A Discussion of **"Fragility of Safe Asset Markets'**

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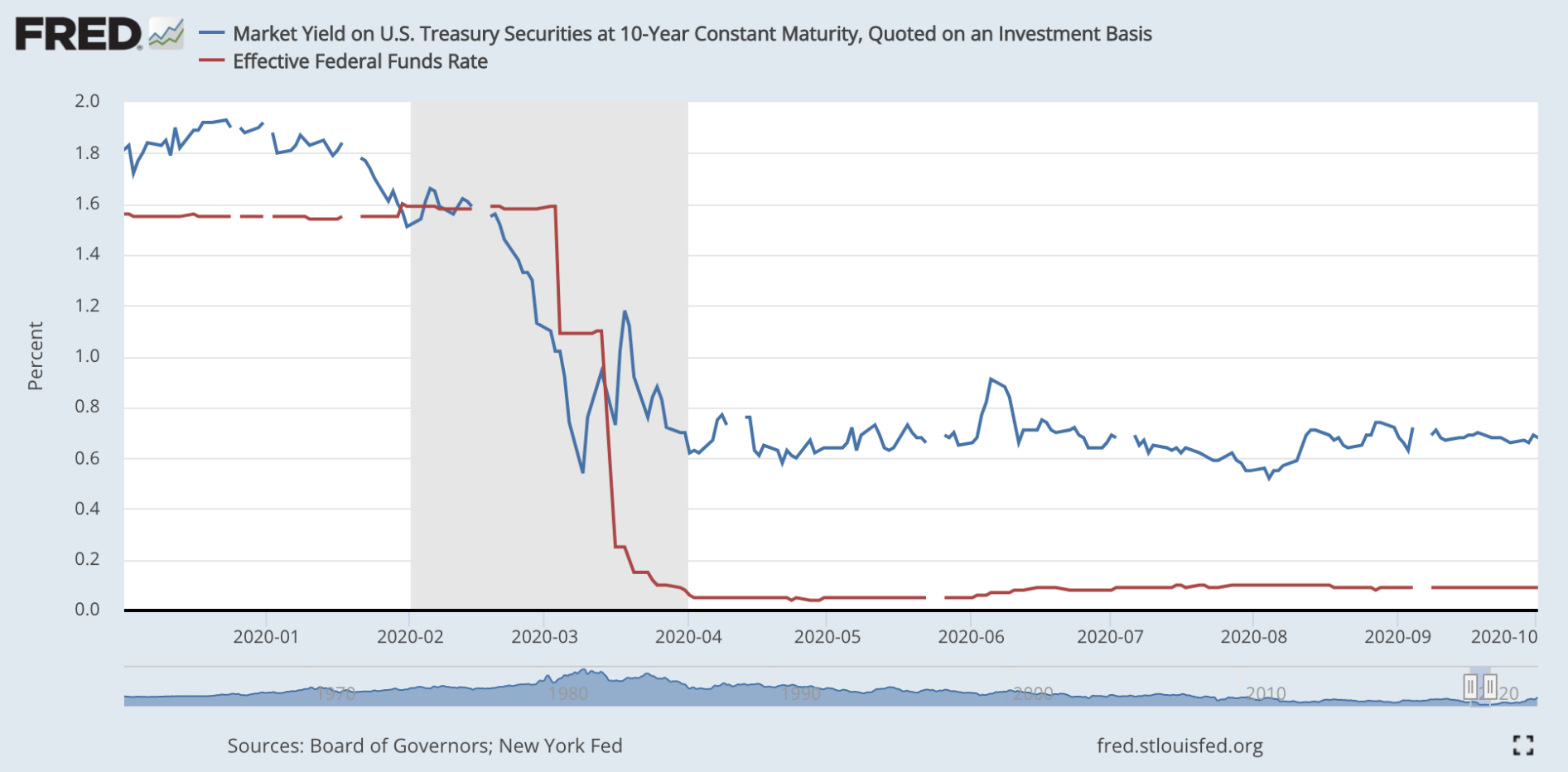
Treasury Market Fragility in March 2020: Yields



See also Zhiguo He, Stefan Nagel, and Zhaogang Song (2022)

