Inelastic Markets: The Demand and Supply of Risky Sovereign Bonds

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Motivation

- EMEs rely heavily on foreign funding
- Standard representative agent textbook models are insufficient for making sense of the ("inelastic") behavior observed by investors in international markets
- Empirical question: how to estimate demand elasticities for risky sovereign bonds?
- Ideal experiment: exogenous shift in supply, leaving all other aspects of the economy unchanged

Identification Concerns

- Theoretical difficulty: risky bond prices are intrinsically linked to default risk
  - Bond supply decisions are endogenous
  - Default risk is imperfectly observed
  - Default is an endogenous decision, jointly determined along with bond prices

- Empirical strategy: use index rebalancings to identify exogenous shifts in demand, which act as shifts in residual supply

- But even if supply is fixed, the decision to default may change $\implies$ disentangle these effects through a rich sovereign default model

My View: Preferred Habitat Framework

- Vayanos-Vila preferred habitat model: bond prices determined by interaction of arbitrageurs and preferred habitat investors
- Arbitrageurs with mean-variance preferences

$$\max E_t(\mathrm{d}W_t) - \frac{a}{2} Var_t(\mathrm{d}W_t)$$

$$\text{s.t. } \mathrm{d}W_t = W_t i_t \,\mathrm{d}t + \int_0^T X_t^{(\tau)} \left(\frac{\mathrm{d}P_t^{(\tau)}}{P_t^{(\tau)}} - i_t \,\mathrm{d}t \right) \mathrm{d}\tau$$

- Preferred habitat investors and demand for bonds of maturity τ:

$$Z_t^{(\tau)} = -\alpha(\tau) \log P_t^{(\tau)} + \theta(\tau)\beta_t$$

- Habitat demand elasticity $\alpha(\tau)$ and demand shifter β_t ($\uparrow \implies$ increase in demand)

Preferred Habitat: Equilibrium

- How do bond prices evolve in equilibrium?

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

- Endogenous drift $\mu_t^{(\tau)}$ and diffusion $\sigma_t^{(\tau)}$
- Determined by risk factors $\mathrm{d}B_t$ and arbitrageur optimality conditions:

$$\mu_t^{(\tau)} - i_t = \sigma_t^{(\tau)}\Lambda_t^\top$$

$$\Lambda_t = a\int_0^T X_t^{(\tau)}\sigma_t^{(\tau)}\,\mathrm{d}\tau$$

- Market clearing: $X_t^{(\tau)} + Z_t^{(\tau)} = S_t^{(\tau)}$

Preferred Habitat and Demand Shifts

- Textbook view: exogenous shifts in demand (β_t) have no effect on prices
  - "Markets are elastic"
- Under what conditions will this prediction break?
- Generally, away from risk neutrality ($a > 0$) $\implies$ non-zero market price of risk Λ_t
- Market clearing implies Λ_t itself depends on demand from habitat investors. Hence:
  - Bonds subject to duration risk ($\tau > 0$) will react
  - Bonds subject to default risk will react
- In contrast to textbook view, preferred habitat models generally predict that increases in demand push up prices:

$$\frac{\partial P_t^{(\tau)}}{\partial \beta_t} > 0$$

  - "Markets are inelastic"

Preferred Habitat and (Endogenous) Default

- What if fiscal authority chooses supply of bonds $S_t^{(\tau)}$ and default decision D_{t+s}?
- When demand shocks affect price, $\uparrow \beta_t \implies$ fiscal authority can fund deficits more cheaply
- Whether this causes the fiscal authority to increase or decrease supply is unclear
  - Changes in supply $S_t^{(\tau)}$ will mechanically affect price reaction through market clearing
  - If $\frac{\partial Pr[D_{t+s}]}{\partial \beta_t} < 0$, then the price effects are amplified
  - If $\frac{\partial Pr[D_{t+s}]}{\partial \beta_t} > 0$, then the price effects are mitigated
  - This is true even for short-term bonds ($\tau \to 0$)
- Even with a good measure of demand shifts β_t, cannot easily recover demand elasticity
- Key difficulty: exogenous shifts in demand still lead to endogenous shifts in expected payoffs

A Sovereign Default Model with (Endogenous) Default

- Adding (endogenous) default to preferred habitat models is extremely complicated
  - See Costain et al (2023) for some progress adding default into preferred habitat framework
- Setup: fiscal authority maximizes lifetime discounted utility of representative consumer: smooths consumption by issuing bonds B_t
- Output y_t is exogenous and stochastic
- Limited commitment: can choose to default on stock of debt, implying exogenous output loss and temporary exclusion from debt markets
- Novelty: international investors are either “active” or “passive” depending on preferences for tracking a benchmark index

