Interconnectedness, Innovation and Unintended Consequences: What macroprudential policy can do to assess fragilities outside of the banking sector– speech by Randall S. Kroszner

Given at the Federal Reserve Bank of Cleveland and Office of Financial Research's 2023 Financial Stability Conference

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In this speech Randy Kroszner discusses the growth of non-bank financial intermediation since the global financial crisis and the challenges this poses for macroprudential policy. He sets out how the Bank of England's new System-Wide Exploratory Scenario (SWES) will help us better understand the ways in which, in a stress, the actions of individual firms can interact to exacerbate a shock and potentially generate systemic risk. He argues that this exercise provides a template that could usefully be applied in the US and elsewhere to identify potential sources of systemic risk in the non-bank sector.

Speech

1. Thank you to the Federal Reserve Bank of Cleveland and the Office of Financial Research (OFR) for hosting this Financial Stability Conference today and inviting me to speak to you all.

2. This is my first speech as a member of the Bank of England's Financial Policy Committee that I joined earlier this year.[1] Also, I have been chairing the OFR's Financial Research Advisory Committee since 2018. It is a great privilege to be able to bring the skills and experience gained in the United States to my FPC role, while also tackling the specific challenges facing the United Kingdom. As I will describe below, I'm also hopeful that some of the experiences from the FPC can provide helpful suggestions for the US. Both countries share an important relationship of the kind that helps generate a valuable exchange of ideas.

3. A defining moment for policymakers, academics and business was the 2008 global financial crisis (GFC). We all either experienced or understood the impact this financial instability had on people's livelihoods and, as a member of the Board of Federal Reserve Governors at the time, I witnessed what would continue as more than a decade of valuable research influence policymaking and shape today's global financial system. Going into the crisis, lending standards were inadequate, balance sheets were fragile and the level of capital in the system was too low. Reforms since this time have built significant resilience, primarily in the global banking system, and remain necessary to ensure banks can support households and businesses at all times, including times of stress.

4. The current risk environment, while not as dramatic as the 2008-09 period, is what we on the FPC like to call 'challenging'. The ongoing adjustment to higher interest rates as well as the aftermath of recent bank failures and increased geopolitical tensions means that parts of the global financial system remain vulnerable to stress and are subject to significant uncertainty.

5. Jeremy Stein, who you will have the privilege of hearing from tomorrow, famously said that the advantage of monetary policy over supervision and regulation was that it "gets

[1] The **Financial Policy Committee leads the Bank of England's work on financial stability**. It identifies and monitors risks that threaten the resilience of the UK financial system as a whole. The FPC normally has 13 members: six Bank of England staff (including the Governor, four Deputy Governors and the Executive Director for Financial Stability Strategy and Risk); five external members; and the Chief Executive of the Financial Conduct Authority as well as one non-voting member from HM Treasury.

in all of the cracks".[2] A key part of FPC's work over the past year has been to keep an eye on which cracks – that is, fragilities or fault-lines in the system – could potentially cause the wall to crumble as monetary policy does its thing and interest rate risks begin to crystallise. These cracks that we suddenly need to worry about could, for example, be the failure of mid-tier banks in the US earlier this year.

6. This recent period of potential instability and uncertainty, where in the UK we've also seen the stress in UK liability-driven investment (LDI) funds in Autumn 2022, is occurring within a landscape much changed since the GFC. In recent years we've seen a relative shift towards non-bank finance, the result of which is a much-expanded area over which macroprudential authorities like the FPC need to monitor, as well as a potential increase in vulnerabilities and fragilities. And, in recent years, events in a number of global markets have illustrated how liquidity conditions can quickly deteriorate, underlining some of the vulnerabilities in market-based finance.

7. It's the question of how to understand these fragile interconnections within the financial system, including between banks and non-banks, and how vulnerabilities could crystallise during stressed financial market conditions – as well as what policymakers can do to mitigate this – that I'd like to talk to you about today.

8. Specifically, I'd like to say a bit more about the Bank's **System-Wide Exploratory Scenario** (SWES), at the heart of which is a desire to get a better understanding of how the actions of individual firms can interact to exacerbate shocks. It seeks to answer questions such as: what are the drivers of firms' liquidity needs under market stress; what actions do firms take in response to those liquidity needs, and the liquidity available to them; and what additional actions might be taken to deleverage, reduce risk exposures, or rebalance portfolios? This exercise, alongside important efforts to fill the data gaps which we know are impacting our ability to understand the way in which these interconnections work will, I believe, go a long way to support better, more effective policymaking. I also hope the insights gained from this type of exercise will help us to be pro-active in promoting financial stability and thereby reduce the frequency of central banks having to intervene to stabilise markets.

9. But first I thought it might be useful to take a step back and discuss what's happened recently in the financial system which makes the SWES such an important exercise.

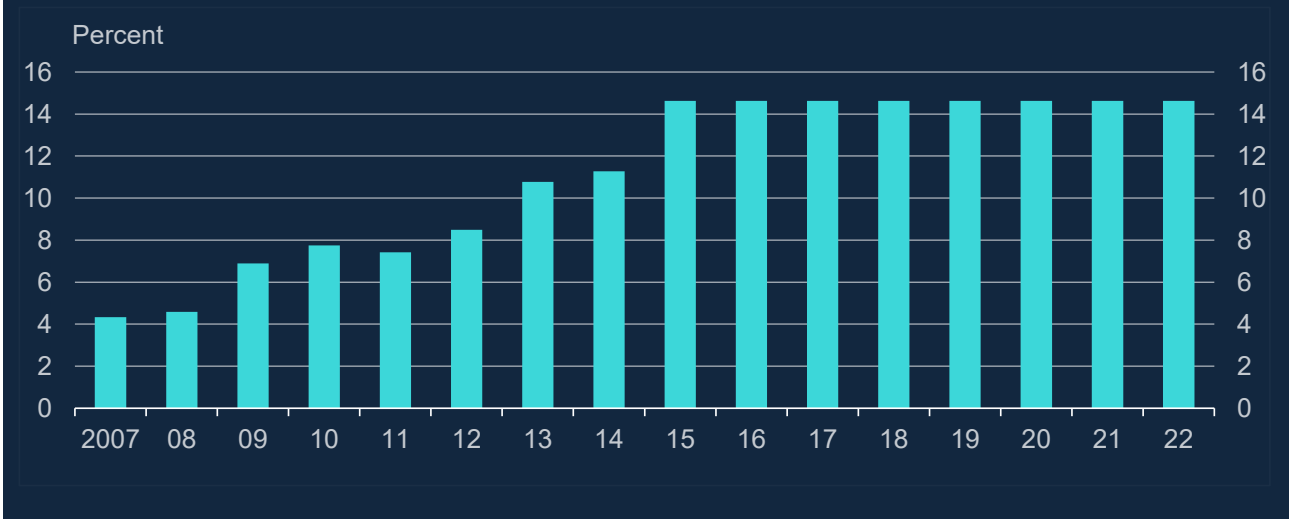
[2] See **Overheating in Credit Markets: Origins, Measurement, and Policy Responses**, speech by Jeremy Stein, February 2013

