The Bank of England's system-wide exploratory scenario exercise final report

The Bank of England's system-wide exploratory scenario exercise explores how the UK financial system would respond to a market shock. It is the first exercise of its kind globally.

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Glossary

Summary

The Bank of England's system-wide exploratory scenario (SWES) exercise explores how the UK financial system would respond to a market shock. It is the first exercise of its kind globally.

The aims of the SWES are to:

1. enhance understanding of the risks to and from non-bank financial institutions (NBFIs), and the behaviour of NBFIs and banks in stress, including what drives those behaviours; and
2. investigate how these behaviours and market dynamics can amplify shocks in markets and potentially pose risks to UK financial stability.

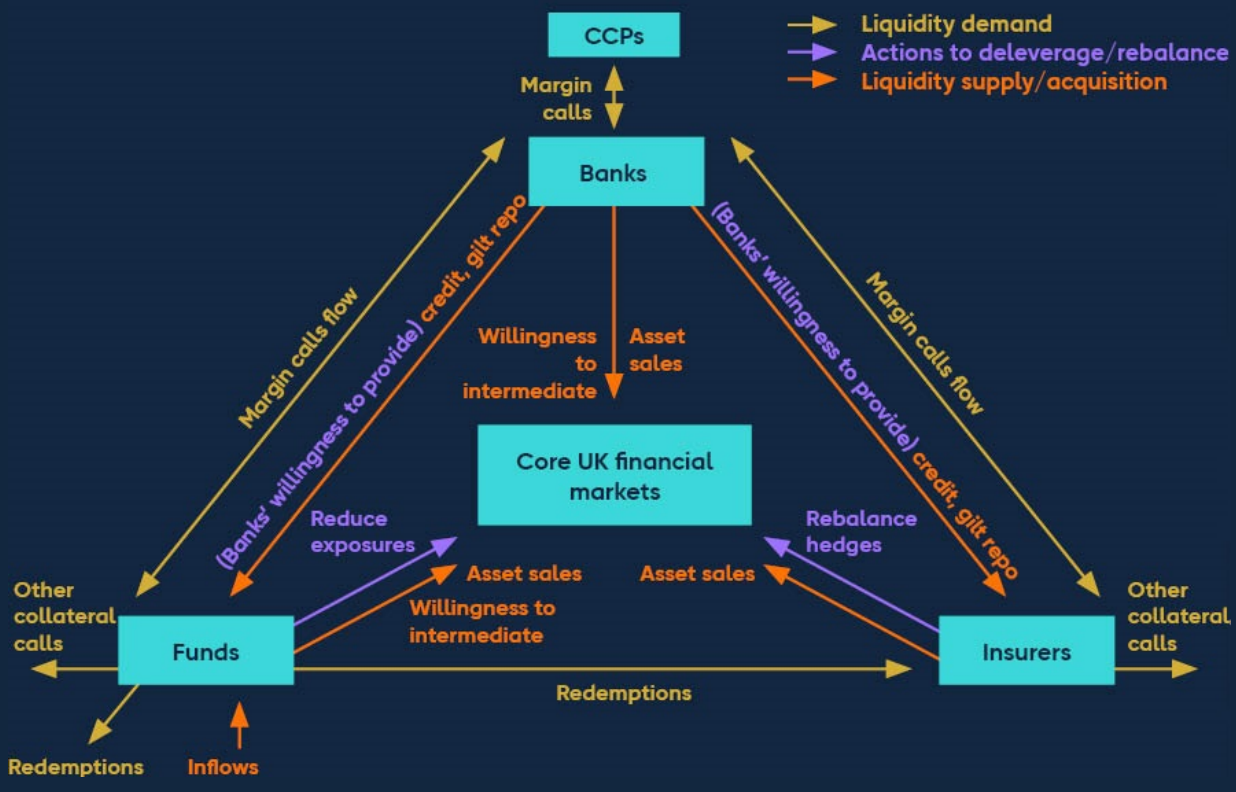
The SWES is a 'system-wide' exercise, incorporating a wide range of financial firms and business models. It therefore provides insights into the behaviour of different parts of the financial system under stress, as well as dynamics driven by their interactions and how these can affect outcomes in markets core to UK financial stability and the financial system as a whole.

To date, system-wide analysis carried out by central banks has tended to be model-based without the direct participation of firms. These model-based exercises are well suited to investigating system-wide dynamics, but have limitations, such as struggling to capture complex behaviours in a stress, which have limited their influence on surveillance and policy making. Conversely, traditional firm-focused stress tests actively involve firms and have become an essential part of the regulatory and financial stability toolkit. But these exercises are not designed to explore system-wide dynamics – they typically focus on a single sector and do not capture interactions with other parts of the financial system. The SWES takes a new approach: it takes a system-wide perspective, and incorporates complex firm behaviours and interactions through the active engagement of around 50 different financial firms. This unique system-wide perspective provides benefits for authorities and market participants. It highlights where there are mismatches in firms' expectations of how each other will act in a stress, supporting better risk management approaches. It improves both our and market participants understanding of risk management within the financial system. And it informs the UK authorities in their work to address vulnerabilities in market-based finance domestically, and internationally through the work led by the Financial Stability Board (FSB).

The exercise is not a test of the resilience of the individual participants. Its focus is system-wide, including on important UK financial markets and their resilience in stress. As with any exercise of this type, the scenario, actions and outcomes are hypothetical and not a forecast. And changes in the financial system, the strategies or starting positions of market participants, or the magnitude and type of shock, would have led to different outcomes. We focus in this report on system-wide and behavioural insights from the SWES, beyond the specifics of any given scenario.

Approach

Key risk transmission channels under investigation in the SWES



We asked around 50 participating firms, including banks, insurers, pension schemes, hedge funds, asset managers and central counterparties, to evaluate how they would be affected by, and respond to, a hypothetical stress scenario.

The SWES scenario comprises a sudden, sharp and severe shock to global financial markets due to sudden crystallisation of geopolitical tensions. The market shock was designed to be faster, wider ranging and more persistent than those observed in recent stress episodes. Rates and risky asset prices move sharply, and these moves persist. Counterparty credit risk

becomes elevated and eventually crystallises with the default of a non-participating hedge fund. The scenario lasts for two weeks and ends with uncertainty and the risk of a broad-based macroeconomic downturn.

The SWES was a collaborative exercise conducted over multiple rounds of engagement, allowing us to explore feedback and amplification effects. By analysing responses across participating firms and supplementing this with qualitative information, including conversations with non-SWES participants, we have been able to explore sectoral behaviours, cross-sectoral interactions and interconnections between different firms, and the combined impact on financial markets. We also carried out sensitivity analysis, which varied by sector, on key aspects of the exercise.

The shock was global, and modelling of the impact on firms and their actions was undertaken on this basis. We focussed our market-level analysis on a set of financial markets that are core to UK financial stability: the gilt market, the gilt repo market, the sterling corporate bond market and associated derivatives markets.

Outcomes

The hypothetical shock causes significant losses for some SWES participants in the exercise, triggering a spike in variation margin calls. Increased volatility causes initial margin required by CCPs to increase, and some funds experience redemptions. Taken together, this leads to a significant redistribution of liquidity across the financial system.

NBFI liquidity buffers fall at the start of the shock, and some firms then quickly act to rebuild them. Many NBFIs act in response to increases in their risk and leverage metrics. Sometimes these metrics approach or hit internal risk limits, but in other cases firms take precautionary action due to the uncertainty in the scenario, or because they adopt a ‘risk off’ stance given the macroeconomic outlook. Investment mandates and commercial pressures also drive the behaviour of SWES participant in markets. As a result, many firms need to deleverage, derisk, or recapitalise quickly.

These actions have an impact on other financial firms and market outcomes. Some firms seeking liquidity redeem from money market funds (MMFs) and open-ended funds (OEFs), leading those sectors to sell assets. Price insensitive sell orders driven by the liquidity needs of some firms lead to greater price falls in the assets sold, or risk a ‘jump to illiquidity’ in markets used as a source of liquidity by others. Banks are willing to temporarily take on some risk from NBFIs as market makers, absorbing part of the shock. But they do not have sufficient willingness in all markets, meaning some come under pressure. Gilt repo market conditions tighten largely due to bank derisking and counterparty credit concerns, and some NBFIs do not receive all the repo financing they expect. And, while the gilt market can largely absorb selling pressures, the sterling corporate bond market experiences a sudden jump to

illiquidity due to the rapid speed of desired sales and limited bank market making capacity. In the SWES firms are often not able to anticipate how their counterparties, investors, or markets they operate in behave in the stress, which could leave them underprepared in a real stress.

Conclusions

Through running the SWES the Bank, working closely with and with the full support of the Prudential Regulation Authority (PRA), Financial Conduct Authority (FCA) and The Pensions Regulator (TPR), has drawn six key financial stability conclusions. These relate to financial firms' risk management, as well as authorities' policymaking and risk monitoring. In addition to these six conclusions, Box C describes findings from the SWES that speak to sector-specific issues, and Annex 1 summarises findings related to how firms may interact in stress and mismatches in their expectations of each other.

Conclusion 1: Firms' collective actions amplify the initial shock. While non-bank resilience has increased in a number of sectors and firms over recent years, some of that resilience could deteriorate or change over time, risking greater amplification by the financial sector in the future.

The SWES scenario, or a similar shock, would significantly impact participating sectors. Some firms rapidly sold assets, needed to recapitalise or limited their intermediation activity, amplifying the shock.

Some NBFI sectors – such as insurers, LDI funds, and MMFs – have higher starting resilience than at the onset of historic stresses. For example, insurers have widened the eligible assets they can post as collateral, and LDI funds and MMFs had buffers well above regulatory minima. Collectively this reduces the severity of amplification and, combined with positions in core markets at the reference date and the specifics of the scenario, mean that the gilt market does not come under severe stress in the SWES. But this result is contingent – particularly as the higher resilience of some sectors is not required by regulation. Lower NBFI resilience would result in a greater demand for liquidity under stress, and more NBFIs taking derisking actions due to risk or leverage constraints, leading to greater risks to financial stability.

Next steps: This highlights the importance of continuing to monitor core UK markets, and considering appropriate resilience across various sectors through domestic and international policy making processes.

Conclusion 2: Repo market resilience is central to supporting core markets in stress. During a market stress, banks are unlikely to provide all of the additional repo financing NBFIs ask for, despite their willingness to draw on central bank lending facilities.

Many firms in the SWES rely on repo to manage liquidity or monetise assets. In the exercise banks have the capacity to lend cash in the gilt repo market. Despite this, they tighten terms for maturing financing, will generally not provide additional repo financing at the onset of the shock, and in some cases may not even roll maturing repo. By contrast, many NBFIs expected they would be able to access additional repo that is unlikely to be available in the scenario.

Next steps: Further policy work to increase repo market resilience, could, alongside central bank facilities, help support repo market resilience and the effective functioning of other markets during stress. The Bank is expanding its tools with the **Contingent NBFI Repo Facility (CNRF)**, which will allow the Bank to provide repo directly to eligible NBFIs if required to address severe gilt market dysfunction.

Conclusion 3: The SWES illustrates how actions taken by authorities and market participants following recent market shocks have improved gilt market resilience; but further work is required given the other vulnerabilities highlighted by this exercise.

The gilt market provides safe assets used to manage liquidity by the financial system, a benchmark for the pricing of finance to households and businesses, and is an important source of financing for the UK government. Following the SWES shock, gilt selling pressures and purchasing in the gilt market – including by banks temporarily holding risk as market makers – are broadly balanced, demonstrating how actions by authorities and market participants have increased market resilience. However, additional sales would quickly exhaust banks' willingness to buy, making further price falls likely. And these outcomes are sensitive to initial conditions – including firms' balance sheets at the reference date, levels of NBFI resilience (see conclusion 1) and banks' ability to intermediate.

In the SWES, LDI funds are recapitalised by their pension fund investors, and would have opted to sell gilts had this been unsuccessful. This underlines the importance of the Financial Policy Committee's (FPC's) recommendation and the FCA's and TPR's 2023 guidance to

increase the financial and operational resilience of pension schemes' LDI positions, and emphasises the importance of maintaining it.

Next steps: Gilt market resilience will be supported by actions under conclusions 1 and 2. The SWES illustrates that the functioning of the gilt market depends on the resilience of the financial sector (conclusion 1) and the markets that support it – particularly gilt repo (conclusion 2), and the derivatives markets that banks use for hedging.

Conclusion 4: The sterling corporate bond market could face a 'jump to illiquidity' in stress, whereby the speed of selling pressures significantly exceeds purchasing capacity and prices need to fall rapidly for the market to clear.

The SWES identified how the sterling corporate bond market may 'jump to illiquidity' after a shock due to sales pressure by firms in several sectors that need to access liquidity or derisk. Banks' willingness to warehouse risk is limited, and potential countercyclical investors only enter the market relatively slowly. Some rapid sales arise from pension schemes meeting recapitalisation calls from LDI funds seeking to rebuild headroom over regulatory buffers. These findings underscore the important role of pension funds to UK financial stability.

The sterling corporate bond market becoming illiquid in stress risks reducing its effectiveness as a source of financing for the real economy, particularly if poor conditions persist or repeated periods of illiquidity reduce longer-term confidence in that market.

Next steps: Greater transparency through improved data collection and disclosures could help to mitigate these risks by raising awareness of potential correlated asset sales. TPR will explore with industry potential improvements to existing data collections to improve contingency planning by pension schemes and reduce risks to corporate bond market functioning. TPR also plans to engage with pension schemes to better understand their behaviour in stressed markets, and explore options to reduce behaviour that amplifies market shocks.

Conclusion 5: System-wide stress exercises have proved to be an effective tool for financial stability authorities to understand system-level vulnerabilities. The Bank, alongside the FCA, will continue to invest in its capabilities in this area for surveillance and risk assessment, and to run future exercises.

The SWES has provided valuable insights into how changes to the resilience, behaviours and interconnectedness of financial firms could affect market dynamics in stress events. The exercise also identified counterparties' inconsistent expectations during a stress and the possible consequences. Insights from the SWES derived from interactions across the system would not be apparent from sector-specific analysis alone.

Next steps: The Bank alongside the FCA will use the experience of the SWES as a framework for future system-wide analysis and embed it into how we conduct market-wide surveillance. To support this we will invest in our in-house capacity to model system-wide dynamics, supported by continuing our engagement with market participants to ensure our understanding of key dynamics remains current. This will allow us to update the SWES findings periodically in a proportionate way as the financial system and risk-taking evolve. We will engage financial institutions and other regulators as we develop this approach.

In addition, SWES-style exercises are a useful tool that the FPC, and other UK authorities, could deploy to investigate other markets in future.

Conclusion 6: System-wide exercises are important for regulators, firms and markets.

The SWES has provided significant benefits for the Bank, PRA, FCA, TPR and market participants. All the authorities have worked closely on the exercise and support the analysis in this report and its conclusions. It will be beneficial for international authorities considering their own system-wide exercises, and the results are informative for a range of international policy workstreams.

Next steps: The SWES highlights the importance of financial institutions considering system-wide dynamics in their internal risk management and stress tests, and provides an evidence base to support this. Annex 1 provides a summary of findings which may be relevant to financial institutions' risk management, with cross-references to further detail.

Acknowledgements

We are grateful to the firms that participated in this important exercise, which would not have been possible without their constructive engagement. We are also grateful to the non-SWES participants that we met with, all authorities that made contributions to the SWES, and international regulators.

Structure of this report

This report begins with background to the SWES exercise, including our methodology, in Section 1. We then describe in detail the responses of firms to the SWES scenario in Section 2, including highlighting mismatches in their expectations of each other (Section 2.3). Section 3 explains what firms' combined behaviours mean for the SWES 'markets of focus'. Our detailed conclusions can be found in Section 4, and a summary of wider SWES findings in Annex 1. Annex 2 lists firms which participated in the exercise. Annex 3 and Annex 4 provide more detail for readers interested in specific topics or individual participating sectors.

1: Background

1.1: Motivation

> **The SWES is a first of its kind exercise globally which explores how the UK financial system would respond to a global financial market shock.**

In recent years, events in a number of global financial markets have illustrated how liquidity conditions can quickly deteriorate, and have brought to light vulnerabilities arising from 'market-based finance' (MBF). MBF refers to the system of markets (eg equity and debt markets), non-bank financial institutions (NBFIs – including investment funds, hedge funds, pension funds and insurers) and infrastructure (such as central counterparties (CCPs) and payments providers) which, alongside banks, provide financial services to support the wider economy.

It is important that the financial system is resilient enough to absorb, and not amplify, financial and economic shocks, so that it can continue to support the provision of financial services to UK households and businesses. But key recent events, including the **'dash for cash' at the onset of Covid** in global markets and the **2022 LDI episode** in the UK, have highlighted vulnerabilities in the financial system and the risks these pose to UK financial stability.

In light of these events, in June 2023, the Bank of England (the Bank) launched its first system-wide exploratory scenario (SWES) exercise with market participants, to complement the **FPC's work programme to address risks in MBF** and ongoing work to ensure the resilience of the banking sector.

> **The SWES aims to improve our understanding of the behaviours of banks and NBFIs during stressed financial market conditions, and how those behaviours might interact to amplify shocks in a specific set of financial markets that are core to UK financial stability – the SWES 'markets of focus'.**

The SWES is not a test of the resilience of individual participating firms; it focuses on resilience at a system-wide level. Carrying out a system-wide exercise provides important benefits. By incorporating the responses of a wide range of firms and sectors, and how these interact under stress, the SWES allows us to examine the key dynamics that might amplify shocks to the financial system as a whole. These dynamics, such as interdependencies between sectors or inconsistent expectations of each other's actions, are the key value added by system-wide analysis.

The Bank conducted this exploratory exercise under the guidance of the FPC and the PRC. Both committees support this exercise and consider it an important contribution to understanding and addressing vulnerabilities in MBF.

The Bank engaged with international regulatory partners and benefitted from working closely with, and with the support of, the PRA, FCA and TPR.

1.2: SWES markets of focus

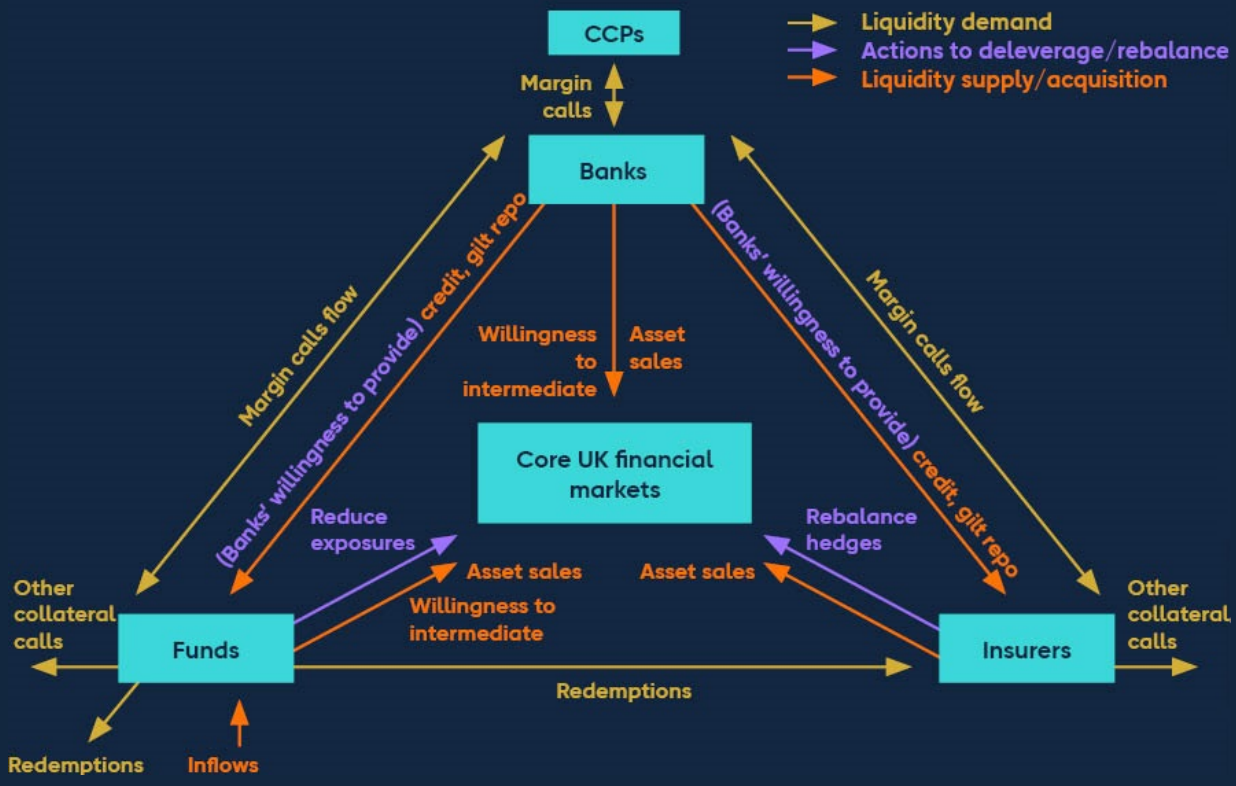
We focused our detailed analysis on a specific set of financial markets that are core to UK financial stability – the SWES markets of focus:

- the gilt market;
- the gilt repo market;
- the sterling corporate bond market; and
- associated derivative markets, where market participants can achieve economically similar returns and/or hedge relevant risks (eg, gilt and SONIA[1] futures; and interest rate swaps, inflation swaps, and cross-currency swaps with a sterling leg).

Figure 1 illustrates the relationships between the different types of market participant and the SWES core markets. It also summarises the three key transmission channels which we set out to explore and which formed the basis of analysis for the SWES: 1) drivers of firms' liquidity needs under the market stress, 2) firms' actions in response to those liquidity needs, and the liquidity available to them, and 3) additional actions taken to deleverage, reduce risk exposures, or rebalance portfolios.

Figure 1: The SWES investigates a range of risk transmission channels

Key interactions between participating sectors and core UK financial markets in the SWES



1.3: Participants

The Bank worked with the PRA, FCA and TPR to identify around 50 firms to participate in the exercise, with the aim to select a sample of firms which are representative of core UK financial markets. The selection was based on firms' activity, business models and investment strategies to ensure diversity in the sample. The sample provides high coverage of important markets and sectors. For example, entities included in SWES participants' responses accounted for over 60% of total turnover in the gilt market in 2023, and participating banks' gilt repo activity represents around 74% of total bank gilt repo activity in the 12 months to 31 October 2023.[2] And we estimate that participating firms cover over 90% of the levered LDI market[3] with higher coverage of pooled LDI funds.

Participating firms come from a range of different sectors, reflecting the wide range of institutions engaged in UK financial markets. This includes large banks, insurers, CCPs, and a variety of funds (including pension funds, hedge funds, and funds managed by asset managers). Many asset managers submitted separately for different fund strategies. A full list

of SWES participants can be found in Annex 2. In addition to these participating firms, we spoke to around 20 other firms for further insights. These include non-bank trading firms, rating agencies, pension fund consultants, and various investors.

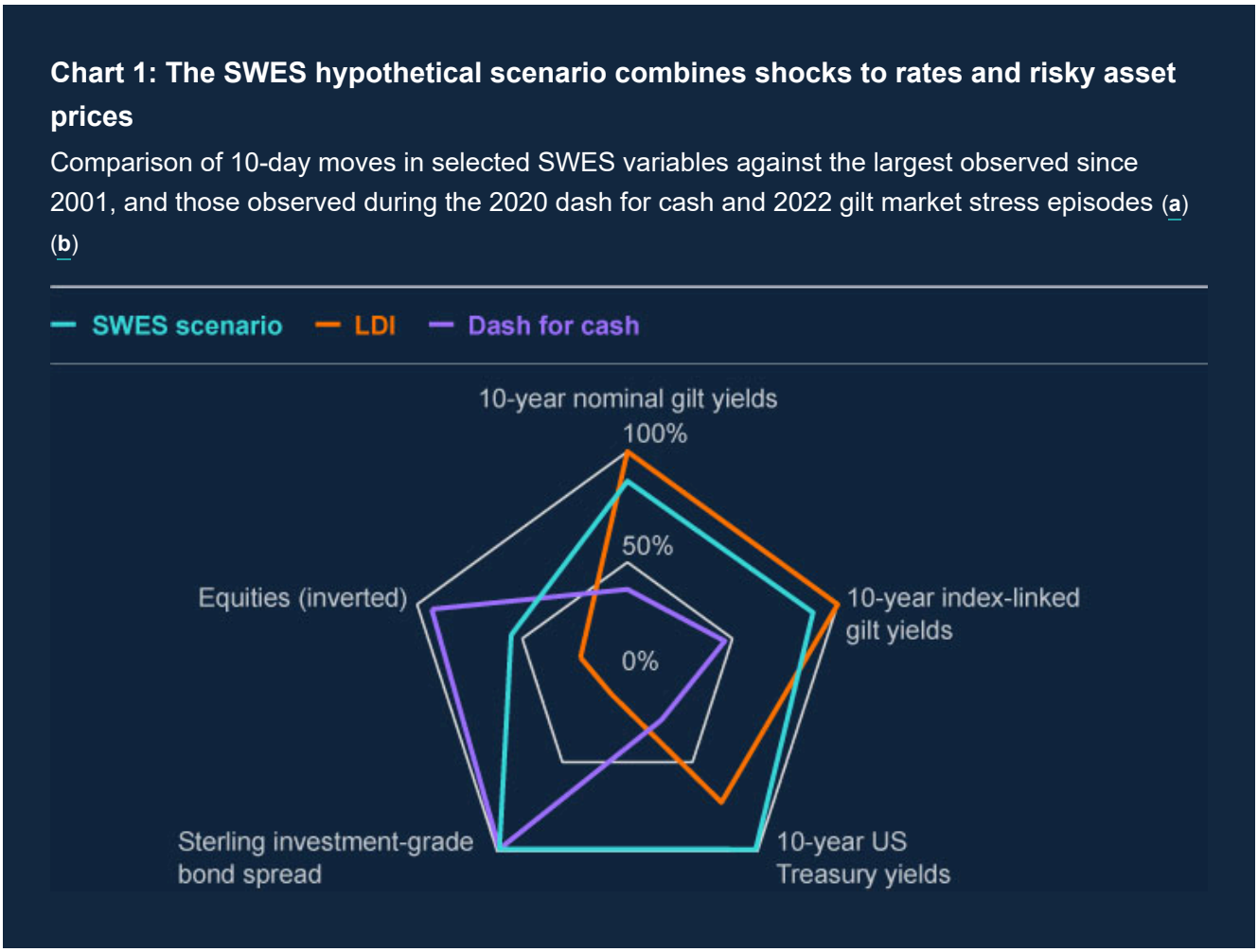
1.4: Scenario

> **We asked SWES participants to evaluate how they would be affected by, and respond to, a hypothetical scenario in which a sudden crystallisation of geopolitical tensions results in a shock to global financial markets.**

The market shock was designed to be faster, wider ranging, and more persistent than those observed in recent stress episodes, cause a significant redistribution of liquidity, and place some firms under stress. It incorporates severe but plausible shocks to a wide range of market prices and indicators over 10 business days. The largest moves are in risk-free rates and credit spreads, which spike to around their historical maxima at the same time. For example, gilt yields are shocked to +115 basis points over the 10-day scenario (slightly less than the equivalent cumulative moves seen during the 2022 LDI episode), whilst credit spreads on sterling investment corporate bonds are shocked to +130 basis points (roughly equal to equivalent cumulative moves seen during the 2020 ‘dash for cash’). The scenario also includes the widening of the ‘basis’ between bonds and bond futures (explained in detail in Annex 4: Hedge funds). That said, not all market indicators are stressed to historical peaks, eg equities (Chart 1).

Chart 1: The SWES hypothetical scenario combines shocks to rates and risky asset prices

Comparison of 10-day moves in selected SWES variables against the largest observed since 2001, and those observed during the 2020 dash for cash and 2022 gilt market stress episodes (a) (b)



Sources: Bank of England, Bloomberg Finance L.P, Board of Governors of the Federal Reserve System (US), Refinitiv Eikon from London Stock Exchange Group and Bank calculations.

(a) Data for gilt yields, US Treasury yield, corporate bond spreads, and equity prices start from 1 January 2000. The data for gilt yields includes September 2022, when yields peaked unusually sharply.
(b) The increase in yields on US Treasuries is similar to that applied to all non-UK advanced economy government debt of similar maturity. This figure displays yields on 10-year US Treasury yields for indicative purposes.

The Bank provided participants with a day-by-day **scenario narrative** as well as quantitative price paths for around 40 key market variables (see annex to the **scenario launch document**). The narrative aimed to capture the uncertainty built into the hypothetical scenario and participants were encouraged to consider their actions in this context. It also included:

1. The default of a mid-sized relative value hedge fund, markedly elevating concerns around counterparty credit risk.
2. Single notch downgrades of several jurisdictions (including the UK) and a small number of financial institutions and corporates.
3. The unexpected announcement by sovereign wealth funds that they will reduce holdings of advanced-economy debt.

4. The expectation of longer-term shocks to economic fundamentals beyond the horizon of the 10-day scenario, meaning that participants needed to consider realistic actions in the context of protracted uncertainty.

