Topic 8 - NBFIs and the stress in money markets during the Covid-crisis

Research questions

- What was the role of NBFIs in the market stress of March 2020 (focus on US dollar money markets: commercial paper, certificates of deposit and repo)? Which factors related to the business models of NBFIs played a destabilizing role?
- What role did broker-dealers play during the stress episode?
- What was the role of central banks and through which tools did they intervene to restore market functioning? What tools were effective and why?

Starting literature

- *Eren, E., A. Schrimpf, and V. Sushko, 2020a, "US Dollar Funding Markets during the Covid-19 Crisis - the Money Market Fund Turmoil," BIS Bulletin, 14.*
- *Eren, E., A. Schrimpf, and V. Sushko, 2020b, "US Dollar Funding Markets during the Covid19 Crisis - the International Dimension," BIS Bulletin, 15.*
- FSB 2020, "Holistic Review of the March Market Turmoil," Financial Stability Board Reports to the G20, 17 November.
- FSB, 2021, "Policy Proposals to Enhance Money Market Fund Resilience," Financial Stability Board Consultation Report, 31 June.
- *Li, L., Y. Li, M. Macchiavelli, and X. Zhou, 2021, "Liquidity Restrictions, Runs, and Central Bank Interventions: Evidence from Money Market Funds," Review of Financial Studies, Forthcoming.*
- The Dynamics of the U.S. Overnight Triparty (Paddrik 2021)

RQs

1. What was the role of NBFIs in march 2020 in US dollar markets (CP, CD, repo)?
2. Which component of NBFIs business model played a destabilizing role?
3. What role did broker-dealers play during the stress episode?
4. What was the role of central banks?
5. With which tools did they intervene to restore market functioning and were they effective?
6. Why where those tools effective?

Collection of Topic-Strings

NBFI

eren_2020a

- *"Dash for Cash"*: Outflows from prime MMFs to government MMFs. This switch from unsecured to secured funding markets caused stress in short-term dollar funding markets.
- NBFI influenced banks, as this lead to increases in bank-funding costs (indicated by LIBOR-OIS spread).
- *NBFIs cause stress for banks*, even if they weren't the epicenter for the liquidity stress.
- The RRP entered the holdings of government MMFs in march 2020 and was not present beforehand. They also increased their holdings in treasury, FFIC and decreased their holdings in financial reverse repo's (dealers balance sheet constraints?)
- Disruptions in short-term funding markets can quickly spill over to financial market segments and the real economy - hence dangerous!
- 2016 reforms still leave MMF redemption channel open
- *"First mover advantage"* - pressure to liquidate can cause discounts i.e. loss in NAV (?). Similarity to bank runs. Investors have an incentive to liquidate before others do and the higher the risk of

redemptions, the stronger is their incentive.
- *Greater importance of NBFIs*, their access and connection to central banks needs to be discussed

eren_2020b

- CD/CP markets: tool for banks to get funding from non-banks such as MMFs, on of the originators of the stress onto banks
- *Funding costs* for market participants reliant on MMFs varied greatly (even for banks of similar ratings)
- US MMFs supply USD to the market - *MMF as USD supply*

