



BANK OF ENGLAND

Speech

Financial resilience and economic earthquakes

Speech given by

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In the aftermath of the financial crisis, a new buzz phrase emerged in economic policymaking: macroprudential policy. It tells you something about economic policymakers that this phrase qualified as buzz. But after a fragile financial system had sideswiped the economy, turning what could have been an economic downturn into a disaster, it was difficult to disagree with the aim: to promote a financial system that could serve households and businesses in bad times, as well as good. That means a financial system that is resilient to the bad times, but not so resilient as to be inefficient the rest of the time.

In many respects, the idea of macroprudential policy was vintage wine in a new bottle. The term was used at least as far back as 1979¹ and the approach was set out in some depth in 2000 by Andrew Crockett, General Manager of the Bank for International Settlements and previously an Executive Director at the Bank of England.²

The innovation after the crisis was to create a new independent committee in the Bank of England – the Financial Policy Committee (FPC) – to make the idea an operational reality. In just the six years of its official existence, the FPC has: boosted the resilience of the banking system, dealt with threats from pockets of credit growth, limited high loan-to-income mortgage lending, built greater resilience to cyber-attack, and ensured the core of the UK financial system is resilient and prepared for Brexit, whatever form it takes.

You may be relieved to know that will be my final mention of Brexit today. We continue our work to ensure the financial system is prepared, but today I want to look beyond, to the future for macroprudential policy. Building on the strong foundation of its achievements so far, the job now is to ensure that standards of resilience in the financial system move with the times. In that, we must be agile and disciplined.

So today, I'll look at two themes. The first is how we keep pace with a changing economy. We are using cutting-edge research to monitor how developments in debt levels today affect the severity of economic downturns in the future. Armed with this, we can consistently build resilience into the financial system well ahead of when that resilience is needed.

The second theme is how we are keeping pace with a changing financial system. New research is enabling us to simulate the effect of economic downturns on the growing non-bank financial system. It has highlighted possible weak spots that need monitoring and some that need new standards of resilience.

Keeping up with the economy

Disciplined macroprudential policy builds resilience to economic shocks into the financial system well before it's needed. You don't make cities near fault lines resilient to earthquakes by waiting until there are tremors that signal a quake may be imminent. That would be not just ineffective; it would be counterproductive,

¹ See Piet Clement, '[The term "macroprudential": origins and evolution](#)', *BIS Quarterly Review*, March 2010.

² Andrew D Crockett, '[Marrying the micro- and macro-prudential dimensions of financial stability](#)', remarks before the Eleventh Conference of Banking Supervisors, Basel, September 2000.

leaving the city with buildings under re-construction and surrounded by scaffolding and cranes just as an earthquake hit.

The right approach, for building resilience to earthquakes into structures, and for building resilience to economic shocks into financial systems, is to focus not on tremors, but on the underlying vulnerability. By underlying vulnerability I mean how serious a quake – real or economic – could be *if one occurred at any point*. Whether a quake seems likely to occur soon has no bearing on this.

For resilience in structures, the best indicator of underlying vulnerability is how close the city is to the fault line or plate boundary. On that basis, Apple's new California HQ uses new earthquake resilient technology.³

For resilience in the financial system, it is how much debt there is in the economy (or economies) to which it's exposed. That's why, when we come to decide how big the banking system's buffers of loss-absorbing capital should be, we don't focus on any economic tremors we may feel. We don't insist on tougher standards just because trade tensions threaten to slow the world economy or changes in sentiment hit financial markets, or because uncertainty is weighing on the domestic economy.

Instead we focus on debt – a key driver of how far up the Richter scale economic earthquakes tend to be.⁴ Think of a build-up of debt as being the economic equivalent of building close to a fault line. When a quake hits, the impact is greater and more resilience is needed in the structures.

This focus means we can appear contrarian. Debt has a habit of increasing in calm periods, when those in the financial system think it's safe to take more risks. So we can find ourselves demanding tougher standards when risks are thought by many to be low. And we don't start demanding them when the tremors start, when risks are thought by many to suddenly be high. We aim to be countercyclical.

Our work shows three features of debt to be of particular importance.

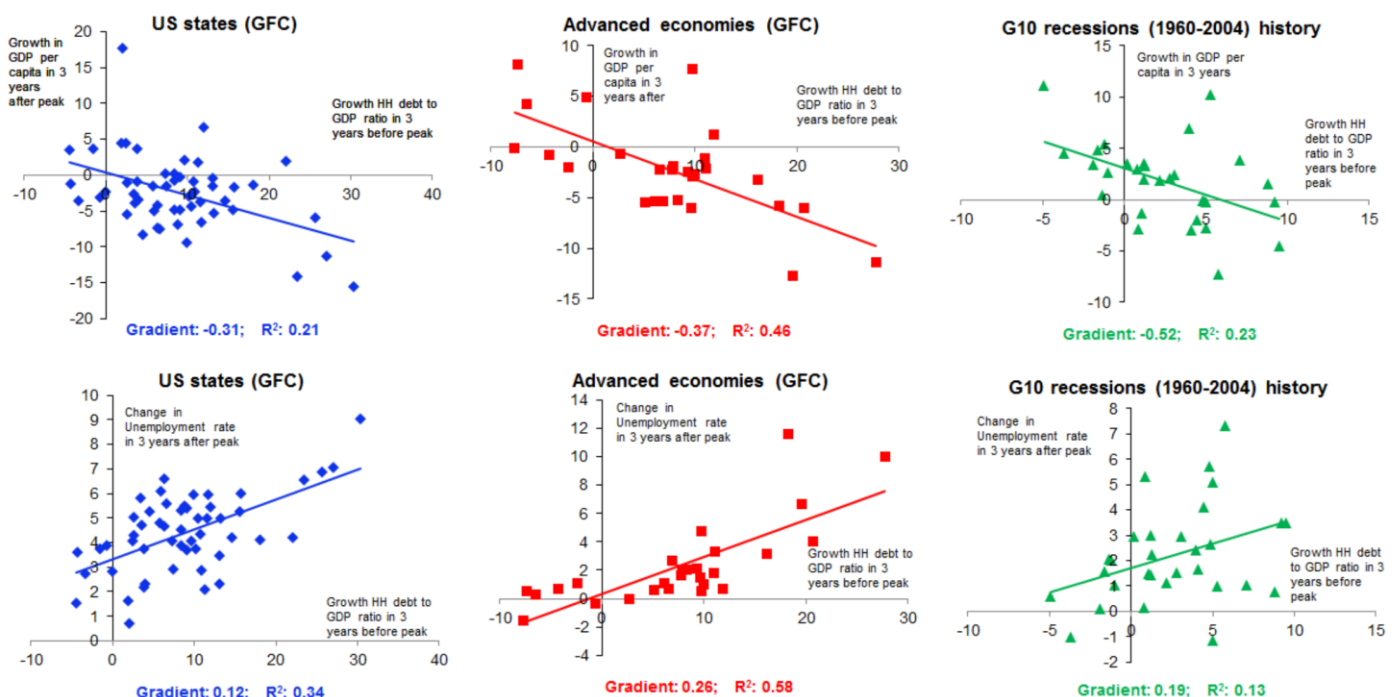
³ Thomas Fuller, '[Inside Apple's Earthquake-Ready Headquarters](#)', *New York Times*, 4 June 2019.

⁴ This approach was exactly what Andrew Crockett outlined almost 20 years ago: "The received wisdom is that risk increases in recessions and falls in booms. In contrast, it may be more helpful to think of risk as increasing during upswings, as financial imbalances build up, and materialising in recessions... And because the timing of downswings is exceedingly hard to predict, the approach implies a focus on measuring the vulnerabilities that build up in the upswing and on the more recurrent features of cycles. We may not know exactly when the rainy day will come, but we can be pretty sure that it will. It is not wise to decide on policies or business strategies on the assumption that it will not, or that we can predict its timing with sufficient foresight."