1.5: Methodology

At the start of the process, the Bank gathered **initial information** from SWES participants to inform the design of the exercise – including the stress scenario. The scenario design was informed by a mixture of firms' internal stress testing, historical shocks, Bank modelling of the impact of different shocks on firms, and Bank staff judgement. We calibrated our model of the impact on firms using data from participants on their exposures and sensitivities to a range of changes in market variables. We then used this to estimate the impact of a given scenario on a firm and what actions they might take (eg based on their waterfall of actions to source liquidity during market stress). The information gathered from participants was then supplemented with an **intelligence-gathering** round with non-SWES market participants.

We implemented the main **scenario phase** of the exercise in two rounds:

In **round 1** we provided participants details of the SWES scenario. We asked NBFI participants to model the impact of the shock on their business on a day-by-day basis, and to explain how they would respond to it and the rationale behind those actions. We asked banks to provide data on how they would expect to act during the stress with detail on their interactions with their NBFI counterparties and how they would expect to act in the SWES markets of focus, including in a market making capacity. And we asked all participants, including CCPs, to provide estimates of the margin they would expect to post to and/or receive from other participants in the stress. We reviewed firm submissions individually, clarifying specific points with firms where necessary. We then aggregated the firm and sector-level information and scaled this up to build a picture of the impacts at the level of the financial system as a whole, including in the SWES markets of focus. We used our aforementioned internal modelling to sense check the results. We also compared responses to observe interactions and to assess where there were mismatches in participants' expectations of how other participants would behave.

In **round 2**, the Bank, FCA and TPR met with participants to discuss key sectoral and system-wide observations from the first round. We highlighted risks of amplification to corporate bond markets and potential mismatches in expectations regarding the availability of repo financing. We also sought to understand better what drove participants' actions in core UK markets, particularly where their actions were different to those taken during previous stress events, as well as to ensure that we had correctly interpreted their submissions, provide them with feedback (eg where they might have had mismatched expectations of other participant's behaviours), and to probe certain elements.

Based on the collective responses of firms in round 1, in round 2 we updated the scenario, increasing the shock to credit spreads, and further deteriorating sterling repo credit conditions and the availability of derivatives used to hedge activity in core UK markets. Participants were then asked to consider how their response might change in light of the updated scenario, for example updating their expected asset sales or purchases given price changes. The second round was also used to refine some participants' responses in light of feedback from round 1, and to sensitivity test the results to understand how they could differ if key judgements or markets conditions had been different.

The Bank also supplemented information captured through firms' quantitative and qualitative submissions through discussions with participants, regulators and other non-SWES market participants and, where relevant, their advisors.

We aggregated data submitted by firms and augmented it to produce the system-wide results in this report in several steps. First, we made a limited number of adjustments to firms' submissions to address discrepancies, often identified in follow-up discussions with firms. Second, we combined firms' submissions with other data and information sources to try to account for gaps in SWES coverage – for example, the fact that a greater share of SWES participants are larger firms than in financial markets more widely. Scaled numbers presented in this report are those where we have mapped aggregate SWES results to markets or sectors as a whole, ie estimating actions for firms outside of the SWES sample. A key judgement in this scaling was the treatment of non-participating pension schemes. We relied on TPR data, information from participating LDI funds and pension schemes, and extensive industry engagement to understand likely reactions to LDI recapitalisation requests by non-participating pension schemes.

1.6: Interpreting the outcomes

As with any simulation, the SWES is a hypothetical exercise and not a forecast. The results reflect the actions that firms reported they would take in the scenario, given the background information and assumptions the Bank provided. It is also stylised, given the practical limitations on the level of detail that can be modelled by firms and the Bank.

Specific SWES results are affected by the design of the exercise…

The SWES was designed to investigate interactions between market participants in the face of a sharp liquidity shock. This means it primarily focuses on a short period of time (two weeks) to allow us to investigate market interactions in detail. However, this also makes it unsuitable for testing the resilience of all parts of the financial system. For example, it did not stress bank balance sheets with significant credit losses, given that in the two weeks of the SWES scenario banks would not understand the longer term macroeconomic impact of the shock (and how that would impact their loan portfolios). Therefore, the exercise focused on

how the uncertainty at the start of a shock would impact the services they provide to NBFIs operating in financial markets. And more generally, the specifics of the scenario (see Section 1.4) affect the impact it has on different sectors and firms.

The SWES also necessarily includes some simplifying assumptions. Financial markets are complex ecosystems with many thousands of participants and asset classes, some of which trade at extremely high frequencies. For the exercise to be practicable, it was necessary to abstract from some of this complexity. For example, to facilitate firms' modelling, the scenario assumed parallel shifts in yield curves, which is not always the case in a real-world shock.

In addition, the SWES incorporated a representative sample of the firms most active in core UK markets. This means that, as described in Section 1.3, although we have strong coverage (particularly of the LDI sector), the sample is necessarily skewed towards larger financial institutions and focuses on their largest positions and entities. This means that dynamics affecting smaller firms may be less well captured in the results.

…and by firms' starting positions.

The SWES was carried out taking firms' balance sheets and risk positions as of 31 October 2023 as a starting point, and projecting forward into the stress scenario. Because where firms start the stress has an important effect on the outcomes, running the exercise with a different cut-off date could lead to different results. For example, in some sectors resilience levels were comparatively high at the start of the exercise (see Section 2.2), meaning outcomes in markets and for other sectors are less severe than they might otherwise have been.

Firms' positioning in financial markets is also dependent on the timing of the exercise. For example, in the gilt repo market, hedge funds – which were net cash lenders in October 2023 – have repositioned over the course of 2024 and are now significant cash borrowers in aggregate (see Section 2.4). This positioning affects how firms are impacted by the shock, and therefore the results of the exercise.

But the main value of the SWES comes from providing insights into behaviours and interactions in the financial system under stress.

Where possible, we have controlled for these factors. For example, we ran the scenario in two rounds to incorporate feedback effects, sensitivity tested key elements of the exercise, and engaged in qualitative discussions about our observations, including with non-participants. Despite this, the assumptions embedded in the scenario, and the date of the exercise – which affects the resilience and positioning of firms at the start of the scenario – have a material effect on the quantitative results, and underlines the importance of ongoing surveillance and exercises of this type.

Overall, this means that SWES results are less effective as a prediction of the precise impacts of an equivalent real-world shock or detailed firm-specific issues. Instead, SWES results are most effective as a means to gain insights into participants' behaviours in response to a stress, understand interactions between firms, and draw wider insights into how the financial system as a whole response to stress. These are insights that apply beyond the specifics of any given scenario and are the key benefit of system-wide exercises such as the SWES.

2: Outcomes: response to the shock

The SWES scenario comprised a rapid and significant shock to rates and credit spreads triggering significant losses and margin calls, with margin flowing from NBFIs to banks and CCPs.

The large and rapid market shock generates significant liquidity needs for many NBFIs, including to meet margin calls and redemption requests. This liquidity impact combines with leverage and risk constraints, as well as investment strategies and other commercial drivers of behaviour, leading to some NBFIs having to recapitalise and/or deleverage rapidly.

Banks have limited appetite to take on additional risk in some SWES markets. CCPs expect to operate as normal.

Consequently, through derisking and deleveraging, the financial system acts to distribute and amplify the impact of the SWES shock and some core UK markets come under pressure.

This section focuses on the impact that the SWES shock has on participants and how they respond. By describing the drivers of the actions taken, it aims to illustrate how the actions and interactions of firms can impact financial stability and core UK markets.

In this section, and Section 3 on market outcomes, all figures are scaled to the level of markets or sectors as a whole, including estimates for firms not participating in the SWES, unless otherwise stated.

2.1: Liquidity impact of the shock

The large and rapid market shock generates a significant liquidity need for NBFIs.

Under the SWES scenario, risk-free rates and credit spreads increase rapidly, leading to a fall in asset prices. The resulting margin calls, redemptions, use of financing, and trading activity results in significant cash and collateral moves across the financial system.

Many NBFIs, including LDI funds, pension schemes, insurers, OEFs and hedge funds, face significant immediate liquidity needs. In large part, these liquidity needs stem from requests to post additional margin given the stressed market conditions, with NBFIs needing to meet approximately £94 billion of margin calls in aggregate. Some rates products faced near-

record one day margin calls reflecting the rapid onset of the scenario. Overall, approximately 85% of NBFIs' reported liquidity needs arise from variation margin (VM) calls, around 8% from initial margin (IM) calls and around 7% from redemptions from UK investors. For example:

- **Pension schemes, LDI funds and insurers** sustain losses on their leveraged gilt and derivative positions. Their banking counterparties then call on them to pay margin calls totalling £92 billion.
- **Hedge funds** make losses of around -0.6% of NAV on average, but with a very wide range of outcomes for individual funds, reflecting the range of strategies they adopt and how they were positioned going into the stress. The sector makes net margin payments of around £2 billion. The increase in volatility causes internal risk limits to become more binding, and some hedge funds take action to reduce risk exposures. Some hedge funds are reliant on leverage provided by banks via repo, and may be forced to sell assets if repo financing was not available. The sector's borrowing using gilt repo has increased considerably since the SWES balance sheet date (see Section 2.4). Participating hedge funds do not face significant redemption pressures given their usually infrequent (eg quarterly) redemption terms.
- **Open-ended funds (OEFs) and MMFs** face redemptions from their investors (including other SWES participants), who seek to redeem to meet their own liquidity needs.

In the SWES, peak daily VM calls are approximately in line with recent historic peaks for interest rate products. VM calls for other products are substantially lower than recent peaks, reflecting the scenario design which focused on shocks in rates and credit markets rather than, for example, equities and commodities.

2.2: Firms' responses

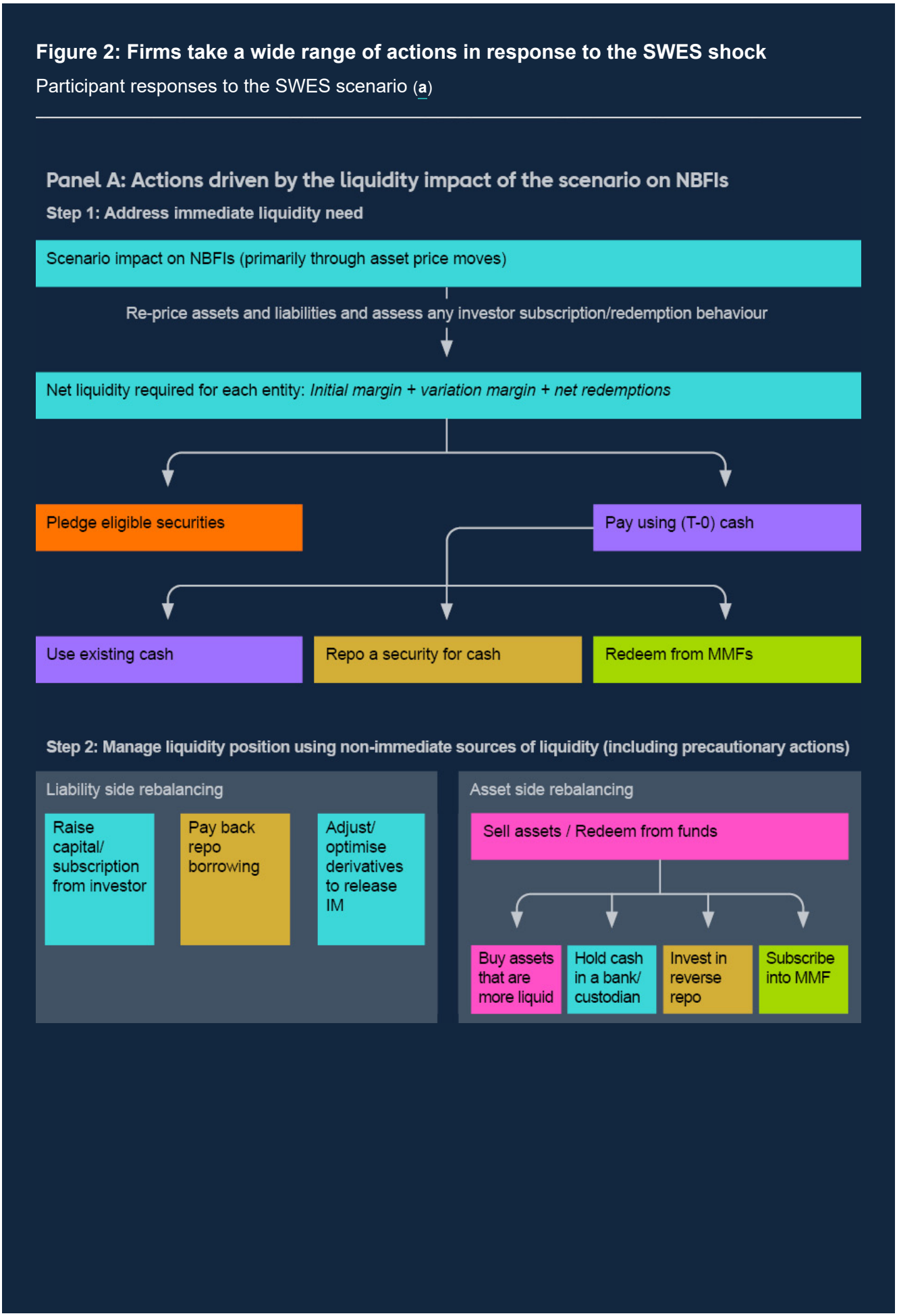
Firms report that they take a wide variety of actions in the SWES, many of which are driven by their investment mandates or due to commercial considerations. In addition to these types of actions, which firms judge to be sensible risk adjusted trades, firms have overarching internal risk appetites. These control how much risk firms can take, and, in some cases, are subject to specific regulatory requirements. In addition, firms take a number of actions to reduce risk that are not driven by immediate proximity to risk limits or regulatory constraints, that we have labelled as precautionary to reflect that these actions are being taken even in cases where firms are far away from those constraints.

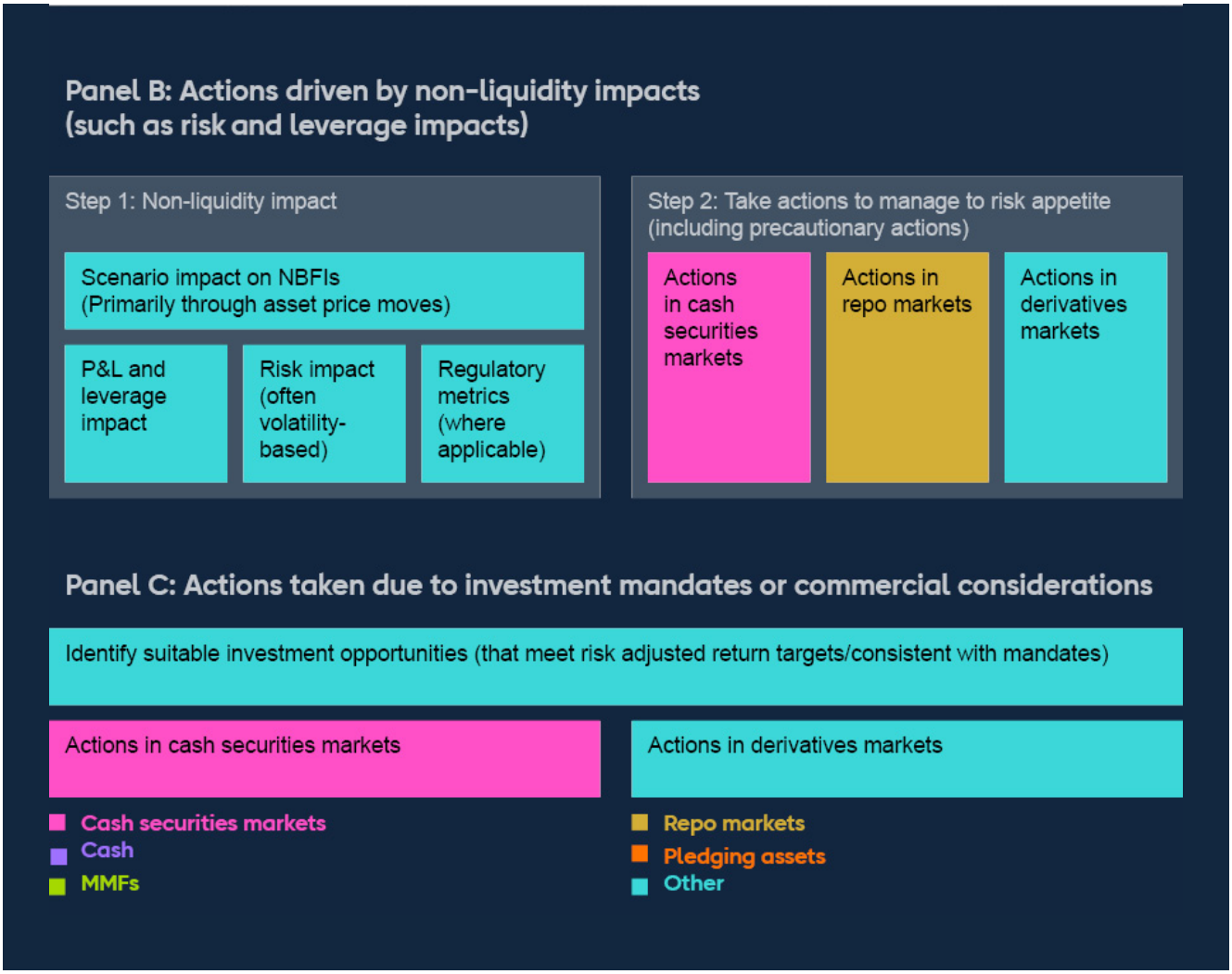
Figure 2 summarises the actions firms take in response to the SWES shock, including those motivated by the liquidity impact of the shock, by non-liquidity impacts (such as risk and leverage impacts), and by investment mandates or commercial considerations. It illustrates the key dynamics modelled and quantified within the SWES. Figure 2 is not exhaustive and

so does not cover all the ways NBFIs were impacted nor all the actions they took in response. It also excludes some interconnections for simplicity (eg where many firms take actions in cash or derivative markets, they are often doing so via an OEF). The rest of this section explores all the actions participants took in more detail, with the consequences in core UK financial markets set out in Section 3.

Figure 2: Firms take a wide range of actions in response to the SWES shock

Participant responses to the SWES scenario (a)





Sources: SWES submissions and Bank calculations.

(a) Panel A: Pledging assets, marked in dark blue, represents 80% of the immediate actions reported by participants. Panel B: P&L, leverage, and liquidity are interdependent. For example, a loss on a bilateral derivative leads to a VM call (representing a need for liquidity) as well as an increase in leverage as the fund's equity falls. Panel C: As most firms typically do not hold a significant amount of cash as dry powder, undertaking actions for investment or commercial reasons will require selling assets, raising financing, or securing additional capital from investors.

> **NBFIs meet much of their initial liquidity needs by running down buffers of available collateral and cash, and some then quickly act to restore them.**

At the exercise start date, many participating NBFIs had higher financial resilience levels than before previous shocks, reflecting regulatory changes or lessons learned from those stresses. These include a greater ability to post a wider range of collateral, larger cash buffers or lower leverage. In particular:

- **Insurers** have often negotiated bilateral agreements with banks that allow them to post corporate bonds in addition to sovereign bonds as collateral (see Annex 4: Insurance). They have also reduced liquidity risks in derivative portfolios, and have arranged committed funding from banks. This leads to lower redemptions from OEFs and MMFs in

which insurers are an end-investor, as they have less need for cash to meet immediate liquidity demands. It also reduces the risk of insurers, and the MMFs and OEFs they invest in, engaging in forced sales under stress.

- Following the 2022 LDI episode, the FPC made a recommendation, implemented via TPR guidance and requirements in Ireland and Luxembourg, that **LDI funds** should hold higher buffers of eligible collateral that allow them to withstand a yield shock of around 250 basis points.[4] On top of this, many LDI funds maintain management buffers over and above the guidance. As a result, they now typically hold much larger collateral buffers which they pledge in response to the margin calls. Operational and governance issues were a key feature of the 2022 LDI episode, prompting the FCA to issue **guidance** to managers. Procedures have since been improved which allow LDI funds to more easily be recapitalised by their pension fund investors, in line with the FPC's judgement that schemes should be expected to be able to deliver collateral to their LDI vehicles within five days (see Annex 4: DB pension schemes and LDI strategies).
- **MMFs** have built up higher liquid asset buffers since 2020, allowing them to meet outflows by letting their short-term assets mature. Despite fewer redemptions by insurers, MMF outflows peak at around 8-9% of assets under management (AUM) for individual participating MMFs, compared with the sector as a whole seeing redemptions of around 11% in March 2020.

Some of these changes are driven by regulatory requirements, such as LDI buffers. However, others are not underpinned by regulation, and therefore resilience could fall over time as memories of recent market events begin to fade. This includes MMFs, where high levels of resilience observed in the SWES have been so far driven by the firms themselves, not regulatory requirements.

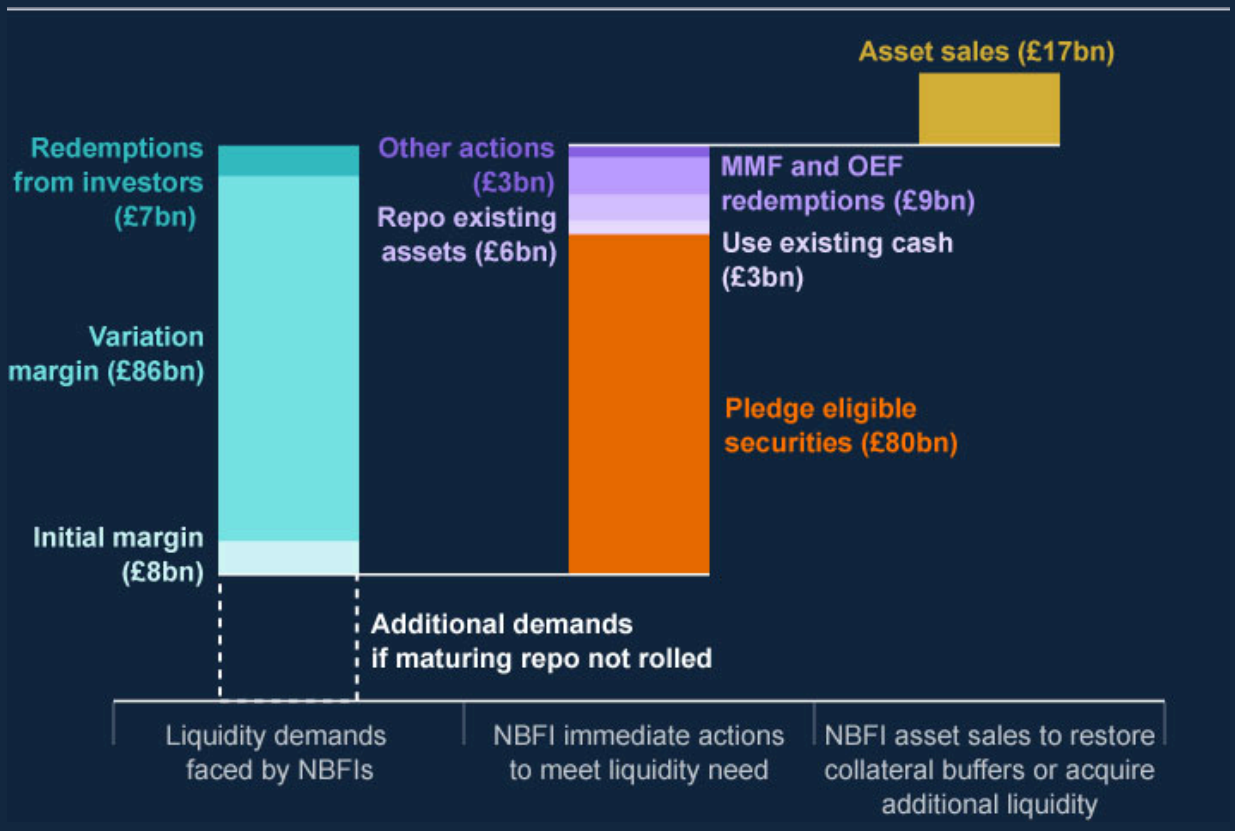
Chart 2 summarises the aggregate liquidity need faced by NBFIs in the SWES, the immediate actions they take in response, and the asset sales they make to restore collateral buffers or acquire additional liquidity. These actions are a subset of their responses to the scenario shown in Figure 2. The majority of NBFIs' liquidity need is met by pledging eligible securities (further details on the use of non-cash collateral are shown in Chart 3). To restore collateral buffers or acquire additional liquidity, NBFIs also sell assets, in sterling and non-sterling markets; the majority of these sales arise from pension funds responding to recapitalisation calls from LDI funds (Figure 3).

Some NBFIs rely on a significant amount of short-term repo being refinanced, and their liquidity needs could have been much larger had they been unable to roll repo that matured within the two weeks of the market stress. The amounts in question vary over time, but for the gilt repo market can be in the order of magnitude of tens of billions of pounds – since 2020, net borrowing by hedge funds (most of which matures in two weeks or less) has varied from -£45 billion to almost +£60 billion (Chart 6). SWES firms are also active in non-sterling

repo markets and use repo secured on assets other than gilts. Restrictions in these markets could also greatly increase the quantum of liquidity needs. Section 3.2 explores the impact of restrictions in the gilt repo market on core UK markets in more depth, and Box B discusses how hedge funds expected to respond if they had faced restrictions in UST repo.

Chart 2: NBFIs met the liquidity need mostly by pledging assets, with the remainder taking action to generate immediate cash. Some subsequently sold assets to restore collateral buffers or acquire additional liquidity

NBFIs' liquidity demand in the SWES and immediate actions taken in response (a) (b) (c) (d) (e)



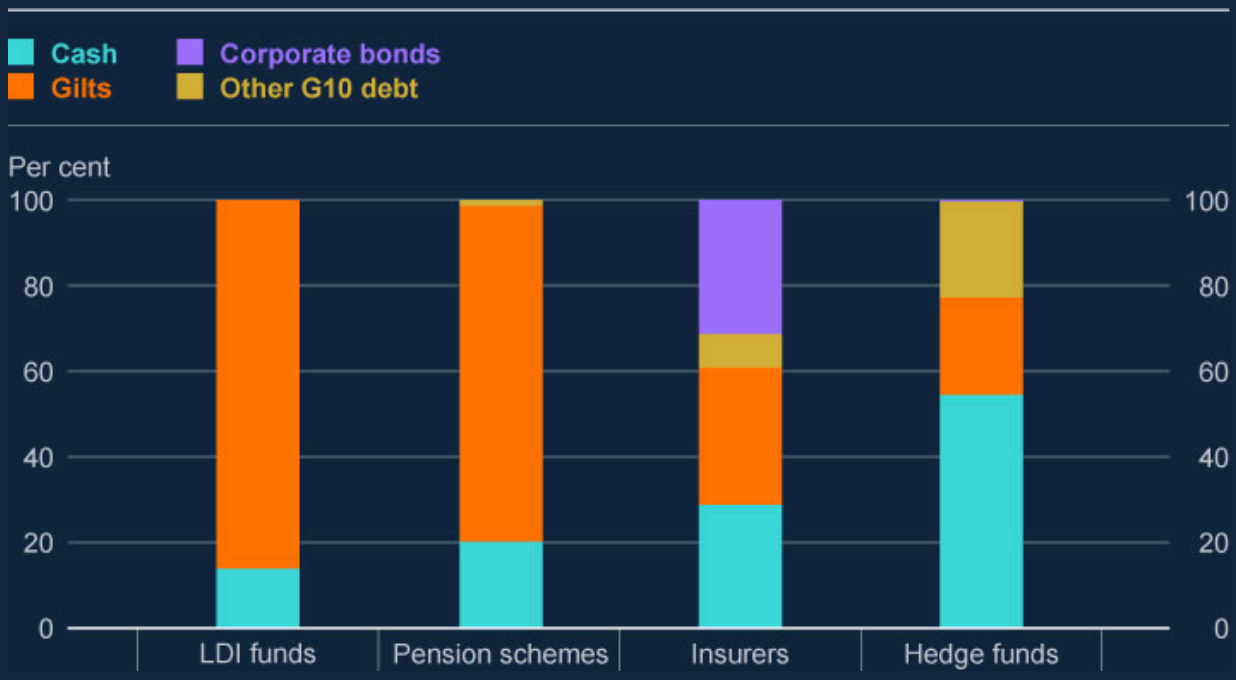
Sources: SWES submissions and Bank calculations.

(a) Immediate actions comprise only those taken to use or generate (T-0) cash. They do not include, for example, actions taken to restore asset buffers, or actions driven by non-liquidity impacts (such as risk and leverage impacts).
(b) NBFIs could face an additional liquidity demand if repo which matures within the 2-week SWES scenario horizon is not rolled.
(c) This excludes redemptions from global bond funds by non-UK investors.
(d) Other actions include MMFs' decision to let their overnight assets mature.
(e) Asset sales only include assets which have been sold to restore collateral buffers or acquire additional liquidity, they do not include actions driven by non-liquidity impacts (such as risk and leverage impacts). These are inclusive of both UK and non-UK products. Asset sales are intended to be illustrative; in particular, the scaling of sales of non-UK assets is highly approximate.

