



BANK OF ENGLAND

Speech

From Lender of Last Resort to Market Maker of Last Resort *via* the dash for cash: why central banks need new tools for dealing with market dysfunction

Speech given by

Andrew Hauser, Executive Director, Markets

Reuters, London

7 January 2021

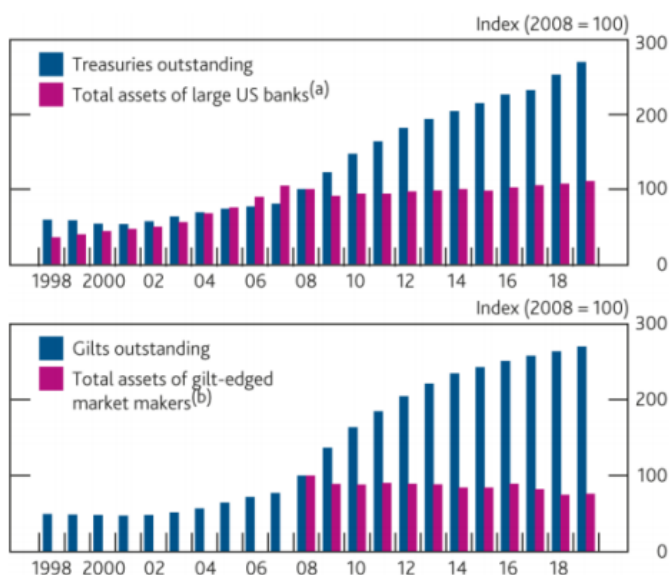
I am grateful to Tim Taylor for his assistance in writing this speech; and to Andrew Bailey, Imane Bakkar, Yuliya Baranova, Charlotte Barton, Alex Brazier, Jon Bridges, Alice Carr, Geoff Coppins, Ed Denbee, Johnny Elliot, Gerardo Ferrara, Bernat Gual-Ricard, Jon Hall, Sarah Hall, Nicholas Jackson, Joshua Jones, Anil Kashyap, Nick McLaren, Ankita Mehta, Matt Roberts-Sklar and Andrea Rosen for their comments and guidance.

Introduction

Increasingly we look to financial markets, rather than banks, to care for our savings or provide credit. Millions save via pension, investment or exchange traded instruments. Companies and local authorities hold cash in money market funds. And firms, large and small, borrow from capital markets or non-bank lenders. Taken together, fully half of all financial assets are now held outside the banking system.

These trends aren't new – and to the extent that they bring broader access to cheaper, faster, and more diverse financial services, they're good news. But they do pose novel challenges to financial stability. In particular, as its usage grows, market-based finance seems increasingly prone to liquidity shocks. Some of that reflects vulnerabilities in business models and practices of specific market participants: including liquidity mismatch in funds; leveraged and trend-following investment strategies; or insufficiently forward-looking margining practices. But it also reflects a growing imbalance between the size of key markets, and the balance sheet capacity of banks and dealers who have traditionally helped transfer risk smoothly between investors and borrowers (Chart 1).¹

Chart 1: Stock of US & UK government bonds relative to bank/dealer balance sheets



Sources: https://www.brookings.edu/wp-content/uploads/2020/05/WP62_Duffie_v2.pdf; UK Debt Management Office; Bank of England Regulatory Returns and Bank calculations.

(a) Total assets for the holding companies of Bank of America, Bear Stearns, Citigroup, Goldman Sachs, JP Morgan Chase, Lehman Brothers, Merrill Lynch, Morgan Stanley and Wells Fargo.

(b) Based on quarterly averages available from 2008, excluding assets of banking entities authorised to operate in the UK through branches. Gilts outstanding as of end-March 2020.

¹ These issues have been discussed in successive Bank of England Financial Stability Reports. For the most recent assessment, see <https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2020/august-2020.pdf>.

The nature of these vulnerabilities, and the need to consider stronger measures to safeguard financial stability, have been extensively discussed in recent years. But last year's Covid 'dash for cash' was a wake-up call as to the scale and urgency of this work.

