Assessing the resilience of market-based finance

A report produced by Bank of England staff, under the guidance of the Financial Policy Committee. This report includes the conclusions of the joint Bank of England and Financial Conduct Authority review into vulnerabilities associated with liquidity mismatch in open-ended funds.

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Content

1: Introduction

Market-based finance refers to the system of markets (eg equity and debt markets), non-bank financial institutions (including investment funds, hedge funds, pension funds and insurers) and infrastructure (such as central counterparties and payments providers) which, alongside banks, provide financial services to support the wider economy. It is an important component of both the global and UK financial systems. Analysis by the Financial Stability Board (FSB) shows non-bank financial institutions account for 50% of the global financial sector's assets, approximately the same share as in the UK (Chart 1). This has grown since the global financial crisis and is likely to continue to grow.

Chart 1: Non-bank financial institutions are a growing part of the UK financial system
Share of UK financial sector assets by subsector (a)

Sources: Association for Financial Markets in Europe, Bank of England, Bloomberg Finance LP, company accounts, FCA, Morningstar, ONS and Bank calculations.

(a) Investment funds also includes money market funds, hedge funds and real estate investment trusts. Other financial intermediaries consists of broker-dealers, holding companies, structured finance vehicles, non-bank mortgage lenders, central counterparties, finance companies and financial auxiliaries.

This growth has diversified the supply of finance for UK businesses.
For example, during the global financial crisis, when banks significantly reduced their lending to corporates, net debt extended to corporates from market-based finance was maintained. More generally, all of the net increase in UK corporate debt between the end of 2008 and the end of 2020 has come from market-based finance.

Market-based finance also provides a number of other critical services to the economy, for example intermediating between saving and investment, insuring against and transferring risk (eg through derivatives markets and insurance companies), and offering payment and settlement services (and other critical infrastructure). It also indirectly supports the real economy, both by supplying finance to businesses and supporting other lenders in supplying credit to the wider economy. It is therefore important that the market-based system supports households and businesses in bad times as well as good.

The resilience of market-based finance reflects the extent to which it can absorb, rather than amplify, shocks and thus continue to support the real economy.
The actions of a range of intermediaries, investors and infrastructure collectively determine how smoothly markets function. Financial stability risks can emerge in a number of ways. For example, when important markets fail to function, credit conditions can tighten for the real economy and reduce the provision of finance. More generally, the sector may be less able to supply the critical services on which the real economy relies. And, because non-bank financial institutions are interconnected within the financial system, they can transmit distress – including to systemic institutions, such as banks.

The Financial Policy Committee (FPC) has been assessing vulnerabilities in market-based finance for a number of years (see Section 2).
As a result the Bank, alongside other UK bodies, has pursued actions to mitigate vulnerabilities in the sector.

In March 2020, underlying vulnerabilities in the financial system catalysed an abrupt and extreme 'dash for cash', in which liquidity deteriorated even in core markets, such as for government bonds (see Section 3.1). This threatened to spill over to the wider economy and amplify the impact of the Covid shock.

This followed evidence that in recent years markets have become more prone to liquidity shocks. One example of this was the volatility in US overnight repo rates in September 2019, leading to the Federal Reserve launching a series of overnight and then short-term repo operations to support the market (see the December 2019 Financial Stability Report (FSR)).

This report supports the FPC's response to HM Treasury's request in its 2020 remit and recommendations letter to publish an assessment of the oversight and mitigation of systemic risks from the non-bank financial sector, by providing additional detail to that contained in the July 2021 FSR section In focus – The resilience of market based finance.[1]

The structure of this report is as follows:

- **Section 2** explains the FPC's framework for assessing vulnerabilities in market-based finance and past work to build its resilience;
- **Section 3** summaries key aspects of the 'dash for cash' in March 2020 and how this was catalysed by vulnerabilities in market-based finance;
- **Section 4** sets out the FPC's current areas of focus, and includes international work to assess and, where necessary, remediate vulnerabilities exposed during the 'dash for cash'; and
- **Section 5** sets out next steps.

2: The FPC's past work on assessing and mitigating vulnerabilities in market-based finance

The FPC has the responsibility to identify, monitor and take action to remove or reduce systemic risks with a view to protecting and enhancing the resilience of the whole of the UK financial system.[2] This includes financial stability risks from the non-bank financial sector, which forms part of the system of market-based finance. The FPC also has a statutory power to make recommendations to HM Treasury in relation to the regulation of the UK financial system, to maintain financial stability. This could involve recommending activities move within the boundary between regulated and non-regulated activities – known as the 'regulatory perimeter' – or recommending changes in regulation for activities already within the perimeter. To inform this judgement, since 2014 the FPC has been regularly assessing risks beyond the core banking sector and published a series of annual assessments from 2015 to 2019 (see the July 2019 FSR).

The FPC's assessment of the resilience of market-based finance differs from its approach to assessing the resilience of banks in several ways.
First, when assessing the resilience of market-based finance, the focus is on activities and markets. By contrast, when assessing the resilience of banks, the focus is generally on the systemic entities themselves. Second, given the global

nature of the sector, the degree of interconnectedness within it, and for some parts of it a lack of data, attaining sufficient and robust information to assess resilience is a key challenge (see Box C).

Third, there is a less comprehensive and less detailed body of international agreements and standards for the market-based finance sector relative to the banking sector. After the global financial crisis, regulators co-ordinated internationally to introduce detailed and comprehensive international standards for banking supervision and regulation across a range of topics.[3] This included much higher standards for banks' equity capital and other loss-absorbing capacity in order to fix some of the major fault lines that contributed to the financial crisis.

As set out in Section 4, the FSB is now working to assess the vulnerabilities exposed during the March market turmoil with a view to assessing whether reforms to regulatory standards are also needed in the non-bank system. The conclusions of this work can help regulators implement robust and consistent reforms across jurisdictions to global markets as needed.

The FPC's assessments of market-based finance are underpinned by a framework that considers both vulnerabilities and transmission mechanisms.
Potential vulnerabilities in the non-bank system include those that make the individual non-bank financial institutions, sectors and financial market infrastructure themselves vulnerable to shocks, in addition to system-wide vulnerabilities that can amplify shocks to the financial system. The framework also considers the transmission channels through which disruptions in non-bank financial system can affect financial stability. These are: through the provision of critical services, risks to systemically important counterparties and disruption to systemically important financial markets.[4]

On that basis, the FPC then decides which activities to explore in greater depth, for example via an in-depth assessment, and whether to recommend any changes to regulation. The FPC's in-depth assessments, covering investment funds, market liquidity, the investment behaviour of insurance companies, derivatives networks and the role of leverage in the non-bank sector, have resulted in a number of policy conclusions and further work.

For example, the FPC's first in-depth assessment in 2015, on investment funds, considered risks associated with open-ended funds.[5]
The mismatch between redemption terms and the liquidity of some funds' assets means there is an incentive for investors to redeem ahead of others, particularly in a stress. This first-mover advantage has the potential to become a systemic risk by creating run dynamics. In 2019, the Bank and Financial Conduct Authority (FCA) launched a joint review into vulnerabilities associated with this liquidity mismatch (Box A presents the conclusions of this review). The review built on the FPC's 2015 assessment; the FCA's 2019 Policy Statement on funds investing in inherently illiquid assets; and the work by the FSB and the International Organization of Securities Commissions (IOSCO).

In a subsequent in-depth assessment in 2017, the FPC assessed post-crisis reforms to derivatives markets.
Derivatives markets provide important services to the economy, but the interconnectedness to which they give rise can amplify shocks in the financial system (see November 2017 FSR). This came into sharp relief during the global financial crisis, when an opaque and poorly collateralised web of derivatives trades amplified the stress as market participants rushed to manage counterparty credit risk. In response, G20 leaders agreed a number of improvements to over-the-counter (OTC) derivatives markets to improve transparency, prevent market abuse and reduce systemic risks. Promoting greater central clearing – via central counterparties (CCPs) – in OTC derivatives markets, supported by robust risk management (including margining) requirements, has been a key aspect of these post-crisis reforms. Central clearing simplifies the network of counterparty exposures and, through multilateral netting, aims to reduce the aggregate amount of risk in the system. And, by ensuring that derivatives exposures are adequately collateralised as market prices change and volatility rises, margin reduces the risk that the failure of one counterparty causes concerns around the solvency of other counterparties – which could otherwise lead to panic that can impair market functioning.

The FPC concluded that these reforms had improved the resilience of the financial system and CCPs themselves were more resilient, but that, in particular, reforms to transparency – such as the sharing of trade repository data with global regulators – had further to go, in order to enhance the positive benefits of derivatives reform.

A list of the FPC's previous in-depth assessments on risks beyond the core banking sector, alongside their key policy conclusions and a number of relevant actions taken by UK and international regulators, is provided in the annex. As set

out in the July 2021 FSR, the FPC will continue to scan for potential vulnerabilities originating outside of the core UK banking sector, and to monitor the growth of risks in those sectors.

3: Testing the resilience of market-based finance: the 'dash for cash'

The FPC's 2020 review of market-based finance was different to its previous assessments. Instead of considering potential vulnerabilities and transmission channels, the behaviour of markets in March 2020 represented a real life stress – the 'dash for cash' – which the FPC analysed in its May 2020 interim FSR and its August 2020 FSR.

3.1: The 'dash for cash'

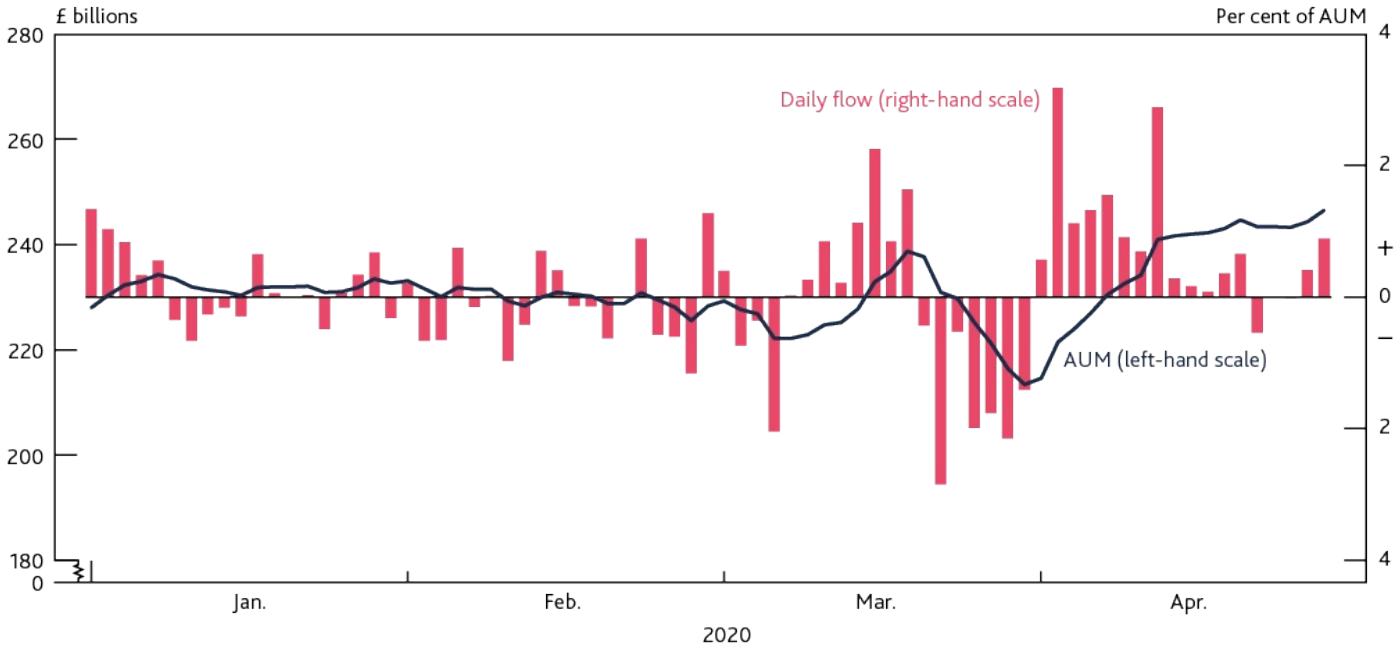
In March 2020, financial markets reacted to the expected effect on economic activity of the Covid pandemic and the public health measures introduced to contain its spread.
This reaction began as a 'flight to safety', where investor appetite shifted from risky assets to more safe and liquid assets. But it soon morphed into an abrupt and extreme 'dash for cash', in which investors sold off even safe assets such as long-term government bonds in order to obtain short-term highly liquid assets. A number of the vulnerabilities that the FPC and other authorities, including the FCA and the FSB, had highlighted were exposed during this 'dash for cash' (see Hall (2021)). This episode, which was underpinned by precautionary demand for liquidity in the real economy and financial markets, caused severe disruption in market-based finance (see the August 2020 FSR for more detail). Evidence of higher demand for liquidity included; outflows from money market funds (MMFs) and other open-ended funds; deleveraging by leveraged investors (such as hedge funds); and institutions raising liquidity to meet margin calls. Other factors limited the supply of liquidity, including dealers' capacity to intermediate and some structural features of markets.

