Bond Supply and Excess Bond Returns

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Summary

- Representative agent models: bond supply is irrelevant for asset pricing.

- However... treasury buyback program, Operation Twist, Greenspan’s conundrum.
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**Question:** How does bond supply affect bond prices and bond risk premia? Why?

**Contribution:**
- Testable implications from a no-arbitrage “preferred habitat” model (Vayanos and Vila, 2007).
- Empirical evidence supporting the model’s predictions.
Summary: Testable Implications

1. Relative supply of long-term bonds ↑
   - Bond yields and premia for all maturities ↑.
   - The effect is more significant for long maturities.

2. Arbitrageur’s risk aversion ↑
   - Bond yields are more sensitive to the relative supply of long term bonds.
   - Stronger covariance between spreads and expected returns.
Theoretical Approach

Short-term rate:

\[ dr_t = \kappa_r (\bar{r} - r_t) dt + \sigma_r dB_t. \]

Bond returns:

\[ \frac{dP_t^{(\tau)}}{P_t^{(\tau)}} = \mu_t^{(\tau)} dt - A_t^{(\tau)} \sigma_r dB_t. \]

From the risk-averse arbitrageur’s portfolio choice problem:

\[ \mu_t^{(\tau)} - r_t = aA_r(\tau) \sigma_r^2 \int_0^T x_t^{(\tau)} A_r(\tau) d\tau. \]

Equilibrium condition:

\[ x_t^{(\tau)} = s_t^{(\tau)} \equiv \beta(\tau) + \alpha(\tau) \log P_t^{(\tau)}. \]

Time-varying expected excess returns if \( \alpha(\tau) \neq 0. \)
Theoretical Approach

Risk-averse arbitrageurs require a compensation for holding long-term bonds

\[ \downarrow \]

the compensation is determined by the exposure to short-term rate risk

\[ \downarrow \]

the exposure increases as the average maturity of bond supply increases.
One Factor Model: \( \tau y_t^{(\tau)} = C(\tau) + A_r(\tau) r_t \).

\[ s_t^{(\tau)} = \beta(\tau) - \alpha(\tau) \tau y_t^{(\tau)} \]

Baseline: \( \beta(\tau) \equiv 1, \alpha(\tau) \equiv 1 \). Experiment: \( \Delta \beta(2) = -1, \Delta \beta(10) = 1 \).
Elastic Bond Supply: $s_t^{(\tau)} = \beta(\tau) - \alpha(\tau)\tau y_t^{(\tau)}$

- What are the microfoundations?
Elastic Bond Supply: \( s^{(\tau)}_t = \beta(\tau) - \alpha(\tau)\tau y^{(\tau)}_t \)

- What are the microfoundations?
- What determines \( \alpha(\tau) \)?
  “Bonds in the utility function” (Krishnamurthy and Vissing-Jorgensen, 2007).

\[
\max_{\{c_t, c_{t+1}, \theta_t\}} u(c_t) + \beta u(c_{t+1}) + v(\theta_t)
\]

s.t.
\[
c_t + \theta_t \leq w_t, \\
c_{t+1} \leq w_{t+1} + \theta_t(1 + y_t).
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\]

\[
v'(\theta_t) = u'(c_t) - (1 + y_t)\beta u'(c_{t+1}).
\]

If \( v''(\theta_t) < 0 \Rightarrow \) downward sloping demand for bonds.
Two factor model: \( \tau y_t^{(\tau)} = C(\tau) + A_r(\tau)r_t + A_z(\tau)z_t. \)

\( z_t \sim \) fiscal policy shock.

\( s_t^{(\tau)} = \beta(\tau) + \gamma(\tau)z_t, \quad dz_t = -\kappa_z z_t dt + \sigma_z dB^z_t. \)

\[ \gamma(2) = -10, \quad \gamma(10) = 10 \]
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Persistent policy shocks increase the volatility of long-term yields.
Time-Varying Risk Aversion

- Comparative statics: low \( a \) vs. high \( a \).

![Graphs showing average yields, yield standard deviation, and excess returns over different maturities for different levels of risk aversion.]

- What are the implications from a model with endogenous time-variation in risk aversion, \( a = a(W) \)?
Final Comments

- Short-term rate.
  - Endogenous.
  - Coordination of fiscal and monetary policies.

- Optimal debt structure: what are the welfare implications of changes in debt maturity?

- Lesson: Bond supply can be a significant determinant of bond yield dynamics.