Overall, margin calls were more often met by pledging gilts (and corporate bonds for insurers) than seen in previous shocks, where a greater proportion of margin calls were met with cash. This includes VM, where insurers and pension schemes use securities to meet the majority of calls. Chart 3 shows the high proportion of non-cash collateral posted by many NBFI sectors under the SWES scenario, with insurers meeting around 30% of their IM and VM calls using corporate bond collateral.

Chart 3: NBFIs primarily use non-cash collateral to meet margin calls

Collateral pledged by different NBFI sectors in the SWES (a)



Sources: SWES submissions and Bank calculations.

(a) Gilts, or UK government bonds, includes both conventional and index-linked instruments. Other G10 debt includes US treasury bills, supranational bonds and securities backed by government guarantee. Corporate bonds refer to bonds issued by the private corporate sector (including financial issuers).

All else equal, in a scenario like the SWES where margin flows from NBFIs to banks, greater use of non-cash collateral reduces NBFIs' cash needs in a stress, reducing selling pressures in financial markets and so increasing the liquidity resilience of the system. But the use of non-cash collateral also increases some risks.

In particular, banks must regularly revalue already pledged collateral to ensure it remains sufficient to support positions, and hence are exposed to revaluation risk and other financial risks. As a result, many NBFIs are likely to need to top up collateral more regularly and

operational processes will become more complex exposing firms and markets to greater operational risks if not well managed. Operationally, collateral management may not be straightforward as asset eligibility and haircuts may vary by position and collateral type. Increasing use of bespoke and complex arrangements may result in more disagreements between counterparties on what is eligible. And NBFIs may be more at risk of making suboptimal collateral decisions (by pledging assets which are likely to be eligible first, instead of efficiently matching collateral for each transaction).

In addition, there are greater financial and valuation risks. Banks typically apply higher haircuts to corporate bond collateral than gilt collateral or cash (which has no haircut), reflecting the additional liquidation risk in the event of a counterparty default. We return to the use of corporate bond collateral by insurers in Annex 4: Insurance, and discuss the impact on banks of receiving this collateral in Annex 4: Banks.

> **Liquidity needs combine with other leverage and risk constraints, as well as investment strategies and other commercial drivers of behaviour, leading to some NBFIs having to recapitalise and/or deleverage rapidly.**

Against the backdrop of potentially prolonged economic uncertainty, many firms act quickly to restore buffers after the initial liquidity shock – sometimes as the stress is still unfolding (Chart 2).

- **LDI funds** look to restore their depleted regulatory buffers by rapidly seeking recapitalisation from investor pension schemes. We estimate that pension funds will face £16.5 billion of recapitalisation requests. In most cases, fund managers implement this by following pre-agreed instructions to sell specific assets in a price insensitive way. If LDI funds do not receive the capital subscriptions from their pension scheme investors within around a week, they will cut LDI exposures – so pension schemes are very keen to meet any calls, to avoid losing the liability hedging provided by their LDI investment.
- **Hedge funds** react to losses and increased volatility by deleveraging and reducing risk-taking activity. Several hedge funds' derisking decisions are driven by their approach to risk management, often as a result of an increase in volatility-based risk metrics in the scenario. In some cases, fund managers deleverage across their whole portfolio. Many loss-making hedge funds report that they would sell unencumbered assets to improve their liquidity position, although UK assets do not feature prominently in these sales. See Annex 4: Hedge funds for a detailed discussion of how the scenario affects hedge funds.
- A small number of **insurer participants** seek to generate liquidity through asset sales to restore unencumbered asset buffers, which in some cases is in response to their internal liquidity risk metrics approaching or falling below tolerance. Others seek to derisk for precautionary purposes, even though they are often far from internal risk management thresholds. Some insurer participants noted that there was a risk that credit downgrades could negatively impact insurer solvency positions and they therefore sought to sell credit

assets which they considered to be particularly vulnerable to further downgrades, and substitute these for gilts.

NBFIs often seek to rebuild buffers, including headroom over regulatory requirements, quickly. This leads them to act in ways that can affect other parts of the system.

These actions reflect that NBFIs generally seek to maintain, or quickly restore, liquidity buffers in a stress, rather than rebuilding them over a long time period. Funds, for example, often have targets for liquidity metrics which, once breached, prompt immediate action. And, in the case of LDI funds, action is prompted by a desire to maintain headroom over regulatory requirements. This means that, while NBFIs' buffers allow them to absorb the initial impact of the shock, they relatively quickly take actions – such as asset sales – which can impact other parts of the financial system.

For example, pension schemes typically meet the capital calls from LDI funds by redeeming from MMFs and other OEFs (including asset-backed security (ABS) funds, and corporate bond funds), as well as selling some direct holdings of assets. Figure 3 provides a breakdown of the ways in which pension schemes source funding to meet LDI recapitalisation calls. Pension schemes invested in pooled funds are most likely to meet capital calls with cash or by redeeming from MMFs, although a few sell credit assets or equities. Larger pension schemes that invest via segregated mandates are more likely to meet capital calls by redeeming from corporate bond OEFs or ABS funds. A minority of segregated mandate clients also sell gilts. See Annex 4: DB pension schemes and LDI strategies for more detail.

In turn, corporate bond OEFs are forced to sell approximately £7 billion assets (Figure 3), primarily corporate bonds, to meet these redemptions. Based on data from September 2022 and discussion with firms, we judge that about half of these sales by corporate bond OEFs could take place in sterling markets, but this will be sensitive to market conditions and other factors. Asset sales could have been higher had a few large pension schemes and LDI funds been less resilient at the start of the shock. And corporate bond OEFs sell more assets in response to redemptions from insurers and other investors (see Annex 4: OEFs (including MMFs) for more detail). The impact of these sales, and of offsetting countercyclical purchases of corporate bonds made by some sectors (eg insurers) to take advantage of opportunistic prices, is explored in Section 3.3.

Figure 3: Pension funds meet capital calls from LDI funds mainly by selling assets

Sources of cashflows used to meet LDI recapitalisation calls (a)

Sources: SWES submissions and Bank calculations.

(a) Arrows indicate the flow of cash to meet LDI capital calls.

CCPs do not judge the scenario significantly changes the risks of their clearing members or counterparties. They do not change collateral haircuts nor how they invest IM received during the stress.

CCPs judge that the credit risk of clearing members does not change significantly during the SWES scenario. They do not undertake any extraordinary actions such as increasing haircuts on collateral received or changing how they invest receipts of IM, continuing to lend a significant proportion of sterling collateral received via repo markets. This is broadly consistent with behaviours in recent stresses. If increased counterparty risk were a concern, depositing receipts of IM in their reserves accounts at the Bank would be CCPs' preferred alternative to lending in repo markets.

Increases to CCP IM during the SWES scenario are relatively muted compared with recent stress episodes. NBFIs and banks overestimate the IM calls they will face in the SWES as they generally base these estimates on IM changes observed in historic stresses. Overall, ten-day CCP IM calls are less than 5% of IM already posted on the SWES reference date for all clearing services.[5] This is a proportionally smaller increase than during previous stresses – between end-February and mid-March 2020, total IM in place at CCPS rose by 40% globally.[6] In other stresses these dynamics could result in users of CCPs underestimating margin increases – see Box A for more detail.

Banks take actions to derisk following the shock.

Banks provide a range of crucial functions in financial markets, including by market making in cash markets (ie buying and selling securities, such as gilts and sterling corporate bonds, to provide liquidity into those markets), by acting as clearing brokers on behalf of their clients (who typically do not have direct access to cleared markets), and by providing repo and derivative financing directly to their NBFI clients. We see NBFIs demanding all of these services in the SWES scenario, including in the SWES markets of focus. As a result, banks play a very significant role in outcomes in those markets.

The SWES was designed to focus on how banks behave during a market stress; it was not intended to test their solvency and liquidity positions. Banks in the SWES are large and diversified, and so the impact of the shock on their overall financial resilience would only become clear over time, as its impact on the real economy and their wider, non-market business unfolds. The level of uncertainty in the scenario, particularly around how it will evolve over the medium term, is therefore a key dynamic affecting banks' reported behaviours.

Banks therefore expect that the immediate impact of the 10-day SWES scenario would not significantly lower their financial resilience, nor result in breaches of regulatory limits in the near term. In part, this reflects that banks' expected market losses would be at least partially offset by increased trading income, and the fact that they were net receivers of margin from NBFIs. In other cases, it reflects that some banks were in particularly favourable positions at the outset of the exercise, with stronger-than-usual capital positions or particularly low market

risk profiles. Had the exercise taken place at a different point in the year – for instance, shortly after shareholder distributions had been made – some banks' risk management might have led them to react more defensively and be less open to taking risk during the scenario.

In the context of that heightened risk and uncertainty, banks' counterparty, market and liquidity risk management practices drive actions which, while independently prudent, have implications for the rest of the market. As well as proactively monitoring their client portfolios for signs of stress, many banks take actions including asset sales to increase headroom to market risk limits and reducing the risk involved in the repo provided to clients, for example by rolling maturing repo at shorter terms or with increased haircuts.

Several banks also draw on central bank facilities, as a precautionary measure or because they assess pricing would be more attractive than the alternatives available in the SWES. In total, over the two weeks of the scenario, participating banks draw a total of £20bn from a combination of the Bank of England's Short-term Repo (STR) and Indexed Long-term Repo (ILTR) facilities. Banks' use of the Bank of England's lending facilities in the SWES is consistent with the design and motivation behind these tools, which are open for business and intended to meet firms' demand for central bank reserves – the most liquid asset in the economy – as needed.

Banks have limited appetite to take on additional risk in some SWES markets.

As described above, there is significant demand to sell assets from NBFIs who seek to quickly derisk and/or meet liquidity needs. In many cases, these sales are relatively price insensitive, eg some pension schemes which sell specific assets according to pre-agreed waterfalls.

In their capacity as market makers, banks play an important role in absorbing selling pressures like these during times of stress. This helps to bridge the period before buyers can enter the market (which they might ultimately do, eg to take advantage of pricing opportunities).

But, in the SWES, the banking sector's appetite to temporarily increase inventory of gilts and sterling corporate bonds in the face of sales from clients is limited and is concentrated in a small number of banks. Banks will typically only fulfil such requests if they judge that bid-ask spreads, trading opportunities, and franchise benefits from fulfilling them outweigh the risks inherent in warehousing the assets. In turn, this depends on hedging conditions, balance sheet considerations and the maturity of the bond in question (longer-dated bonds entail greater interest rate risk).

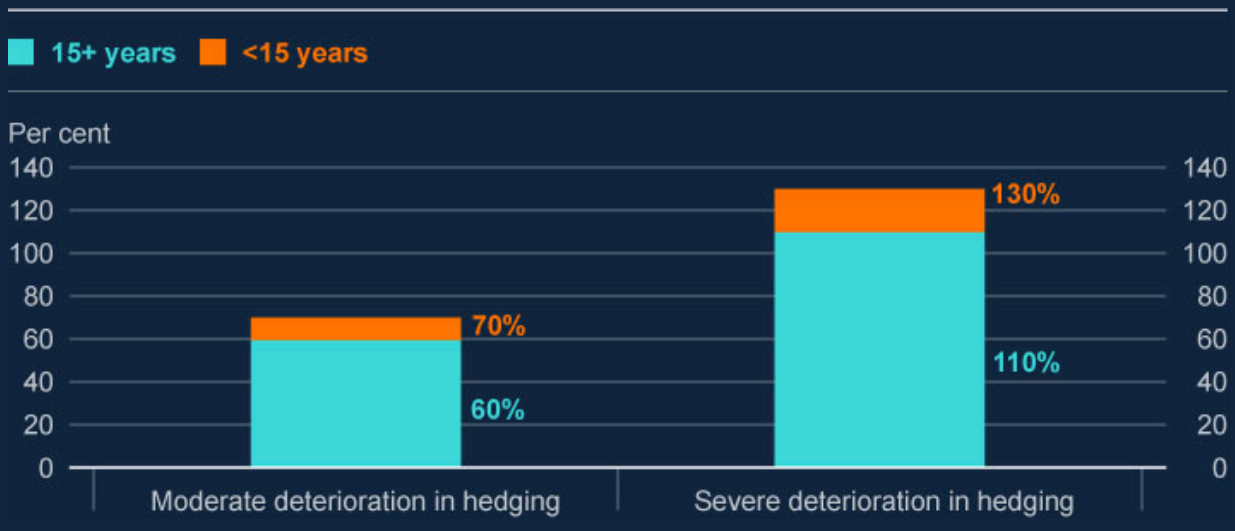
In the **gilt market**, sales in the scenario exhaust the majority (70%) of the appetite banks have to warehouse risk before needing to be compensated by a further widening in bid-ask spreads (Chart 4).

Relatively few additional sales would have been needed to exhaust this remaining appetite, particularly if sales were concentrated in longer-dated gilts. For illustration, additional sales of around £0.5 billion of long-dated gilts (15+ years), or £1 billion–1.5 billion of medium-dated gilts (7–15+ years) would have consumed the remaining appetite banks had before needing to be compensated by further increases in bid-ask spreads. These numbers are small in the context of the size of the gilt market.

Further widening in spreads would have increased some banks' appetites, but only assuming that the availability of hedging products did not deteriorate beyond the moderate stress incorporated in the scenario. Had conditions in interest rate derivative markets deteriorated severely, as has been observed in previous episodes in which large volumes of gilts have been sold, banks' aggregate appetite would have contracted significantly and even a considerable widening in bid-ask spreads would not have been sufficient to increase banks' aggregate appetite beyond that seen in the main scenario.

Chart 4: Gilt sales exhaust the majority of banks' appetite to warehouse risk before needing to be compensated by further widening in bid-ask spreads

Gilt sales as a proportion of banks' appetite under different assumptions about the extent of deterioration in hedging markets (a)



Sources: SWES submissions and Bank calculations.

(a) The SWES scenario incorporated a moderate deterioration in derivative markets used for hedging gilts. Had this deterioration been worse, the selling pressure in gilts observed in the scenario would have exceeded the appetite banks had before needing to be compensated by a further widening in bid-ask spreads. While sales of 15+ year gilts made up less than half of total gilt sales, they consume a greater proportion of banks' appetite because of the longer duration of the bonds.

In the **sterling corporate bond market**, banks' appetite to warehouse risk is also limited, and concentrated in a small number of banks. Banks are willing to warehouse around £4 billion of investment grade sterling corporate bonds in total, 85% of which is concentrated in only five banks. For context, gross daily trading volumes of these bonds were typically around £1 billion in 2023. In response to the deterioration in sterling corporate bond market conditions incorporated in round 2, most banks expected to reduce their warehousing by at least 20%. A minority have the same or greater appetite to purchase in these conditions meaning that, in aggregate, banks' market making appetite across the two rounds falls only slightly but becomes even more concentrated in the three largest purchasers.

More broadly, in a live stress, decision makers in banks may be more cautious about purchasing and holding large volumes of both gilts and sterling corporate bonds in the face of significant non-bank selling pressures across both markets – especially if they face demand to sell from clients in both sterling and non-sterling markets or are facing acute balance sheet impacts from the shock.

> **Most banks' appetites to extend additional repo financing during the stress are severely limited, given their risk management approaches.**

Banks' willingness to extend repo depends on a number of conditions, including counterparty and other risk judgements, the risk/reward profile of the trade being sufficiently attractive, not being constrained by balance sheet impacts (eg leverage ratio), and being able to finance the trade (in some cases, this means being able to find an offsetting reverse repo transaction of a similar tenor).

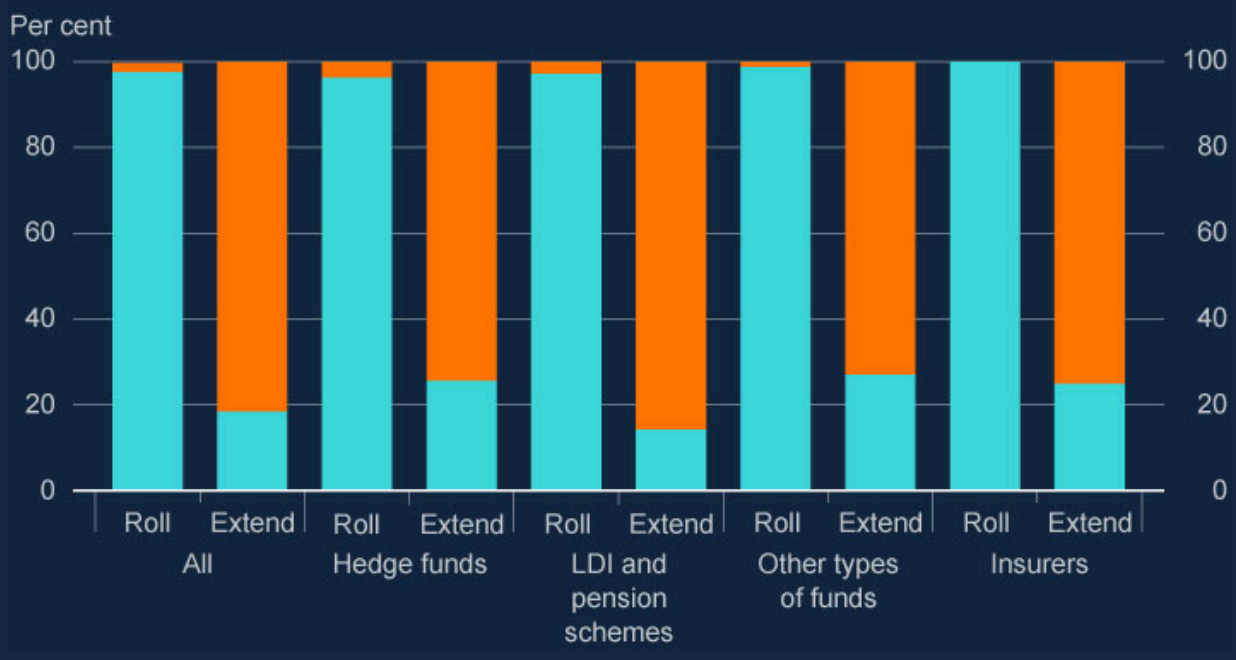
Counterparty risk assessments are a key determinant of bank actions in historical stresses, and the SWES scenario incorporated elevated counterparty credit concerns including the default of a mid-sized hedge fund. Given this context, and the fact that banks were not constrained by balance sheet or funding impacts in the SWES, counterparty risk management was the main inhibitor to repo provision. There were exceptions, in a few cases where banks judged conditions allowed them to extend additional repo, likely motivated by the opportunity to deepen relationships with clients. But most banks had no or very little appetite to increase the value of clients' repo financing (Chart 5). This is an example of how individually prudent behaviour to manage risk can affect conditions in markets. It also represents a mismatch with NBFIs' expectations that they would be able to access repo in stress – see Section 2.3.

In a small number of cases, banks were not willing to rollover maturing gilt repo for particular clients, due to counterparty-specific risk judgements (Chart 5). This occurs even though banks have sufficient financial resources, and many are willing to draw on central bank facilities if needed. In the SWES scenario this has relatively limited direct impacts on NBFIs, because demand for increases in gilt repo financing are relatively small overall and rarely

driven by NBFIs' direct liquidity needs. This means that, in this scenario, where new gilt repo financing is not extended, NBFIs are generally able to fall back onto alternatives (such as pledging cash from existing buffers to meet margin calls).

Chart 5: Banks were typically willing to roll maturing repo but unwilling to grant requests for additional repo financing

Banks' willingness to roll and extend repo for participating clients in the SWES (a)



Sources: SWES submissions and Bank calculations.

(a) For each of their legal entity clients participating in the SWES, banks were asked whether, had the client requested to 1) roll their maturing repo or 2) increase in the value of their repo line, they would or would not have been willing to accept the request.

Had banks been more constrained, the impact on their clients and markets could have been more severe.

Had banks' balance sheets been under more pressure (for example, had they become more acutely constrained by the leverage ratio or seen a significant deterioration in liquidity or funding metrics), many banks thought they might have needed to derisk repo books more aggressively and reduce financing to a broader range of clients than they did in the scenario. This, and a consideration of what the consequences might have been if NBFIs had had lower starting resilience and had required more repo, is explored further in Section 3.2.

2.3: Mismatches in participant expectations and other interconnections

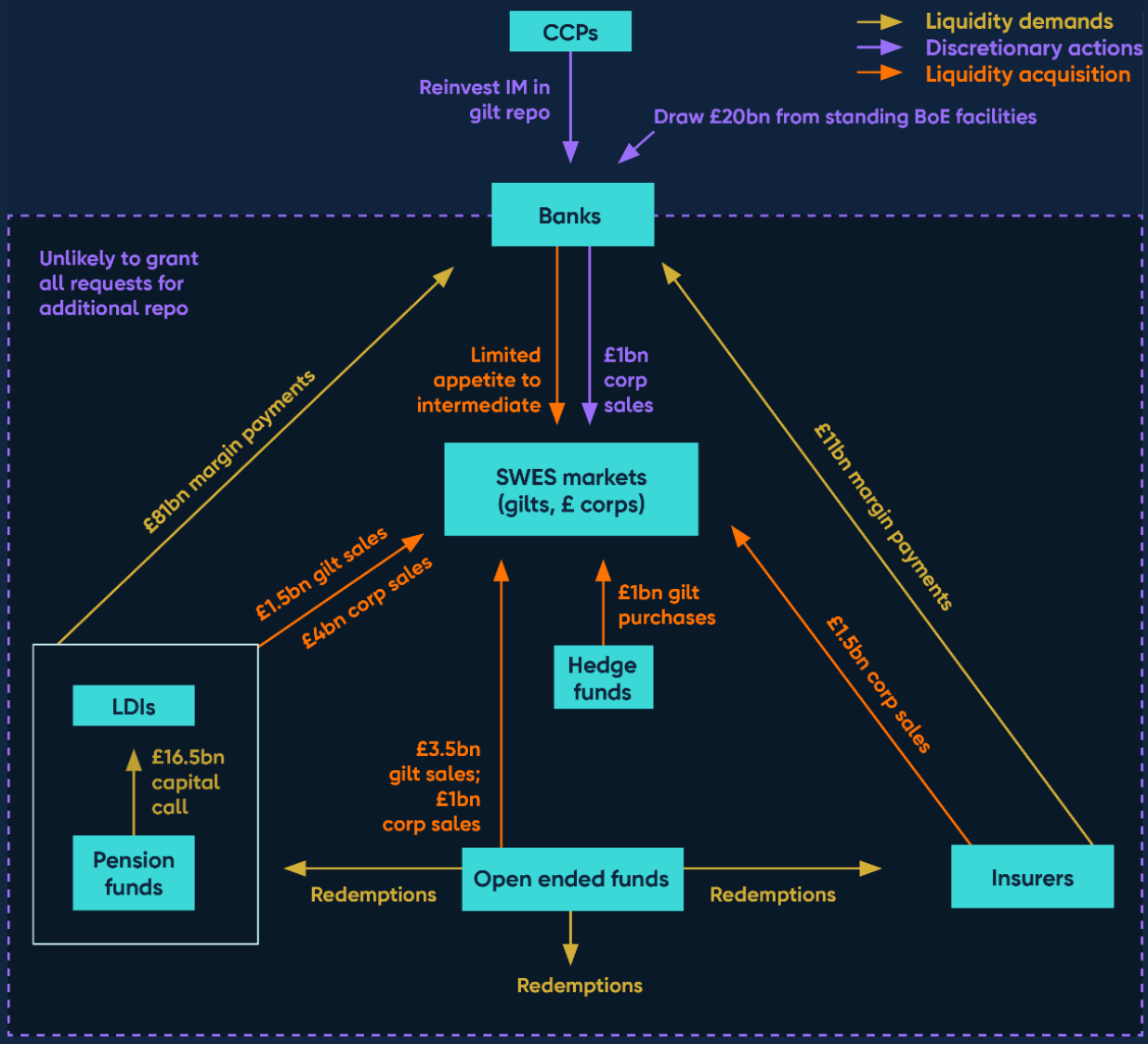
The SWES enabled the Bank to consider participants' responses on a sector-by-sector basis and understand interconnections between different types of participants.

The simultaneous participation of multiple sectors enabled the Bank to explore how the combination of behaviours can interact, and how participants' actions are often dependent on each other. In several cases we were able to directly compare participants' responses to identify differences in expectations.

Firms' interactions are summarised in Figure 4, which builds on the diagram of key risk transmission channels (Figure 1) in Section 1.2. NBFIs' actions in response to the shock, for example to acquire liquidity or meet redemptions, have knock-on impacts on other sectors, and affect conditions in financial markets (the impact on the SWES markets of focus is described in Section 3).

Figure 4: Firms' reactions to the shock lead to complex interactions

Key interactions between sectors in the SWES in relation to sterling financial markets (a) (b) (c) (d) (e)



Sources: SWES submissions and Bank calculations.

(a) The most significant interactions between sectors that arose in sterling markets in response to the SWES scenario are shown. Liquidity needs are rounded to the nearest £1bn; transactions to the nearest £0.5 billion.
(b) Values marked 'corp sales' reflect sell orders of sterling investment grade corporate bonds.
(c) The figure for Bank of England lending facility usage represents the gross value drawn by bank participants from the STR and ILTR over the two weeks of the scenario.
(d) Margin payments and transactions values are combined for the LDI fund and pension scheme sectors. Margin payments shown exclude hedge fund margin payments, which – relative to other sectors – are small (£2 billion) on net.
(e) Redemption flows shown from OEFs are by three types of client – UK pension schemes, UK insurers and other investors, which includes retail and non-UK institutional investors. Asset sales by OEFs to meet redemptions by UK pension schemes and insurers have been allocated to their respective end-investors.

In many cases participants anticipate others' behaviours in the stress correctly – but there are some significant areas where expectations are mismatched.

Participants were often able to correctly anticipate the behaviour of other participants. For example, where behaviours rely on simple and transparent processes – such as inferring VM calls for a given change in the underlying security referenced by a derivative – firms' responses were aligned with each other. The same was typically true where there are pre-determined arrangements which specify how investors will react (eg investment management agreements between LDI providers and their pension scheme investors). Firms that manage a range of funds and are vertically integrated can have greater visibility of potential flows from, and actions of, investors (eg where the same asset manager operates both an LDI mandate and the MMF they invest in). We observed mixed evidence on how well that vertical integration was used to understand and plan for interfund dynamics that can arise in stress.

But counterparty and investor behaviours are less predictable in other areas. There was a significant mismatch in expectations in the **gilt repo** market. Given banks' limited repo financing appetite (see Section 2.2), some NBFIs do not get all the repo financing they demand in the SWES. This means there is a risk that even large, sophisticated NBFIs have less access to finance in a stress than they expect.

While NBFIs are generally aware that conditions in the repo market will tighten during the scenario, many underestimate the extent to which their own access to repo may deteriorate in the stress. More than half of participating fund managers consider additional repo an option available to meet at least some urgent liquidity needs. But banks' responses suggest that over a third of these would not have been granted additional repo by any SWES bank for one or more of their funds, had they requested it during the scenario. Most would also have found the majority of their banking counterparties unwilling to extend them additional repo, limiting the quantum of financing available. In a small number of cases, based on counterparty-specific judgement, banks reported they would be unwilling to roll maturing repo. This reinforces the importance of market participants having a clear understanding of the repo market and of banks' risk management processes.

NBFIs being unable to access the repo financing they expect could exacerbate stress dynamics in several ways. First, where NBFIs are surprised by a reduction in access to repo, they may reassess their liquidity and funding options. This could lead to them, for instance, precautionarily selling assets to generate cash, which they would not do if they continued to be able to monetise assets in stress using repo. If this lack of access to repo is not expected, this could also fuel negative market sentiment about the risk environment – which could trigger further amplification through liquidity hoarding or precautionary asset sales. Second, had an NBFI urgently needed additional financing (eg to meet a margin call in cash), they might have struggled to source it – given the general unwillingness of banks to offer extensions of repo during the stress. Third, an investor willing to purchase gilts to take

advantage of falling prices, but in need of financing, might be unable to enter the market. And many hedge funds would need to use financing for the returns from such a trade to meet their hurdle rates. Such 'countercyclical' purchases would otherwise have helped to stabilise the market.

Repo markets were not the only market where the SWES identifies mismatches in expectations. As set out in Box A, banks and NBFIs often struggled to accurately estimate changes in **CCP IM**. While in the SWES this led to overestimation of IM by NBFIs, in alternative exercises we might have seen underestimation. And in some cases MMFs found it difficult to predict **redemptions** and subscriptions from their investors.

Firms' resilience is interrelated, because one firm's actions in stress can affect others.

Many firms in the SWES – particularly LDI funds and some pension schemes – redeem from MMFs and OEFs to meet their initial liquidity needs (see Section 2.2). MMFs in particular are critical for investors who need to access cash at short notice. When repo markets are functioning normally, investors can use repo borrowing to fund temporary cash needs. But if a stress impacts the resilience of the banking sector, or if banks become less willing to lend in repo markets, redemptions from MMFs could increase. This means that the resilience of these funds, their end investors, and the functioning of repo markets, is interrelated. The better prepared OEFs and MMFs are to meet heightened redemptions in stress, the more liquidity their investors can access during stress. Seen from the other perspective, the more resilient end investors are to liquidity shocks, the less likely OEFs and MMFs are to see spikes in redemptions during stress.