fsb 2021

- detailed information on MMFs (Box 1)
- Largest market of MMFs is the US, most public debt shares in USA, non-public debt split up quite evenly between the different players
- Usually denominated in local currency, except for the EU (EUR, GBP, USD)
- MMFs as important investors in short-term debt (repo, CD, CP)
- Features which are valued by investors
  - Principal stability (cash-like)
  - Yields in line with market-rates (typically higher than bank-deposit rates) through low-cost exposure to wholesale money-market instruments
  - Variety of instruments issued by different counterparties, more diversified credit risk
- Features which are valued by borrowers
  - cost savings compared to bank loans, however difficult to measure see p.14
  - diversification (borrow money through intermediated pool of investors)
  - flexibility of funding
  - for some jurisdictions: ability to access USD
- substitutes for MMFs (reforms to MMFs might make these grow)
  - Investors: bank deposits (flaws: less diversification, large bank deposits are discouraged)
  - Borrowers: bank loans (flaws: one counterparty?), public debt MMF, large institutional investors who normally stay outside of the money-market due to too low yields (if these rise, they might start investing here)
  - non-public debt MMF: public debt MMF
- MMFs provide USD funding, especially for banks headquartered outside the US which do not have access to insured retail dollar deposits. Can be an unreliable source during stress! GFC, European sovereign crisis (2011-2012), March 2020 - USD MFF portfolios are very similar in different jurisdictions, argument in favor of a more holistic approach to regulating MMFs
- Vulnerabilities in MMFs
- sudden and disruptive redemptions (e.g. US & EU MMFs in 2008 (prime MMF broke the buck) and 2020 (dash for cash)), large redemptions increase funding costs
  - Causes disruptions for CD and CP, which might have a systemic importance that goes beyond their notional values
  - Outflow out of prime MMFs to government MMFs during March 2020
- Liquidity transformation (also determining current market values of assets in highly volatile environment is challenging), cash-management (expected to behave like cash even in times of stress - even harder for non-public MMFs, harder to trade due to a small secondary market), credit risk (small changes might cause investors to loose trust in fund - especially so, for stable NAV MMFs)

- In addition for some MMFs (mainly prime MMFs?): "cliff effects" (threshhold and gates - Li, Danieli, Capota) and more sensitive investor types such as institutional investors (forced to meet margin calls)
- *First-mover advantage* (last ones bear the additional costs) and run effects, even more so for non-public debt MMFs
- challenges in selling assets, especially under stressed conditions: assets have limited liquidity, especially in times of stress. Usually, deal with redemptions by letting assets mature. There is nearly no secondary market for CP and CD - even worse so in time of stress when dealers do not intermediate (see below). In addition, MMFs hold similar portfolios - hence there will be overlap in the illiquid assets they are trying to sell off, making the problem even worse.
- These vulnerabilities exacerbate stress on MMFs and even have spillover effects onto the financial system (investors and borrowers of MMFs)
- Contagion risks, as MMF portfolios are very similar. Also they share regulations and structure - news about one fund might lead to redemption in "related fund". Their use for cash management and use to meet margin calls, might make it worse.

Dealers

eren_2020a

- *Balance sheet constraints* made intermediation of rebalancing more difficult
- "Dash of cash": Dealers were unwilling or unable to expand their balance sheets and intermediate all of the rebalancing - central bank's (the Fed) intervention restored market functioning.
- Dealers faced *difficulty absorbing the assets* shed by prime funds, trouble to balance their balance sheets (also due to other assets they have taken in)
- *Substitution towards cleared repo segment* [Fixed Income Clearing Corporation (FICC)] away from bilateral reverse repos. Due to netting, the cleared repo segment impacts the balance sheet less. Another indication of dealer's balance sheet constraints.

fsb 2021 (especially box 3)

- Dealers as intermediaries in the repo market and the primary markets for CP and CD - help issuers to sell their papers to investors including MMFs!
- Box2 Structure and functioning of CP, CD and repo markets in key MMF jurisdictions
- **Money-Market Ecosystem Graph**
- March 2020: High uncertainty, reduced appetite for intermediation. Everybody scrambled for cash, dealers were unwilling to put long term credit positions on their books to intermediate
- Dealers are unlikely to intermediate large, on-direction flows of stress
- Dealers also faced internal risk management limitations: these responded to the increased level of uncertainty - defensive posture necessary, prevent balance sheets from expanding
- Home-office environment might have compounded challenges to dealers. Operational issues.
- Beyond these factors, dealers simply have not been able to intermediate the sheer quantity of one-way flows (selling of assets, demand for cash), which was caused by MMFs, other investors and issuers all looking to raise cash / sell assets

Central Bank

eren_2020a

- Fed's intervention restored market functioning when dealers weren't intermediating the rebalancing
- *Mutual Fund Liquidity Facility* provides loans to dealers to purchase eligible assets from MMFs. *Successive measures* by the Fed until mid-April. Modest inflows to prime funds and increase in maturity of holdings.

