma_\lambda^2\right]}$$

Novelty: Preserve affine structure. Demand is microfounded. Identify habitat investors:

▶ Habitat investors as delegated asset managers: Portfolio choice with benchmarking.
▶ Habitat investors as P&Is: Duration matching between assets and liabilities.