Treasury Market Fragility in March 2020: Bid-Ask Spread

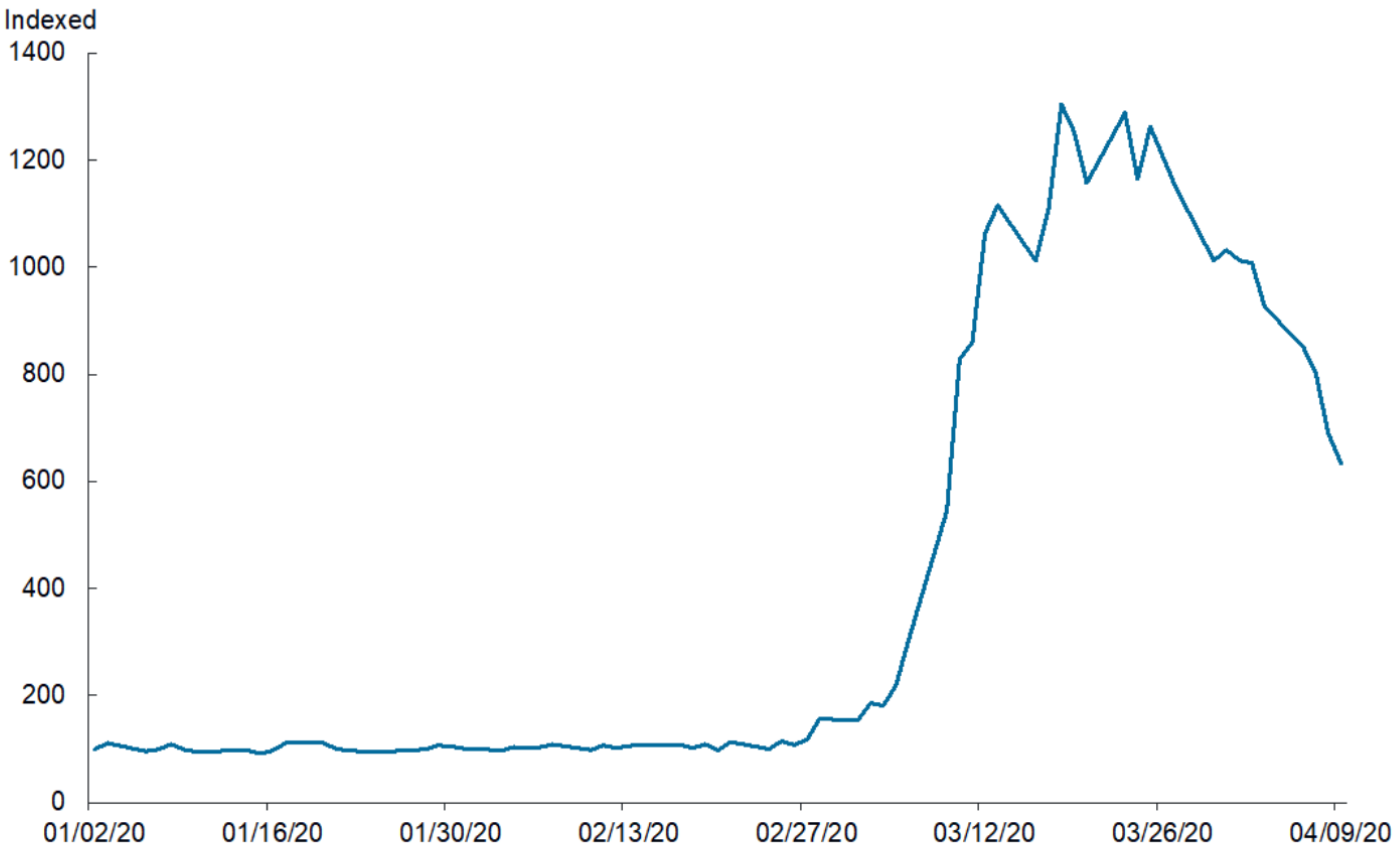


Figure 8. Treasury bid-offer spreads posted at Bloomberg, indexed to 100 at January 2, 2020. Figure source: Lorie Logan, Manager of the System Open Market Account and Head of the Open Market Trading Desk, Federal Reserve Bank of New York, published with her speech of April 14, 2020. The underlying data source is Bloomberg Financial LP.

Source: Darrell Duffie (2022), "Still the Worlds Safe Haven? – Redesigning the U.S. Treasury Market After the COVID- 19 Crisis," Hutchins Center Working Paper Number 62, Brookings Institution, May, 2020.

