

# Unwinding Monetary Stimulus in an Uneven Economy: Time for a New Playbook?\*

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## I. Introduction

Central banks around the world responded aggressively to Covid using a range of tools (English et al., 2021). As the pandemic fades and economic activity recovers, many central banks are nearing the time (if not already there) when some of this stimulus can be withdrawn without undermining the recovery. After any ongoing asset purchase programs are completed (i.e., any tapering is finished), what is the best strategy for reducing stimulus in a way that sustains the recovery with inflation settling around targets? Should central banks return to the usual “playbook” that involves first increasing policy interest rates and then unwinding asset purchases?<sup>1</sup> This paper argues central banks should place a greater priority on unwinding asset purchases than in the past due to the uneven impact of the pandemic combined with changes in the economic landscape over the last decade.

As quantitative easing/large-scale asset purchase programs (referred to as QE throughout this paper) became more widely utilized in response to the Global Financial Crisis (GFC), central banks believed most of the increase in their balance sheets would be temporary; they planned to unwind at least a portion of their asset purchases as the recovery solidified and after beginning to raise interest rates. Most central banks never specified exactly when or how this unwind would occur, however, as persistently weak inflation and slow recoveries delayed the increases in interest rates that would precede any action on asset holdings. Only one major central bank was comfortable making any meaningful reduction in its stock of bond holdings: the US Federal Reserve. The Federal Reserve initiated a series of rate hikes in 2015 (very slowly) and then began reducing its stock of asset holdings in 2017 by

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<sup>1</sup> Governor Bailey of the Bank of England broached this question last year at the Jackson Hole Symposium (Bailey, 2020), but there has been little subsequent discussion in other central banks—at least publically. The few central banks that have recently discussed sequencing have generally reaffirmed that the policy rate is the primary tool for adjusting the monetary policy stance, with few details on plans for any subsequent unwinding of balance sheets.

gradually decreasing its reinvestment of principal. This “wind down”, however, lasted less than two years and reduced the Federal Reserve’s asset holdings by far less than had been expected when the unwind began.

Over the last few years, the economic landscape has changed in several important ways relevant to central banks’ balance sheet strategies. First, the size of asset holdings has ballooned relative to pre-Covid. This increases a number of vulnerabilities, such as generating fiscal losses when interest rates increase from today’s record-low levels and aggravating tensions around central bank independence.<sup>2</sup> Second, a share of the assets central banks currently hold were purchased to support market functioning and provide liquidity in response to a temporary shock. This is a different motivation than much of the post-2008 QE aimed at supporting economic growth and stabilizing prices. Finally, central banks better understand that  $r^*$  has fallen to levels that will limit their ability to tighten monetary policy in the future. As a result, they now realize that if they follow their earlier “playbook” of waiting to unwind asset holdings until after interest rates are raised several times, they may never reach a point where they can reduce holdings.

As these changes in the economic landscape have occurred, the more widespread use of QE has motivated a series of academic papers improving our understanding of how QE works (albeit with key gaps remaining). Easing monetary policy through either QE or lower policy interest rates stimulates the economy through many of the same mechanisms, but the relative importance of different channels varies across these two tools. For example, changes in policy rates stimulate the economy more through the short-term real interest rate, and therefore have a relatively larger impact than QE through reducing borrowing costs on bank loans for SMEs and on short-term household liabilities (such as credit card debt and auto loans). In contrast, QE stimulates the economy more through the term premium, and therefore has a relatively larger impact through reducing borrowing costs on longer-term household liabilities (such as mortgages) and some types of longer-term financing for larger companies. The specific assets purchased in a QE program also benefit from a greater reduction in yields—and therefore provide relatively more stimulus to the corresponding sector (i.e., if MBS or corporate bonds are included in the QE program, this tends to reduce yields on mortgages or eligible corporate bonds, respectively, more than if they were not included in the program). These different channels through which policy rates and QE (as well as the specific design of the QE program) affect the economy should be factored into the playbook of options for adjusting monetary policy.

Unwinding the current monetary stimulus will involve many decisions—including when to begin, how quickly to tighten, and how to order and coordinate adjustments via different tools. This paper focuses on just one aspect—how to prioritize unwinding asset holdings relative to raising policy interest rates.<sup>3</sup> Following the traditional playbook of tightening monetary policy by first raising interest rates would have several important advantages: nimble; easier to calibrate to achieve a given economic effect; creates space to lower interest rates during the next downturn; and less likely to destabilize financial markets. On the other hand, unwinding QE could also provide several important advantages: better target sectors requiring less stimulus; reinforce central bank independence by showing that QE is

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<sup>2</sup> Central banks have been candid about the risk of future losses from QE programs, and many have made substantial profits on their asset holdings to date. Future losses could still generate a political backlash, especially if they occur when fiscal positions are under pressure after large Covid-related stimulus.

<sup>3</sup> Unwinding could mean outright bond sales, ending reinvestments when holdings expire, partial reinvestments to reduce holdings by a fixed amount each month, reducing holdings of certain types of bonds but not others, or the many alternatives.

not permanent financing of government deficits; reduce future financial losses from higher interest rates; and potentially have less contractionary effect (if not seen as a signal of future increases in interest rates) so that there is more space to normalize both asset holdings and interest rates over time. Financial stability risks (including international spillovers) should also be considered—but there is not yet convincing empirical evidence on the different effects of raising policy rates relative to reducing asset holdings on these multifaceted risks.

Also important, several characteristics of this uneven, pandemic economy strengthen arguments to revisit the usual playbook and give more priority to unwinding QE—possibly even before raising interest rates. First, the housing market has been unusually strong, so that unwinding asset holdings (which have more impact on the medium and longer-end of the yield curve), and especially unwinding any holdings that more directly affect mortgages (such as MBS in the U.S.), would tighten credit conditions relatively more in this segment of the economy that no longer needs stimulus. Second, and in contrast, other segments of the economy are more vulnerable and would benefit from maintaining supportive credit conditions for longer—such as SMEs that rely more on short-term bank loans to stay afloat and households struggling to repay their pandemic-related credit card debt and auto loans. The borrowing costs of these more vulnerable sectors are linked more closely to the short-term policy rate than QE. Third, the pickup in inflation, combined with large fiscal deficits, has made it more important for central banks to show QE is not simply financing government budget deficits. Unwinding asset holdings would be an important signal that central banks are not subject to fiscal dominance and thereby help ensure that inflation expectations remain anchored. Finally, and related, after central banks took on unprecedented new roles to support the economy during Covid, reducing the size of balance sheets and unwinding asset holdings could be important to show that this “expansion of reach” was a temporary response to a crisis and not a permanent expansion of market involvement.

The remainder of this paper is as follows. Section II discusses how the landscape around unwinding QE programs has changed. Section III summarizes the evidence on how adjustments to policy rates and asset purchases affect the economy, focusing on the relative importance of different channels and what this implies for different sectors of the economy. Section IV builds on this evidence to evaluate the advantages of removing monetary stimulus through raising policy rates versus unwinding asset holdings, highlighting new considerations during this uneven recovery. The last section quickly concludes.

