Quantitative Easing, the Repo Market, and the Term Structure of Interest Rates

Ruggero Jappelli (Warwick Business School)
Loriana Pelizzon (SAFE Goethe University)
Marti G. Subrahmanyam (NYU Stern)

Discussion: Walker Ray (LSE & CEPR)

EFA, August 2024

Motivation: QE Effects in Bond and Money Markets

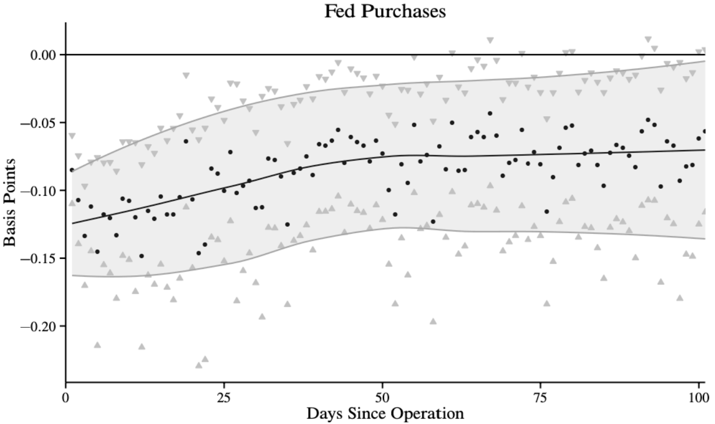
- Frictionless models of bond markets are insufficient for understanding balance sheet policies over the last 15 years
- Macro-finance literature on unconventional policy transmission:
  - Constrained intermediation [Gertler & Karadi (2012, 2015), Sims and Wu (2021), ...]
  - Departures from rational expectations [Farhi & Werning (2017), Iovino & Sergeyev (2023), ...]
  - Market segmentation and preferred habitat [Vayanos & Vila (2021), Greenwood & Vayanos (2014), ...]
- The preferred habitat tradition has gained in popularity, but mostly focused on simple bond markets

This paper:

- Extends the preferred habitat framework to model both bond and repo markets
- Takeaway: QE impact on repo rates is important (missing in standard habitat models)

Motivating Facts

- QE has large effects on spot yields and repo rates [D'Amico, Fan, & Kitsul (2018)]



Model Overview

- Continuum of zero-coupon bonds with maturity τ, with risk-free rate r_t (following exogenous stochastic process)
- Bonds are either "general" or "special" (as a function of investor demand and segmentation frictions). Bonds on special have overnight repo rate $r_t^{(\tau)}$
- Risk-averse arbitrageurs allocate wealth across all assets. Bond carry trades:
    - General bonds with funding cost r_t
    - Special bonds with repo rates $r_t^{(\tau)}$
- Specialized preferred habitat investors trade special bonds only of specific maturities
- Bond yields and repo rates determined in equilibrium:
    - Arbitrageurs satisfy their optimality conditions
    - Habitat investors are on their demand curve
    - Markets clear $\implies$ market price of risk reacts to demand (QE) shocks

Standard Preferred Habitat: Setup

- Suppose there are two types of bonds: "silver" and "gray": $P_t^{(\tau,s)}$ and $P_t^{(\tau,g)}$
- Habitat investors like silver bonds, dislike gray bonds

$$Z_t^{(\tau,s)} = -\alpha(\tau)\log P_t^{(\tau,s)} - \beta_t^{(s,\tau)}, \quad Z_t^{(\tau,g)} = 0$$

- Arbitrageurs with mean-variance preferences solve

$$\begin{aligned} &\max E_t(\mathrm{d}W_t) - \frac{a}{2} Var_t(\mathrm{d}W_t) \\ \text{s.t. } \mathrm{d}W_t =& W_t r_t \,\mathrm{d}t + \int_0^T X_t^{(\tau,s)} \left(\frac{\mathrm{d}P_t^{(\tau,s)}}{P_t^{(\tau,s)}} - r_t \,\mathrm{d}t \right) \mathrm{d}\tau + \int_0^T X_t^{(\tau,g)} \left(\frac{\mathrm{d}P_t^{(\tau,g)}}{P_t^{(\tau,g)}} - r_t \,\mathrm{d}t \right) \mathrm{d}\tau \end{aligned}$$

- Market clearing:

$$Z_t^{(\tau,s)} = -X_t^{(\tau,s)}, \quad Z_t^{(\tau,g)} = -X_t^{(\tau,g)} = 0$$

- Risk factors: short rate r_t and demand shocks $\beta_t^{(\tau)}$

Standard Preferred Habitat: Equilibrium

- How do bond prices evolve in equilibrium?

$$\frac{\mathrm{d}P_t^{(i,\tau)}}{P_t^{(i,\tau)}} = \mu_t^{(i,\tau)}\,\mathrm{d}t + \sigma_t^{(i,\tau)}\,\mathrm{d}B_t\,, \quad i = s, g$$

- Endogenous drift $\mu_t^{(i,\tau)}$ and diffusion $\sigma_t^{(i,\tau)}$ for $i = s, g$ determined by:

$$\begin{aligned} \mu_t^{(i,\tau)} - r_t &= \sigma_t^{(i,\tau)}\Lambda_t^\top \\ \Lambda_t &= a\int_0^T \left[X_t^{(s,\tau)}\sigma_t^{(s,\tau)} + X_t^{(g,\tau)}\sigma_t^{(g,\tau)}\right]\mathrm{d}\tau \\ &= a\int_0^T \left(\alpha(\tau)\log P_t^{(\tau,s)} + \beta_t^{(s,\tau)}\right)\sigma_t^{(s,\tau)}\,\mathrm{d}\tau \end{aligned}$$

- Demand shocks $\beta_t^{(s,\tau)}$ affect *both* bonds
- Why? The (global) market price of risk Λ_t is equivalent across both types of bonds

$$\Longrightarrow \; P_t^{(\tau,s)} = P_t^{(\tau,g)}$$

Preferred Habitat and Segmentation

- Because arbitrage is global, demand shocks in one market have spillover effects through the re-pricing of risk in other markets
    - With “silver” and “gray” bonds, the pass-through is one-to-one
    - In more realistic situations, the spillovers depend on the equilibrium loadings on joint sources of risk
- But preferred habitat models still feature some kinds of segmentation in equilibrium
    - Localization across maturities [Vayanos & Vila (2021), Ray, Droste, & Gorodnichenko (2024)]
    - Imperfect spillovers to risky assets [Ray, Droste, & Gorodnichenko (2024)]
    - Spillovers across currencies [Gourinchas, Ray, & Vayanos (2024)]
- However, other types of more extreme segmentation cannot be captured
    - On/off the run
    - Covered interest parity
- Even with extreme segmentation due to habitat forces, strict no-arbitrage conditions imposed by arbitrageurs imply silver and green bonds have the same price

Comments and Suggestions

- Extending the preferred habitat framework to capture additional sources of segmentation is crucial! Great contribution
- Spell out very precisely what additional frictions your model imposes
  - Segmentation via habitat demand alone is not necessarily enough
- Discuss and contrast with the local/global spillovers in the model which are inherited from the preferred habitat setup