The changing landscape

10. In the immediate aftermath of the GFC, myself[3] as well as others such as my colleague and predecessor on the FPC, Anil Kashyap, along with Jeremy Stein and Samuel Hanson, warned that the nature of competition in financial services meant that even the 'modest' effects of post-financial crisis higher capital requirements "raise significant concerns about migration of credit-creation activity to the shadow banking sector, and the potential for increased fragility of the overall financial system that this might bring".[4]

11. The intended consequences of post-GFC bank regulatory reforms around the world have been to make banks more resilient to shocks. This includes higher capital and liquidity requirements as well as a variety other regulatory changes. As a result, the aggregate common equity Tier 1 (CET1) capital ratio of the major UK banks has risen from just over 4% at end-2007 to 14.6% at the end of 2022. In the US it has increased from just under 5% at the beginning of 2009 to 12.4% at the end of last year. (**Charts 1 and 2**).

Chart 1: Aggregate CET1 capital ratio of major UK banks (a)



Sources: PRA regulatory returns, published accounts and Bank calculations.

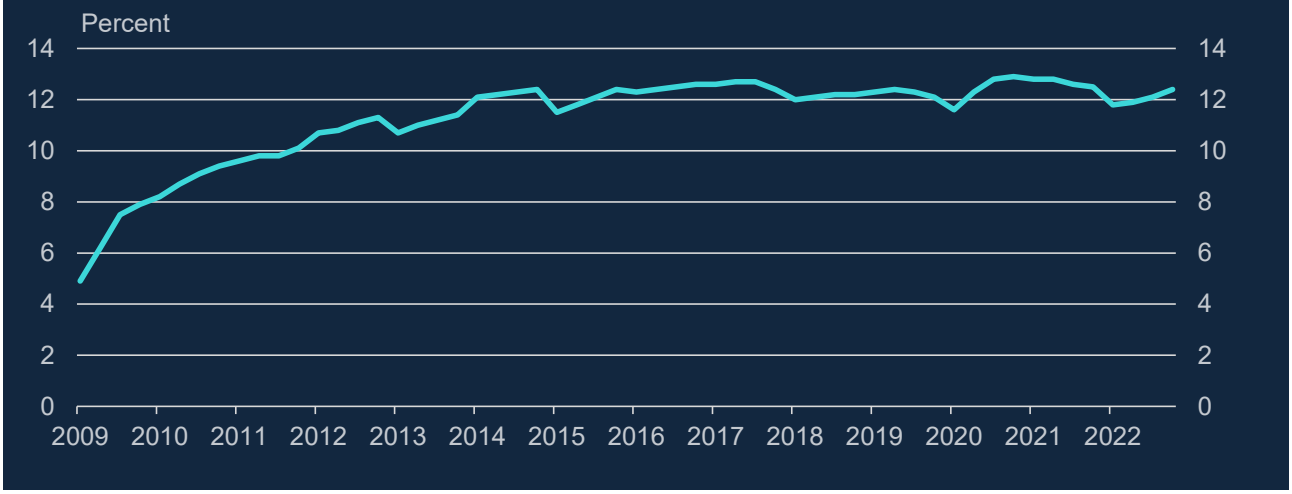
(a) The CET1 capital ratio is defined as CET1 capital expressed as a percentage of risk-weighted assets. Major UK banks are Barclays, HSBC, Lloyds Banking Group, Nationwide, NatWest Group, Santander UK,

[3] See Chapter 2 in Randall S. Kroszner and Robert Shiller, 'Reforming U.S. Financial Markets: Reflections Before and Beyond Dodd-Frank', Cambridge MA: MIT Press, 2011; Kroszner and William Melick, 'The Response of the Federal Reserve to the Recent Banking and Financial Crisis' in Jean Pisani-Ferry, Adam Posten, and Fabrizio Saccomanni, eds., 'An Ocean Apart? Comparing Transatlantic Response to the Financial Crisis', Brussels: Bruegel Institute and Peterson Institution for International Economics, 2011; and Kroszner, 'Stability, Growth and Regulatory Reform', in Financial Stability Review: Public Debt, Monetary Policy and Financial Stability, Banque de France, Paris, April 2012, pp. 87-93.

[4] See **An Analysis of the Impact of 'Substantially Heightened' Capital Requirements on Large Financial Institutions,** Anil Kashyap, Jeremy Stein and Samuel Hanson, May 2010.

Standard Chartered and (from December 2020) Virgin Money. From 2011, data are CET1 capital ratios as reported by banks. Prior to 2011, data are Bank estimates of banks' CET1 ratios.

Chart 2: Aggregate common equity capital ratio for 23 banks in the 2023 US supervisory stress test



Source: US Federal Reserve, **Dodd-Frank Act Stress Test 2023: Supervisory Stress Test Results June 2023**

12. Bank capital was clearly inadequate prior to the GFC and so reforms to increase the resilience and safety and soundness of the banking system have been extremely important for financial stability, as well as to protect the taxpayer against losses. That was the intended consequence – to make the banks more resilient to shocks and reduce incentives for excessive risk taking – or 'moral hazard'.

13. But risk does not necessarily disappear. It may instead migrate to other parts of the financial system, where it might be more difficult to observe, measure and monitor. In fact, we have seen an increase in non-banks undertaking functions that were previously primarily undertaken in banks, and this change is – in part – an unintended consequence of the post-GFC reforms.

14. In addition, technological and financial innovation is allowing new players to enter the market. Research by Lerner and others (2021)[5] has found that a majority of financial innovation since the GFC has been done by information technology firms and non-banks, rather than in the banking system. Buchak et al, looking at mortgage lending specifically, found that between 2007 and 2015, while regulation was responsible for roughly 60% of shadow bank growth, technology accounted for around 30%.[6] Whilst

