

QE at the Bank of England: a perspective on its functioning and effectiveness

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Foreword

In the face of the global financial crisis in 2009, the Bank of England embarked on a programme of large-scale asset purchases. This reflected a need to further ease monetary conditions with Bank Rate at its effective lower bound. The Bank's Monetary Policy Committee (MPC) decided to purchase mostly UK long-term government bonds, with those purchases financed by the issuance of newly created, interest-paying reserves. These asset purchases were labelled quantitative easing (QE).

In 2021 the Bank of England's Independent Evaluation Office (IEO) published a report on the Bank's approach to QE. One of the report's recommendations was that the Bank should periodically update technical audiences about its latest thinking on QE.

This article is part of the Bank's response to that recommendation. It has been authored by Bank staff at the request of the MPC, and summarises a large body of research and analysis on QE produced both inside and outside the Bank. The article therefore gives insight into the body of technical work that has underpinned and framed the MPC's discussion of QE in recent years. It should be read against the background of the academic articles, staff working papers and reports published by Bank staff on this topic, some of which are cited in the article itself.

That said, the article does not seek to give a single MPC view about how QE works. Individual MPC members, in line with the wider academic and economic community, naturally have their own views about which transmission channels of QE are likely to prove most important, about how that assessment may vary across different economic circumstances, and about the effectiveness of QE in easing financial conditions and stimulating the economy. These individual opinions are recorded in MPC meeting minutes and reported in speeches and testimony to Parliament. It is one of the strengths of the UK monetary policy framework that MPC members are individually accountable for their decisions and votes. The resulting expression of differing views and encouragement of debate among them helps to improve the robustness of the final policy decision.

This article also addresses another recommendation in the IEO report, namely that the Bank should raise awareness of the cash transfer arrangements between the Bank's Asset Purchase Facility (APF) and HM Treasury (HMT). The APF is a financial vehicle that holds

the portfolio of bonds accumulated as a result of the MPC's asset purchases. It is indemnified by HMT. This article provides an updated analysis of the cash flow transfers between HMT and the APF arising from that arrangement.

The stock of assets held in the APF peaked at £895 billion towards the end of 2021, following the implementation of further QE in response to the Covid-19 crisis and its aftermath. But, at its February 2022 meeting, the MPC voted to begin unwinding the APF portfolio by ceasing to reinvest maturing bonds, as well as conducting a programme of corporate bond sales (to be completed no earlier than towards the end of 2023). Furthermore, in May 2022 the MPC asked Bank staff to work on a strategy for UK government bond sales, which would allow the Committee to make a decision at a subsequent meeting on whether to commence such sales.

Just as it is important to flag what this article is about, it is also important to highlight what it is not about. With QE unwind now underway, it is important to clarify that this article does **not** evaluate the economic and market impact of such quantitative tightening (QT), nor is it intended to offer any signal about the prospects for QT in the UK.

The MPC set out its initial thinking on QT in the August 2021 Monetary Policy Report. It noted there that **“the impact on monetary conditions of a reduction in the stock of purchased assets ... is likely to be smaller than that of asset purchases on average over the past” provided that such a reduction takes place “in a gradual and predictable manner and when markets are functioning normally”**. On this basis, the impact of QE in the past cannot be mechanically applied to anticipate the impact of QT in the future, simply with the sign reversed. The research results presented in this article certainly should not be read in that way.

Now that the gradual reduction of the APF portfolio has started, it is a good time to reflect on the lessons to be drawn from the past decade or so's experience with QE in the UK. These lessons should help frame any discussion of its potential future use.

At the outset, it is important to recognise the difficulties faced in extracting strong conclusions from the available experience. In the UK, there have been only five episodes of QE since 2009. The evidence base for QE is therefore narrow, certainly narrower than that available for assessing conventional interest rate policy (a 'small sample' problem). Moreover, QE has been implemented in the face of economic and market disturbances. It is difficult to distinguish the impact of the QE implemented in response to those disturbances from the impact of the disturbances themselves (an 'identification' problem). Researchers at the Bank and elsewhere have made valiant efforts to address these challenges, reflected in the studies summarised in this article. But drawing robust and universal conclusions is difficult. When interpreting the results for policy purposes, an appropriate degree of circumspection is required.

Nevertheless, we can draw out some lessons. From experience in the UK and elsewhere, we have learnt that QE mainly works through lowering interest rates at various maturities, thereby lowering borrowing costs. Indeed, it is by lowering yields at longer maturities that QE can ease monetary conditions further once Bank Rate has reached its effective lower bound.

In lowering interest rates, QE operates via a number of channels, which are explained in the article. These include: a portfolio balance channel, a signalling channel, a liquidity channel, a market functioning channel, and an uncertainty channel. The available evidence suggests that both the absolute and the relative importance of each of these channels has varied through time, as economic circumstances and market conditions have evolved. The impact of QE on interest rates and yields therefore depends on the context in which it is implemented ('state contingency').

If the effect of QE on yields is uncertain and time-varying, then the impact of QE on the real economy and ultimately on CPI inflation (which the MPC targets) is, unsurprisingly, also both uncertain and likely to vary over time. This notwithstanding, on balance the evidence surveyed in this article suggests that, in the face of the multiple large shocks to the UK economy since the onset of the global financial crisis, QE has helped the MPC meet its 2% inflation target while also sustaining growth and employment in line with the MPC's remit.

The Bank seeks to encourage an active and informed debate about its monetary policy framework and choices. Publishing and discussing the analytical work undertaken to support those choices is central to this ambition. By summarising the research that has informed decisions about QE, this article seeks to contribute to that debate.

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Executive summary

Over the course of the past two decades, and especially since the onset of the global financial crisis (GFC), quantitative easing (QE) has become an important instrument of monetary policy for central banks, including the Bank of England.^[1] This article reviews the available evidence on the impact of QE and draws out lessons from that experience for the design and conduct of monetary policy.

The article was written in response to a recommendation of the Bank's Independent Evaluation Office (IEO) contained in its report on QE that was published last year.^[2] The report recommended that the Bank should periodically update technical audiences on its latest collective thinking on QE. The article also addresses their

recommendation that the Bank should raise awareness of the cash transfer arrangements between the Asset Purchase Facility (APF)^[3] and HM Treasury (HMT), by providing an updated analysis of the cash flow transfers between HMT and the APF.

QE is an additional tool employed by the MPC in pursuit of its price stability remit.

QE was one of several novel policy instruments deployed in the aftermath of the GFC. It has helped the Bank to respond flexibly and efficiently to a number of large economic shocks: not only the GFC itself, but also the euro area sovereign debt crisis, the initial reaction to the EU referendum vote, and the onset of Coronavirus pandemic.

QE involves the central bank purchasing financial assets – in the UK case, mostly longer-term government bonds ('gilts') – in exchange for newly created interest-paying reserves. QE is intended to ease financial conditions, boost aggregate demand and thereby prevent inflation from being below the 2% target on a sustained basis. Similar to a cut in Bank Rate, QE seeks to lower interest rates, thereby stimulating demand by reducing borrowing costs for households and corporates, supporting asset prices, and putting downward pressure on the exchange rate.

This article summarises research evidence showing that the announcement of asset purchases under the Monetary Policy Committee's QE programmes has indeed lowered interest rates at various maturities, consistent with the summary view of QE's transmission mechanism.

Both the magnitude of this effect and the strength of the evidence is greatest for the first QE programme, announced in 2009 during the most intense phase of the GFC. Nonetheless, on balance, the available evidence suggests QE announcements also helped to lower longer-term interest rates, albeit to a lesser extent, during subsequent rounds, even when market stress and dysfunction were not as pronounced.

QE lowers interest rates via several channels that are complementary and vary in intensity over time.

In the first step of its transmission mechanism, QE influences interest rates and yields through a number of channels: (1) reducing expected future policy rates ('signalling'); (2) increasing demand for longer maturity or riskier assets ('portfolio balance'); (3) lowering liquidity premia on eligible assets ('liquidity'); (4) improving 'market functioning' more broadly; and (5) reducing policy and economic uncertainty ('uncertainty').

These channels are not mutually exclusive, and the intensity of each of them is likely to vary over time as circumstances change. This 'state-contingency' means that the observed impact of asset purchases in one set of circumstances cannot easily be translated into a view about the potential impact of asset purchases - or sales - in other circumstances. At the very least, a cautious reading of the evidence is required when drawing policy conclusions.

A growing number of studies, including some conducted by Bank staff, explore the contribution of these various channels to the observed overall impact of QE in different contexts. While there are few episodes to draw on and it is difficult to generalise from any individual study, overall the evidence reported in this article suggests that the signalling, portfolio balance and uncertainty channels have operated in concert, albeit with varying potency – both in absolute terms, and relative to one another – across the various QE programmes implemented since 2009.

On balance, the evidence suggests that QE supports the objective of monetary policy, namely price stability.

While, on balance, the evidence suggests QE has influenced the yield curve and resulted in lower borrowing costs, quantifying its impact on GDP and inflation is much more challenging and the evidence base is smaller. However, the available literature suggests that QE programmes provided positive stimulus to activity and supported inflation in the face of disinflationary pressure.

In March 2020, QE was one of several policies that sought to improve market functioning and mitigate an unwarranted tightening of financial conditions.

In March 2020, there was an extreme spike in the demand for liquidity in financial markets and the real economy, at a time where dealers' intermediation capacity was constrained. This was associated with an abrupt deterioration in market functioning and a surge in gilt yields, which could have tightened financial conditions and exacerbated the adverse economic impact of Covid-19. Along with other monetary authorities, the MPC responded with a QE programme of unprecedented scale and pace.

The evidence reported in this article suggests this QE programme had a substantial impact on interest rates, with gilt yields retracing a significant portion of their surge shortly after the 19 March 2020 asset purchase announcement. The evidence also suggests gilt market liquidity improved after the Bank's purchases began, suggesting there was a greater role for the market functioning channel compared to other programmes. However, other schemes introduced by the Bank at that time to improve market functioning and actions by other central banks are also likely to have contributed.

Beyond gilt purchases undertaken within QE programmes, purchases of UK corporate bonds can be effective in lowering corporate borrowing costs and stimulating corporate debt issuance.

As part of its efforts to stimulate demand following the 2016 EU referendum and the 2020 Covid-19 pandemic, the MPC also purchased bonds issued by corporates that make a significant contribution to the UK economy. The evidence suggests that the 2016 Corporate Bond Purchase Scheme succeeded in lowering interest rates on UK corporate bonds and stimulating sterling corporate bond issuance. Corporate bond yields also stopped increasing and eventually declined after the announcement of corporate bond purchases in 2020.

1: Introduction

Quantitative Easing (QE) involves large-scale asset purchases by a central bank, financed by the creation of central bank reserves.^[4] These purchases seek to boost aggregate demand and hence inflation. Since the global financial crisis (GFC), QE has become part of the Bank of England's monetary policy toolkit. As set out in the [response to the 2021 Independent Evaluation Office \(IEO\) report on QE](#), the Bank is committed to ensuring it uses QE as effectively as possible, in order to achieve its inflation target. To do so, the Bank contributes to, and draws on, economic research into the impact of QE in the United Kingdom (UK) and overseas.

The objective of this article is to review evidence on the impact of QE in the United Kingdom, and draw out implications for monetary policy.

While little evidence was available to guide the first QE programmes introduced in 2009, over time a growing number of studies have analysed the impact of QE, with a particular focus on advancing understanding of the channels through which QE transmits to financial markets and the real economy. Bank staff have contributed to this literature, with earlier reviews of the UK evidence provided by [Haldane et al. \(2016\)](#) and [Bailey et al. \(2020\)](#). In addition, the 2020 asset purchase programmes, which were unprecedented in terms of their scale and pace, provide further insights into how QE can work in situations of market dysfunction and uncertainty. This article, written in response to the recommendation of the Bank's Independent Evaluation Office that the Bank should periodically update the technical audience on its latest collective thinking on QE, takes stock of the key insights from this material and discusses how it advances technical understanding of QE, drawing out the implications for monetary policy. It also addresses the IEO's recommendation that the Bank should raise awareness of the cash transfer arrangements between the Asset Purchase Facility (APF) and HM Treasury (HMT), by providing an updated analysis of the cash flow transfers between HMT and the APF.

