Mutual Fund Liquidity Transformation and Reverse Flight to Liquidity

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Motivation

- Covid-19 crisis: traditionally liquid assets became strained from unusually high selling pressures
  - e.g. Haddad, Moreira, and Muir 20; Duffie 20; He, Nagel, and Song 20; Kargar et al. 20
  - Reverse flight to liquidity

- Conventional wisdom: flight to liquidity during market distress
  - high buying pressure for liquid assets
Heightened Selling Pressure in Treasury Market

Treasury discount ↓

= Interest swap yield + Treasury CDS - Treasury yield ↑
Motivation

- The conventional negative correlation between Treasury yield and VIX is reversed in Covid-19 crisis

**Figure:** Treasury Yields and VIX in Jan-Apr 2020
Motivation

- Conventional wisdom: flight to liquidity

**Figure**: Treasury Yields and VIX in Aug-Sep 2008
Heightened Selling Pressure in IG Corp Bonds

CDS-bond basis ↓

= corporate bond CDS spread ↑ - corporate bond spread ↑↑↑
Motivation

The market for U.S. Treasuries has long been viewed as the world’s most liquid financial market. That presumption was questioned...

“Still the World’s Safe Haven?” Darrel Duffie
What caused the reverse flight to liquidity phenomenon?

- Bond mutual funds
  - Liquidity transformation → large redemption in crisis
  - Pecking order of liquidation → concentrated sale of liquid assets

Implications of the reverse flight to liquidity phenomenon

- With more liquidity transformation by bond funds
- Liquid assets may experience more volatility
- May steer central banks towards providing liquidity backstops to bond funds
What caused the reverse flight to liquidity phenomenon?

- **Bond mutual funds**
  - Liquidity transformation $\rightarrow$ large redemption in crisis
  - Pecking order of liquidation $\rightarrow$ concentrated sale of liquid assets

- **Implications of the reverse flight to liquidity phenomenon**
  - With more liquidity transformation by bond funds
  - Liquid assets may experience more volatility
  - May steer central banks towards providing liquidity backstops to bond funds
1. Disruptions in liquid asset market during Covid-19
   ▶ Haddad, Moreira, and Muir 20 and Kargar et al. 20: document debt market disruptions
   ▶ Duffie 20, He, Nagel, and Song 20: dealer constraints
   ▶ Falato, Goldstein and Hortacsu 20: fragility in fund flows
   ▶ A new explanation for heightened selling pressure in liquid assets through mutual fund liquidity transformation

2. Financial intermediation by banks versus non-banks
   ▶ E.g. Diamond and Dybvig 83, Goldstein and Pozner 05, Hanson, Shleifer, Stein, and Vishny 15, Ma, Xiao, and Zeng 20
   ▶ Asset-side implications of liquidity provision by mutual funds versus banks

3. Mutual fund flows and financial stability
   ▶ E.g. Chen, Goldstein, and Jiang 10, Goldstein, Jiang, and Ng 17, Chernenko and Sunderam 17, Jiang, Li, and Wang 20
   ▶ ↑ fund asset illiquidity → ↑ potential for liquid asset market disruptions
Roadmap

1. Aggregate Trends
2. Empirical Evidence
Bond Fund Growth

- Bond mutual funds have become increasingly important...

**Total Assets**

**Fund Shares/Deposits**

- AUM: $1 trillion to $4.5 trillion from 2007 to 2019
- Shares/Deposits: 0.22 to 0.35 from 2007 to 2019
Like banks, bond funds provide liquidity by issuing liquid claims backed by (mostly) illiquid assets.

Liquidation transformation may lead to first-mover advantage, e.g., market value drops from 100 to 80 but NAV is still at 90.
Like banks, bond funds provide liquidity by issuing liquid claims backed by (mostly) illiquid assets.

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Like banks, bond funds provide liquidity by issuing liquid claims backed by (mostly) illiquid assets.

Liquidity transformation may lead to first-mover advantage, e.g. Market value drops from 100 to 80 but NAV is still at 90.
Pronounced Outflows at Bond Funds

- Bond funds suffered an unprecedented $264 billion outflows in March, 2020

- Equity funds suffered much smaller outflows → liquidity transformation must matter...
Higher Asset Illiquidity, Larger Outflows

...also evident from more pronounced outflows at more illiquid bond funds

![Chart showing cumulative fund flows (% AUM) for different asset classes from January to May 2020. The chart includes lines for Government, Investment grade, High yield, and Loan assets, with notable declines in fund flows for the latter two categories in April and May.]
Concentrated Sales of Liquid Assets

Liquid assets were disproportionately liquidated
Large Aggregate Liquidations

Aggregate Treasury liquidations by open-end funds amounted to $236 billion in 2020Q1
Empirical Evidence
Liquidity Transformation and Outflows: Fund-level Evidence

Figure: Fund Outflows versus Fund Liquidity Provision Index (LPI)