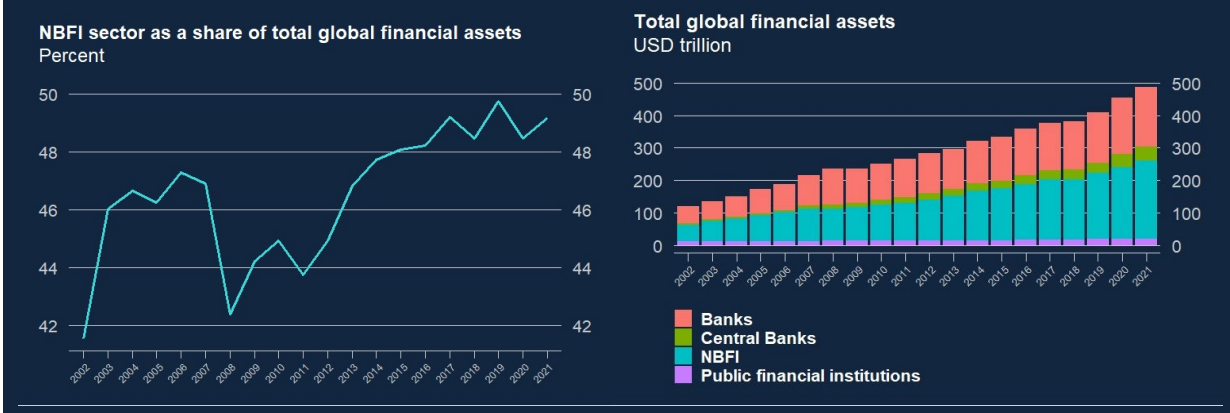
[5] See Josh Lerner, Amit Seru, Nick Short and Yuan Sun, **Financial Innovation in the 21st Century: Evidence from U.S. Patents (nber.org)**, July 2021 (revised March 2023)

[6] Buchak, Greg & Matvos, Gregor & Piskorski, Tomasz & Seru, Amit, 2018. **"Fintech, regulatory arbitrage, and the rise of shadow banks,"** Journal of Financial Economics, Elsevier, vol. 130(3), pages 453-483.

this innovation can lower costs of financial services and bring benefits for households and businesses by allocating capital to its most productive use, regulators have less sight of these developments and the new risks they may pose to financial stability. The FPC has recognised this in its **medium-term priorities**.

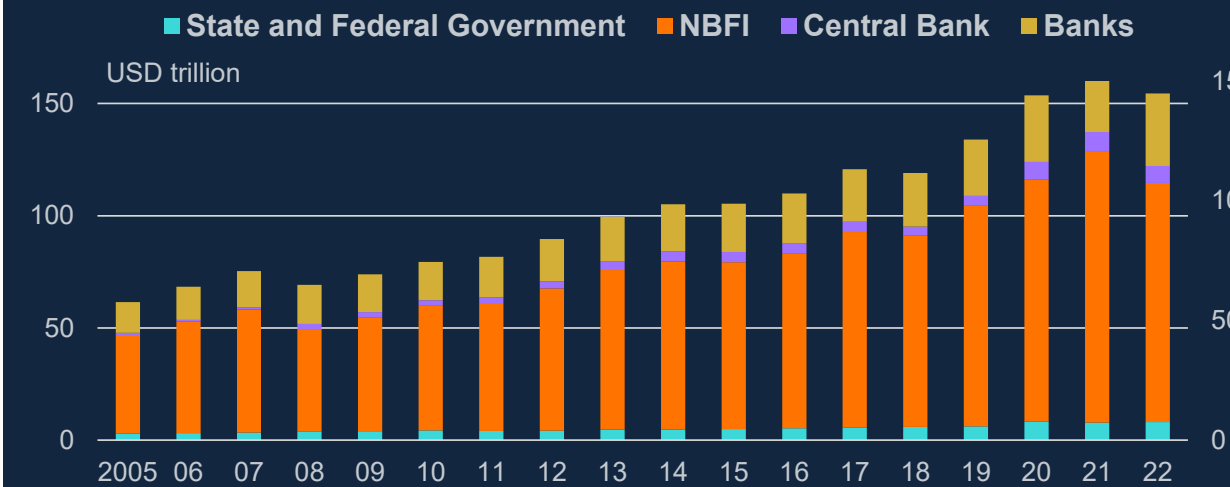
15. The change is clear in the data. In the UK the non-bank financial system more than doubled in size from the start of the GFC to the end of 2020, compared to banking sector growth of around 60%. Data from the Financial Stability Board (FSB) shows that non-banks now account for around half of the total assets making up the global financial system (**Chart 3**). In the both the US and UK there has been strong growth in NBFI financial assets, relative to banks (**Charts 4 and 5**).

Chart 3: The NBFI sector has grown significantly since the Global Financial Crisis



Source: Financial Stability Board, **Global Monitoring Report on Non-Bank Financial Intermediation 2022**, 20 December 2022, Graph 1-1

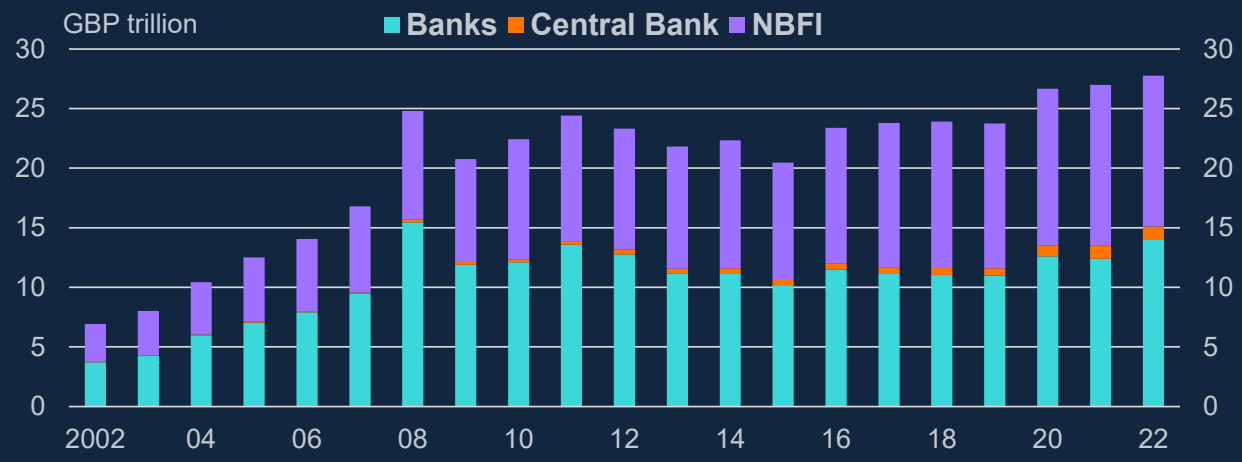
Chart 4: Breakdown of total financial assets in the United States (a)



Source: Federal Reserve Board (accessed via St Louis Fed's FRED database)

(a) NBFI includes mutual funds, ETFs, REITs and closed-end funds, insurance companies, pension funds, hedge funds, MMFs, security brokers / dealers and investment funds.