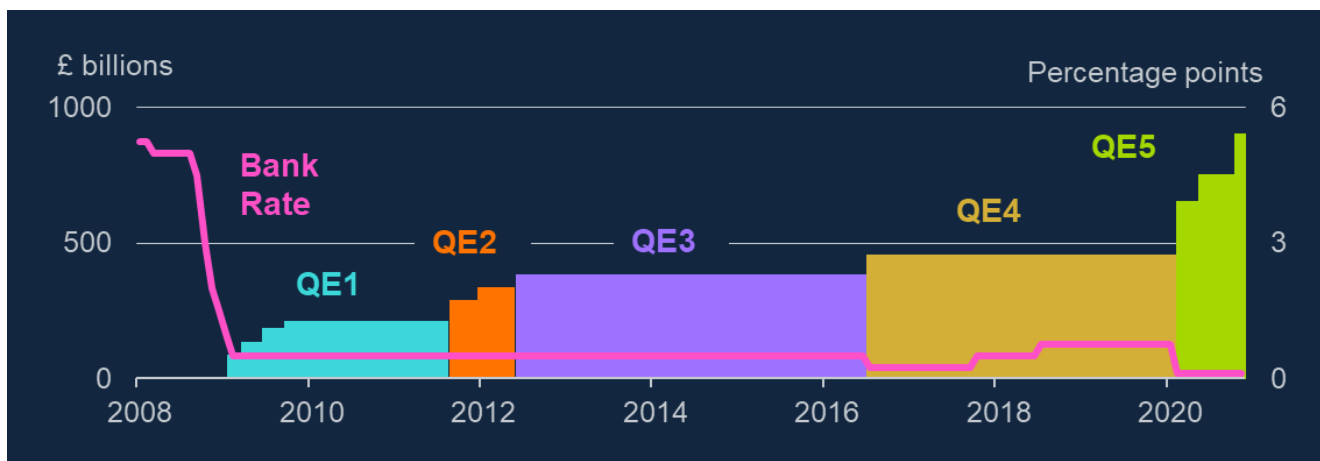
2: Quantitative easing so far

In the aftermath of the GFC, QE was one of several policy tools that allowed the Bank of England and other central banks to respond flexibly to shocks to the inflation outlook.

In response to the GFC, the MPC cut Bank Rate to 0.5% in March 2009 in order to stimulate activity and inflation. However, the MPC judged that further monetary stimulus was needed in order to meet its inflation target, but believed that the effectiveness of any additional Bank Rate cut could be 'significantly impaired'. Instead of using its hitherto 'conventional' Bank Rate tool, the MPC then announced that it would pursue its remit by purchasing assets in secondary markets in exchange for interest-bearing central bank reserves.^[5]

For more than a decade since, QE played a major role in setting monetary policy, with the MPC reviewing and communicating its target for the stock of purchased assets at each meeting. Over time, purchases in response to shocks such as the Eurozone sovereign debt crisis, the referendum vote to leave the EU, and Covid-19 caused the target stock of purchased assets to rise to £895bn (Chart 1). The large majority of purchases have been of conventional UK government bonds ('gilts'), although some sterling-denominated corporate bonds were purchased during the first QE programme^[6] and further purchases were made with the start of the Corporate Bond Purchase Scheme (CBPS) in 2016. The MPC has at times used QE alongside Bank Rate cuts, forward guidance and schemes to improve the monetary transmission mechanism, i.e. the Term Funding Scheme (TFS) and Term Funding Scheme with additional incentives for SMEs (TFSME), reflecting complementarities between these tools.^[7]

Chart 1: MPC asset purchase target (£bn, left scale) and Bank Rate (% , right scale)



Source: Bank of England calculation.

3: Quantitative easing in theory

The main objective of QE is to boost aggregate demand in the economy and hence support inflation, thereby helping the MPC to meet its inflation target.

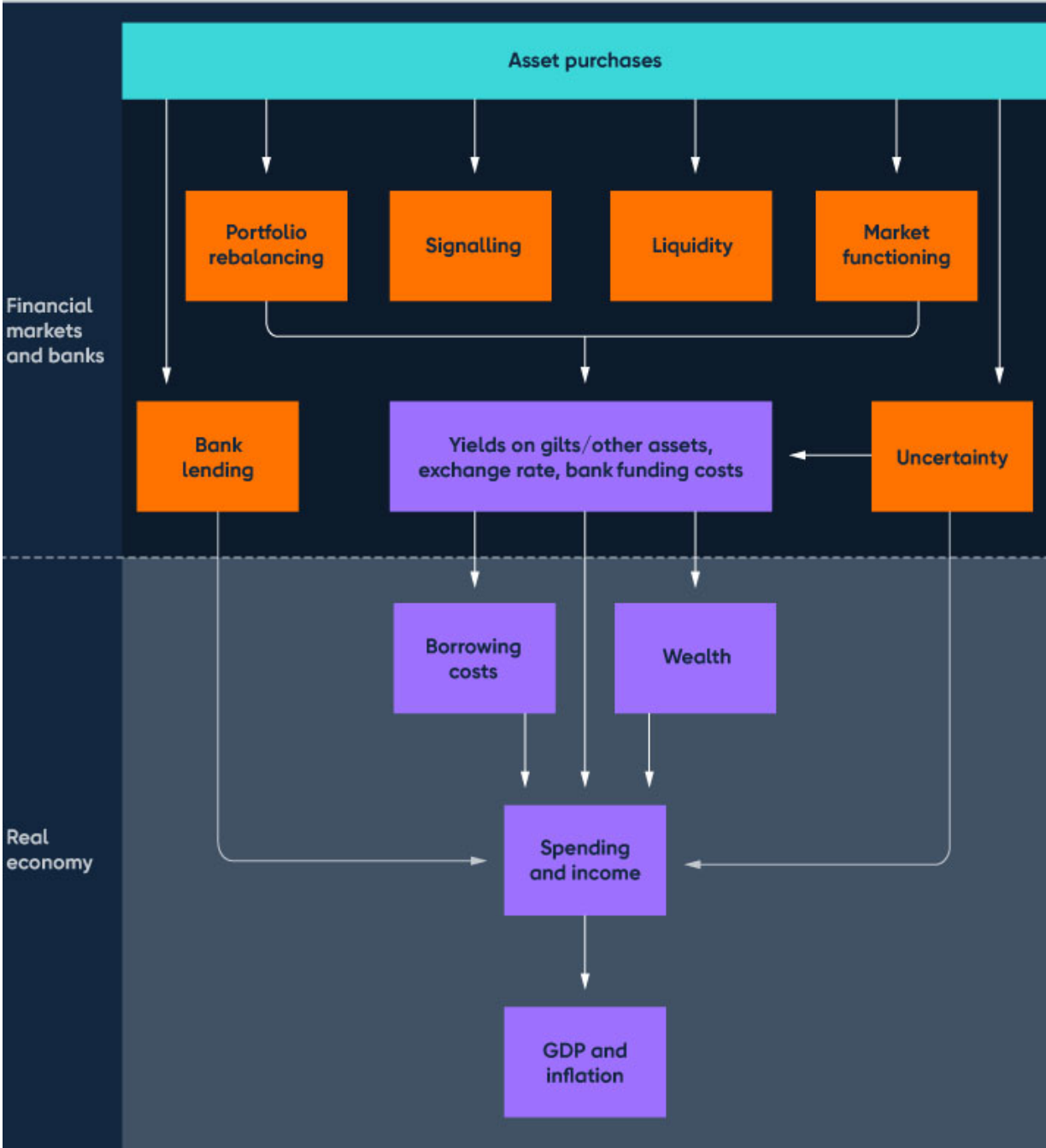
QE typically involves purchasing longer-dated gilts from financial market participants in the secondary market in return for newly created central bank reserves. At a high level, similarly to a Bank Rate cut, these asset purchases should lower longer-term gilt yields and other interest rates, thereby reducing borrowing costs for households and corporates and stimulating spending and investment.

Research has identified a number of channels through which QE can affect economic and financial conditions.

The primary transmission channels are highlighted in orange on Chart 2 and discussed in detail in Box A. Most of these channels initially affect gilt yields, which can be decomposed into two components: the expected policy rate over the bond's term to maturity, and a term premium that captures compensation for the investor from interest rate and illiquidity risk, and also potentially from the impact from demand/supply imbalances. QE can lower the expectations component by conveying information about the future path for the policy rate (signalling channel). QE can also lower term premia via several channels. By shrinking the supply of longer-term bonds, QE can push some investors to rebalance their portfolios towards other bonds and thereby lower their yields, as well as increasing the price of other assets (portfolio balance channel). QE can also reduce any liquidity premia on purchased assets (liquidity channel). In stressed circumstances, QE can improve market liquidity more broadly by lowering risks to dealers who are intermediating trades (market functioning

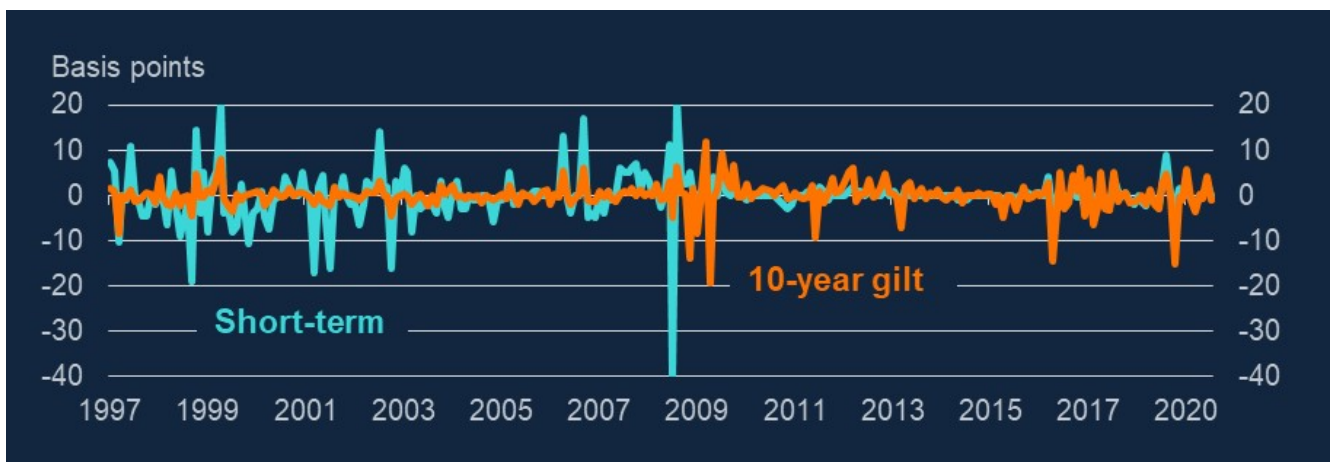
channel). In addition, QE can mitigate uncertainty in financial markets and the real economy (uncertainty channel), which may also reduce term premia, as well as having wider effects. And under some conditions QE can stimulate credit supply by increasing banks' holdings of reserves (bank lending channel).

Chart 2: Stylised transmission mechanism



Whereas three of these channels are also part of the transmission mechanism of changes in Bank Rate, the liquidity, market functioning, and portfolio balance channels are specific to QE. Given the mix of channels, and to the extent that term premia tend to increase in importance with bond maturity, QE should have stronger effects on longer-term rates compared to changes in Bank Rate. In line with this, 10-year gilt yields have become more responsive to MPC announcements since the introduction of QE in 2009 (Chart 3).

Chart 3: Change in short-term interest rates (blue) and 10-year gilt yields (orange) following MPC announcements (a) (b)



Sources: Refinitiv Tick History; [Kaminska and Mumtaz \(2022\)](#).

(a) In addition to asset purchases, changes in 10-year yields may also reflect other tools used to set monetary policy during the period, such as forward guidance, although in theory other tools should have less impact on long yields, see

[Greenwood et al. \(2016\)](#)

(b) Difference in yields within a window spanning up to 50 minutes around the MPC announcements. The short rate is a mix of the first four short sterling future contracts.

Box A: The transmission channels of QE

This box summarises the main transmission channels of QE and the theoretical conditions that underpin them. One common thread is that the extent to which these conditions are met is likely to depend on the state of the economy and financial markets. Therefore the mix of channels, and the total impact of QE, may vary across time according to circumstances, implying the different QE programmes may have different effects on asset prices and the real economy.^[8]

1: Signalling channel

When the central bank engages in QE, markets may infer that the central bank is credibly committing to a period of protracted low policy rates. One reason for this belief could be related to the expectation by market participants that the central bank will not raise policy rates before the end of the QE programme.^[9] This would lower longer-term interest rates by lowering the expectation component of government bond yields.

2: Portfolio balance channel

In aggregate, QE reduces the 'free-float' of bonds available to financial market participants. This may increase the price of bonds and lower hence their yields, via two main effects. First, reducing the supply of certain bonds can lower the yield on these bonds and on other assets that investors might consider close substitutes ('local supply' channel). Second, by shifting investors' portfolios towards shorter-dated assets, QE reduces the overall amount of duration risk borne by market participants and may therefore lower term premia across the yield curve ('duration channel').

According to some theories, one necessary condition for changes in the supply of bonds to affect yields is that some investors do not view the bank deposits they receive in exchange for bonds as a perfect substitute.^[10] This means they would look to rebalance their portfolio towards other assets, pushing up their price. This can be the case, for instance, if some investors have preferences for bonds with a specific maturity. An additional requirement is that other investor groups should not be able to undo this effect by exploiting arbitrage opportunities across bonds; for instance, because they are risk averse or subject to financial constraints.^[11]

3: Liquidity channel

Bond yields can also incorporate a liquidity premium to compensate investors for the risk that they might not be able to sell the bond immediately, particularly in times of stress. In this case, purchases of assets by the central bank can improve the liquidity of assets purchased or eligible for purchases by reducing this risk and stimulating trading.

4: Market functioning channel

In exceptionally stressed circumstances, when dealers' capacity to intermediate trades is limited, large-scale asset purchases can improve wider market liquidity and mitigate the risk of a broader tightening in financial conditions that might disrupt the monetary transmission mechanism. The strength of this channel therefore depends on the degree of market dysfunction and the amount of gilts held by dealers.