Mortgage debt

Households with more mortgage debt tend to cut back more in downturns. People do everything they can to pay the mortgage. During the financial crisis, the fall in consumption relative to income among UK households with loan to income (LTI) ratios above four was around three times larger than the fall among those households with LTI ratios between one and two. But the effect can be to prolong the economic pain for everyone by reducing spending, and therefore amplifying the effect on incomes and output in the economy. The evidence, across countries, recessions (and US states) is compelling: build-up of household debt means an economy is exposed to more severe recessions (**Chart 1**).

Chart 1 Household debt growth in the boom and the economic severity of the subsequent bust: across US states, countries and time for GDP and unemployment



Source: David Aikman, Jonathan Bridges, Anil Kashyap and Caspar Siebert, '[Would macroprudential regulation have prevented the last crisis?](#)', Bank of England Staff Working Paper No. 747, August 2018.

Notes: State level household debt statistics (left hand panel) from Federal Reserve Bank of New York; GDP data from Bureau of Economic Analysis (BEA); unemployment data from Bureau of Labour Statistics. Change in household debt to GDP ratio from 2004 to 2007 on x-axis, economic performance from 2007 to 2010 on y-axis. International data (middle and right panels) uses [Bridges et al. \(2017\)](#) dataset: household debt data from Bank of International Settlements "Long series on total credit and domestic bank credit to the private non-financial sector"; real GDP and unemployment data from the OECD, the Global Financial Database and national statistics websites. Middle panel shows experience across 27 advanced economies in the Global Financial Crisis, using same dates as U.S. state panel. Right hand panel is for recession episodes in G10 countries from 1960 to 2004 (i.e. Great Recession not included). A recession is defined as two consecutive quarters of negative real GDP growth, with at least eight quarters between consecutive peaks or troughs.

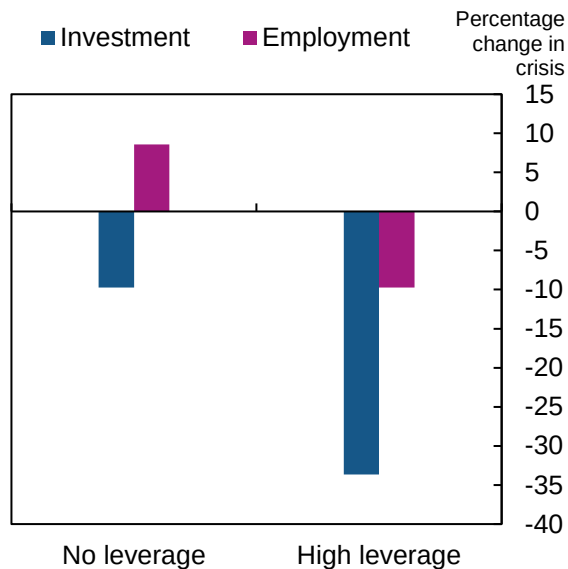
Corporate debt

A similar picture is apparent across companies. In a recession, companies with more debt tend to cut back on investment and employment by more than others. The evidence here is that companies with net debt more than about four times their cashflow cut investment twice as sharply as others (**Chart 2**).

Financing from overseas

Public debt, in contrast, tends not to deepen recessions, at least in countries issuing the debt in their own currency and within the bounds of sustainability. However, whether debt is raised by governments, households or corporates, the source of it does matter. A reliance on inflows of foreign capital — what Governor Carney has called the ‘kindness of strangers’ — can mean future recessions tend to be deeper. The evidence is that those strangers tend to be more flighty when the economic ground shakes, ceasing to fund new investments, raising the cost of finance in the economy and magnifying recessions.⁵ Other things equal, countries running bigger current account deficits tend to have deeper recessions.

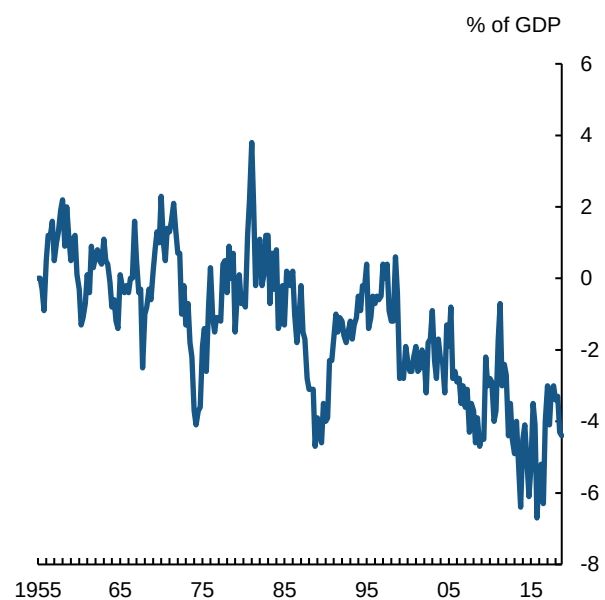
Chart 2 Highly indebted companies cut investment and employment more than unleveraged companies in the global financial crisis



Sources: S&P Global Market Intelligence and Bank calculations.

Notes: Change in investment and employment in the financial crisis for unleveraged companies and companies with high leverage ratios. Percentage change reflects the average log change in investment and employment between 2007 and 2009. High leverage companies are those with net debt/EBITDA ratio higher than four in 2006.

Chart 3 UK current account balance as a percentage of GDP since 1955



Source: ONS

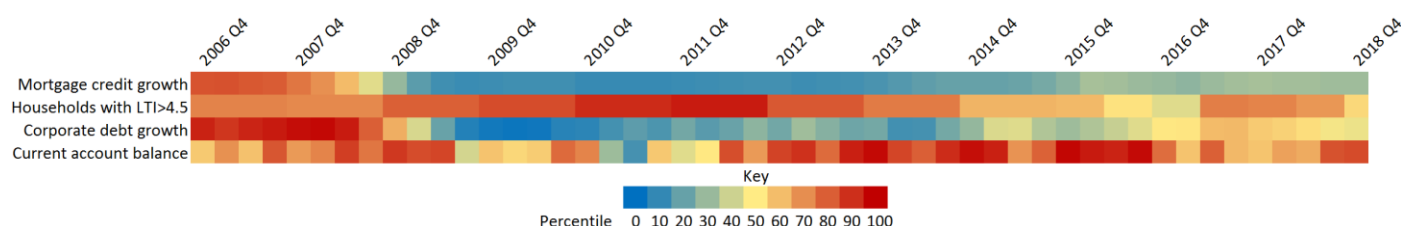
⁵ See, for example, Olivier Blanchard and Gian Maria Milesi-Ferretti, '[\(Why\) Should Current Account Balances Be Reduced?](#)', *IMF Economic Review*, April 2012 and Julián A. Caballero, '[Do Surges in International Capital Inflows Influence the Likelihood of Banking Crises?](#)', *Economic Journal*, March 2016.

Recent developments

What, then, has been happening in the UK to these drivers of underlying economic vulnerability?

Developments are summarised in the 'heat map' below (**Chart 4**). The colours represent how high each indicator is relative to past outcomes. The deepest red, for example, means the indicator is beyond the 90th percentile of its historic distribution.

Chart 4 Selected indicators of underlying vulnerabilities



Series and sources: 12-month mortgage credit growth (Bank of England); share of households with mortgage LTIs above 4.5 (UK Finance); corporate debt growth (annual) – Bank staff measure (Bank of England, Association of British Insurers, Cass Commercial Real Estate Lending Survey, Datastream from Refinitiv, Deals Business Intelligence from Refinitiv, Deloitte, LCD, an offering of S&P Global Market Intelligence, London Stock Exchange, ONS, Preqin and Bank calculations); UK current account balance (% GDP) (ONS and Bank calculations).