Model Setup

- One safe asset with fixed payoff 1 at the end of period 1.
- Two types of agents: investors and dealers. Investors are subject to i.i.d. liquidity shock (forced sales) with probability s in both periods. They are strategic absent from the shock, selling α fraction at $t = 0$.

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- Let $p_0^e(\alpha)$ and $p_1^e(\alpha)$ be the expected price of liquidation at period 0 and 1. Decision criteria:

$$\pi(\alpha) = \underbrace{p_0^e(\alpha)}_{\text{liquidate now}} - \underbrace{(sp_1^e(\alpha) + (1-s)\cdot 1)}_{\text{wait till next period}}$$

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  For individual firm: liquidate (strategically) at $t = 0$ if and only if $\pi(\alpha) > 0$.
- Dealers are myopic, making zero profit on each extra unit of sequentially executed orders. Thus,

$$p_0^e = \frac{1}{2}\left(p_0(q_0 = 0) + p_0(q_0 = s + (1-s)\alpha)\right)$$

$$p_1^e = \frac{1}{2}\left(p_1(q_1 = 0) + p_1(q_1 = s(1-s)(1-\alpha))\right)$$

Equilibrium

- There are three types of equilibria (before introducing global games):
  - $\pi(0) < 0$: nobody wants to liquidate the asset.
  - $\pi(1) > 0$: everyone wants to liquidate the asset.
  - $\pi(\alpha^*) = 0$ for $\alpha^* \in (0, 1)$: a Nash equilibrium.

- Coexistence and strategic complementarity:
  - Strategic substitutes (more sales discourage further sales): if $\pi'(\alpha) < 0$ for all $\alpha \in (0, 1)$, then at most one of the above holds.
  - Strategic complementarity (more sales encourage further sales): if $\pi'(\alpha) > 0$ for all $\alpha \in (0, 1)$, then the above three could coexist.

- Literature
  - Bernardo and Welch (2004). Liquidity and financial market runs. Only strategic substitutes.
  - Morris and Shin (2004). Liquidity black holes. Contain strategic complementarity but need VAR constraint.

Strategic Complementarity

- Strategic complementarity $\Rightarrow$ equilibrium multiplicity $\Rightarrow$ sudden change of equilibrium and asset-market fragility.

- The condition $\pi'(\alpha) > 0$ is equivalent to

$$p_0'(\alpha) > s \cdot p_1'(\alpha)$$

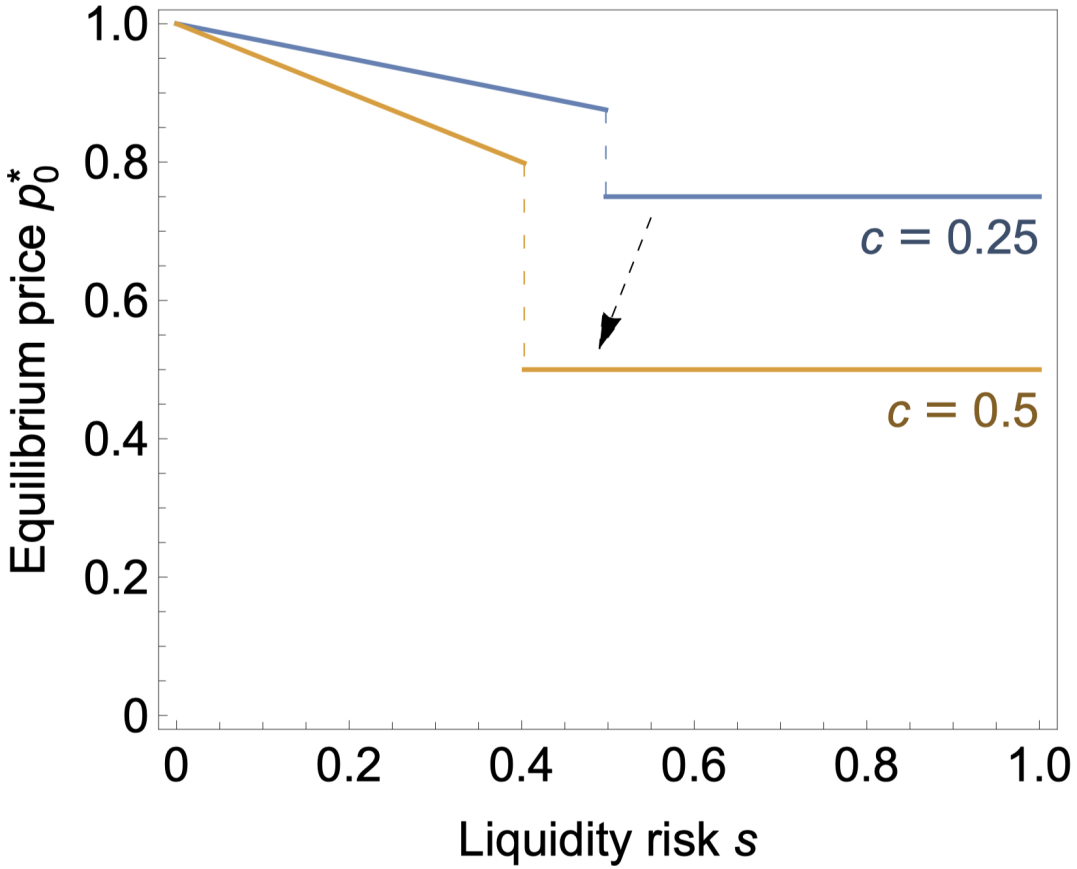
  Note that the impact is negative, i.e., $p_0'(\alpha) < 0$, and $p_1'(\alpha) < 0$, so it is equivalent to