5: Uncertainty channel

QE might also help to lower yields by reducing uncertainty about the economic outlook and the path for the policy rate. In particular QE could be seen to lower the probability of the most negative economic outcomes when Bank Rate is close to zero, relative to a situation in which Bank Rate is the only available policy instrument. This channel might be particularly strong when the central bank engages in QE for the first time.

6: Bank lending channel

When selling gilts to the Bank of England, a market participant will see an increase in its deposit account with a commercial bank.^[12] At the same time, the commercial bank's reserves with the central bank will increase by the same amount. Under some conditions this can increase the bank's ability and willingness to lend, particularly if greater holdings of liquid assets relax the bank's financial constraints. But whether this is the case in practice depends on regulatory requirements and the bank's financial position and risk appetite. It will also depend on how stable this new source of funding is.

4: The impact of QE on the yield curve

QE is transmitted to the economy by reducing interest rates across the yield curve.

Since financial market participants are forward-looking, the expected impact of asset purchases should be reflected in asset prices as soon as the central bank announces a change in its purchase target.^[13] In line with this idea, a large number of studies have estimated the impact of QE by exploring how asset prices change within a short time interval (window) after each QE announcement, with the length of the window chosen in order to help exclude the influence of other news. Among others, the evidence on the yield impact of QE announcements has been reviewed by [Gagnon \(2016\)](#), [Haldane et al. \(2016\)](#), and [Hartley and Rebucci \(2020\)](#)

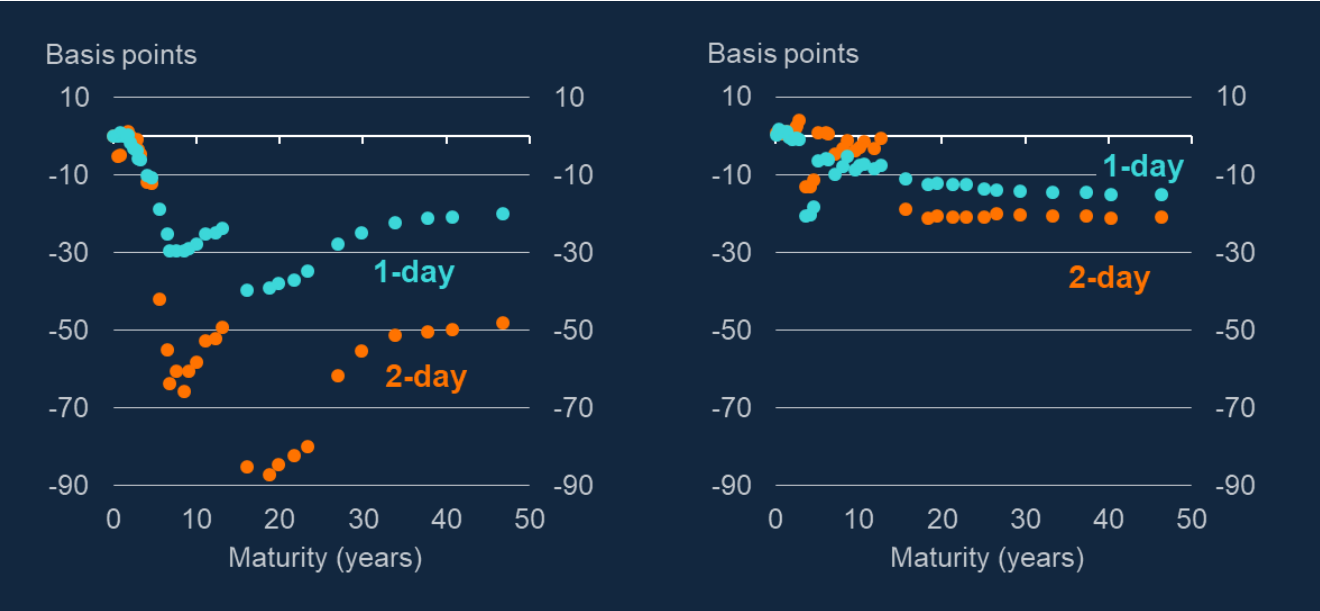
There is consistent evidence that MPC QE announcements have lowered interest rates across the maturity spectrum.

On balance, studies focused on the UK find that gilt yields have fallen after QE announcements. In particular, medium to long-term gilt yields fell by about 100bps in response to the first £200bn QE programme ([Joyce et al. \(2011\)](#), [Christensen and Rudebusch \(2012\)](#) ^[14] Studies for the US and euro area have found broadly comparable effects when adjusting for differences in programme size.^[15]

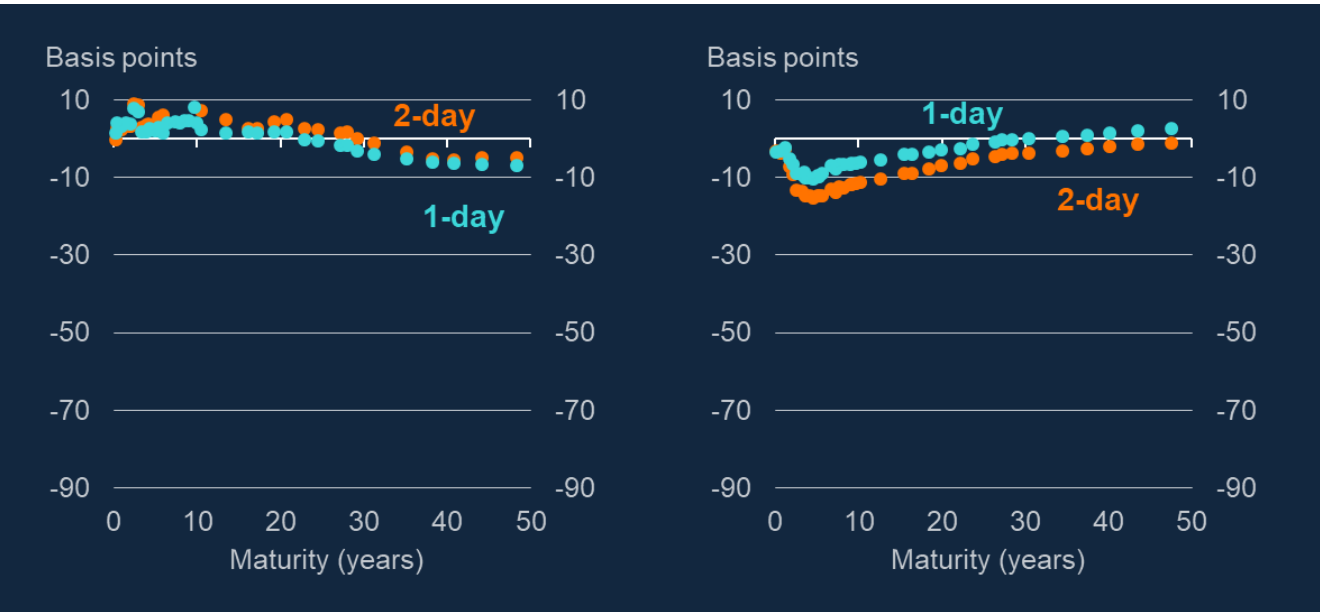
These studies focus on the first QE rounds, but evidence across all the major QE episodes to date also suggests that gilt yields fell across the maturity spectrum after the MPC announced an increase in the target stock of purchased assets (Chart 4).^[16]

Chart 4: Change in gilt yields by maturity after Bank purchase announcements: one-day (blue) and two-day window (orange)

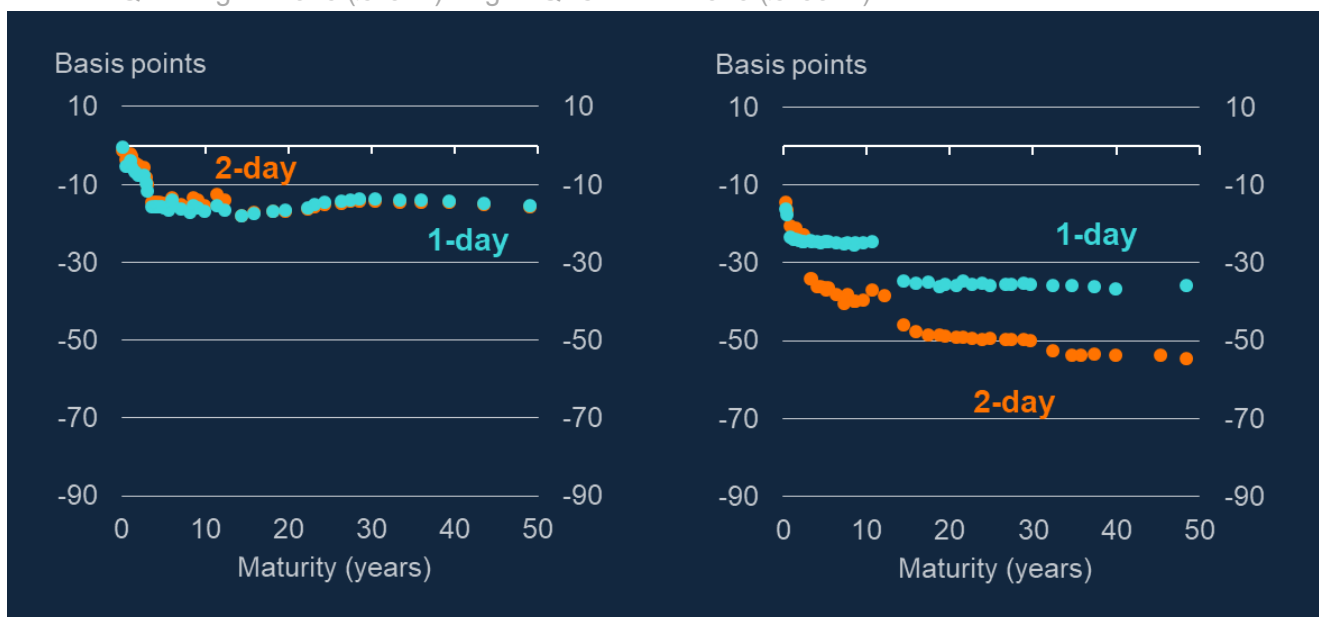
Left: QE1 March 2009 (£75bn). Right: QE1 August 2009 (£50bn).



Left: QE2 October 2011 (£75bn). Right: QE3 July 2012 (£50bn).



Left: QE4 August 2016 (£70bn). Right: QE5 March 2020 (£200bn).



Sources: Tradeweb; [Froemel et al. \(2022\)](#) calculations.

The evidence points to significant variation across rounds, with the largest moves being associated with the first QE programme.

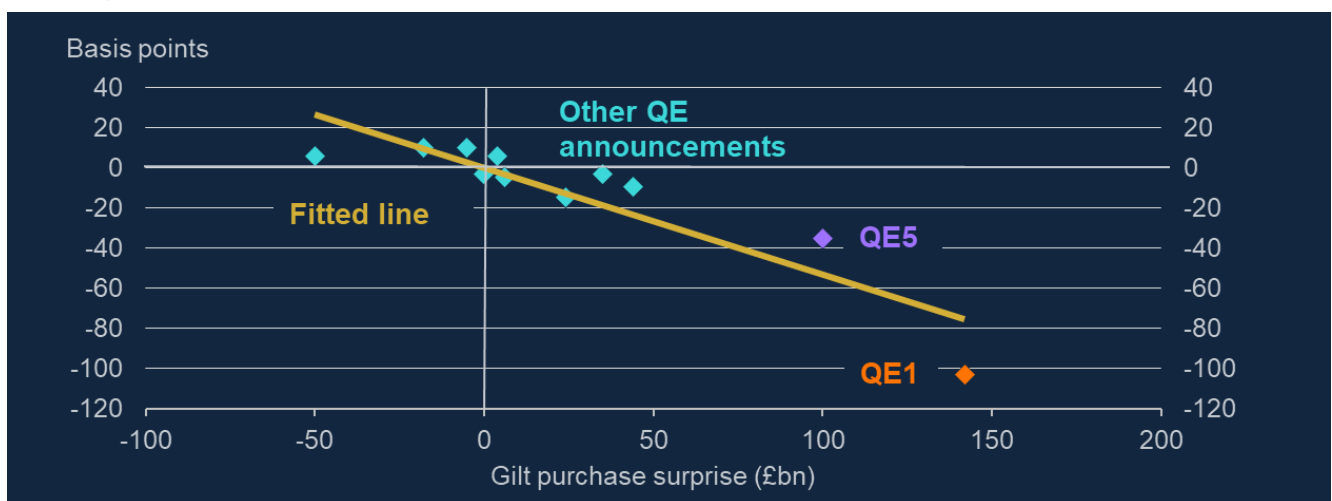
Overall the economic research suggests that the impact of QE has changed materially over time. The largest impact was associated with the first programme in March 2009, with yields falling by relatively less in response to subsequent MPC announcements (Chart 4). Variation between the first and subsequent programmes was also observed in the US, leading to a debate about how effective QE was outside of crises.^[17] One argument is that in times of stress, the conditions necessary for QE to lower yields via liquidity, market functioning, portfolio balance, and uncertainty effects are likely to be met to a larger degree (Box A). Applying this argument to the UK, [Vlieghe \(2021\)](#) argues that QE has had little impact outside situations of market stress like March 2009 and March 2020.