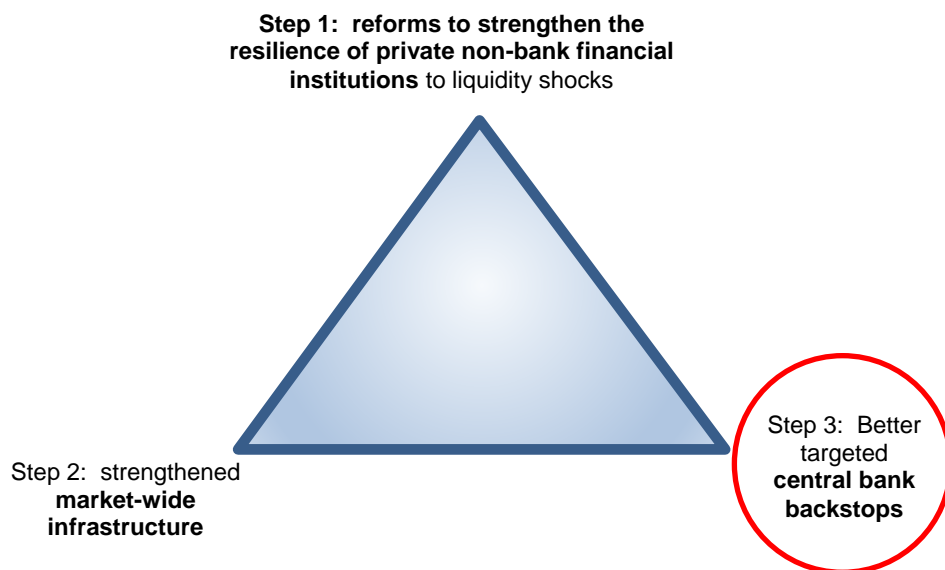
It is unsurprising that the initial wave of lockdowns last Spring caused a surge in demand for precautionary liquidity. But the implications of that shift were greatly amplified by a breakdown in the functioning of markets core to the maintenance of monetary and financial stability. Many of those longstanding vulnerabilities I mentioned a moment ago were in play. Liquidity imbalances between asset maturities and redemptions in money market and other open-ended funds exacerbated moves in asset prices. Gaps in liquidity planning meant some firms had to scramble to meet margin calls. And sharp disruptions in government and corporate bond markets raised questions about the role of leveraged investors, and the willingness and capacity of dealers to intermediate at times of stress.

To avoid an even deeper economic collapse, the functioning of these markets had to be restored rapidly. And that was achieved through swift and decisive central bank action, using large-scale asset purchases and other tools capable of tackling both the economic shock and the market dysfunction. Since March of last year, G10 central bank balance sheets have risen by over \$8 trillion.

This was an appropriate response to a truly unprecedented situation – just as powerful anti-inflammatory medicines are the right solution to a sudden and massive flare up. But such drugs are less well suited to treating long-term conditions – and there is every reason to believe that, absent further action, we will see more frequent periods of dysfunction in the very markets increasingly relied on by households and firms, if business model vulnerabilities persist and intermediation capacity remains strained. The public authorities cannot afford to ignore such dysfunction if it reaches a scale that threatens financial stability. But equally we cannot rely on central bank medicine of the scale and duration seen in 2020 every time we see an inflammation. The costs, in terms of bloated public sector balance sheets and mispriced private sector risks, will be too high. And the policy actions needed to secure monetary and financial stability may not always be as well aligned as they have been during the current crisis.

If financial markets are to support the increasing reliance placed on them safely, we must do more to reduce the scale of inherent vulnerabilities *ex ante*, and build better-targeted tools for dealing with financial instability caused by market dysfunction *ex post*. And that, in turn, requires work in three separate but self-reinforcing areas – as illustrated in Chart 2.

Chart 2: Strengthening market functioning



Step 1 – ensuring that non-banks active in financial markets are more resilient to future liquidity shocks – is under way, co-ordinated by the Financial Stability Board.² If successful, this should both reduce the likelihood of instability arising in the first place, and improve the private sector's ability to deal with it, if it does occur.