By including MMFs and OEFs, as well as firms investing in these funds, the SWES provides an insight into these dynamics. Heightened resilience of NBFI end investors and a lack of significant redemptions by the corporate sector means that redemptions from MMFs and OEFs are lower than they have been in previous stresses. LDI funds have significantly reduced their leverage. Total liabilities hedged using LDI have fallen from about £1.4 trillion at end-2021 to about £600 billion at end-2023, while LDI funds' leverage has also fallen substantially. This increases the capacity of LDI funds to weather gilt market stress without asset sales (either directly or to support their pension scheme sponsor recapitalising the LDI fund).

The SWES also highlights the critical role of banks as market makers and providers of funding to NBFIs, and how banks' decisions in stress can affect other firms. This is described in Section 2.2, and the consequences for individual markets explored in Section 3.

Risk management in many sectors is driven by recent stress events.

While not a focus of the exercise, NBFIs' responses gave us a unique insight into the broad range of risk management practices, modelling, and other capabilities. For instance, many NBFIs demonstrated that they run relatively sophisticated stress tests as part of their business as usual (BAU) risk management. Many firms use similar approaches to measure and manage risk which could drive correlated behaviours in markets. One example of this is the use of recent data to inform modelling and risk management – for example, in estimating IM (see Box A), or for volatility-based risk metrics and stress tests used by funds and banks to manage market risk. This means that as the stresses of recent years fall out of the data used by firms, risk limits may loosen in tandem in different parts of the financial system and then be at risk of significantly tightening during a market stress, which could result in more pro-cyclical behaviours.

2.4: Developments which could affect these dynamics in future stresses

Evolutions in financial markets, the wider macroeconomic context, and in firms' positioning as well as broader sectoral trends are among the factors that will shape the dynamics in future shocks. There have already been important changes that would affect how the SWES scenario would play out if repeated – and there will be further developments in the future. These changes will also affect the impact of future shocks on core UK markets described in Section 3.

> **The way firms behave in a shock depends on their financial resilience and the positions they have taken in financial markets when the shock hits.**

Firms' positioning in markets will change over time, in some cases quickly. For example, hedge funds were net cash lenders in the gilt repo market at the start of the SWES in October 2023. But over the course of 2024 they have repositioned, and are now significant cash borrowers in aggregate due to changes in expectations about rates (Chart 6).

This means that the risk of hedge fund distress impacting the gilt market is higher than at the time of the exercise. At the time of the SWES, the hedge fund sector as a whole had a net short gilt exposure, and therefore benefitted from the rise in rates in the scenario. A contraction in repo and reverse repo availability would have resulted in net purchases of gilts by the sector in aggregate. The sector has increased its net gilt repo borrowing (to around £50 billion – Chart 6), suggesting the sector is, on average, long gilts. Most of this borrowing is short term, with a weighted average maturity of around two weeks. A similar rates up stress in October 2024 would likely result in losses for hedge funds with long gilt exposure, and a simultaneous 10% contraction of repo lending by banks to the sector could result in up to £5 billion additional gilt sales – more than doubling the sales in the SWES – depending on whether hedge funds chose to absorb any of the impact using cash buffers. Assuming banks' market-making appetite remained fixed, these additional sales by NBFIs would have fully

exhausted banks' remaining market making capacity which, as described in Section 2.2, is limited – in which case the market might not have cleared, and we might have observed further price amplification in the market.

And as a consequence of hedge funds' greater net borrowing, banks have increased their net repo lending to the sector – at the same time as lending by banks' prime brokerage divisions to the hedge fund sector has also increased significantly. Banks' capacity to provide additional client financing in stress could therefore be lower, and increased interlinkages between these sectors could amplify some of the dynamics observed in the SWES.

Chart 6: The hedge fund sector's position in gilt repo markets has changed significantly since the SWES reference date

Hedge fund net gilt repo borrowing (a)

Sources: Sterling Money Market Data (SMMD) and Bank calculations.

(a) Latest data are as of 14 November 2024. The SWES reference date is 31 October 2023.

Similarly, in the SWES, some banks purchased gilts to support their own dealing activities (see Section 3.1). Had they started with different gilt market positioning, they might have been less inclined to purchase gilts, resulting in a more imbalanced gilt market. And, as set out in Section 2.2, many NBFIs enter the SWES with higher resilience than at the onset of past stresses, reducing their need to obtain liquidity rapidly or take derisking actions, whilst many banks have particularly strong balance sheets entering into the SWES scenario.

Evolutions in the broader macroeconomic environment will also shape firms' risk appetites and behaviours – in business as usual, as well as in stress.

One example is the reduction in reserves supplied by the Bank of England, where central bank reserves held by banks are reduced as market participants purchase gilts from the central bank (unwind of quantitative easing (QE)) or banks repay central bank funding

schemes (Term Funding Scheme with additional incentives for SMEs (TFSME)) using central bank reserves as payment. UK-headquartered banks were asked how their actions in the SWES might have differed had the exercise occurred in the context of fewer reserves. In some cases, banks expected to respond to this evolution by passing on any additional costs and/or haircuts to clients. For further details see Annex 4: Banks.

Sectoral trends could also give rise to changes in market outcomes in stress. One example of relevance in particular to the SWES core markets and the dynamics we observe is the continued growth in the bulk-purchase annuity (BPA) market. Increased demand by pension schemes for BPA transactions would likely result in insurers taking on a greater share of pension scheme liabilities. This could affect market outcomes in a number of ways, as pension schemes and insurers tend to have different approaches to asset allocation, use of leverage and risk management.

Box A: Mismatches between participants' estimates of cleared IM calls

Margin calls are a key driver of liquidity needs in times of market stress. As part of the SWES exercise, each participant provided the Bank with estimates of how much margin they would expect to post to and/or receive from other participants during the scenario.[7] This allowed a direct comparison of participants' projections to assess whether there were any material differences (for example, whether the amount of margin that banks expected to post to CCPs matched what CCPs expected to receive from banks).

CCPs collect IM and VM from clearing members. They collect IM to cover potential changes in the value of members' positions during the time it would take the CCP to close them out after a default while VM is collected in response to changes in market prices.

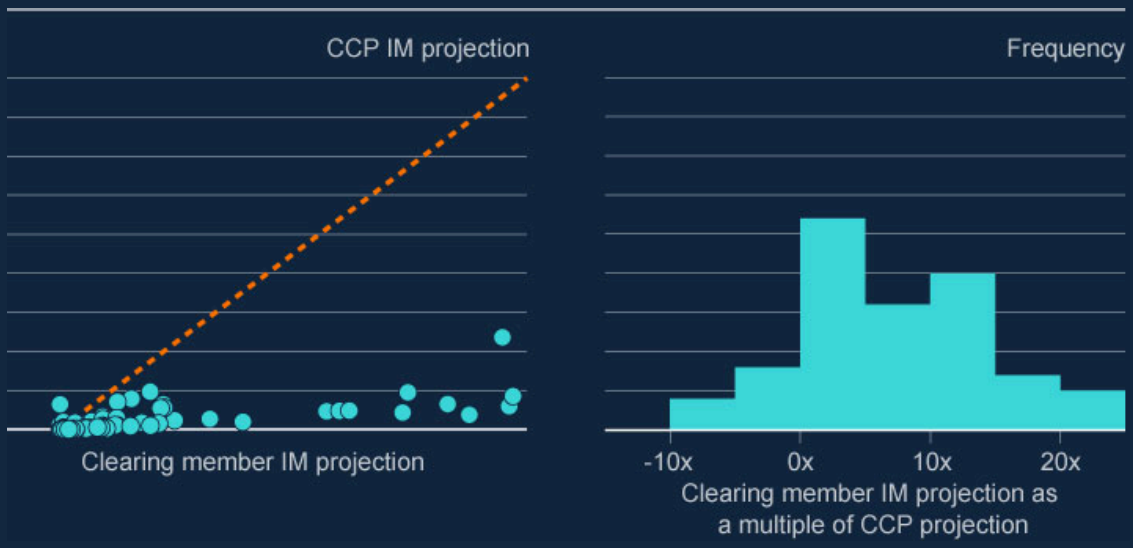
The SWES scenario generates a smaller increase in CCP IM than in previous stress episodes. This is because the data used to calibrate CCPs' IM models currently include recent stresses (eg the dash for cash and LDI episodes) which have some similar characteristics to the SWES scenario. As a consequence, the SWES scenario has a relatively limited impact on CCP IM requirements compared to some other stress periods. Overall, ten-day CCP IM calls in the SWES are less than 5% of IM already posted on the SWES reference date for all clearing services. This is proportionally smaller than calls during previous stresses; between end-February and mid-March 2020, IM in place at CCPs rose by 40% globally.

There are material differences between clearing members' and CCPs' projections of IM calls during the scenario (Chart A) – with the median clearing member IM projection being nine times higher than the equivalent CCP projection. Some NBFIs which access CCPs indirectly via clearing members had similar difficulties estimating IM. A minority further overestimate IM, using scalars several multiples greater again than those of clearing members, suggesting an extremely conservative approach. Globally, some clearing members have, in previous stresses, increased margin multipliers applied to CCP IM calls when passing them through to clients. Most participating clearing members reported they would not increase margin multipliers during the SWES scenario, except if they had significant counterparty credit concerns about a specific client. Some, however, indicated they would do so for a broader range of clients. In total, margin multipliers were increased for about 15% of relationships with participating clients.

In the rest of this report, when discussing margin calls, we use clearing members' and NBFIs' conservative estimates of margin calls arising from centrally cleared positions. This allows us to consider the impact the SWES scenario would have were preceding stresses with similar characteristics not included in CCPs' IM lookback periods.

Chart A: Clearing members' IM projections tended to be larger than CCPs' projections

CCP and clearing member IM projections and distribution of mismatches (a)



Sources: SWES submissions and Bank calculations.

(a) Each point on the LHS chart represents a single CCP account. Clearing members' projections are along the horizontal axis, CCPs' are along the vertical axis. If a point falls below the 45° dotted line, then the clearing member's projection is higher than the CCP's. Outliers have been removed, as have accounts when only a clearing member or a CCP projection could be identified. Values have been removed from scales to preserve the anonymity of data.

The mismatches between CCPs' and other participants' projections are a consequence of the approaches clearing members and NBFIs took to estimating margin calls. Some use historical data, such as percentage increases in previous stresses, to calibrate a uniform uplift to IM for all accounts (with different clearing members applying a wide range of uplifts), while others use models which generate different uplifts for portfolios with different characteristics. In both cases, they assume that the proportional increase to IM during the SWES scenario would be similar to the proportional increase during recent stresses. While in the SWES that approach leads to overestimation, in other contexts reliance on previous stresses could lead to

underestimation. This illustrates the importance of ongoing international policy development on the transparency and responsiveness of initial margin in centrally cleared markets (see Box C).

3: Outcomes: SWES markets of focus

The SWES markets of focus[8] are core to UK financial stability and to the provision of finance to households and to businesses. It is important that these markets function effectively in good times as well as bad. A key analytical focus of the SWES is to assess what market participants' behaviours under the SWES scenario mean for the markets of focus.

The SWES scenario includes a large shock to global rates, including in the gilt market, driven by the geopolitical shock. After the rates shock, selling pressures in the **gilt market** are broadly met by purchases. This results in a market that clears – but, crucially, that outcome depends on banks' willingness to warehouse risk, the resilience of some sectors, their positioning at the point of the exercise, and the specifics of the stress scenario. This is a finely balanced outcome, and a small amount of additional selling pressure could lead to the financial system amplifying the initial shock. As part of the exercise, we have identified a number of reasons why we could see additional price-insensitive gilt sales over time or in a different scenario.

Gilt repo market conditions tighten. Additional repo is generally not available and some NBFIs do not receive all the repo financing they expect. Though most non-banks are able to cope with severely limited access to new repo in the SWES without resorting to asset sales, had banks further restricted the supply of gilt repo, consequences for other markets could have been material.

The **sterling corporate bond market** faces severe pressure reflecting rapid selling pressures from sellers who are often insensitive to deteriorating prices. These behaviours amplify the effect of the initial scenario. The market experiences a jump to illiquidity (see **Foulger (2024)**), meaning that the market will operate poorly as a source of liquidity for the financial sector. Many sales that firms need to undertake for liquidity or derisking purposes are likely to only be possible during the SWES scenario with further price falls. But over a longer time period, firms would likely re-enter the market, restoring liquidity. In the exercise, we did not find evidence of feedback effects where the price falls expected in sterling corporate bonds would result in significant additional sales, risking a feedback loop. Notwithstanding this, disruption to corporate bond markets – particularly if persistent or repeated – can have important real economic impacts (see Section 3.3).

Despite not being a focus of the SWES, we have identified risks similar to those observed in the sterling corporate bond market in the **sterling asset-backed security (ABS) market**.

As explained in Section 2.2, many NBFIs entered the SWES with higher resilience than at the onset of previous shocks, and banks were particularly strongly capitalised. There have already been important changes that would affect how the SWES scenario would play out if repeated – and there will be further developments in the future (see Section 2.4). These changes will also affect the impact of future shocks on these markets.

3.1: The gilt market

In response to the large price moves in the gilt market, selling pressures are broadly met by purchases. This results in a functioning market under the SWES scenario.

The **geopolitical shock** that triggers the SWES scenario results in a sharp deterioration in the economic outlook, and financial asset prices begin to fall. Advanced-economy government bond yields rise despite the broader de-risking, in part owing to announced sales by sovereign wealth funds. SWES participants were asked how they would respond to this dislocation, allowing us to explore system-wide dynamics in the gilt market (eg accounting for any amplification effects given participants' combined responses).

Overall, we see NBFIs selling approximately £4.7 billion of gilts in the response to large price falls. Two main types of NBFI sell gilts (Chart 7):

- First, **UK pension schemes**, who sell gilts (either directly from their own balance sheet or indirectly via redemptions from OEFs) to fund capital calls from LDI funds.
- Second, **OEFs**, who sell gilts to meet redemptions from international investors, and those looking to rebalance their portfolios as a result of the price shock in the scenario.

The selling pressures are relatively small compared to previous stresses, in particular the 2022 LDI episode where LDI and pension funds sold approximately £38 billion in gilts in the first three weeks, far in excess of daily average market trading volumes at the time (£12 billion for long-term gilts).

The main buyers of gilts are banks. Banks purchase gilts as part of their own proprietary hedging/rates activities £2.2 billion, as well as in their capacity as market makers. Hedge funds also purchase some gilts £0.9 billion where this allows them to realise profits and reduce risk exposures.

Overall, these purchases (including those made by banks in a market making capacity) broadly offset the sales made by NBFIs. So, after the initial market repricing, in the exercise gilt prices stabilise.

Chart 7: Selling pressures and purchasing in the gilt market are broadly balanced, demonstrating how actions by authorities and market participants have increased market resilience

System-wide sale and purchase orders of gilts, by sector (a) (b) (c) (d)

Sources: SWES submissions, MiFID, Morningstar London Stock Exchange, PRA regulatory returns, and Bank calculations.

(a) Gilts, or UK government bonds, include both conventional and index-linked instruments. Treasury bills are excluded from this definition.
(b) Data presented in this chart reflects an estimate of system-wide gross actions in the gilt market in response to the SWES scenario, aggregated at the sector-level.
(c) Estimated additional purchasing capacity assumes additional sales have the same average maturity as sales made in the scenario. Were sales to be exclusively at the long end of the curve (15 years +), additional capacity would be limited to £0.5 billion.
(d) Asset sales by OEFs to meet redemptions by UK pension funds and insurers have been allocated to their respective end-investors.

> **But this gilt market outcome relies on banks' willingness to warehouse risk, the current levels of resilience of some sectors, firm positioning at the time of the exercise, and on the shape of the stress scenario. Changes to these could lead to greater market stress.**

The system-wide analysis undertaken in this exercise highlights a number of preconditions that are important for gilt market functioning in the SWES. For example, that:

- Banks are willing to warehouse virtually all the gilts NBFIs want to sell – where there is not another NBFI buyer – at least for the two weeks of the SWES scenario.
- Derivative markets used to hedge sterling rates risk can still be used (though we assume in the SWES that conditions deteriorate).
- LDI funds are successfully recapitalised by their pension scheme investors, so do not need to deleverage by selling gilts as they did in 2022.
- Some NBFI sectors have a high starting level of resilience, reducing potential selling pressures.
- Gilt repo financing can generally be rolled, albeit on tighter terms, even if additional repo is largely not available.

But over time, or given a different scenario, these conditions might not hold. Through sensitivity testing and firms' behavioural responses, we have explored what the impact might be if this was the case.

- **Banks are willing to warehouse virtually all the gilts NBFIs want to sell – where there is not another NBFI buyer – at least for the two weeks of the SWES scenario.** As explained in Section 2.2, the majority of banks' willingness to purchase gilts in a market making capacity is used up by sales in the scenario, and – assuming no further increases in bid-ask spreads – this would have been fully exhausted with relatively small additional sales of longer-maturity gilts. Some banks also bought gilts as part of their own hedging/rates strategies for their own balance sheet (around £2 billion in total). Had these banks entered the scenario with different positioning they are unlikely to have made these purchases. In this case, banks' market making capacity would have been exhausted by observed selling pressures, and this would likely have resulted in further deterioration in the gilt market.
- **Derivative markets used to hedge sterling rates risk can still be used (though conditions deteriorate).** Some firms will only buy gilts if they can hedge the interest rate risk. As explained in Section 2.2, in the event of a severe deterioration in interest rate derivatives market conditions, gilt sales would have exceeded banks' appetite. The gilt market would have felt pressure – especially in the long end where bank appetite to warehouse risk is most depleted.
- **LDI funds are successfully recapitalised by pension schemes, so do not need to deleverage by selling gilts as they did in 2022.** If the operational enhancements in their processes that have been built since 2022 (discussed in Annex 4: DB pension schemes and LDI strategies) were not maintained or did not function as intended in stress, there would be a much higher risk of forced deleveraging and higher gilt sales.
- **Some NBFI sectors have a high starting level of resilience compared to at the onset of previous stresses, reducing potential selling pressures.** For instance, both MMFs

and LDI funds held liquidity buffers above the current regulatory minima at the SWES reference date. This helps to alleviate selling pressure in the gilt market in the exercise.

- **Gilt repo financing can generally be rolled, albeit on tighter terms, even if additional repo is largely not available.** If financing were not available, this could add to selling pressures (as firms can use repo to convert gilts into cash without having to make sales), while reducing the ability of firms to step in to make purchases (as firms use repo to finance long positions in gilts). See Section 3.2 for more detail.

In addition, hedge fund positioning in gilt repo markets has changed significantly since the date of the SWES (see Section 2.4). This suggests a larger net long position on gilts for the sector, potentially increasing the risk that hedge fund sales of gilts amplify a SWES-like shock.

3.2: The gilt repo market

> **Participants use the gilt repo market for both short-term cash management activities and longer-term leveraged portfolio financing.**

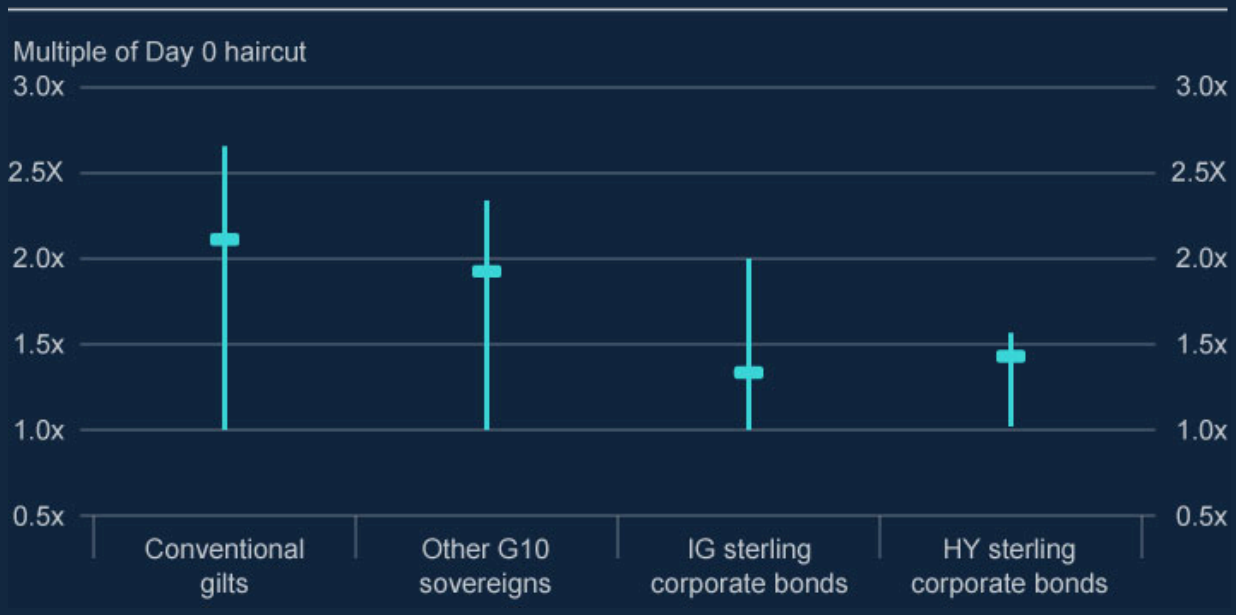
In the SWES we saw a range of actions in the gilt repo market from CCPs and non-banks. CCPs receive inflows of IM and invest some of these cash receipts into the overnight (reverse) repo market. MMFs, facing redemptions from investors, allow some of their reverse repo positions to mature. And a range of participants seek to use the repo market for various purposes, including to replenish cash buffers and to facilitate transactions they intend to undertake in the gilt market.

> **As the SWES scenario unfolds, gilt repo conditions tighten with haircuts increasing significantly.**

As described in Section 2.2, given the uncertainty and elevated counterparty credit concerns generated by the SWES shock (including the default of a non-SWES participant relative value hedge fund in the scenario narrative), banks have limited appetite for risk in repo markets. Many banks apply higher haircuts on repo and reduce the tenors they are willing to offer. Haircut increases are made quickly, typically applying within a few days for any new or rolled trades, and often to double the size of the original haircut (Chart 8). Banks that reported deliberately setting haircuts at conservative levels in good times were less likely to increase haircuts during the stress than some other banks. In some cases, banks who did not increase haircuts noted they preferred to manage exposures by reducing unutilised counterparty limits instead.

Chart 8: Many banks increase repo haircuts in the SWES, often to double their starting value

Interquartile range of haircuts on repo collateral by the end of the SWES scenario relative to starting haircuts for representative clients (a)



Sources: SWES submissions and Bank calculations.

(a) Banks were asked to provide the haircuts they charge representative clients at the start ('Day 0') and end ('Day 10') of the scenario. The chart shows the Day 10 haircut as a multiple of the Day 0 haircut, where '1x' indicates the haircut is unchanged and '2x' indicated that it has doubled. The top and bottom of each line reflect the 1st and 3rd quartile of responses and the bar reflects the median response. Instances where banks reported initial haircuts (on 'Day 0') of zero are not included in this chart, as the proportional increase in these cases is undefined.

SWES NBFI participants could absorb the haircuts on their gilt repo financing doubling in stress without having to take significant derisking actions. Many could have absorbed even larger increases in haircuts – such as an additional 50 basis points increase in UST repo haircuts and a 200 basis points increase in gilt/other G10 sovereign haircuts. Faced with higher haircuts, some NBFIs would decide not to roll repo, instead depleting their cash buffers. This reduces NBFIs' resilience to further liquidity stress, as well as their effective capacity to hold government bonds in periods of stress.

Additional repo is generally not available and some NBFIs do not receive all the repo financing they expect.

Most banks also have very little, if any, appetite to increase the amount of repo finance they extend to non-banks during the stress. Multiple NBFIs reported that they would seek additional repo borrowing during the scenario horizon. In the SWES, a small number of banks

are willing to increase the value of many clients' repo financing, and by doing so satisfy most NBFIs' needs. But repo provision being concentrated in a limited set of banks increases the risks that individual banks' risk management and decision-making could affect system-wide outcomes. And our wider information gathering suggests that while many NBFIs rely on additional repo financing as part of their liquidity planning, banks responses suggest over a third of participants who made this assumption would not have been granted additional repo by any SWES bank for one or more of their funds. Most funds would also have found the majority of their banking counterparties unwilling to extend them additional repo, limiting the quantum of financing available.

In addition, in a small number of cases where banks have particular credit concerns about their counterparties, they reported they would be unwilling to roll maturing repo. Some NBFIs would therefore see existing repo reduced unexpectedly.

In general, under the SWES scenario, NBFIs are able to cope with challenges around accessing additional repo. This is because the extensions they seek are relatively small and driven by cash-management activities, and alternative options are available such as withdrawing from MMFs or running temporarily lower cash buffers. Had NBFIs entered the SWES with lower resilience they would likely have had a greater demand for repo. In those circumstances, a lack of repo access would result in firms facing unexpected liquidity pressures. And as described in Section 2.3 this would then increase pressure on related firms (eg through greater redemptions to access liquidity) and markets (eg price insensitive sales to raise liquidity).

Banks' behaviour – where not anticipated by other market participants – could exacerbate stress dynamics. This is explored in Section 2.3.

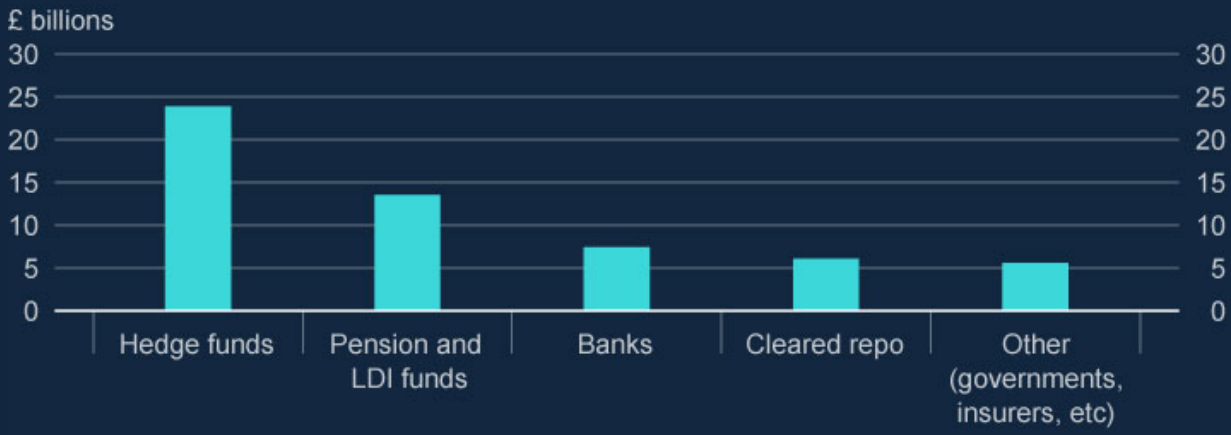
> **Had banks further restricted gilt repo, consequences for other markets could have been material.**

In the second round of the SWES, we asked banks how they would act if forced to reduce client financing activity rapidly – for instance, if they judged they were at risk of being constrained by their balance sheet capacity. Many banks thought the factors likely to lead them to cut repo to a wider range of clients would be: significant deterioration in liquidity metrics, leverage ratios, or their own funding positions, or if they had material concerns about counterparty defaults. If faced with making such reductions, banks' responses suggest the largest reductions would have been to hedge funds and LDI clients (Chart 9), in part reflecting the scale of these sectors' repo activities and the fact that the SWES scenario included the default of a relative value hedge fund. Banks' responses imply a particularly large reduction in hedge fund gilt repo financing, equivalent to around 30% of the sector's gilt repo borrowing at the SWES reference date, with smaller reductions for other types of NBFI. Smaller clients, those of lower credit quality and clients from which banks generate fewer

profits, are likely to be more vulnerable to reductions in repo funding. Most banks reported that they would prioritise supporting their larger and preferred clients, which will typically include large established NBFIs such as those in scope of the SWES exercise.

Chart 9: If faced with cutting repo provision by 15%, hedge funds would likely see the largest reductions from banks

Bank responses to: if you had to reduce client gilt repo financing by 15%, who would you reduce to and how much would those clients see their repo provision reduced by? (a)



Sources: SWES submissions and Bank calculations.