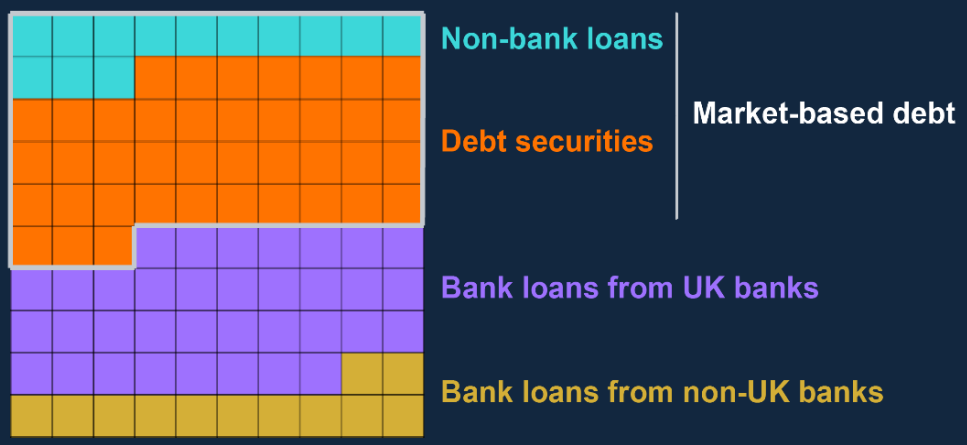
Chart 5: Total financial assets in the UK



Source: Bank of England and Office for National Statistics

16. In the UK, more than half of the total stock of corporate debt and nearly all of the net increase in lending to UK corporates since 2007 is in the form of non-bank loans or debt securities (**Chart 6**). The upside of this is that it has diversified the supply of finance for UK businesses. But it also means the FPC needs to ensure its net is cast widely enough to spot vulnerabilities within NBFIs and market-based finance that could pose risks to financial stability.

Chart 6: Composition of the current stock of UK corporate debt



Sources: Bank of England, Bayes CRE Lending Report (Bayes Business School (formerly Cass)), Deloitte, Eikon from Refinitiv, Financing and Leasing Association, firm public disclosures, LCD a part of PitchBook, ONS, Peer-to-Peer Finance Association and Bank calculations.

17. Private credit – defined as lending bilaterally negotiated between borrowers and lenders and typically arranged by non-banks – has also grown rapidly in recent years[7], generating increased attention amongst commentators, industry and policymakers. A recent report by Moody's warned that lack of visibility in this context would "make it difficult to see where risk bubbles may be building" and warned that "these trends could have repercussions for the broader economy."[8]

18. The net result is that a diverse range of banks, non-banks and financial intermediaries now interact to determine the operation of important financial markets. As such it is crucial in assessing the post-GFC reforms, and in assessing the stability of the overall financial system, that we look at risks beyond banks. The challenge for policymakers, however, is that relatively little is known about the risks and operation of NBFIs. The concern is that we end up playing a game of whack-a-mole, where a particular activity is pushed out of the banks but then pops up in institutions or markets in unforeseen ways because regulators, supervisors, as well as market participants may not have the same line of sight as they have with the banking system. Additionally, even though some of the firms holding the risk might seem small when considered individually, they may be large in aggregate or be correlated in their risks and behaviours in the face of a shock.

19. To redress this, we need to increase our understanding of how NBFIs operate and the risks they pose. And that means considering not just systemically important institutions but also the impact of many small but highly correlated NBFI firms on systemically important markets,

20. Janet Yellen **recently** underscored the potential risks associated with 'systemically important (non-bank) financial institutions', and the subsequent new analytical **framework adopted by FSOC** shows that this issue is top of mind for regulators in the US as well. Until we understand the fragilities in the NBFI sector and the potentially fragile interconnections among NBFIs and with the traditional banking sector, however it will be difficult to make these judgements and set priorities.

A framework for considering fragilities and risks that could become systemic

21. So how should we think about these risks and vulnerabilities? In my teaching I tend to focus on three sources of fragility in the system: leverage, liquidity, and interconnectedness.[9]

[7] See Bank of England, **Financial Stability Report**, July 2023
[8] Moody's Investor Service, 28 September 2023, Private Credit - Global
[9] See Reforming U.S. Financial Markets: Reflections Before and Beyond Dodd-Frank, Cambridge, MA: MIT Press, 2011, co-authored with Robert J. Shiller; and Kroszner, Banque de France (2012)

22. In each of these buckets we face choices involving trade-offs and risk appetite. High leverage means a smaller cushion against losses, but higher leverage also means more credit to finance growth. And, as my FPC colleague Jon Hall has argued, high leverage can increase the likelihood of pro-cyclical behaviour that amplifies shocks.[10] The maturity transformation of short-term deposits into long-term loans throws up all sorts of questions about liquidity risks. Interconnections have helped drive efficiencies and innovations but can also lead to unexpected correlations which amplify idiosyncratic problems and turn them into systemic crises. The role of policymakers and regulators is more than simply identifying these risks and acting on them. As I've long argued, we always need to consider unintended consequences and cost-benefit trade-offs, even for extremely well-motivated rules.[11]

23. But we are still in a learning phase as we get to grips with this new landscape and work out what we know, and what we don't. At the heart of the FPC's approach is the belief that, given the interconnectedness in the financial system, we must go one step further and think about the system-wide risks from the actions and behaviours of agents in the financial system as a whole, even if individual actors (banks or non-banks) are well supervised and subject to robust regulation.

24. I am often asked what I would have done differently as a Governor at the Federal Reserve during the GFC. I reply I would have wanted more data and a deeper understanding of the financial system as a whole. Better data would have given us earlier sight of the interconnections in the system that turned problems in sub-prime mortgages into a global crisis. It would have helped give regulators and policymakers a broader view of the system and perhaps encouraged them to ask more questions about how risks could transmit within the financial system and across the globe. It would have made things that seem obvious in retrospect more apparent at the time. I often use an iceberg analogy: the risks of an iceberg are not simply what you can see above the water line but what you cannot see below the water line.[12]

25. So, the need for better – and more – data is something I continue to argue for. Not just through my membership of the FPC but also as Chair of the Financial Research Advisory Committee of the OFR.

26. In the FPC we have been clear how, given the global and fragmented nature of market-based finance, some **important gaps remain in the data available**, and this can impede the effectiveness of our risk assessment and actions to enhance resilience in the system.

27. Addressing these gaps in the data to provide a better view of risks and support UK and global financial stability, and how the FPC uses data more broadly, is a key priority.

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[10] See **With leverage comes responsibility − speech by Jonathan Hall | Bank of England**
[11] See Randall S. Kroszner, A shipping disaster's lessons for Dodd-Frank, Financial Times, July 2015
[12] See Randall S. Kroszner, **Written evidence to Treasury Select Committee**, January 2023

This will require a combination of improvements to the type, quality, and coverage of the data; international efforts to share data across borders more openly and collaboratively; and a better understanding of contingent liquidity risk to determine the scale of the threat to financial stability. Relying on exposures data alone is sub-optimal, especially when positions are dynamic.