Another explanation is that subsequent QE rounds were anticipated by the market to a greater extent ([Gagnon \(2018\)](#) [Bernanke \(2020\)](#)). In line with this, survey data for the UK suggest that a majority of MPC QE announcements were expected to a significant degree by financial market participants. In some cases QE announcements were also smaller than expected. However, the fact that QE programmes were anticipated does not mean they were less effective. Instead, it implies that the expected impact of future programmes may have already been incorporated into asset prices ahead of QE announcements, and that yields would therefore be less responsive to these announcements themselves.

The evidence suggests that QE announcements can also lower yields when markets are not stressed.

The impact of QE appears to vary across programmes, even if one allows for what had been expected beforehand. The response to the surprise component of QE – the announced target less what markets had anticipated – was much greater in March 2009 than at other times (Chart 5). But there was still a measurable impact of QE surprises on other occasions, even when markets were functioning well (Chart 6).

Chart 5: Change in 10-year gilt yields after QE announcement and gilt purchase surprise (a)



Sources: Bloomberg Finance L.P, Refinitiv Eikon, Reuters and Bank of England calculations.

(a) February and March 2009 are shown in orange, while March 2020 is shown in purple. The chart shows two-day windows around announcements except when there are confounding events within this window. The changes over two days after the announcement have been suggested as a plausible time frame for markets to absorb news in the context of QE1 ([Joyce et al \(2011\)](#)). October 2011, February 2012, and March 2020 use a narrower window, as MPC announcements coincided with other central bank announcements or major political news. The picture is similar if one uses an average across gilt maturities. Purchase surprise is the change in the expected target stock of QE purchases among market participants surveyed by Reuters (QE1–QE4) and market intelligence (QE5). The purchase surprise for QE1 is the difference in the terminal expectation for asset purchases between April and February 2009, while the surprise in QE5 is estimated using market intelligence obtained shortly before the March 2020 MPC meeting.

Chart 6: Empirical relationship between 10-year gilt yield changes and gilt purchase surprise (a)



Sources: Bloomberg Finance L.P, Refinitiv Eikon, Reuters and Bank of England calculations.

(a) The average fall in yields is derived by fitting a linear trend line to three different samples from the points displayed in Chart 5 (eg, the fitted line included in Chart 5 is for all announcements). R2 is the fraction of the variation across announcements that is explained by the linear trend.

One critique of this body of research is that the identified impact of QE announcements on gilt yields might be a short-term effect that would reverse before it can have any impact on real outcomes. Bond yields will fluctuate with a range of domestic and global factors, and this can offset any impact from a QE announcement – particularly in an open economy like the UK. But insofar as these factors would exist absent QE, any reversal in yields does not necessarily mean that the effect of QE is transient.^[18] In addition, while the full effects would be expected to manifest in gilt yields over a few days, there is evidence that the spillovers to other assets may take place over several weeks.^[19] However if QE succeeds in strengthening the economy, there will ultimately be upward pressure on yields. Available studies point to announcement impacts that persist as long as several months and up to two years.^[20] Overall, QE has created substantial policy ‘space’ by increasing the MPC’s ability to lower longer-term interest rates.^[21]

5: Evidence on the transmission channels of QE

This section discusses the main channels that could explain the reaction of yields to the announcement of QE programmes before 2020. As discussed above, the impact on the yield curve could reflect a combination of signalling, portfolio balance, liquidity, and uncertainty effects. Separating these channels is challenging given the relatively small number of QE programmes that have been undertaken. With the passage of time, the body of evidence on the contribution of different channels is growing. Although generalising from individual studies is difficult, looking across a range of studies suggests a number of common themes.

The evidence suggests that different channels have operated together, but have varied in strength over time.

One key distinction is between channels that work by lowering term premia – including portfolio balance and uncertainty – and those operating by lowering expectations of future policy rates (signalling). Decomposing these effects is difficult because these components are unobserved and must therefore be inferred from models.^[22]

Focusing on the UK, [Kaminska and Mumtaz \(2022\)](#) decompose high-frequency changes in the yield curve using a dynamic term structure model over a sample period which includes the first four UK QE programmes. Their decomposition suggests that QE announcements lowered interest rates via both term premia and expectations, often simultaneously. When monetary policy was implemented using QE, announcements had a stronger impact on term premia, compared to cases in which monetary policy was implemented using changes in Bank Rate.^[23]

Signalling has been found to have played a significant role in some programmes.

The decomposition by [Kaminska and Mumtaz \(2022\)](#) also suggests that signalling has been one of the key QE channels, although its importance was relatively less pronounced during the first QE programmes. Similarly, other papers have found that initially the signalling channel played a statistically significant but quantitatively modest role. Using different methods to decompose short-term changes in gilt yields, [Christensen and Rudebusch \(2012\)](#) and [Joyce et al. \(2011\)](#) both find that expectations of future Bank Rate fell in response to the announcement of the first Bank QE programme – in line with a signalling channel. But according to their decompositions, signalling effects across the entire programme explain at most up to a third of the announcement impact of QE on gilt yields. By comparison, some studies (see e.g. [Christensen and Rudebusch \(2012\)](#) [Bauer and Rudebusch \(2014\)](#)) find that signalling explains a larger share of the impact of the announcement of the Fed's first QE programme - perhaps because the Fed also gave explicit guidance about the future path for policy rates.

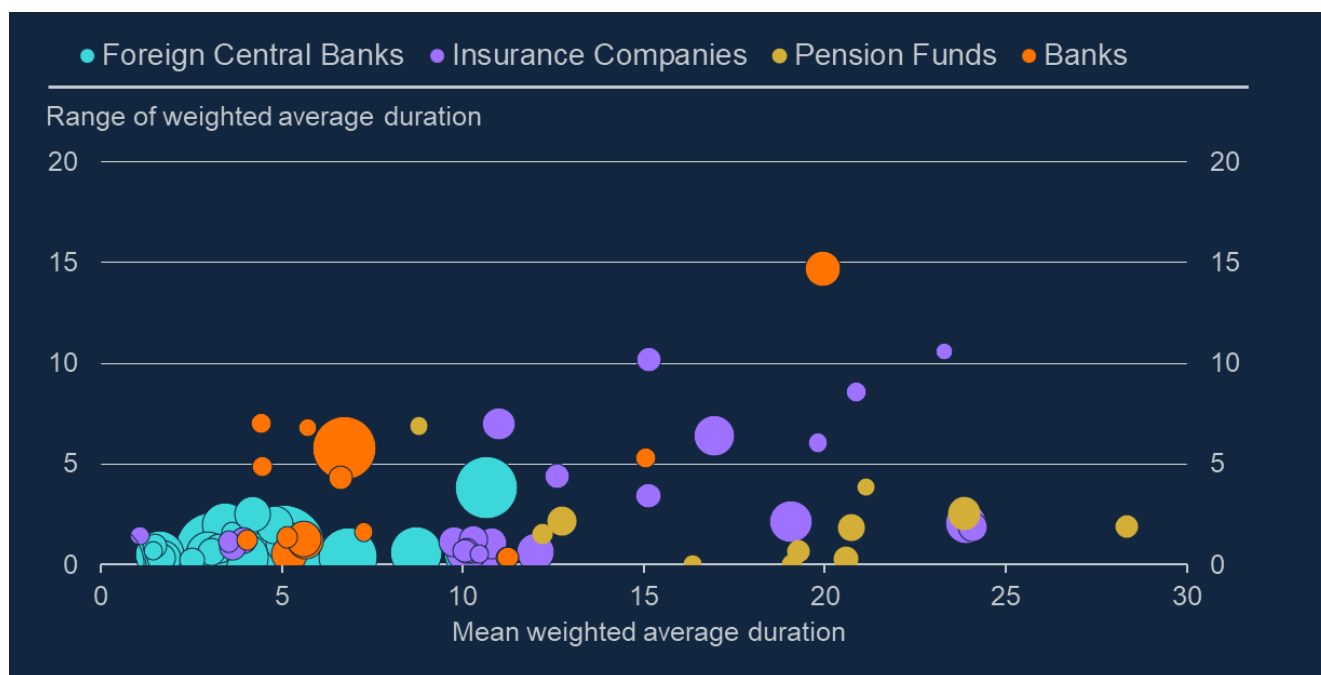
The finding that signalling explains only a portion of the impact of QE is consistent with a substantial role for portfolio balance in helping to lower yields by compressing term premia.

| There is empirical support for ‘preferred habitat’ behaviour.

As discussed in Box A, some theories suggest that for QE to lower bond yields by shrinking the supply of longer-term bonds (‘portfolio balance channel’) some investors must have a preference for bonds of specific maturities. Insurance companies and pension funds (ICPFs) are often thought to have such ‘preferred habitats’ because they tend to hold long-term assets in order to match their liabilities.

In recent research, [Giese et al. \(2021\)](#) show that preferred habitat behaviour in the gilt market exists across the term structure and that foreign central banks (at shorter maturities) and ICPFs (at longer maturities) make up some of these preferred habitat investor groups (Chart 7). These investors’ gilt holdings are less sensitive to changes in the price of gilts, consistent with the idea that they value these assets for non-pecuniary reasons. In addition, one of these groups of investors – including insurance companies – reduced their gilt holdings more than proportionately during the 2016 QE4 programme, in line with these investors playing an important role in the transmission of QE. Similarly, [Joyce et al. \(2017\)](#) find that ICPFs played a significant role in selling gilts to the Bank as part of the QE1 and QE2 programmes. Worldlidge (2022) finds a similar result for QE5, in that ICPFs reduced their net acquisition of gilts and increased their net investment in corporate bonds.[24]

Chart 7: Sectoral mapping of gilt investor groups (a)



Sources: Euroclear and Bank calculations; [Giese et al. \(2021\)](#)

(a) X-axis: weighted average duration of investor's conventional gilt holdings. Y-axis: 90th–10th percentile range of investor portfolio's weighted average duration. Bubble sizes reflect the portfolio size.

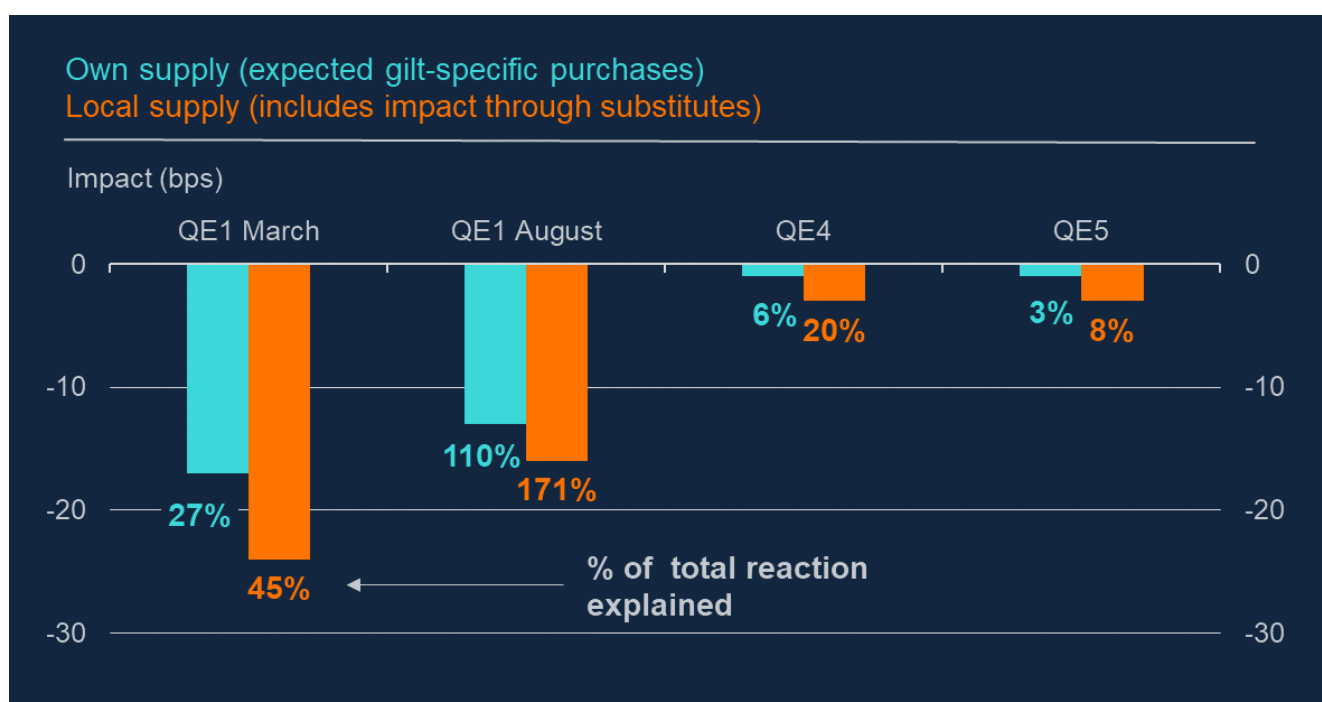
Evidence suggests that local supply effects (part of the portfolio balance channel) were important in the first QE programmes.