Conditions in government bond markets deteriorated quickly.
Markets came under forced selling pressure as they became characterised by exceptionally high demand for cash, and cash-like short-dated assets (see Hauser (2020)). Hedge fund deleveraging in US Treasury markets contributed to stress in that market in particular. A number of relative value hedge funds engaged in arbitraging deviations between US Treasuries and US Treasury futures encountered substantial losses. They reduced their exposures to these positions – the US Office of Financial Research (OFR) found that in March 2020, hedge funds reduced their long US Treasury exposures by US$242 billion[6] (a 17% reduction) – which exacerbated the stress in that market.

There is no evidence of significant hedge fund deleveraging in gilt markets. But as volatility and uncertainty increased, dealers' bid-offer spreads widened – for example, gilt market bid-offer spreads were around four times their normal levels. A fuller account of these dynamics is available in the Bank of England Financial Stability Paper, Czech et al (2021).

Redemptions from MMFs was one way in which NBFIs sought to raise cash.
Sterling-denominated MMFs saw outflows of around £25 billion; or 11% of their total assets (Chart 2). At first, the outflows were met by MMFs running down their holdings of liquid assets and withdrawing funds from gilt repo markets. But as the outflows increased, MMFs found their ability to generate additional liquidity to meet daily redemptions constrained, since some of the assets they held – particularly commercial paper (CP) and certificates of deposit (CD) – could not be sold under strained market conditions (see Czech et al (2021)). This exposed the risk of a run on these funds.

Chart 2: Sterling-denominated MMFs saw large outflows during the 'dash for cash'
Sterling MMFs' assets under management (AUM) and daily flows (a)



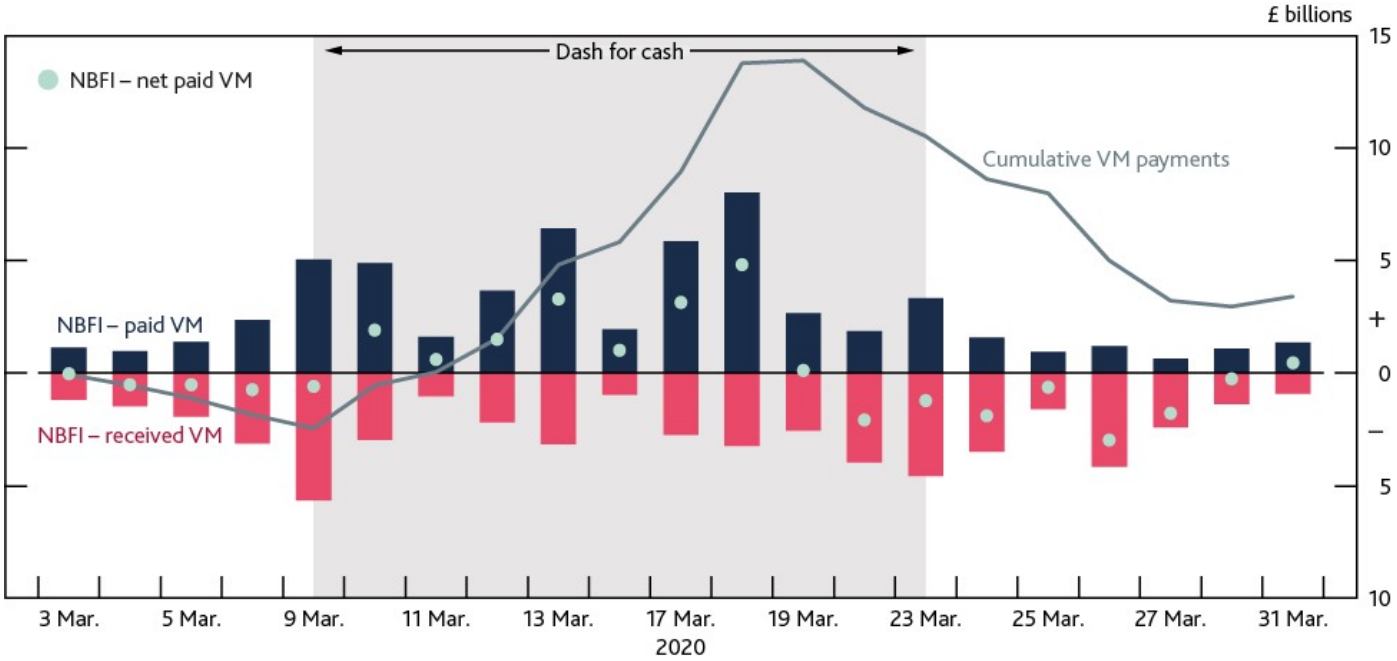
Sources: Crane Data LLC and Bank calculations.

(a) Over 95% of the sample are prime (by AUM) and the remainder are public debt.

Furthermore, open-ended funds experienced large redemptions, which were particularly acute for bond funds, and resulted in selling in gilt and corporate bond markets.
Outflows from global bond funds reached US$315 billion in March 2020, equivalent to 4.9% of assets under management.[7]

As discussed in Section 2, changes to margining requirements and increased central clearing were some of the key reforms following the global financial crisis of 2007/08. **During the 'dash for cash', the very large moves in asset prices, increased trading volumes and asset price volatility also led to significant increases in initial and variation margin calls, on both cleared and uncleared derivatives** (see Czech et al (2021)).[8] For example, variation margin calls for UK non-bank financial institutions on their cleared and uncleared derivatives exposures increased sharply once the 'dash for cash' period had begun (Chart 3). While increases in margin are to be expected in volatile markets, they should not be more procyclical than warranted. It is also possible that some non-bank financial institutions may not have anticipated the size or timing of the increase in margin requirements (see Section 4.1.3).

Chart 3: There was a large increase in daily variation margin calls during the 'dash for cash'
Estimated variation margin (VM) payments for UK non-bank financial institutions (a) (b)



Sources: European Market Infrastructure Regulation (EMIR) Trade Repository Data and Bank calculations.

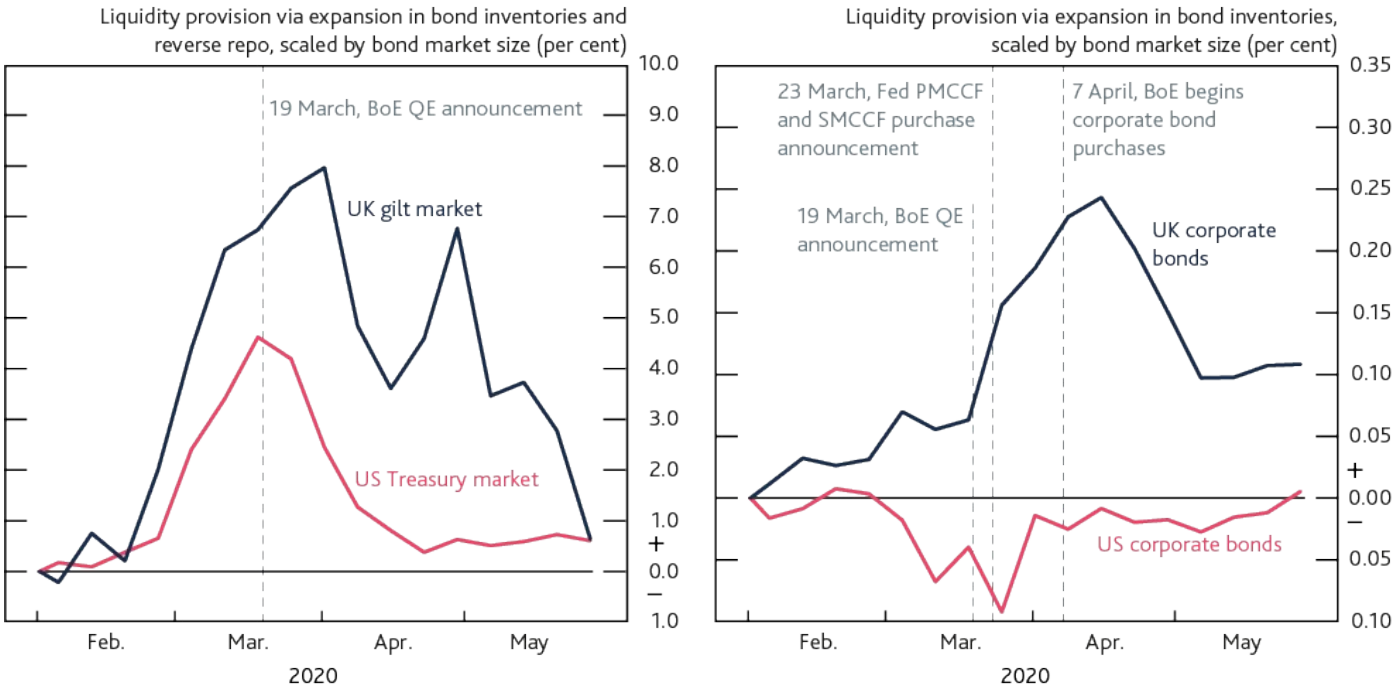
(a) Variation margin calls are estimated using the EMIR Trade Repository Data on interest rate swaps, forward rate agreements, inflation swaps and cross-currency basis swaps. The estimates are based on the methodology used in Bardoscia et al (2020), 'Simulating liquidity stress in the derivatives market'.
(b) Because variation margin reflects the new market price of a product, gains by market participants on one side of the trade are always equal to the losses incurred by other market participants. This means that, in aggregate, variation margin does not remove liquidity from the system, it redistributes it.

Dealer banks were initially able to absorb, rather than amplify, the shock by continuing to provide liquidity to market participants, both via repo lending and security purchases.

For example, ahead of the central bank interventions, dealers provided an additional £50 billion of lending to clients via reverse repo, and expanded their gilt inventories by around £10 billion (Chart 4) – comprising, in total, around 8% of the gilt market held by investors.

Chart 4: Dealers increased liquidity supply in government bonds markets in March 2020

Change in liquidity provision in UK and US government and corporate bond markets scaled by the size of the respective markets (a)



Sources: Bank of England Asset Purchase Facility Quarterly Report, Bank of England Sterling Money Market data collection, Debt Management Office, DBI from Refinitiv, New York Fed, MiFID II, Securities Industry and Financial Markets Association and Bank calculations.

(a) Data for US markets cover US primary dealers; data for UK markets cover gilt-edged market makers, G-16 dealers and major UK banks. Market sizes are as of end-2019, excluding central bank holdings. UK corporate bonds refer to bonds issued by UK firms in sterling. PMCCF is the Primary Market Corporate Credit Facility and the SMCCF is the Secondary Market Corporate Credit Facility.

This response by dealers was not common across all markets, however. Dealers' provision of liquidity in both UK and US corporate bond markets was more limited. They held their sterling corporate bond inventories broadly flat over the stress episode and reduced their US corporate bond inventories. And, while dealers initially accommodated some of the demand for liquidity from MMFs by repurchasing their own short-term debt, they quickly reached the limits of their willingness to do so given the magnitude and one-sided nature of the flows.

Overall, dealers' liquidity provision was insufficient to accommodate liquidity demand, which came from the non-bank sector in particular.

Staff analysis suggests dealer constraints in supplying liquidity to the market might have accounted for around a third of March's increases in term gilt reverse repo spreads, with the rest attributed to the demand for liquidity by market participants.[9]

3.2: The global policy response to the 'dash for cash'

The spread of Covid and the public health measures introduced to contain it severely disrupted both the UK and global economies.

Authorities responded swiftly – for example, in the UK, the Monetary Policy Committee cut Bank Rate to 0.1%, the FPC cut the UK countercyclical capital buffer rate to 0%, and HM Treasury introduced the Coronavirus Job Retention Scheme to support employment and household incomes.

It quickly became apparent that, as a whole, market-based finance was not sufficiently resilient to cope with the market stress associated with the Covid pandemic.