- *Fed's overnight reverse repo*, usually an outside option was an important haven for government MMFs. They even accepted a o% return to prevent negative returns.
- Fed's swift actions mitigated spillover of short-term funding market stress onto other financial markets and the real economy.
- *Central bank's balance sheet* as an important buffer: accommodated demand for safety from NBFI sector
- Broader access to central bank support for a wider set of players?

eren_2020b

- *FX swap lines with other central banks*
- Standing swap-lines efficient in reducing stress on other central-banks, funding stress eased quickly for banks in jurisdictions with standing USD swap lines
- Fed's swap lines as an effective tool to transmit its monetary policy to foreign markets
- *Expansion of swap-lines* took time, but seems effective now that it is in place
- Swap lines have been used more than the MMLF and the CPFF
- Confusing numbers: Assessing price based on LIBOR or OIS yielded different insights in pricing of USD. normally USD price is aligned with unsecured money-markets and not with interest-free rate
- Access to central bank is key: banks that had no access were facing higher funding costs
- International cross-currency arbitrage helped to alleviate stress in core USD markets and reduced rates in unsecured MFF markets (i.e. rates of CD/CP)
- Foreign banks faced substantially higher CP/CD funding costs than US banks - dispersion in bank funding costs increased

Data Ideas

Overlap of MMFs

- Look at asset portfolio of different MMFs
- Look at returns / movement of different MMFs and report correlations
- Granger causality? Dip / news in one MMF precedes dip in other MMF?

Further Notes - unordered

FSB 2020

Covid-19 was a shock to the financial system that originated outside the financial markets. Mainly banks and financial market infrastructure absorbed large parts of the shock, but *key funding markets* were stressed by the shock and institutions needed to intervene to support the supply of credit to the economy.

Pre-Covid

Outlooks for economics growth started to weaken, corporate debt was high and rising with real interest rates falling. Investors were looking for yield and hence turned from high quality cash-like assets to more risky assets.

State of the Financial System

- Increased dependence on market-based intermediation because of growing levels of debt
- Growth of NBFI lead to larger importance of market liquidity for financial resilience
- banks became more constrained, lowering there market-making capabilities
- provision of liquidity by new entities (NBFI[1]?) and electronic markets is less robust

[1]Non-bank financial intermediaries

Covid Shock in March

- Unprecedented breadth of economic shock and liquidity stress
- Caused a repricing of risk and demand for safe assets (like previous shocks did). **BUT:** The shock also caused large and persistent imbalances of demand and supply of cash / liquidity to support intermediation!
- sales of large assets caused liquidity shortages for dealers, increasing chaos in the short-term funding market
- *large-asset sales and reluctance of dealers to intermediate* became self-reinforcing
- good response by central banks: asset purchases, liquidity operations, targeted liquidity to specific entities ("surgery" / *"bottlenecks"*).
- Especially *"announcement effects"* of central banks seemed to be crucial. But: This might lead to *"moral hazard"* problems down the line - financial entities assume, that central banks will bail them out

Need to Bolster NBFI Sector

- Market mechanisms that caused liquidity imbalances and propagated stress
  - Outflows from money-market funds
  - Outflows from open-ended funds (less intense)
  - Redistribution of liquidity from margin-calls (derivatives)
  - Willingness and ability of dealers to intermediate in "core funding markets"
  - Dislocations in key government bond markets
- Increased importance of *interconnectedness* and system-wide *liquidity conditions*

Focus Areas of Regulatory Community

1. Find risk-factors and markets that amplified the shock (short-term measures, hot-fix)
2. Understanding of systematic risks in NBFI and the financial system, including interactions (banks & non-banks, cross-border spillovers)
3. Regulate this risk with policies

FSB Work Programme

Goal: Enhance the resilience of the NBFI sector, while preserving its benefits.