One way to shed light on the role of portfolio balance is to study how the impact of QE announcements varies across individual gilts. If QE lowers gilt yields by shrinking the supply of gilts, those gilts more likely to be purchased by the central bank should see larger drops in yields after announcements. Exploiting changes in the purchase ranges used by the Bank to buy gilts across different maturity buckets, [McLaren et al. \(2014\)](#) find that this was the case for the first two QE programmes. From their estimates, they calculate that this 'local supply' effect explains around half of the total impact of the QE1 and QE2 announcements on medium and long-term gilt yields.^[25] Comparable estimates suggest that local supply explains around two-thirds of the response of US Treasury yields to the Fed's first QE programme.^[26] [McLaren et al. \(2014\)](#) also find that longer-term bonds react more strongly to QE announcements, in line with a duration effect (Box A).

More recent evidence suggests that the importance of portfolio balance may have diminished over time.

Recent research by [Froemel et al. \(2022\)](#) sheds light on the importance of the local supply channel across all Bank programmes to date. They find that QE announcements lead to larger falls in the yields of gilts that are more likely to be purchased by the Bank, or that could be seen as substitutes, consistent with the operation of this channel. Over time, however, the yield reductions associated with these two effects seem to have become smaller, and to account for a smaller fraction of the overall yield response to announcements (**Chart 8**).^[27]

Chart 8: Average impact on yields explained by relative scarcity, 2-day window around announcements



Source: [Froemel et al. \(2022\)](#).

QE has also been found to reduce uncertainty.

QE can also lower term premia by reducing uncertainty about the economy and the future path of the policy rate, in particular when the policy rate is close to its effective lower bound. In line with this, the decomposition by [Kaminska and Mumtaz \(2022\)](#) suggests that term premia associated with uncertainty about the future path for Bank Rate fell after QE was introduced in 2009. Feeding this decomposition into a macroeconomic model, they estimate that lower uncertainty translates into lower corporate bond spreads and improved economic outcomes. Using a vector autoregression approach, [Weale and Wieladek \(2016\)](#) also find that proxies for financial market and household uncertainty fell in response to earlier MPC QE announcements.

QE might have particularly helped to lower uncertainty when used for the first time at the peak of the GFC. In this situation, QE might have reduced the perceived risk of tail outcomes. Conceptually, this channel could affect both the quantity and pricing of risk in a persistent way.

There is limited evidence that QE purchases lowered yields by reducing liquidity premia in the gilt market.

While asset purchases can improve the liquidity of purchased gilts around auction times, these benefits should be short-lived and limited to periods of poor gilt market liquidity.^[28] For example, for the UK, [Joyce and Tong \(2012\)](#) find that during the early stages of the QE1 auctions yields fell most for less liquid gilts, but these effects were small and temporary. But beyond a certain point, by reducing the free float of bonds, central bank purchases may also potentially reduce bond liquidity – although the Bank’s purchase caps and gilt lending scheme are intended to limit this effect (see Box B). The international evidence suggests that asset purchases have a range of impacts on bond liquidity. In Sweden, for example, [Blix Grimaldi et al. \(2021\)](#) found that the Riksbank’s purchases of government bonds improved liquidity as long as the Riksbank held less than 40% of these bonds, but impaired liquidity past that level. These findings are unlikely to be representative of the impact of asset purchases when there is a stress in government bonds and pressure on dealers’ ability to intermediate, as was the case in March 2020. As discussed in Section 7, in these circumstances there is more scope for asset purchases to improve market functioning and liquidity. The potential for purchases of UK corporate bonds to improve liquidity is also greater because they are less liquid than gilts (Section 8).

There is no evidence of a material bank lending channel in the UK.

By lowering gilt rates, QE will tend to lower rates on bank loans to households and corporates as well as on banks’ wholesale funding. All else equal, this should translate into more bank lending. However there is less direct evidence that QE operates through a more specific bank-lending channel.

As discussed in Box A, the influx of reserves and deposits associated with QE could allow commercial banks to increase their holdings of riskier or less liquid assets – including loans to households and businesses – or to grant cheaper loans. But this might not be the case if banks are not constrained by regulations or other constraints in the first place, and if the deposits are ‘flighty’ – possibly because depositors subsequently rebalance their portfolios towards riskier securities.^[29] In line with this, the evidence suggests that UK banks experiencing a larger influx of reserves as a result of QE did not increase lending relative to other banks during QE1 and QE2.^[30]

6: The impact of QE on other asset prices and the real economy

As discussed in the previous sections, lower interest rates across the yield curve should stimulate investment and consumption and therefore support demand in the economy by easing financial conditions and increasing wealth.

Evidence suggests that the impact of QE on the yield curve spills over into other financial market prices.

For a fall in interest rates across the yield curve to stimulate demand, it should lower borrowing costs for households and corporates in a sufficiently persistent way. These costs reflect default-free rates plus a credit risk premium. A fall in the yield curve from QE will lower the first component (by lowering expected risk-free rates via the signalling channel and by increasing the demand for corporate bonds via portfolio balance effects – although this effect might materialise more gradually). QE can also help to lower the second component by improving the outlook for the economy and therefore decreasing default risk for corporates.

In line with this, event studies for the UK suggest that corporate bond yields fell significantly in response to the announcements of the QE programmes ([Joyce et al. \(2011\)](#); [Joyce, Tong and Woods \(2011\)](#) [McLaren et al. \(2014\)](#) [Haldane et al. \(2016\)](#); [D'Amico and Kaminska \(2019\)](#)). High-yield corporate bonds seem to react particularly strongly, suggesting that QE lowered downside tail risks in the corporate sector.^[31] In addition, [D'Amico and Kaminska \(2019\)](#) find that after QE announcements, there was a larger drop in the yield on investment-grade corporate bonds with maturities similar to the purchased gilts. This impact peaks after a few months, consistent with portfolio rebalancing into riskier assets occurring gradually and having a persistent impact on financial conditions.

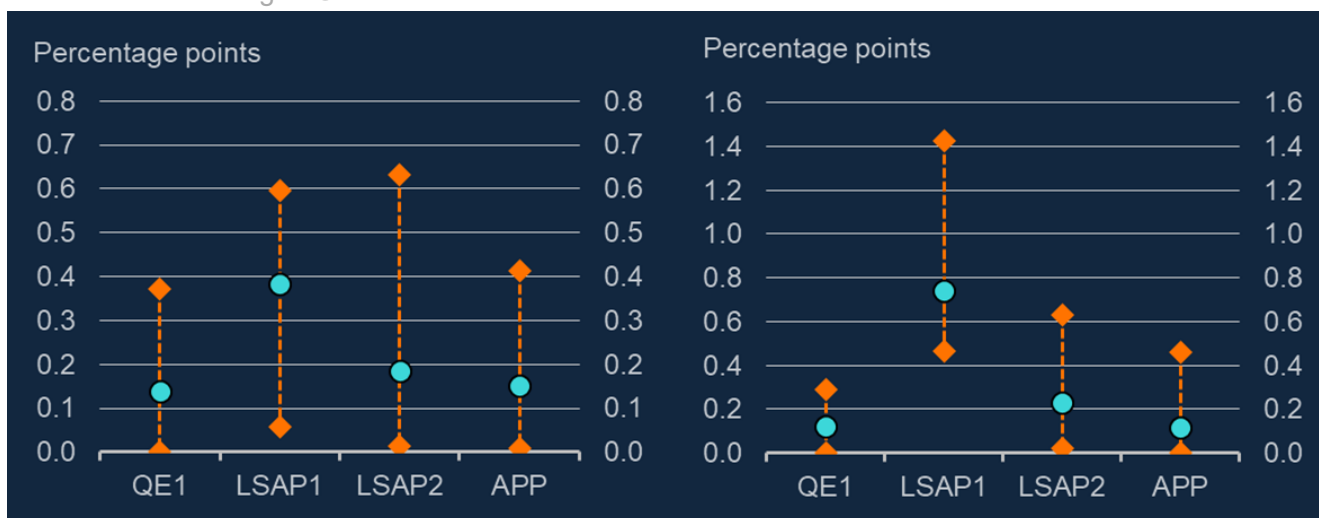
Furthermore, lower interest rates could also put some downward pressure on the exchange rate. The empirical evidence suggests that, consistently with this mechanism, the pound has tended to depreciate in response to QE announcements by the MPC.^[32]

While estimating the impact on real activity is more challenging, the literature suggests that QE programmes provided positive stimulus.

Averaging across 16 studies by academic and central bank researchers, the Bank's QE1 was estimated to have increased UK inflation and annual GDP growth by up to 1.8pp and 1.6pp at its peak, respectively. To put this into context, UK GDP dropped by 4.2% between the start and the trough of the GFC. In comparison, the Fed's first Large-Scale Asset Purchase (LSAP1) programme was estimated to have had a larger impact on the economy, especially in terms of GDP (Chart 9).^[33]

Chart 9: Empirical estimates of peak impact of QE programmes: average (blue dots), minimum and maximum (orange squares) (a)

Left: Inflation. Right: GDP.



Sources: [Fabo et al. \(2021\)](#) and Bank calculations.

(a) APP: ECB’s Asset Purchase Programme. LSAP: Federal Reserve’s Large Scale Asset Purchase programme. Estimates are re-scaled to reflect a purchase programme worth 1% of domestic GDP.

The range of estimates across studies and QE programmes is very wide – particularly for inflation.

Researchers typically use models calibrated from historical relationships between bond yields and GDP and inflation to estimate the macroeconomic impact of QE announcements. However these models often embody a limited range of potential transmission channels and their estimates depend on the chosen identification scheme.^[34]

As Chart 9 shows, impact estimates across different studies and programmes vary considerably, especially for inflation.^[35] More broadly, there is substantial uncertainty around each individual estimate ([Williams \(2013\)](#), leading [Borio and Zabai \(2016\)](#) to argue that, even though the positive effect of QE is clearly present, its size and stability are quite uncertain. Therefore, and unsurprisingly given the identification challenges, there remains room for disagreement about the economic significance of individual QE episodes. This is also consistent with these programmes having operated through a mix of channels with different impacts on the real economy.

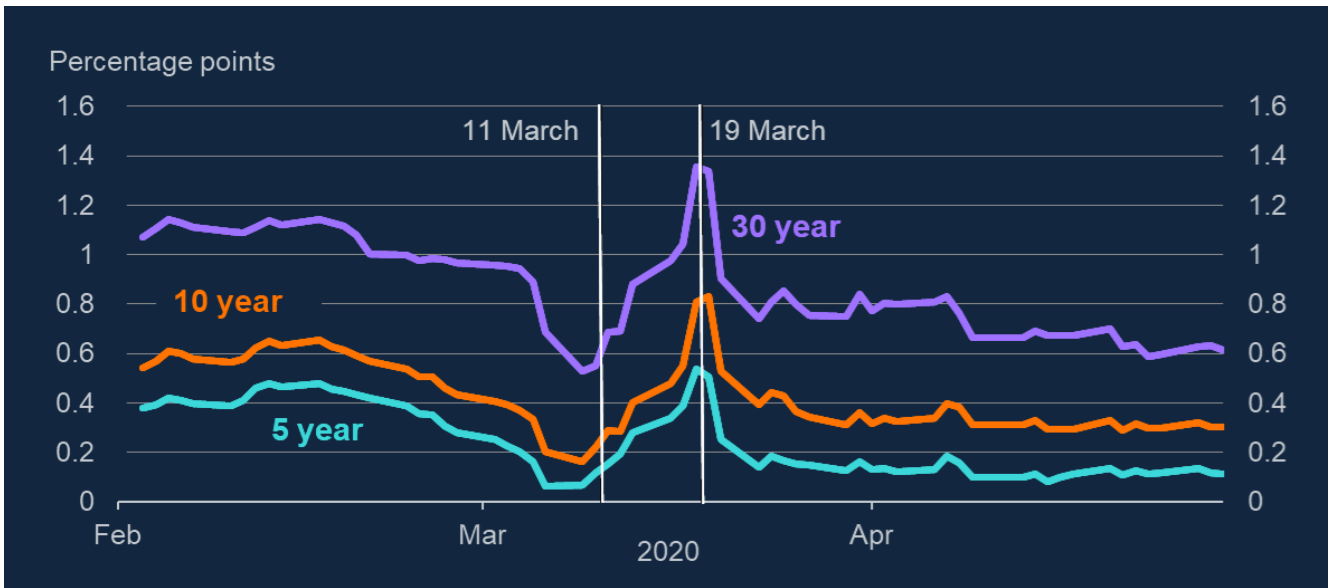
Understanding the strength of different channels is important to quantify the macroeconomic impact of QE.

While a majority of existing studies focus on the first QE programmes, [Kaminska and Mumtaz \(2022\)](#) study all of the MPC's programmes before 2020 together and allow for a range of transmission channels (signalling, QE-specific supply, uncertainty). Their results suggest that insofar as it lowers gilt yields on announcement, QE has been associated with an improvement in real activity. They also find that the impact of QE on economic activity varies in strength with the mix of channels. In particular, the signalling channel can have a persistent impact on interest rates at the short end of the yield curve and so affect the pricing of a broad range of loans and financial assets. In contrast, local supply and duration effects have their main impact at the longer end of the curve. In line with these ideas, [Kaminska and Mumtaz \(2022\)](#) estimate that a given reduction in long gilt yields is associated with relatively larger changes in the exchange rate, corporate bond yields, and inflation and activity if it is driven by signalling rather than channels operating via term premia.