Market-based finance risked amplifying rather than dampening the stress. Absent action, it is likely that the stress faced by the financial system would have worsened, driven by self-reinforcing dynamics. Wider bid-ask spreads, higher volatility

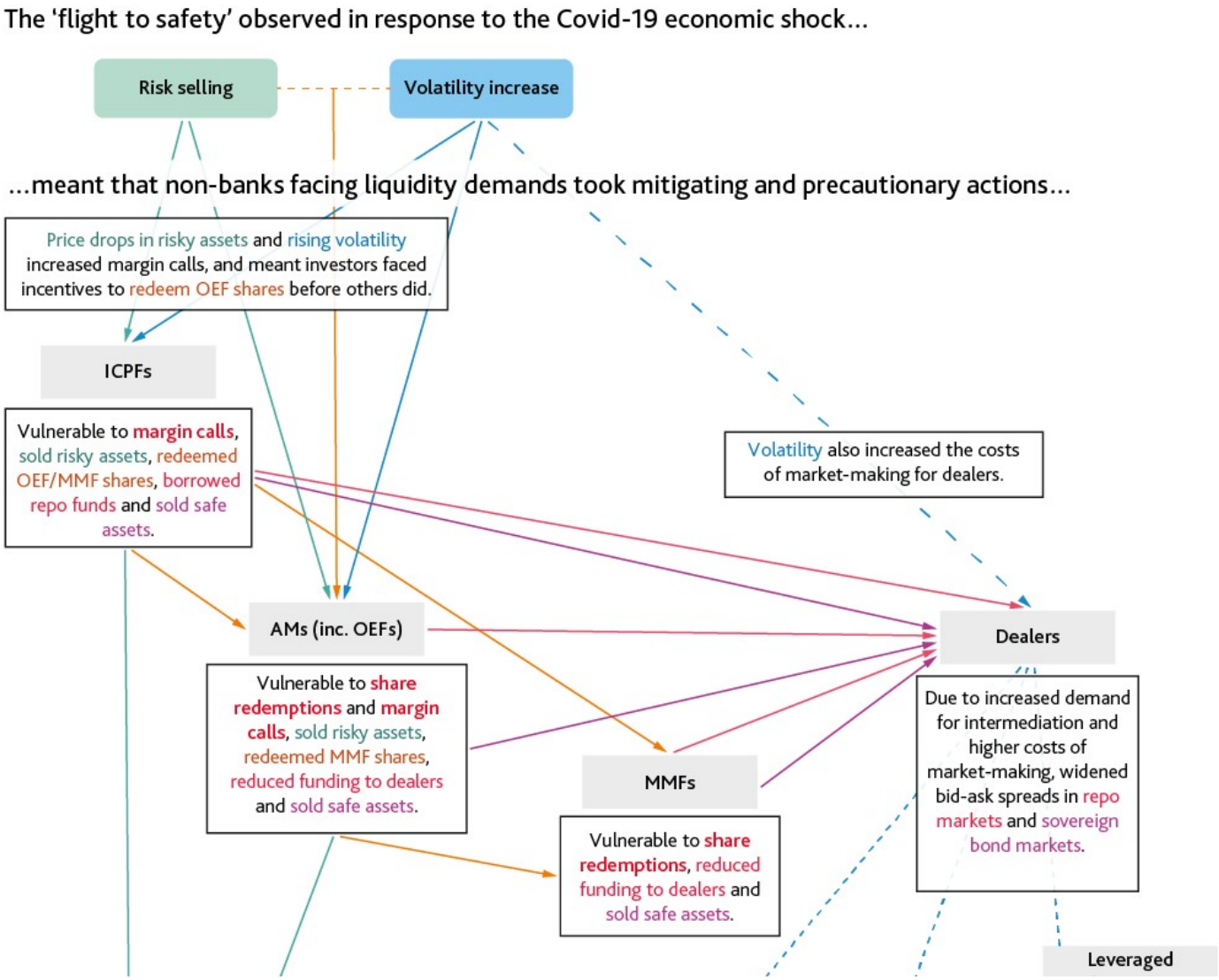
and larger liquidity risk premia would have led to further difficulties in raising cash for financial institutions. For example, MMFs, which were already experiencing outflows, could have experienced suspensions – in turn, this could have impacted the ability of some large companies and other investors to access cash. And stress in government bond and repo markets could have been amplified further had losses at leveraged hedge funds prompted further deleveraging.

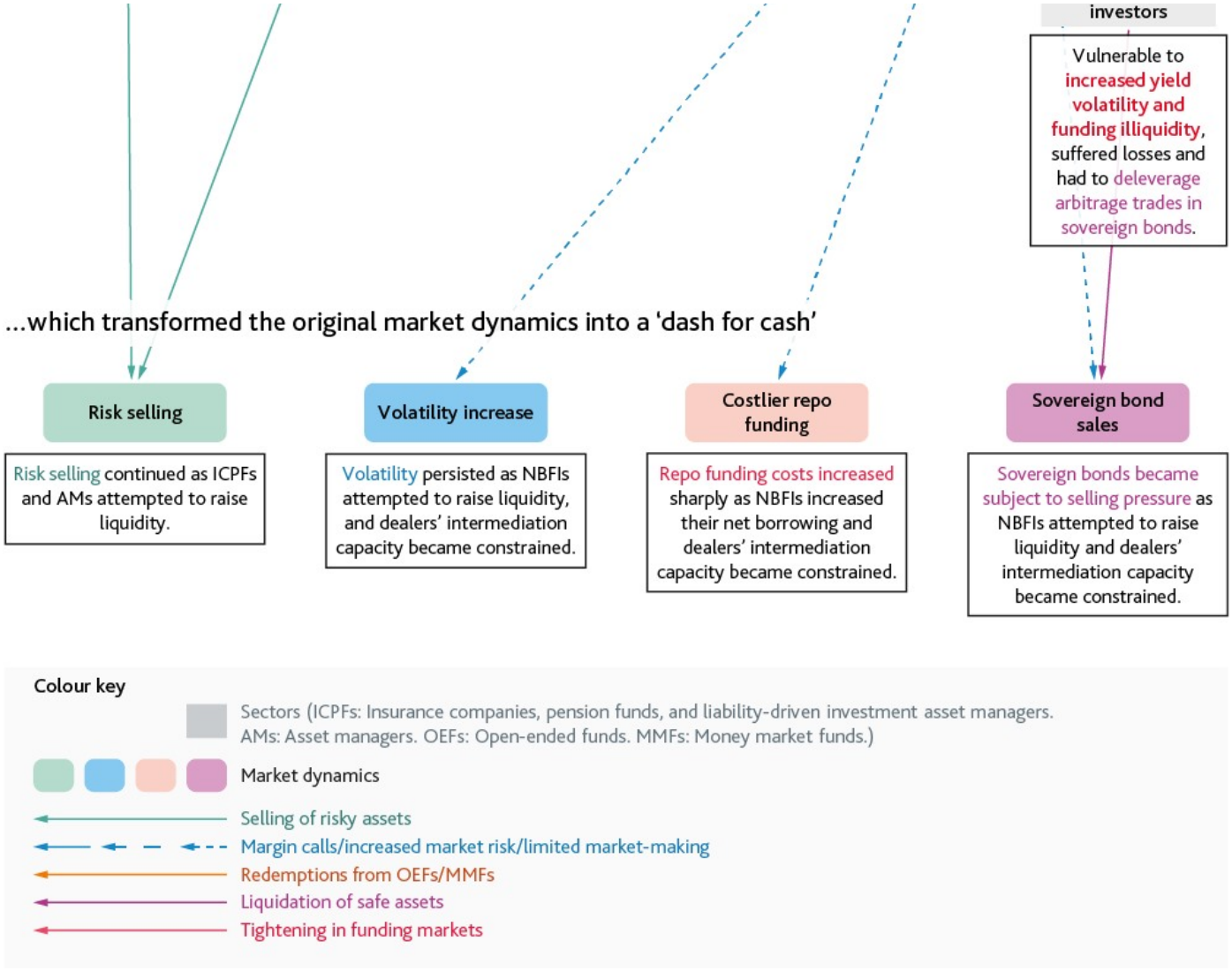
The impact would have been severe for the real economy. Financial conditions would have materially tightened, placing the continued financing of UK households and businesses at risk. This would have come at a time when the UK economy, and economies around the world, were in need of broad-based support and stimulus to weather the pandemic.

Central banks globally stepped in with actions to maintain monetary and financial stability, including through monetary easing, liquidity facilities and enhanced US dollar liquidity arrangements. Large-scale asset purchases, a monetary policy response implemented to support demand and output by preventing a material tightening in financial conditions, were able to address the market dysfunction (see Hauser (2021)). This stimulus also proved effective at stabilising the financial system, and preventing wider economic damage.

While markets have since functioned well there have been signs that fragility remains. In March 2021 advanced-country government bond yields rose markedly. The increases in yields reflected improvements in the growth outlook, but were also associated with some instances of illiquidity, with some signs of market function deteriorating. For example, market depth on US Treasuries declined substantially, with five-year Treasuries experiencing a particularly marked fall. This reinforces the risk of further episodes of market disruption in the event of very sharp changes in economic prospects, potentially related to future developments in the Covid pandemic.

Figure 1: Market-based finance is complex and interconnected
Map of actions taken by non-bank financial intermediaries in the 'dash for cash'





Source: Czech et al (2021).

Figure 1 shows how actions taken by some non-bank financial institutions in March 2020 interacted with vulnerabilities in the system in ways that increased financial stability risks. It also shows the interconnectedness of non-bank institutions, including how stress was transmitted – and amplified – through the system. This highlights the importance of taking a holistic approach to assessing, and where necessary reinforcing, the resilience of the sector.

4: Current priorities for remediating vulnerabilities in market-based finance

Recognising the global nature of these markets, the FSB published a holistic review of the March 2020 turmoil in November 2020 and initiated work to co-ordinate the international regulatory community's assessment of identified vulnerabilities and the appropriate financial policy response.
In July 2021, the FSB published an update on this workplan in its interim report 'Lessons learnt from the Covid-19 pandemic from a financial stability perspective'. The Bank, the FCA and HM Treasury are working closely with international counterparts in the FSB on the next stages of this work to develop common approaches to enhance the resilience of the market-based financial system.

Reforms to enhance the resilience of market-based finance should build on work to increase the resilience of the financial system to date.
Consistent with the FSB's workplan, the FPC's work to identify ways to increase the resilience of market-based finance

is focusing on three key areas (see July 2021 FSR):

- reducing the demand from the non-bank financial system for liquidity rising unduly in stress periods;
- ensuring the resilience of the supply of liquidity in stress; and
- assessing what can, or should, be done by central banks to backstop market functioning effectively, without creating incentives for market participants to take on more risks.

Table A sets out the main examples of policy work on the agenda to address vulnerabilities in market-based finance, and includes topics under discussion at international fora. Many of these issues are global, and so will require the co-operation of international jurisdictions.

Table A: Possible areas for consideration in the market-based finance sector

FPC's areas of focus	High-level objective	Description	
Manage the demand for liquidity in stress	Examine and address the liquidity mismatch in funds	• There is a need to examine and address the mismatch between the liquidity of assets held in open-ended funds – including money market funds (MMFs) – and the redemption terms they offer • Many investors regard their MMF holdings as 'cash-like', but they are subject to risks because MMFs may not always be able to make good on this expectation • Some open-ended funds offer daily redemptions but invest in illiquid assets – this means there is an incentive for investors to redeem ahead of others, particularly in a stress	Improve the robustness and coverage of data, domestically and globally
	Assess the role of leveraged non-bank investors in the functioning of core markets under stress	• The use of leverage can offer market efficiency benefits but also makes the investor less resilient and can amplify stress in core markets • Data reported to supervisors of non-banks do not include all information important to assessing risks from leverage	
	Assess liquidity demands from margin calls in stress	• Margin requirements are designed to increase in stress to increase protection in the system, but this should not be more procyclical than warranted and market participants need to be prepared to meet those demands • International work is examining the framework and dynamics of margin calls in centrally cleared and uncleared derivatives markets and the liquidity management and preparedness of market participants to meet margin calls	
Ensure the supply of liquidity is resilient	Enhance the capacity of markets to intermediate in a stress without compromising on the resilience of dealers	• The use of banks' capital and liquidity buffers in times of stress can support market capacity • Some structural features of markets may also act to reduce market capacity in stress	
Consider potential central bank actions to backstop market functioning	Identify potential new central bank liquidity tools that can address dysfunction in core markets	• Central bank liquidity support can support market functioning in extreme circumstances • Such tools should minimise moral hazard, and avoid posing excessive risk to central bank balance sheets	

4.1: Limiting the demand for liquidity rising unduly in stress periods

Demand for liquidity increases in stress, as investor appetite usually shifts from risky assets to safer, more liquid assets. But vulnerabilities within the financial system can exacerbate this demand for liquidity, including:

- the mismatch between the liquidity of assets held in open-ended funds – including MMFs – and the redemption terms

offered by those funds (Section 4.1.1);
- the forced unwinding of leveraged positions by non-bank financial institutions (Section 4.1.2); and
- the management of liquidity demands following increases in derivative margin calls (Section 4.1.3).

4.1.1: Examining and addressing the liquidity mismatch in funds

As the FPC has previously noted, there is a need to examine and address the mismatch between the liquidity of assets held in open-ended funds – including MMFs – and the redemption terms they offer.
In December 2019, the FPC established three principles for achieving greater consistency in the design of open-ended funds between:

- the liquidity of a fund's assets;
- the price received by redeeming investors for their units in the fund; and
- the redemption frequency and/or length of notice periods[10]

The FPC has judged that the mismatch between the redemption terms and the liquidity of some funds' assets means there is an incentive for investors to redeem ahead of others, particularly in a stress. This first-mover advantage has the potential to become a systemic risk by creating run dynamics. The Bank and FCA have concluded their joint review into vulnerabilities associated with the liquidity mismatch in open-ended funds. The conclusions of the review are presented in Box A.