$$|p_0'(\alpha)| < s \cdot |p_1'(\alpha)|$$

- Meaning: the price impact of current sales on current price is smaller than liquidity shock probability * **impact on future price**.

Strategic Complementarity Generates Fragility

- Introduce global games to get a unique equilibrium (everyone sells v.s. only those with liquidity shocks sell).
- **Fragility**: small change in liquidity risk s causes large change of price.



Mechanism: Benchmark against Diamond and Dybvig

Assumptions of Diamond and Dybvig (1983):

- **Financing friction**: banks cannot immediate raise financing when there is a run on the deposits.
  This paper: dealers cannot offload inventory at time 1 before the arrival of extra client demand. Otherwise $p_1'(\alpha) > 0$ *– positive price impact.*

- **Asset illiquidity**: liquidating the assets before maturity incurs costs. *This paper: dealers have inventory costs. Otherwise* $p_1'(\alpha) = p_2'(\alpha) = 0$.

- **Demandable (non pari-passu) debt causes strategic complementarity**: when more depositors liquidate, those who wait will get less.
  This paper: if more investors liquidate early, then the extra inventory that dealers carry has a larger impact on next-period price, making early liquidation more preferable.

A Simplified Model

The liquidity shock s at time $t = 0$ is unnecessary for the model. Removing it strengthens the theoretical mechanism.

- Period-0 sales $= \alpha$, and period-1 sales $= (1 - \alpha)s$.

$$p_0 = 1 - \frac{c}{2} \cdot \underbrace{\alpha}_{\text{period-0 sales}}$$

$$p_1 = 1 - 2c \cdot \underbrace{\alpha}_{\text{period-0 sales}} - \frac{c}{2} \cdot \underbrace{(1-\alpha)s}_{\text{period-1 sales}}$$

  which implies

$$\pi(\alpha) = 1 - s + \frac{c}{2}s^2 + \frac{c}{2}(-1 + 4s - s^2)\alpha$$

- Strategic complementarity **always holds** for all $s \in [0, 1]$:

$$\pi'(\alpha) = \frac{c}{2}(-1 + 4s - s^2) > 0$$

Dissecting Strategic Complementarity

- Is it affected by pooled v.s. sequential execution of orders? Yes.
  - Under pooled execution, we have $p_0^e = p_0$ and $p_1^e = p_1$, so

$$p_0 = 1 - c \cdot \underbrace{\alpha}_{\text{period-0 sales}}$$

$$p_1 = 1 - 2c \cdot \underbrace{\alpha}_{\text{period-0 sales}} - c \cdot \underbrace{(1-\alpha)s}_{\text{period-1 sales}}$$

$$\pi'(\alpha) = c(-(s-1)^2) < 0$$

- Sequential execution magnifies the ratio between legacy inventory effect v.s. marginal price effect at period 0.