7: The role of asset purchases at the onset of the Covid-19 pandemic

At the start of 2020, the spread of Covid-19 and the measures taken to contain the virus triggered a sharp deterioration in the economic outlook and an increase in economic uncertainty. In response, investors suddenly demanded more liquid and safe assets. This 'flight-to-safety' was initially evident in an increase in the price of gilts and therefore a decline in their yields. But around mid-March the sell-off also extended to advanced economy government bonds, despite typically being considered the most liquid and safe asset class, reflecting a 'dash-for-cash'. As a result, between 10 and 18 March, 10-year gilt yields increased by around 60bps (Chart 10), with similar spikes in US Treasuries and German Bunds.

Chart 10: Gilt yields between February and April 2020 (a)



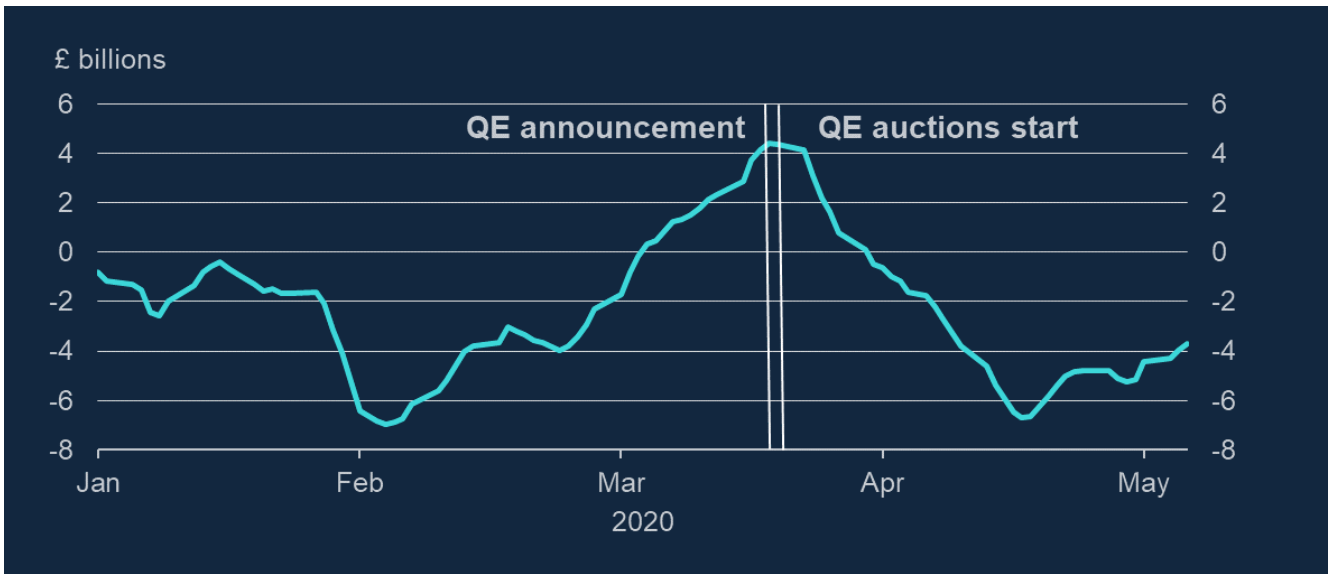
Sources: Bloomberg Finance L.P, TradeWeb and Bank calculations.

(a) Zero-coupon spot rates derived from gilt prices.

The ‘dash-for-cash’ reflected an extreme spike in the demand for liquidity, at a time where dealers’ capacity to intermediate in the gilt market was constrained.

In the UK, the demand to liquidate gilts was driven in part by a need for investors, such as domestic insurance and pension funds, to meet significant margin calls.^[36] In normal circumstances, dealers provide liquidity by holding gilt inventories on their balance sheets. In March 2020, the growing imbalance between the demand from clients wishing to sell gilts relative to those wishing to buy required dealers to ‘warehouse’ unusually high volumes of gilts on their balance sheets (Chart 11), and liquidity provision was insufficient to fully accommodate demand.^[37] The combination of these factors resulted in a sharp deterioration of market liquidity. One way this manifested was in an abrupt widening of bid-ask spreads, which is one of the ways dealers are compensated for the risks of holding gilt inventories (Chart 12).^[38]

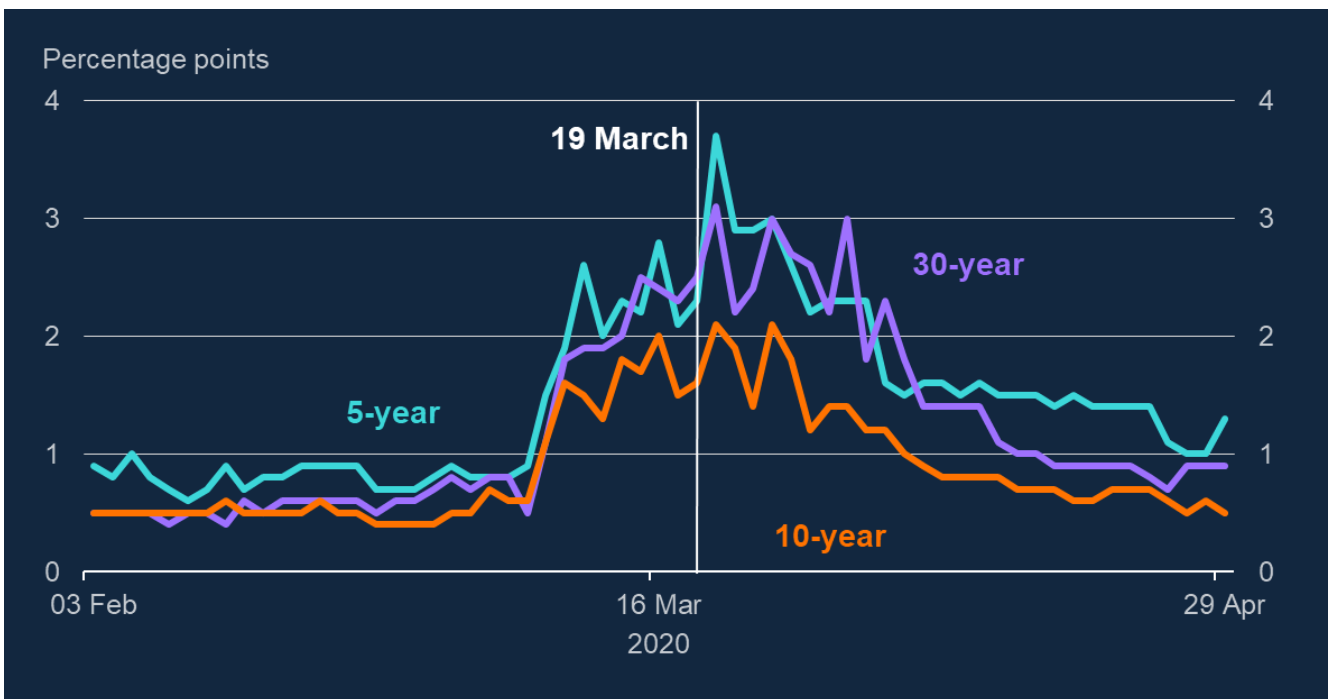
Chart 11: Cumulative net purchases of gilts by dealers (a) (b) (c)



Sources: MiFID II transaction data and Bank calculations.

- (a) Includes all conventional UK government bonds. Measured in nominal value.
- (b) Estimated from transaction reports.
- (c) Smoothed using a centred five day moving average of cumulative purchases net of sales.

Chart 12: Gilt bid-ask spreads



Sources: Eikon Refinitiv and Bank calculations.

Central banks responded with asset purchases of unprecedented scale and speed, along with other measures aimed at improving market functioning and mitigating an unwarranted tightening in financial conditions.

Other things equal, the deterioration in gilt market conditions and the associated tightening in financial conditions would have further depressed the UK economy. Therefore, on 19 March the MPC announced that it had voted unanimously to increase the stock of asset purchases by £200bn, and that it would complete the programme 'as soon as operationally possible, consistent with improved market functioning'.

At the same time, the Fed and ECB also announced unusually large and fast-paced asset purchase programmes (Table A). In addition, major central banks reinstated and extended swap line programmes. This allowed the Bank to lend US dollars to its counterparties, potentially mitigating their liquidity needs.^[39] On 24 March the Bank also launched the Contingent Term Repo Facility (CTRF), with the objective of further supporting market functioning.

Table A: Timeline of key policy announcements in March 2020

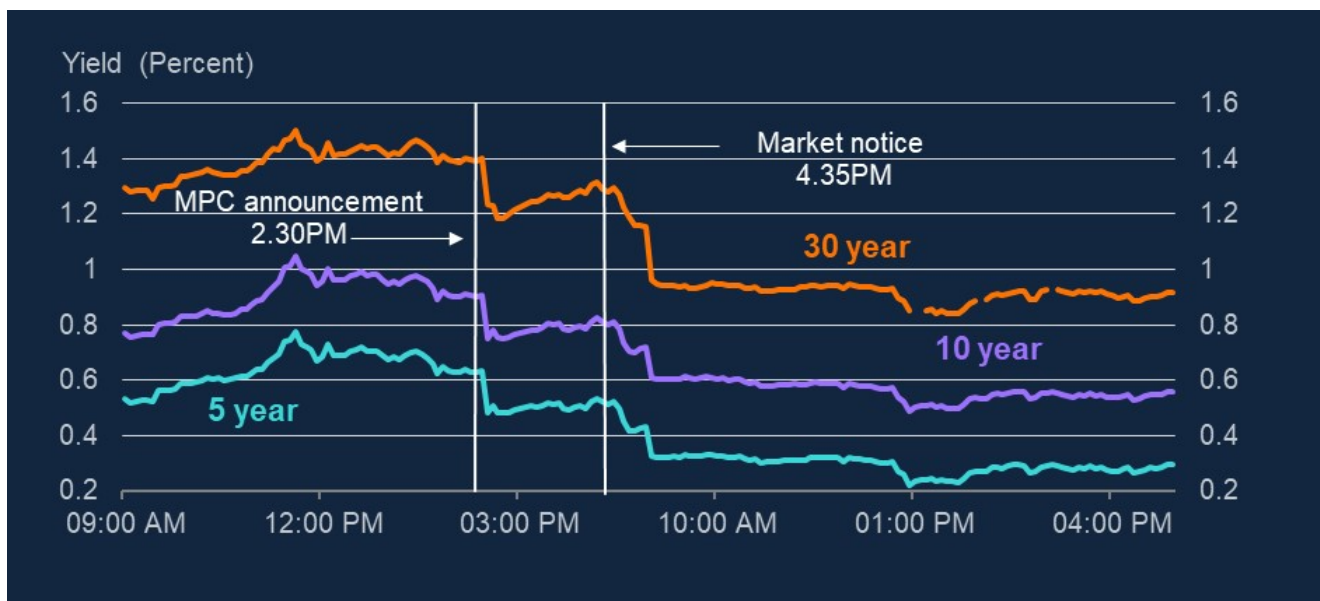
Date	Announcement
11.03	UK: Bank Rate cut to 0.25%; TFSME
15.03	US: Fed Funds cut to between 0% and 0.25%
	US: >\$500bn Treasury purchase programme
	Swap lines costs reduced
17.03	US: Primary Dealer Credit Facility
18.03	EA: Pandemic Emergency Purchase Programme
19.03	UK: £200bn QE programme
	UK: Bank Rate cut to 0.1%
	US: Treasury purchases surge to over \$60bn/day
20.03	Swap lines frequency switched to daily
23.03	US: Treasury purchase 'in the amount needed'
	US: Corporate bond purchase facilities;
24.03	UK: Contingent Term Repo Facility (CTRF).

Gilt yields retraced a significant portion of their surge after the MPC's announcement.

Summing together the high frequency reactions to the 19 March MPC announcement and the subsequent Market Notice, 10-year gilt yields fell by 24 basis points (Chart 13) – around 40% of the surge in yields over the ten preceding days.^[40] Since there was no other significant news over this window, this effect can be attributed to the Bank's announcements. Since it

might have taken time for markets to fully absorb the news however, these moves could provide a lower bound for the full impact of the announcements.^[41] On average, medium and long-term gilt yields fell by around 40 bps in the two days after the announcements. This might be an upper bound because the parallel extension of Fed and ECB asset purchases and swap lines could also have helped to lower gilt yields by improving market functioning.