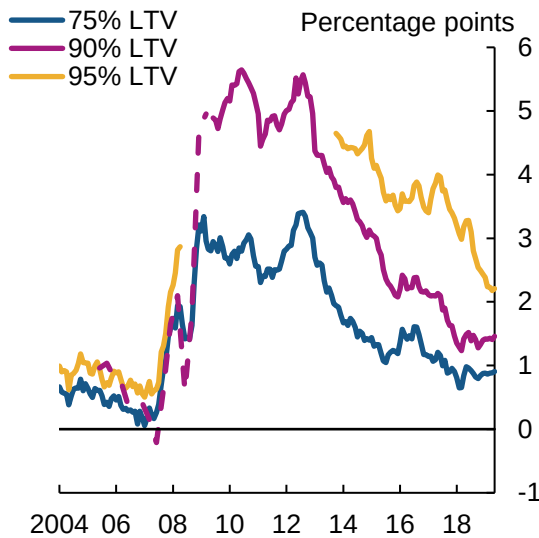
Notes: Each data series included in the heatmap has been rescaled into a percentile by using a kernel density estimate of its cumulative distribution function using all available data back to 1987. The Bank staff estimate for corporate debt adjusts the official ONS measure by adding sources of market-based finance not captured by the ONS and by removing other sources of market-based finance that have been misallocated to corporate debt. The net effect of these adjustments is predominantly to decrease the level of debt pre-crisis. Stocks of PNFC debt at 2018 Q3 split: 43% bank loans, 39% corporate bonds, with residual being money market instruments and other forms of non-bank finance.

The temperature overall doesn't look elevated. The only warm colour on this heat map stems from the UK's continued reliance on the kindness of strangers – its persistent current account deficit, running currently at 4.4% of annual GDP (**Chart 3**).

Although banks have real appetite to lend, households don't have the appetite to borrow. Credit conditions in the mortgage market are easy and mortgage pricing competitive. The share of new mortgage lending at loan-to-value ratios above 90% is approaching pre-crisis highs as the price of such lending falls relative to that on lower LTV mortgage lending (**Chart 5**). And yet, mortgage debt is growing no faster than the economy as a whole (**Chart 6**).

Of course, the level of household debt is high (**Chart 7**). But the share of households with very high debt burdens is in fact very low. In a low mortgage interest rate environment, only around 1% of households face debt servicing costs of more than 40% of their pre-tax income. It would take a large and sudden rise in interest rates – of up to 300bp – to take that fraction of households to around its historic average (**Chart 8**).

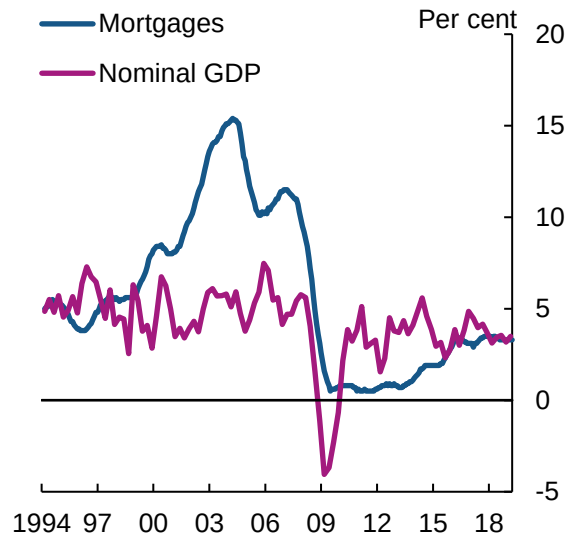
Chart 5 Quoted spreads over risk-free rates on two-year fixed-rate mortgages



Sources: Bank of England, FCA Product Sales Database and Bank calculations.

Notes: Spreads are taken relative to the risk-free rate of the same maturity. Dashed line is an estimate of historical 90% LTV spreads, which uses rates reported on new mortgages in the FCA Product Sales Database.

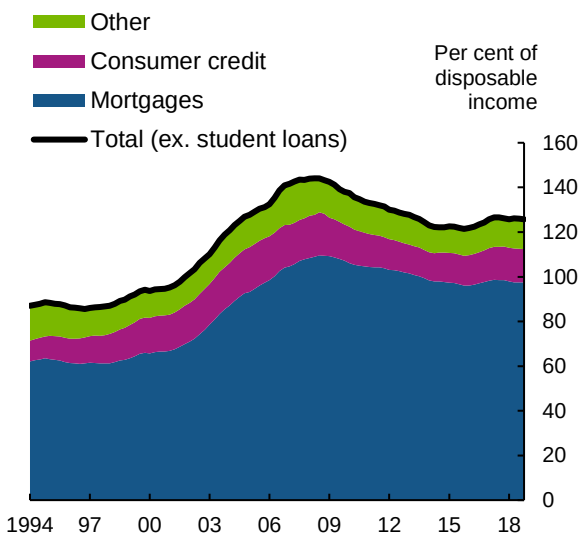
Chart 6 Annual growth rates for mortgage lending and nominal GDP



Sources: Bank of England and ONS.

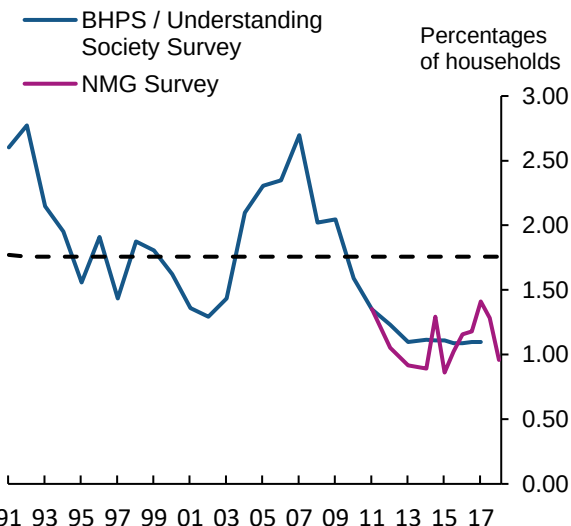
Notes: Mortgage lending defined as twelve-month growth rate of total sterling net secured lending to individuals seasonally adjusted. Nominal GDP is gross domestic product at current prices seasonally adjusted.

Chart 7 UK household debt to income ratio



Sources: Bank of England, ONS and Bank calculations.

Chart 8 Percentage of households with mortgage DSRs of 40% or greater



Sources: British Household Panel Survey/Understanding Society (BHPS/US), NMG Consulting survey and Bank calculations.

There has been a substantial reduction in corporate debt since the crisis as commercial real estate companies have repaired their balance sheets after over-extending them before the crisis (**Chart 9**). Banks

and investors have had strong appetite for corporate lending but corporate debt has only just outpaced the growth of the economy (**Chart 10**).