While the FPC's three principles were developed in the context of the joint Bank and FCA review into open-ended funds, they also apply to money market funds. As noted in Section 3.1, the liquidity mismatch inherent in MMFs was exposed during the 'dash for cash'. Some MMFs came close to regulatory thresholds at which point they would have had to discuss whether or not to suspend or 'gate' withdrawals, or apply liquidity fees. The prospect of suspensions can create incentives for investors to redeem early and quickly, which can introduce the risk of a 'run' on the MMF and the possibility of the MMF needing to suspend redemptions.

A run on a single MMF can raise fears of suspensions at other funds, triggering further runs. If MMFs had suspended in March, there would have been a significant threat to wider UK financial stability, due to their interlinkages with and associated contagion to other institutions, including other open-ended funds, pension funds and insurance companies, which rely on MMFs to manage short-term liquidity and to meet margin calls. In addition, MMF suspensions can have a direct adverse impact on the economy – corporates and local authorities would be unable to access their holdings to pay creditors, taxes or wages. In March 2020, swift and decisive central bank actions supported financial system functioning and eased financial conditions, which alleviated the liquidity strains on MMFs. Nonetheless, the underlying vulnerabilities exposed in March 2020 remain.

To address vulnerabilities in the global money market fund sector, a robust and coherent package of international reforms needs to be identified. As noted in a speech by the Governor of the Bank of England, it is important that any package removes the adverse incentives introduced by liquidity thresholds related to the use of suspensions, gates and redemption fees (see Bailey (2021)).

But removing these cliff effects are unlikely to be sufficient to address the liquidity mismatch.
It is likely to require a combination of measures to reduce risks to a sufficiently low level and make MMFs resilient for the purpose for which they are used. For example, a coherent policy package could include reforms to: (i) remove adverse incentives introduced by the threat of restrictions on redemptions when regulatory thresholds are breached; (ii) ensure that liquid asset buffers are usable in stress; (iii) limit the proportion of private (ie non-government) assets held by MMFs; and (iv) structure funds as variable net asset value to reduce first-mover advantages and potential cliff-edge effects.

Internationally, the FSB has published a consultation paper which sets out policy options to enhance MMF resilience, including with respect to the appropriate structure of the sector and of underlying short-term funding markets. The policy options are intended to inform jurisdiction-specific reforms and any necessary adjustments to the policy recommendations for MMFs issued by IOSCO. Given the global nature of MMFs, it will be important for any final framework to promote a common, baseline level of resilience for MMFs internationally.

4.1.2: The role of leveraged investors as a source of liquidity demand in core markets

Under stressed conditions, hedge funds' risk-management approaches may lead them to reduce their market positions as part of derisking and/or deleveraging.
This can have a negative effect on market liquidity, because they reduce their provision of liquidity or switch to demanding liquidity as positions are unwound. This was evidenced in the March 2020 'dash for cash', particularly with respect to US Treasury markets (as noted in Section 3.1, hedge funds reduced their long US Treasury exposures by 17%, or US$242 billion). This episode demonstrates the trade-off between the increased efficiency enabled by leverage under normal market conditions, and the consequences of a high degree of leverage in stress.

In contrast to US Treasury markets, hedge funds did not appear to deleverage in gilt markets.
Czech et al (2021) find that hedge funds appeared to accumulate gilts in both the 'flight to safety' and the 'dash for cash'. However, further work to understand potential risks from hedge funds and their overall resilience is warranted, given their role in gilt markets (and the importance of these markets to the real economy), and the ability for stress in US Treasury markets to spill over to gilt markets.

The strategies employed by hedge funds in government bond markets affected their incentives to delever.
In US Treasury markets, hedge funds were significant borrowers of cash in repo markets ahead of March 2020 (see Kruttli et al (2021), and Bank of England (2020)). This was likely driven by relative value hedge funds exploiting price differences between US Treasury bonds and futures. However, in gilt repo markets, hedge funds had broadly similar amounts of cash borrowing and lending. While this also largely reflected relative value hedge funds' positions, in gilt markets they generally exploited price differences between different bonds on the yield curve – meaning they did not face the same pressures as in US Treasury markets.

The default of Archegos Capital Management (Archegos), a family office rather than a hedge fund, in March 2021 also illustrated vulnerabilities associated with the use of leverage.
Archegos' positions in equity derivatives were financed by banks, who made margin calls when the underlying stock prices fell. When Archegos could not meet the margin calls, some banks sought to limit their own exposures by exiting positions. This precipitated further price falls in those specific stocks. This episode led to some banks experiencing substantial losses. While this was not a systemic event, the experience highlights the transmission channels for the behaviour of leveraged investors to affect both markets and the banking sector. It also demonstrates the need for greater visibility of the exposures of non-banks given the limited information available about Archegos' positions. [11] Such information could be acquired from the non-banks directly, or alternatively from the banks who finance their activity. This is important if counterparties of non-banks are to be able to manage risk, particularly counterparty credit risk, effectively. Box C sets out further detail on the limits of data available to regulators.

Relevant policy responses to vulnerabilities arising from hedge funds likely centre around the use of leverage.
The right balance will need to be struck between limiting risks from deleveraging while retaining the benefits leveraged investors can provide for market efficiency.

An essential first step is to improve the availability of timely, decision-useful data on leveraged non-bank financial institutions.
As the FPC set out in its in-depth assessment of leverage in the non-bank financial system, data currently reported to the supervisors of non-banks do not include all the information needed to monitor the risks from leverage. To monitor the potential financial stability risks from fund leverage, supervisors need information on funds': (i) use of borrowing and derivatives; (ii) potential losses across their whole portfolios; and (iii) potential liquidity demands, relative to available liquid assets, either from collateral calls on their derivatives and repo, or from their short-term borrowing not being rolled over.

The Bank has made some progress in its ability to analyse existing sources of data on leveraged investors (for example on derivatives and repo transactions) and in bridging the lack of information about funds exposures via the Hedge Fund as Counterparty Survey. But more work is needed to secure the necessary degree of transparency in this area (see Box C).

The FSB's workplan includes work to assess the role of leveraged investors in core government bond markets, to assess whether excessive leverage could be a cause for concern in future episodes of market dysfunction.

4.1.3: Managing liquidity demands from margin calls in a stress

Reforms to promote central clearing and develop margining standards have been a key aspect of the reforms introduced following the global financial crisis of 2007/08 (see Section 2). The collection of margin reduces and mitigates risks that the failure of one firm could have a severe impact on the rest of the financial system. In March 2020, as a result of very large asset price moves, margin calls increased significantly, as expected during periods of increased risk. Aside from a very small number of exceptions, this increase in margin calls was met and ensured that counterparty credit risks were contained.

The post-crisis reforms promoted the increased central clearing of OTC derivatives, supported by robust margining requirements. As the prices of derivatives contracts change, market participants exchange gains and losses daily, preventing the build-up of exposures between firms. This is known as variation margin. Market participants must also post collateral to cover potential future adverse changes in the market value of the contract following a default; this 'pre-paid self-insurance' – known as initial margin – increases as volatility rises, since the potential for losses is higher when markets are volatile. Initial margin, on cleared and uncleared derivatives, protects market participants from counterparty credit risk.

By design, margin requirements are procyclical in that they rise in stressed market conditions, to match the increase in expected losses and risks. This ensures that counterparty risk is properly mitigated, but requires counterparties who need to post margin to find additional liquid assets at precisely the time when it is most difficult for them to do so. In particular, increases in margin that are unpredictable, unexpectedly large, or more procyclical than warranted can cause severe liquidity strains on market participants and the financial system as a whole.

Although more rapid reallocation of liquidity around the system and margin requirements that rise with volatility are a key and well-understood feature of post-crisis derivatives reforms, some users of derivatives were better prepared than others for the liquidity pressures in 2020. For example, in order to raise cash to meet redemption pressures and margin calls, replenish their liquid asset holdings, or in anticipation of further calls, some non-bank financial institutions redeemed MMF shares, borrowed in the gilt repo market, and sold gilts and corporate bonds (see Czech et al (2021)). These actions contributed to selling pressures in those markets and the large withdrawals from MMFs in mid-March.

In light of the March 2020 market disruption, some firms have reported that they have made changes to their liquidity risk management practices, for example by improving their stress testing. Some non-bank financial institutions have also renegotiated contracts to allow corporate bonds to be used as collateral, which reduces the risk of forced selling of assets but may increase counterparty credit risk and push the risk-management problem to banks.

Notwithstanding these changes, vulnerabilities remain.[12] **Managing the liquidity demands of margin calls is a key component of risk management for derivatives users.**[13] All derivative users need to have structures and processes in place to predict and manage potential liquidity outflows due to margined trades (see Hall (2021)). It is also important to consider whether there are design elements of margin models that led to increases in margin calls that were in some cases more procyclical than warranted in March 2020, placing unnecessary liquidity pressures on market participants. Transparency regarding CCP IM models is also important in ensuring market participants are able to prepare prudently for margin calls. There is considerable variation in the level of transparency regarding margin models and potential margin calls provided by CCPs internationally.

The FPC has noted that it supports international work to assess whether there was more procyclicality in margin calls than was warranted, whether market participants were prepared for margin calls in a stress, and any consequent need for policy in light of this, without compromising the benefits of the post-global financial crisis margining reforms.
The right balance of policy responses will depend on further evidence gathering. The FPC has noted that it supports work on an international level that aims to:

- understand the drivers of differences in procyclicality across CCPs, asset classes, and products, and for setting out clear criteria for analysing the levels and effects of procyclicality;
- examine the degree to which prudent pre-crisis margin levels driven by CCPs' anti-procyclicality measures or other tools or actions taken by CCPs helped to dampen the response of initial margin to extreme volatility;
- assess the extent to which non-bank clients were adequately prepared for the size of margin calls and to what extent their actions to raise liquidity impacted the rest of the financial system; and
- analyse the extent to which the information made available by CCPs to market participants is or can be used in liquidity planning.

Following agreement by the G20, the FSB, in co-ordination with standard-setting bodies, is looking at issues around margin calls during the early stages of the pandemic. This includes analysis of margin calls in cleared and uncleared markets during March and April 2020, the drivers of these calls, a review of margin practice transparency and predictability across markets and analysis of liquidity management preparedness by market participants.

4.2: Increasing the resilience of the supply of liquidity in stress

The non-bank financial system is always likely to need additional liquidity in stress. It is important to ensure this need can be met in ways that avoid forced asset sales or disruption to market functioning.

4.2.1: Dealer intermediation capacity

Regulation to safeguard the core banking system may have played a part in constraining dealers' capacity to intermediate during the Covid stress.
At the outset of the Covid pandemic, the largest global dealer banks (the G-16) had Tier 1 capital levels of 15.6%. Dealers' capacity to intermediate in gilt and gilt repo markets may, in some cases, have been related to how far away they were from regulatory thresholds. For example, UK dealer subsidiaries that entered the stress with higher buffers over the leverage ratios expected by their supervisors appeared to use those buffers more to support client activity, including to expand repo intermediation. Market and supervisory intelligence suggests that some dealers had significant buffers above leverage requirements at Group level, but that the approach taken to balance sheet management meant that extra capacity was not always readily available to the subsidiary or desk responsible for market intermediation. Of course, this may partly reflect prudent balance sheet management, given uncertainty regarding the evolution of the Covid pandemic – for example, to retain additional capacity should it be needed to support other businesses lines (eg lending via committed

credit facilities).

Similarly, internal risk limits likely limited the extent to which dealers were able to expand their government bond inventories, and incentivised holding more liquid and less volatile securities (eg those with shorter maturities). Internal risk limits and risk appetite were particularly important in driving dealers' behaviour in the corporate bond market and impacted dealers' willingness to materially expand their inventories.

There is merit in exploring ways to enhance dealer capacity.
However, seeking to increase the resilience of the supply of liquidity from banks to non-banks in stress by compromising on the resilience of banks would not be effective in enhancing the resilience of the system as a whole. One way that market capacity could be enhanced, without compromising resilience, may be through banks making more use of capital and liquidity buffers in times of stress. Over the course of the Covid pandemic, the FPC and the Prudential Regulation Committee (PRC) emphasised the role and usability of these buffers.

But it is also important to address structural features of markets to support market capacity – for example, by helping to ensure that pricing is transparent and there are efficient ways of matching buyers and sellers (see Section 4.2.2).

The FSB has established a workstream to examine dealer behaviour, the determinants of their ability and willingness to intermediate markets (including with respect to prudential regulation), and the implications for market functioning and liquidity. This work may identify issues for further consideration. In parallel, the Basel Committee on Banking Standards (BCBS) is undertaking an evidence-based evaluation of the effectiveness of the Basel III reforms, taking into consideration the lessons learned from the Covid pandemic. The BCBS published their interim report, 'Early lessons from the Covid-19 pandemic on the Basel reforms' in July 2021. The Bank is contributing to both workstreams.