Entities of Interest

- Money Market Funds
- Open-Ended Funds
- Core Bond Markets
- (Further) NBFIs

Concepts of Interest

- Resilience to shocks
- Liquidity risk
- Margining practices (margin calls)
- (Systemic) risk

See table of FSB work programme on p. 3

Timeline of Financial Market around March

1. Optimism at the beginning of the year, temporary decline of equity markets in late January due to concerns about Wuhan

2. *Flight to safety*: Bond yields[2] declined, because of portfolio rebalancing and demand for safety. In the third week of march Covid "hit" the equity markets leading to a strong shock in stock prices across the globe. Spike in 10y-government bond yields countered the stock-price developments. Worries about oil prices put even more pressure on the financial markets (OPEC+ would not cut outputs).

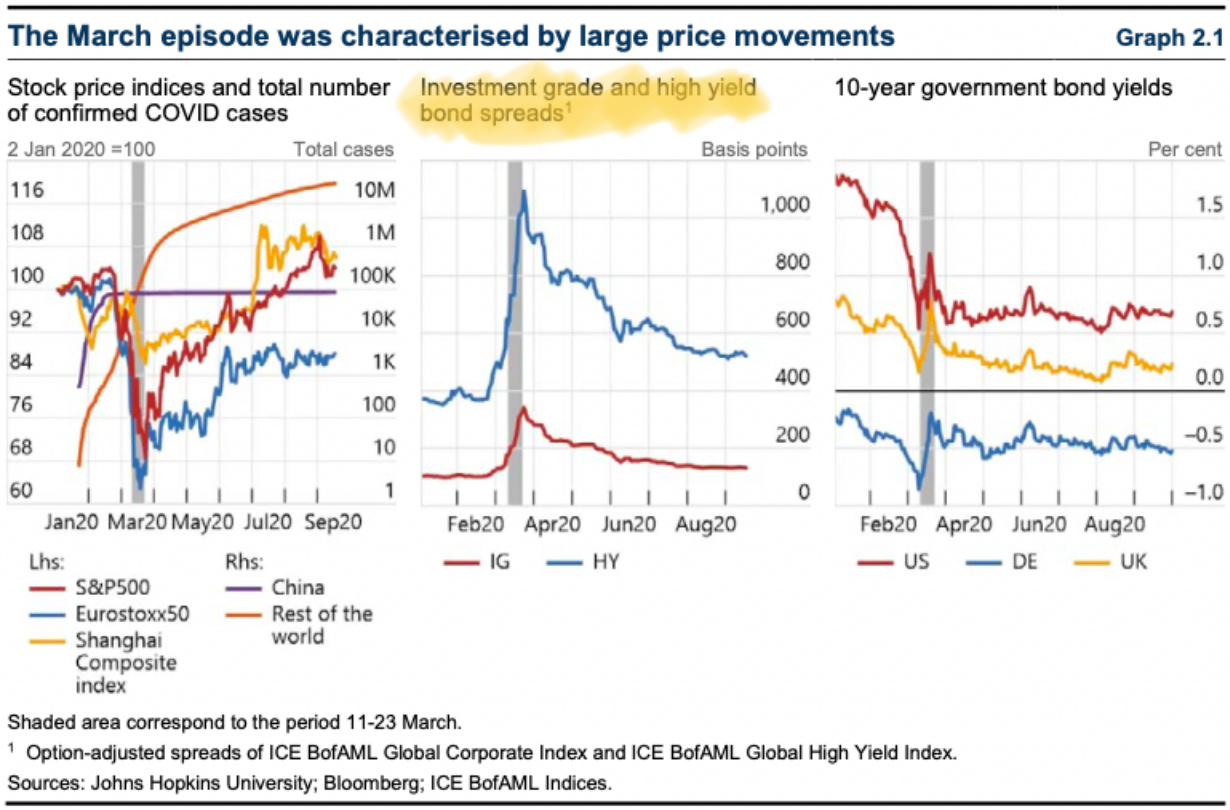

Figure 1: Price Movements in March

3. *Dash for cash*: High demand for (near-) cash, but selling-off of large assets caused the buying party to need cash themselves. Also operational challenges (home-office / lockdown). *Outflows* from *non-government MMFs*[3], equity and bond funds from EMEs[4] and "safe havens" like T-bills and similar bonds. At the same time *government MMFs* experienced strong *inflows*.