Chart 9 Corporate debt, % of GDP

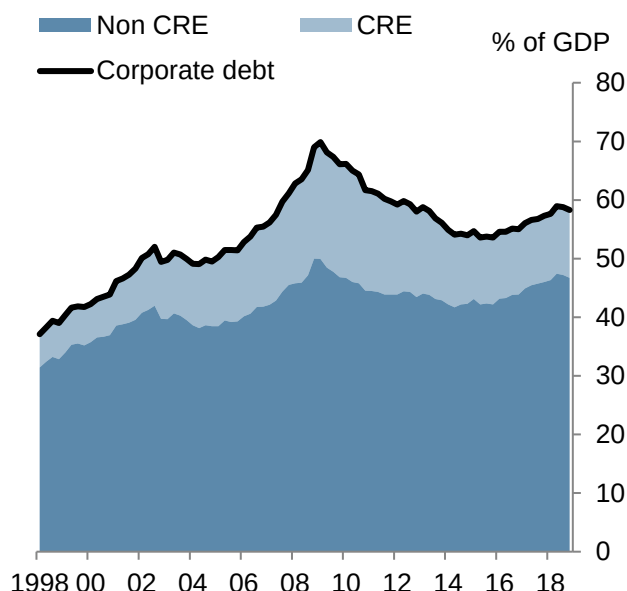
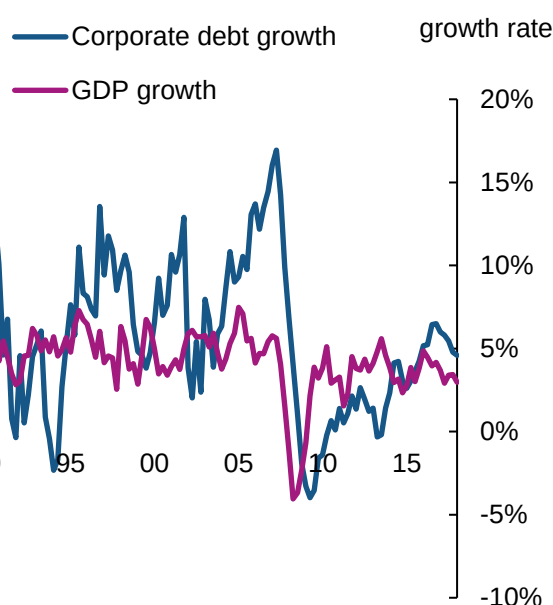


Chart 10 Corporate debt growth versus nominal GDP growth



Sources: Association of British Insurers, Bank of England, Cass Commercial Real Estate Lending survey, Datastream from Refinitiv, Deals Business Intelligence from Refinitiv, Deloitte, LCD, an offering of S&P Global Market Intelligence, London Stock Exchange, ONS, Preqin and Bank calculations.

Adding it all up

The challenge for us is to put developments across the heatmap into a common currency; to prioritise them; ask whether one outweighs another; and consider what they mean all together for how damaging any future economic earthquake could be.

In this we are drawing on cutting edge research in the Bank.⁶ That work, sometimes referred to as calculating 'GDP at risk', seeks to translate developments in each metric into its typical effect on the depth of recessions.⁷

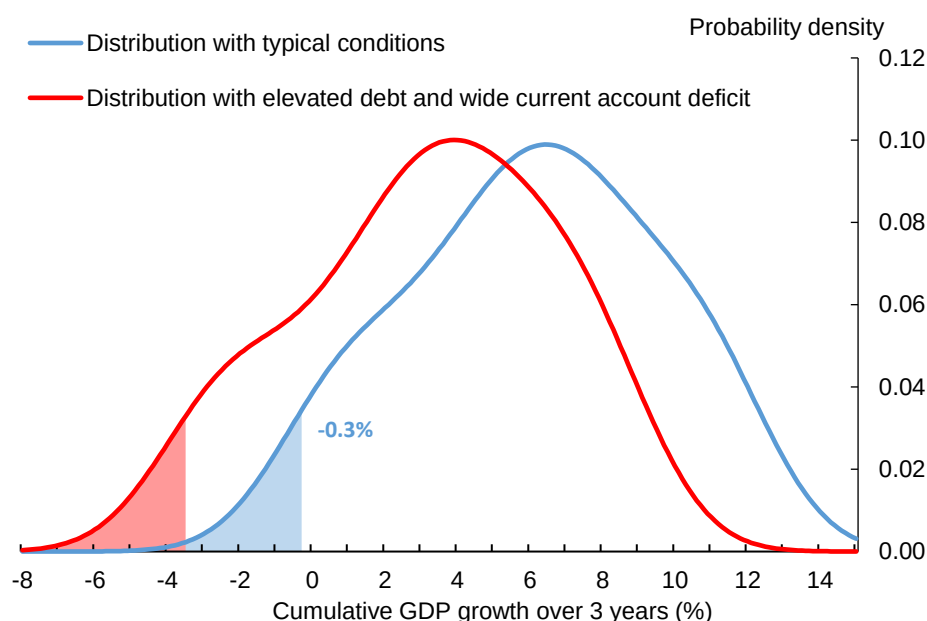
Without unusual developments in debt, the distribution of GDP growth over the next three years is shown by the blue distribution in **Chart 11**. A typical economic earthquake – the sort that tends to occur every twenty years or so – results in a recession and subsequent recovery that leaves economic output after three years just 0.3% below where it was when the shock hit.

⁶ David Aikman, Jonathan Bridges, Sinem Hacioglu Hoke, Cian O'Neill and Akash Raja, 'How do financial vulnerabilities and bank resilience affect medium-term macroeconomic tail risk?', Bank of England Staff Working Paper, forthcoming.

⁷ This work builds on research at the IMF, with whom we have collaborated closely. Governor Carney used the same analytical approach to consider 'Capital flows at risk' – see '[Pull, push, pipes: sustainable capital flows for a new world order](#)', speech given at the 2019 Institute of International Finance Spring Membership Meeting, Tokyo, June 2019.

When debt builds up, the distribution of future growth outturns shifts. It skews towards weaker growth. The red line shows how this distribution shifts in response to elevated levels of credit and a wider current account deficit. A 1-in-20 earthquake tends to be more damaging.

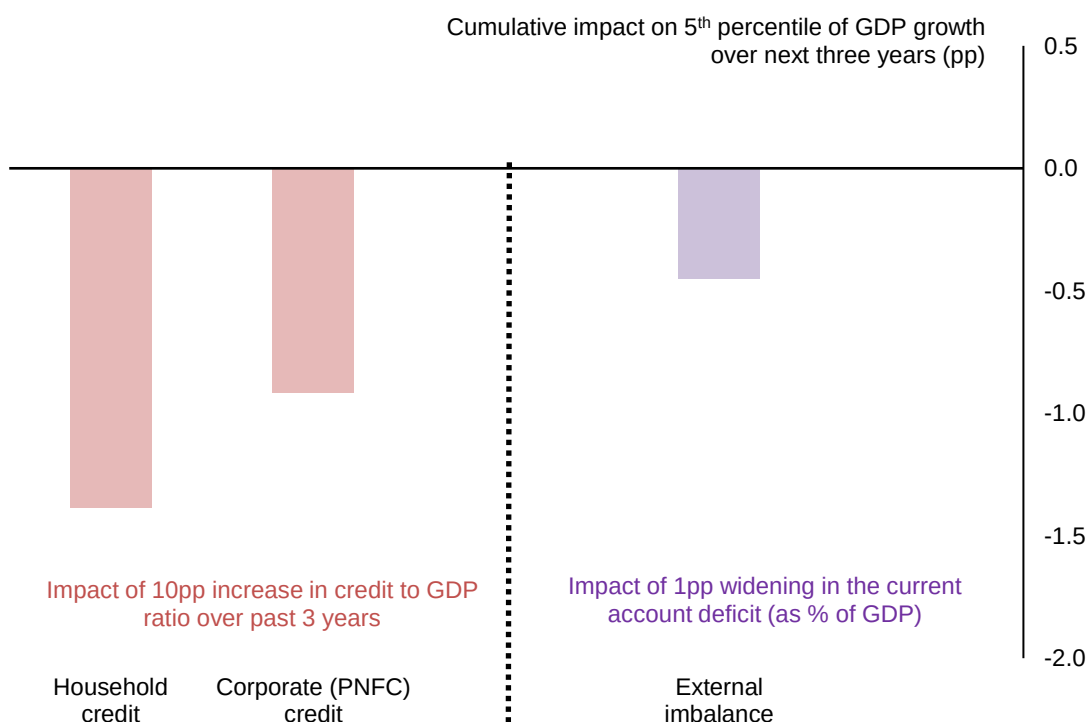
Chart 11 Distributions of cumulative 3-year GDP growth under typical conditions and with elevated debt and a wide current account deficit



Notes: Chart shows the predicted distribution of the cumulative GDP growth rate over 3 years. The blue line is the predicted distribution when the change in household credit-to-GDP, the change in corporate credit-to-GDP and the current account deficit are at their historical average in the UK. The red line shows how this distribution shifts when household and corporate credit have increased by 10pp relative to GDP, and the current account deficit has widened by 2pp.