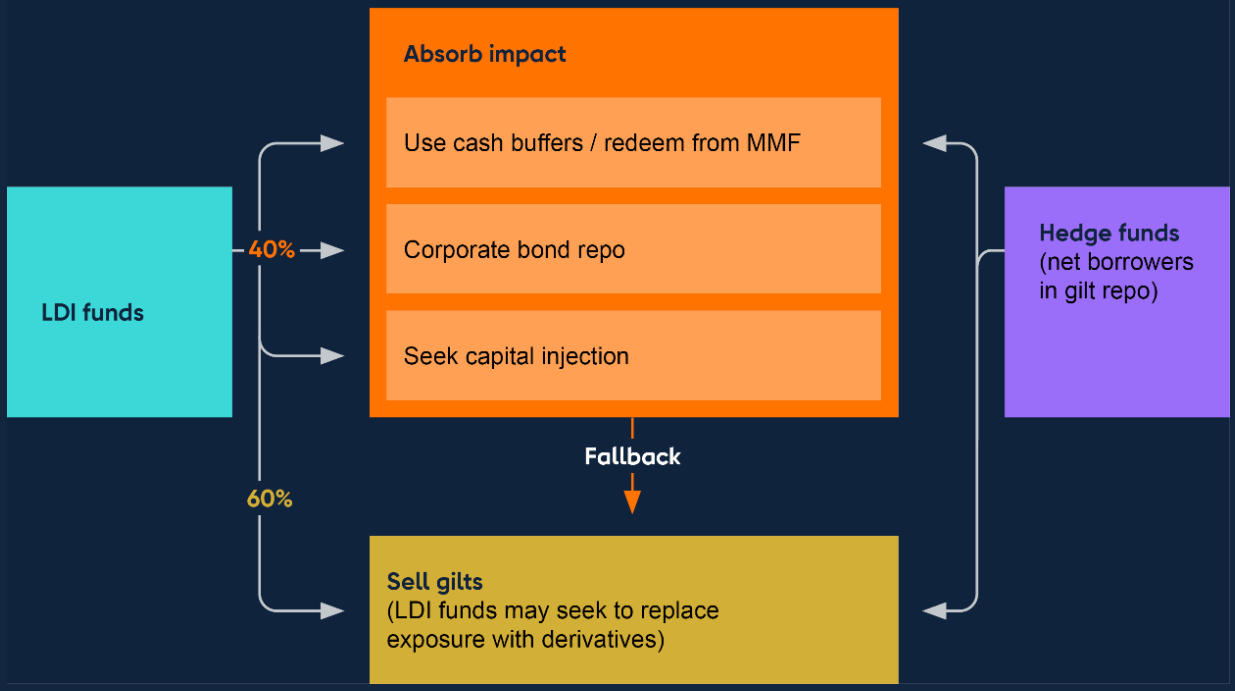
(a) Banks were told to assume they had decided to reduce their client financing provision by 15%, and then asked how such a reduction would be allocated across their client base. This chart shows the total reductions participating banks indicated they would make to clients of different sectors.

Reduced access to gilt repo financing would have resulted in some additional gilt sales. LDI funds – who use gilt repo to finance their holdings of gilts – are one likely seller. Many LDI managers reported that, had the stress persisted until more of their outstanding repo reached maturity, and banks had refused to roll the repo, they would have had to sell the underlying gilts. This would add to downwards pressure on prices. Hedge funds reported they would respond to reduced repo through a range of actions. These include closing out positions, long or short, which could not be financed (and, in some cases, replacing them with synthetic exposures), or financing the positions using their own cash reserves. Some hedge funds who were net cash borrowers from the gilt repo market expected to sell gilts as part of closing out positions. Figure 5 summarises the actions LDI funds and hedge funds reported they expected to take in response to a cut in gilt repo financing, with approximate proportions by volume shown for LDI funds.

Hedge funds reported that reductions in US Treasury (UST) repo availability would be far more significant for them than reductions in gilt repo availability. For further discussion of hedge funds and repo markets, including in the context of recent changes in gilt repo positioning, see Box B.

Figure 5: Reduced access to gilt repo financing would likely have resulted in additional gilt sales from LDI funds and hedge funds

LDI and hedge funds' responses to a reduction in gilt repo supply (a)



Sources: SWES submissions and Bank calculations.

(a) Percentages reflect the amount allocated to each response as a proportion of participating LDI funds' net reduction in gilt repo. Data cover actions taken directly by LDI funds, and do not include any actions taken by pension schemes following LDI recapitalisation calls. Values are omitted from hedge funds due to a small sample.

3.3: The sterling corporate bond market

> **In the SWES scenario we see significant and rapid selling pressures in the sterling corporate bond market, driven by sellers who appear largely insensitive to deteriorating prices.**

In response to the initial SWES scenario, several market participants sell sterling corporate bonds (Chart 10). **Pension funds**, particularly large schemes with segregated mandates, sell to meet recapitalisation requests resulting from their LDI positions. **Insurers** sell to restore

cash buffers or for precautionary purposes, including due to concerns about potential downgrades of these bonds. And **banks** sell to reduce their exposure to corporate bonds and to increase headroom to risk limits. Pension funds, insurers and other investors also redeem from **credit-focused OEFs**, which sell to meet those redemptions.

The selling pressure is rapid, and it quickly exhausts banks' risk appetite to warehouse sterling corporate bonds as part of their market making. Given there is significant unmet selling pressure from firms who still need to sell quickly for liquidity or derisking purposes (about £3 billion of unmet sales orders), these sellers would need to offer yet lower prices – meaning that prices would need to fall further for the market to clear. The financial system therefore amplifies the initial shock in the sterling corporate bond market, resulting in prices quickly deteriorating much further.

The selling pressures are in large part driven by the needs of investors to raise cash (or to derisk by selling specific assets) and, as a result, are relatively price insensitive. Specifically:

- Where LDI fund managers have delegated authority to access the assets of pension schemes, they report having very little discretion to deviate from selling the assets that they have pre-agreed to sell with their pension scheme clients, in the event of a recapitalisation request. Larger pension schemes that do not delegate authority to LDI fund managers would, in theory, have more flexibility to respond to market conditions – but, in practice, all participants expected it would be difficult to deviate from pre-agreed plans.
- Sales of sterling corporate bonds by banks are also relatively price insensitive, often because they assess that the alternative – hedging the risks associated with continuing to hold the bonds – would be prohibitively expensive.
- Sales of sterling corporate bonds by insurers are generally price insensitive given they are selling the assets that they consider to be most at risk of downgrade.
- But managers of OEFs reported having some discretion over asset sales, provided the fund remained within the tolerance of its specified risk factors (eg for duration, geographical and sectoral exposures).

This means that, in almost all cases, firms continue to seek to sell even once prices deteriorate further in the second round of the SWES, given liquidity and risk pressures faced.

> **The significant selling pressures arise early in the scenario, but prospective purchasers do not appear to be able to step into the market for weeks or even months.**

We designed the SWES to allow for significant interaction with participants about their reported behaviours, so that we were able to probe the system-wide dynamics we had observed in light of their combined responses. This engagement, and engagement with non-

SWES participants, highlighted a range of challenges to firms entering into markets experiencing significant price dislocations, including that:

1. Many end-investors use delegated fund managers to manage a large proportion of their investments, and not all of these arrangements build in flexibility to take advantage of market dislocations.
2. Some potential countercyclical investors do not aim to take outright market risk and/or may require financing to purchase bonds (but, as we know from banks' submissions, additional financing is likely to be scarce in stress).
3. Retaining cash as 'dry powder' to be used when an opportunity arises drags on performance in BAU. Some managers therefore only increase cash balances if they anticipate a market event (but the SWES scenario represented an unforeseen sharp and sudden shock).
4. To avoid 'catching a falling knife', countercyclical investors need confidence that prices represent a divergence from fundamentals and will correct – but it takes time to analyse and understand market dynamics. This is particularly true for corporate bond markets, where investors additionally have to perform due diligence on the underlying issuer. And it is even more relevant to the sterling bond corporate market, where many large firms are not active enough in the market to have the ability to quickly take decisions.

These challenges help to explain why, in periods of stress, many firms cannot rapidly act in a countercyclical way that might help stabilise the market. This is despite some SWES participants, who were not facing an immediate liquidity need, reporting that they would be in a position to take advantage of the price falls by purchasing corporate bonds.

We observe a number of these dynamics in participants' reported responses to the stress. For example, most pension funds and insurance companies do not seek to trade based on short-term movements in corporate bond markets, and do not expect to respond to the fall in prices within the timescales of the SWES. Actively managed corporate bond funds and specialised credit-focused investment funds reported they would be likely to take advantage of buying opportunities, but their activity would be idiosyncratic and asset purchases would need to be funded by sales of other bonds. Some potential buyers would require access to corporate bond repo in order to purchase assets, and accessing financing in this market could be challenging (as with gilt repo financing). And participants thought it was more likely that unleveraged capital from other investors would respond to the price falls over months rather than within days.

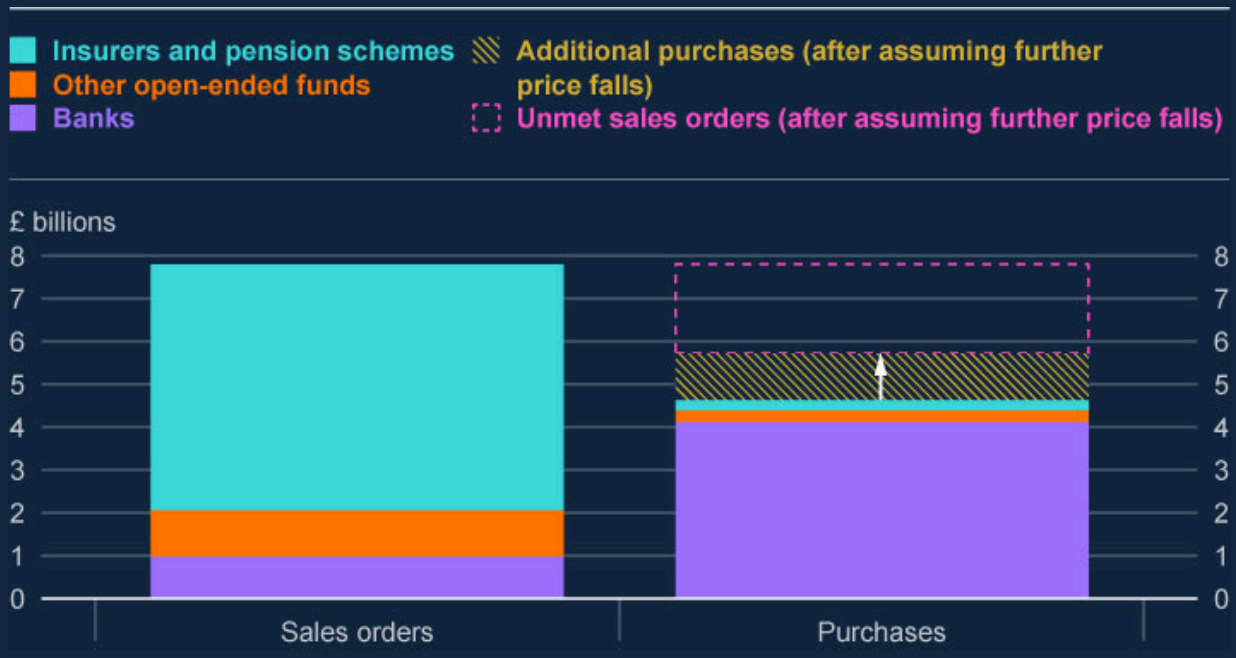
> **Given these constraints on purchasers, the sterling corporate bond market is very likely to 'jump to illiquidity' early in the scenario – with significant selling pressures that make price discovery especially challenging.**

In response to the initial shock, from the early days of the scenario, many NBFIs seek to sell sterling corporate bonds (including pension schemes, OEFs, and insurers). Banks' limited appetite to warehouse risk is quickly exhausted, being the only large purchasers, and there remains significant unmet demand to sell. Though when, in round 2, we specified that sterling corporate bond prices fall further, we observe some additional purchases by insurers and pension schemes in the second week of the scenario, as well as small reduction in insurers' sales which is broadly offset by an equally small increase in sales by banks. However, this is not sufficient to close the gap, and we still see approximately £2 billion of unmet sell orders (Chart 10).

This means that, for the market to clear, sellers would need to accept more significant price discounts than were specified in the second round of the SWES (so as to generate a sufficiently attractive return for more firms to be willing to buy and/or for existing purchasers to do so in greater size). These market conditions will make price discovery challenging, and liquidity will be severely impaired, likely resulting in a 'jump to illiquidity'. Jumps to illiquidity can arise when rapid asset sales overwhelm market capacity, and particularly when dealers and other intermediaries are unable or unwilling to sufficiently expand their balance sheets to absorb the sales (see **Foulger (2024)**).

Chart 10: Faced with significant selling pressure, the sterling investment-grade corporate bond market requires more time and further price falls to clear

System-wide sale and purchase orders of sterling investment-grade corporate bonds, by sector after the second round of the SWES was completed (a) (b) (c) (d)



Sources: SWES submissions, MiFID, Morningstar London Stock Exchange, PRA regulatory returns, and Bank calculations.

(a) Sterling investment-grade corporate bonds are defined as investment grade bonds issued by financial and non-financial corporates (UK or international) in sterling currency. Bonds issued by other agents in sterling, including supranationals, or other types of bond, such as covered bonds or commercial paper, are excluded.
(b) Data presented in this chart reflects an estimate of system-wide gross actions in the sterling investment-grade corporate bond market in response to the SWES scenario, aggregated at the sector-level.
(c) Asset sales by OEFs to meet redemptions by UK pension funds and insurers have been allocated to their respective end-investors.
(d) After assuming further price falls, sales orders would fall by £0.2bn, which has not been depicted for simplicity.

In response to these challenging market conditions and to falling prices, some firms may opt to sell other assets where possible. But we observe limited evidence of this in the SWES, given the described price insensitivity of most sellers. Though some firms sell gilts in response to further price deterioration in sterling corporate bonds, in other cases, this is not a feasible response – for example, insurers who are looking to derisk by selling bond of specific issuers before they are downgraded.

As illustrated by **recent research**, the quality of relationships between NBFIs and their dealers affects both the pricing and trading capacity that NBFIs can access in stress. This suggests that, in the SWES scenario, those NBFIs with particularly strong relationships with dealer banks may be able to execute their selling needs more effectively than others.

These dynamics are likely to be exacerbated by the relatively low liquidity of sterling corporate bonds.

Relative to US dollar and euro corporate bond markets, the sterling corporate bond has a smaller size and most of these bonds are held by long-term investors until their maturity, and so are traded relatively infrequently. Active trading is typically focused on newly issued bonds, a concentrated set of investors are active in the market and a smaller number of banks provide market making services than do so in US dollar and euro corporate bond markets.

Corporate bonds are also relatively heterogenous and so have more idiosyncratic risk factors compared to government bonds (such as the issuer, their sector, credit rating and exposure to the business cycle). These factors, among others, mean the sterling corporate bond market is less liquid (eg than the gilt market) and therefore more prone to sharp price movements in a stress.

But significant feedback effects – in which the expected price falls in sterling corporate bonds result in significant additional sales – were not apparent.

The SWES explored the consequences of material falls in sterling corporate bond prices. Such falls would result in some firms that are selling to meet liquidity pressures, and therefore relatively price insensitive, needing to sell a greater nominal value of bonds to generate the same amount of cash. However, the SWES did not find evidence that this would lead to further significant demand for liquidity – which would, in turn, lead to further selling pressure. The lack of significant further demand for liquidity means that substantial forced sale dynamics (such as those observed in the gilt market in autumn 2022, in which price falls resulted in greater liquidity needs, so more asset sales, and so yet further price falls) appear to be less likely.

Over a longer time horizon, both participating and non-participating sectors have reported that they are likely to step into this market and purchase bonds. This means that the market is likely to ultimately stabilise. But, in the intervening period, it is likely to function poorly as a source of liquidity for financial firms and as a source of finance to the real economy.

Sterling corporate bond markets are important for the financing of UK corporates.

Corporates use the sterling investment grade corporate bond market for a number of reasons, predominantly for **operational purposes or to refinance existing debt**, some of which may have been originated to finance M&A activity. Assessing the impact of the SWES scenario on corporates is outside the scope of the exercise. However, given the short-term nature of the SWES scenario and the fact that corporates typically **build a buffer of multiple months into refinancing plans** (to avoid being forced to issue during periods of temporary disruption), many firms are likely to have the option to delay issuance, at least for the 10 days of the scenario. Some corporates might also have the option to draw on bank credit (eg

revolving credit facilities) or to use other sources of MBF including non-sterling corporate bond markets , assuming these markets are not experiencing the same disruption as the sterling market. Banks did not expect their lending to UK non-financial corporates to be materially impacted during either during the stress or in the 2–3 months after the shock.

But there are a number of reasons why disruption to corporate bond markets poses a concern, particularly were that disruption to be recurrent or persistent. Were the types of dynamics observed during the SWES to occur regularly without mitigation during shocks, this might increase refinancing costs in the medium to longer run. For instance, if investors were to require more compensation for the risk of holding securities which had experienced significant illiquidity in stress, or corporates might choose to issue in foreign currency, further decreasing the size and liquidity of the market. More generally, there is evidence that more persistent financial market shocks to corporates can negatively affect the wider economy. For example, shocks to corporate bond spreads beyond those justified by macroeconomic fundamentals have been shown to predict declines in economic activity.[9] And during the 2008 global financial crisis (GFC), when corporates bond markets and MBF were smaller than today, the evidence suggests they played a significant role in transmitting shocks from the financial system to the real economy. For example, researchers have found that fire sales of corporate bond by insurers and mutual funds during the GFC reduced investment by affected firms by more than 1%,[10] and market-based credit shocks reduced euro-area GDP in 2009 Q1 by 1.3 percentage points.[11]

3.4: The asset-backed security market

> **We learned through the SWES that sterling asset-backed security (ABS) markets also face similar pressure in stress.**

To meet the capital call from LDI funds, pension funds also expect to redeem from open-ended funds that invest in sterling asset-backed securities. These instruments are securitised loans (often residential mortgages, car loans and credit card receivables). They are structured to obtain a high credit rating and pay a floating rate coupon, which means they carry less credit risk and interest rate risk than the sterling corporate bonds discussed above. In the SWES, we estimate that pension funds expect to raise approximately £5 billion through redemptions from ABS funds, about half of which would translate into sales of sterling denominated ABS. During September 2022, the market reportedly functioned reasonably well, despite experiencing similar levels of selling pressures – though spreads did widen modestly.

There are significant data gaps related to the sterling ABS market, and it was not a SWES market of focus. However, market intelligence suggests that the investor base for sterling ABS is relatively concentrated and pension schemes currently account for a meaningful proportion of the investors in ABS funds. There are risks that significant redemptions from

pension funds might result in similar dynamics to those observed in corporate bond markets in Section 3.3. Such a structural vulnerability could result in less liquidity or greater price falls than investors expect if they need to use these markets to generate liquidity under stress.

Box B: Hedge funds and repo

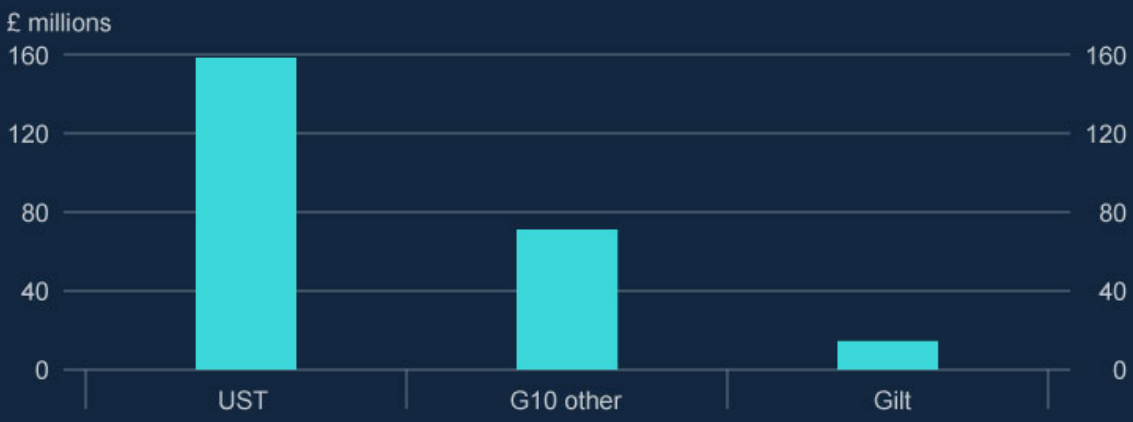
Hedge funds are significant users of repo markets. In UST repo markets, participating hedge funds are large net borrowers of cash in many cases to support UST-basis trading strategies (see Annex 4: Hedge funds for more detail), whereas in other G10 government bond repo markets, their aggregate net repo positions are more balanced. Gilt repo makes up only around 6% of participating hedge funds' gross repo and reverse repo balances at the SWES reference date.

Because of the short-term nature of many hedge funds' repo, they are vulnerable to funding being withdrawn at short notice and haircuts increasing quickly in stress. Given this vulnerability, we tested the impact of further increases to haircuts and reductions to repo rolls, beyond that implied directly by the SWES scenario.

We found that, at the scenario start date, the impact on hedge funds' liquidity (cash and unencumbered assets) of higher haircuts on UST repo was much larger than the impact of higher haircuts on gilt repo, reflecting the relative size of their UST repo borrowing relative to gilt repo borrowing (Chart A). We also observed that a number of hedge funds with positions in the UST-basis trade choose to term the maturity of their repo financing such that it matures at the same time as the matching futures contract, reducing the impact of increased haircuts or reduced repo availability.

Chart A: Hedge funds in the SWES are much more affected by UST repo haircuts

Illustrative impact on participating hedge funds of a 10 basis point increase in repo haircuts by collateral asset (a)



Sources: SWES submissions and Bank calculations.

(a) Participating hedge funds were asked to estimate the impact of an increase in repo haircuts of at least 50 basis points for UST collateral, and 200 basis points for gilts and other G10 government bond collateral. We estimate the impact per 10 basis point increase in haircut for each collateral asset using the proportions of each hedge fund's net repo positions represented by transactions with each underlying collateral type. Data are aggregated for all participating hedge funds but not otherwise scaled.

Several of the hedge funds in the SWES have direct membership of the Fixed Income Clearing Corporation (FICC), through a subsidiary entity, or sponsored membership via a traditional clearing member, making switching to centrally cleared repo operationally feasible. Hedge funds perceive that the availability of direct access to central clearing in the UST repo market may make it more resilient to shocks that might affect banks' willingness to provide bilateral repo funding (Chart B). This resilience would rely on cash providers also moving to cleared repo, as the hedge funds' net cash need is unchanged. If banks' reduction in repo funding were motivated by counterparty credit risk concerns this may be a reasonable assumption, as lending via a CCP would mitigate these concerns. If banks were reluctant to lend for other reasons – for example, if their own balance sheets were under stress – then switching to cleared repo may not address the underlying lack of cash providers in the market.

Chart B: Hedge funds considered cleared UST repo a feasible fallback option

The impact of a 10% contraction in UST repo availability on participating hedge funds and their actions in response (a)

Sources: SWES submissions and Bank calculations.

(a) Net impact and actions are aggregated for all participating hedge funds but not otherwise scaled. In some cases hedge funds indicated they would generate more liquidity than the net impact of the reduction to their repo and reverse repo lines, hence the actions do not sum to the net impact. Bank staff judgement has been used in attributing responses to actions.

4: Conclusions

The Bank, working closely with, and with the full of support of the PRA, FCA and TPR has drawn six key financial stability conclusions from the SWES:

1. Firms' collective actions amplify the initial shock. While non-bank resilience has increased in a number of sectors and firms over recent years, some of that resilience could deteriorate or change over time, risking greater amplification by the financial sector in the future.
2. Repo market resilience is central to supporting core markets in stress. During a market stress, banks are unlikely to provide all of the additional repo financing NBFIs ask for, despite their willingness to draw on central bank lending facilities.
3. The SWES illustrates how actions taken by authorities and market participants following recent market shocks have improved gilt market resilience; but further work is required given the other vulnerabilities highlighted by this exercise.
4. The sterling corporate bond market could face a 'jump to illiquidity' in stress, whereby the speed of selling pressures significantly exceeds purchasing capacity and prices need to fall rapidly for the market to clear.
5. System-wide stress testing has proved to be an effective tool for financial stability authorities to understand system-level vulnerabilities. The Bank, alongside the FCA, will continue to invest in its capabilities in this area for surveillance and risk assessment, and to run future exercises.
6. System-wide exercises are important for regulators, firms and markets.

In addition, the granularity of the analysis provides fresh evidence in relation to certain sectoral vulnerabilities, in particular around estimation of CCP IM and redemptions from OEFs. These are set out in Box C.

This section of the report highlights six key conclusions from the SWES and explains how they will inform the FPC's approach to monitoring and taking action to mitigate financial stability risks. The first four conclusions focus on the resilience of the financial system and core UK markets, and the final two conclusions relate to the value of system-wide stress testing and implications for future work.

We expect that the SWES conclusions will support UK authorities in their work to address vulnerabilities in MBF domestically, and internationally through the work led by the FSB. The PRA, FCA, and TPR played an important role in running the SWES and fully support its

conclusions.

4.1: The resilience of the financial system and core UK markets

Conclusion 1

Firms' collective actions amplify the initial shock. While non-bank resilience has increased in a number of sectors and firms over recent years, some of that resilience could deteriorate or change over time, risking greater amplification by the financial sector in the future.

The SWES demonstrates some of the ways in which NBFIs can amplify shocks to markets in stress, due to high levels of leverage, or to risk management practices that, while prudent at an individual firm level, result in procyclical outcomes.

The SWES scenario, or a similar shock, would significantly impact participating sectors. The nature of the shock created particular stress for LDI portfolios and for their pension scheme investors, as well as for certain types of hedge fund. Some firms – acting to manage their business to risk appetite or investment mandates – rapidly sold assets, needed to recapitalise or limited their intermediation activity. This illustrates how the financial sector can amplify the effect of macroeconomic shocks.

A number of sectors have increased levels of resilience, reducing the risk of market disruption.

Some NBFI sectors – in particular LDI funds, insurers, and MMFs – entered the SWES scenario with higher levels of resilience, on average, relative to their position in historic market stresses, limiting their need to take actions that could amplify the initial shock. In particular, recent regulatory reforms for LDI funds have significantly reduced their leverage and hence increased their capacity to weather a gilt market stress without recourse to asset sales.

The SWES highlights a trend of increasing use of non-cash collateral to meet margin calls – which includes corporate bond collateral for insurers (see Section 2.2). This also reduces selling pressures in the SWES markets of focus,[12] although exposes firms to additional operational and financial risks in managing their collateral.

In the SWES, heightened resilience of NBFI end-investors, such as insurers and pension funds, reduces their need to redeem from OEFs and MMFs. In particular, recent regulatory reforms for LDI funds have significantly reduced their liquidity risk and leverage and hence

increased their capacity to weather a gilt market stress without recourse to asset sales. And the high levels of liquidity held by MMFs means they are able to meet the residual cash demand. But in other scenarios or where MMF investors had a greater liquidity need, these outcomes could be different.

This highlights the benefits of continued monitoring and embedding levels of NBFI resilience as appropriate.

These higher levels of resilience mean that the gilt market does not come under severe stress in the SWES. But this outcome is very sensitive to the type of shock and the financial system's resilience at the date of the exercise. And in many cases the higher observed level of resilience may be cyclical rather than permanent. This resilience could wane over time in the face of competitive pressure, and as recent market stress events become less of a focus for modelling and risk management.

The SWES also demonstrates the important role MMFs and OEFs play in meeting firms' initial liquidity needs in stress. Increased resilience of NBFI end-investors therefore supports the resilience of MMFs and OEFs, by reducing the severity of redemptions they face. This is particularly relevant given the challenge of predicting redemptions in stress – in a number of cases MMFs found it difficult to confidently predict the size of redemptions in the scenario.

Next steps

The effect of greater NBFI resilience in reducing market stress and spillovers to other sectors highlights the importance of continued monitoring and the range of ongoing policy initiatives seeking to embed and maintain appropriate resilience across various sectors. These include the proposed introduction of a PRA liquidity reporting regime for insurers, work by UK authorities on MMFs, and the FSB work on NBFI leverage.

Conclusion 2

Repo market resilience is central to supporting core markets in stress. During a market stress banks are unlikely to provide all the additional repo financing NBFIs ask for, despite their willingness to draw on central bank lending facilities.

The SWES demonstrates that the gilt repo market is critical to the resilience of UK core markets, but that its capacity in stress is limited.

Many firms in the SWES rely on repo to manage liquidity or monetise assets. In the exercise, banks have the funding and balance sheet capacity to meet borrowing requests in the gilt repo market, and many banks either draw, or were willing to draw, on central bank lending.

Despite this, their counterparty risk management means that most banks will generally not provide additional repo financing at the onset of a shock.

The exercise also illustrates that in some cases banks may be unwilling to roll NBFI's maturing repo. In the SWES scenario, banks are largely willing to rollover repo for SWES participants, who are among the largest firms in markets covered by the SWES. But even amongst this subset there were a small number of counterparties for whom some banks would have declined to rollover maturing repo, based on counterparty-specific judgements. And had banks faced more acute impacts from the shock, many indicated they thought they would reduce repo provision to a wider range of clients.

Haircuts applied in the SWES are procyclical and many banks increase repo haircuts as transactions roll during the scenario. Others choose not to increase repo haircuts, for example because their haircuts are already calibrated conservatively, or because they prefer to cut unused credit limits instead. While participating NBFIs are able to absorb the immediate impact of higher haircuts in the SWES without resorting to asset sales, procyclical changes in haircuts do contribute to overall liquidity demands placed on them. And, had haircuts been set at higher levels on entry to the stress, some banks may have felt less need to cut unutilised counterparty limits.