Finally, several caveats on what is (and is not) covered in this paper. This discussion focuses on unwinding asset purchases, but does not tackle the related and important set of issues around how any such unwinding would occur. For example, it does not discuss the triggers or pace, or whether any reduction in balance sheets should occur through the automatic rolling-off of expired maturities or outright asset sales, or related issues around whether it is the flow or stock of central bank assets which matters most.<sup>4</sup> Given the uncertainty around the effects of balance sheet unwind, however, any adjustments should be slow, gradual, and well communicated in advance. Second, the discussion of unwinding asset purchases should not be interpreted as implying that all bonds purchased through QE programs should be sold so that central bank asset holdings return to pre-2008 levels. Changes in macroprudential regulation and market structure over the last decade require central banks to hold

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<sup>4</sup> It also does not discuss how these strategies may differ based on whether a central bank had previously relied on open-ended QE (such as the U.S. Federal Reserve) or a fixed quantity of purchases (such as the BoE).

larger amounts of reserves on their balance sheets to provide liquidity and support market functioning. The level of asset holdings to achieve these goals is less than today's large holdings, but more than in 2008—leaving a very large range. Third, this paper focuses on issues most relevant to advanced economies, and although many of these issues are also relevant to emerging markets, does not attempt to tackle the broader set of related challenges for many emerging markets (such as around currency mismatch or less well-anchored inflation expectations). Finally, this discussion focuses on unwinding stimulus through two of the most important central bank tools—adjustments to policy interest rates and asset holdings. It does not address the timing and use of other tools (such as liquidity support programs, bank-lending programs, and macroprudential regulations). It also does not discuss forward guidance, which could interact in important ways with changes in policy rates or changes in asset holdings. All of these tools are important—and the optimal central bank “playbook” would consider options that involve the use and coordination of this full range of instruments.

## **II. Scaling Back: How the Landscape for Unwinding QE has Changed**

In response to the Global Financial Crisis (GFC), a number of central banks launched QE programs, primarily through central bank purchases of government debt on secondary markets.<sup>5</sup> These QE programs were intended to be a temporary measure, with central banks planning to unwind a significant portion of their bond purchases over time and when consistent with achieving their mandates. This intention to unwind asset purchases was important in some countries to show that central banks were not coordinating with governments to support their fiscal policies, and that QE was not intended to finance government budget deficits.

Despite their intentions to unwind QE at some point, the subsequent slow recovery and low equilibrium interest rate mean that most central banks made little progress in the aftermath of the GFC. The consensus “playbook” was that when it was appropriate to remove monetary stimulus, the first step would be to increase the policy rate, and then if the recovery remained on track, it would be appropriate to begin unwinding the stock of asset holdings.<sup>6</sup> Most central banks were vague about how this would occur—such as to what level the policy interest rate would need to be raised before discussing unwind, or how any unwind would occur (such as through stopping reinvestments or outright sales).

One central bank that was more explicit on how any unwind would occur and interact with changes in the policy interest rate was the Bank of England (BoE). In November 2015, the BoE stated that it would maintain its existing stock of purchased assets until its policy rate “had reached a level from which it can be cut materially”, specified as Bank Rate around 2%. This threshold was then reduced to 1.5% in June 2018 when the MPC reassessed that the ELB was lower (providing more policy space to adjust the policy rate in the future), and again to 0.5% in August 2021 when the ability to use negative

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<sup>5</sup> Although the details varied across countries, I will use the term QE to refer to the range of asset purchase programs, including programs purchasing agency debt in the U.S. and corporate bonds in different countries. I will not discuss many of the short-term liquidity and lending support programs, as well as other central bank programs, that could involve exposure through the same asset-purchase facilities.

<sup>6</sup> Soon after the GFC, the Federal Reserve discussed unwinding some asset holdings before raising interest rates, but the sharp reaction from the taper tantrum caused them to be more cautious and delay unwinding its bond holdings.

interest rates was operationalized (implying a further reduction in the ELB).<sup>7</sup> In each case, however, this guidance on balance sheet unwind was not intended to indicate any near-term change in asset holdings (and in August 2021 the BoE was even still purchasing assets). On each occasion, the market path for interest rates suggested that the thresholds would not be met for at least a year (and often much longer), and even if the threshold was met, the guidance only established a sufficient condition to start asset reductions, not a commitment to act.

Most central banks could avoid giving any such guidance on how they would unwind asset holdings as they were expected to be behind the BoE in starting a tightening cycle. The U.S. Federal Reserve was the only major, advanced economy central bank able to sustain a single increase in interest rates during the “recovery” from 2011 through 2016. Several central banks raised interest rates—but then had to reverse course and reduce rates to even lower levels.<sup>8</sup> When central banks subsequently began raising rates nearly a decade after the GFC, inflation still remained muted and below target in most advanced economies, despite unusually gradual and limited tightening cycles. With such constraints on their ability to raise interest rates, central banks could delay providing any detailed guidance on asset holdings.

Adding to central banks’ hesitation to discuss a “playbook” for unwinding asset purchases was the high degree of uncertainty about the economic impact. In the immediate aftermath of the GFC, there was substantial skepticism about whether QE could even boost growth and inflation. For those who believed QE had a substantial impact, there was uncertainty about whether it only worked when markets were dysfunctional and/or liquidity unavailable—implying that asset purchases would have little impact during periods of well-functioning markets and ample liquidity. As evidence began to build that QE worked even when markets were not dysfunctional<sup>9</sup>, an even harder question emerged: were the effects of unwinding asset holdings symmetric to buying the same assets (but with the opposite sign)? With no concrete evidence, one approach to assess magnitudes was to estimate the impact of asset purchases and then flip the sign. This (very unsatisfactory) approach implied a large and meaningful negative impact of unwinding asset holdings on inflation and growth. Taking the opposite view, others (such as Vlieghe, 2018) argued that any unwinding could have minimal impact if it was communicated as a technical adjustment that happened automatically in the background and therefore did not provide any signal about the future path of interest rates (i.e., akin to “watching paint dry” as suggested by Chair Yellen<sup>10</sup>).

Further complicating central banks attempts to understand the impact of unwinding QE is that only one central bank has managed to unwind a meaningful amount of its recent bond purchases: the U.S. Federal Reserve.<sup>11</sup> The U.S. Federal Reserve reduced its reinvestments from 2017 to 2019, but at such a modest pace that the balance sheet only declined by about \$750bn to \$3.8tn in 2019.

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<sup>7</sup> In August 2021 the BoE also specified that any balance sheet unwind that began after Bank Rate reached 0.5% would only occur by not reinvesting maturing bonds and active sales of bonds would only be considered when Bank Rate reached 1.0%.

<sup>8</sup> See Forbes (2017) for more details on this “Failure to Launch”.

<sup>9</sup> For example, Weale and Wieladek (2016) find no significant difference in the UK between the initial round of QE (when markets were dysfunctional) and later programs. See Section III for more discussion of the evidence.

<sup>10</sup> For example, see <https://www.federalreserve.gov/mediacenter/files/fomcpressconf20170614.pdf>

<sup>11</sup> The ECB also modestly shrank its balance sheet over about 2 years starting in 2012, but by allowing its liquidity support facilities to expire and not reducing its bond holdings. The ECB then restarted QE in 2015 and increased the size of its balance sheet. See Orphanides (2021) for more details. Before the GFC, the Bank of Japan reduced its holding of JGBs from ¥63.8 trillion in January 2006 to ¥49.2 trillion in March 2007—despite inflation being well below target (about 0%).

Communication highlighted that changes in policy rates remained the active tool, and the initial unwind appeared to have minimal impact on the broader economy (Greenlaw et al., 2018), supporting the “paint drying” hypothesis. By 2019, however, the unwind appeared to be contributing to an unexpected tightening in financial conditions—supporting the estimates of larger effects. With evidence from only one country during one period (which also included a number of global shocks), it is impossible to use this experience to estimate the impact of unwinding QE with any accuracy.