Our work finds that if the economic earthquake comes after a 10% increase in household debt relative to incomes, the cumulative loss of output over the 3 years after the quake is 1.5%. If it comes after a 10% increase in corporate debt, the cumulative loss of output is 1%. And for every 1% of current account deficit before the quake, a further 0.5% of output is lost after the quake (**Chart 12**).

Chart 12 Impact of debt vulnerabilities on depth of economic earthquakes



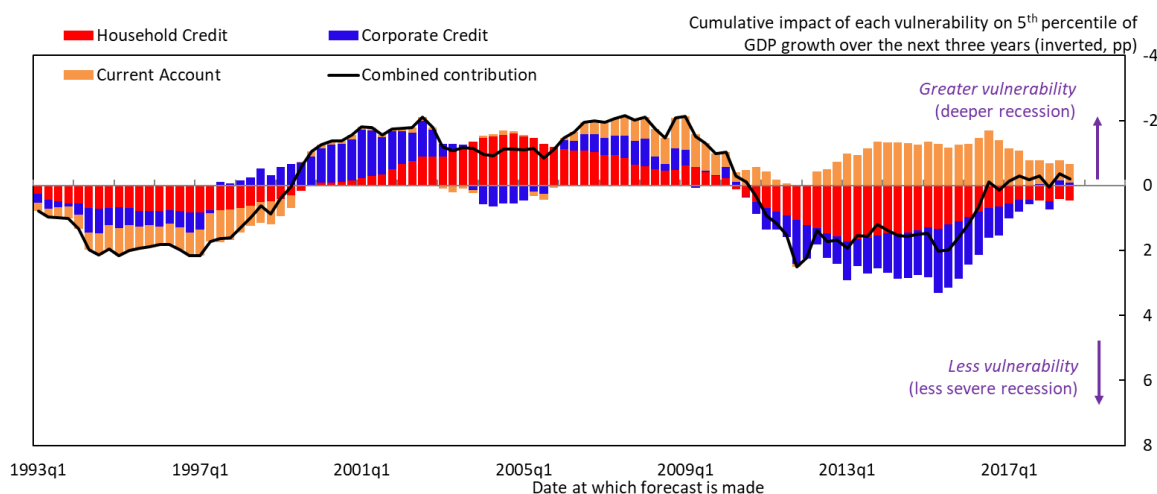
Notes: Figure based on Aikman et al. (forthcoming). It shows the impact of an increase in each vulnerability indicator at time t on the 5th percentile of real GDP growth over the next three years. The cumulative three-year impact on the left-hand tail of GDP growth is shown. For household and corporate credit in turn, the impact of a 10pp increase in the credit to GDP ratio over the subsequent three years is shown. For the current account, the impact of a 1pp (relative to GDP) widening in the deficit is shown. For reference, for the UK 1980-2018, a one standard deviation increase in three-year credit growth was 5.9pp (household) and 8.1pp (corporate) and for the current account was 1.7pp.

Using these estimates we can add up the different developments in debt to see what they might mean for the overall degree of underlying economic vulnerability. **Chart 13** shows their sum total over time.

Two points stand out from this chart. First, the sum of recent developments isn't elevated. The UK's current account position creates some additional vulnerability, but recent developments in overall corporate debt are neutral (though with a caveat I'll come on to explain), and household developments slightly offsetting.

Rather, the underlying level of economic vulnerability has returned to a standard level after a long period in the aftermath of the financial crisis in which it was subdued as debt levels fell back. That's consistent with the Financial Policy Committee's judgement that the degree of underlying economic vulnerability is at a standard level. That judgement drives our assessment of how resilient the financial system needs to be, in particular how large should be the buffers of capital banks run with.

Chart 13 ‘Adding up’ the impact of debt vulnerabilities on the possible damage caused by a 1-in-20 economic earthquake



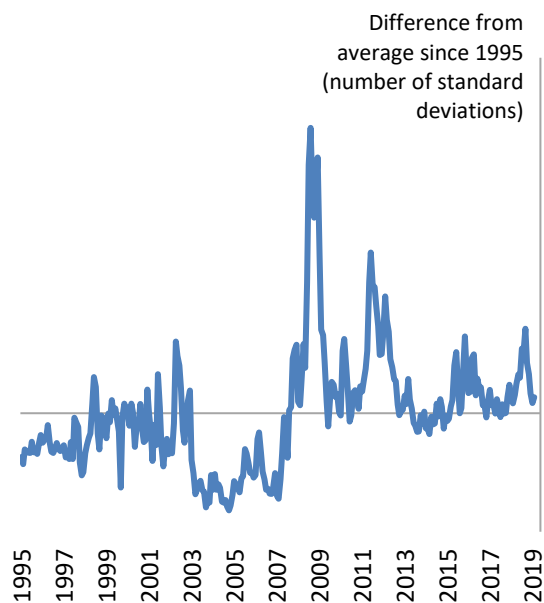
Notes: Figure based on Aikman et al. (forthcoming). The black line ‘adds up’ the combined impact of each vulnerability indicator at time t on the 5th percentile of real GDP growth cumulatively over the next three years. For example, the point labelled 2005q1 shows the estimated impact of these vulnerabilities on the left tail of GDP growth over the period 2005q1-2008q1. The decomposition uses full sample coefficient estimates (based on 16 advanced economies 1980-2017), applied to the UK data. Each indicator enters relative to its UK historical average, so that if credit growth and the current account deficit were at their average levels, the bars would be zero. The chart shows a subset of a larger model, which also includes equity volatility, house prices, bank capital and macroeconomic control variables.

The second standout from the chart is that developments in debt prior to the 2008 financial crisis would have been sufficient to make an economic earthquake 2% more damaging. As it was, almost 4% of output was lost in the three years between 2008 and 2010. Why did output fall so much more than might have been expected? Was it bad luck? Was the economic earthquake off the Richter scale?

Our research concludes that the 2008 recession was not the result of an unusually severe earthquake. The UK’s current account deficit and debt run-up prior to the crisis meant we were closer to the fault line. As important was the fact that the banking system did not have the strength to reflect that. As a result, it collapsed, tightening financial conditions for the economy and adding to the damage.

Once we account for these factors, the depth of the 2008 recession is consistent with a 1-in-20 economic earthquake (**Charts 14 and 15**). It wasn’t that we were hit by a seismic event of unprecedented scale. The scale of the economic damage was avoidable.