Step 2 relates to the potential for market participants, acting on their own or in concert with the authorities, to reduce vulnerabilities by strengthening market-wide infrastructures or practices. The recent proposal by Darrell Duffie to mandate central clearing of US government bonds is an example of this type of work.³

But my topic today relates to Step 3: the role that central bank balance sheets should play in dealing with market dysfunction. I deliberately come to this last, because, while it is central banks' job to restore financial stability where self-insurance is too socially costly, they should be backstop providers of liquidity, not a first port of call. In that sense, their tools should complement, not substitute for, the other vertices of the triangle. Outside of pandemics, massive doses of system-wide anti-inflammatories do not meet that design brief. Long-term protection requires a more targeted remedy, as the Bank's Financial Policy Committee concluded last October.⁴

² <https://www.fsb.org/2020/11/fsb-acts-to-address-issues-highlighted-by-march-market-turmoil/>

³ <https://www.brookings.edu/research/still-the-worlds-safe-haven/>

⁴ 'The FPC considers it important to examine whether central banks should have facilities to provide liquidity to the wider financial system in stress, in order to support market functioning. Any such backstop of liquidity would need to be provided in a way that is not just effective and efficient but that also, through appropriate pricing and accompanying regulatory requirements, reduces incentives for excessive risk taking in the future' (<https://www.bankofengland.co.uk/financial-policy-summary-and-record/2020/october-2020>). See also Box 7 of the August 2020 FSR (<https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2020/august-2020.pdf>) and the Governor's remarks at Jackson Hole (<https://www.bankofengland.co.uk/speech/2020/andrew-bailey-federal-reserve-bank-of-kansas-citys-economic-policy-symposium-2020>).

In the remainder of my remarks today I want to look, first, at the evolving role of central banks as liquidity providers; second, at the lessons from the dash for cash episode; and, third, at some possible design features and challenges for a ‘new’ generation of central bank tools aimed at market dysfunction. I put ‘new’ in inverted commas because in many cases we are building on the substantial foundations provided by past thinking, given new urgency by our recent experience.

I) The evolving role of central banks as providers of public liquidity insurance

According to Ralph Hawtrey, one of the doyens of early twentieth century economics, the defining feature of central banking lies in taming the ‘inherent instability of credit’.⁵ And the canonical description of how to achieve that is given by Walter Bagehot’s description of the ‘Lender of Last Resort’ (LOLR), which (in essence) recommends stemming financial panics by lending freely, to sound institutions, against good collateral, and at rates materially higher than those prevailing in normal conditions.⁶

For much of their lifespan, central banks have provided LOLR primarily to commercial banks. Banks specialise in lending to households and firms, but are inherently vulnerable to liquidity risk, given the maturity mismatch between their long-term assets and their short-term liabilities. Over time, and the experience of successive banking crises, LOLR has been supplemented by an extensive prudential regulatory regime, requiring banks to take greater ownership of managing their own risks, and setting quantitative minima for liquidity buffers. In short, a banking version of Chart 2.⁷

But while LOLR may have been primarily focused on banks, there are also historical precedents for central banks stepping in to restore broader market functioning at critical moments. In July 1914, for example, the Bank of England made large-scale purchases of bills of exchange after the uncertainty caused by the onset of World War 1 brought the market to a halt, threatening widespread contagion (the bill market was at that time the engine of global trade finance).⁸ The Federal Reserve took similar actions in the US Treasury bond market in 1939 (at the start of World War 2), 1958 (following a regime change in government funding arrangements) and 1970 (amidst unrest over the Vietnam war).⁹

By degrees, these and other actions show a gradual broadening in focus by central banks from backstopping the funding liquidity of banks to backstopping market liquidity,¹⁰ when severe dysfunction threatens financial stability.

⁵ ‘Currency and Credit’ (1919) and ‘The Art of Central Banking’ (1932), by Ralph George Hawtrey.

⁶ ‘Lombard Street: A Description of the Money Market’ (1875), by Walter Bagehot.

⁷ These tools have been further supplemented by deposit insurance, macroprudential and resolution frameworks, though these are typically more focused on solvency than liquidity considerations.