4. Easing out of Market Stress

- Stock markets "bottomed out" in the third week of March 2020, in early April most markets were back in a "bull state"
- By end of August, most risky assets recovered 75% of their losses

See Timeline of p.52

Classification of Policy Measures, including timeline: p. 53

Backdrop of March Market Stress

- Predicted "Lower for Longer" environment caused accumulation of debt, making investors more susceptible to tightening financial conditions

[2]Increases in bond demand increase their prices, lowering their yields!
[3]Money Market Funds
[4]Emerging-Market Economies

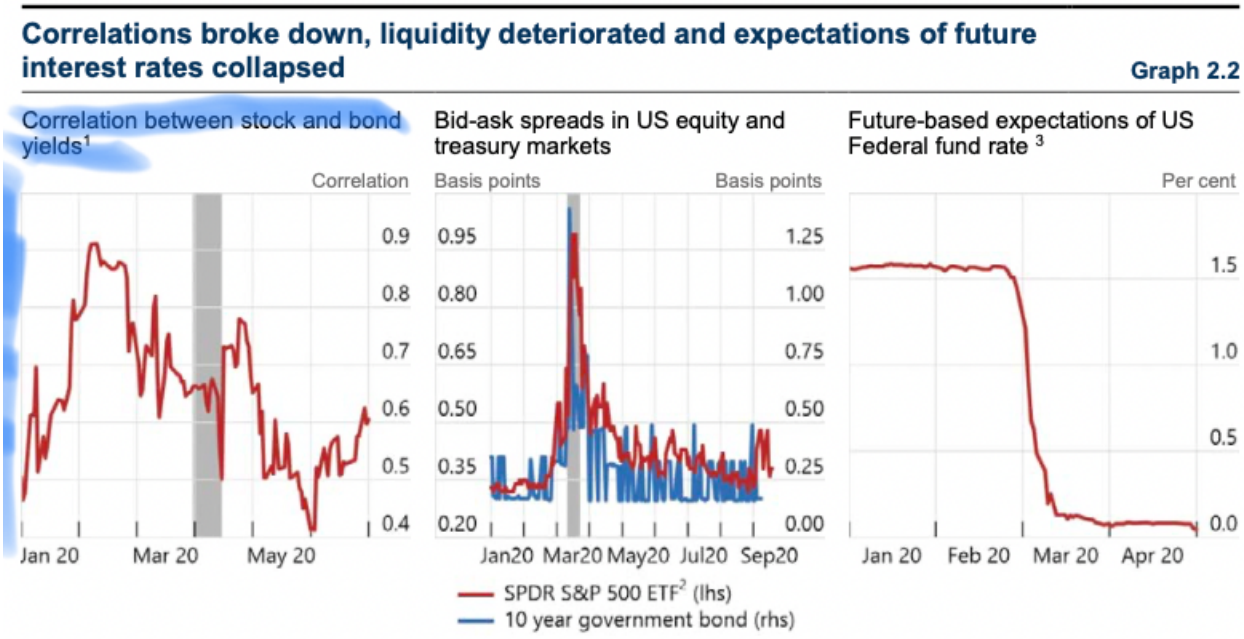

Figure 2: Lack of Liquidity, Anticipation of depression?