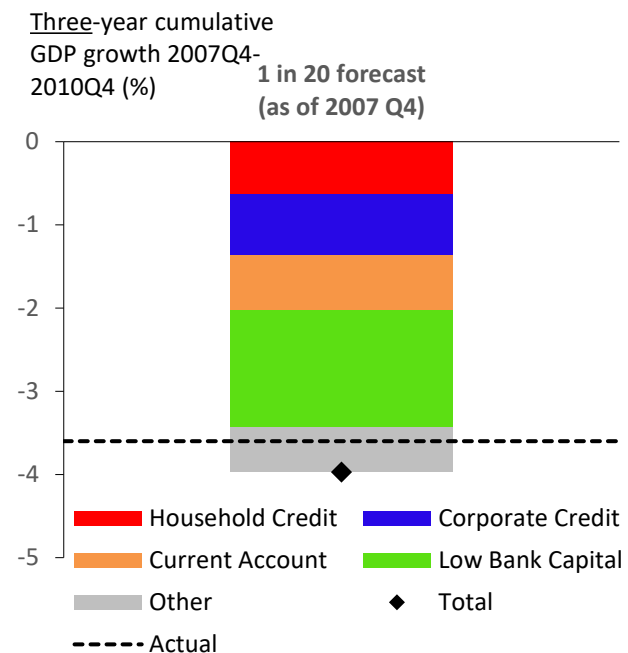
Chart 14 Financial conditions index (UK)



Sources: Bloomberg Finance L.P., Eikon by Refinitiv and Bank calculations.

Notes: Financial conditions index (FCI) estimated using principal component analysis. The FCI summarises information from the following financial series: term spreads, interbank spreads, corporate spreads, sovereign spreads, long-term interest rates, equity price returns, equity return volatility and relative financial market capitalisation. An increase in the index indicates a tightening in conditions.

Chart 15 GDP fall during the crisis compared to tail risks flagged by high debt vulnerabilities and low bank capital resilience



Notes: Figure based on Aikman et al. (forthcoming). The chart compares the actual cumulative three-year fall in UK GDP during 2008-2010 to the 5th percentile of real GDP growth forecasted for the same period as of end-2007. This estimate is decomposed in the same way as described in the note to Chart 13 and additionally shows the estimated impact of low bank capital resilience.

The job the FPC has been given in the aftermath is to avoid another avoidable disaster. And real progress has been made. Through new capital requirements the banking system now has the resilience to absorb even a repeat of the 2008 recession, without causing serious economic damage.

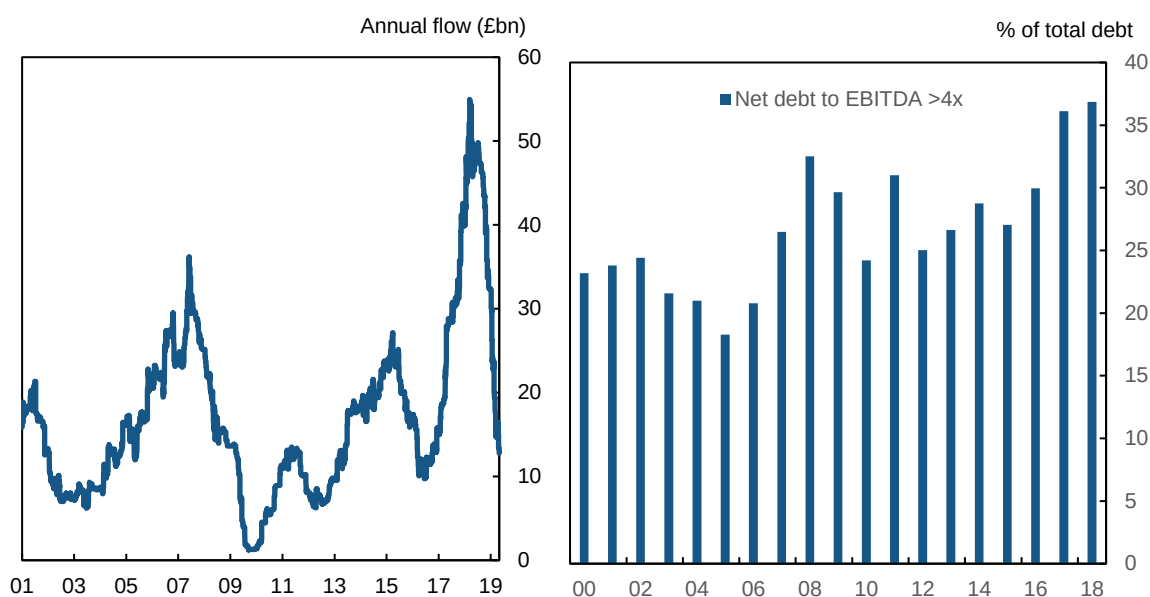
And with the help of this work, we can stay agile as debt evolves so we can ensure the resilience of the system keeps pace with the underlying vulnerability in the economy.

That's not to say we will be slaves to any particular approach. No single model can capture everything. The point is that we have a benchmark for our assessment, ensuring continuity and discipline in our approach. To that benchmark, we can apply judgements.

A pocket of risk

In that regard, we're watching closely what's happening in corporate debt. Although, as we've seen, the aggregate picture looks fairly benign, a more concerning development hides underneath. We have just been through a period of rapid growth of one type of corporate lending: leveraged lending. That is, lending to companies who have high levels of debt.⁸

Chart 16 The flow of gross issuance of leveraged lending to UK companies has declined from post-crisis highs and there is a tail of highly indebted firms



Source: S&P Global Market Intelligence.

Notes: Gross issuance of leveraged loans by UK companies on a 12 month rolling basis. Net debt to EBITDA ratios of the top 500 largest non-financial corporates by revenue outside of real estate and oil & gas weighted by debt.

That rapid growth has now eased right off. But it has left a legacy on the balance sheets of some companies and on the balance sheets of those who have lent to them. The legacy on the balance sheets of companies is that more than a third of corporate debt is now in companies that have debt more than four times their cash flow (**Chart 16**).

That can raise the underlying level of economic vulnerability. As we saw earlier, high-debt corporates are likely to cut back more sharply in downturns. The effect overall is unlikely to be large – a few tenths of one per cent on the depth of an economic earthquake. But this, for me, particularly when coupled with the clear appetite of lenders and creditors to lend, means the vulnerability level needs to be watched closely.

⁸ Leveraged loans are typically loans to corporate borrowers that are highly indebted (for example with net debt to EBITDA ratios greater than 4x) or that are owned by a private equity sponsor. However, there is no widely-accepted definition.

The legacy effect on the balance sheets of lenders and investors could potentially be of more significance. There is a real risk of loss to those exposed to these loans. In the financial crisis, we estimate that 8% of these loans soured, twice the loss rate on loans to businesses overall.⁹ The shift to riskier lending matters.

Since the financial crisis, underwriting standards on leveraged lending have deteriorated. Lenders have real appetite for risk, reducing the price of these loans while also shunning covenants on borrowers. Ten years ago all leveraged loans imposed some restrictions on borrowers. Now only one third have them. And companies are increasingly making use of earnings add-backs, which involves assuming future earnings improvements, to flatter their leverage at issuance. With this deterioration in standards, loss rates are probably now more sensitive to economic conditions than they were a decade ago.

This is why we're working to ensure that the period of rapid growth we've been through hasn't compromised banks' resilience to economic downturns. UK banks have £60bn of exposures to non-investment grade UK and US corporates. Through rigorous stress tests, we're ensuring that banks have the capital to withstand loss rates on their loans greater than those seen in the financial crisis. Consistent with our overall approach, those loss rates reflect not the recent good performance of these loans, but the not-so-good underwriting standards applied as they were originated.

However, even then our work to ensure the resilience of the system keeps pace will not be done. The leveraged loan market is one illustration of a broader development in finance over the past decade: the growth of finance provided by institutions other than banks.