The System-Wide Exploratory Scenario (SWES)

28. Given all of the above, I am delighted to say that last Friday the Bank of England announced further details of how it will undertake an exercise that will be the first of its kind to increase substantially our understanding of risks in the NBFI sector and how these risks interact with the rest of the financial system to affect financial stability.

29. The exercise includes over 50 participants from across the UK financial system - banks, insurers, central counterparties, pension funds, hedge funds and asset management funds. We have received excellent cooperation, support and input from these firms to consider a scenario that aims to enhance our understanding of the risks to and from NBFIs. This includes a better understanding of the behaviour of NBFIs and banks in stress, what drives that behaviour; and a means of investigating how these behaviours and market dynamics can amplify shocks in markets and potentially bring about risks to UK financial stability. It focuses on markets that are core to UK financial stability and where fragilities can manifest, namely markets for government and corporate bonds, repo markets for these assets and associated derivatives markets, such as interest rate, cross-currency and inflation swaps. It will go a long way to help us better understand the fragilities I mentioned earlier of leverage, liquidity and interconnectedness.

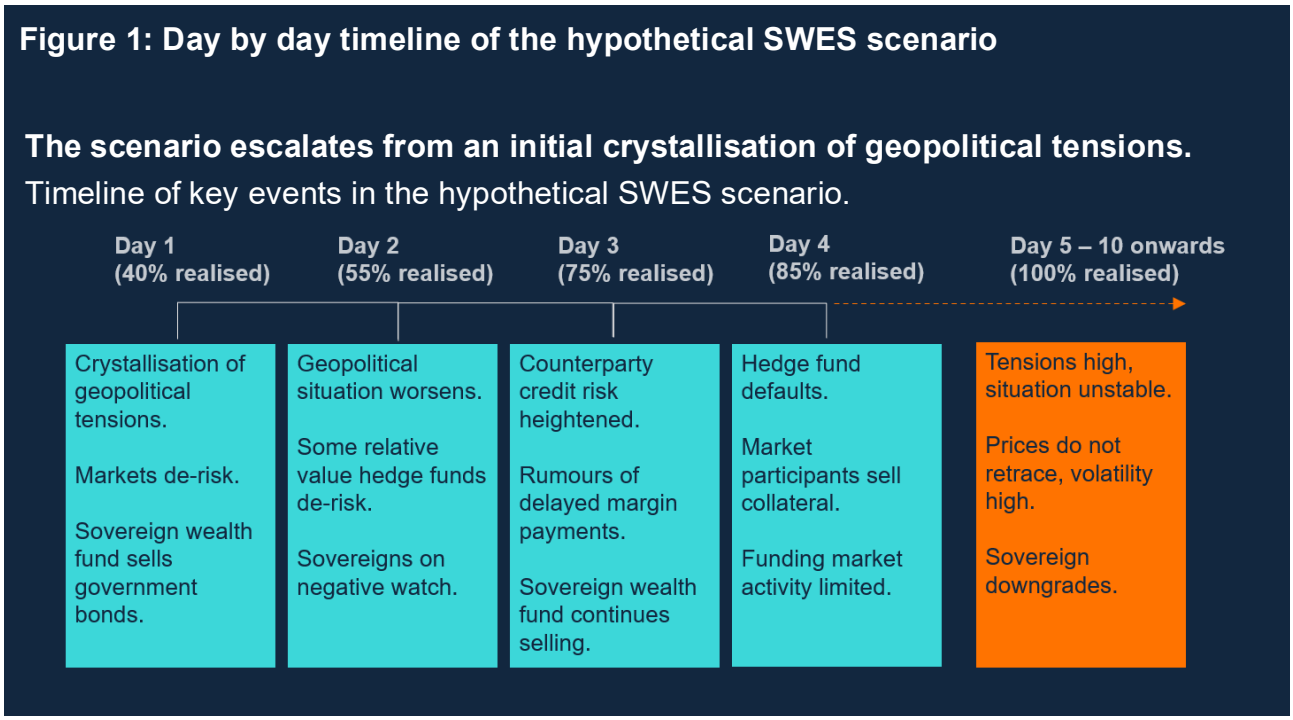
30. In June the Bank launched an initial information gathering of the SWES and then last week we published details of the severe but plausible stress to global financial markets that participating firms will need to evaluate the impact of.

31. I'd like to spend a bit of time now taking you through details of the exercise, including what we published last week.

32. In the scenario (**Figure 1),** a sudden crystallisation of geopolitical tensions causes a sharp deterioration in expectations of economic fundamentals, along with elevated uncertainty about future developments. Markets begin de-risking, risky asset prices fall, and volatility sharply increases.

33. The scenario plays out over several days with significant sales of advanced-economy government debt. Falls in asset prices are exacerbated by de-risking at relative value hedge funds and by the fourth day of the scenario one of the mid-sized hedge funds in stress defaults and firms act to sell collateral in the markets, driving further asset price falls.

Figure 1: Day by day timeline of the hypothetical SWES scenario



Source: Bank of England

34. The specific shocks to rates and risky asset prices incorporate many elements of recent real-life events. For example, the shock to yields on 10-year gilts are roughly 90% of the severity of those observed during the LDI episode while the shock to yields on 10-year US Treasury notes is comparable to the largest historically observed.

35. Taken together, the severity of the aggregate shock in these paths is largely faster, wider ranging, and more persistent than observed in both the March 2020 'dash for cash' when the actions of some NBFIs amplified the initial market reaction to the Covid-19 pandemic to create a severe liquidity shock globally,[13] and the 2022 LDI episode in the UK.[14]

36. What's more, the narrative around the shock particularly emphasises the inherent uncertainty in the hypothetical scenario and the expectation of longer-term shocks to economic fundamentals. The aim is that this will help ensure action from SWES participants are realistic in a context of heightened and protracted uncertainty which is difficult to quantify in short-term price paths alone.

What we can learn from the SWES

37. Last week's publication allows for Round 1 of the scenario to begin in earnest. Participants will first be asked to model the impact of the shock, and their intended actions in response to it. Once these firms have told us how they would respond to the

[13] See '**The role of non-bank financial intermediaries in the 'dash for cash' in sterling markets' | Bank of England Financial Stability Paper No.47 June 2021**
[14] See **letters from Sir Jon Cunliffe, Deputy Governor of Financial Stability at the Bank of England to the Chair of the Treasury Committee dated 5 October** and **18 October**.

initial stress scenario, staff at the Bank of England will look to identify how that scenario may be affected by their collective actions. The Bank will then ask how an updated scenario, which takes into account any potential amplification effects, might lead firms to take different actions.