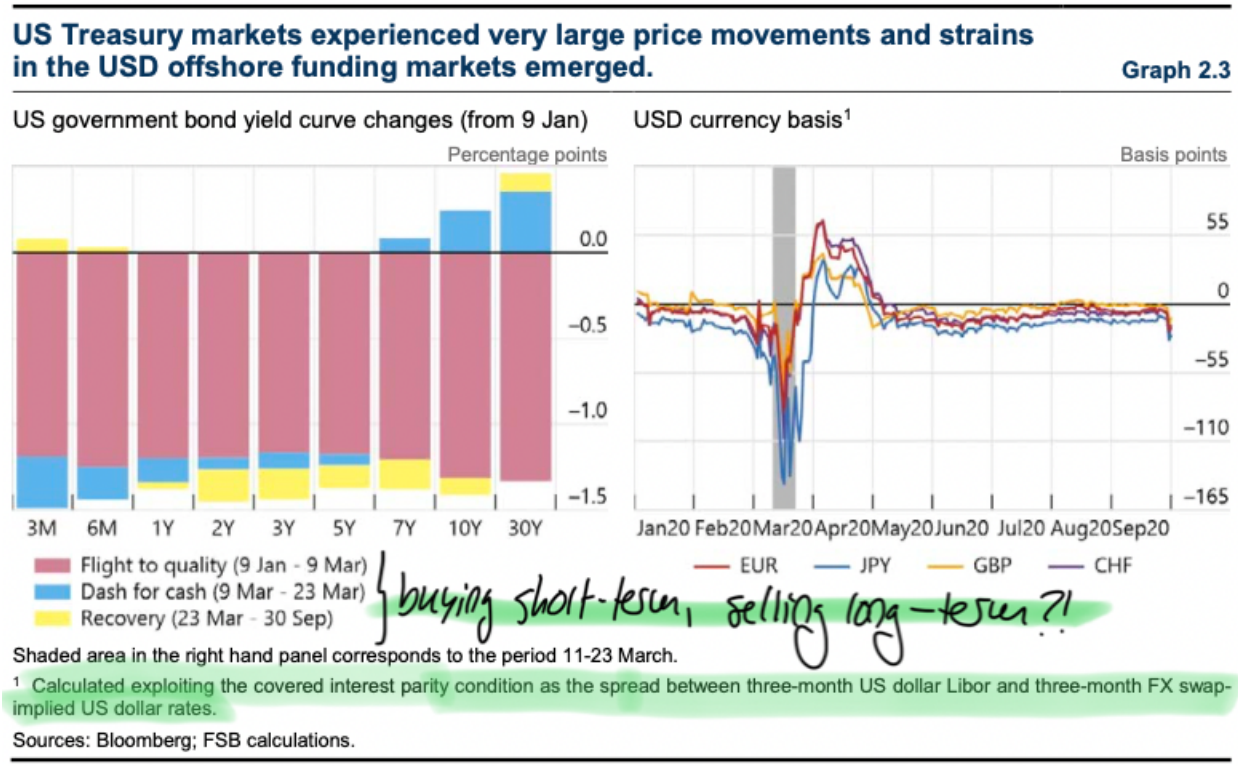

Figure 3: Increased demand for short-term bonds, USD gaings in worth due to demand because of USD denomination of many assets

- Investors turned to lower quality assets / assets with higher risk, because they faced compressed risk premia

Reasons for Vulnerabilities

- *"liquidity mismatches and the build-up of leverage in certain types of investment funds. In an environment of low interest rates, growth in asset management was accompanied by increased holdings of higher-yielding but riskier and less liquid assets through open-ended funds that offer daily redemptions to investors."*
  - worse equity-debt ratios in investment funds, *liquidity mismatches*, low-interest environment pushed investors towards higher yields at the cost of liquidity

Schrimpf 2021

- deleveraging and "dash for cash" are two sides of the same coin
- NBFIs have a greater involvement in intermediation of debt and risk sharing in the financial system
- Money market funds as "Institutional Investors" - bridging the gap to the "Ultimate Savers"

Investing in non-public debt

- Prime funds, LVNAV, VNAV
- Invest proceeds in certificates of deposit (CD) and commercial paper (CP)
- Typically held to maturity

Investing in public debt

- Short dated treasury securities
- reverse repos backed by treasury-collateral (crucial for USD repo market and source of funding for broker-dealers and hedge funds)
- MMFs hold assets with variable prices, but issue liabilities with approximately stable value - hence they engage in *liquidity transformation*.
- Because of *liquidity transformation* they are susceptible to runs i.e. sharp spikes in liquidity demand. This happens if investors think that the assets do not cover the liabilities
- Stable net asset values are only permissible for funds investing in government securities and for the funds targeted at *retail investors*
- Prime funds and funds targeted at *institutional investors* need to over a floating NAV
- Expectation: MMF is similar to cash - value is stable and redeemable at around par
- aversion to "breaking the buck", MMF sponsors tend to support their fund to hold value stable