⁸ <https://bankunderground.co.uk/2019/04/30/the-great-war-and-the-bank-of-england-as-market-maker-of-last-resort/>

⁹ <https://libertystreeteconomics.newyorkfed.org/2020/08/market-function-purchases-by-the-federal-reserve.html>

¹⁰ Ie the ability to transact in reasonable size at or close to mid-market prices prevailing prior to the trade – as discussed, eg in <https://www.bankofengland.co.uk/financial-stability-paper/2015/the-resilience-of-financial-market-liquidity>

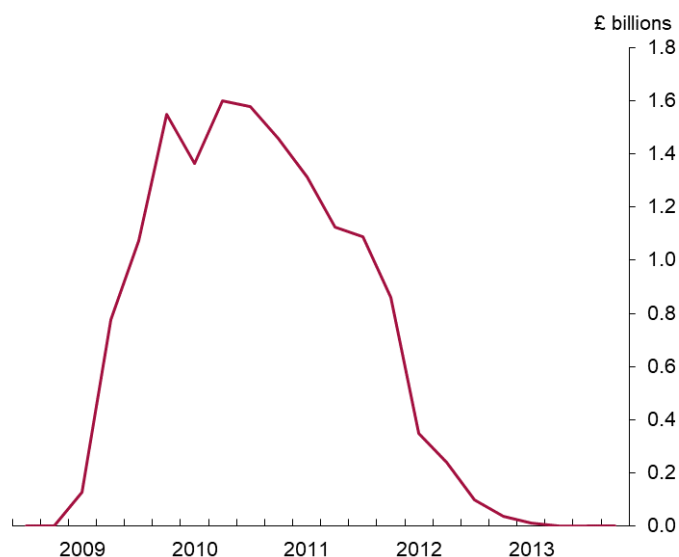
But it wasn't until 2007, in the foothills of the Global Financial Crisis (GFC), that Willem Buiter and Anne Sibert coined the phrase now widely used for this activity: 'Market Maker of Last Resort' (MMLR).¹¹ Buiter and Sibert believed that central banks, acting as MMLR, should be ready to tackle dysfunction in securities markets relevant to monetary or financial stability, by making two way prices to buy and sell those securities, or lending against them. Risk would temporarily be transferred off dealers' balance sheets, freeing up capacity to return market liquidity to more normal levels.¹² In all other respects, they recommended following Bagehot's principles: ie standing ready to operate at scale, but only at prices, rates and collateral haircuts that would protect public money and avoid moral hazard. Such terms, they believed, would also ensure that the central bank's financial exposures naturally unwound as market conditions normalised, with purchased assets being sold back to the market, or repo exposures maturing.

Many historical central bank operations in securities markets, including some undertaken in the 2008-9 crisis, involved one-way purchases, and hence did not have this self-liquidating feature. One exception was the Bank of England's Corporate Bond Secondary Market Scheme, introduced in 2009, and from 2010 offering daily two-way prices on a wide range of high-quality sterling corporate bonds issued by non-financial companies, to aid secondary market liquidity. These prices were determined as a spread around the market price (so moved up and down with the market), and set at levels that incentivised market participants to sell to the Bank when market functioning was poor, and buy when market functioning returned to normal. The implications for the public sector balance sheet were modest: even at its peak, the scheme only owned about 1% of eligible bonds. But the existence of live two-way backstop prices helped liquidity to return to the market – and delivered a natural unwind in the facility, with bonds being sold back to market participants as functioning normalized (Chart 3).

¹¹ See for instance <https://voxeu.org/article/subprime-crisis-what-central-bankers-should-do-and-why> and <https://maverecon.blogspot.com/2007/08/central-banks-in-time-of-crisis.html>.

¹² In practice, effecting full risk transfer through central bank repo requires it to be done on a 'non-recourse' basis (ie relying solely on the collateral provided for risk mitigation in the event of default). The principles of such operations are discussed in <https://www.imf.org/en/Publications/WP/Issues/2017/07/10/Central-Bank-Emergency-Support-to-Securities-Markets-45012>, and were put into practice by the Federal Reserve in its Money Market Fund facilities provided during the GFC and the Covid crisis.