38. As I mentioned earlier there are three key transmission channels which the FPC will be studying closely, which are also illustrated in **Figure 2**:

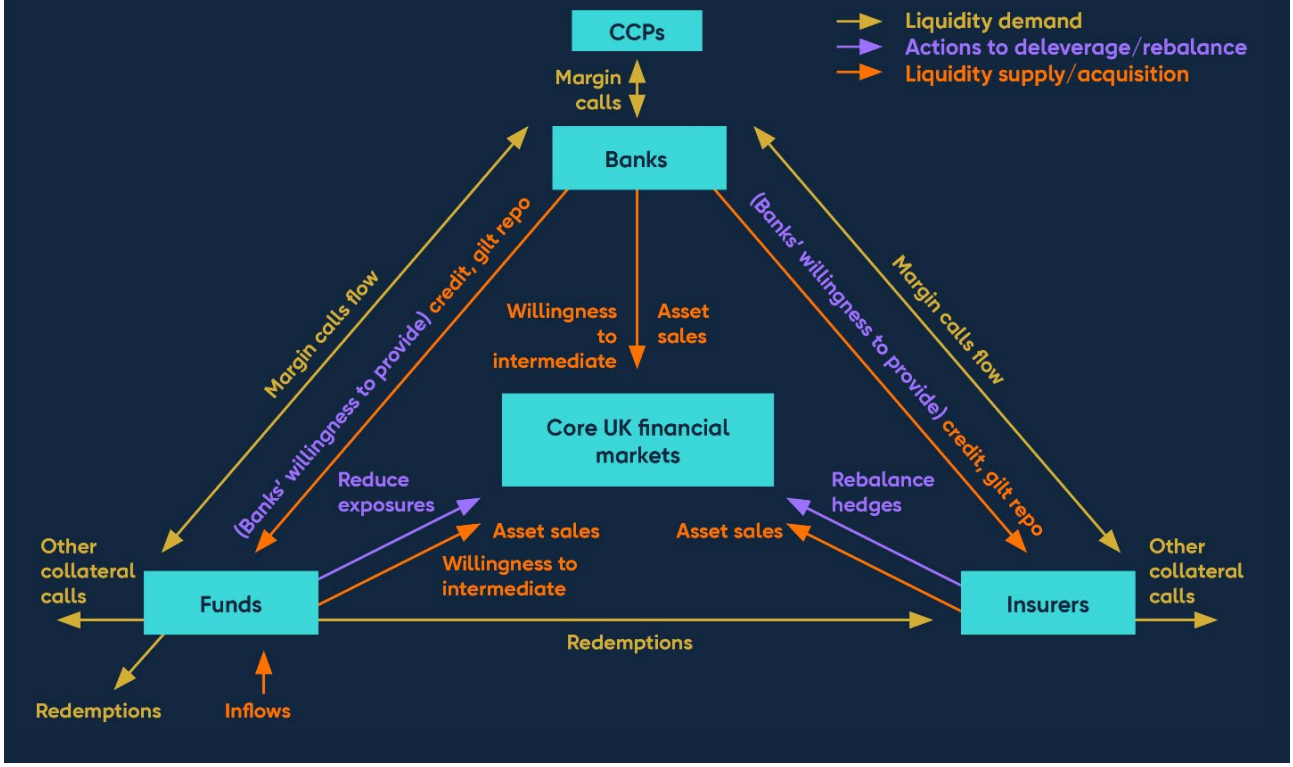
- **What are the drivers of firms' liquidity needs under the market stress:** For example, during the stress investors might make redemptions from funds which would lead to a direct reduction in their liquidity. Firms may also be required to post additional collateral.

- **What actions do firms take in response to those liquidity needs, and the liquidity available to them**: Firms may need to sell assets or draw down on credit facilities to meet those liquidity needs. They may also use liquidity management tools, for example to manage costs associated with redemptions.

- **What additional actions might be taken to deleverage, reduce risk exposures, or rebalance portfolios**: The FPC is keen to investigate both actions taken to respond to the elevated risk environment and those that reflect a reduction in risk appetite. For example, during the stress, firms may take steps to limit their exposures to certain counterparties or reduce or exit positions in certain markets. Firms may additionally have mandates or internal limits that prevent them from holding certain types of instruments, or that require them to maintain a particular balance between holdings.

39. The channels above mostly relate to how NBFIs behave in the stress. But we'll also examine the role of banks and central counterparty clearing houses (CCPs) in the scenario. This will include banks' willingness to act as intermediaries in these markets and provide financing to the wider financial system. We will ask CCPs for information on the impact of the stress, their role in issuing margin calls, and how they might reinvest some of the margin received.

Figure 2: The key transmission channels the SWES will investigate



Source: Bank of England

40. CCPs sit at the centre of the UK and global financial system and so their resilience is important to financial stability in both the UK and globally.[15] Last week the Bank of England also published its latest **CCP supervisory stress test** showing the UK CCPs were resilient to market stress scenarios that are of equal or greater severity than the worst-ever historical market stresses. Supervisory stress test like these, alongside exercises like the SWES, will have a key role to play in assessing resilience, providing transparency, and promoting confidence.

41. A novel exercise like the SWES will go a long way in helping the FPC better understand vulnerabilities in the NBFI sector going forward. Alongside the learnings around behaviour I've mentioned already, I expect the exercise to help us identify data gaps that might impact our ability to monitor developments as deeply as we would like.

42. We currently stress test different sectors of the financial system separately to ensure resilience and set policy for each sector. While it is necessary to understand each set of risks, this approach is incomplete. We also actively need to consider risks from a system wide perspective and set macroprudential policy given interactions between

[15] See Randall S. Kroszner, On the historical role of CCPs and systemic risk, see Kroszner, "Lessons from Financial Crises: The Role of Clearinghouses," Journal of Financial Services Research, December 2000, vol. 18, pp. 157-71; and Kroszner, "Can the Financial Markets Privately Regulate Risk? The Development of Derivatives Clearing Houses and Recent Over-the-Counter Innovations," Journal of Money, Credit, and Banking, August 1999, 569-618.

different sectors in the financial system, especially as the non-bank sector has experienced rapid growth since the GFC.

43. Unlike the Bank's concurrent stress test of the UK banking sector the SWES is not a test of the resilience of individual firms participating in the exercise. It is deliberately exploratory in nature, to help policymakers build up a more detailed understanding of how individual components of the financial system interact together in stress. I'm genuinely excited about what we'll learn from the exercise, and I'd encourage colleagues here in the US to consider the benefits of running a similar assessment here.

44. There potentially remain a number of risks from changes and innovation in the financial system that we have not yet considered, and which may not be captured by exercises like the SWES. For these, we should step back and focus more on the drivers of financial innovation. This might help us to spot risks before they grow and interact with existing vulnerabilities; innovations in financial markets can take place whenever the conditions are ripe, even if they are not taking place in sectors that we monitor more heavily.