As the pandemic spread in early 2020, any discussion of unwinding QE was deferred as central banks aggressively eased monetary policy through a combination of lower interest rates, asset purchases, liquidity and credit support programs, macroprudential easing, and a range of new initiatives.<sup>12</sup> In many cases the new QE programs were much larger, much faster, and included a broader range of assets than in the past. This large-scale expansion of central bank balance sheets was a key part of the central bank response to Covid in many countries—including in a number of emerging markets that had not previously used QE. This large-scale expansion of balance sheets, however, was in addition to what were already record bond holdings given countries limited ability to unwind earlier purchases.

Also noteworthy were changes in how the initial asset purchases adopted in response to Covid were initially justified. In the spring of 2020, several major central banks (such as the Federal Reserve, BoE and Bank of Canada) justified new QE programs with the main objective of easing market dislocations and alleviating dealer’s balance sheet risk (English et al., 2021). The ECB launched a new asset purchase program (the PEPP) to provide more flexibility in allocating purchases across countries—with a key goal of addressing the sharp increase in bond spreads in peripheral economies. Although these justifications for QE programs could be linked to traditional central bank mandates of supporting inflation and employment, there was clearly a different motivation for these large and rapid asset purchases. There was also no attempt to link the size of programs to multipliers of how they would be expected to affect key variables that translated into a certain amount of GDP or inflation (as traditionally done when calibrating the size of stimulus). As financial markets stabilized, central bank communications shifted to justifying later rounds of QE as aimed at achieving the traditional mandates of price stability and employment—but suspicions remained that QE programs were driven by other motivations, especially to explicitly finance government deficits. For example, the BoE was harshly criticized in a report by the UK House of Lords for seeming to coordinate asset purchases to absorb the large increase in Covid-related government debt issuance (House of Lords, 2021).

As the recovery from the pandemic gains strength, central banks will (hopefully) soon be in a position to begin removing monetary stimulus (of course, when merited given growth and inflation dynamics). After ending any ongoing asset purchase programs, it would be easy to return to the pre-Covid playbook: begin by gradually increasing policy interest rates and then consider unwinding asset purchases. While this strategy may have made sense in the past, this brief history of QE programs suggests that the landscape has changed in three important ways that should be considered when evaluating how to unwind monetary stimulus.

First, the size of asset holdings has ballooned relative to pre-Covid levels (Figure 1). Since these holdings are financed with short-term liabilities (central bank reserves), this has significantly shortened the maturity structure of government debt. BIS (2021) reports that in advanced economies, some 15-

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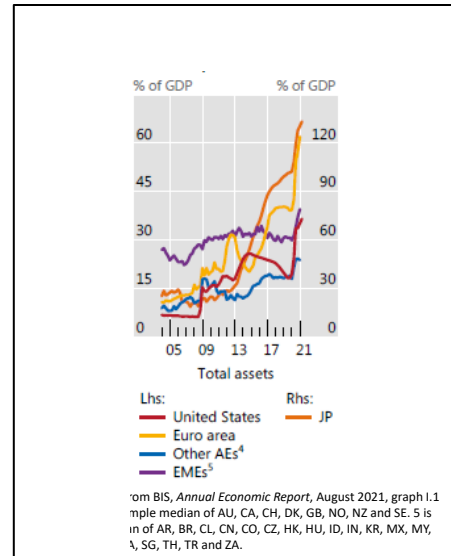
<sup>12</sup> See English et al. (2021) for a discussion of the range of central bank responses around the world, details on the new rounds of QE packages, as well as discussion of how the responses in emerging markets compare to those in advanced economies.

45% of all sovereign debt is now de facto overnight. When interest rates rise from their current low levels, central banks will shift from earning profits on their holdings of government bonds to suffering losses, which are generally passed on to governments.<sup>13</sup> These losses (even if indemnified) and the sheer volume of these positions is likely to aggravate concerns about central bank independence. If central banks never unwind their purchases of government debt, it could feed this perception that new QE programs are aimed at fiscal financing. Also, the volume of these holdings could potentially impede market functioning and infrastructure in the future, especially if central banks do not reduce holdings during recoveries but periodically “ratchet up” these positions during slowdowns.<sup>14</sup>

Second, a share of the assets central banks are currently holding were purchased to support market functioning and provide liquidity during a temporary shock—a very different motivation than much of the post-2008 QE. Now that market functioning has stabilized and liquidity has returned—do central banks still need to maintain these holdings? Granted, it is difficult to separate which assets were purchased for these types of temporary reasons from those done for the more traditional motivation of supporting inflation and growth, but it raises the important question of whether purchases aimed at addressing a short-term market issue need to be held after the emergency has passed.<sup>15</sup> This is particularly important as these “temporary” shocks drive such a large volume of asset purchases.

Finally, the low level of  $r^*$  implies that central banks may only be able to make modest adjustments to monetary policy (and far less than during historic tightening cycles) before achieving inflation targets sustainably. This suggests they may need to choose between which monetary tools to tighten. In fact, there is a chance that some countries never even raise policy interest rates to positive levels before the next shock or recession occurs. As a result, if central banks continue to prioritize raising interest rates to a certain level before reducing asset purchases, there is a good chance they will not begin unwinding their large balance sheets for a very long time (if ever). This is a very different understanding of the situation than when QE programs were initially introduced (albeit, with the benefit of hindsight,  $r^*$  had already fallen sharply after the GFC so this tradeoff has likely existed longer than appreciated).

These changes in the economic landscape raise several important questions about how central banks should approach unwinding QE in the future. Should unwinding QE become more of a priority for central banks—and possibly even take precedence over raising policy interest rates? Does unwinding QE



<sup>13</sup> This occurs because the purchases of government bonds (which yield the long-term interest rate) are paid for by central bank reserves (which carry a short-term floating rate). When interest rates increase, the short-term rate that central banks pay on reserves will increase faster than the rate earned on their bond holdings. See Vlieghe (2021) for details on this issue in the UK.

<sup>14</sup> Although this may seem a distant concern in countries with large and liquid government bond markets, this was a factor contributing to the BoJ’s shift to yield curve control in 2016. One aim was to mitigate concerns that the BoJ could run out of JGBs to buy in its QE program after accounting for domestic financial institutions’ demand for liquidity and regulatory requirements. Governor Bailey at the BoE has also expressed concerns about running out of “policy space” for large-scale QE in the future. See English et al. (2021) for more discussion of these issues.

<sup>15</sup> The ECB has been more explicit in differentiating between these goals in its different asset purchase facilities.

have different economic effects than raising interest rates—effects that may make more (or less) sense in an uneven recovery after a pandemic? If QE was done to support markets during a period of temporary illiquidity and dysfunction—could those purchases be unwound without undermining the real economy? To answer these questions, it is necessary to take a closer look at the evidence on how QE works and how its effects differ from adjustments in policy interest rates.

### III. Policy Rates vs. Asset Purchases: Channels and Impact

Many years of experience, combined with an extensive academic literature, provide evidence of the channels by which changes in policy interest rates boost inflation and growth. A reduction in the policy interest rate causes an immediate reduction in the risk-free interest rate, which usually corresponds to a reduction in the cost of funds for banks and reduced risk aversion.<sup>16</sup> These effects, in turn, correspond to increased bank lending, stronger credit growth, lower borrowing costs for households and firms (for everything from credit cards to mortgages to business loans), increased leverage, higher house prices, higher equity valuations, lower risk premia, and lower spreads for all types of debt—especially riskier debt. All of these effects contribute to higher inflation, stronger growth and higher employment.