Dissecting Strategic Complementarity

- Is it affected by dealer's myopic decisions? Yes.
  - A strategic dealer will optimize profit. At period 1,

$$\max_{q_1^D}(1-p_1)q_1^D - c(q_0^D + q_1^D)^2$$

$$\Rightarrow q_1^D(q_0^D) = \frac{1-p_1}{2c} - q_0^D$$

  - At period 0, consider $q_1^D(q_0^D)$ and maximize total profit:

$$\max_{q_0^D}(1-p_0)q_0^D + (1-p_1)q_1^D(q_0^D) - c(q_0^D)^2 - c(q_0^D + q_1^D(q_0^D))^2$$

$$\Rightarrow q_0^D = \frac{p_1 - p_0}{2c}$$

  - Taken together, we have

$$p_1 = 1 - 2c(q_0^D + q_1^D)$$
$$p_0 = 1 - 2c(q_0^D + q_1^D) - 2cq_0^D$$

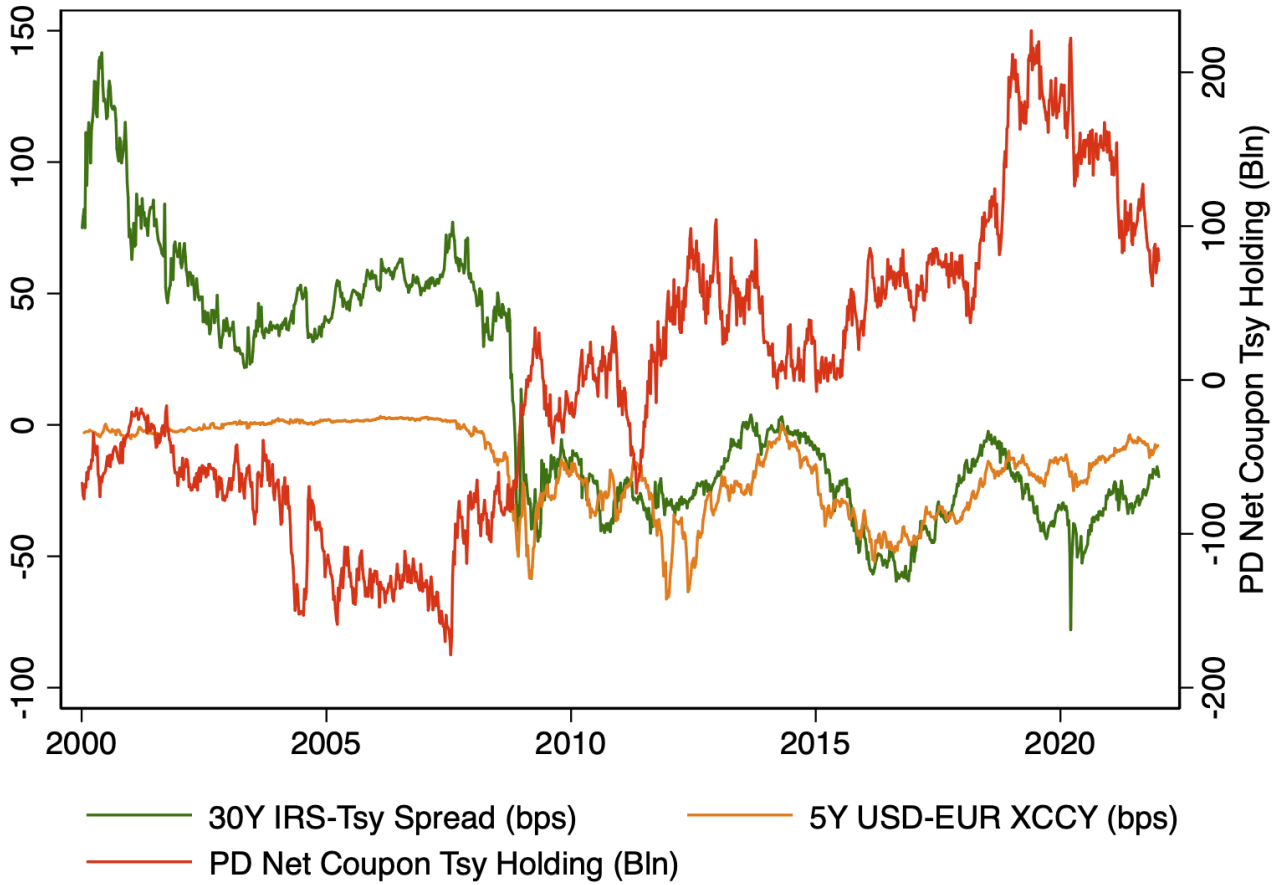
  - Thus,