4.2.2: Structural features of markets

Structural features of these markets were important in driving market capacity during the Covid stress and in some cases interacted with dealers' balance sheet constraints.
UK dealer subsidiaries charged materially less for less capital-intensive term gilt repo transactions (ie those that are nettable in the leverage ratio exposure measure) relative to those that are more capital-intensive (ie those that are 'non-nettable'). Prior to Covid, they charged on average 1 basis point more for non-nettable transactions. But in the first half of March 2020, they were charging around 6 basis points more and, at the peak of the stress in this market, around 8 basis points more, for these non-nettable, more capital-intensive transactions. This too suggests that less capital-intensive forms of repo, including cleared trades, may have been more resilient during the stress.

Changes to market structure could enhance the resilience of liquidity in core UK markets.
The share of nettable gilt repo, comprising both cleared transactions and those that are nettable bilaterally, has grown over recent years reaching just under 60% of the repo market in 2021 Q1. Around half of nettable repo is cleared, and the majority of these cleared trades are between dealers (very few non-banks are direct members of CCPs).

It may therefore be worthwhile to consider, as part of future work, whether greater central clearing of government bond and repo transactions could bring about further netting benefits.
Staff analysis, such as that presented earlier, suggests that less capital-intensive forms of gilt repo, including cleared repo trades, might be more resilient in times of stress. Others have also suggested greater clearing in government bond markets more broadly, such as those for US Treasuries, may be beneficial (eg Duffie (2020)). However, such proposals should be carefully reviewed with respect to their expected effectiveness at enhancing market capacity, and hence market liquidity, during stressed periods.

The relative importance of different types of market participants in different markets is worth exploring further.
Principal trading firms (PTFs) have become increasingly prevalent participants in some markets (see Box 3 of the July

2019 FSR). These are a diverse set of smaller, non-bank firms that typically deploy automated trading strategies on electronic trading venues, often at much faster speeds than other market participants. PTFs have become substantial short-term liquidity providers in some markets. For example, as shown in the July 2019 FSR, they accounted for around 35% of long gilt futures volume. They are also very active in parts of the US Treasury market, accounting for around 60% of the electronic interdealer market and just under half of the total interdealer market (see Principal Trading Firm Activity in Treasury Cash Markets, by the Federal Reserve). PTFs only account for around 1% of cash gilt trading volume, but stress in gilt futures – where PTFs are more active – can nevertheless spill over to cash gilt markets.

In normal market conditions, PTFs can enhance overall liquidity, for example in terms of volumes traded. But, as noted in Hall (2021), while primary dealers commit to provide continuous two-way liquidity under all conditions, other market makers are generally exempt from providing liquidity in 'exceptional circumstances' of severe volatility. In times of high volatility or when correlations break down, some PTFs may withdraw their prices until market conditions calm down. Given their importance to core government bond markets, either directly as in US Treasuries or indirectly via futures markets for gilts, it is important to understand whether their actions amplify shocks. This was visible in the 'dash for cash', where their liquidity provision, measured in both volumes and submitted prices declined sharply, contributing to the disruption in US Treasury markets.

As set out in the July 2019 FSR, the FPC will continue to monitor such 'fast markets' closely, and in particularly the risks posed by flash episodes becoming more frequent or market dysfunction being longer-lasting in any future episode.

4.3: What can, or should, be done by central banks to backstop market functioning

In normal times, financial markets help ensure that market participants can access liquidity – cash and highly liquid assets – when needed. However, as demonstrated in March 2020, access to liquidity via the market for even the safest core sovereign debt may be reduced or disrupted during times of stress. And while it is first and foremost for market participants to manage the liquidity risks they face, it is not realistic or efficient to expect them to self-insure against every conceivable shock or stress.

Central banks have traditionally focused on providing backstop liquidity via the banking system.
The Bank of England, for example, offers a range of facilities which are available to banks and broker dealers including the Indexed Long-Term Repo and Contingent Term Repo Facility which were available during the stress triggered by Covid. While these facilities proved effective in supporting resilience and preventing stress amongst banks, they were not sufficient to address the scale of stress in the wider financial system, and in particular that amongst non-bank financial institutions. Asset purchases implemented under quantitative easing (QE) were needed to effectively restore monetary and financial stability. Other major central banks took similar action to tackle market dysfunction in core markets.

Given traditional central bank lending tools were insufficient to resolve the 'dash for cash', there may be a need for new tools to tackle core market dysfunction in response to how markets are changing.
The growth of non-banks as key intermediaries and providers of finance to the real economy, and the constraints that traditional central bank counterparties face during stress mean that there is a growing chance of tail-risk liquidity events within financial markets to which central banks will feel compelled to respond. Formalising the terms and conditions on which liquidity will be available in advance can help set expectations among market participants about the circumstances in which central banks will, and will not, act.

In considering the design of such tools, central banks will need to ensure that they will be effective in resolving dysfunction particularly given there could be scenarios where resort to using monetary policy tools such as QE would not be appropriate given the monetary policy stance. More generally, central banks will need to ensure that these tools act as a backstop; that the risks to the central bank balance sheet can be managed; and that they do not result in negative side effects such as perverse incentives to take risks.

One potential option to enhance the central bank toolkit could be to amend the terms and parameters of central bank lending/repo operations such that they directly or indirectly provide liquidity against high-quality sovereign debt to a broader range of counterparties such as non-banks. A key policy question to consider would be which entities might be eligible for access to such a facility. In order for the tool to be fully effective it would need to be available to a broad

enough set of firms to capture those with significant presence in the core market in question. However, there may be a risk that a formal central bank backstop encourages greater leverage among these participants. Therefore, as with central bank lending, the official sector will need to consider whether and how such moral hazard can be avoided, including through regulation and design parameters such as pricing and haircuts.

While a broader access lending/repo tool would likely give central banks substantially improved ability to tackle future instances of dysfunction, it is conceivable that such a tool might not be fully effective in all scenarios.

For example, there may be circumstances where market participants seek to sell an underlying asset rather than borrow against it in order to remove market risk from their balance sheets. In circumstances where dealer balance sheets are constrained, such selling pressure might similarly lead to periods of core market dysfunction. There is merit in exploring how central banks could operate two-way buy and sell facilities in such markets. The Bank of England has previous experience with such a facility in its Corporate Bond Secondary Market Purchase Scheme launched in 2009. Such a facility would need to be appropriately priced to act as a backstop and designed to unwind once the period of dysfunction had concluded.

The debate around the role of central banks and whether new liquidity supplying tools are needed is underway in a number of jurisdictions recognising that existing traditional central bank liquidity tools were not always sufficient to resolve the dash for cash (see Liang and Parkinson (2020), Schnabel (2020), Hauser (2021), and the Federal Open Market Committee minutes from April 2021).

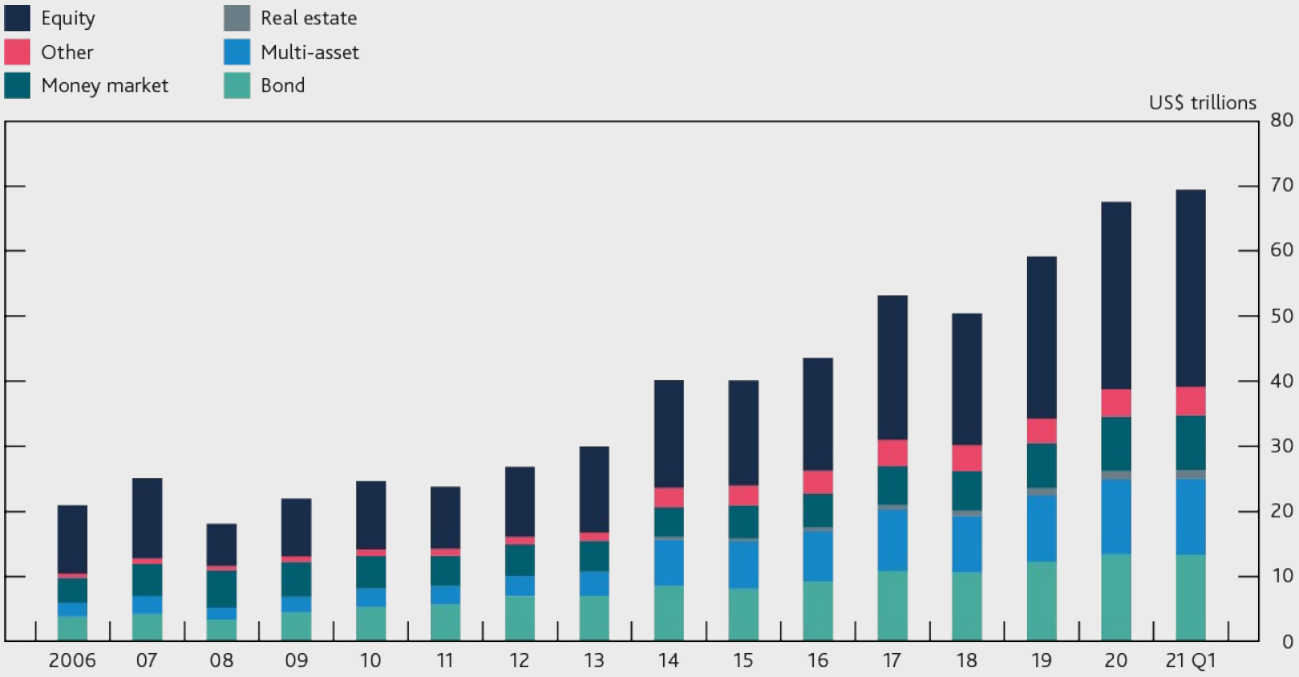
Box A: Concluding the joint Bank and FCA review into open-ended funds

Open-ended funds play an important and increasing role in the provision of finance, both globally and in the UK.

Open-ended funds are collective investment vehicles that can create units and sell them directly to investors. When investors exit an open-ended fund, they receive a price for the units being redeemed based on the fund's net asset value (NAV). Total assets managed by open-ended funds worldwide have more than doubled since the global financial crisis of 2007/08, to around US$70 trillion (Chart A.1).

Chart A.1: Total net assets of open-ended funds have more than doubled since the global financial crisis

Open-ended fund assets worldwide (a)



Sources: European Fund and Asset Management Association and Bank calculations.

(a) Total net assets of worldwide regulated open-ended funds. Includes exchange-traded funds and funds of funds.

The FPC has judged that the mismatch between redemption terms and the liquidity of some funds' assets means there is an incentive for investors to redeem ahead of others, particularly in a stress, and that this could become a source of systemic risk (see December 2019 FSR).

The vast majority of open-ended funds domiciled in the UK offer daily redemptions to investors, accounting for over 96% of UK open-ended funds' assets. At the same time, funds' holdings of assets that take longer to liquidate in an orderly way, especially during a period of market stress, are increasing. Globally, more than US$40 trillion of assets are now held in open-ended funds that offer short-term redemptions while investing in longer-dated and less liquid assets, such as corporate bonds. And according to Bank estimates, UK and foreign funds now hold around 17% of total sterling corporate bonds outstanding, up from 8% in 2006.[14]

By offering daily redemptions while investing in less liquid assets, funds can create incentives for investors to redeem ahead of others, particularly in a stress. This first-mover advantage has the potential to become a systemic risk by creating run dynamics. It could result in forced asset sales by funds, further amplifying asset

price moves and, by testing markets' ability to absorb sales, contributing to dysfunction in markets of the sort observed in March 2020. This could impair the issuance of new securities and thereby disrupt the supply of credit to the real economy.

In 2019, the Bank and FCA launched a joint review into vulnerabilities associated with the liquidity mismatch in open-ended funds.
As part of the review, in a survey, the Bank and FCA collected the data from 272 UK authorised funds (representing total assets under management of £137 billion) on their approach to liquidity management, including during the March 2020 market disruption. The survey questions mainly explored funds' use of liquidity management tools – particularly pricing adjustments – and also investigated fund managers' approach to liquidity assessments and classifications. The findings of the survey are described in the March 2021 report 'Liquidity management in UK open-ended funds'.

The survey provided several important insights into UK funds' liquidity management practices. In particular:

- Fund managers have a wide range of discretionary liquidity management tools available to them, and predominately adjust pricing to reflect the potential dilution effects of flows for remaining investors (so-called 'swing pricing').
- In addition to liquidity tools, fund managers managed fund liquidity by holding buffers of cash and non-cash liquid assets. Liquidity buffers can improve the marginal liquidity of funds' asset portfolios, and are important to help manage or anticipate future margin calls. At the same time, liquidity buffers can be a drag on funds' returns. And if a fund sells a representative sample of its assets to fulfil redemption requests, liquid asset buffers would do little to reduce any liquidity mismatch. Liquidity buffers may actually increase first mover advantage if investors anticipate the fund may use the most liquid part of the portfolio to pay redeeming investors.
- Fund managers intensified and adapted their use of swing pricing during the March 2020 market disruption, although there were large variations in how swing pricing was applied.
- An indicative 'top-down' liquidity classification suggested that fund managers may be overestimating the liquidity of their fund portfolios.