The literature assessing how QE works is much more recent, more tentative, and includes a range of (sometimes contradictory) results. Nonetheless, a fairly consistent set of results is beginning to emerge (and is well summarized in Bernanke, 2020). Asset purchases also lower borrowing costs—but more through a reduction in term premia instead of lower short-term real interest rates (which often remain around the ELB); as a result, QE has a larger effect at the intermediate and longer-end of the yield curve.<sup>17</sup> This reduction in term premia is partly driven by a “portfolio rebalancing effect”, as investors that sell their bonds to the central bank reinvest in other assets, reducing yields and increasing asset values (such as on high-yield debt and equities). QE can also reduce borrowing costs through a “signaling channel”—as QE announcements can show that central banks are intent on supporting the economy for longer, thereby affecting financial markets’ expectations about the future path of the policy rate (Eggertson and Woodford, 2003). During periods of market dysfunction, asset purchases can also have a powerful effect through a “liquidity” channel that supports market functioning and reduces default risk. Some of these effects appear to be state-contingent (especially the latter), but evidence from the use of QE during periods when markets are functioning normally and liquidity is abundant (such as when the BoE used QE in 2016 after the Brexit vote) suggest that QE can be potent in “non-stress” states. All of these channels by which QE can affect the economy can contribute to higher inflation, stronger growth and higher employment.

There is also evidence that the specific assets included in a QE program determine which markets are most affected. Krishnamurthy and Vissing-Jorgensen (2011) show that the Federal Reserve’s QE

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<sup>16</sup> This assumes the reduction in rates is not anticipated; if it was anticipated, these effects usually precede the change in the policy rate as the change begins to be built into expectations.

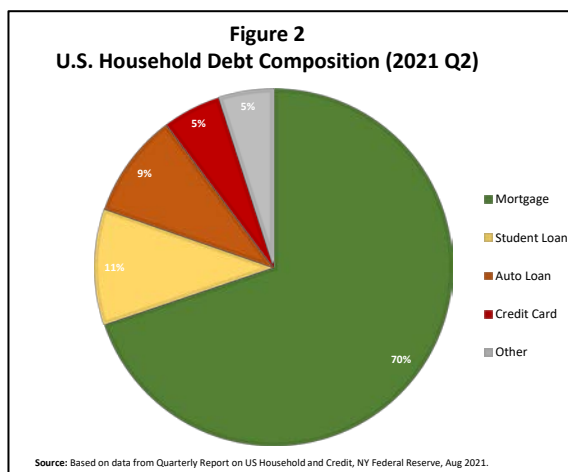
<sup>17</sup> Swanson (2017) compares surprises in the federal funds rate to large-scale asset purchases (LSAPs). He finds that shocks to the funds rate have the largest effects at the short end of the yield curve and die off monotonically as the maturity of the interest rate increases. In contrast, the effect of LSAPs “on yields is relatively small at short and medium horizons but increases steadily with maturity—exactly the opposite of changes in the current federal funds rate.” He also finds, however, that most of these effects are fairly short-lived. Krishnamurthy and Vissing-Jorgensen (2011) also find that QE significantly reduces yields on intermediate and long-maturity bonds (especially 5-10 year), with less effect on short-term bonds.



programs which included mortgage-backed securities (MBS), had larger effects on MBS rates than programs which only included Treasury purchases, and Di Maggio et al. (2015) show that mortgage rates linked to MBS that qualified for QE programs fell by twice as much as mortgage rates linked to non-qualifying MBS (jumbo mortgages). Similarly, D’Amico and Kaminska (2019) show that BoE QE programs that included corporate bonds generated a larger reduction in corporate bond spreads than programs which did not include these assets, and Boneva et al. (2018) show that corporate bond spreads fell significantly more for bonds eligible for QE programs than corporate bonds that were not eligible (but issued by the same company). In each case, the QE programs still reduced yields for bonds that were not directly included in the program—showing the broader spillover effects of QE—but these results suggest that QE programs could be designed to provide relatively more support for certain assets and segments of the economy.

If QE (and exactly what assets are purchased in a QE program) affect financial markets in different ways than reductions in policy interest rates, than unwinding asset holdings is also likely to affect the economy in different ways than raising interest rates. More specifically, if QE has larger effects on the medium- and longer end of the yield curve than changes in policy rates (which primarily effect the shorter end), than unwinding QE should have relatively larger effects on the borrowing costs for medium- and longer- term debt (such as mortgages), while increasing the policy rate would have relatively larger effects on the borrowing costs for shorter-term loans (such as credit card debt, auto loans and SME loans). If QE was unwound during a period of ample liquidity and well-functioning financial markets, and not interpreted as a signal of changes in the path for policy interest rates (i.e., did not work through the signaling or liquidity channel), it could have a much smaller effect on borrowing costs and the broader economy than when the assets were purchased. In fact, if an announcement of unwinding QE signaled that increases in the policy rate would be delayed relative to expectations, it could even generate a fall in short-term interest rates (thereby providing more stimulus to sectors more closely linked to the short end of the yield curve). Similarly, if any unwinding of asset holdings primarily occurred through assets other than the government bonds that constitute the majority of asset holdings (such as through MBS or corporate bonds), it would likely have a relatively larger effect on the corresponding markets (albeit still increase yields to some extent for all bonds).

To provide a more specific example, Figure 2 shows the distribution of U.S. household debt as of Q2 2021, with debt for which the borrowing cost is relatively more affected by unwinding QE in green and debt relatively more affected by changes in policy interest rates in red and orange.<sup>18</sup> US household debt is dominated by mortgages (constituting 70% of US household debt). Rates for new mortgages are linked to yields on MBS, which tend to be longer term and therefore relatively more affected by changes in QE (and MBS purchases) than short-term policy interest rates.<sup>19</sup> At the other



<sup>18</sup> The “Other” category includes HE revolving and “other” debt. Data from the NY Federal Reserve, available at: [https://www.newyorkfed.org/medialibrary/interactives/householdcredit/data/pdf/HHDC\\_2021Q2.pdf](https://www.newyorkfed.org/medialibrary/interactives/householdcredit/data/pdf/HHDC_2021Q2.pdf)

<sup>19</sup> Most mortgages are for 30 years, and the majority of pass-through MBS have stated maturities of 30 years, 15 years and 5 years. Changes in asset holdings or interest rates would only impact new loans or variable-rate loans, and not the existing stock of mortgages financed at fixed rates.

extreme, about 5% of household debt is in the form of credit card debt, for which rates are more closely linked to the short end of the yield curve and the policy rate, and less sensitive to unwinding QE (assuming QE does not generate a signaling effect on short-term rates). The 9% of debt in the form of car loans would also be somewhat less sensitive to unwinding QE and more to changes in the policy rate, as car loans are most closely linked to the Federal funds rate and the average loan term was 71 months (as of March 2020).<sup>20</sup> Student loans are somewhere between—with the rates on federal student loans set by congress and based off the 10-year Treasury note.

A full analysis of the borrowing patterns of the financial and non-financial corporate sector is beyond the scope of this paper—and likely to vary substantially across countries based on institutional characteristics and the role of banks as a source of financing. At a very high level, however, in most countries small and medium enterprises (SMEs) tend to be more dependent on bank loans (or personal loans) for financing, with lending rates shorter-term and more closely correlated with the policy rate. Larger, non-financial companies tend to have a larger share of longer-term financing than SMEs—whether through equity, corporate bonds, or longer-term bank loans—and therefore be relatively more affected by any adjustments in asset holdings that have relatively larger effects on longer-term yields. This greater sensitivity of larger companies to QE would be accentuated if any adjustments in asset holdings involved corporate bonds.