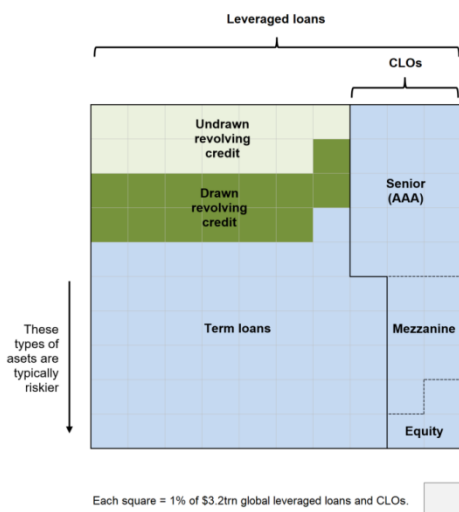
The leveraged loan market is global. The UK has not been alone in experiencing rapid growth in leveraged lending. The United States and Europe have seen it too and, unlike the UK, they still have it. Globally, we estimate that 45% of the finance comes ultimately from non-banks. Sometimes they hold the loan exposure directly. And sometimes they hold tranches of securitised packages of leveraged loans – collateralised loan obligations (CLOs). Some 25% of loans have been securitised. And the holders of the equity slice of CLOs – the slice that takes the losses on the loans in the package before the other investors – are at real risk. If leveraged loans experienced loss rates in line with the financial crisis, the equity tranches of CLOs would lose all their principal.

Before everyone takes fright at the 's' word, some important context is needed. These securitisations are very different beasts to their ancestors of 2008. CLOs now have much less embedded leverage than they did before the crisis, with equity tranches around 25% thicker. And they are not held in 'shadow banks' like investment vehicles that turn out really to be a part of banks. They are held properly outside the banking system, on the balance sheets of non-banks like hedge funds and open-ended funds. **Chart 17** shows our map of who holds the loans and in what form.

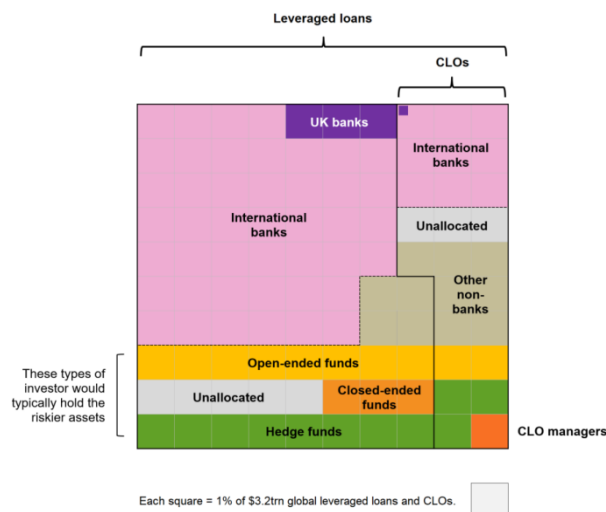
⁹ These are estimated five-year loss rates based on observed default rates during the global financial crisis on the S&P leveraged loan indices for the US and Europe and Moody's data for all corporates. We assume a recovery rate in line with the average on first lien loans.

Chart 17 Map of who holds leveraged loans and in what form

Indicative estimated global stock of leveraged loans by product type



Indicative estimated holdings of leveraged loans by global investors



Sources: BarclayHedge, Bloomberg Finance L.P., FCA Alternative Investment Fund Managers Directive (AIFMD), Firm public disclosures, LCD, an offering of S&P Global Market Intelligence, Morningstar, National Association of Insurance Commissioners, Securities Industry and Financial Markets Association, Solvency II submissions and Bank calculations.

Notes:

- Estimates of the total stock are based on Bloomberg's definition of leveraged loans. Given the lack of a consistent definition of leveraged lending, there is uncertainty over the total stock of outstanding leveraged loans.
- For loans that are distributed to non-bank investors and CLOs, allocation across investors is based on 'bottom-up' estimates of holdings from a range of sources. Hence, there is a significant proportion of institutional loans that are unallocated.
- For hedge fund holdings of leveraged loans and CLOs we scale up holdings reported to UK authorities by non-EEA managed AIFs to reflect the size of the global hedge fund universe. This means these estimates are particularly uncertain.
- Revolving credit facilities and amortising term loans are allocated to banks given that they are typically the holders of these facilities.

This picture is consistent with wider developments in corporate credit. Non-banks account now for 56% of the stock of UK corporate debt. Market-based debt has accounted for all of the growth in the stock of debt to UK businesses since end-2007.

Overall, that shift is positive for the resilience and stability of the system. Other things equal, £1 of loss incurred in the non-bank financial system is almost certainly less disruptive to the wider economy than £1 of loss incurred in the banking system. But without the right resilience, could the non-bank system also result in some damage to the economy in an economic earthquake? How should financial building standards adapt to the changing nature of the buildings in our economic city?

Keeping up with a changing financial system

Given the non-bank system's growth and new-found importance, we face a challenge. There is little evidence of past performance to guide any assessment of the non-bank system. And it would not be sensible to wait until we have some.

Our solution is to replace wait with simulate. So this is yet another area where we are developing cutting-edge work, this time to simulate how an economic earthquake could play out in the non-bank system.¹⁰ It is our version of what earthquake engineers call a 'shake table': a device for testing how models of new structures respond to tremors.

The simulator considers generic markets – for equity, corporate credit, government bonds and some key types of funding and derivatives – and representative insurance, hedge fund and mutual fund sectors. The sectors trade with each other, and with the banking system, behaving in ways that we calibrate to known features of the system. That means behaviour in one part of the system affects decisions elsewhere. The system is more than the sum of its parts.

The simulator, by its nature, does not capture the full diversity of the assets and participants in the system. It is a simplified version of reality, helping to guide us. Using it, we can begin to assess what different features of the system might matter for the resilience of corporate credit supply.

In general, it highlights how financial institutions do not need to be at risk of failure for credit supply conditions to be fragile. I'll highlight two features that stand out in the simulator, both centred on liquidity: cashflow pressures on leveraged investors like hedge funds, and redemption pressures on open-ended funds.

Cashflow pressures on leveraged investors

Investment funds have grown in importance as holders of corporate debt in general, and they now hold around 25% of the global leveraged loan market – a quarter of which is in the form of CLOs, often the most risky slices.

The relevant funds are not the super-financially-leveraged, dangerous institutions of some imaginations.¹¹ Even hedge funds take positions worth only about one and a half times net asset value – materially less than they did a decade ago.¹² And financial leverage in funds other than hedge funds is generally limited.

¹⁰ David Aikman, Pavel Chichkanov, Graeme Douglas, Yordan Georgiev, James Howat, Benjamin King, 'System-wide stress simulation', Bank of England Staff Working Paper, forthcoming.

¹¹ For more on developments in hedge funds and prime brokers since the financial crisis, see Frank Kenny and David Mallaburn, '[Hedge funds and their prime brokers: developments since the financial crisis](#)', Bank of England Quarterly Bulletin, 2017 Q4.

¹² See [ESMA Annual Statistical Report on EU Alternative Investment Funds 2019](#).

However, funds can face cashflow pressures from their use of derivatives to create synthetic leverage. When they do, market moves can mean more collateral – often cash – needs to be posted against a derivative position. In the simulator, without the cash on hand, such margin calls could mean further forced sales of assets, leading to a tightening of credit conditions.

Our work suggests that funds today have stocks of liquid assets to meet the margin calls on their interest rate swap positions even after very severe market moves. They would not be forced sellers of corporate credit assets. However, there is nothing to guarantee that will remain the case. So the potential for derivative margin calls and the ability of funds to meet them smoothly has to be monitored.¹³

The sorry fact is that such data just aren't currently reported to market regulators. That's why we're fully behind the call of the Financial Stability Board of the G20 for consistent measures of leverage in funds to be developed in this area to help enable direct comparisons across funds and at a global level.¹⁴ The International Organisation of Securities Commissions (IOSCO) has consulted on how to do this and will finalise its work on leverage measures this year.¹⁵

We believe that a core set of measures will need to be consistent across jurisdictions. A consistent set of measures must allow the demands on liquidity that funds of all sorts could face, and the liquid assets they have available to meet those demands, to be monitored. Only then can we assess properly how their resilience is evolving.