Simplifying Model Assumptions

- Drop the entire term structure: one bond with probabilistic maturity
- Benchmark trackers demand T_t is subject to exogenous shocks (act like "preferred habitat" investors)
- "Active" investors price bonds with "wedge" in the Euler equation, capturing demand (in)elasticity:

$$q_t = \beta^* E_t \left[R_{t+1}\right] \Psi(y_t, T_t, B_t)$$
$$R_{t+1} \equiv (1 - d_t)(1 - \lambda)(\nu + q_{t+1})$$
$$\log \Psi(y_t, T_t, B_t) \equiv -\kappa_0 \frac{Var_t \left[R_{t+1}\right]}{E_t \left[R_{t+1}\right]} (B_t - T_t - \kappa_1)$$

  - More akin to "(in)convenience yield" though it depends on the riskiness of default
- These assumptions allow for the model to be represented recursively, and to jointly solve for bond prices and the optimal supply/default decisions

Empirical Strategy

- First, need to identify exogenous shifts in passive demand
- Approach: index rebalancing
  - J.P. Morgan EMBI Global Diversified: rebalancings take place end-of-month, inducing changes in passive portfolios tracking the index
- Construct Flows Implied by the Rebalancings (FIR):

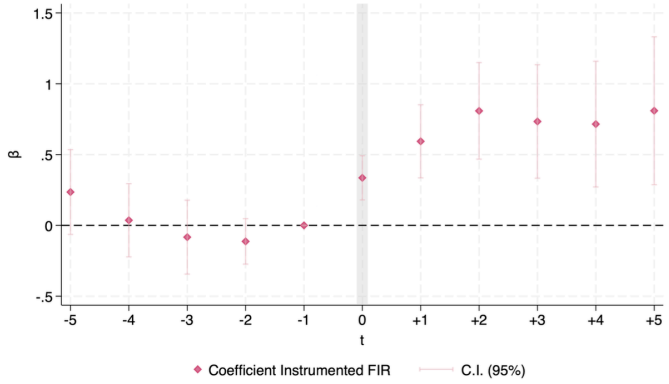
$$FIR_{c,t} \equiv \frac{(w_{c,t} - w_{c,t}^{BH})A_t}{q_{c,t-1}B_{c,t-1} - w_{c,t-1}A_{t_1}}$$

$$w_{c,t} = \frac{q_{c,t}f_{c,t}B_{c,t}}{q_t, l_t}, \quad w_{c,t}^{BH} = w_{c,t-1}\frac{q_{c,t}/q_{c,t-1}}{q_t/q_{t-1}}$$

  - $w_{c,t}$: benchmark weight for country c
  - $f_{c,t}$: face-value share of country c tracked by index
  - $w_{c,t}^{BH}$: "buy and hold" weight – the benchmark weight for country c had the index composition had not changed
  - A_t: assets under management of passive investors tracking the index

Empirical Results

- Changes in $FIR_{c,t}$ may not be independent of fundamentals, as it depends directly on issuance today and is mechanically correlated with past bond price changes
- Instrument $FIR_{c,t}$ with a synthetic index based only on face value (not market value) of countries with no new bond issuance
- Main IV results: 1ppt increase in $FIR_{c,t} \implies$ 65 bp increase in bond returns



Empirical Decomposition

- Consistent with the mechanisms of the model, 1ppt increase in $FIR_{c,t} \implies$ 2.9 bp decrease in CDS spreads
- Calibrated version of the model

Calibration of the Model

Panel A: Fixed Parameters			Panel B: Calibrated Parameters		
Param.	Description	Value	Param.	Description	Value
γ	Risk aversion	2.00	β	Discount rate	0.947
r	Risk-free interest rate	0.01	$\bar{d}_0$	Default cost—level	-0.24
λ	Debt maturity	0.05	$\bar{d}_1$	Default cost—curvature	0.29
z	Debt services	0.03	κ_0	Downward sloping demand	50.0
θ	Reentry probability	0.0385	κ_1	Downward sloping demand	0.54
ρ_y	Output, autocorrelation	0.93			
σ_y	Output, shock volatility	0.02			

- Implies that the repayment channel can lead to somewhat sizeable amplification of price effects
- On average: explains one third of observed price response

Comments

1. Demand shocks and endogenous payoff risk: more general than just sovereign default!

2. Duration risk? Other risk factors? Including “safe” bonds? Correlated default risk and “spillovers”?

3. Mechanism: amplification depends on (in)elasticity; default risk is lower since fiscal authority cannot issue so many bonds. But what about higher risk premia?

4. Passive investors care about tracking error, not holdings *per se*

5. Fiscal authorities strategically choose issuance to be included in index?

Concluding Remarks

- Great paper!
- Welcome addition to the broad “inelastic markets” literature
- Endogenous interaction between demand shocks and payoff risk is a great insight
- Would love to see more digging into the mechanisms of the model
- Some modeling/empirical robustness related to the context of sovereign index inclusion