Finally, changes in policy interest rates and QE also affect the economy through other channels—such as equity prices, the exchange rate, leverage, risk premia, other asset markets. Any of these channels could have implications for financial stability—from stoking a stock market bubble, incentivizing companies to take on excessive leverage, or depreciating the exchange rate and creating challenges for firms with currency mismatch. Although there is a popular perception that QE tends to have larger effects on these types of financial vulnerabilities than reductions in policy interest rates, the empirical evidence is mixed and inconclusive.<sup>21</sup> Weale and Wieladek (2021) is one of the few papers to attempt this comparison and does not find evidence that QE is boosts equity prices or other asset markets more than a comparable reduction in interest rates.<sup>22</sup> There is not yet any assessment of whether unwinding asset holdings has different effects than a comparable increase in interest rates. Moreover, the different channels through which QE works provide reasons why it could—or could not—have a greater impact on different metrics of financial stability. On one hand, if the portfolio-rebalancing channel of QE causes investors to sell Treasuries and buy riskier assets, then QE would be more likely to increase concerns about pricing in these markets. On the other hand, if QE flattens the yield curve, it could reduce the incentive for maturity transformation and reduce overall duration risk in the private sector (Woodford 2016). There is slightly more evidence that asset purchases generate larger international spillovers (through currencies and international asset prices) than changes in short rates—although both policy tools generate spillovers in the same direction (Miranda-Agrippino and Nenova, 2021 and Gourinchas et al., 2021). Understanding if a given amount of monetary stimulus (or given

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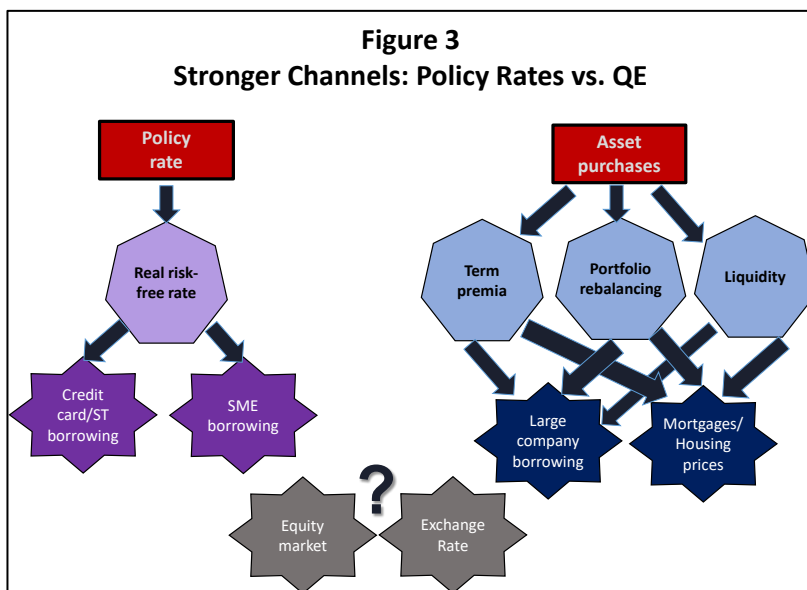
<sup>20</sup> Source: Experian State of the Auto Finance Market.

<sup>21</sup> For summaries of the mixed empirical evidence on asset prices, see Bernanke (2020) and Bhattarai and Neely (2020). For a discussion of the mixed evidence on the exchange rate, see Brainard (2017) and Forbes (2019). For evidence of the different international spillovers from US and ECB monetary policy tools, see Miranda-Agrippino and Nenova (2021).

<sup>22</sup> Weale and Wieladek (2021) scale QE and adjustments in the policy rate so that each shock yields an equivalent impact on inflation and find that the two policies generally have the same “financial side effects”—measured as the impact on private credit imbalances, financial market risk spreads, asset price valuations, and EM bond spreads. The main exceptions are for the US BAA spread (one of their risk measures) and CEMBIG (emerging market corporate bond spreads), where changes in the policy rate have stronger effects than QE.

monetary tightening) that occurs through asset holdings has different effects on financial stability and international spillovers than when done through adjustments in policy rates is an important area for future research.

To summarize, the empirical evidence suggests that easing monetary policy through either adjustments in policy rates or QE both stimulate the economy and work through many of the same channels, but the relative importance of some of these channels varies across tools. Figure 3 attempts to summarize the key differences. Changes in policy rates work more through the short-term real interest rate, and therefore have a relatively larger effect on the borrowing costs of SMEs and for shorter-term household borrowing (such as credit card debt and auto loans). QE works more through term premia and longer-term interest rates, and therefore has a relatively larger effect on the borrowing costs of larger companies and for longer-term household borrowing (such as mortgages). The assets purchased in a QE program also tend to experience a greater reduction in yields—and therefore provide relatively more benefit to the given sector (whether corporate bonds or mortgages linked to MBS). These different relative effects of adjustments in policy interest rates and asset holdings should be factored into any strategy for unwinding monetary stimulus.



#### IV. Different Playbooks for Unwinding: Pros and Cons

The economic landscape around QE has fundamentally changed over the last few years (Section II) and our understanding of the channels by which QE works has also improved (Section III)—albeit with some key questions still unresolved. What are the implications for how best to unwind monetary stimulus? Do the unusual characteristics of this uneven recession and recovery have any implications for the optimal approach? To answer these questions, this section discusses the pros of two strategies to remove stimulus: first raising interest rates or first unwinding some asset holdings. (There are obviously a large number of ways to combine these two policies, but to facilitate discussion, I will focus on prioritizing progress on one dimension before utilizing the other tool.) Then this section discusses special considerations given the uneven nature of this pandemic economy.

Before discussing the advantages of these two approaches for tightening monetary policy, however, it is worth highlighting one important consideration about which we do not yet have sufficient evidence: which strategy better mitigates financial stability risks. If maintaining policy interest rates near zero, or maintaining asset holdings at current levels, contributed relatively more to the buildup of different financial stability risks (whether in the housing market, equity prices, leverage ratios, international spillovers, or the exposures of various financial institutions), this could be an important

consideration in terms of which policy to adjust first. Or, if either moderate increases in the policy interest rate or gradual reductions in asset holdings were more effective at mitigating the buildup of future financial stability risks, this could be an important consideration for prioritizing such a strategy. Although both low interest rates and large QE programs appear to contribute to a range of financial stability risks, there is unfortunately not yet convincing empirical evidence on whether adjustments at each margin generate a relatively larger reduction in financial stability risks (Section III).<sup>23</sup> Compelling new evidence could be an important factor in constructing the best “playbook” for unwinding stimulus.

#### **A. Advantages of Raising Policy Interest Rates**

There are several advantages to following the traditional playbook of first tightening monetary policy through raising the policy interest rate.

**1. Nimble and quick.** Adjustments in the policy interest rate can be made immediately, and then adjusted again if the economic outlook changes. Although announcements of QE programs can also be done quickly and have an immediate market impact, QE programs can take longer to design (especially if there are decisions on which types of assets to purchase) and then to implement the purchases—sometimes locking a central bank into a commitment that can be harder to adjust if the economic situation changes.

**2. Easier to calibrate the size of adjustments and predict the economic effects.** Since central banks have adjusted policy interest rates for years and in different economic environments, they have a better (albeit still far from perfect) understanding of the effects, including a better understanding of how much adjustment is required for a given economic impact. The more limited experience with QE, with a large share of the examples during unusual periods of market stress, makes it harder to predict the effects and calibrate the appropriate size of any package.<sup>24</sup> The effects of QE also appear to be even more state-dependent than changes in interest rates, making it even harder to assess the impact in different economic environments.