Chart 13: Gilt yields on 19 and 20 March 2020



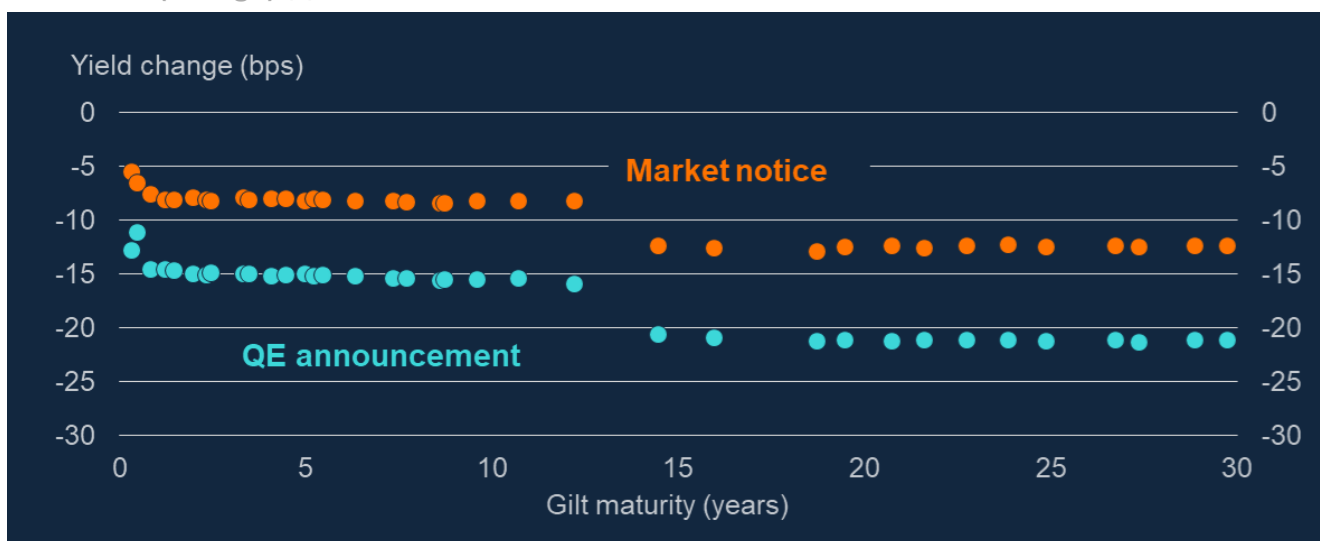
Sources: Bloomberg Finance L.P and Bank calculations.

A market functioning channel is likely to have played a larger role during the March 2020 QE compared to previous rounds.

Given the imbalance between the demand to liquidate gilts and the market’s ability to absorb them, there was an unusually large scope for asset purchases to improve market functioning in March 2020. In particular, the presence of a large ‘backstop’ buyer could reduce the risk of holding gilt inventories and thereby increase dealers’ capacity to accommodate selling pressure from their clients.

One feature of the reaction to the 19 March announcements is that, compared to previous programmes, although long rates fell by more, there was little variation in the reduction in quoted yields across individual short to medium-term gilts and across quoted yields on individual longer-dated gilts (Chart 14). This could have been a symptom of market dysfunction and uncertainty, making dealers reluctant to discriminate between gilts within broad yield curve segments.

Chart 14: Change in gilt yields after 19 March QE announcement (blue) and Market Notice (orange) (a)



Sources: Bloomberg Finance L.P and Bank calculations.

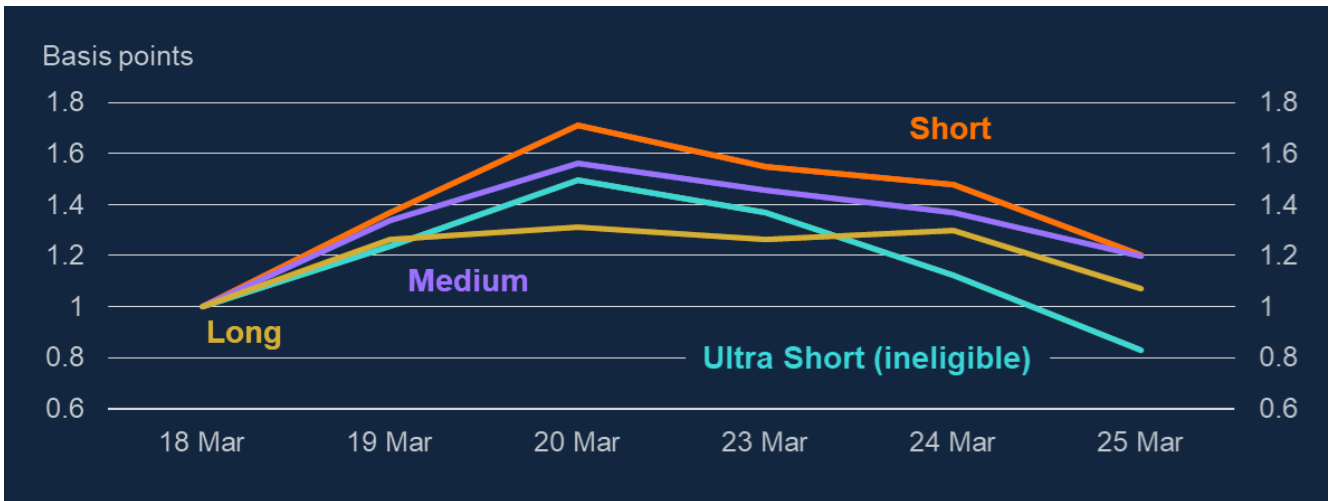
(a) Change in gilt yields (bps) in a 30-minute window around each event.

In line with the importance of a market functioning channel, gilt liquidity improved after the Bank’s purchases began.

Unlike gilt yields, indicators of liquidity conditions did not improve immediately following the 19 March announcement. That might have been expected, given that it would require actual purchases to ‘unclog’ dealers’ balance sheets and increase their appetite to provide liquidity. However, it is possible that the response of gilt yields might have partly reflected an improvement in expected liquidity conditions.

The precise timing of the improvement in market liquidity varied across indicators.^[42] Measures based on dealer quotes, like bid-ask spreads, did not react strongly on 19 March, but they fell across the maturity spectrum after the Bank began buying assets through its QE auctions (Chart 15). The fact that bid-ask spreads also decreased for very short-term gilts ineligible for Bank purchases is also consistent with an improvement in dealers’ appetite to provide liquidity after auctions had started.

Chart 15: Gilt bid-ask spreads (a)

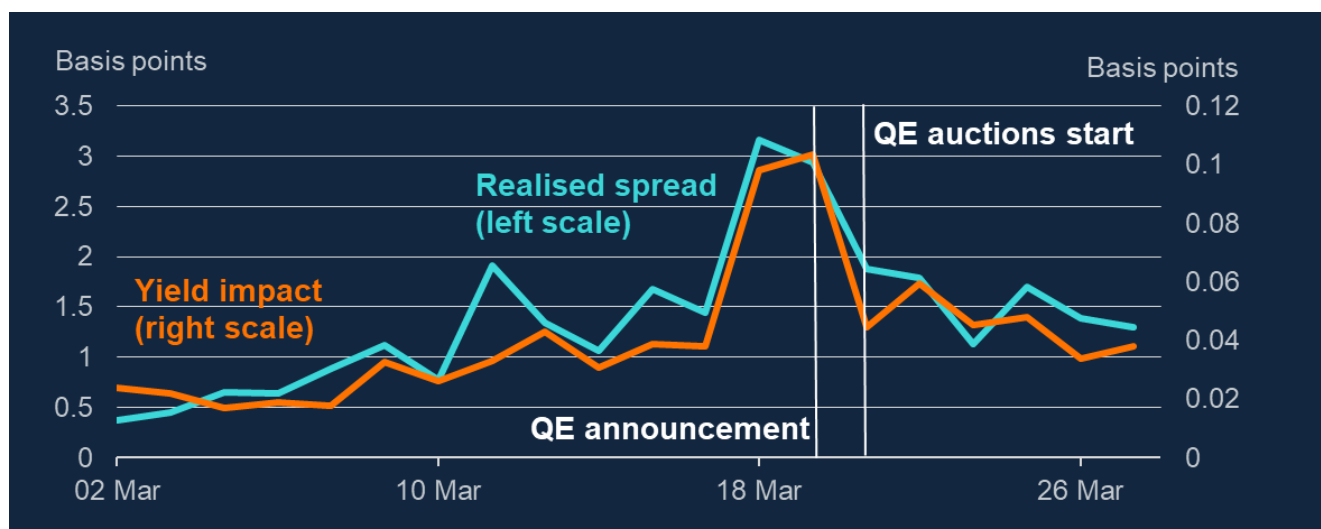


Sources: Tradeweb and Bank calculations.

(a) Average intraday bid-ask spread using the best bid and best ask.

Meanwhile, transaction-based measures^[43] suggest that liquidity improved decisively on 20 March, the first day of QE auctions (Chart 16). It is possible that these measures respond more quickly than bid-ask spreads, for example if the bargaining power of gilt sellers increased due to the impending auctions. In general however, the impact of QE on gilt market liquidity is difficult to separate out from the effect of the parallel Fed purchases and swap lines.

Chart 16: Transaction-based liquidity measures (a)



Sources: Tradeweb, FCA MiFID II data and Bank calculations.

(a) Realised spread: average difference between the transacted yield and the best market quoted yield 5 minutes after the trade. Yield impact following [Blix Grimaldi et al \(2021\)](#) median change in yield following a transaction divided by the remaining maturity of the bond.

The US and EA experiences are also consistent with asset purchases contributing to restoring market functioning.

A range of observers have argued that asset purchases played an important role in restoring market functioning, along with other central bank interventions.^[44] While US Treasury yields kept rising in the days after the Fed announced its asset purchase programme, they fell sharply after purchases accelerated and indicators of Treasury liquidity improved.^[45] There were comparable falls in bond yields in response to QE announcements in other advanced economies.^[46] Similarly, the ECB's Pandemic Emergency Purchase Programme seems to have helped to restore sovereign debt market functioning in the euro area.^[47]

The macroeconomic impact of the March 2020 QE programme is likely to have been material.

Asset purchases helped to offset a substantial part of the surge in gilt yields during the dash-for-cash episode. In addition it is likely that gilt yields would have increased further absent these purchases. But since instances of gilt market dysfunction are rare, it is difficult to quantify this effect, and to estimate how financial conditions and economic activity might have contracted in that counterfactual scenario.^[48] That said, the limited historical evidence suggests that episodes of market illiquidity associated with constraints on dealers' capacity to intermediate are associated with adverse macroeconomic outcomes.

8: The impact of the Bank's corporate bond purchase scheme

In August 2016, as part of a package of measures to provide additional support to growth and to achieve a sustainable return of inflation to target after the outcome of the EU referendum, the MPC announced it would purchase up to £10 billion of investment-grade sterling-denominated non-financial bonds issued by corporates 'making a material contribution to the UK economy'. This Corporate Bond Purchase Scheme (CBPS) was modest compared to the purchase target for gilts (£435bn at the time) and the size of the UK sterling corporate bond market (£500bn), but market participants reportedly viewed the size of the announced CBPS as non-negligible relative to the amount of outstanding eligible bonds.^[49]

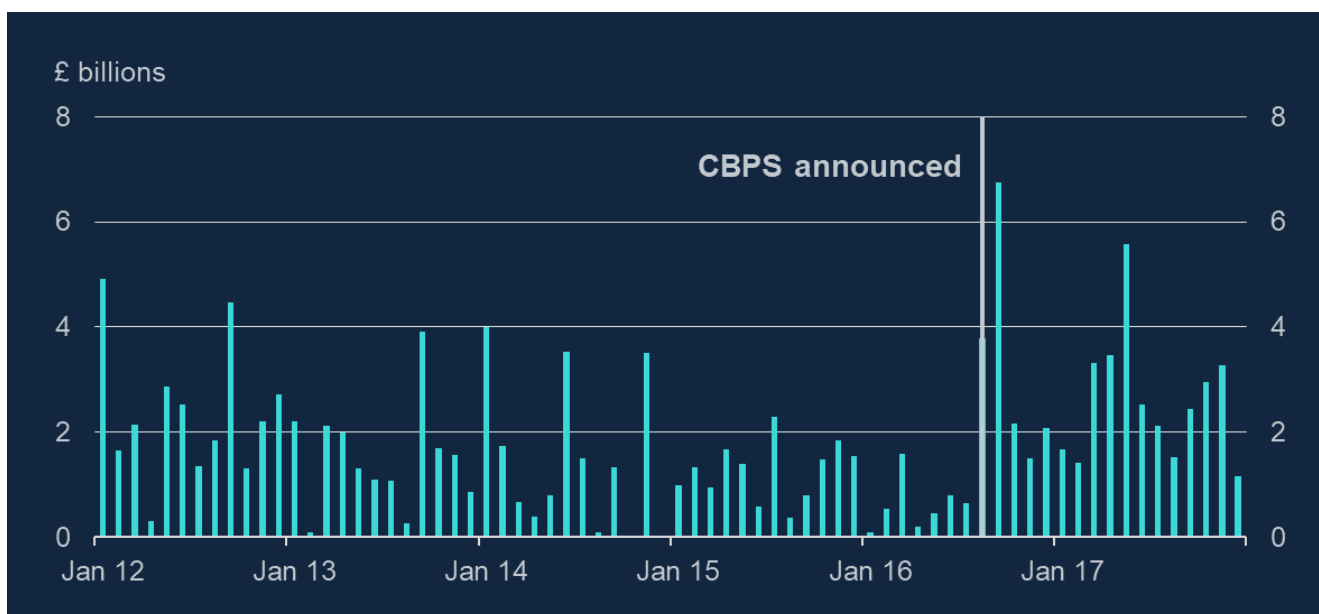
Chart 17: Investment-grade corporate bond yields (a)



Sources: [Boneva et al \(2021\)](#) and Bank of America.