Next steps

> **Market participants should be cognisant of risks that they cannot access additional repo or are unable to roll their maturing repo during market stress.**

Many NBFIs expected they would be able to access repo as needed in the scenario which many banks would not be willing to provide . NBFIs should carefully consider their strategies and the extent to which they are resilient to the actions of other market participants' during periods of stress. Strategies in place among SWES participants to cope with reduced repo provision in stress include: having repo lines established with multiple banks and/or secured on a range of collateral types, sufficient buffers or unencumbered assets and, in some cases, establishing direct or sponsored access to cleared repo (eg for UST repo). Most banks in the SWES said that they would be more likely to maintain or extend additional repo funding in a stress scenario to funds who trade repo on a centrally cleared basis, due to the reduced counterparty risk and lower balance sheet usage involved.

> **Further policy work to increase repo market resilience would be beneficial and will complement the role of existing central bank facilities.**

Individually prudent decisions by banks to tighten repo availability could have negative consequences for core UK markets as well as for NBFIs. Reductions in availability of additional repo may inhibit countercyclical investors accessing the financing needed to take

advantage of attractive pricing and so reduce stabilising market forces. And being unable to roll maturing repo is likely to lead NBFIs to sell gilts, increasing pressure on this core UK market (see conclusion 3).

There is merit in exploring market structure reforms to improve the resilience of gilt repo markets. This could include considering the case for policies that increase dealers' balance sheet efficiencies and reduce counterparty credit risk during periods of market stress, such as greater clearing in the gilt repo market. It is not currently common for NBFIs to have direct or sponsored access to cleared gilt repo markets.

There may also be merit in considering policy interventions to reduce risks related to procyclical haircut behaviour in the gilt market, which would also operate to reduce counterparty credit risk in stress. There may be a role for policy makers to prevent commercial pressures resulting in haircuts being set at artificially low levels during good times, only to be abruptly increased during periods of stress.

The Bank of England remains ready to provide liquidity to the banking system through its lending facilities. In addition, the Bank recognises there may be times when banks cannot, or will not, lend in sufficient size or sufficiently rapidly to prevent a shock from undermining financial stability. The Bank is therefore expanding its financial stability toolkit to intervene where severe dysfunction in the gilt market threatens financial stability by developing tools that will allow eligible NBFIs to borrow cash against gilts. As a first step in this work, the Bank is developing the **Contingent NBFI Repo Facility (CNRF)**, which will be open to eligible pension funds, insurance companies and LDI funds. The CNRF will be activated at the Bank's discretion, and used as a backstop in preference to asset purchases where lending is likely to be effective in tackling gilt market dysfunction and when the demand for liquidity is outside the reach of the Bank's existing facilities to lend to banks.

Conclusion 3

The SWES illustrates how actions taken by authorities and market participants following recent market shocks have improved gilt market resilience; but further work is required given the other vulnerabilities highlighted by this exercise.

The gilt market is an important source of liquidity in the UK financial system, and underpins the pricing of a wide range of financial products. Following the SWES shock and its rapid increase in risk-free yields, reported purchasing and selling pressures in the gilt market –

including by banks temporarily holding bonds in their market making capacity – are broadly balanced. This functional market outcome demonstrates how gilt market resilience has been enhanced since 2022.

However, relatively few additional sales would quickly exhaust banks' willingness to warehouse risk, meaning price falls would likely be needed to enable firms to sell, amplifying the initial shock. And outcomes in gilt markets are very sensitive to both initial conditions including starting positions of firms, and the nature of the shock. In particular, the SWES highlights the importance for gilt market outcomes of 1) levels of NBFI resilience, which for many were higher than at the onset of other shocks (see conclusion 1), 2) banks' willingness and ability to warehouse risk, and (3) functioning derivative and gilt repo markets.

> **The resilience of some NBFIs at the onset of the SWES reduced the risk of feedback loops in gilt markets.**

As described in conclusion 1, improvements in LDI and pension sectors financial and operational resilience have reduced the risk of feedback loops where falls in gilt prices lead to forced gilt sales. Increases in resilience in other NBFI sectors also reduce risks of them undertaking disorderly sales of gilts after a shock.

Next steps

> **The SWES has demonstrated the effectiveness of existing TPR guidance on LDI. It is crucial that this guidance remains in place to support effective functioning of the gilt market.**

In the SWES, LDI funds need to recapitalise from their pension fund investors. Were this to be unsuccessful, LDI funds would opt to sell gilts instead. The SWES shows that TPR's 2023 guidance to increase the financial and operational resilience of pension schemes' LDI positions is instrumental in limiting the risk of forced gilt sales in a stress, and emphasises the importance of maintaining it.

> **But outcomes in the gilt market are inherently tied to those of other markets – most importantly, repo financing markets and rates derivative markets.**

The functioning gilt market in the SWES also depends on a functioning gilt repo market that continues to support investors seeking liquidity or financing for gilt purchases. Most banks also indicated that their willingness to warehouse risks would reduce if the swaps and futures markets ceased functioning well.

Any constraints on bank financing and market-making – and therefore their willingness to warehouse risk in the market – would reduce the ability of the gilt market to absorb NBFI responses to a shock, such as forced deleveraging. And positioning in the gilt repo market

can change rapidly, and has done since the date of the SWES (see Section 2.4). This will affect how the gilt market functions in stress, given banks' lack of appetite for taking additional risk in gilt repo.

Collectively, this illustrates that the behaviours identified in the SWES could result in different outcomes in the gilt market with a different set of initial conditions or with a different shock. Were firms less resilient at the start of a future shock, or had larger positions to unwind, there would likely be greater gilt sales. Concerns about the use of leverage in markets, including in the gilt market, and the risks associated with rapid deleveraging, has motivated international work at the FSB to develop recommendations for authorities to address financial stability risks from NBFI leverage. Gilt market resilience will also be supported by actions taken under conclusions 1 and 2.

Conclusion 4

The sterling corporate bond market could face a 'jump to illiquidity' in stress, whereby the speed of selling pressures significantly exceeds purchasing capacity and prices need to fall rapidly for the market to clear.

The SWES identified how the sterling corporate bond market may be impaired as a source of liquidity and real economy financing after a SWES-like shock due to relatively price insensitive sellers rapidly acting to obtain liquidity or derisk through this market.

Many investors in the sterling corporate bond market do not tend to act quickly in a countercyclical fashion. For instance, they noted needing further time to access financing and to perform necessary due diligence to assess the corporate bond market. In addition, some end-investors use delegated fund managers to manage a large proportion of their investments, and not all of these arrangements build in flexibility to take advantage of market dislocations. This means that, in the timeline of the SWES, falling corporate bond prices do not lead to significant purchases.

Significant price-insensitive selling by pension funds causes stress in corporate bond markets.

In the SWES a key source of pressure in corporate bond markets arises from the use of leveraged LDI strategies by pension schemes. Compared with 2022, LDI funds are now much more resilient and can meet the margin calls they face following the SWES rates shock by running down buffers. However, they then seek to replenish these buffers by issuing recapitalisation calls to pension scheme clients. While these recapitalisation calls are smaller

than estimates of those issued during the 2022 LDI episode, pension schemes still need to meet them rapidly. Many schemes will meet recapitalisation calls by rapidly selling fixed-income assets, in particular corporate bonds and asset-backed securities. Because LDI funds face simultaneous needs, and many pension schemes have similar waterfalls determining which assets to sell, sales will be correlated. And pension scheme sellers of corporate bonds are relatively price insensitive – they continue to sell in spite of deteriorating credit spreads, in some cases owing to the fixed nature of their liquidity waterfalls. This all contributes to pressure on sterling corporate bond markets.

> **A jump to illiquidity in the corporate bond market could impair its effectiveness as a source of liquidity for financial institutions and, if disruption were persistent, financing for the real economy.**

The outcome in the SWES is a 'jump to illiquidity' in the sterling corporate bond market. The speed of selling pressures from NBFIs in the first days far exceeds purchasing which occurs over weeks to months. Banks' warehousing capacity is not sufficient to fulfil the demand to sell from clients, and, as with other forms of repo, banks were generally unwilling to provide extensions in corporate bond repo financing. Even after feedback to firms on market conditions, and how the financial system is amplifying the falls in prices, most sellers continue to want to sell. These dynamics will likely result in challenges in price discovery, a sudden jump in market conditions to a state of illiquidity, and prices needing to fall further for the market to clear. But the SWES did not find evidence that there could be a self-reinforcing spiral of price falls and more sales.

The sterling corporate bond market becoming illiquid in stress risks reducing its effectiveness as a source of financing for the real economy. In the short term, disruption to corporates' financing is unlikely, as they generally build contingencies into their issuance schedule and in many cases will have access to other sources of financing. But by reducing confidence in the sterling corporate bond market as a reliable source of finance, such market disruption can have an impact over the longer term. And were poor market conditions to persist for an extended period, financing to the UK real economy would be affected.

The outcome in the SWES also raises questions about the extent to which sterling corporate bonds, or other sterling credit assets such as ABS, are a reliable source of liquidity in stressed conditions and whether it would be appropriate to automatically rely on them in a stress. In particular, the strategy of placing bonds high in a firm's liquidity waterfall, or automatically disposing of them under certain conditions

> **ABS markets were not a market of focus in the SWES, but the results indicate similar risks to those in corporate bond markets.**

Information gathered in the SWES suggests that many pension schemes would seek to sell sterling ABS to respond to LDI capital calls. This could have similar outcomes to those outlined above in the corporate bond market.

Next steps

Authorities are planning to take actions to understand and reduce risks in sterling corporate bond markets.

In thinking about how to mitigate these risks, authorities are considering whether private or public data collections and disclosures could be used to raise awareness of the potential for correlated asset sales in corporate bond markets, and whether additional information could help firms with their approach to liquidity preparedness. Working closely with Bank staff, TPR will be taking forward follow-up work with the pension industry to explore potential improvements to existing data collections to provide insight around intended aggregate asset sales, in order that firms are aware of potential correlation risks in their pre-planned liquidity waterfalls. In addition, TPR is planning to better understand the discretionary behaviour of pension schemes under stressed market conditions and whether the functioning of key sources of liquidity can be improved.

4.2: The role of system-wide stress testing

Conclusion 5

System-wide stress exercises have proved to be an effective tool for financial stability authorities to understand system-level vulnerabilities. The Bank, alongside the FCA, will continue to invest in its capabilities in this area for surveillance and risk assessment, and to run future exercises.

The SWES has provided the Bank with a new analytical lens for exploring risks and resilience in the financial system.

The SWES has provided valuable insights into how changes to the resilience, behaviours and interconnectedness of financial firms could affect market dynamics in future stress events. For example, the SWES illustrated i) how LDI investors are better prepared for shocks and insurers increasingly have the option to use non-cash collateral; ii) how this would affect other market participants (e.g. MMFs, OEFs) in a stress; and iii) what the ultimate outcome might be for gilt and corporate bonds markets following a shock in risk-free rates.

The exercise also helped us to identify areas where market participants lack clarity around, and did not anticipate, their counterparties' actions during a stress and the likely consequences. For example, the SWES identified significant mismatches in expectations of counterparties for changes to initial margin and access to repo financing that could exacerbate market stresses.

Many of the insights from the SWES rely on observing the interconnections and interactions between sectors, and so would not be apparent from sector-specific analysis alone. For example, the SWES showed that a confluence of different behaviours – the need to meet liquidity needs associated with margin calls, rebalancing to target portfolios, recapitalisation requests and changes in risk appetite – could all combine to lead to material selling pressure in sterling corporate bonds.

An ongoing system-wide stress simulation capability would allow the Bank to update its understanding of systemic risks.

A number of factors that underpin the SWES findings may change over time or depend on the scenario used. Firms' portfolios and positioning in markets will change, in some cases relatively quickly. For example, since the SWES cut-off date, the hedge fund sector has significantly increased net borrowing in gilt repo markets. And structural changes in the financial sector or macroeconomy such as normalisation of the Bank of England's balance sheet or the growth in the BPA market will change the resilience and behaviour of firms over time. This means that the insights from any given exercise will need to be updated over time as the financial system changes.

Next steps

Experience of the SWES has shown how the Bank, alongside other regulators, could conduct system-wide stress simulations in house in a streamlined way.

Experience running the SWES has illustrated how investment in the Bank's system-wide modelling capabilities – focused on more data-driven approaches – could allow for ongoing system-wide analysis at a lower cost to the Bank, other regulators, and firms.

The Bank alongside the FCA intends to use this experience and the SWES findings as a framework for future system-wide analysis, by building our capacity to conduct in-house simulations that model system-wide dynamics of the kind tested in the SWES.

If supplemented by continued close engagement with firms on such system-wide analysis this would enable the Bank to further improve its technical and behavioural understanding of NBFIs under stress.

Engagement with firms and feedback will also help improve the risk management and preparedness of firms for system-level risks that can only be observed through exercises conducted at a system-level or identify mismatches in expectations of counterparties.

The engagement of financial institutions and other regulators was integral to the success of the SWES, and we will engage them fully in determining how to take forwards this conclusion.

SWES-style exercises are a useful tool that the FPC, and other UK authorities, could deploy to investigate other markets over time.

SWES-style system-wide stress tests are particularly well suited to analysing issues which involve cross-sector interactions, actors which sit at the outskirts of the regulatory perimeter, and in areas where authorities have material data gaps or need engagement from firms to understand behaviours. As the complexity and importance of market-based finance continues to grow, SWES-style exercises will be crucial for regulators, firms and markets in understanding how risks and shocks can propagate. The Bank and FPC will consider deploying them in the future where relevant and proportionate, to increase our understanding of particular issues or markets. Any future SWES-style exercise will be considered in the context of the broader FPC and PRC stress testing toolkit, and the international agenda. Similar to this SWES, we would engage extensively with financial institutions before launching an exercise.

Conclusion 6

System-wide exercises are important for regulators, firms and markets.

The SWES has shown that system-wide exploratory exercises are a useful tool for authorities to better understand vulnerabilities that can drive risks during a stress…

The SWES has provided benefits for the Bank, PRA, FCA and TPR, and financial institutions. Working closely on the exercise, all authorities have improved their understanding of key dynamics that may affect firms and markets in stress – including those driven by interactions that are only apparent from a system-wide perspective. The Bank will use this to inform its assessment of systemic risks and policy making in the UK and internationally. The SWES will be beneficial for international authorities considering their own system-wide exercises, and the results are informative for a range of international policy workstreams.

…while firms can also gain useful insights to help inform their risk management practices.

SWES participants engaged constructively with the exercise. By doing so the SWES has allowed them to consider system-wide risks and behaviours that are challenging to assess as an individual firm, and to better understand how their counterparties and investors might behave in a stress.

Next steps

> **Financial institutions should consider system-wide dynamics and the likely behaviour of markets and other financial institutions they interact with. This report highlights a number of dynamics to consider.**

The SWES highlights the importance of financial firms considering system-wide dynamics in their stress testing and contingency planning. In particular, it shows how system-wide stress dynamics, and the behaviour of their counterparties, means some firms' access to liquidity may deteriorate further than they expect in a stress.

SWES findings that may assist firms in considering system-wide dynamics are summarised in Annex 1. For example, the SWES results suggested that in some cases NBFIs have material difficulties estimating CCP IM calls (Box A), or the liquidity needs of their end investors in stress (Section 2.3). Banks were often more conservative in providing repo financing than NBFIs expected (Section 2.2). And investors relying on credit assets for liquidity may find that, in a stress, these markets do not function as well as they expect (Section 3.3). Firms should consider whether their stress testing, risk management, and contingency planning have realistic assumptions and are updated as their business and financial markets evolve. The SWES findings provide an evidence base to support firms taking a more system-wide perspective in their own stress testing.

Box C: Conclusions on certain sectoral vulnerabilities

Thanks to the sector-by-sector granularity of the analysis, the SWES also provides fresh evidence in relation to certain sectoral vulnerabilities.

> **NBFIs found it challenging to estimate increases in CCP IM, supporting ongoing work to improve margin practices.**

SWES participants were generally able to model instantaneous shocks to their resilience effectively, and to correctly anticipate the behaviour of other participants. For example, hedge funds were generally able effectively to estimate likely changes to repo haircuts in response to the shock. But, as described in Box A, in the SWES banks and NBFIs generally overestimated changes in CCP IM, and we could see underestimation in future stresses if one hits following an extended period of relatively low volatility.

This supports the case for ongoing policies to improve margin practices and the transparency and predictability of IM practices in centrally cleared markets as well as enhanced margin preparedness by participants. In particular, they support the case for additional disclosures by CCPs on their IM models, enhanced functionality of margin simulation tools which CCPs make available to clearing members, and for ensuring that clearing members facilitate clients in accessing CCP-provided disclosures and margin simulators, where necessary. These are among a set of recommendations about transparency and responsiveness of initial margin in centrally cleared markets that **BCBS, CPMI, and IOSCO consulted** on in January 2024. The findings also suggest that there is a need to strengthen market participants' preparedness to meet margin calls, as identified by a **joint BCBS-CPMI-IOSCO report on margin practices** (September 2022).

> **Redemptions from open-ended funds in a stress are highly dependent on their investor base, as well as their returns.**

The SWES illustrates that the scale of redemptions that OEFs are likely to experience in a stress can depend heavily on their investor base and the investors' levels of resilience. For example, smaller pension schemes may have less scope for discretionary decision-making and may therefore redeem from OEFs regardless of price changes.

The SWES also highlights the reliance of end investors on daily dealing OEFs for their liquidity needs. Fund managers should therefore consider whether their asset liquidity profile in both stress and normal times is appropriately aligned with the redemption

terms of the funds.

In line with ongoing international policy work, and FCA supervisory work and dear CEO letters, these findings support the need for managers to have appropriate liquidity management frameworks, understand their investor base (including investor type and concentration), and how the particular OEF may be used by investors. In particular, they should consider whether they have the ability to model and prepare for stressed redemption flows, taking into account the likely behaviour of their investor base.

Annex 1: Summary of SWES findings

Table A1.A provides a brief summary of the SWES findings set out in this report, including those supporting our key conclusions. It also sets out potential next steps, including particular risks and other factors emerging from the SWES findings which market participants may wish to consider going forwards. More information on the findings can be found in the highlighted sections.

Table A1.A: SWES findings

Finding	Further detail
Inconsistent expectations between participants	
Many NBFIs expect **repo financing** to be available in stress, but banks were mostly unwilling to extend new financing.	There was a fundamental difference between many NBFIs' expectation that new repo financing would be available in the SWES, and banks' very-limited willingness to provide this. This inconsistency in expectations means there is a risk that even large, sophisticated NBFIs have less access to finance in a stress than they expect. See Sections 2.2, 2.3 and 3.2. **Next steps** Market participants should consider taking steps to prepare for risks that they cannot access additional repo during market stresses. In periods of severe stress and where counterparty risk is elevated, participants could prepare to be unable to roll their maturing repo.
There are material differences between firms' and CCPs' projections of **IM calls** during the scenario.	Firms found it **challenging to estimate** increases in **CCP IM**. In the SWES, banks and NBFIs generally overestimated changes in CCP IM, but in other contexts reliance on experiences in previous stresses could lead to underestimation. See Box A and Box C. **Next steps** Market participants should consider these dynamics in their risk management and stress testing, particularly after extended periods of low volatility. This supports the case for ongoing policies to improve margin practices and the transparency and predictability of IM practices in centrally cleared markets as well as enhanced margin preparedness by participants.

Finding	Further detail
Fund managers did not always accurately **predict stressed redemptions**.	In a number of cases MMFs and OEFs found it difficult to confidently predict the size of redemptions in the scenario. This was partly due to uncertainty over the behaviour of investors, and the degree to which they would demand cash in a stress. See Section 2.3 and Annex 4: OEFs (including MMFs). **Next steps** Managers of MMFs and OEFs should consider the extent to which they understand their investor base, and are able to plan for severe but plausible redemptions levels.
System-wide interactions	
MMFs are critical to meeting intraday liquidity needs; their resilience is linked to that of their end investors.	Many firms in the SWES rely on MMFs to meet immediate liquidity demands. This means that MMF resilience supports the resilience of their end investors, and vice versa. **Next steps** The FCA is finalising rules to enhance MMF resilience following the UK authorities' consultation paper published in December 2023. Managers of MMFs should consider whether they continue to hold robust levels of liquidity and the extent to which they have a strong understanding of their investor base, including the potential for outflows under stressed conditions.
Redemptions from open-ended funds in a stress are highly dependent on their investor base, as well as their returns.	The scale of redemptions OEFs experienced in the SWES depended heavily on their investor base and the investors' levels of resilience. For example, smaller pension schemes often had less scope for discretionary decision-making and may therefore redeem from OEFs regardless of price changes. See Sections 2.2, 2.3 and Box C. **Next steps** Fund managers should consider whether they have the ability to prepare for stressed redemptions, taking into account the likely behaviour of their investor base. They should consider whether their asset liquidity profile, in both stress and normal times, is aligned with the redemption terms of their funds, in line with the **FSB's Revised Policy Recommendations**. They should also consider whether they have appropriate liquidity management tools to manage such redemptions, including the use of anti-dilution tools such as swing pricing as well as setting appropriate redemption terms.

Finding	Further detail
Pension schemes are likely to **sell corporate bonds and ABS** to recapitalise LDI funds.	LDI funds now have greater liquidity and are much less leveraged, and in many cases have delegated authority to sell pension scheme assets to meet their recapitalisation needs. This drives price insensitive selling of some assets, including corporate bonds and ABS. See Sections 2.2 and 3.3, and Annex 4: DB pensions schemes and LDI strategies. **Next steps** TPR will consider improvements to data collection and disclosures on pension funds liquidity waterfalls, and plans to better understand the behaviour of pension schemes in stressed markets and whether the functioning of key sources of liquidity can be improved. Pension schemes should consider whether the nature of the assets they hold to meet liquidity needs is appropriate, having regard to the need to make prudent assumptions of the extent to which they will be able to raise liquidity in stressed conditions.
Repo terms tighten substantially in stress.	In response to the SWES shock, many banks reduce tenors and increase haircuts for maturing repo financing, with repo haircuts often doubling over a few days. This adds to the liquidity demands on NBFIs in the SWES. See Section 2.2. **Next steps** Market participants should consider whether they need to prepare for tighter financing terms in stress on existing financing. Further policy work to increase repo market resilience, including on market structure, could, alongside central bank facilities, help support repo market resilience and the effective functioning of other markets during stress. The Bank is expanding its toolkit for addressing severe liquidity-related dysfunction in core financial markets that threatens UK financial stability by developing the ability to lend to non-bank financial institutions. As a first step in this work, the Bank is developing the Contingent NBFI Repo Facility (CNRF) to supply cash to eligible pension funds, insurance companies and liability-driven investment funds against gilts for a short lending term. The CNRF will be used as a backstop in preference to asset purchases where lending is likely to be effective in tackling gilt market dysfunction and when the demand for liquidity is outside the reach of the Bank's existing facilities to lend to banks.
Sectoral behaviour	

Finding	Further detail
Banks' risk appetite means they will likely **act conservatively** in a stress, even if not acutely impacted by the stress themselves	Banks in the SWES are not acutely impacted by the stress. However, the uncertainty in the scenario and their risk management means they were often reluctant to extend new financing or warehouse risk in core markets to the extent demanded by SWES participants. See Sections 2.2 and 3. **Next steps** Market participants should consider whether they need to take steps to prepare for risks that they cannot access additional repo or are unable to roll their maturing repo during market stress. Further policy work to increase repo market resilience, including on market structure, could, alongside central bank facilities, help support repo market resilience and the effective functioning of other markets during stress.
Hedge funds are sensitive to conditions in the **UST repo** market.	An increase in UST repo haircuts or a contraction in availability would have a significant impact on a number of hedge funds, including those who also operate in core UK markets. See Box B. **Next steps** The Bank and other regulators should continue to monitor the UST repo market, given the potential for spillovers to core UK financial markets.
Many types of firm use similar approaches to **risk management**. This is often driven by **recent stress events**.	Many firms and sectors use similar approaches to manage risk. In particular, volatility-based metrics or stress tests are widely used in risk management. Because the data currently used in these approaches include a number of recent stress events, they risk reverting to less binding limits in a correlated way following a more benign period. **Next steps** Firms should consider the extent to which risk management frameworks are driven by recent events and be cognisant of how common approaches can drive correlated behaviour.

Finding	Further detail
The use of **non-cash collateral** has increased, which has benefits and costs.	Many NBFIs make significant use of government bond collateral to meet margin calls; insurers in particular were also able to meet a significant portion of their calls with corporate bonds. This reduces their need for short-term liquidity, but potentially increases valuation and, in some cases, operational risks for banks and NBFIs. See Section 2.2 and Annex 4: Insurance. **Next steps** Further policy work is ongoing to improve initial and variation margining practices, to both limit the potential impacts of margin procyclicality, and better prepare market participants to face jumps in margin and collateral calls. Authorities are developing recommendations and best practice guidance across cleared and non-cleared markets. In April 2024, the FSB published a **consultation paper** on liquidity preparedness for margin and collateral calls.
Countercyclical buyers only enter corporate bond markets **slowly**.	Various frictions mean buyers seeking to take advantage of price falls enter the sterling corporate bond market more slowly than sellers. This increases the risk of sharp falls in prices. See Section 3.3. **Next steps** TPR will consider improvements to data collection and disclosures on pension funds liquidity waterfalls, and plans to better understand the behaviour of pension schemes in stressed markets and whether the functioning of key sources of liquidity can be improved. Firms should be aware of the potential dynamics of the sterling corporate bond market under stress, particularly if they intend to use corporate bonds as a source of daily liquidity. Fund managers should consider whether they need to better align funds redemptions terms with the underlying liquidity of their assets.

Finding	Further detail
Operational frictions to recapitalising LDI funds have been substantially reduced.	In line with FPC recommendations and guidance from the FCA and TPR as well as Luxembourg and Irish authorities, pension schemes are now much better able to rapidly recapitalise LDI funds. See Annex 4: DB pension schemes and LDI strategies. **Next steps** Guidance to LDI funds should be maintained. More generally, market participants should consider the resilience and effectiveness of their operational processes and collateral management practices. Further policy work is ongoing to improve initial and variation margining practices, to both limit the potential impacts of margin procyclicality, and better prepare market participants for jumps in margin requirements.

Annex 2: Participating firms

Table A2.A: List of SWES participants

abrdn PLC	AHL Partners LLP	Aviva Investors
Aviva Life & Pensions UK Limited	Banco Santander S.A. (London Branch)	Barclays
Blackrock Group Limited	BNP Paribas (London branch)	Brevan Howard Asset Management LLP
BT Pension Scheme Trustees Limited	Capula Investment Management LLP	Citadel Advisors
Citibank, N.A. (London branch)	Citigroup Global Markets Limited	Columbia Threadneedle Investments
Deutsche Bank AG (London branch)	Goldman Sachs International	Greater Manchester Pension Fund
HSBC	HSBC Bank Pension Trust (UK) Limited	ICE Clear Europe Limited
Insight Investment Management (Global) Limited	J.P. Morgan Securities plc	JPMorgan Chase Bank, N.A. (London branch)
LCH Limited	Legal & General Assurance Society Limited	Legal & General Investment Management Limited
Lloyds Banking Group	Lloyds Banking Group Pensions Trustees Limited	LMR Partners LLP
M&G Investment Management Limited	Man Group Investments Limited	Mariner Investment (Europe) LLP
Merrill Lynch International	Millennium Capital Partners LLP	Morgan Stanley & Co. International plc
NatWest Group	Pension Insurance Corporation plc	PIMCO Europe Limited
Point72 Europe (London) LLP	Railways Pension Trustee Company Limited	RBC BlueBay Asset Management
Rokos Capital Management LLP	Rothesay Life plc	Royal London Asset Management Limited

Santander UK	Schroder Investment Management Limited	Scottish Widows Limited
Standard Chartered	The Pension Protection Fund	The People's Pension Trustee Limited
The Prudential Assurance Company Limited	Universities Superannuation Scheme Limited	Vanguard Asset Management Limited

Annex 3: Operational frictions

The SWES did not include any operational incidents. However, because operational disruptions can act as amplifiers in episodes of financial stress, participants were asked to consider operational frictions which might affect them during the SWES scenario. This annex summarizes their responses.

Participants did not expect material financial impacts from operational frictions.

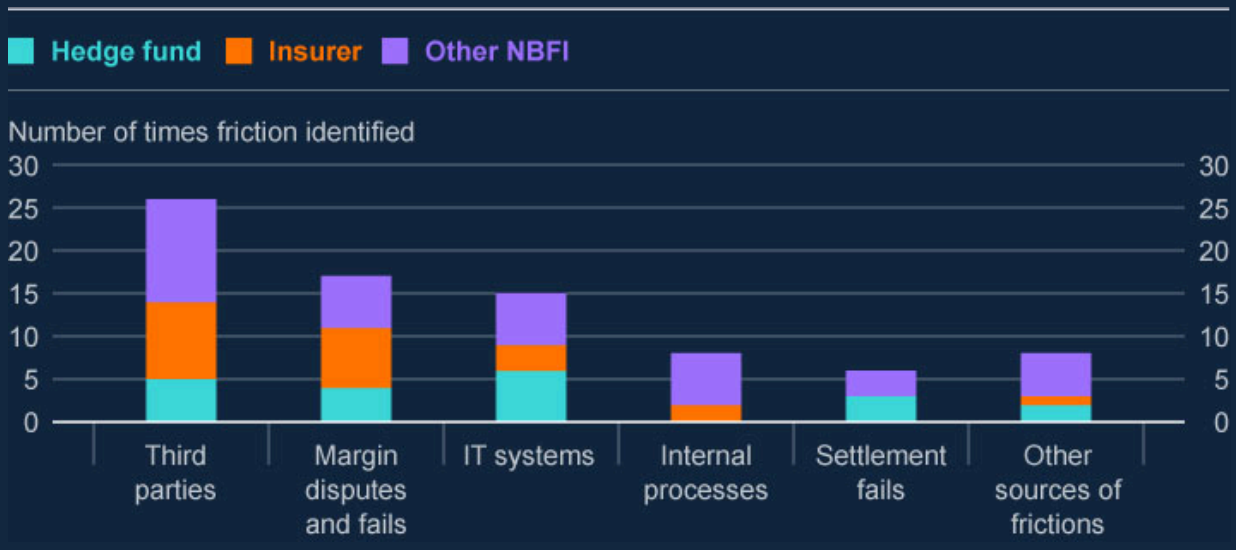
Participants generally did not quantify the impacts of operational frictions when modelling the impact of the scenario or the actions they would take in response. Many reported that they did not think that any frictions would have material financial impacts. Participants did, however, provide qualitative evidence about potential frictions which could arise during the SWES scenario.