**3. Creating space to lower interest rates during the next recession.** Monetary policy should not be tightened preemptively just to “create space” to support the economy in the future—but having the ability to lower interest rates would be a useful tool whenever the next recession occurs. With policy interest rates at or near their lower bounds in many advanced economies, and a low  $r^*$  which implies that any tightening of monetary policy will likely be limited and gradual over the next few years, many central banks will be constrained in their ability to create “policy space” to adjust interest rates in response to the next recession. In contrast, there is substantial room for additional QE in most countries—even if central banks do not unwind current asset holdings—due to different types of assets that could be purchased and the increase in debt issuance in most countries. Moreover, rules on what assets are eligible for purchase can be adjusted to create more space if necessary (such as the share of each issuance, the duration of the debt, or the country allocation in the case of the ECB).

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<sup>23</sup> One recent exception is evidence on how large balance sheets are affecting the extent to which the supplementary leverage ratio binds, and thereby taxes market making in government securities for dealer banks. See Hubbard et al. (2021).

<sup>24</sup> This includes a poor understanding of the optimal amount of reserves that central banks should hold in the future to support market functioning and provide liquidity. There is general agreement that the current holdings are more than required, but the pre-GFC levels are less than required—leaving a very large region of uncertainty.

**4. Less likely to create a surprise that causes a sharp financial market reaction.** Central banks have substantial experience on how to prepare investors for increases in interest rates, so that following the usual playbook is less likely to generate volatility and surprise investors. In contrast, central banks have less experience preparing markets for adjustments in QE programs—and the market responses to surprises can be large (such as during the “taper tantrum”). The double challenge of not only announcing an unwind of asset holdings, but combining this with changing the usual order of policy adjustments, could generate an even greater surprise and spike in volatility if not well communicated and if financial institutions are not prepared.

## ***B. Advantages of Unwinding Asset Holdings***

There are also several advantages to rewriting the traditional playbook and tightening monetary policy by prioritizing reducing asset holdings—possibly even before raising interest rates.

**1. Ability to target tightening for sectors requiring less stimulus.** Unlike the “blunt” tool of adjusting interest rates, QE programs can be designed to have relatively larger effects on certain sectors of the economy (based on what assets are included). Just as yields for the specific assets purchased in QE programs fell more than the assets not included (Section III), unwinding central bank holdings of certain assets would likely have a relatively larger impact on those sectors whose borrowing costs are linked to those assets (albeit with some effects across all sectors). For example, if the housing sector was stronger than the broader economy, unwinding MBS before government debt would likely have a larger relative effect on mortgage borrowing costs.

**2. Reinforce that central banks are independent and not using QE to finance government deficits.** Although raising interest rates and selling government bonds would both make it harder for governments to finance deficits, recent criticism that QE was done to “bail out governments” would be more directly addressed by selling government bonds (or letting holdings run off). This would reinforce central bank communication that asset purchases through QE programs are intended to be temporary and not a permanent financing of government debt.

**3. Reduce future losses from raising policy rates.** Although selling assets will likely involve an immediate loss (as most assets were purchased above par), these losses are likely to be smaller than the cost of holding the bonds in an environment with increasing interest rates. If interest rates are raised first, central banks will suffer losses on their holdings and these losses could be substantial over time given the size of asset holdings (as discussed in Section II).

**4. Potentially limited economic effect.** If any adjustments occur during a period of ample liquidity and well-functioning markets, and central banks include explicit guidance that changes in interest rates are the active tool for monetary policy so that adjustments to asset holdings do not provide any signal on the future path of the policy interest rate, then several of the key channels through which QE stimulated the economy might not work in reverse when the holdings were unwound. This could potentially mitigate the impact of unwinding asset holdings on the broader economy. In fact, if unwinding the balance sheet was seen as allowing the central bank to delay any increase in interest rates (such as by addressing overheating in a specific sector), this could further dampen any contractionary effects. Effective central bank communication would be critical.

### C. *Special Considerations in an “Uneven” Economy*

Several characteristics of today’s pandemic economy strengthen arguments to revisit the usual playbook and consider unwinding asset purchases before raising policy interest rates. In particular, and as highlighted throughout this symposium, the current recession and recovery have been “uneven” and differed from traditional business cycles on several important dimensions.

- **Unusual Strength in Housing Market.** After a brief period of weakness early in the pandemic, housing markets in most countries have been extremely strong. The combination of low borrowing costs combined with mobility-restricted households seeking more space (often away from urban areas) has driven a rapid increase in housing prices—even reaching records by some metrics. BIS analysis suggests that “since the start of the pandemic, house prices have risen by more than fundamental drivers, such as borrowing costs and rents, would imply...This apparent divergence between house prices and their fundamental determinants could make them more vulnerable to larger corrections in the future...” (BIS, 2021). In other words, the housing sector does not appear to need any additional stimulus from monetary policy, and reducing the existing stimulus sooner rather than later would reduce the risk of a sharp price adjustment in the future. This supports arguments to withdraw monetary stimulus using tools that have larger relative effects on the medium- and longer-term yields to which mortgages are linked (i.e., unwinding asset purchases), or unwinding those assets that have a relatively larger effect on mortgage costs (i.e., unwinding holdings of MBS).<sup>25</sup>

- **Uneven Effects of Pandemic on Companies.** Some companies have thrived during Covid, while others (particularly consumer-facing and service-oriented businesses) have struggled. Gourinchas et al. (2021) show that in order to avoid unnecessary bankruptcies for companies that would remain solvent when activity normalizes, many SMEs will need continued support as temporary fiscal programs are wound down. Their analysis shows the most effective strategy for avoiding an unnecessary “time bomb” for SMEs is to maintain supportive credit conditions—especially through the bank loans on which SMEs depend. Since SME bank loans are more tightly linked to short-term interest rates, removing stimulus in a way that has less impact on short-term interest rates (and primarily tightens through the longer end of the yield curve), would tighten credit conditions more for segments of the economy that need less support (i.e., mortgages), but provide SMEs more time for business to normalize in this uneven economy.

- **Uneven Effects of the Pandemic on Households.** Similar to for companies, some workers and households have been extremely hard-hit during the pandemic (whether due to health issues, riskier jobs that must be done in-person, challenges providing childcare, or job losses) while others have been relatively less affected (especially for people who can work remotely).<sup>26</sup> Although government stimulus programs have provided substantial support to hard-hit households on average, there are still some that are financially vulnerable and struggling to stay current on debt. Delinquencies on US household debt remain low by historic standards, but different patterns by debt type show what sectors are more vulnerable—and more at risk as stimulus is withdrawn. More specifically, auto loans and credit card

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<sup>25</sup> Adjusting macroprudential tools to address any risks in the housing sector would also be beneficial for countries that have such tools.

<sup>26</sup> For evidence, see Cajner et al. (2020), Clark et al. (2020), Lee et al. (2021) and Ruffini and Wozniak (2021).

loans currently have the highest transitions into delinquency—while delinquencies on mortgage debt are at record lows.<sup>27</sup> As discussed in Section III, auto and credit card loans are more tightly linked to the short-term policy rate, while mortgage rates are relatively more closely linked to the longer-end of the yield curve. This suggests removing stimulus in a way that has less impact on short-term interest rates and primarily tightens through the longer end of the yield curve would provide more time for these financially vulnerable individuals to recover; this could be particularly important for individuals that have been unable to work due to health concerns as it would keep debt payments low until the risks from the pandemic abate and they can return to work.

- **Above-target Inflation Combined with Large Fiscal Deficits.** Inflation has picked up to above target in many countries, and even if much of the recent acceleration is transitory, the combination of high inflation and large fiscal deficits could aggravate concerns about whether central banks are independent and willing to “take away the punch bowl” if needed. These concerns, especially in countries with a weaker history of central bank independence, could cause inflation expectations to drift up. Unwinding asset holdings would be a clear demonstration by central banks that they are not subject to fiscal dominance and that QE programs were used to achieve central bank mandates (rather than to finance budget deficits). This signal of central bank independence is particularly important in this uneven economy given unusually strong inflation for this stage in a recovery (reflecting the demand rebound combined with supply-side constraints). This increases the importance of ensuring that inflation expectations remain anchored as the supply-side recovers.