▶ LPI = per dollar expected contract payment - direct liquidation value assets (Ma, Xiao and Zeng 19)
Cross-section Determinants of Outflows

- High asset illiquidity → more outflows

<table>
<thead>
<tr>
<th></th>
<th>(1) Outflow</th>
<th>(2) Outflow</th>
<th>(3) Outflow</th>
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<tr>
<td>Fund illiquidity</td>
<td>0.546***</td>
<td>0.545***</td>
<td>0.537***</td>
<td>0.564***</td>
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<td></td>
<td>[0.092]</td>
<td>[0.092]</td>
<td>[0.094]</td>
<td>[0.096]</td>
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<td>Institutional</td>
<td>0.137</td>
<td>0.135</td>
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<td></td>
<td>[0.203]</td>
<td>[0.203]</td>
<td>[0.204]</td>
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<td>Index fund</td>
<td></td>
<td>-0.259</td>
<td>-0.614</td>
<td></td>
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<td></td>
<td></td>
<td>[0.595]</td>
<td>[0.602]</td>
<td></td>
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<tr>
<td>Fund objective F.E.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
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<td>Observations</td>
<td>6,355</td>
<td>6,355</td>
<td>6,355</td>
<td>6,355</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.005</td>
<td>0.005</td>
<td>0.005</td>
<td>0.021</td>
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</table>

- Other controls: yield, return volatility, expense ratio, turnover ratio
What did funds sell when they face redemption?
Reverse Flight to Liquidity: Pecking Order

Liquidations_{i,j} = \beta \text{Fund Outflow}_j + \gamma X_i + \theta X_j + \epsilon_{i,j}

Figure: Liquidation to Redemption Sensitivity by Bond Rating
Pecking Order based on Relative Liquidity: Measure

$$\text{Rank}_{i,j} = \sum_{i'} \text{Share}_{i',j} \times 1[\text{Liquidity}_i > \text{Liquidity}_{i'}]$$

- Rank$_{i,j}$ is defined as the sum of shares of assets held by fund $j$ that are less liquid than bond $i$
Pecking Order based on Relative Liquidity: An Example

- Compare two identical Treasury bonds held by (1) a Treasury fund and (2) a corporate bond fund
- Treasury bond fund has more liquid assets → ranked lower in the pecking order
- Corporate bond fund has more illiquid assets → ranked higher in the pecking order
- Corporate bond fund is more likely to sell the Treasury bond for the same redemption
Reverse Flight to Liquidity: Pecking Order

\[ \text{Liquidation}_{i,j} = \beta \text{Outflows}_j \times \text{Rank}_{i,j} + \gamma X_{i,j} + \epsilon_{i,j} \]

<table>
<thead>
<tr>
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<th>(1) Open-end All</th>
<th>(2) Open-end Active</th>
<th>(3) Open-end Passive</th>
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<tr>
<td>Outflows</td>
<td>0.268***</td>
<td>0.208***</td>
<td>0.224***</td>
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<tr>
<td></td>
<td>[0.016]</td>
<td>[0.024]</td>
<td>[0.035]</td>
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<td>Outflows*Rank</td>
<td>0.198***</td>
<td>0.386***</td>
<td>0.082</td>
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<tr>
<td></td>
<td>[0.047]</td>
<td>[0.060]</td>
<td>[0.151]</td>
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<td>Bond F.E.</td>
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<td>Yes</td>
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<td>Fund objective F.E.</td>
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<td>Observations</td>
<td>79,050</td>
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<td>39,410</td>
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<td>Adj. R-squared</td>
<td>0.067</td>
<td>0.071</td>
<td>0.050</td>
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</table>
Did funds’ selling pressure affect prices of liquid assets?
Bond yields by liquidation rank

**Figure:** Pecking order of liquidation and bond yield
Impact on Asset Prices

Imputed Outflow_{i,t} = \sum_j \text{Fund outflow}_{j,t} \times \frac{\text{Holding}_{i,j,2019Q4}}{\sum_k \text{Holding}_{i,k,2019Q4}}

Return_{i,t} = \beta \text{Imputed Outflow}_{i,t} \times \text{High rank}_i + \gamma X_{i,t} + \epsilon_{i,t}

<table>
<thead>
<tr>
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<td><strong>Outflows</strong></td>
<td>-1.646</td>
<td>-1.741</td>
<td>-1.856</td>
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<td></td>
<td>[1.167]</td>
<td>[1.174]</td>
<td>[1.194]</td>
</tr>
<tr>
<td><strong>Outflows*High rank</strong></td>
<td>-3.443**</td>
<td>-3.550**</td>
<td>-3.506**</td>
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<td></td>
<td>[1.426]</td>
<td>[1.433]</td>
<td>[1.459]</td>
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<td><strong>Rating-Time F.E.</strong></td>
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<td>No</td>
<td>No</td>
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<td><strong>Maturity-Time F.E.</strong></td>
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<td>No</td>
<td>No</td>
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<tr>
<td><strong>Issuer F.E.</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Bond F.E.</strong></td>
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<td>No</td>
<td>Yes</td>
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<td><strong>Observations</strong></td>
<td>398,678</td>
<td>398,678</td>
<td>398,677</td>
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<tr>
<td><strong>Adj. R-squared</strong></td>
<td>0.174</td>
<td>0.175</td>
<td>0.166</td>
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What were the effects of Fed interventions?
Fed Intervention