In the context of the joint Bank and FCA review, the FPC set out three key principles for fund design that, in its view, would deliver greater consistency between funds' redemption terms and their underlying assets:

1. **Liquidity classification:** The liquidity of funds' assets should be assessed either as the price discount needed for a quick sale of a representative sample of those assets or the time period needed for a sale to avoid a material price discount. In March 2021, the FPC judged that the survey indicated that consistent and more realistic classification of the liquidity of funds' assets is an essential first step to ensuring funds can address mismatches between asset liquidity and redemption terms.
2. **Pricing adjustments:** Redeeming investors should receive a price for the units in the fund that reflects the discount needed to sell the required portion of a fund's assets in the specified redemption notice period. In March 2021, the FPC judged that the calculation and application of swing pricing could, in principle, be enhanced in order to reduce the systemic risk that could be associated with first-mover advantage.
3. **Notice periods/redemption frequency:** Redemption notice periods should reflect the time needed to sell the required portion of a fund's assets without discounts beyond those captured in the price received by redeeming investors.

The FPC also judged that the survey indicated that swing pricing had been inconsistently applied across funds and even when deployed, in many cases the swing had been insufficient. Bank staff have also undertaken further analysis to consider whether pricing adjustments applied by funds in March 2020 adequately reflected the price uncertainty of the underlying bonds, or the cost of sales to meet redemptions during the stress (see Box B).

In March 2021, the FPC noted that funds that hold highly illiquid, infrequently traded assets, such as real estate,

might not be able to implement swing pricing effectively in practice. This is because swing pricing adjustments require reasonable information on the price, liquidity and transaction costs of an asset. In these cases, longer redemption notice periods could address the first-mover advantage and potential financial stability risks that may otherwise arise.

More generally, the development of funds with longer notice periods could help to increase the supply of productive finance to the economy. Such funds can hold illiquid assets like unlisted equities, safely and sustainably. But some investors feel there are barriers to this type of investment, related to fund structures as well as to wider operational issues. The Bank, HM Treasury and the FCA have established an industry working group to break down some of those barriers and facilitate investment in productive finance. The FCA is also consulting on a regime to enable UK-authorised open-ended funds to invest more efficiently in long-term, illiquid assets through a Long-Term Asset Fund (LTAF) structure.[15]

Informed by the results of the joint Bank and FCA survey, the Bank and the FCA have concluded their joint review into vulnerabilities associated with the liquidity mismatch in open-ended funds, which considered how the FPC's three principles could be developed further, to support UK financial stability.

In concluding the review, Bank and FCA staff have now put forward a possible framework for how an effective liquidity classification framework for funds could be designed, as well as for the calculation and use of swing pricing.
The views outlined in this framework are intended to facilitate discussion and not to be rules in themselves. There are a range of ways to address liquidity mismatches in open-ended funds, and more work is needed to consider the right balance of policy responses before any rules are established. With that in mind, the following section describes a possible framework to illustrate what any approach should achieve, along with any trade-offs, to inform thinking in the ongoing international work with a view to further policy development by securities regulators.

A possible framework for a consistent and realistic classification of the liquidity of funds' assets

1. An effective liquidity classification framework would capture the full spectrum of liquid and illiquid assets, and consider both normal and stressed conditions. Under current rules, fund managers are required to have appropriate liquidity management arrangements to measure and manage a variety of risks. Liquidity risks include, for example, the risk of not being able to fulfil redemption requests without a price discount on the assets sold, or not being able to meet other liabilities such as margin calls. Classifying and measuring liquidity in all market conditions therefore has important benefits in terms of managing liquidity to meet anticipated redemptions.

2. An effective liquidity classification framework should play a role in the design of a fund and in determining appropriate redemption terms. A liquidity classification framework, along with other metrics such as investor profile and concentration, could inform the appropriate liquidity management tools as regards redemptions. For example, for funds that primarily invest in inherently illiquid assets, notice periods might be a more appropriate liquidity management tool than pricing adjustments. A consistent framework can therefore also help better identify whether the liquidity tools a fund uses are appropriate for the assets it holds.

3. A consistent and realistic classification of the liquidity of funds' assets could be used to enhance funds' internal risk management practices, particularly stress testing. Stress testing is already an important aspect of liquidity management frameworks and allows firms to assess the impact of market stresses, anticipate activity in stressed market conditions and identify potential vulnerabilities. However, if funds are overoptimistic about the liquidity of their holdings, this might undermine the value of their stress tests. Better and more consistent liquidity classifications could therefore usefully inform funds' stress testing processes by providing a more complete view of their liquidity profile.

4. The classification should be sufficiently granular and should be available for regulatory reporting purposes. In the Bank-FCA survey, managers of surveyed funds were asked to classify their asset holdings

using an indicative and non-prescriptive liquidity classification with five categories of assets. A liquidity classification at least as granular as this could allow fund managers to account for differences in their actual holdings, but allow sufficient consistency to be used by regulators as a check on fund managers' own classification of their holdings across liquidity categories.

There are trade-offs between a 'top-down' asset liquidity based classification (whereby liquidity is classified by the asset-class), and a 'bottom-up' securities-based approach (whereby funds allocate securities to specific 'liquidity' categories). A top-down framework allows for a more consistent measurement of the liquidity of funds' holdings, but may camouflage idiosyncratic liquidity risks within an asset-class. A bottom-up framework would allow fund managers to consider the inherent liquidity profile of their securities, but assessment of liquidity is challenging and ultimately based on both information and judgment.

There is also a trade-off between flexibility and prescriptiveness no matter the form of any liquidity classification: allowing funds the scope to define their own liquidity classifications would likely result in less consistency in funds' classifications than if regulators' specified the liquidity of particular asset classes. But the latter could result in fund managers overestimating the liquidity of some of their holdings.

Better and more consistent information on funds' liquidity profiles could be helpful to inform regulators' assessments of how risks from liquidity mismatches might evolve, and also for fund managers' own liquidity management. It could also help investor decision-making. After a period of implementation, consideration could be given to the pros and cons of public disclosure.

A possible framework for enhancing the calculation and use of swing pricing

Swing pricing is an anti-dilution tool which seeks to ensure fairness across investors by protecting existing investors from potential dilution of value of their investments through ensuring that subscribing and redeeming investors bear the costs of their trading activity.[16] Adjusting the price received by redeeming investors to reflect such transaction costs could also help address the potential financial stability risks stemming from first mover advantage, by removing the incentive to redeem from a fund ahead of other investors, particularly in a stress.[17] The Bank-FCA survey indicated that UK corporate bond funds rely predominantly on swing pricing to manage dilution risks, including during the March 2020 stress period. The survey indicated that funds intensified and adapted their use of swing pricing during the stress period, although there were significant variations in how swing pricing was applied. To help ensure that swing pricing better reflects the costs of investor flows, its calculation and application could be enhanced. This would allow swing pricing to work more effectively as an anti-dilution tool and continue to promote investor protection, while at the same time help address the potential financial stability risks associated with first mover advantage.

1. More consistent and complete swing pricing could be developed in order to better reflect the costs of exiting a fund and also to promote financial stability by reducing first mover advantage. Enhancing the application and calculation of swing pricing to reflect the true marginal impact of redemptions on a fund could reduce the risk associated with first mover advantage. In principle, this could be achieved if funds applied 'full swing' pricing.[18] Responses to the Bank-FCA survey indicated that there were significant differences in how similar funds facing similar flows applied swing pricing. Some fund managers used discretion to switch from partial swing to full swing pricing. Fund managers reported that different thresholds for applying swing pricing and a range of methodologies had been used for calculating swing factors. Fund managers reported mainly using bid-ask spreads, followed by explicit costs of the transaction (eg commissions and fees) as the main components in calculating swing factors. Most funds managers did not factor market impact explicitly into their swing factors. Consideration should be given to the benefits of greater consistency in the application of swing pricing across funds, including with regard to how the swing factor is calculated.

2. Swing pricing adjustments should be based on the following principles:

(a) Swing pricing adjustments should, as far as possible, take into consideration the full cost of meeting investor flows. Overall, swing pricing adjustments should be a reflection of liquidity classification, the

size of investor flows, and market conditions. Particular factors that should be considered include: (i) explicit transaction costs, for example bid-ask spreads on assets and fees; and (ii) measures of implicit transaction costs, including estimates of market impact for a sale equivalent to the net redemption. Other factors may also provide additional relevant information for fund managers when considering how to calibrate pricing adjustments, particularly during stress periods. For example, for some funds, the bid-ask spreads and NAV discounts of comparable exchange-traded funds (ETFs) may provide useful information alongside other relevant pricing information (see Box B).

(b) Swing pricing adjustments should reflect the prevailing market conditions and associated costs of net flows. For example, in stressed market conditions, a higher swing factor will be required, while in liquid markets with low transaction costs, the appropriate swing factor may be very small. This is important to ensure that first-mover advantage is addressed consistently and reduces the risk of 'cliff effects' as funds switch to using swing pricing only in specific circumstances.

3. Swing pricing adjustments should be subject to periodic review to assess whether they remain valid and ensure reasonable levels of confidence around estimates. Doing so could help improve swing pricing calculations over time, and identify best practice.

4. Consideration should be given to the adequate level of transparency regarding the approach to and effects of swing pricing. All funds need to disclose the range of liquidity management tools available in their prospectus ex ante according to UK fund rules.[19] But the Bank-FCA survey results indicated that the actual use of these tools ex post was only disclosed to investors in some cases. This means that investors exiting a fund may not have full information on the dilution adjustment costs charged at the time of their transaction. Additional transparency regarding whether a fund has used swing pricing and the effects of a fund's use of swing pricing can help investors better assess risks associated with investing in a particular fund.

Recognising the global nature of asset management and of key markets, the Bank and the FCA will take account of the conclusions of the review in engaging with ongoing international work on open-ended funds.

It will be important to address liquidity mismatches in open-ended funds internationally, given the global nature of asset management and of key markets. The effectiveness of any domestic policy measures will depend in part on policies implemented in other jurisdictions. In this context, the Bank and FCA continue to support the ongoing international work led by the FSB and IOSCO. This is examining the availability and effectiveness of liquidity risk management tools for open-ended funds, including the experience of redemption pressures and use of tools during March 2020, as well as their aggregate impact on the market.

Box B: Comparing open-ended funds' swing factors with ETF bid-ask spreads and NAV discounts

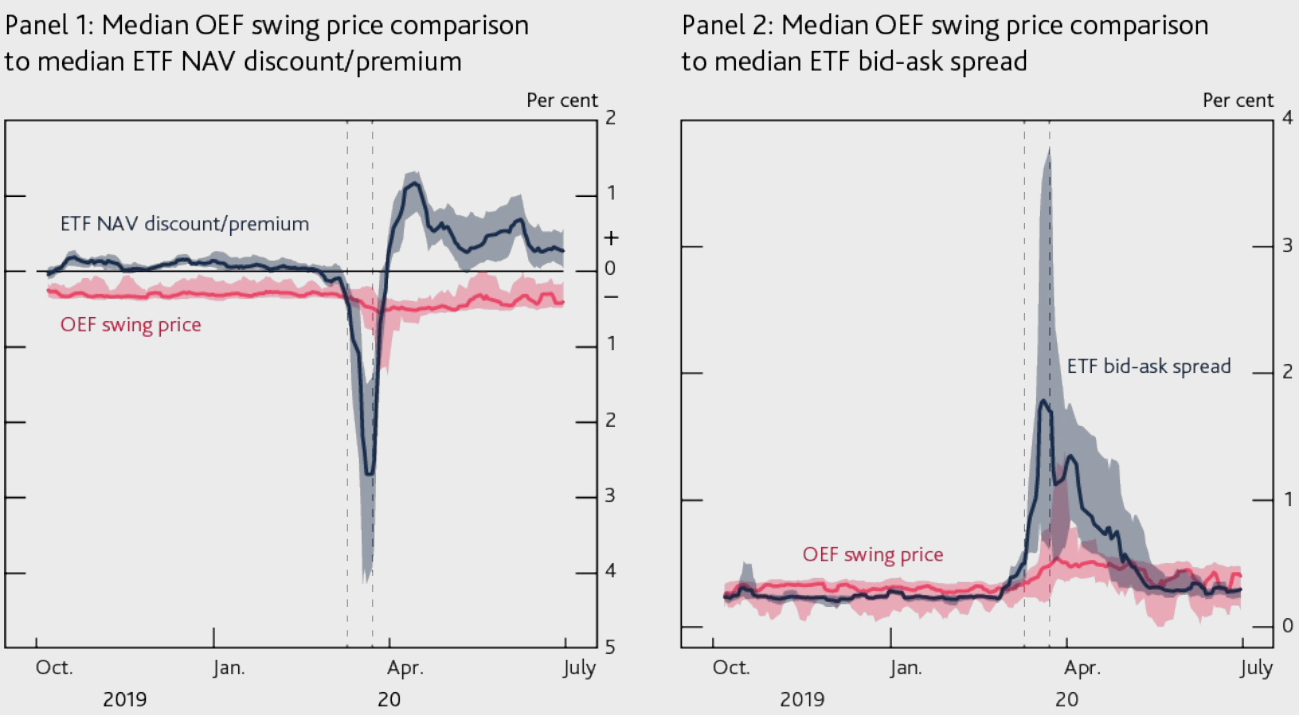
UK authorised funds have a wide range of liquidity management tools available, which they can utilise to manage large net flows. Swing pricing is one such tool which allows a fund manager to adjust ('swing') the unit price to offset potential dilution costs to other investors in the fund. Swing pricing therefore has the potential to reduce first-mover advantage by helping ensure that the cost of meeting redemptions is borne by investors making those redemptions, rather than investors who remain in the fund.