- **Reduced Role of Central Banks after their “Expansion of Reach” during the Pandemic.** Central banks around the world responded to Covid with an “unparalleled expansion of reach—well beyond the narrow inflation-targeting focus of most central banks” (English et al., 2021). In many cases this involved propping up financial markets, directly supporting individual companies, subsidizing bank lending, and purchasing government debt at unprecedented levels and at record speed. As the pandemic fades, central banks are likely to come under increased scrutiny for this expansion of powers. If central banks wish to maintain the ability to use these tools to support the economy during the next crisis or pandemic, it will be important to show that this “expansion of reach” was a temporary response to a pandemic, rather than a more permanent expansion of authority. Unwinding “unconventional” programs and reducing the size of central bank balance sheets would directly address these concerns—while raising policy interest rates would not. Even if QE is increasingly viewed as a “conventional” tool for monetary policy, it will be important to show that this tool can be used in both directions—with balance sheets being wound down as well as expanded.

- **Different Reasons for Initial Covid-related Increase in Asset Purchases.** Closely related, most QE programs enacted before Covid were justified primarily to achieve traditional central bank mandates of price stability and employment. The large-scale QE programs announced at the beginning of the pandemic, however, were often justified to address market stability and liquidity concerns. Although market instability and insufficient liquidity make it difficult for central banks to achieve their traditional mandates, and the justification for QE programs later in the pandemic changed to achieving inflation and employment goals, central banks are still left with a large stock of assets that were purchased

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<sup>27</sup> Source: NY Federal Reserve, *Quarterly Report on Household Debt and Credit*. 2021: Q2. Note that low delinquency rates for some categories of loans reflect government support packages, such as forbearance on student loans as part of the CARES act.

primarily to address stability/liquidity issues. This different justification for the asset purchases than in the past may make it more important to prioritize unwinding holdings, and might even imply a smaller economic effect if the unwind is seen as reflecting the normalization of financial conditions rather than a tightening of monetary policy.

• **Greater Attention to Marginalized Workers and Inequality???** Although inequality and the distribution of income across households and companies is not in central banks' mandates, increased inequality during the pandemic, combined with increased public concern about inequality, has made it more important for central banks to understand how monetary policy interacts with the distribution of income and wealth. Moreover, if different monetary tools have differential effects on labor supply (such as by bringing marginalized workers into employment), this should be part of the evaluation of the costs and benefits of different tools. All monetary policy tools have distributional implications, but unfortunately there is no evidence on whether adjusting monetary policy through changes in interest rates versus asset purchases has differential effects on inequality and labor force participation.<sup>28</sup> Moreover, in the current uneven recovery, monetary policy (in any form) may be less likely to boost employment opportunities and earnings as there is strong demand for workers (and the main constraints in the labor market are on the supply side). If lower policy interest rates boost SME employment more than QE, and thereby keep more small business owners in the labor force (as discussed above), this could possibly provide more of a boost to labor force participation (and generate a corresponding reduction in inequality). More important for inequality would likely be if different monetary policy tools had differential effects on asset prices. As discussed above, however, the empirical evidence on these various effects is inconclusive to date.

## V. Conclusions

As the recovery progresses and ongoing asset purchase programs are tapered, central banks will soon be faced with a decision of when—and how—to remove the expansive monetary stimulus put in place to support economies during the pandemic.<sup>29</sup> One important part of this decision is how to prioritize raising policy interest rates relative to unwinding stocks of asset purchases. The usual “playbook” of removing stimulus by first raising the policy rate has a number of advantages—particularly in being nimble, easier to calibrate, creating space to use this preferred tool during the next recession, and being less likely to unhinge financial markets. Removing stimulus by prioritizing unwinding balance sheets can also have important advantages, however, such as being able to better target specific sectors, reducing future costs when interest rates increase, reinforcing that QE is not intended to finance budget deficits, and possibly implying smaller contractionary effects.

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<sup>28</sup> For example, recent empirical evidence suggests that looser monetary policy tends to increase inequality because the boost to lower-income individuals from improving employment opportunities (including lifetime earnings) are generally outweighed by the boost to higher-income individuals from increasing asset prices (and the corresponding wealth effects). See Bartscher et al. (2021) for a recent summary and evidence on how monetary policy affects racial inequality—but no analysis of how the effects may vary across different monetary policy tools.

<sup>29</sup> Of course, the timing of when to remove stimulus will vary across countries based on their economic circumstances. As argued in Hofmann et al. (2021), central banks such as the ECB that are constrained by the ELB and that have struggled with debt deflation should be more cautious.



During standard business cycles, these arguments for prioritizing raising interest rates appear to be more powerful—especially as some of the potential benefits of unwinding asset holdings are more tentative given central bank’s limited experience with QE. The uneven nature of the pandemic-driven recession, however, as well as changes in the economic landscape since 2008, however, suggest that central banks should give more priority to unwinding balance sheets than in the past. In particular, sectors that are stimulated relatively more by asset purchases (such as the housing market) have experienced a strong recovery, while many sectors that are more closely linked to the short-term policy rate (such as bank loans to SMEs and credit card debt, auto loans and other short-term household borrowing) will need continued support during this uneven recovery. Moreover, unwinding asset holdings may more effectively address a number of concerns that have been aggravated during the pandemic—such as the independence of central banks from fiscal authorities and the recent expansion of central bank powers and reach.

If central banks were to put more weight on unwinding asset purchases (whether before raising policy interest rates or just earlier in a standard tightening cycle), one of the greatest potential risks of such a change in strategy would be a sharp reaction in financial markets, especially if any large financial intermediaries are caught unprepared. This makes it even more important for clear communication and a discussion of these issues in advance, ideally well ahead of when any adjustments in balance sheets would occur. The Bank of England is one of the few central banks that has addressed these issues proactively—with a speech by Governor Bailey at Jackson Hole one year ago, and new guidance from the MPC this month.<sup>30</sup> Other central banks might benefit even more from this careful rethinking of strategy—especially if they own different types of assets that they could unwind at different paces to better target stimulus and/or have more limited macroprudential tools to address risks in specific sectors (such as the U.S.).<sup>31</sup>

Just as any good coach reviews his playbook well before the big game—and discusses the new plays with the rest of the coaching staff and team—now is an opportune time for central banks to begin reviewing and possibly rewriting their playbook.

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<sup>30</sup> See Bailey (2020) and the August 2021 Monetary Policy Report (Box A) for the updated guidance.

<sup>31</sup> Woodford (2016) discusses how macroprudential policy could be combined with QE to reduce financial stability risks.