Propagation of systemic risk

- domino model
- Other potent channel of risk propagation: Fluctuations in leverage caused by shifts in risk-taking capacity, especially if there is market based intermediation
  - Idea: At my high risk profile, I borrow a lot of money (high leverage), but when my risk-taking shifts down I am lookin to get rid of debt i.e. lower leverage! This in turn diminishes assets of the lender (?) causing their leverage ratio to be too high in relation to the current risk level and so on?
  - Attainable leverage is *reciprocal* of the margin-size investors post when they open their position (larger margin, smaller leverage)
  - Changes in margin are changes in leverage - higher risk environment corresponds to lower margins?

- Insolvencies exacerbate stress (domino model), but *pecuniary externalities* i.e. spillovers that work through prices are already enough to pass stress forward

Framework for debt capacity

- fluctuations of risk capacity are amplified by actions of market participants themselves
- sum of margins cannot be larger than the available economic capital (which cannot be larger than the equity)

Risk accounting

1. Debt capacity is recursive: leverage enables greater leverage, debt capacity of an investor is increasing the the debt capacity of other investors. Hence, a spike in margins causes generalised **de-leveraging** via these spillovers
2. The way to deleverage can be "cash hoarding" or the so called **"dash for cash"**. Increase in margins causes re-allocation of scarce economic capital, into assets with low margin requirements such as cash and cash substitutes

   "Deleveraging channel" of risk propagation is the same thing as the **"cash hoarding channel"**!

- Investors look to maximize expected return from bonds, subject to a VaR constraint:
-
$$Max_y \ \mu' y \ s.t. \ \alpha\sqrt{y'\Sigma y} < \ \kappa$$
- Solving for y yields a term, that is proportional to

$$\kappa$$

Example Long-short bond portfolios

- Exploit very high correlations between to assets for "quasi-arbitrage", go long in the asset with higher yield and shorten the other one to finance this
- As correlation between assets declines, the VaR constrain becomes tighter
- An initial shock might lead to too low of a correlation for the VaR constraint, here the investor needs to unwind parts of his position ("airpocket")
- Airpocket as the gap in the size of the position due to the VaR constraint!
- Unwinding leads to further decline in correlation, making it necessary to further unload assets (deleveraging)
- deleveraging leads to higher-margins - see data on spikes in *derivatives margins* in March 2003

Portfolios of market participants

- Portfolios consist of three major components: Inside debt claims, inside equity claims, outside assets (taxonomy to describe NBFI actors)
- Model reflects that debt capacity depends on the debt capacity of others. Also, increases in the market price of assets (collaterals are worth more?), fall in margins has a greater impact on debt capacity as there is a multiplicative effect (will also work the other way around - increases in margin will have a multiplicator and hence affect debt capacity *of the system* more strongly)
- Increase in margins makes it necessary to shift portfolio weights to assets classes with lower margins i.e. cash's zero marging requirements hold great importance now!
- Dash for cash as the flipside of deleveraging induced by the spike of margins!

Observations in March 2020

- Outflows from US prims MMFs to MMFs invested into public debt
- Even the mere possibility of "gates" can lead managers to fire sales