As described in the Bank-FCA survey on liquidity management in open-ended funds, swing pricing is the most widely available liquidity management tool in the UK. 202 funds or 83% of single-priced funds in the survey indicated having in place the option to use swing pricing incorporating a dilution adjustment. However, the FPC judged in March 2021 that the use of swing pricing was inconsistently applied across funds in the survey and even when deployed, in many cases the swing factor was insufficient. The FPC judged that the calculation and application of swing pricing could, in principle, be enhanced in order to reduce systemic risk that could be associated with first-mover advantage.

Initial analysis by Bank staff suggests that swing pricing as currently applied by corporate bond open-ended funds, may not fully reflect the cost of sales to meet redemptions, nor the price uncertainty of the underlying bonds.
Staff have compared swing factors of UK corporate bond open-ended funds to the bid-ask spread and net asset value (NAV) discounts of a set of UK corporate bond exchange-traded funds (ETFs) with similar asset compositions.[20] During the March 2020 market disruption, median UK corporate bond ETF bid-ask spreads and NAV discounts increased substantially, while swing factors of comparable open-ended funds remained largely under 100 basis points (Chart B.1).

Chart B.1: During the March 2020 market stress, there were substantial differences between ETF price factors and the swing prices of comparable open-ended funds

Median swing price comparison to median ETF NAV discount and bid-ask spread (a) (b)



Sources: Bank and FCA survey responses, Bloomberg Finance L.P., Morningstar, Refinitiv Eikon from LSEG and Bank calculations.

(a) The red line denotes the five-day average median open-ended fund swing factor, with the red swathes reflecting the IQR around this. The blue line is the five-day average median NAV premium/discount or bid-ask spread, with the blue swathes representing the IQR around this. The dashed lines represent the period from 10–23 March 2020.
(b) Bank staff have compared eight sterling corporate bond ETFs with similar asset composition, to a set of UK corporate bond open-ended funds. To be considered a 'match', an open-ended fund had to have a minimum of 40% ISIN-level asset overlap with at least one of our ETFs, and no more than a 20% difference in industry exposure or credit rating.

ETF price factors – such as the NAV discount and bid-ask spreads – can provide informational value on what the 'actual' cost of trading the underlying assets should be. This could be useful when considering how to calibrate an appropriate swing factor for a comparable open-ended fund, particularly during stressed periods. But we would not expect ETF and open-ended fund prices to be identical, nor for such a comparison to be relevant for all funds.

In stressed market conditions, the additional liquidity in ETF secondary markets compared to the markets for their underlying assets, may mean that the ETF bid-ask spread is a better indicator of the 'true' trading costs of the underlying assets than the reported spreads on the individual assets themselves.[21] And similarly, ETF NAV discounts may act as a price discovery mechanism in these periods, offering one of the best available indicators of the actionable price of fixed-income securities relative to their NAV. At the same time, research suggests that there may be other factors – ie not just price discovery – that can drive ETF NAV discounts. For example, the arbitrage mechanism – which keeps bond ETF prices aligned with the value of the underlying investments – may be weakened by ETF sponsors offering authorised participants less liquid redemption baskets during stress, as well as by the authorised participants' own incentives (see 'The anatomy of bond ETF arbitrage').[22] More work is needed to study the impact of these competing dynamics.

Preliminary analysis by Bank staff also indicates that ETF NAV discounts provided information about future changes in open-ended fund NAVs, suggesting that ETFs incorporated new information more rapidly than open-ended fund NAVs during the March 2020 market stress. In particular, during this stress period, a 1% NAV discount was associated with a 0.28% negative change in expected open-ended fund NAV movements.[23] If investors anticipate that open-ended fund NAVs are 'stale' and slow to adjust, this could trigger a first-mover

advantage.

Box C: Non-bank financial institution indicators and data gaps

It is essential to improve the coverage and quality of data available to support policymakers in monitoring, assessing and mitigating risk.
Challenges from insufficient data are compounded by the interconnected nature of non-bank finance, making it challenging to form a view on the resilience of the system.

These issues around the sufficiency of available data affect regulators globally.
The FSB for example has previously noted in its assessment of the leveraged loan market that there were important data gaps that prevented regulators reaching a comprehensive, system-wide view. The Bank of International Settlements has also identified data gaps that need to be addressed to have a fuller picture of financial vulnerabilities. This reflects multiple factors, including: the heterogeneity of the non-bank sector which comprises a number of different types of institutions, carrying out some very different functions; and that these institutions often operate in multiple jurisdictions.

In reaching its own assessment, the FPC seeks to mitigate these deficiencies by using a broad range of data sets and indicators, as highlighted in previous FSRs.
These data are used by the FPC to assess the resilience of various parts of market-based finance. For example, survey data assist the FPC in assessing a specific sector, including broad trends, while more frequent and regular data are used to monitor risks such as leverage. Examples of the data used by the FPC are:

- The biannual Hedge Fund as Counterparty Survey, which provides information such as hedge funds' participation in the gilt market, their net repo borrowing, and the maturity of their holdings.
- More recently, the Bank and FCA's joint survey of funds provided new information on the availability and use of tools to mitigate liquidity mismatch in open-ended funds.
- This institution-focused analysis is complemented by analysis of developments in the liquidity and functioning of government bond, equity and corporate bond markets. Market intelligence can also provide a further perspective on this.
- The Bank has also developed over time its usage and capabilities with respect to accessing data from regulatory sources, such as the data from trade repository records collected and maintained under the European Market Infrastructure Regulation.[24] The Bank has, in some cases with the help of the FCA, built monitoring capabilities for certain types of funds (eg MMFs, property funds, ETFs and open-ended funds) from external data providers. For example, on MMFs, the Bank is able to regularly monitor outflows as well as their holdings of liquid assets.

These mitigants notwithstanding, improving the quality and coverage of both domestic and global data on market-based finance remains essential to develop a more comprehensive understanding of the risks to and resilience of the sector. For example:

- Current leverage metrics reported by asset management firms under the UK provisions implementing AIFMD and UCITS are of limited use to understand risks of potential losses at the fund level, nor do they alert to potential fire sales that could create market contagion and have system-wide consequences. This is an international issue, as highlighted in the FPC's 2018 non-bank leverage in-depth assessment. In December 2019, IOSCO published its recommendations for a framework to assess leverage in investment funds. In July 2019, the FPC noted that, to deliver on the FSB's recommendation in this area, a core set of measures would need to be consistent globally. As IOSCO's framework provides considerable discretion to national regulators, it is unlikely a globally consistent set of measures will be implemented.
- Authorities have detailed data on CCP margin practices, allowing for domestic and international work on the role played by CCPs in the 'dash for cash'. However, more appropriate, timely and granular data are needed

to fully understand the liquidity demands on different types of non-bank financial institutions, their preparedness to meet these demands and the possible knock-on impacts on the financial system.

- While it is not plausible to derive a single summary statistic for measuring risk, a small number of complementary measures reported on a consistent basis by funds could enable more ready comparison of potential losses or margin calls with liquid asset or net worth.
- There is no direct measure of dealers' inventories of gilts, nor of sterling corporate bonds.

Work to achieve this is under way both domestically and internationally. For example, the Bank has worked – and continues to work – closely with the FCA on data relating to many issues covered in this report. This includes the joint Bank and FCA survey of funds, which has provided important information to understand the financial stability risks associated with liquidity mismatch in open-ended funds (see Box A). The Bank also works with other authorities and is, for example, working with the Office for National Statistics to improve the quality, coverage and granularity of the UK Financial Accounts as part of the 'Flow of Funds' initiative.

The Bank will continue to invest in its capabilities with respect to existing data, and will work closely with other organisations and stakeholders to help remediate data gaps. There may also be opportunities domestically to further consider how UK regulators may acquire data on the non-bank sector, for example as part of HM Treasury's next steps following the recent Call for Evidence on the Overseas Framework. And improvements to data collection are being considered as part of HM Treasury's on-going review of Solvency II.[25]

But this can only address a portion of the limitations identified in this report. Considerable global co-operation and data sharing is required to remediate the data gaps effectively, given the global nature of markets and the many cross-border activities of non-bank financial intermediaries.

Internationally, the Bank and the FCA contribute to the FSB's annual monitoring exercise to assess global trends and risks from non-bank financial intermediation, as well as current work in light of Covid. The interconnectedness and global nature of non-bank financial institutions makes data sharing between countries vital for assessing vulnerabilities. As set out in the July 2019 FSR, the FPC noted the need for progress in aggregating and sharing trade repository data across countries.

Intensified global co-operation and data sharing can and should begin in some areas, even while further analysis of the 'dash for cash' and associated vulnerabilities in market-based finance are pending. For example, efforts to aggregate and share trade repository data with other global regulators has stalled internationally. Reinvigorating this important work is one way that global regulators can take immediate, concrete steps to remediate data gaps. In other areas, it would be sensible to ensure first that we have learned the lessons from recent experiences, such as the March 2020 'dash for cash' and the more recent default of Archegos. Once regulators globally have reached consensus on the global standards to apply to market-based finance, it will be important to identify:

- what information we need to understand risks from, and the resilience of, the sector;
- how best to use data to measure this;
- the frequency at which these data need to be refreshed/reacquired; and
- from whom it should be collected, and with whom it should be shared.

5: Conclusions and next steps

Market-based finance is essential to the UK real economy.
UK businesses relied on the support of the sector in the global financial crisis as banks withdrew from lending and they have subsequently raised significant financing, particularly via equity and debt markets. The UK economy benefits from other services provided by the sector, including intermediating between saving and investment, insuring against and transferring risk (eg through derivatives markets and insurance companies), and offering payment and settlement services.

The sector is therefore of importance to UK financial stability. In order for it to continue to serve UK households and businesses in bad times as well as in good, the sector needs to be sufficiently resilient.

Authorities need to be able to effectively monitor market-based finance.
This report has set out a number of the data gaps faced by domestic and global regulators, and the action that the Bank and other UK authorities have taken to remediate these (see Box C). It will be essential that this work progresses, in order to effectively monitor the sector. But, given the global nature of markets and the cross-border activity of many non-bank financial institutions, it is also essential that this work is taken forward internationally.

It is important that market-based finance is resilient to, and does not amplify, shocks.
Recent events, including the disruption to US repo markets in 2019 and the dysfunction in March 2020, suggest that the sector is increasingly prone to 'jumps to illiquidity'. This can undermine market functioning and, by tightening credit conditions, impair the provision of credit to the real economy.

The 'dash for cash' exposed a number of vulnerabilities in the sector that the FPC had previously identified. The default of Archegos in March 2021 illustrates another channel by which the behaviour of non-banks can have wider consequence, including for other financial institutions. While the default was not a systemic event, a number of banks experienced significant losses, as noted earlier.

There is an important programme of work, co-ordinated by the FSB, to understand and, where necessary, remediate the vulnerabilities exposed in the 'dash for cash'.
The Bank, the FCA and HM Treasury are significantly engaged in this work. In July, the FSB published its 'Lessons learnt from the Covid-19 pandemic from a financial stability perspective', It is important that this work, and the work of other global standard-setters, considers the system as a whole, including how existing vulnerabilities interact. Any global approaches reached at such fora can support regulators in implementing robust and consistent reforms to global markets in their domestic jurisdictions.

As set out in the July 2021 FSR, the FPC is committed to the implementation of robust domestic and international standards on market-based finance. The FPC will also continue to scan for potential vulnerabilities originating outside of the core UK banking sector, and to monitor the growth of risks in those sectors.
The FPC will continue to use the data and analysis available to scan the horizon for new and growing risks as the financial system continues to evolve. This includes monitoring developments in parts of the financial system that are already systemically important, as well as those which may not yet be systemically important but have the potential to become so, including as the result of innovations and the use of new technologies. And as set out in Box C, the Bank alongside other UK authorities, will continue work to improve understanding of and data on the sector as a whole.