Chart 3: Holdings in Corporate Bond Secondary Market Scheme



Source: Bank of England

The review of the Bank's liquidity framework carried out by Bill Winters in 2012 recommended formalising the Bank's approach to MMLR, setting out public principles under which future interventions might occur.¹³ Various proposals on these points had been made in the wake of the GFC, by – amongst others – Paul Tucker, Perry Mehrling, Michael Dooley and Stephen Cecchetti.¹⁴ But in the event, the Bank – in common with other central banks – chose to say relatively little in public. That reflected a number of factors, including the practical challenges of determining in advance the markets in which central banks might operate, the terms on which they would do so, and the consequences for public money.

In the years that followed, the topic received little active attention, either inside or outside central banks.

II) Covid, market dysfunction and central bank interventions

The experience of Covid has changed that.

This is not the place to review the actions taken by central banks since last Spring in detail: many have covered that elsewhere.¹⁵ Instead, I want to pull out a number of lessons from that experience that, directly or indirectly, can help inform future tool design.

¹³ <https://www.bankofengland.co.uk/-/media/boe/files/news/2012/november/the-banks-framework-for-providing-liquidity-to-the-banking>

¹⁴ See for example <https://www.bankofengland.co.uk/speech/2009/last-resort-lending-market-making-and-capital>, <https://press.princeton.edu/books/hardcover/9780691143989/the-new-lombard-street>, and the papers from the 2014 workshop on 'Re-thinking the lender of last resort' held at the Bank for International Settlements (<https://www.bis.org/publ/bppdf/bispap79.pdf>).

¹⁵ My own remarks are available at <https://www.bankofengland.co.uk/speech/2020/andrew-hauser-speech-hosted-by-bloomberg-via-webinar>.

The first highlights limitations in our existing liquidity provision toolkit, which is focused primarily on lending to banks.¹⁶ The Bank of England provided extra liquidity to banks through a wide range of facilities, at favourable rates, in the early stages of the March crisis – including FX lending backed by dollar and euro swap lines, and sterling lending through both our standing Indexed Long Term Repo facility, and the specially-activated Contingent Term Repo Facility. Other major central banks took similar steps.¹⁷ Using these facilities, banks did play a part in channelling liquidity to the wider market, materially increasing both their borrowing from central banks, and their on-lending to their own counterparties. But they by no means exhausted the extra central bank liquidity on offer – and their on-lending was insufficient to meet the explosion in liquidity demand from non-banks, driving term repo rates and government bond yields sharply higher.

With the normal central bank antibiotics struggling to reach the source of the infection, it was time for stronger medicine.

The huge asset purchase programmes unleashed in Spring 2020 had a dramatic and immediate calming effect, ‘getting in all the cracks’ of the liquidity shortage amongst non-banks, and taking duration risk off dealers’ balance sheets. Central banks made it clear their operations were aimed, in part, and at least initially, at restoring market functioning. The Bank of England said it would complete its asset purchases ‘as soon as is operationally possible, consistent with improved market functioning’.¹⁸ The Federal Reserve said it would ‘purchase Treasury securities and agency mortgage-backed securities in the amounts needed to support smooth market functioning’.¹⁹ And the ECB framed its decisions in the context of ‘severe strains in the financial markets’ posing risks ‘of the ECB’s monetary policy transmission becoming significantly impaired’.²⁰ Asset purchases have accounted for all of the net increase in Bank of England and Federal Reserve balance sheets since last Spring, and about half of the ECB’s. Many other central banks took similar actions.²¹

¹⁶ The Bank of England expanded its own lending facilities to include broker dealers and CCPs in 2014, in response to the recommendation of the Winters Review: <https://www.bankofengland.co.uk/news/2014/november/widening-access-to-the-smf>.