$$\pi'(\alpha) = 2c(-2 + 2s - s^2) < 0 \text{ for all } s \in [0,1]$$

Generality

- The same mechanism also works for risky assets.
  - Equivalent model: Risky asset with expected payoff $= 1$ and risk-neutral agents
- The effect of extra safety demand could be the effect of any extra demand coming from other reasons.
- Thus, any result from the paper is more broadly applicable.
- From a different perspective: what is the unique feature of safe assets in this setting?

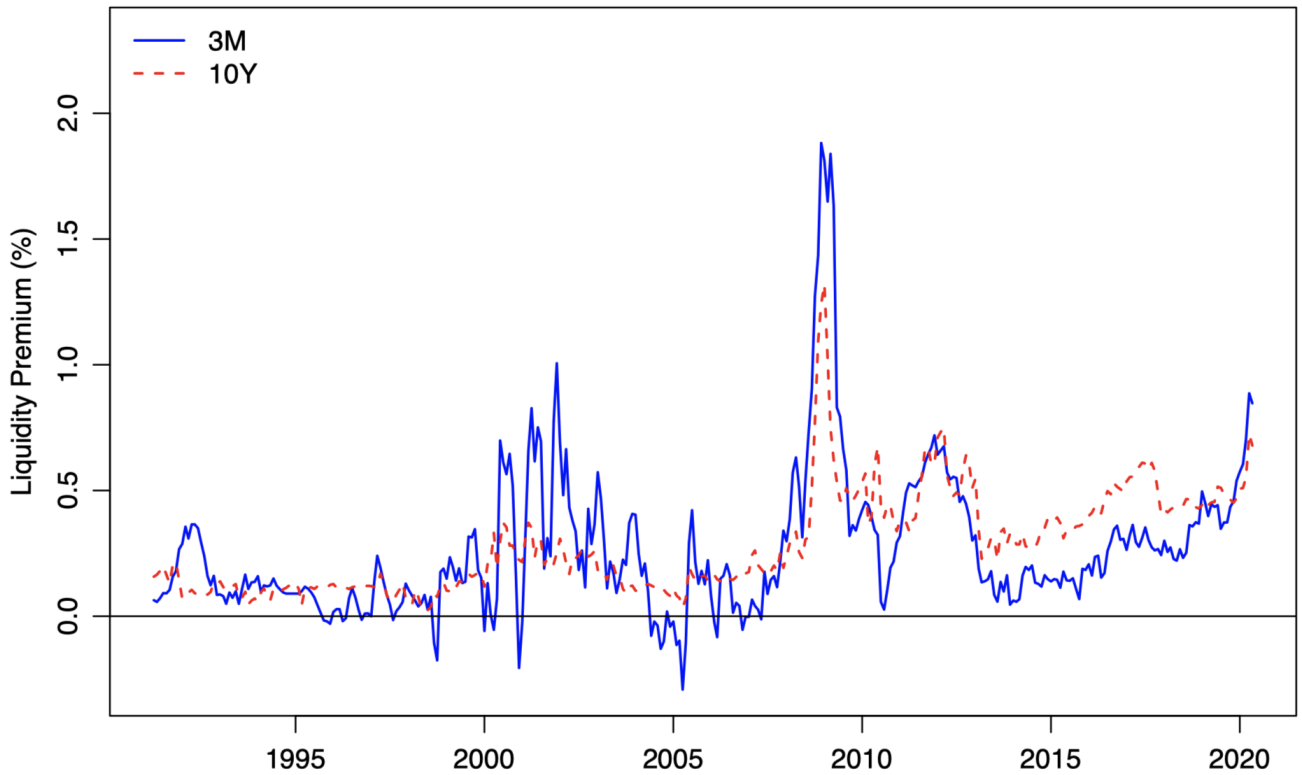
Evidence Supporting Balance Sheet Cost and Treasury Pricing



Source: Wenxin Du, Ben Hebert, and Wenhao Li (2022).