Conclusion

45. It is crucial for regulators and supervisors to be aware of, and sensitive to, the intended and unintended consequences of their actions for financial stability.

46. The pace of technological innovation we are currently living through means it is also easier for non-traditional competitors to enter the financial markets and for innovations such as AI to change behaviour in those markets. Thus, it is crucial for macroprudential policymakers to try to understand where the cracks and fault-lines are in the system as a whole, not just in the banking sector, as the players providing financial intermediation services rapidly evolves.

47. We should not just "look under the lamppost" where we already have light by way of extensive and granular data. We must also try to build a greater understanding of NBFI that is increasingly important but where we have much fewer data and where there is much less light.

48. That is why SWES-style exercises are such an important part of our work. I hope that it will generate new data and identify where key data gaps are, hence, where we should focus efforts to gather data. I also hope that the FPC's pioneering foray into this area will spur others to undertake similar exercises in their jurisdictions. Relatedly, this may provide the basis exercises that involve regulators, supervisors, banks, and non-bank financial institutions and markets around the globe to understand cross-country fragilities and channels of risk transmission.

49. In the US, for example, the OFR could play and important role with the FSOC to design a stress scenario and help to provide a foundation for the analysis of what institutions and markets the FSOC might focus on as ‘systemically important.’

50. Such work will help to improve macroprudential policy by shedding light on the ‘shadows’, identifying cracks and fault-lines and, I hope, make the financial system more resilient globally with fewer calls on central banks to intervene to stabilise the financial system. I look forward to your comments and questions.

51. I am grateful to Steve Dodkins, Gary Harper, David Latto, Maighread McCloskey, Sumer Singh and Angus Peniston-Bird for helping to prepare this speech, and to Martin Arrowsmith, Jon Hall and Matt Waldron for their helpful comments and contributions.

Annex – Further details of SWES scenario

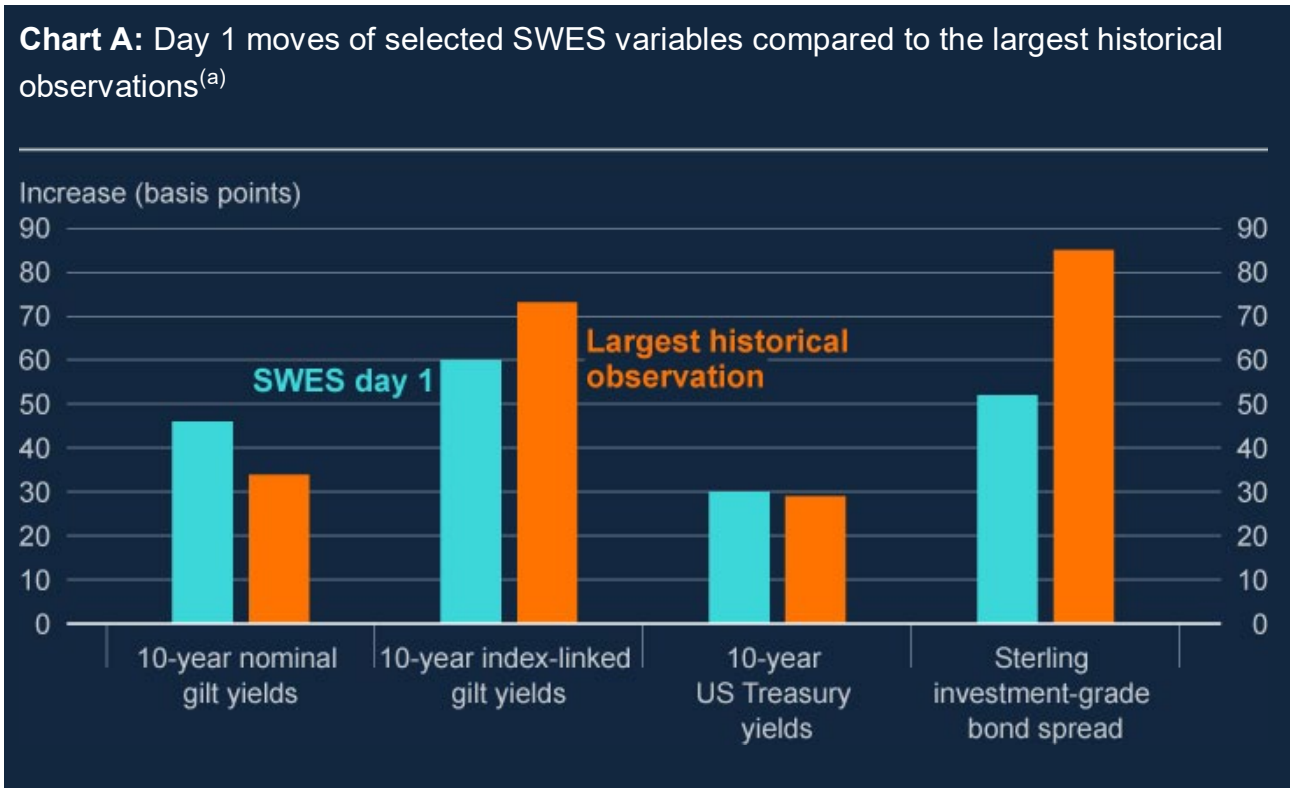
Table A: Comparison of shock severity

	SWES scenario	'Dash for cash'	LDI event	Largest historical observation	ACS 2022 [(a)]
10-year nominal gilt yields	115 basis points	50 basis points	133 basis points	133 basis points	95 basis points
10-year index-linked gilt yields	150 basis points	79 basis points	170 basis points	170 basis points	N/A
10-year US Treasury yields	75 basis points	20 basis points	35 basis points	76 basis points	90 basis points
Sterling investment-grade corporate bond spread	130 basis points	132 basis points	14 basis points	132 basis points	60 basis points
Equities (global)	-15%	-25%	-7%	-27%	-21%

Source: Bank of England

(a) ACS 2022 refers to the scenario used in the Bank of England's stress test of the UK banking system. Further details, including the results, can be found **here.**