¹⁷ Lorie Logan of the New York Federal Reserve, for example, set out the US approach in a speech last October: <https://www.newyorkfed.org/newsevents/speeches/2020/log201023>

¹⁸ <https://www.bankofengland.co.uk/monetary-policy-summary-and-minutes/2020/monetary-policy-summary-for-the-special-monetary-policy-committee-meeting-on-19-march-2020>

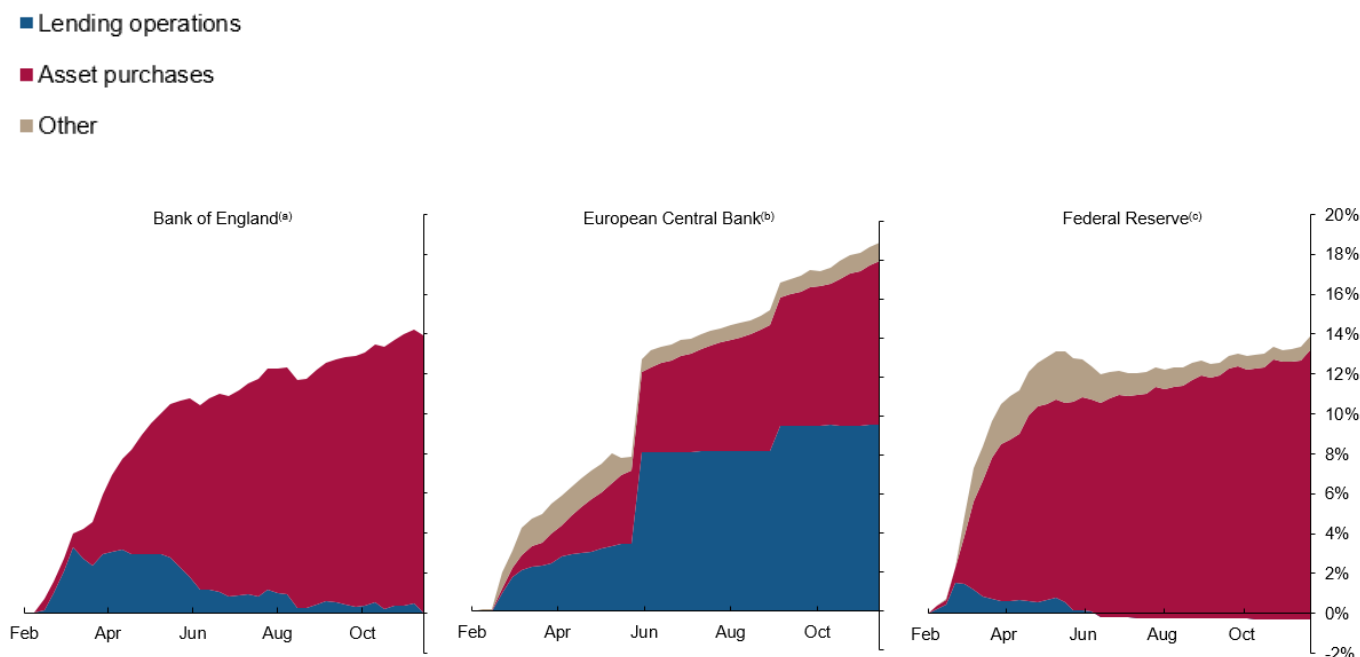
¹⁹ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200323b.htm>

²⁰ https://www.ecb.europa.eu/press/accounts/2020/html/ecb.mg200409_1~baf4b2ad06.en.html

²¹ See for example ‘Central bank bond purchases in emerging market economies’ by Yavuz Arslan, Mathias Drehmann and Boris Hofmann, BIS Bulletin no.20 at: <https://www.bis.org/publ/bisbull20.pdf>.

Chart 4: Central bank balance sheet responses to the Covid-19 shock during 2020

Changes in components of central bank balance sheets since end-Feb 2020 (as % of 2019 nominal GDP)



Sources: Bank of England, Bureau of Economic Analysis, European Central Bank, Eurostat, Federal Reserve Board, ONS and Bank calculations.

- (a) Bank of England lending operations shown here: Indexed long-term repo, Contingent term repo facility, US dollar repo operations, Liquidity Facility in Euros, Term Funding Scheme and Term Funding Scheme with additional incentives for SMEs. Bank of England asset purchases shown here: Asset Purchase Facility and Covid Corporate Financing Facility.
- (b) ECB lending operations: Lending to euro-area credit institutions related to monetary policy operations denominated in euro. ECB asset purchases: Securities held for monetary policy and other purposes.
- (c) Federal Reserve lending operations: Repurchase agreements, Loans and Net portfolio holdings of TALF II LLC. Federal Reserve asset purchases: Securities held outright. Section of chart lying below the zero line from mid-2020 reflects a decline in repo outstanding relative to end-February.