## References

- Bailey, Andrew. (2020). "The Central Bank Balance Sheet as a Policy Tool: Past, Present and Future." Speech given at Jackson Hole Economic Policy Symposium, August 28. Available at: <https://www.bankofengland.co.uk/speech/2020/andrew-bailey-federal-reserve-bank-of-kansas-city-economic-policy-symposium-2020>.
- Bailey, Andrew, Jonathan Bridges, Richard Harrison, Josh Jones and Aakash Mankodi. (2020). "The Central Bank Balance Sheet as a Policy Tool: Past, Present and Future." *Bank of England Staff Working Paper No. 899*.
- Bank for International Settlements. (2021). *Annual Economic Report, June 2021*. Available at: <https://www.bis.org/publ/arpdf/ar2021e.pdf>.
- Bartscher, Alina, Moritz Kuhn, Moritz Schularick, and Paul Wachtel. (2021). "Monetary Policy and Racial Inequality." *CEPR Discussion Paper DP15734*.
- Bhattarai, Saroj and Christopher J. Neely. (2020). "An Analysis of the Literature on Unconventional Monetary Policy." *Federal Reserve Bank of St. Louis Working Paper 2016-021*.
- Bernanke, Ben. (2020). "The New Tools of Monetary Policy." *American Economic Review* 110(4):943-983.
- Boneva, Lena, Calebe de Roure, and Ben Morley. (2018). "The Impact of the Bank of England's Corporate Bond Purchase Scheme on Yield Spreads." Bank of England Staff Working Paper No. 719.
- Brainard, Lael. (2017). "Cross-Border Spillovers of Balance Sheet Normalization" Board of Governors of the Federal Reserve System speech, given in New York. Available at: <https://www.federalreserve.gov/newsevents/speech/brainard20170711a.htm>
- Cajner, Tomaz, Leland Crane, Ryan Decker, John Grigsby, Adrian Hamins-Puertolas, Erik Hurst, Christopher Kurz, and Ahu Yildirmaz. (2020). "The U.S. Labor Market during the Beginning of the Pandemic Recession" *NBER Working Paper No. 27159*, May.
- Clark, Robert, Annamaria Lusardi, and Olivia S. Mitchell. (2020). "Financial Fragility during the COVID-19 Pandemic." *NBER Working Paper No. 28207*. December.
- D'Amico, Stefania and Iryna Kaminska. (2019). "Credit Easing versus Quantitative Easing: Evidence From Corporate and Government Bond Purchase Programs", *Bank of England Staff Working Paper No. 825*.
- Di Maggio, Marco, Amir Kermani, and Christopher Palmer. (2015). "Unconventional Monetary Policy and the Allocation of Credit." Working paper available at: <https://www.stern.nyu.edu/sites/default/files/assets/documents/Di%20Maggio.pdf>
- Eberly, Janice, James Stock, and Jonathan Wright. (2019). "The Federal Reserve's Current Framework for Monetary Policy: A Review and Assessment." NBER Working Paper 26002.
- Eggertsson, Gauti, and Michael Woodford. (2003). "The Zero Bound on Interest Rates and Optimal Monetary Policy." *Brookings Papers on Economic Activity* 34 (Spring): 139–211.
- English, William, Kristin Forbes and Angel Ubide. (2021). *Monetary Policy and Central Banking in the Covid Era*. CEPR Press: Centre for Economic Policy Research and International Center for Monetary and Banking Studies e-book. Available at: <https://voxeu.org/content/monetary-policy-and-central-banking-covid-era>

Forbes, Kristin. (2019). "Capital Flows, Monetary Policy and Globalization." Comments at ECB Colloquium in Honor of Benoît Coeuré, December. Available at: <https://mitsloan.mit.edu/shared/ods/documents?PublicationDocumentID=6085>

Forbes, Kristin. (2017). "Failure to Launch." Bank of England speech, given at the London Business School, June 17. Available at: <https://www.bankofengland.co.uk/speech/2017/failure-to-launch>

Gourinchas, Pierre-Olivier, Sebnem Kalemli-Özcan, Veronika Penciakova, and Nick Sander. (2021). "COVID-19 and SMEs: A 2021 'Time Bomb'?" *NBER Working Paper No. 28418*. January.

Gourinchas, Pierre-Olivier, Walker Ray and Dimitri Vayanos. (2021). "A Preferred-Habitat model of Term Premia, Exchange Rates and Monetary Policy Spillovers." Mimeo.

Greenlaw, David, James Hamilton, Ethan Harris, and Kenneth West. (2018). "A Skeptical View of the Impact of the Fed's Balance Sheet." Paper prepared for the U.S. Monetary Policy Forum and available at: <https://www.chicagobooth.edu/-/media/research/igm/docs/2018-usmpf-report.pdf>.

Hofmann, Boris, Marco Lombardi, Benoit Mojon and Athanasios Orphanides. (2021). "Fiscal and Monetary Policy Interactions in a Low Interest Rate World. *CEPR Discussion Paper 16411*.

House of Lords. (2021). "Quantitative Easing: A Dangerous Addiction?" HL Paper 42. Economic Affairs Committee. Available at: <https://publications.parliament.uk/pa/ld5802/ldselect/ldeconaf/42/42.pdf>

Hubbard, Glen, Donald Kohn, Laurie Goodman, Kathryn Judge, Anil Kashyap, Ralph Koijen, Blythe Masters, Sandie O'Connor, and Kara Stein. (2021). *Task Force on Financial Stability*. Available at: [https://www.brookings.edu/wp-content/uploads/2021/06/financial-stability\\_report.pdf](https://www.brookings.edu/wp-content/uploads/2021/06/financial-stability_report.pdf)

Krishnamurthy, Arvind and Annette Vissing-Jorgensen. (2011). "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy." *Brookings Papers on Economic Activity, Fall 2011*, pgs. 215-265.

Lee, Sang Yoon (Tim), Minsung Park, and Yongseok Shin. (2021). "Hit Harder, Recover Slower? Unequal Employment Effects of the Covid-19 Shock." *NBER Working Paper No. 28354*. January.

Miranda-Agrippino, Sylvia and Tsvetelina Nenova. (2021). "A Tale of Two Global Monetary Policies." Paper prepared for NBER-ISOM conference in June.

Orphanides, Athanasios. (2021). "The Year the Power of Central Bank Balance Sheets was Unleashed." In William English, Kristin Forbes and Angel Ubide, eds. (2021). *Monetary Policy and Central Banking in the Covid Era*. CEPR Press: Centre for Economic Policy Research and International Center for Monetary and Banking Studies e-book.

Ruffini, Krista and Abigail Wozniak. (2021). "Supporting Workers and Families in the Pandemic Recession: Results in 2020 and Suggestions for 2021." *Brookings Papers on Economic Activity*, Spring 2021 meetings and available at: [https://www.brookings.edu/wp-content/uploads/2021/03/SPEASP21\\_Ruffini-Wozniak\\_conf-draft\\_updated.pdf](https://www.brookings.edu/wp-content/uploads/2021/03/SPEASP21_Ruffini-Wozniak_conf-draft_updated.pdf)

Swanson, Eric. (2017). "Measuring the Effects of Federal Reserve Forward Guidance and Asset Purchases on Financial Markets." *NBER Working Paper 23311*. April.

Vlieghe, Gertjan. (2021). "What are Government Bond Yields Telling Us About the Economic Outlook?" Bank of England speech, available at <https://www.bankofengland.co.uk/>

</media/boe/files/speech/2021/may/what-are-government-bond-yields-telling-us-about-the-economic-outlook-speech-by-gertjan-vlieghe.pdf>

Vlieghe, Gertjan. (2018). "The Yield Curve and QE." Bank of England speech, available at: <https://www.bankofengland.co.uk/-/media/boe/files/speech/2018/the-yield-curve-and-qe-speech-by-gertjan-vlieghe.pdf>

Weale, Martin and Tomasz Wieladek. (2021). "Financial 'Side Effects' of QE and Conventional Monetary Policy Compared." *CEPR Discussion Paper DP 16395*. July.

Weale, Martin and Tomasz Wieladek. (2016). "What are the Macroeconomic Effects of Asset Purchases?" *Journal of Monetary Economics* 79:81-93.

Woodford, Michael. (2016). "Quantitative Easing and Financial Stability." *National Bureau of Economic Research Working Paper 22285*, May.