Participants often identified dependencies on IT systems and third parties as potential sources of operational frictions.

NBFI participants were asked to identify the vulnerabilities that they thought were most likely to crystallise in a stress. The most commonly identified vulnerabilities related to dependencies on IT systems and internal processes, and on third parties including financial market infrastructure (Chart A3.1).

Chart A3.1: NBFIs' often identified third-party dependencies and IT systems as potential vulnerabilities in stress

Operational frictions identified by NBFIs that could impact them in stress (a)



Sources: SWES submissions and Bank calculations.

(a) Based on the responses of 26 SWES participants.

Several participants observed that, over recent years, an increasing number of asset managers have outsourced some trading, middle and back office operations. In some cases outsourcing has been carried out to reduce costs. They suggested that this trend could create bottlenecks during future stresses because, in a stress, elevated transaction volumes could place substantial operational burdens on providers which manage operations on behalf of a large number of clients. A number of participants reported that they had brought previously outsourced operations back in-house to reduce potential frictions from external dependencies.

High transaction volumes could lead to increased settlement failures and other frictions.

Some participants said that they would expect the number of settlement failures and margin disputes to increase if transaction volumes increased significantly during a stress, although failure rates as a proportion of transactions might remain constant. Banks were more likely than NBFIs to expect an increase in settlement failure rates. Many banks reduce repo tenors they are willing to offer in the SWES (see Sections 2.2 and 3.2). This increases the volume of outstanding repo rolling on any given day, which increases the potential for operational frictions. Market volatility could make pricing more difficult, which would in turn increase the likelihood of pricing or valuation discrepancies and cause margin delays. Increased volumes

could also test firms' capacities to handle client inquiries in a timely manner and might cause dealers to take longer to respond to inquiries. Operational frictions could also affect the ability of firms to post non-cash collateral.

Participants reported actions taken to mitigate potential frictions.

Submissions included information about steps taken by participants to reduce the likelihood and potential impact of operational frictions. Many participants reported actions intended to mitigate dependencies on third parties. These included improvements to communications with third parties (including more detailed and regular reporting), improvements to outsourced providers' own processes, developing relationships with multiple providers for some services, and developing workarounds to fall back on if systems became unavailable. A minority of participating NBFIs reported that they explicitly account for operational frictions in their liquidity stress tests. Others hold liquidity buffers which assume constrained market liquidity (without specifying the causes of illiquidity) or which are intended to cover unmodelled liquidity needs (including operational frictions).

Regulatory landscape for operational resilience

Actions to improve operational resilience can reduce the potential impacts of some of the operational frictions identified in the SWES. There is a range of firm-level and system-wide policies and tools focused on strengthening operational resilience across the UK financial system. The FPC set out in detail its **macroprudential approach to operational resilience** in March 2024. Additionally, the Bank has developed a range of tools to support system-wide resilience, including **CBEST**, **Cyber Stress Tests**, and **SIMEX** exercises to test and explore the ability of firms and the financial system as a whole to protect themselves from, and recover after, serious operational incidents, including cyber attacks. Meanwhile, the PRA, Bank of England, and FCA have set out requirements and expectations for **critical third parties** to manage potential risks to the stability of the UK financial system from disruption to services Internationally, the FSB recently **consulted** on a recommendation that NBFIs ensure that they have resilient and effective operational processes and collateral management practices.

Annex 4: Sector-specific deep dives

Insurance

Insurance sector response to the scenario

Insurers face significant liquidity needs in the SWES scenario, comparable in magnitude to those they faced during the 2022 gilt market dysfunction. The liquidity needs stem mainly from VM calls on derivatives positions which are sensitive to increases in interest rates and sterling depreciation.

Insurers primarily meet these margin calls by pledging assets from their large stocks of eligible securities, including corporate bond collateral. Their ability to do so reflects steps they have taken since 2022. In particular, many insurers have the right to post corporate bonds as collateral under the terms of the credit support annexes (CSAs) of their agreements with banks – so-called 'dirty' CSAs. A significant proportion of insurer CSAs have been renegotiated since 2020 to increase flexibility around types of eligible collateral, and so there has been an increase in the use of corporate bond collateral. Overall, around 30% of IM and VM calls are met with corporate bond collateral by insurers under the SWES scenario, similar to the shares met with gilts and with cash (Chart 3).

After meeting the initial liquidity need, a small number of insurers seek to restore their buffers by selling assets, in some case as a result of breaching their own individual risk tolerances in the scenario. Some insurers take additional precautionary actions given the risk that further credit downgrades could negatively impact their solvency positions. These insurers sell credit assets which they consider to be particularly vulnerable to further downgrades – in part because downgrades could lead to increases in capital requirements relating to risks of default – substituting these exposures for gilts.

Insurers take fewer actions to restore their asset buffers than in recent stresses. This partly reflects a reduction in derivatives exposures given a change made to their hedging strategies since 2022, which reduces their stressed liquidity needs. It also reflects insurers' preparations to meet to sharp liquidity demands. For example, relative to 2022 insurers have more cash and non-cash liquidity resources, including committed financing lines from banks (eg, committed repo lines, revolving credit facilities). Insurers have also enhanced their tools to estimate margin requirements in a stress, and improved liquidity reporting during stress – against the backdrop of the PRA's ongoing work to introduce a new liquidity reporting framework for insurers.

Wider lessons about sector dynamics

Insurers play an important role in core UK markets – including in sterling corporate bond markets. Reflecting this, given the price deterioration seen in the SWES scenario, some insurers who benefit from a current surplus of high-quality liquid assets (HQLA), plan to act countercyclically by making opportunistic purchases of corporate bonds. These are funded by sales of other assets, including gilts, and redemptions of MMFs.

But not all insurers are able or willing to do so. Some insurers use delegated fund managers to manage a large proportion of their investments, and only some mandates have flexibility to take advantage of market dislocations. Other insurers are apprehensive about 'catching a falling knife' and need further time to analyse and understand market dynamics to gain assurance that prices will eventually correct. See Section 3.3 for more discussion of these dynamics.

Unlike LDI funds and hedge funds, insurers generally use repo as a cash management tool, rather than to obtain leverage to finance asset purchases. Given deteriorating repo terms, some insurers indicate that they would no longer use repo to generate liquidity and instead seek to draw down on other facilities. And, as described, the increasing use of non-cash collateral by insurers reduces their cash needs in a liquidity stress. Ultimately, their heightened liquidity preparedness reduces their redemption from OEFs and MMFs in which they are the end investor.

When asked about sensitivities insurers indicated that, were the shock to occur when their internal risk metrics were already approaching 'amber', they would take additional management actions to restore liquidity buffers. The expected actions were highly firm-specific, but asset sales were typically seen as a last resort and would depend on the market environment – firms typically preferred to draw on committed repo facilities and existing revolving credit facilities in the first instance, with some firms also seeking to use repo to upgrade their collateral pool and others settling derivatives transactions. Insurers also reported that they would not be materially impacted by a temporary freezing of the repo market during a period of extreme market stress.

Hedge funds

Hedge funds are active participants in financial markets and, by trading to take advantage of arbitrage opportunities, can be important providers of market liquidity. Many hedge fund strategies involve leveraging their capital to express views on the future path of asset prices and to arbitrage differences in relative prices that do not appear to align with fundamentals. In normal times, this activity contributes to price discovery and the provision of liquidity in financial markets. In stressed market conditions, however, these positions are vulnerable to

losses as prices deviate from fundamentals. Hedge Funds seek to manage their liquidity needs by having high levels of unencumbered cash to meet potential IM/VM calls, and by having less frequent redemption terms/conditions (eg, quarterly)

The use of leverage by hedge funds means they are largely reliant on financing provided by banks, through prime brokerage, the repo market and via derivatives. If this financing is not forthcoming, hedge funds could be forced to close out positions at a loss. Hedge fund positioning in markets can also change quickly, and how they are affected by a shock will be sensitive to the specific point in time it occurs.

The SWES was designed to explore the impact of stress on three distinct types of hedge fund strategy:

1. Fixed-income relative-value hedge strategies, which seek to benefit from moves in relative prices of economically similar securities – for example, the prices of two government bonds of a similar maturity.
2. Macro strategies, which seek to benefit from broad moves in asset classes, or moves in yield curves, reflecting a view on the future evolution of the economy – for example, a view on the expected future of central bank policy rates.
3. Momentum strategies, sometimes called ‘trend seeking’ strategies, which seek to benefit from trends in asset prices. These strategies are usually agnostic about the reasons why prices are moving, and instead follow the behaviour of other market participants – for example, by buying as prices are rising and selling as prices are falling.

While some hedge funds focus on a single strategy, many adopt a combination of strategies. As well as having different trading strategies, different hedge funds approach portfolio management in different ways. Some hedge funds operate with a single, centralised, approach to portfolio management, while others, often called multi-manager funds, are composed of a number of different portfolio managers each responsible for a share of capital with an overarching portfolio and risk management function. Given this range of investment strategies and management styles, there is variation in hedge funds’ exposures at the SWES reference date.

All participating hedge funds use leverage, including both financial leverage (in the form of repo and reverse repo) and synthetic leverage (through the use of derivatives such as interest rate swaps and futures contracts). The use of leverage allows hedge funds to gain a larger economic exposure to moves in market prices than would be possible using only their own capital. This allows them to increase their potential returns – though it also increases the risk of losses.

Hedge fund sector response to the scenario

The impact of the SWES scenario on hedge funds is heterogenous. The outcome for any individual hedge fund in the SWES depends on the balance between different strategies they were following at the outset of the SWES scenario as well as how the shock to market prices affects their individual positioning. On average, participating hedge funds incur losses of around 0.6% of their net asset value (NAV), but within this individual fund performance was widely dispersed, with large gains and losses seen.

The actions hedge funds report taking as a result also depend on several factors, including the scale of the impact on their fund's NAV or profits and losses, liquidity position, risk metrics and funding, as well as their approach to portfolio management. While a few hedge funds take actions that could be considered countercyclical, most take actions that are likely to be procyclical and so have the potential to amplify moves in market prices.

The direct profit and loss impact for different hedge fund strategies

Most hedge funds whose portfolios include **relative value strategies** were impacted by the significant increase in the price difference between government bonds and the associated bond futures contracts – the so-called 'cash-futures basis'. This 'basis' widens across a range of markets in the SWES scenario, most significantly in the US. The prices of these instruments must converge by the time the futures contract matures, and so being positioned for this convergence represents a genuine arbitrage opportunity (so long as the position can be held to maturity). Because the price difference is small, hedge funds use leverage to increase returns and most assume significant funding mismatches. And, because the price difference increases rather than decreases during the scenario, these hedge funds suffer mark-to-market losses on the position. The use of leverage means they are required to post VM to cover these losses, which in turn depletes their unencumbered cash.

A number of hedge funds that follow **macro strategies** had the view at the onset of the SWES scenario that central banks would need to raise interest rates faster than was implied by market prices. Given the sharp increase in government bond yields in the SWES scenario, these hedge funds make gains. Specifically, these funds had taken leveraged short positions in government bonds (including gilts) – either by borrowing the bonds in reverse repo and selling them in the secondary market, or by selling a bond futures contract. When bond yields increase and prices fall in the SWES, these hedge funds make gains – either by buying the bonds back for less than they sold them for, returning the bonds back to the counterparties they borrowed from (gaining from the difference in sale and purchase prices), or by buying back the relevant futures contract. The use of leverage and the exchange of VM means these gains are realised immediately as these hedge funds will receive VM payments, usually in cash.

The rise in government bond yields also impacts on hedge funds following **momentum strategies**. In the months preceding the exercise, government bond yields had been rising and a number of trend-seeking strategies used leverage to position for bond yields to continue to rise. In a similar way to macro strategies, these positions benefit from the moves in asset prices in the scenario.

Other impacts on unencumbered capital

As well as the direct impact on hedge fund profit or loss, most hedge funds expect CCPs and banks to increase IM requirements and to raise haircuts on securities posted as repo collateral. While this activity does not affect the NAV of a hedge fund, it does reduce the amount of cash and unencumbered assets the hedge fund has available to meet VM calls. Some hedge funds respond by selling securities or by adjusting their derivatives portfolio to release IM. Others expect they would be protected from increases in bilateral margin requirements through margin lock-ups that define how frequently a bank can change margin terms, although they noted that CCP margin requirements could still increase.

The role of risk limits and volatility

In addition, all participating hedge funds are affected by the rise in volatility in the scenario. In several cases, this drives pro-cyclical actions to reduce risk exposures. The rise in volatility affects hedge funds risk measures, in addition to the impact on margin requirements.

Specifically, hedge funds often have internal risk limits that are based on Value-at-Risk (VaR) style models. These models use volatility as an input which means that, as volatility increases, the model will predict a bigger probability of a given size loss (or equivalently a larger loss for a given probability). Hedge funds therefore expect market risk measures to become more binding because of the increase in volatility. If risk metrics approach or breach internal limits, portfolio managers may be required to reduce risk exposures, which will often involve deleveraging. In the SWES exercise, several hedge funds report that these risk limits would be breached, and portfolio managers would be expected to reduce risk as a result. A number of SWES hedge funds report that some portfolio managers in multi-manager funds entered the stress scenario running relatively close to their risk limits and would have found themselves breaching those limits and been required to cut their exposures. A number of hedge funds also report cutting exposures due to heightened levels of uncertainty rather than binding risk constraints, with portfolio managers choosing to wait until the uncertainty had resolved or reduced.

Some hedge fund strategies also involve a mechanical link between volatility and trading activity. Volatility scaling is an approach where hedge funds target a given level of volatility in their overall returns. This means when the general level of volatility in asset prices is low, hedge funds following this strategy will increase the amount of risk they are taking (usually by increasing the amount of leverage they are using) to keep the volatility of the overall portfolio

constant. By contrast, when the volatility of asset prices increases, these hedge funds will cut back risk-taking, often by deleveraging. This behaviour is inherently procyclical as it involves increasing risk-taking during periods of low volatility and scaling back activity in volatile markets.

The impact of this risk reduction depends on the precise nature of the positions, and most hedge funds did not model the action they would take in detail. That said, given the positioning of hedge funds at the time of the SWES exercise, the direct impact of the sector on UK markets (gilt, gilt repo and sterling corporate bond markets) is relatively muted. As explained above, hedge funds that were active in gilt markets tended to be positioned for rates to increase made profits in the exercise, and so the action they take involves closing out positions that had gained in value, for example by buying gilts or gilt futures, which would have provided liquidity to the sellers of those assets. This has a countercyclical effect as they buy assets (gilts and futures) that other participants sell.

Some participating hedge funds with positions in the US Treasury cash-futures basis reported that internal risk limits would be breached and that portfolio managers would be told to reduce positions. A number of hedge funds expect to unwind some relative value positions, such as those in the US Treasury market, which would involve trading in a way that could cause bigger mark to market losses for those continuing to hold the position. This dynamic was observed during the dash for cash in March 2020. Others said they would be able to absorb the temporary losses and maintain their positions, and a small minority expect to be able to take advantage of the stress by increasing their relative value positions – which has a countercyclical effect.

Funding constraints

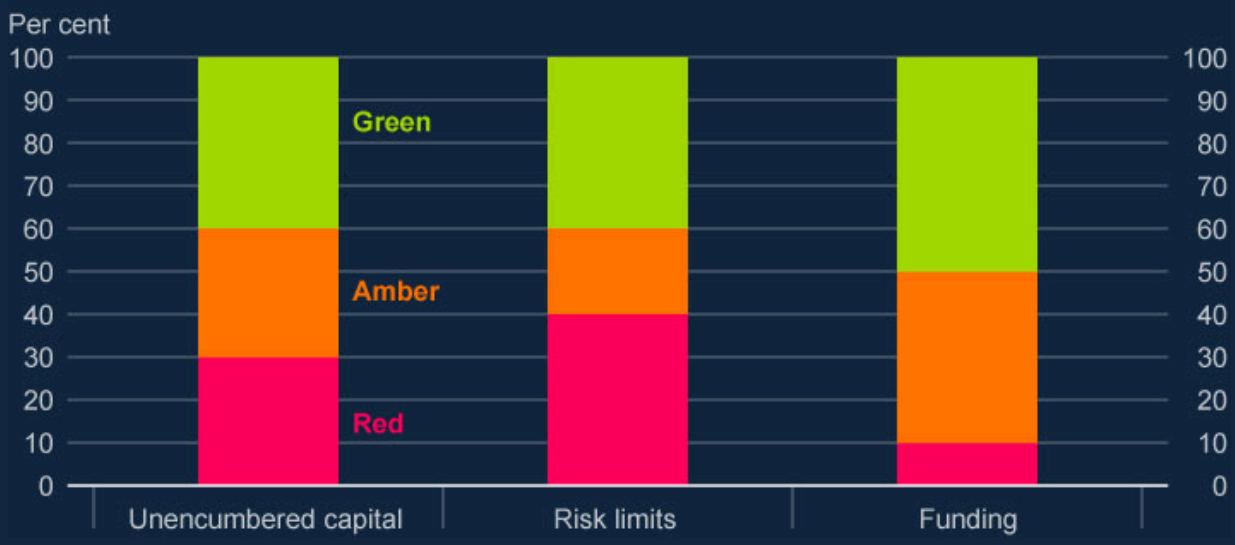
As well as taking actions that are driven by losses (or prospective losses), hedge funds are reliant on the provision of leverage by banks, and if they aren’t able to access or roll over funding, they may be forced to close out positions. Most hedge funds do not expect to face significant funding constraints. If this did not hold, eg if they faced significant reductions in their repo financing from banks, there would have likely been a bigger impact on cash/unencumbered assets, and funds might have come closer to breaching risk limits. We tested what would happen in this case – see Box B.

Overall drivers of responses

Chart A4.1 provides a qualitative summary of the drivers of responses by hedge funds in the SWES.

Chart A4.1: Hedge funds cited a range of internal constraints that could trigger financial market actions in response

Key hedge fund constraints and their propensity to prompt mitigating actions (a) (b) (c) (d)



Sources: SWES submissions and Bank calculations.

(a) For unencumbered capital, red denotes capital down over 30%, amber down 10-30%, and green either down less than 10% or up.
(b) For risk limits, red denotes that risk limits were hit and action was taken in response, amber that some risk limits were triggered, and green that no risk limits were reported as breached.
(c) For funding, red denotes where demand for funding by funds exceeded the funding supply from banks, amber where funding demand approximately matched funding supply, and green where funding demand fell below supply.
(d) Hedge funds do not necessarily report the same rating in all comments.

Wider lessons about sector dynamics

While the proportion of hedge funds deleveraging the basis trade in the SWES is relatively small, the SWES participants are some of the larger and longer-established hedge funds in the sector. Some participants noted that out of sample hedge funds may be more vulnerable to these risks owing to their investment approaches. In a real stress, deleveraging activity by some hedge funds could cause the basis to widen further, making deleveraging by other hedge funds more likely.

Though we see some limited evidence of hedge funds taking countercyclical positions, as described above, in general, participating hedge funds do not expect to increase risk positions significantly or to take advantage of distressed pricing in the sterling corporate bond market.

Procyclical	Countercyclical
Cutting losses on positions which lost	Taking profits on positions which gained
Volatility scaling	Putting on new relative value positions
Risk-off, not deploying risk capital	Deploying dry powder

As described in Section 2.4, the current risk of hedge fund distress impacting the gilt market in a SWES-like shock is higher than at the time of the exercise given large increase in gilt repo borrowing by hedge funds.

In the SWES, hedge funds with a more centralised approach to portfolio management tend to adopt a less diversified trading strategy and therefore returns for those funds have the largest variance of outcomes. By contrast, multi-manager hedge funds are more likely to adopt a combination of strategies, and these funds tend to see relatively smaller overall gains or losses.

Defined benefit pension schemes and liability-driven investment strategies

Liability-driven investment (LDI) is an investment approach that allows institutional investors, predominantly defined benefit (DB) pension schemes and insurers, to match the interest rate sensitivity of their assets and liabilities. This strategy often involves using leverage, which allows pension schemes to hedge their liabilities while also investing in other types of assets, usually to seek a higher return in order to close funding gaps.

Smaller pension schemes typically implement LDI strategies by buying units in a **pooled LDI fund**, while larger pension schemes implement LDI strategies on a bespoke basis, usually under a **segregated mandate** with a fund manager (or sometimes using the legal wrapper of a pooled fund in a so-called ‘pooled fund of 1’). SWES participants manage over 90% of the total assets under management in the sterling LDI sector.

The 2022 LDI episode was triggered by the unprecedented repricing of long-term gilts linked to the announcement of changes to UK fiscal policy. This led to losses for funds which held gilts, and margin calls for funds which had used gilts in repo borrowing.

LDI funds initially met margin calls with unencumbered assets, and then issued capital calls to investors to recapitalise the fund and replenish buffers of unencumbered assets. This process was strained by large increases in gilt yields, which led to large margin calls and

capital calls.

Some LDI funds that were highly leveraged, particularly pooled multiclient LDI funds, came close to running out of assets to meet margin calls as they could not source additional capital from their pension scheme members quickly enough. In these cases, LDI funds were forced to unwind their leveraged positions by selling gilts, **further amplifying the increases in gilt yields**. This created a feedback loop, triggering gilt market dysfunction that was judged a risk to financial stability and necessitating Bank intervention to avert that risk. A full explanation of this event is set out in this **2022 letter to the Treasury Select Committee**.

The financial and operational resilience of the LDI sector has significantly improved since 2022. A recent FPC recommendation led to **TPR guidance** requiring pension schemes to ensure that the LDI funds they invest in hold buffers sufficient to be resilient to a yield shock of at least 250 basis points, as well as the introduction of macroprudential measures by the **Central Bank of Ireland (CBI)** and the **Commission de Surveillence du Secteur Financier (CSSF)**. This is in addition to the resilience required to manage other risks and day-to-day movements in yields.

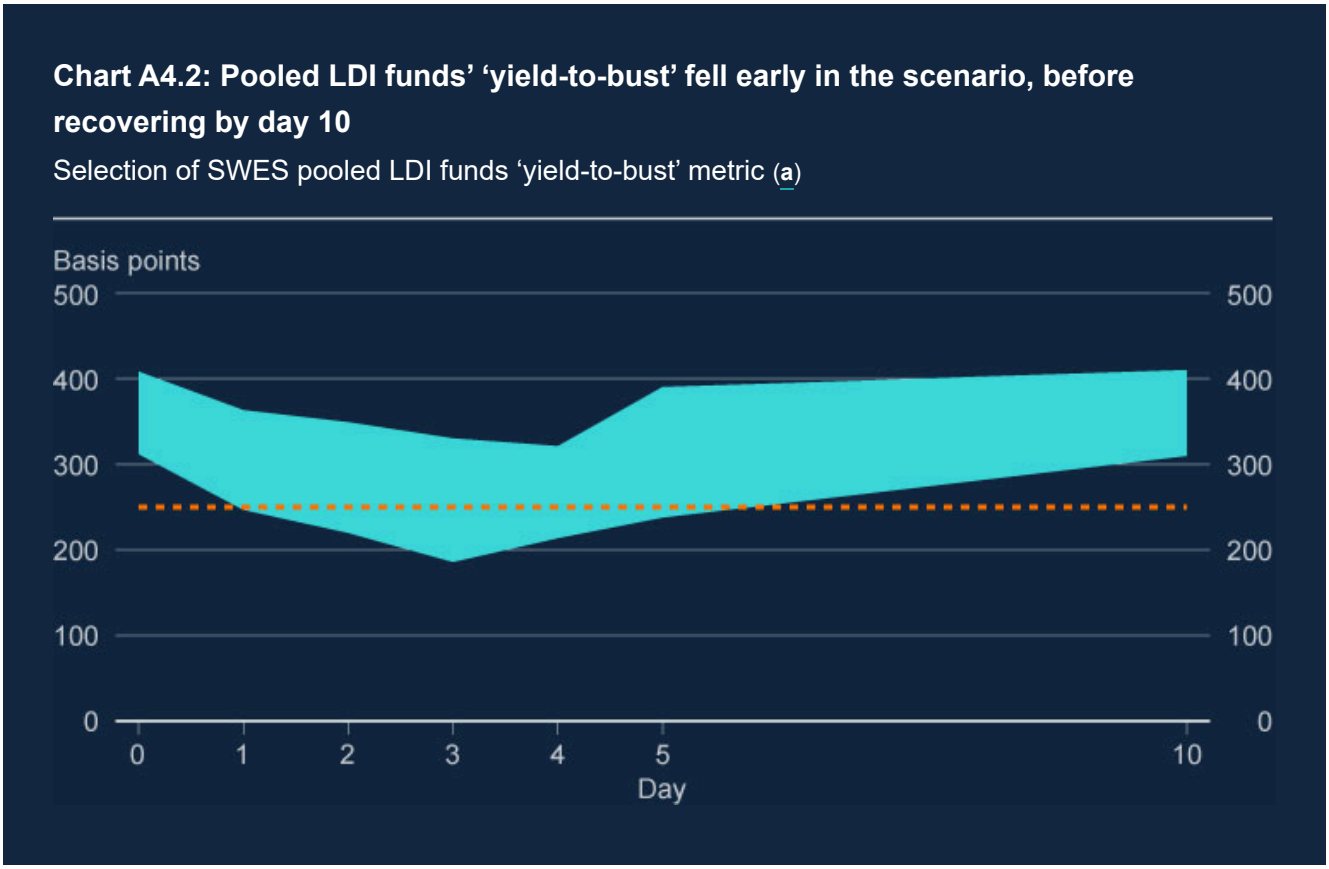
DB pensions and LDI sector response to the scenario

Under the SWES scenario, LDI funds face margin calls on repo borrowing and derivative positions. These margin calls were smaller than in the 2022 LDI episode and participants reported that they would meet these calls mostly by posting unencumbered gilts.

LDI managers then call on pension scheme investors to provide capital subscriptions in order to restore these buffers of unencumbered assets. LDI resilience is often measured in terms of ‘headroom’ or with a metric known as ‘yield-to-bust’. This number refers to the move in interest rates that would be required to exhaust an LDI fund’s stock of available collateral to post to meet margin calls. Most LDI managers reported that they have implemented processes whereby if a fund falls below 300 basis points of headroom, they will call on pension schemes to provide sufficient capital to restore around 350–370 basis points within 1–2 weeks. If pension schemes fail to meet these timescales, the LDI fund managers would instead restore headroom by selling gilts to reduce their leverage. This rapid action to restore buffers means LDI fund resilience is quickly rebuilt after the initial shock, but also implies asset sales while the stress is still unfolding (see below). Chart A4.2 shows the range of ‘yield-to-bust’ metrics during the SWES scenario for a selection of participating pooled LDI funds.

Chart A4.2: Pooled LDI funds' 'yield-to-bust' fell early in the scenario, before recovering by day 10

Selection of SWES pooled LDI funds 'yield-to-bust' metric (a)



Sources: SWES submissions and Bank calculations.

(a) Dashed line indicates the 250 basis point level recommended by the FPC.

Pooled LDI funds typically use higher levels of leverage and so are more likely to make a capital call under the SWES scenario than LDI strategies implemented in segregated mandates. Segregated mandates often have very high headroom (many could in theory withstand a rate shock >1,000 basis points) as they tend to hold more of the pension scheme's assets within the same investment structure alongside the levered gilts – effectively diluting the overall leverage. Asset sales could have been higher had a few large pension schemes and LDI funds had less resilience entering into the SWES shock.

SWES participants and market intelligence suggest that pension schemes are highly motivated to make capital calls to avoid losing the liability hedging provided by their LDI investment. LDI fund managers reported that if they did not receive capital calls in time, they would unwind those hedges.

Wider lessons about sector dynamics

We have learned through the SWES that the dynamics of LDI have changed considerably since the 2022 LDI episode. Since 2022, both financial and operational resilience of the sector have improved. In addition to holding buffers of unencumbered assets to meet margin

calls, operational frictions for clients of pooled funds appear to have reduced significantly. Participants reported that the majority of pension schemes have given their pooled LDI manager control of other assets that can be used to meet capital calls in line with a pre-agreed waterfall. Pension consultants reported that many schemes have now set up contractual obligations for managers to provide robust data during a crisis. Fund managers have also improved systems, and are able to send communications to multiple investors more easily. Pension schemes are also more careful about their choice of collateral assets, and now skew towards daily traded assets with settlement within T+4.