Multiple Safe Assets

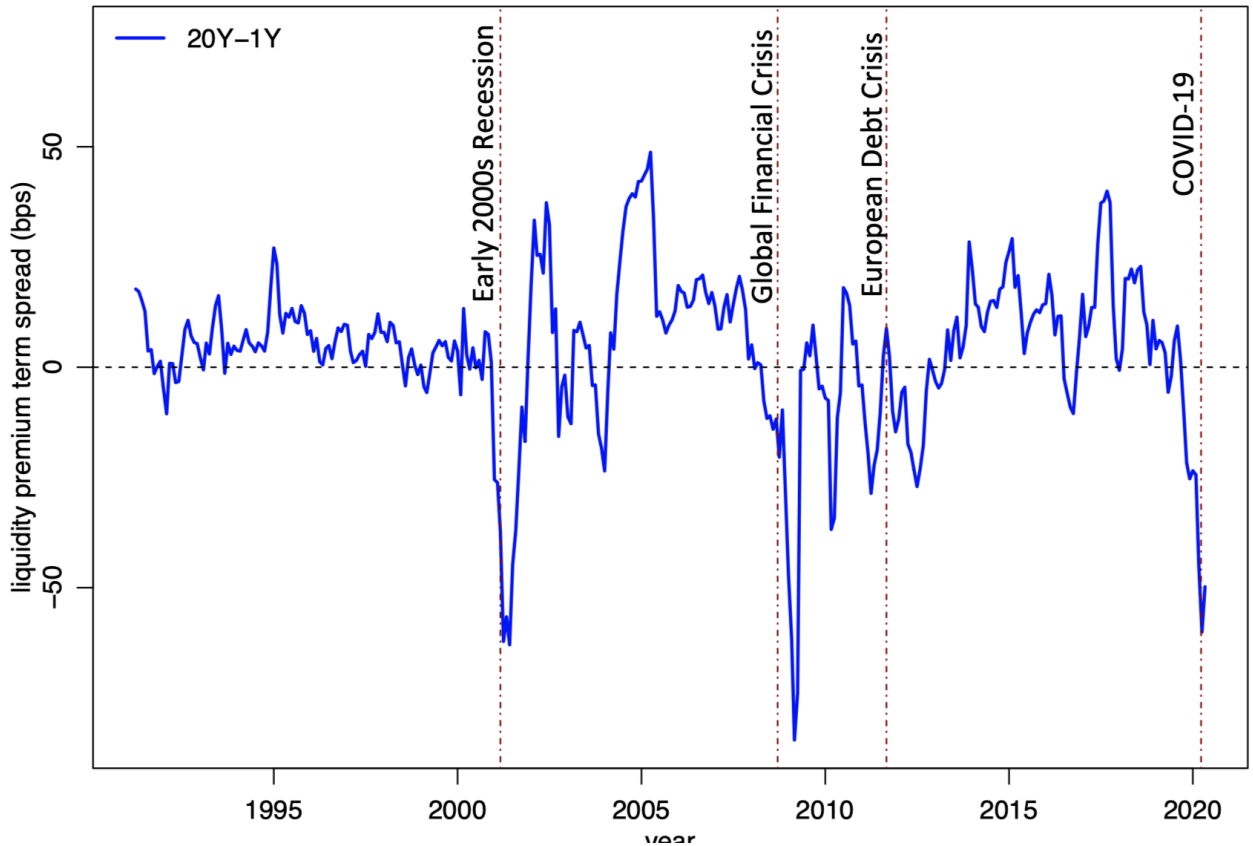
- Agency debt is also safe, but the market size is smaller and the demand for such asset is lower.
- The spread between agency and Treasury debt may reflect fragility defined in this paper.



Source: Scott Joslin, Wenhao Li, and Yang Song (2022). Liquidity premium is measured as the spread between Refcorp STRIPS and Treasury STRIPS of matched maturities.

Dynamic Effect and the Term Structure of Liquidity

- What if the distress lasts longer than one period? What is the dynamic asset pricing implication of Treasury market fragility?



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Summary

- Very interesting paper on an important topic!
- Model could be further simplified and the message gets stronger.
- Food for thought:
  - Sequential order execution is needed for the results. Can we generalize the assumptions?
  - What is the defining nature of safe asset in this setting?
  - Implications on multiple safe assets and dynamic effects.