Despite their success in the unparalleled circumstances of Covid, these actions provide only limited guidance as to how central banks might best respond to future instances of market dysfunction driven by the more structural trends I outlined at the start of my remarks:

- They were one-way purchase operations of relatively long-duration assets – so they were not pre-programmed to unwind or self-liquidate when core market functioning returned, as it did by the late spring of 2020. Central banks were ‘buyers of last resort’ more than ‘market makers of last resort’.
- Purchases typically took place at prevailing market prices: ie the Bagehot principle was not applied.²² While not charging an ‘insurance premium’ to market participants for an extended period may be understandable in a severe unexpected pandemic, it would be harder to justify providing

²² Arguably this was not true at the very height of the dysfunction, when central banks were buying at prices well below pre-stress levels. But this behaviour was not expected by the market *ex ante*, and prices of government securities in most markets bounced back rapidly following the initial central bank interventions.

market participants with an expectation of similarly-priced public support if market dysfunction occurred because of well-understood vulnerabilities.

- A key part of the success of the Covid asset purchase programmes was that they took large quantities of risk off private sector balance sheets, meeting the heightened demand by non-banks for cash and allowing intermediaries to return to providing finance to the real economy. At the same time, of course, that means more risk on public sector balance sheets. ‘Whatever it takes’ may apply in a global pandemic. But public authorities will be more sensitive to the cost to the public purse if future episodes of market dysfunction emerge because of vulnerabilities in the system.
- The Covid response was unanticipated and discretionary. While that was fully justified in this instance by the unprecedented nature of the shock, the use of ad hoc tools risks embedding inappropriate expectations about how central banks might behave in future cases of market dysfunction.
- Finally, and perhaps most profoundly, the fact that the economic shock and the market dysfunction were both caused by the same exogenous event meant that a single tool – large scale, discretionary purchases of duration assets at market prices – could effectively restore both monetary and financial stability. In different circumstances, however, the optimal policy response for the two goals could diverge.

III) Central bank tools for market dysfunction: some design considerations

Drawing together the unfinished business of post-GFC thinking, the Covid experience, and the expectation of continued reliance on financial markets by households and companies, let me identify a number of tentative conclusions for the future design of central bank tools. The key points of this section are summarised in Table 1.

Table 1: Lessons from the dash for cash for future market dysfunction tool design

	Positives	Challenges	Future design questions
Standing liquidity facilities for banks	Regular, well understood	Banks did not meet all non-bank liquidity needs – so not a fully effective conduit for central bank liquidity	<i>Whether central banks need the ability to reach a wider range of market participants directly (and, if so, who)</i>
Special market wide operations using large scale asset purchases and other pre-existing tools	Ability to ‘go big and go fast’ necessary in the face of the Covid pandemic	Operations typically one way (‘buyer of last resort’) and much longer duration than the dysfunction	<i>Whether there should be more targeted two-way or self-liquidating tools better aligned with term of dysfunction</i>
		Operations conducted using tools also aimed at easing monetary policy	<i>How to deal with market dysfunction in periods when the optimal policy response differs from that required for monetary policy purposes</i>
		Operations were ad hoc or discretionary	<i>Whether more permanent standing facilities might better shape expectations</i>
	Effectiveness – ‘got in all the cracks’	No explicit ‘insurance premium’ in facility pricing – risks fuelling moral hazard if expected to prevail in future	<i>Whether to adopt Bagehot pricing/terms: eg buying at below pre-stress prices but above stress prices and/or pricing / haircuts</i>
	Took risk off private sector balance sheets	Added risk to public sector balance sheets	<i>How to judge appropriate risk sharing, and set bounds on public sector exposure</i>

The first is that central banks are likely to face increasing calls to provide public liquidity insurance for instances of severe financial market dysfunction in the years ahead, as the reliance on those markets grows, vulnerabilities to liquidity shocks persist, and intermediation capacity remains constrained. Clarity will be required as to whether, and if so how, such activities fall within their formal remits. In some cases they may be able to use existing tools designed for monetary policy purposes, as they did in the Covid crisis. But in others, those tools may prove poorly suited to the task, and new ways will be needed to achieve those ends, whether through outright purchase and sale operations, repo facilities or other means.