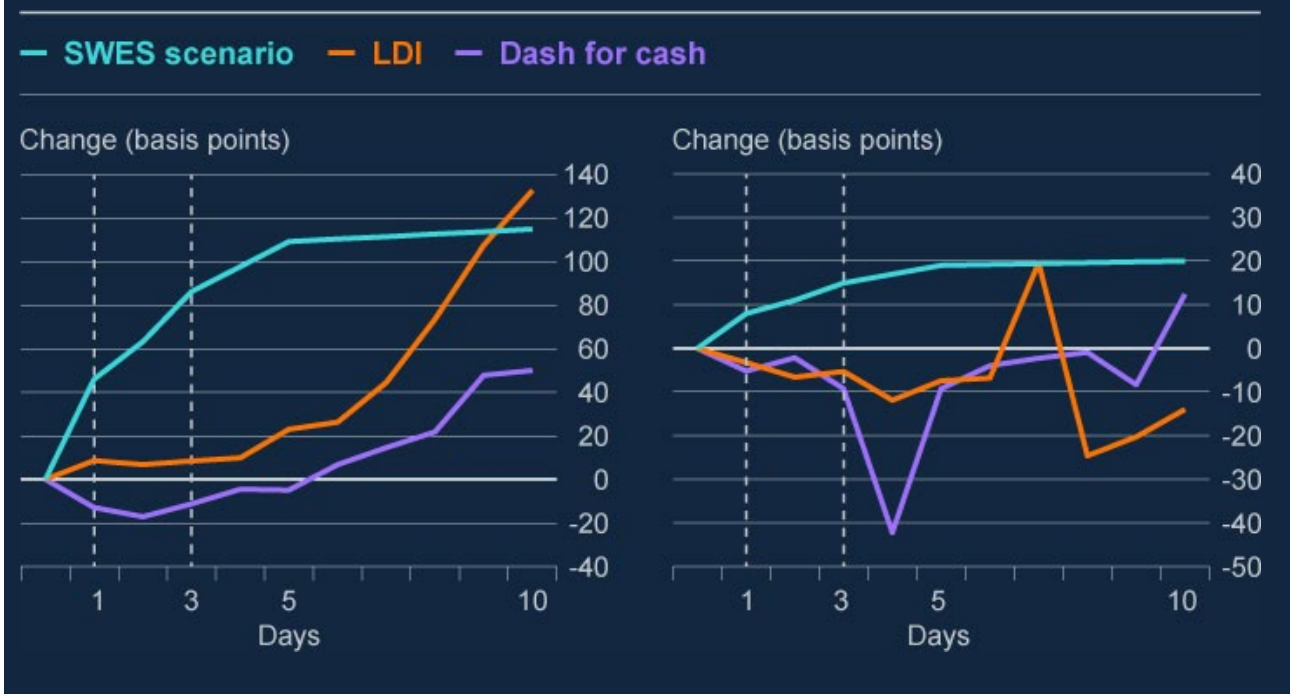
Chart A: Day 1 moves of selected SWES variables compared to the largest historical observations[(a)]



Sources: Bank of England, Bloomberg Finance L.P, Board of Governors of the Federal Reserve System (US) and Bank calculations.

(a) The gilt yield, US Treasury yield, corporate bond, and equity back data start from 1 January 2000. Repo rate back data start from 1 July 2016. The back data for all gilt yields includes September 2022, when yields peaked unusually sharply.

Chart B: Evolution of 10-year gilt yields (left) and gilt repo rates (right) over the 10-day horizon encompassed in the price paths, compared to the dash for cash and LDI episodes[(a)]



Sources: Bank of England and Bank calculations.

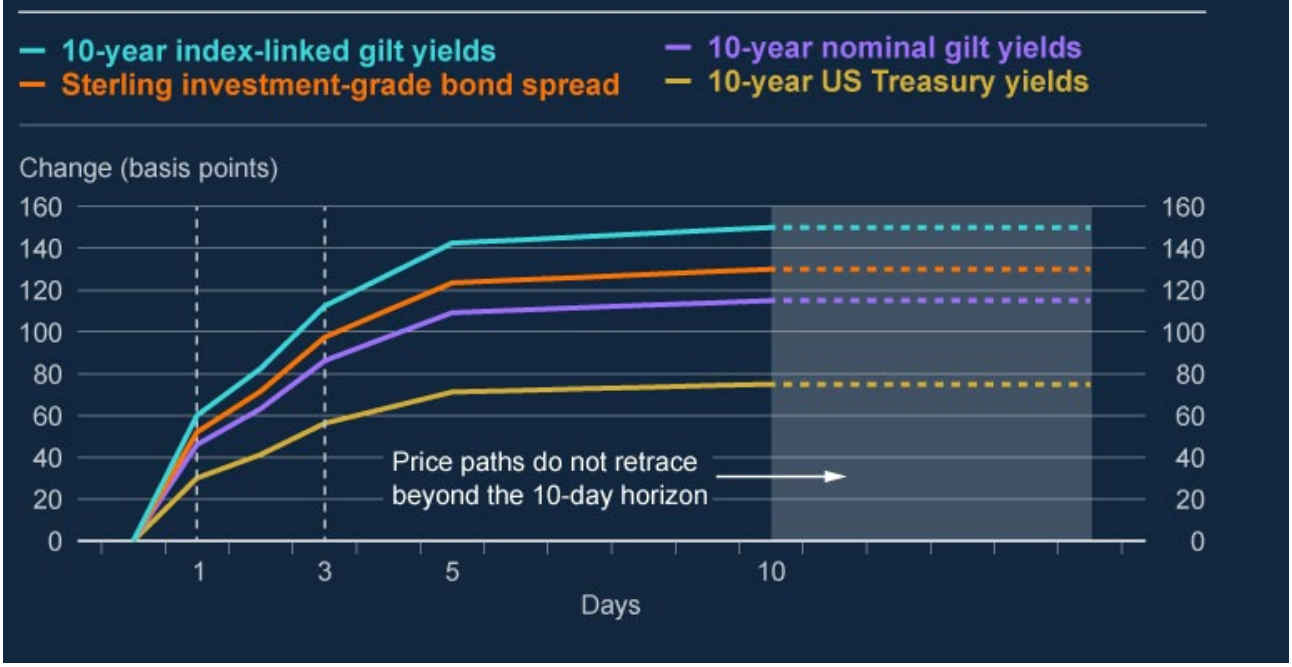
(a) For comparison we have charted daily moves relative to 10 days before 19 March 2020 and 27 September 2022 for the dash for cash and LDI series respectively.

Chart C: Evolution of 10-year US Treasury yields (left) and sterling investment-grade corporate bond spreads (right) over the 10-day horizon encompassed in the price paths, compared to the dash for cash and LDI episodes[(a)]

Sources: Bloomberg Finance L.P, Board of Governors of the Federal Reserve System (US) and Bank calculations.

(a) For comparison we have charted daily moves relative to 10 days before 19 March 2020 and 27 September 2022 for the dash for cash and LDI series respectively.

Chart D: Evolution of 10-year nominal gilt yields, 10-year index-linked gilt yields, 10-year US Treasury yields, and sterling investment-grade corporate bond spreads



Sources: Bank of England, Bloomberg Finance L.P, Board of Governors of the Federal Reserve System (US) and Bank calculations.