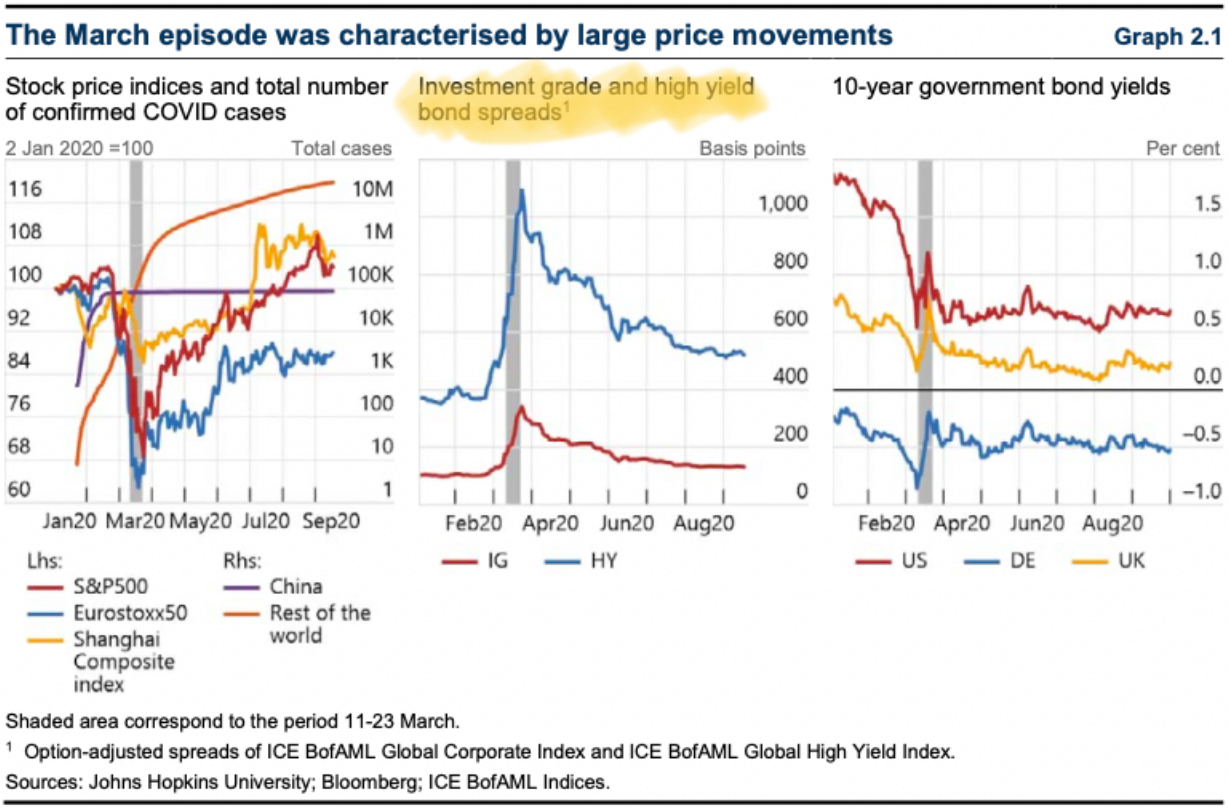

Figure 4: Outflows from prime funds to US governement funds

- Future margins spiked in early 2020
- MMF funded large amounts of sponsored repo

Implications for policy and insights

- Containing solvency risk and investor protection is not enough, because of externalities that the distress of intermediaries imposes onto others. For example via non-fundamental price movements or struggles to provide liquidity. NBFI regulation is necessary on a big-picture scale.
- Shifts in intermediation have made the financial system more resilient against credit risk, but more vulnerable towards liquidity risk!
- cost of market intervention could be large and there could be unforeseen side effects

Other Research

- LIBID: LIBOR, but for rate at which funds are purchased at the market, bank want to borrow money at that rate
- MMF: Looking to perform at a rate higher than the LIBID? Basically offering a similar service, but are paying more for cash. The share of the MMF should be as quickly redeemable as lending money to a bank at the LIBID, but it would be great if it would pay back a little more interest?
- MMF tend to hold cash and bonds with (A-AAA)

- Collateralization: securing a loan with an asset
- Repo: Collateralised short-term loans in the form of asset sales with an agreement to buy back later at a pre-set price. I sell you this security against a collateral and next week, I will buy it back at price X.
- Implied Volatility Index VIX

Questions

- How is a "liquidity mismatch" created? What is meant by that?
- What are "key funding markets"?
- Why are OEFs less liquid?
- What is "Gating"?