Second, central banks will need to decide which marketable assets should be in scope of any new tools. The most obvious candidate is government bonds, which lay at the epicentre of the dash for cash. For other, riskier, assets to qualify, a case would need to be made both that they are sufficiently core to monetary and financial stability, and that central banks can price and risk manage them effectively. It is notable that many central banks bought a range of assets beyond government bonds during the 2008-9 and Covid crises, including corporate bonds and commercial paper.

Third, central banks will need to reflect on whether the use of their balance sheets to address market dysfunction should remain primarily discretionary, or whether at least aspects of that role should be formalised into standing facilities, the terms of which are known in advance. The case in favour of such an approach is that a known 'reaction function' allows market participants to organise their affairs and price risks in advance of episodes of dysfunction, avoiding over-optimism about the circumstances in which public support will not be forthcoming (incentivising appropriate self-insurance), and over-pessimism about when it would (allowing safe business to thrive). It may also provide confidence that the system is backstopped against operational or other idiosyncratic market-wide events, such as systemic IT outages. Similar arguments have been used to rationalise standing facilities for banks.

Fourth, careful consideration would need to be given to who should have access to these tools, either directly or indirectly. Restricting such access to banks alone is unlikely to prove sufficient to stabilise core markets, given the increasing importance of the sorts of non-bank participants I discussed earlier. But access criteria would still be needed – to limit the financial risks to which public money is exposed; to ensure public insurance is not provided to firms who have not first taken steps to provide for their own resilience, or that of the wider system; and to ensure the sheer operational feasibility of any new tool.²³ The quid pro quo between central bank access and meeting robust prudential standards is one of the key reasons why these discussions need to happen in parallel with those taking place at the Financial Stability Board.

Fifth, and finally, the terms and conditions of such facilities will also need to be carefully calibrated to ensure those same risks are effectively managed. In particular that will mean:

- Ensuring that prices, rates and collateral haircuts are well aligned to the Bagehot principle to ensure any facilities remain strictly backstops that are used when conditions become materially dysfunctional, but leave the burden of ensuring safe operation during a wide range of normal and less-normal market conditions with market participants, and the regulatory regimes they are subject to; and
- Ensuring facilities are naturally self-liquidating, in that they build up exposures when markets are dysfunctional, but run them down when functioning returns to normal – delivering sufficient risk

²³ Investment funds, for example, outnumber banks by several orders of magnitude.

transfer to kick start private sector activity during periods of dysfunction, while limiting the scale and persistence of risks to public funds.

These are not straightforward tradeoffs, and different jurisdictions may choose different points along them, depending on the relative importance of banks and financial markets in their local economies, their central bank mandates, and their risk preferences. But given the multiple institutional, technological and cross-border linkages that characterise our core markets, we have a strong common interest in setting out the choices. A recent Brookings paper by Nellie Liang and Pat Parkinson touches on a number of these issues as they relate to the US Treasury market.²⁴

Conclusion

It is sometimes said that hard cases make bad law.

We should certainly be wary of drawing overly direct conclusions from the Covid pandemic, given how truly unique the circumstances have been.

But many of the vulnerabilities in financial markets exposed last Spring have been staring us in the face for some time – and will only grow in importance in the years ahead, as households and firms come to rely ever more closely on such markets to care for their savings, and fund investment.

So we must seize this opportunity for reform.

The primary focus lies in strengthening the resilience of those active in financial markets, through the vital work underway at the Financial Stability Board. Prevention is better than cure.

But central bank tools have a part to play too. I have discussed here today some of the design features that a new generation of such tools might have. I look forward to the debate to come.

Thank you.

²⁴ <https://www.brookings.edu/research/enhancing-liquidity-of-the-u-s-treasury-market-under-stress/>