Unprecedented intervention by the Fed in fixed income markets:

- March 15: Announced purchase of Treasuries
- March 23: Announced purchase of IG corporate bonds
- April 9: Announced extension of corporate bond purchase
  - Larger volume
  - Include “fallen angels”
### Effect of Fed Interventions on Fund Flows

\[
Outflows_{i,t} = \beta FedIntervention_t + \gamma X_{i,t} + \epsilon_{i,t}
\]

<table>
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<td>Govt</td>
<td>0.014</td>
<td>0.043</td>
<td>0.093***</td>
<td>0.093***</td>
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<td></td>
<td>[0.032]</td>
<td>[0.039]</td>
<td>[0.026]</td>
<td>[0.033]</td>
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<tr>
<td>Treasury bond purchase</td>
<td>0.217***</td>
<td>0.366***</td>
<td>-0.057</td>
<td>0.161***</td>
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<tr>
<td></td>
<td>[0.040]</td>
<td>[0.063]</td>
<td>[0.035]</td>
<td>[0.051]</td>
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<tr>
<td>Corp bond purchase expansion</td>
<td>0.057***</td>
<td>-0.039**</td>
<td>-0.069***</td>
<td>-0.073***</td>
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<tr>
<td></td>
<td>[0.017]</td>
<td>[0.019]</td>
<td>[0.008]</td>
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<td>Control</td>
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<tr>
<td>Fund fixed effects</td>
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<td>Month fixed effects</td>
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<td>Yes</td>
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<td>Observations</td>
<td>13,573</td>
<td>6,452</td>
<td>17,819</td>
<td>9,364</td>
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<tr>
<td>Adj. R-squared</td>
<td>0.058</td>
<td>0.071</td>
<td>0.067</td>
<td>0.096</td>
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</table>

- Announcements of corp bond purchase stopped outflows, but Treasury bond purchase did not
Effect of Fed Interventions on Fund NAV

\[ \Delta NAV_{i,t} = \beta Fed\text{Intervention}_t + \gamma X_{i,t} + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th></th>
<th>(1) Govt</th>
<th>(2) IG</th>
<th>(3) HY</th>
<th>(4) BL</th>
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<tbody>
<tr>
<td>Treasury bond purchase</td>
<td>0.241**</td>
<td>0.188</td>
<td>-2.336***</td>
<td>-2.618***</td>
</tr>
<tr>
<td></td>
<td>[0.119]</td>
<td>[0.236]</td>
<td>[0.274]</td>
<td>[0.290]</td>
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<tr>
<td>Corp bond purchase</td>
<td>0.901***</td>
<td>0.866**</td>
<td>-1.261**</td>
<td>-1.941***</td>
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<tr>
<td></td>
<td>[0.178]</td>
<td>[0.400]</td>
<td>[0.486]</td>
<td>[0.487]</td>
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<tr>
<td>Corp bond purchase expansion</td>
<td>0.399***</td>
<td>1.616***</td>
<td>1.621***</td>
<td>1.114***</td>
</tr>
<tr>
<td></td>
<td>[0.039]</td>
<td>[0.066]</td>
<td>[0.111]</td>
<td>[0.095]</td>
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<tr>
<td>Control</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td>Month fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Observations</td>
<td>13,565</td>
<td>6,451</td>
<td>17,816</td>
<td>9,357</td>
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<tr>
<td>Adj. R-squared</td>
<td>0.180</td>
<td>0.427</td>
<td>0.323</td>
<td>0.377</td>
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</tbody>
</table>

- Announcements of corp bond purchase increased NAVs, but Treasury bond purchase did not
Why did reverse flight to liquidity emerge this time?

- Increased liquidity transformation by funds since last crisis
- Bond fund AUM: $1 trillion to $4.5 trillion from 2007 to 2019

With increased mutual fund liquidity transformation, going forward:
- Increased volatility in traditionally liquid assets
- "Are US Treasury Bonds Still a Safe Haven?" (He and Krishnamurthy, 2020)
- Mutual funds conduct liquidity transformation outside public liquidity backstops
- More reliance on unconventional central bank asset purchases
Conclusion

1. What caused the reverse flight to liquidity phenomenon?
   Mutual funds transform liquidity by issuing demandable equity shares + using pecking order of liquidations

2. What are the policy effects?
   The purchase of illiquid assets directly alleviates fund outflows and is more effective than the purchase of liquid assets

3. What was special about the Covid-19 crisis? Could everything happen again in the future?
   Migration of liquidity transformation to mutual funds