Annex

Progress update on previous in-depth assessments by the FPC

In-depth assessment	The FPC's key findings and policy conclusions	Progress since in-depth assessment
Investment funds (December 2015 FSR)	Some open-ended funds can have liquidity mismatch, offering short-term redemptions while holding less liquid assets. Investors' and fund managers' procyclical behaviour could amplify shocks. The FPC supports the FSB's recommendations to address structural vulnerabilities from asset management activities, focused on liquidity mismatch and leverage. Funds should be incorporated into the Bank's system-wide stress simulation initiative To monitor the potential financial stability risks from fund leverage supervisors need information on funds': (i) use of borrowing and derivatives; (ii) potential losses across their whole portfolios; and (iii) potential liquidity demands.	In 2016 the FCA published good practice on liquidity risk management to help firms to improve their own liquidity management. To operationalise the FSB's liquidity mismatch recommendations, the International Organization of Securities Commissions (IOSCO) published recommendations on liquidity risk management and good practices in February 2018. The Bank and FCA have reviewed liquidity mismatch in open-ended funds. In December 2019, the FPC established principles for fund design that would deliver greater consistency between asset liquidity, pricing of redemptions and the length of notice period. Following a Bank and FCA survey on liquidity management of open-ended funds, the FPC judged that the survey indicated: • that consistent and more realistic classification of the liquidity of funds' assets was an essential first step to ensuring funds could address mismatches between asset liquidity and redemption terms; and • that use of swing pricing had been inconsistently applied across funds and even when deployed, in many cases the swing had been insufficient. The Bank and FCA have concluded their joint review (see Box A of this report). In doing so, the Bank and FCA have developed a possible framework for how an effective liquidity classification for open-ended funds could be designed, and for the calculation and use of swing pricing. The FCA published a Policy Statement in September 2019, setting out a number of changes to the way that certain open-ended funds investing in inherently illiquid assets should operate. The Policy Statement included a requirement for funds investing in property and other immovables to suspend dealing if there was material uncertainty about the value of at least 20% of the fund's assets. The FSB carried out a systemic stress assessment that examined the potential impact of portfolio rebalancing behaviours by asset managers and institutional investors on liquidity in fixed-income markets. The Bank continues to develop system-wide stress simulations, which incorporate investment funds. A Staff Working Paper published in July 2019 sets out the model developed for this purpose. An ongoing international workstream led by the FSB and IOSCO is examining the availability and effectiveness of liquidity risk management tools for open-ended funds, including the experience of redemption pressures and use of tools during March 2020, as well as their aggregate impact on the market.

In-depth assessment	The FPC's key findings and policy conclusions	Progress since in-depth assessment
Market liquidity (July 2016 FSR)	Key dealer-intermediated markets, including some corporate bond and repo markets, saw reduced liquidity – partly due to post-crisis regulation of dealers. International leverage ratio standards should be amended to minimise their impact on the liquidity of these markets without lowering resilience.	In December 2017, the Basel III leverage ratio for internationally active banks was finalised (see Box 3 of the June 2018 FSR). This leverage ratio: (i) includes a buffer for global systemically important institutions; and (ii) nets cash receivables and payables from securities sales with the same counterparty. In 2019, the Basel Committee on Banking Supervision (BCBS) finalised policy to support market liquidity without compromising resilience. Specifically, the BCBS: • revised the leverage ratio to allow margin received from a client to offset the exposure amounts of client-cleared derivatives, reducing the capital cost of client clearing to leverage-constrained dealers; and • revised leverage ratio disclosure requirements to curb leverage ratio window dressing (whereby banks adjust their balance sheets around reporting dates). Banks will be required to disclose their leverage ratios based on the quarter-end and average values of securities financing transactions. A comparison of the two sets of values will allow market participants to better assess banks' actual leverage throughout the reporting period. In the UK, banks subject to the UK leverage ratio framework are already required to report and disclose average leverage ratios (eg using averages of exposure amounts based on daily or month-end values) to address this.
Insurance companies (November 2016 FSR)	The International Capital Standards (ICS) for internationally active insurance groups should avoid incentives to invest procyclically, whereby they may amplify market movements. Under its current design, the 'risk margin' could, in future, encourage insurance companies to reinforce falls (rises) in risk-free interest rates by switching into (out of) low-risk assets. Limiting sensitivity of the 'risk margin' to changes in risk-free interest rates would have macroprudential benefits	The Bank is engaged in the International Association of Insurance Supervisors' work to develop ICS for internationally-active insurance groups. The Bank is working to avoid a design which creates unnecessary procyclicality, volatility or unwarranted increase in the regulatory burden on firms. The FPC had previously noted that reform of the Solvency II 'risk margin' would have macroprudential benefits. In October 2020, the Government commenced a review of Solvency II; the period of consultation ended in February 2021 with conclusions to follow in due course. This review is expected to address potential reforms to the 'risk margin'.

In-depth assessment	The FPC's key findings and policy conclusions	Progress since in-depth assessment
Derivatives networks (November 2017 FSR)	Post-crisis reforms have made the financial system more dependent on central counterparties (CCPs) in order to reduce systemic risk. Reforms have also made the CCPs themselves more resilient, although it is important that authorities globally finalise and implement standards for CCP resolution Transaction-level trade repository (TR) data have increased the transparency of OTC derivatives markets to authorities, but reforms to transparency have further to go.	In April 2018, the Committee on Payments and Market Infrastructure (CPMI) and IOSCO published a framework for supervisory stress testing of CCPs. In August 2018, the FSB and standard-setting bodies published analysis of central clearing interdependencies and, in November 2018, published a final report on incentives to centrally clear OTC derivatives. In May 2020, the FSB consulted on draft guidance on financial resources to support CCP resolution and on the treatment of CCP equity, based on an earlier discussion paper. Final guidance is forthcoming. Progress on aggregating TR data across countries has stalled following the G20 commitments to reform derivative markets made in 2009. Significant progress has been made internationally in removing legal barriers to sharing TR data as well as in developing international data standards and related governance arrangements to support the implementation, maintenance and oversight of those standards for TR data. However, no international work is currently under way to decide on how a cross-border data aggregation mechanism should work in practice to provide a global view of derivatives markets. Data quality would also need to be assessed ahead of any aggregation. The FSB's ongoing work programme on non-bank financial institutions includes work to examine the frameworks and dynamics of margin calls in centrally cleared and uncleared derivatives markets and the liquidity management preparedness of market participants.
Non-bank leverage (November 2018 FSR)	Non-bank leverage can support financial market functioning, but it can also expose non-banks to greater losses and sudden demands for liquidity, which can give rise to financial stability risks. The Bank will work with other domestic supervisors to enhance risk monitoring. Data gaps around leverage prevent holistic risk assessment.	In September 2019, the PRA published a supervisory statement on 'Liquidity risk management for insurers', which sets out its expectations as to how insurers might go about managing liquidity risk, including risks through margining requirements for derivative platforms. The Bank is working with The Pensions Regulator (TPR) to enhance the monitoring of possible systemic risks from pension funds' use of derivatives and repo. In December 2019 TPR published results from a survey on liquidity and leverage in pension funds. In December 2019, IOSCO published its recommendations for a framework to assess leverage in investment funds. The framework provides considerable discretion to national regulators, and therefore make it unlikely that a globally consistent set of measures will be implemented. The FPC noted that, to deliver on the FSB's recommendation in this area, a core set of measures would need to be consistent globally.

1. The resilience of critical infrastructure is a key part of market functioning; this is not covered in this report but is instead addressed in the Bank of England's supervision of financial market infrastructures annual report.
2. See the Bank of England Act 1998 s. 9.
3. These were then implemented in regulation and rules within national jurisdictions – the 'Basel 3' revisions to the Basel Accords are a clear example of this process. International standards form the basis of banking regulation in many countries, resulting in consistent regulation, with benefits for both individual countries', and global, financial stability.
4. A full account of this framework is available in the November 2017 FSR.
5. Open-ended funds are collective investment vehicles that can create units and sell them directly to investors.

6. Of this, US$203 billion was from the top 10% of hedge funds by leverage, equivalent to a 19% reduction of their holdings.
7. Covers sterling, Europe, US and emerging market fixed-income funds in the Morningstar database.
8. Derivatives margin requirements have two components. 'Variation margin' is exchanged between holders of derivatives contracts daily to cover actual changes in the market value of the contract, preventing the build-up of counterparty credit risk. 'Initial margin' is posted to absorb further losses in the event individual counterparties default, and is recalculated on a regular basis.
9. This analysis is based on the methodology used in Noss and Patel (2019).
10. Notice period refers to how much notice the investor has to give before their money is returned to them. Redemption frequency refers to how often the investor can request to have their money returned to them, for example once per month.
11. In the case of Archegos, the firm used Total Return Swaps (TRS) for which the disclosure requirements are more limited than for positions in the underlying securities. TRS are contracts in which two parties exchange payments – one party makes a payment based on a fixed rate and the second makes a payment that is based on an underlying asset. This enables the first party to gain returns based on the underlying asset, without actually having to own it.
12. A more recent example is the default of Archegos, which highlighted the risks of inappropriate margining practices in uncleared markets (see Section 4.1.2).
13. For example, The Pensions Regulator has noted the need for more robust liquidity risk analysis to be carried out to allow for – among other things - the extent and composition of derivatives exposure to margin calls (see 'Now is the time to manage liquidity risk'). For insurers, the PRA has set out expectations concerning the liquidity risk management framework an insurer must have in place in Supervisory Statement 5/19.
14. Source: Morningstar.
15. See FCA CP21/12: A new authorised fund regime for investing in long term assets. The consultation paper sets out that LTAFs would be expected to be set up with notice periods and other liquidity management features that take account of the liquidity profile of the underlying assets.
16. Under FCA rules, an authorised fund manager operating either a dilution levy or a dilution adjustment, must operate that measure in a fair manner to reduce dilution and solely for that purpose (COLL 6.3.8R(2)).
17. There is a body of literature that demonstrates that alternative pricing rules can reduce the sensitivity of outflows to bad performance (see, for example, Capponi et al (2018); Lewrick and Shanz (2017); and Jin et al (2019)).
18. A swing pricing adjustment can be undertaken when a certain level of net redemptions or subscriptions is reached (partial swing), or for a net flow of any size (full swing). If using a partial swing, the fund manager sets a threshold (level of net out/inflows as a share of NAV) at which the manager applies the swing price based on assessments of current or expected fund flows.
19. COLL 4.2.5R(18) requires funds to disclose which anti-dilution mechanisms they have available and to provide information about when it might be used and the extent to which it might be used.
20. The **open-ended fund swing factor** is calculated as the percentage difference between the adjusted and unadjusted price (ie the net asset value or 'NAV'). A critical distinction of ETFs from open-ended funds is that ETFs trade like a stock in real time. This means that an **ETF share can trade at a premium or discount to the NAV** of the fund, depending upon investor preferences. We look at the **ETF NAV discount** as the difference between the last price of the ETF and its end of day NAV. Contacts and research suggest that the persistent discounts of corporate bond ETFs during the dash for cash played a role in price discovery. The **ETF bid-ask spread** is a reflection of the liquidation costs of executing a transaction in the funds underlying securities, market demand/supply factors, plus any hedging or transaction costs imposed by the market maker. It is also likely to take into account price impact, such that a larger trade in an ETF with a less-liquid underlying market will have a bigger spread.
21. The Bank-FCA survey noted that, when calculating swing factors, most funds managers relied on bid-ask spread of the underlying securities alongside explicit transaction costs. But in the March 2020 'dash for cash', many of these managers reported that quoted corporate bond bid-ask spreads did not reflect the actionable trading costs in the underlying market.
22. ETF's Authorised Participants (APs) have the ability to create or redeem shares with the ETF sponsor. In a creation, the AP provides the ETF sponsor with the basket of underlying securities in return for an ETF share. If a gap opens up between the price of an ETF share and the underlying basket of securities, an arbitrage opportunity arises for the AP, whereby it can exchange the cheaper of the basket of securities or ETF share for the other one. This arbitrage process should keep the ETF price in-line with the price of the underlying price in perfect market conditions.
23. A least squares dummy variable specification with fund fixed effects was used to estimate the impact of the median sterling corporate bond ETF NAV premium/discount on expected change in next day UK corporate bond open-ended fund NAVs.

Period interaction terms are included for the jump to illiquidity (25 February–10 March), and dash for cash (10–23 March), to isolate the relationship between ETF NAV discounts and open-ended fund NAVs during these periods. UK corporate bond movements are controlled for using the S&P UK corporate bond index.

24. As such Regulations form part of domestic law under the EU (Withdrawal) Act.
25. The PRA is currently consulting on the first phase of reporting reform for UK insurers – see CP11/21, 'Review of Solvency II: Reporting (Phase 1)'.

BANK OF ENGLAND