Intermediation Frictions in Incomplete Markets

ECON 810A - Project

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Secondary Treasury Market in COVID-19 Crisis

- The U.S. Treasury market - widely considered the world's deepest and most liquid financial market - is intermediated by large U.S. banks acting as broker-dealers.

- In March 2020, concerns about COVID-19 prompted many large investors (e.g., hedge funds and foreign governments) to liquidate their holdings of Treasuries.

- Intermediaries in the secondary market for U.S. Treasuries were overwhelmed (Duffie 2020).
  - Yield rose sharply.
  - Space on the balance sheet of broker-dealers for warehousing additional trades diminished.
  - Bid-offer spreads widened.
  - Settlement failures increased.

- Aggressive intervention by the Fed restored market liquidity.

Sources of Intermediation Frictions in Treasury Market

- This episode raised questions about the functioning of the secondary Treasury market, doubts about the safe-haven status of Treasuries, and calls for reform.
- The growth in U.S. government debt outstanding may have outstripped the ability of broker-dealers to effective intermediate the secondary Treasury market.
- Broker-dealers pointed to post-financial-crisis bank regulatory reform - in particular, the Supplementary Leverage Ratio requirement - as the source of the disruption.
- **Research Question:** How does the intermediation of illiquid assets affect portfolio choice?

Multiple Assets

- To explore this question, I turned to Bewley-style models with multiple assets.
- In the baseline Bewley model (and models covered in ECON 810A), household can only invest in risk-free bonds.
- In reality, households invest in many assets, including cash, real estate, stocks, bonds, etc.
- Optimal portfolio choices change with wealth and age (Brandsas 2020).
- The curse of dimensionality quickly hampers rich portfolio choice problems in Bewley-style model.

Literature Review - Kaplan and Violante (2014)

- Empirical literature finds that households spend about 25 percent of tax rebates on consumption immediately inconsistent with prediction from single-asset Bewley.
- Build a Bewley-style model with two assets: low return liquid asset and high return illiquid asset.
- HHs must pay fixed cost to adjust illiquid asset holding.
- Many HHs are optimally "wealthy hand-to-mouth" (i.e., hold very little liquid assets despite sizable amount of illiquid assets).
- Wealthy hand-to-mouth HHs have high MPC and rationalize empirical motivation.

Literature Review - Rios-Rull and Sanchez-Marcos (2008)

- Build a Bewley-style model with financial assets and nonfinancial assets.
- Financial assets are perfectly divisible and costless to buy or sell.
- Nonfinancial assets are bulky and indivisible and have transaction costs.
- Label the nonfinancial assets as “houses”.
- Find reasonable lifecycle pattern: HHs accumulate some financial assets for downpayment, then buy a small house, then buy a large house.
- HHs pay a fixed cost to trade their house.

Environment

- Two agents:
  - Households.
  - Intermediaries.

- Two assets:
  - Cash/consumption good without no return.
  - Long-term illiquid bonds with return r.
  - Each period fraction $\delta \in (0, 1)$ of long-term bonds mature into cash each period.

- Households and intermediaries randomly meet:
  - If an household and an intermediary meet, they can trade long-term bonds.
  - Nash bargain over price with $\theta \in (0, 1)$ being the bargaining power of the household. Let $P(b)$ be the price for b long-term bonds.
  - HHs can always buy long-term bonds at price $q = \frac{1}{1+r}$ (i.e. "on-the-run" Treasuries), but can only sell them through an intermediary (e.g. "off-the-run" Treasuries).

Model Timing

- Exogenous labor income is drawn.
- Long-term bonds return r.
- Households and intermediaries meet.
- Matched households decide the LT bonds to sell.
- Households and intermediaries bargain.
- Value functions are evaluated.
- Consumption good is eaten.

Intermediaries

- Intermediaries are infinitely lived and risk-neutral.
- Discount factor β_I.
- They have "deep pocket".
- They consume long-term bonds as they mature.
- Their value for buying b long-term bonds from a HH:

$$W(b) = \underbrace{\delta b}_{\text{consumption in period of trade}} + \underbrace{\beta_I(1-\delta)\delta b}_{\text{consumption one period after trade}} + \underbrace{\beta_I^2(1-\delta)^2\delta b}_{\text{consumption two periods after trade}} + \ldots$$

$$= \frac{\delta b}{1-\beta_I(1-\delta)}$$

Households

- Live for T periods.
- Risk averse.
- Discount factor β.
- Exogenous Markov process for labor earnings y.
- Make consumption-savings choice with zero borrowing limit.
- Hold cash a.
- Hold long-term illiquid bonds b.
- Meet an intermediaries with probability γ and can liquidate fraction ℓ of their long-term illiquid bonds.
- The HHs value function is:

$$E[V_t(a,b)] \equiv \underbrace{\gamma E[V_t^M(a',b')]}_{\text{value if matched}} + \underbrace{(1-\gamma)E[V_t^U(a',b')]}_{\text{value if matched}}$$

Unmatched Households Value Function

- A HH that is not matched with an intermediary choose consumption c, cash tomorrow a', and purchase new long-term bonds $\tilde{b}'$ to maximize utility:

$$V_t^U(a,b) = \max_{c,a',\tilde{b}'} \left\{ \underbrace{u(c)}_{\text{instantaneous value}} + \underbrace{\beta E[V_{t+1}(a',b')]}_{\text{continuation value}} \right\}$$

subject to

$$c + a' + \underbrace{q\tilde{b}'}_{\text{spending on new LT bonds}} = y + a + \underbrace{\delta b(1+r)}_{\text{matured LT bonds}}$$

$$b' = \underbrace{\tilde{b}'}_{\text{new LT bonds}} + \underbrace{(1-\delta)b(1+r)}_{\text{unmatured LT bonds}}$$

$$a', \tilde{b}' \geq 0$$

Matched Households Value Function

- A HH that is matched with an intermediary can choose either to buy LT bonds (same problem as unmatched) or sell LT bonds:

$$V_t^M(a,b) = \max_{c,a',\ell} \left\{ \underbrace{V_t^U(a,b)}_{\text{buying LT bonds}}, \underbrace{u(c) + \beta E[V_{t+1}(a',b')]}_{\text{selling LT bonds}} \right\}$$

subject to

$$c + a' = y + a + \delta b(1+r) + \underbrace{P(\ell(1-\delta)b(1+r))}_{\text{proceeds from the sale of LT bonds}}$$

$$b' = \underbrace{(1-\ell)(1-\delta)b(1+r)}_{\text{unsold, unmatured LT bonds}}$$

$$a' \geq 0$$

$$\ell \in [0,1]$$

Nash Bargaining

- The matched household has $\hat{b} \equiv \ell(1-\delta)b(1+r)$ LT bonds to sell.
- The outside option for the household is the unmatched value function: $V_t^U(a,b)$.
- The outside option for the intermediary is zero.
- Nash bargaining solves:

$$\max_{P(\hat{b})} [P(\hat{b}) - V_t^U(a,b)]^\theta [W(\hat{b}) - P(\hat{b})]^{1-\theta}$$

$$\implies P(\hat{b}) = \theta V_t^U(a,b) + (1-\theta)W(\hat{b})$$

References

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