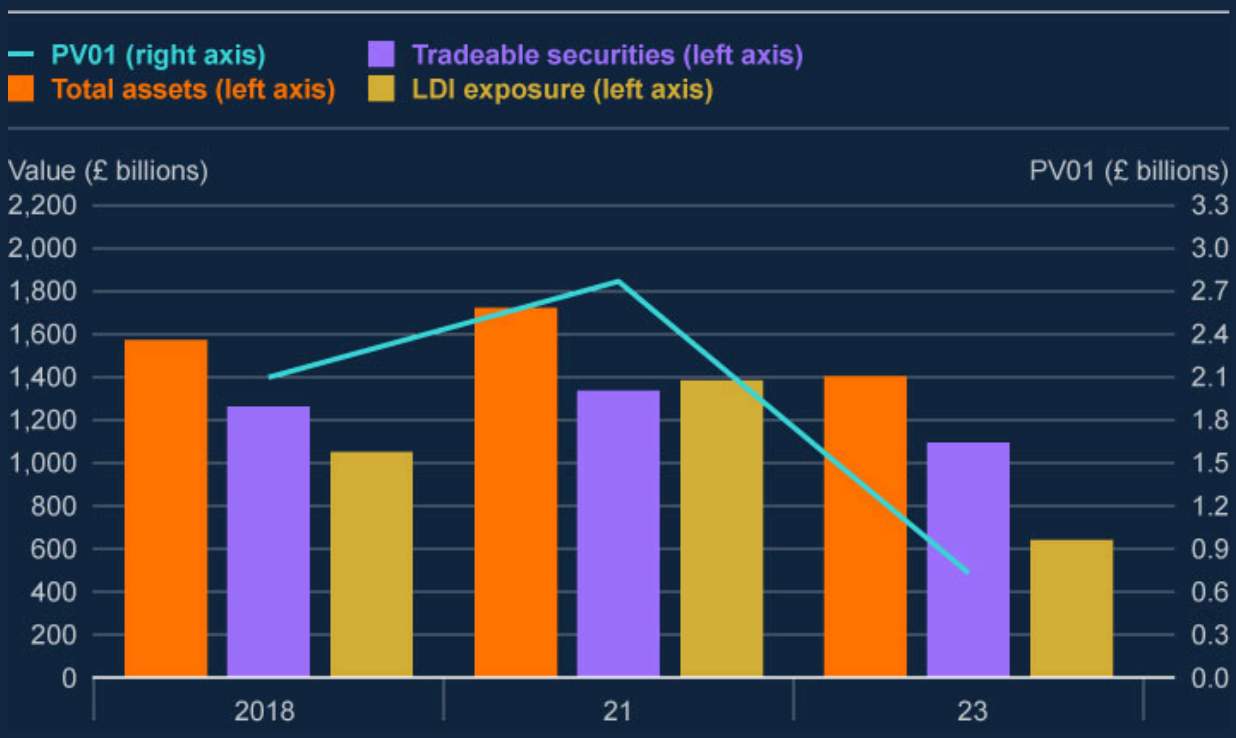
The dynamics of LDI sector have also changed as pension schemes' demand for leverage has fallen for several reasons:

1. Many pension schemes are now fully funded (they have more assets than liabilities). Prior to 2020, most pension schemes were running a deficit (more liabilities than assets). Being in deficit creates an incentive to use leverage to free up capital to invest in growth assets in order to reduce their deficits. With smaller deficits or a surplus, schemes' demand for leverage has fallen.
2. There has been a trend for the liabilities of closed pension schemes to be bought out in a BPA deal. This is in part a second order effect of being fully funded – schemes no longer need to persuade their sponsoring employer to make up the deficit, so 'buy out' is much more affordable.
3. As pension schemes mature and the share of scheme members in retirement increases, their liabilities become more certain – which means growth assets like equities become less well suited as an investment strategy.

All of this means that LDI funds and mandates are less levered than pre-2022 and so have less need to take risk to make up deficits and can, all else equal, withstand a greater interest rate shock. Chart A4.3 shows estimates of how the LDI exposure, and sensitivity to interest rates (PV01) of DB pension schemes has evolved since 2018. Between 2021 and 2023, the large rise in interest rates had driven a sharp fall in the value of LDI liabilities.

Chart A4.3: Pension schemes' LDI exposures have fallen in recent years

UK DB pension scheme assets, LDI exposure and LDI risk sensitivity (a) (b)



Sources: XPS Liability Driven Investment Annual Survey 2019, The Pension Protection Fund 2023 Purple Book, FCA industry data, TPR staff estimates and Bank calculations.

(a) Tradeable securities are the subset of assets comprising securities which can be traded in secondary markets. LDI exposure is the estimated notional liabilities hedged with leveraged LDI.
(b) PV01 risk sensitivity represents the sensitivity of the value of hedged liabilities to a one basis point parallel move in yields across all terms.

While LDI funds are much less likely to sell gilts than in 2022, the SWES revealed that pension schemes will need to sell other assets, particularly other types of credit, to recapitalise LDI funds in a stress. Those sales could vary depending on market dynamics and developments.

The assets that pension schemes sell to meet capital calls will depend on (1) the assets they hold in their portfolios; (2) their pre-agreed 'waterfalls' for asset sales in stress; and (3) the relative liquidity of the different asset classes they hold in a specific stress.

Asset holdings: Some LDI managers and pension consultants told us that pension schemes are increasingly holding liquid collateral in ABS funds. Some managers are in the process of launching new ABS funds and marketing them to pension schemes. In future, we might

therefore expect pension schemes to redeem more ABS funds (and potentially fewer corporate bonds and MMFs) to meet LDI capital calls in a stress.

But at the same time, pension schemes that wish to position themselves for buyout may prefer to invest in corporate bonds, as they hedge the prices insurers charge to take on pension liabilities. So corporate bonds holdings by pension schemes may increase, which could – all else equal – result in increased corporate bond sales by pension schemes in a stress.

Asset waterfalls: Pension scheme clients of pooled LDI funds typically agree a waterfall for asset sales in stress with their LDI managers. They give managers control of liquid assets that can be sold to meet liquidity needs. LDI managers have very limited scope to deviate from this agreement. Larger clients with segregated mandates will agree a waterfall with their managers but managers may, in theory, have more scope to deviate from the agreement depending on the market outlook.

Relative liquidity of different assets: Where LDI managers do have discretion over what to sell, they will have regard to the relative liquidity of different asset classes available. Some market participants generally consider ABS funds to be more liquid than corporate bond funds. ABSs tend to be floating rate, reference a diversified pool of loans and, through tranching, carry a high credit rating. These factors can make the securities more liquid than fixed-rate bonds issued by an individual corporate. This could mean ABS funds are more likely to face larger redemptions in a future stress. On the other hand, there are some circumstances where corporate bonds might be more liquid than ABSs. For example, in 2008 , securitised financial assets became particularly illiquid. In these circumstances, schemes might sell more corporate bonds than ABS funds.

Pension schemes will also have regard to the relative liquidity of different global markets, when deciding whether to redeem from sterling focused bond funds or to sell other-currency denominated credit assets to meet capital calls. In September 2022, sterling markets were the focus of stress and so pension schemes were able to meet a substantial proportion of the recapitalisation requests from their LDI managers by selling overseas assets. In the SWES scenario global markets faced similar stresses, and so the ability to switch to selling overseas assets was not as great. And while holding foreign-currency assets diversifies the markets which pension schemes can transact in to generate liquidity, it introduces other risks such as exposure to variation margin calls on exchange rate hedges.

Open-ended funds (including money market funds)

The SWES included a number of OEFs, managed by participating asset managers, that invest in UK government bonds and sterling corporate bonds. UK and other European OEFs do not typically use leverage, and so do not receive or make significant margin payments, but

they are impacted by the use of leverage by other market participants, and by the falls in prices of the assets they hold.

The profile of assets held by an OEF depends on the mandate for the fund. Some funds are designed to follow a benchmark (such as a sterling investment-grade corporate bond index) and must hold a portfolio of assets which closely matches the risk characteristics of this benchmark. Other funds are marketed as being 'actively managed' and these employ portfolio managers who aim to beat a benchmark, usually by selling bonds they consider relatively overvalued and buying bonds they consider relatively undervalued. A third class of funds is marketed as being 'buy and hold' or 'buy and maintain'. These funds are aimed at long-term investors who often expect to hold assets to maturity (for example, because they are intended to meet known liabilities) and therefore portfolio managers can deliver value by reducing expected transaction costs.

Money market funds (often marketed as 'liquidity funds' or 'liquidity plus' funds) usually offer faster settlement times than other OEFs, which means they can be used by investors to meet immediate cash needs such as those arising from margin calls. Unlike other OEFs, MMFs typically do not meet redemptions by selling assets. Instead, they maintain a stock of assets that matures overnight (often bank deposits and overnight reverse repo) and use this to meet any net redemptions. Other assets held by the fund are relatively short term and tend to be held to maturity, which replenishes the overnight buffer.

OEF sector response to the scenario

The impact of the scenario on participating OEFs depends on the behaviour of investors in the funds as well as risk profile and strategy of the fund. Sterling-focused funds participating in the SWES are typically used by institutional investors (mainly insurance companies and pension funds) and retail investors. Globally focused bond funds tend to be larger and have a more globally diversified investor base. As well as funds with multiple investors, asset managers often create and manage an OEF for a single investor, and they manage segregated funds for individual investors in a so-called 'segregated mandate' or 'separately managed account'.

The behaviour of OEF investors depends on how the scenario has affected them. Some investors face an urgent need for liquidity, and so redeem from OEFs to obtain that liquidity. This channel was the most significant in the SWES. Other investors act in response to the change in relative asset prices, or in response to changes in their expectations of how the scenario might unfold in future, for example by acting to avoid future price falls or potential credit downgrades.

OEF redemptions

As noted in Section 2.2, in the SWES, pension funds redeem from credit focused OEFs in order to meet capital calls on leveraged LDI investments. The funds they redeem from include funds that are marketed as ‘buy and hold’, actively managed and passively managed index-tracking funds. These funds often offer daily dealing in their liabilities with settlement a few days later which means, under normal conditions, investors can submit a redemption request on any given business day and receive the cash in time to meet the capital call. In the SWES scenario, funds meet the redemption request through a mixture of drawing down cash buffers and asset sales. Pension funds redeem around £7bn from OEFs, which could results in sales of up to £5bn sterling corporate bonds. ‘Buy and hold’ funds or index-tracking funds have limited scope to choose which assets to sell to meet redemptions.

Insurance companies also use OEFs in order to invest in securities. In the SWES, the insurance sector faces lower cash demands than the pension fund sector (see Section 2.2), and so in the SWES there are fewer redemptions from OEFs by insurance clients than by pension fund clients. Insurance companies often delegate the management of their assets to asset managers through fund structures, including segregated mandates. This delegation can include authority to actively manage the portfolio in a way that matches the preferences and expectations of the client. For example, an asset manager may sell bonds that might be at higher risk of being downgraded, or buy bonds that appear relatively undervalued. In the SWES, a small number of asset managers report making transactions like these on behalf of insurance clients, but the majority of asset managers and insurance participants did not anticipate trading activity for these reasons within the time horizon of the scenario.

Retail investors use OEFs to invest long term savings. They often access these products through platforms such as those provided by internet-based intermediaries. When these platforms are used, fund managers often report finding it difficult to determine who the end investor is and therefore how they might behave in a stress. Retail investors, and some institutional investors, may seek to reduce their allocation to asset classes which have underperformed or fallen in value, especially if those investors believe there is an increased risk of further price falls. In the SWES exercise, a number of OEFs expect to receive redemptions from retail, intermediated and foreign investors looking to reduce exposures to falling asset prices following losses, but participants generally expected this behaviour to be highly uncertain, as well as being more likely to occur over a longer time horizon rather than within the two-week scenario.

Portfolio rebalancing

Some investors hold shares in bond funds alongside other asset classes and these investors will sometimes target a fixed proportion of holdings for each asset class, for example 60% in bonds and 40% in equities. If the price of one asset class falls relative to another, the market value of assets allocated to each asset class will deviate relative to this target. If the deviation becomes large enough, the investor may reallocate, by redeeming from funds invested in

asset classes that performed relatively well, and subscribing into funds that invest in asset classes that preformed relatively poorly. In the SWES scenario, the price of corporate bonds falls by more than the price of equities, and therefore some fund managers expect to receive subscriptions into their corporate bond funds from this portfolio rebalancing effect.

How OEFs meet redemptions

Net redemptions from OEFs are met by asset sales. Depending on the type and mandate of fund, the fund manager may have more, or less, discretion over which assets are sold to meet the redemption. Index tracking funds and funds with fixed-investment mandates have less discretion and may be more likely to be price insensitive sellers. In the SWES exercise, the majority of asset sales by OEFs depend only on the quantity of redemptions faced by the fund and not on the price of the asset.

In total, we estimate that corporate bond OEFs sell approximately £2 billion of sterling corporate bonds , mainly driven by redemptions from insurers and pension funds. OEFs have a number of liquidity management tools that can be used to manage the liquidity mismatch between the redemption terms of the funds liabilities and the liquidity of the assets it holds. One such liquidity management tool is swing pricing. Swing pricing is designed to pass the liquidity costs arising from redemptions on to the redeeming investor, in order to avoid ‘diluting’ the value for the investors who remain in the fund. Swing pricing would therefore expected to be used in cases where markets are illiquid and the liquidity premium in market prices is high, such as in the SWES scenario.

The impact on MMFs

In the SWES exercise, all participating MMFs faced redemptions following the initial shock to asset prices, as investors required cash to meet margin payments. MMFs were able to meet these redemptions using overnight assets, and participating MMFs, which cover around 50% of the sterling MMF sector, did not face significant pressure in the SWES (Chart A4.4). This reflects several factors, which may vary over time and with the nature of a stress event.

- At the SWES reference date, MMFs voluntarily held liquid assets well in excess of regulatory requirements, and so the significant and rapid redemptions did not lead to them breaching those requirements.
- End investors in MMFs, notably pension schemes, LDI funds and insurers, are more resilient than before previous shocks. That reduces their need to redeem from MMFs. Had MMF investors been less resilient, redemptions from MMFs could be higher than that seen in the SWES.
- The SWES did not include a significant stress of corporates which use MMFs. If the corporate sector has faced a greater need for working capital (for example, as seen during March 2020), redemptions from MMFs would have been higher. In such a scenario,

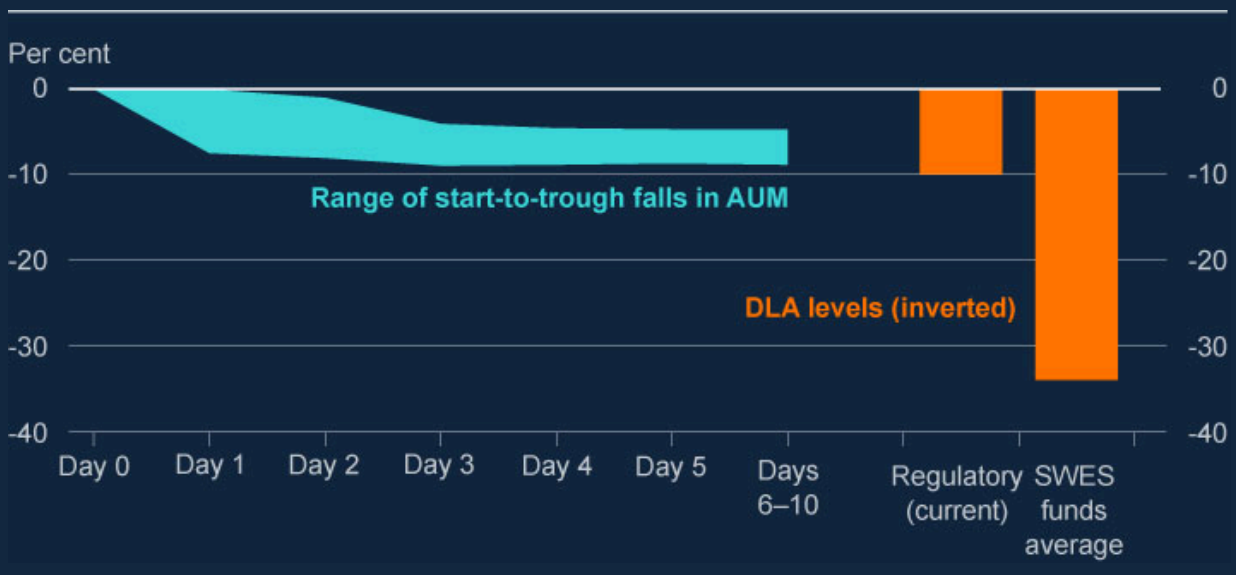
corporates would also have drawn on credit facilities provided by banks, increasing the liquidity stress for banks, with potential additional consequences for market liquidity, including in repo markets.

- The SWES contained elevated counterparty credit risks in the NBFI sector but did not materially impact banking sector resilience and credit risk. MMF assets include claims on the banking sector, so a different stress could also lead to elevated redemptions from MMFs as investors seek to reduce exposures to the banking sector.

A number of MMFs reported that they would attempt to sell assets in order to manage risks in the portfolio other than redemptions (such as counterparty concentration limits). Several participating MMFs managers described finding it difficult to predict with confidence the size of redemptions in the scenario. This was partly due to uncertainty over the behaviour of investors, and the degree to which they would demand cash in a stress. It was also partly due to uncertainty over where the redemptions would flow to. For example, redemptions from pension funds to meet LDI calls may be reinvested in MMFs once received by the LDI fund manager, so while the gross redemptions and subscriptions could be large, the net flows were difficult to predict.

Chart A4.4: MMFs remain above minimum liquidity requirements throughout the SWES

MMF redemptions versus DLA levels



Sources: SWES submissions and Bank calculations.

Wider lessons about sector dynamics

The SWES exercise highlights the critical role played by OEFs, and particularly by MMFs, in meeting the urgent liquidity need faced by investors in a stress. These investment vehicles offer daily dealing in their liabilities and settlement periods which are compatible with the timelines governing the LDI recapitalisation process. However, redemptions from OEFs leads to asset sales and as described in Section 3.3, the sales can amplify price falls in some asset classes. And redemptions from MMFs can only be sustained while the fund holds sufficient buffers of overnight assets. As described in Section 3.1, a partial or delayed recapitalisation of LDI funds will very likely result in sales of gilts.

A number of OEF and MMF managers noted particular difficulty in assessing the likely scale of redemptions in the SWES scenario A key driver of OEF and MMF redemptions is the impact of the scenario on investors in those funds, and fund managers do not always have enough information to estimate this impact. Expected redemptions from OEFs could vary considerably depending on how fund managers assumed their investors would behave – for example, if their actions would be more like those seen in the 2022 LDI episode or the 2020 dash for cash episode. And the net effect of LDI recapitalisation on MMF redemptions depends on the balance between whether pension funds redeem from MMFs to source capital and whether LDI funds reinvest capital subscriptions back into MMFs This led to a very wide range of assumptions by SWES participants, from zero net outflows to outflows considerably larger than seen historically, leading to uncertainty as to whether a suspension could occur in more extreme cases

Banks

Banking sector response to the scenario

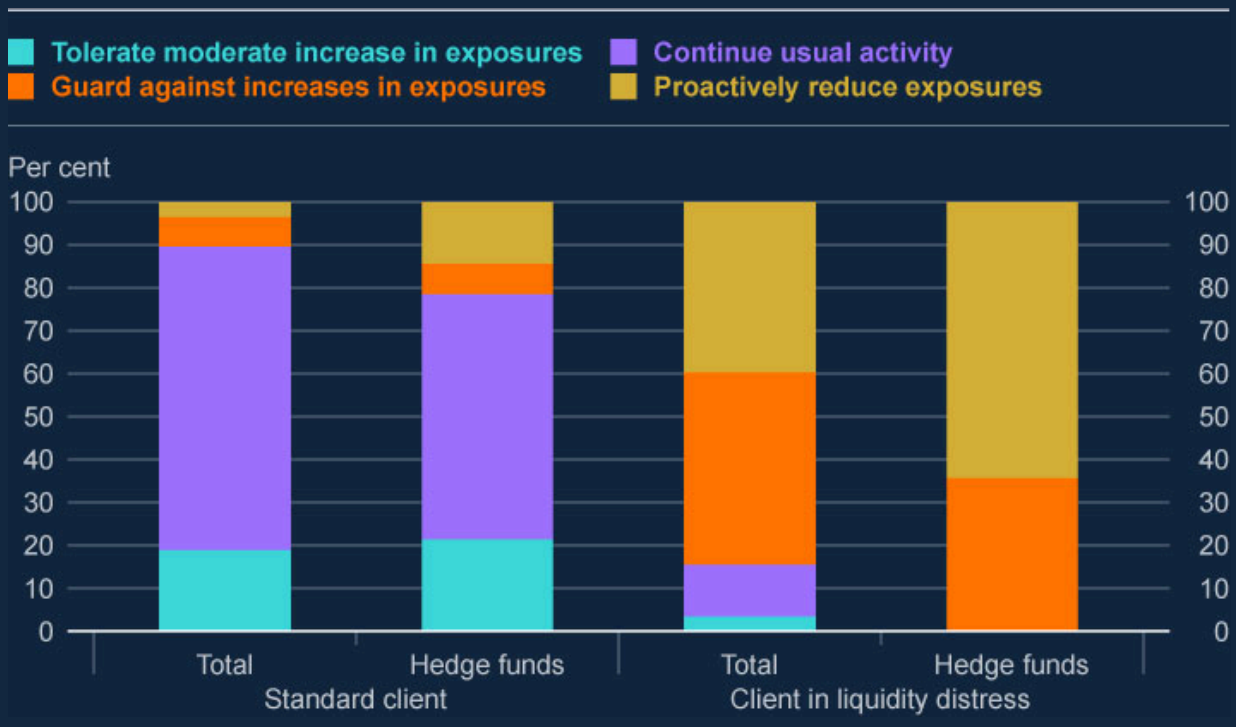
Section 2.2 includes a detailed summary of the direct impact of the SWES scenario on participating banks, and how they behave in response, while Section 3 includes a description of the resulting impact of these behaviours on the SWES markets of focus.

Banks are also indirectly impacted by the SWES scenario via its impact on their counterparties. One important dynamic we observe is that banks receive a notable volume of corporate bond collateral from insurers – although this is small in the context of large bank balance sheets. Banks cited a number of approaches to accepting corporate bonds as collateral. These included recycling received bonds into other margin pools and/or seeking to repo the bonds where possible. Some of these strategies may not be straightforward to execute successfully during a period of market disruption, for example if credit repo markets are stressed, or if banks' clients' positions are correlated.

Banks expected to be particularly cautious around hedge fund clients, given the stress amongst this sector that was inherent in the scenario narrative, including the default of a medium-sized relative value hedge fund in the first week of the scenario (Chart A4.5).

Chart A4.5: Banks often treat the hedge fund sector more cautiously than other clients in the SWES, particularly where there are signs of liquidity stress

Banks' characterisation of their overall approaches to different types of client during the SWES scenario (a)



Sources: SWES submissions and Bank calculations.

(a) Banks were asked to characterise their overall approach to each of the insurance, pension scheme, LDI fund / segregated mandate and hedge fund client sectors during the SWES scenario. The left-hand bars reflect banks' responses to 'standard' clients (ie clients who are not experiencing liquidity/solvency stress and who are not considered 'preferred' or 'upper tier' clients). The right-hand bars reflect banks' responses to clients experiencing liquidity stress.

Most banks thought a decline in corporate bond prices would lead them to review the risks they were exposed to in the asset class. Many expected this to lead to a restriction in appetite to provide additional corporate bond repo financing, and a few banks expected their appetite would reduce significantly. These firms would still be willing to provide additional corporate bond repo financing, but would reassess clients (including for counterparty credit risk) and potentially reduce tenors and increase haircuts. Banks tended to prefer to provide

financing through sovereign government repo than via corporate bond repo in stress owing to the lower risk and greater liquidity of gilt collateral. The importance of well-functioning repo markets is discussed in more detail in Section 3.2.

Banks were asked about how the stress would affect their provision of services to the real economy, during the ten days of the stress and, assuming the disruption in corporate bond markets persisted, over the next 2–3 months. Banks did not believe their willingness to provide services to the UK private non-financial corporate (PNFC) sector would be materially impacted during the scenario horizon, aside from transaction timetables being adjusted to avoid periods of poor market sentiment. In the medium term, banks generally did not expect that continued disruption in the corporate bond market would significantly affect their appetite to provide financing to the real economy, aside from in specific cases for weaker PNFC clients. Banks were also aware that impacted PNFC clients may draw down on revolving credit facilities which in turn would have some impact on their leverage and liquidity positions. Banks did not however expect this to the extent seen during the covid-induced “dash for cash”, where many PNFCs rapidly drew down on facilities for working capital or precautionary purposes, and which significantly influenced some banks’ behaviour in 2020.

Wider lessons about sector dynamics

UK-headquartered banks were asked how their actions in the SWES might have differed had the exercise occurred in the context of fewer central bank reserves. This question is in the context of the reduction in reserves supplied by the Bank of England, where central bank reserves held by banks are reduced as market participants purchase gilts from the central bank (unwind of QE) or banks repay central bank funding schemes (TFSME) using central bank reserves. Some noted that a reduction in reserves would i) reduce their excess cash which they might have deployed in the repo market ii) increase competition in funding markets used by banks and iii) increase leverage utilisation should banks opt to hold gilts instead of leverage-exempt reserves. But most banks noted that they expect to use central bank facilities such as the Short-Term Repo (STR) and the Indexed Long-Term Repo (ILTR) Facilities more, in both normal and stressed conditions, and no bank expected that their willingness to provide financing under a stress like the SWES would materially change. Banks’ responses underlined the importance of the STR facility in supporting their repo operations and in mitigating volatility in the price of shorter-duration gilts and relates markets. In some cases, banks expected to pass on any additional costs and/or haircuts to clients. In other cases, banks expected little change; particularly for repo lent to clients that is ‘matched’ against repo borrowed from other clients, rather than from central bank facilities.

Some banks noted that their response to the shock could have been quite different in the face of a different scenario. Had the exercise taken place at a different point in the year – for instance, shortly after shareholder distributions had been made – some banks' internal risk

management might have led them to react more defensively and be less open to taking on risk during the scenario. Had the scenario involved a liquidity shock to banks, such as significant drawdowns of revolving credit facilities provided by banks to NBFIs, the impacts on bank balance sheets might also have been quite different. Many banks reported that more acute impacts on their liquidity metrics, leverage ratios or funding positions, or material concerns about counterparty defaults would be the most likely factors resulting in a decision to reduce the scale of their client financing activity and provision of financial services generally.

Glossary

Abbreviations

ABS – asset-backed securities.

AUM – assets under management.

BAU – business as usual.

BPA – bulk purchase annuity.

CBI – Central Bank of Ireland.

CCP – central counterparty.

CNRF – Contingent NBFI Repo Facility.

CSA – credit support annex.

CSSF – Commission de Surveillance du Secteur Financier.

DB – defined benefit.

DLA – daily liquid assets.

FCA – Financial Conduct Authority.

FICC – Fixed Income Clearing Corporation.

FPC – Financial Policy Committee.

HQLA – high-quality liquid asset.

ILTR – Indexed Long-Term Repo.

IM – initial margin.

LDI – liability-driven investment.

MBF – market-based finance.

MMF – money market fund.

NAV – net asset value.

NBFI – non-bank financial institution.

OEF – open-ended fund.

PNFC – private non-financial corporation.

PRA – Prudential Regulation Authority.

PRC – Prudential Regulation Committee.

SONIA – sterling overnight index average.

STR – Short-Term Repo.

SWES – system-wide exploratory scenario.

TPR – The Pensions Regulator.

UST – United States Treasury.

VaR – value at risk.

VM – variation margin.

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1. **Sterling overnight index average**.
2. Bank calculations based on MiFID data and Bank Sterling Money Market Data (SMMD).
3. Unless otherwise specified, references to LDI funds in this report includes both pooled funds and segregated mandates.
4. Minimum resilience around this level would ensure that funds could absorb a severe but plausible historical stress and still have a remaining level of headroom necessary to operate during a period of recapitalisation.
5. IM calls are modelled assuming constant portfolios and do not reflect changed which might be made to portfolios over the ten days of the scenario.
6. **Review of margining practices**.
7. Unlike other parts of the SWES, for this data submission all participants were told to model the impact of the scenario as an instantaneous shock on a static balance sheet / static portfolios as this was the only way to compare estimates across firms. Some non-CCPs, in practise, used quantification techniques better suited for assessing a non-instantaneous shock. Further investigation showed this was not a material driver of the mismatches shown in this box and had CCPs modelled as a series of daily shocks it would not alter these conclusions.
8. The gilt market, the gilt repo market, the sterling corporate bond market, and associated derivative markets.
9. **Gilchrist and Zakrajšek (2012)**.
10. **Aslan and Kumar (2018)**.
11. **Griškevičienė et al (2021)**.

12. The gilt market, the gilt repo market, the sterling corporate bond market, and associated derivative markets.