Redemption pressures on open-ended funds

The role of investors in open-ended funds is the second feature of the non-bank system that could shape the resilience of credit supply. More than \$30 trillion of global assets are now held in investment funds that offer frequent, often daily, liquidity to investors despite investing in potentially illiquid underlying assets.¹⁶ These funds hold 13% of outstanding corporate bonds in the UK and 25% in the euro area. Ten years ago they held less than half those shares. And they now hold around 10% of the global leveraged loan market.

When investors in these funds redeem their investment, the fund must sell a slice of its assets to meet the cash need. As redemptions accelerate, a fund can become a forced seller. This 'fire sale' pressure can matter. It can help to drive asset prices down and tighten credit conditions during downturns.

It is therefore striking that, the more illiquid (that is, difficult to trade) are the assets held in an open-ended fund, the more aggressively its investors withdraw their funds as the prices of the assets held in the fund fall.

¹³ See 'The FPC's assessment of the risks from leverage in the non-bank financial system', [Financial Stability Report, November 2018](#).

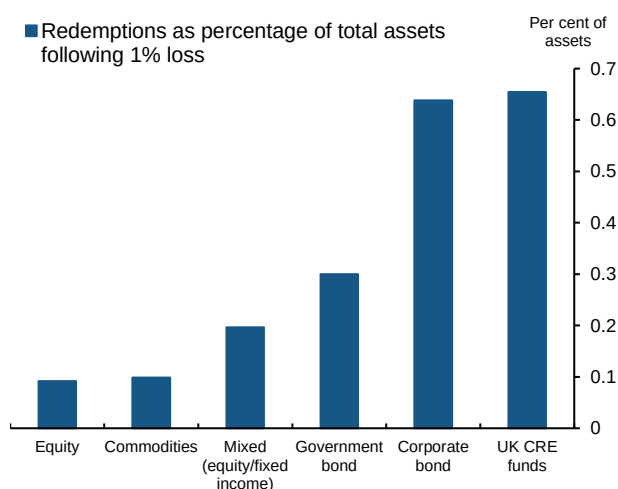
¹⁴ See FSB, '[Policy Recommendations to Address Structural Vulnerabilities from Asset Management Activities](#)', January 2017.

¹⁵ See IOSCO, '[IOSCO Report: Leverage](#)', Consultation Paper, November 2018.

¹⁶ See FSB, '[Global Monitoring Report on Non-Bank Financial Intermediation 2018](#)', February 2019.

When a fund holds assets traded almost instantly on exchange – like blue-chip equities – investors tend to sit on their hands. At the other end of the spectrum, investors in open-ended funds holding commercial real estate – which, on average, takes 298 days to sell – take out 0.6% of their money for every 1% fall in the value of their funds. Investors in corporate bond funds behave similarly (**Chart 18**).

Chart 18 Fund redemptions following 1% fall in asset value



Sources: Morningstar and Bank calculations.

Note: Procyclicality estimates reflect monthly redemptions from European open-ended investment funds in response to a 1% loss incurred over the previous month. Estimates were produced using panel regression methodology and monthly data covering 2005–15. Work is currently underway to update these estimates with the latest available data.

This raised an important question: does mismatch between the liquidity of a fund's assets and its redemption term encourage its investors to head for the exit after a shock?

Fund managers are, on one level, simply the custodians of assets for their investors. Unlike banks, it is the investors who bear any losses. And many have measures in place to ensure investors are treated fairly. For example: when selling assets they must sell a representative slice of the fund, and the price offered to redeeming investors can – through swing pricing – include a discount for the cost of trading. Nevertheless, the structure of funds may well create incentives for investors to try to be at the front of the queue to redeem.

If redeeming investors receive the market price of the assets in the fund, but those assets have to be sold faster than it typically takes to obtain the market price, remaining investors may fear that the value of their share will be reduced as others redeem.

This fear can be avoided – as it seems to be in blue-chip equity funds – when the redemption period of the fund is aligned with the sale period that's needed to realise the market price of the assets it holds. In

principle it could be avoided too by pricing units of funds to capture any difference between the redemption period and the typical sale period of the assets. Liquidity isn't costless.

Of course, redemptions can be suspended – funds can be gated – to limit the selling pressure. But such measures are a double-edged sword. They can allow time for an orderly re-structuring of a fund, avoiding unnecessary fire sale pressure, but the expectation that such measures could be imposed tomorrow can create an incentive to be at the front of the redemption queue today.

We saw in both 2008 and 2016 how fears and incentives like these can drive material outflows from funds invested in commercial property. And last December, as leveraged loan prices fell in global markets, investors in open-ended leveraged loan funds followed the example, redeeming \$37bn of around \$200bn invested in these funds. This isn't an issue about a single fund or even about funds invested in a single asset class.

Any incentive for investors to be at the front of the queue might be detrimental to the resilience of finance for the real economy. The emerging evidence is that companies whose existing liabilities are subject to selling pressure from funds tend to cut back new issuance and – presumably to protect their cash flow position – cut both investment and employment.¹⁷

If these new forms of finance are to give maximum support to long-term economic growth and investment, we need them to be consistent. So, after highlighting this issue in late 2015, the FPC supported the work of the Financial Stability Board (FSB) of the G20, culminating in the FSB's January 2017 recommendation that market regulators should ensure funds' redemption terms are consistent with their assets and investment strategy.¹⁸ Since then, global market regulators, who are at the coal face of these issues, have been turning this recommendation into new rules. Here in the UK, the FCA is finalising its own rules for funds investing in illiquid assets to strengthen liquidity management.¹⁹

These are global issues. So macroprudential authorities across the world will need to review new global asset management rules. An assessment is needed of whether they will be effective in dampening any restriction to the supply of finance during economic downturns. If financial resilience is to keep pace with the changing system, regulations must serve not just conduct of business and market integrity, they must also be prudent from a macro perspective. The growing non-bank system must be able to serve the wider economy not just in the good times, but also in the bad.

¹⁷ See, for example, Xiaoxia Lou and Albert Y. Wang, '[Flow-Induced Trading Pressure and Corporate Investment](#)', *Journal of Financial and Quantitative Analysis*, February 2018.

¹⁸ FSB, '[Policy Recommendations to Address Structural Vulnerabilities from Asset Management Activities](#)', January 2017. To operationalise some of the FSB recommendations, the IOSCO, the international body of securities regulators, in 2018 issued recommendations and good practices to improve liquidity risk management for investment funds – see '[IOSCO issues recommendations and good practices to improve liquidity risk management for investment funds](#)', media release, February 2018.

¹⁹ See the FCA's [Business Plan 2019/20](#) and '[Consultation on illiquid assets and open-ended funds and feedback to Discussion Paper DP17/1](#)', Consultation Paper CP18/27, October 2018.

Conclusion

Macroprudential may no longer be the buzz phrase it was a decade ago. But its objective of promoting a financial system that can serve households and businesses in bad times as well as good remains as important as ever. The avoidable damage caused by the economic tremors of 2008 is a salutary reminder of the costs a fragile financial system can impose on an economy.

In the UK at least, macroprudential policy has become an operational reality. Now, with the help of research and the latest techniques, we're looking to the future. That work will help us stay disciplined and agile in keeping up with changes in the economy. It's guiding us to what needs to be monitored closely in the non-bank system and where new standards of resilience might be needed to keep up as the financial system changes shape.

Keep up we must. It's no use waiting for the tremors. When the economic ground shakes, whenever that may be, we will all want the financial system to be resilient.