(a) Option-adjusted spreads for investment grade non-financial corporate bonds.

Chart 18: Corporate bond issuance volume (a)



Sources: [Boneva et al \(2021\)](#), Thompson Reuters.

(a) Monthly gross issuance of sterling-denominated investment grade non-financial corporate bonds.

The evidence suggests that the 2016 Corporate Bond Purchase Scheme succeeded in lowering interest rates on UK corporate bonds (through the portfolio balance channel) and stimulating sterling corporate bond issuance (see Charts 17 and 18, also [D'Amico and Kaminska \(2019\)](#)). Since corporate bonds are less liquid than gilts, the CBPS could also reduce the liquidity premia of purchased bonds. And although [Boneva et al \(2019\)](#) find that the announcement of CBPS did not lead to an immediate improvement in liquidity, the liquidity of bonds eligible for purchases did improve with the start of the auctions. These 'flow' effects associated with the auctions were short-lived though, and dissipated by the end of the programme.

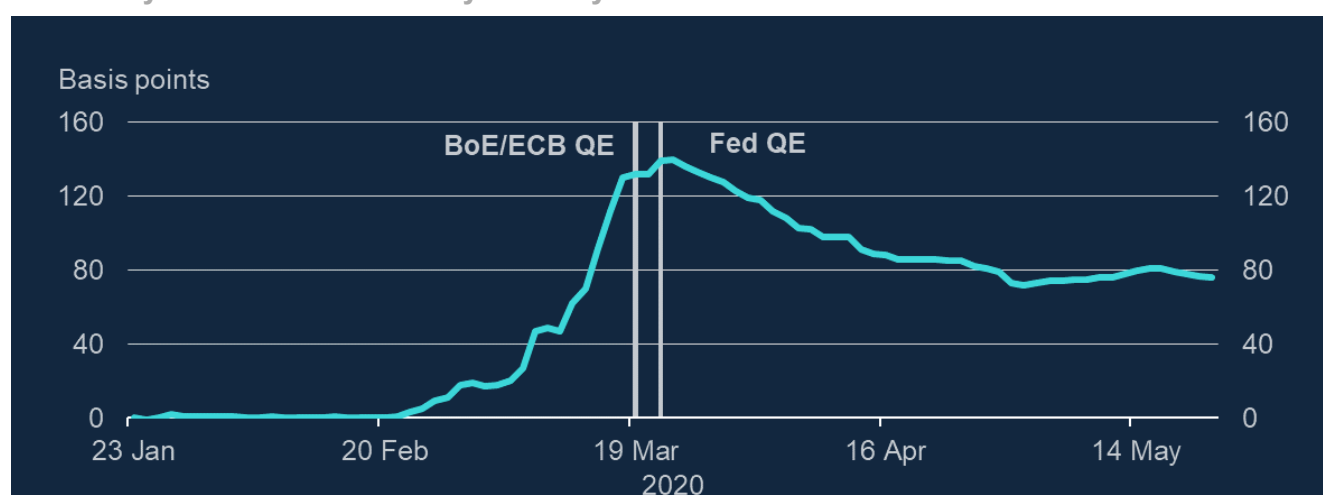
In March 2020, the MPC and other monetary authorities also launched further corporate bond purchase programmes.

As investors 'flew to safety' in early 2020 (Section 5), the demand to liquidate UK corporate bonds surged. As a result, in the days leading up to 19 March, yields on investment-grade UK corporate bonds rose by around 140bps (Chart 19). There were significant macroeconomic risks from these developments because corporate bonds account for around half of Private Non-Financial Corporate (PNFC) debt, and higher yields and transaction costs reduce corporates' appetite to borrow and invest. Therefore the Bank announced that it intended to purchase at least £10 billion more of sterling corporate bonds at a 'significantly faster pace than in 2016'.

While the surge in corporate bond yields at the time will have partly reflected a deterioration of confidence in the outlook for companies, market dysfunction likely played an important role as well. There was a significant increase in the demand to liquidate bonds, as shown by significant outflows from UK bond funds, and the market's ability to accommodate that demand also appears to have been insufficient.^[50]

In this environment, there was a significant scope for corporate bond purchases to improve liquidity. This is broadly in line with the evidence from the US and EA.^[51] Also broadly consistent with this, the surge in UK corporate bond yields slowed down after 19 March, before falling afterwards (Chart 19). But it is difficult to separate out the impact of the Bank's announced corporate bond purchases from other news. And unlike for gilts, corporate yields did not fall back to their initial level – although that could reflect the persistent economic effect of Covid-19 on the outlook for corporates rather than continued market dysfunction.

Chart 19: Cumulative change in sterling-denominated investment-grade corporate bond yields between January and May 2020



Sources: Eikon Refinitiv, ICO/BoAML Global Research and Bank calculations.

Box B: QE in practice

Between March 2009 and December 2021, the MPC communicated its decisions for the target stock of purchased assets at each of its meetings. This box discusses how these decisions were supported by staff analysis and the key design options considered.

QE decisions are based on the MPC's judgment of the monetary stance necessary to meet the inflation target, given the outlook set out in the Monetary Policy Report. To inform the MPC's judgment on the desirability and calibration of QE programmes, staff consider a range of factors, including the potential macroeconomic stimulus from QE, the range of alternative potential tools, and the headroom for asset purchases.

Potential macroeconomic impact

In assessing the potential impact of QE, staff typically start by reviewing the evidence on the impact of QE announcements on yields discussed in **Section 4**. In a second step, these shocks to gilt yields are fed into macroeconomic models calibrated using historical relationships between yields, asset prices, and macroeconomic outcomes.^[52] In parallel, staff typically draw on any available estimates for the macroeconomic impact of QE from the literature. The estimates in [Joyce, Tong and Woods \(2011\)](#) for the impact of QE1 on yields, GDP, and inflation often served as a starting point for this exercise.

Although there was little evidence to inform the first QE programme in 2009, over time the UK and international evidence base has grown.^[53] Staff have therefore regularly re-assessed their estimates of the likely impact of QE.

Since the impact of QE could be state-contingent, staff do not treat estimates in a mechanical fashion but adjust them to the circumstances. For instance, theory suggests that a number of QE channels should be stronger in times of market stress (Box 1). Therefore there were good reasons to believe that the impact of the March 2020 programme would be closer to the one from QE1, whereas the impact of subsequent programmes was likely to be lower, as market dysfunction and risk aversion had abated.

The MPC currently conditions its projections for output and inflation on market interest rates and a range of asset prices and yields. Those interest rates and asset prices will reflect market expectations of future QE programmes. Therefore one important part of the QE decision-making process is for staff to evaluate how much additional QE is already embodied in current market prices, and whether that expectation is consistent with the inflation target being met at the relevant horizon given the forecast set out in the 'Monetary Policy Report'. As a starting point for this exercise the staff draws on surveys of market participants and market intelligence.

Despite the growing body of evidence, state-contingency and the limited number of observations mean that there remains considerable uncertainty about the strength of different channels and the overall real-economy impact of QE.^[54] Therefore, there will likely be differences in view across policymakers in assessing the desirability and calibration of any QE programme.

Toolkit decisions

Since the global financial crisis, the expansion of the MPC's toolkit has made the monetary policy decision-making process more multi-dimensional ([Bailey \(2021\)](#)). In addition to judging the appropriate policy stance, monetary policy decisions now involve a judgement about the tool or combination of tools most suited to achieve a given stance. In that context, QE is one of several options for the MPC, alongside forward guidance, bank funding schemes and, more recently, potential Bank Rate cuts below zero.

As a result, staff assess the pros and cons of each option in the particular context at the time. For instance, in the context of Covid-19, staff compared the potential to stimulate demand and meet the inflation remit via QE, setting a negative Bank Rate, or forward guidance – allowing also for the potentially greater impact from deploying some of these tools in stressed circumstances. In addition to the potential macroeconomic stimulus from deploying each tool, staff also considered the uncertainty around central-case impact estimates, and any risks of a counter-productive impact or trade-off with other Bank mandates. In the case of QE, staff paid particular attention to potential side-effects for insurance companies and pension funds (ICPFs) and commercial banks and to any associated risks to credit supply. Staff also considered the possibility that some tools may be mutually reinforcing if used in combination.

Depending on the circumstances, the prevailing level of interest rates can also affect the scope to stimulate aggregate demand in the economy further via QE or other tools. In particular, one possibility is that QE cannot lower longer-term interest rates below a certain level. Whether there is a strict lower bound for long rates, and where it is located, is unclear. One hypothesis is that long rates cannot persistently fall below the market-perceived effective lower bound for Bank Rate.^[55] But, in any case, it is likely that the impact of QE will diminish as rates get closer to this level.

Headroom for gilt purchases

The headroom for easing monetary conditions via gilt purchases is mainly determined by the amount of outstanding gilts that can be purchased from the secondary market at a given point in time. This is subject to the constraint that the Bank limits its purchases of individual bonds to 70% of the free float - that is, the total amount in issue minus government holdings. It also buys evenly across specified gilt maturity sectors.

These gilt maturity sectors have evolved over time. In March 2009, the Bank purchased conventional gilts with a residual maturity of between 5 and 25 years, split evenly across two sectors (5–10 years and 10–25 years). The focus on longer-dated

gilts reflected the MPC's focus on portfolio balance as a key transmission channel.^[56] The maturity sectors were redefined a number of times, including to encompass shorter-dated and longer-dated gilts (Table B).

Table B: Key features of MPC QE programmes to date

Programme		Gilt purchase Target	Other key policy actions	Maturity sectors (years)	Timeframe (months)	
QE1	Mar-09	£75bn	50bps Bank Rate cut	5-10 and 10-25	3	
	May-09	£50bn			3	
	Aug-09	£50bn			3-10; 10-25; >25	3
	Nov-09	£25bn			3	
QE2	Oct-11	£75bn			4	
	Feb-12	£50bn		3-7, 7-15, >15	3	
QE3	Jul-12	£50bn	Funding for Lending Scheme		4	
QE4	Aug-16	£60bn	25bps Bank Rate cut; Term-Funding Scheme		6	
QE5	Mar-20	£200bn	15bps Bank Rate cut ^(a) ; Enlarged Term Funding Scheme	3-7; 7-20; >20	– <u>(b)</u>	
	Jun-20	£100bn			~6 <u>(c)</u>	
	Nov 2020	£150bn			~13 <u>(d)</u>	

- (a) The 15bps Bank Rate cut that happened concurrently with the March 2020 QE announcement was preceded by a cut in Bank rate by 50bps on 10 March during an MPC special meeting.
- (b) The MPC did not announce a timeframe but said the programme 'will be completed as soon as is operationally possible'.
- (c) The MPC said it expected the programme to be completed 'around the turn of the year'.
- (d) The MPC said it expected the programme to be completed 'around the end of 2021'.

Size and pace of purchases

Key features of any QE intervention include the quantity and type of assets to purchase. Another design choice that became more prominent with the 2020 QE programmes is the pace of purchases.

Typically, the MPC announces a target for the purchase volume and a time horizon over which the programme will be completed. Together, these two factors determine the pace at which the Bank conducts purchases. In March 2009 for instance, the MPC announced the Bank would complete the £75bn purchase programme within 3 months, implying a pace of around £6bn per week on average. On average, until QE5, subsequent programmes were conducted at roughly half that pace.^[57]

In normal times, the impact of a QE programme is likely to be mainly determined by its size, and to crystallise when the programme is announced rather than when purchases are conducted. However, as discussed in Section 7, at times of stress, actual purchases can also contribute to improving market functioning and therefore mitigate an unwarranted tightening in financial conditions, and this can increase the importance of purchase pace ([Bailey et al \(2020\)](#)). In line with this, until June 2020, the March 2020 QE programme was conducted at a significantly faster pace of £13.5bn per week – reflecting the MPC's objective to complete the programme 'as soon as is operationally possible, consistent with improved market functioning'. Subsequently, as it announced a further £100bn asset purchase programme in June 2020, the MPC said that 'with liquidity conditions having stabilised, purchases could now be conducted at a slower pace'. However it also said that the pace of purchases could be increased 'should conditions worsen materially again'.

As well as having a potentially distinct role in times of market stress (affecting yields through changes in expected liquidity premia and possibly future policy rate expectations), the pace of asset purchases may also influence the expected future stock of purchased assets. Drawing on survey data on market expectations, [Froemel et al \(2021\)](#) infer that the response of yields to the 2020 QE announcements was consistent with medium term expectations of the stock of purchases responding to

news about the pace of purchases. Therefore, all else equal, a lower than expected announced pace will be associated with a lower expected purchase stock in the medium term, and to potential upward pressure on yields, and vice versa.[58]

Box C: The side effects of QE

In addition to the impact of QE on financial conditions and the macroeconomy, there has been significant interest in the perceived side effects of QE, in particular distributional consequences and perceptions of fiscal dominance. The Bank of England set out its views about these questions in its response to the [House of Lords' Economic Affairs Committee \(2021\)](#) inquiry into QE.[59] This box briefly draws out the key points.

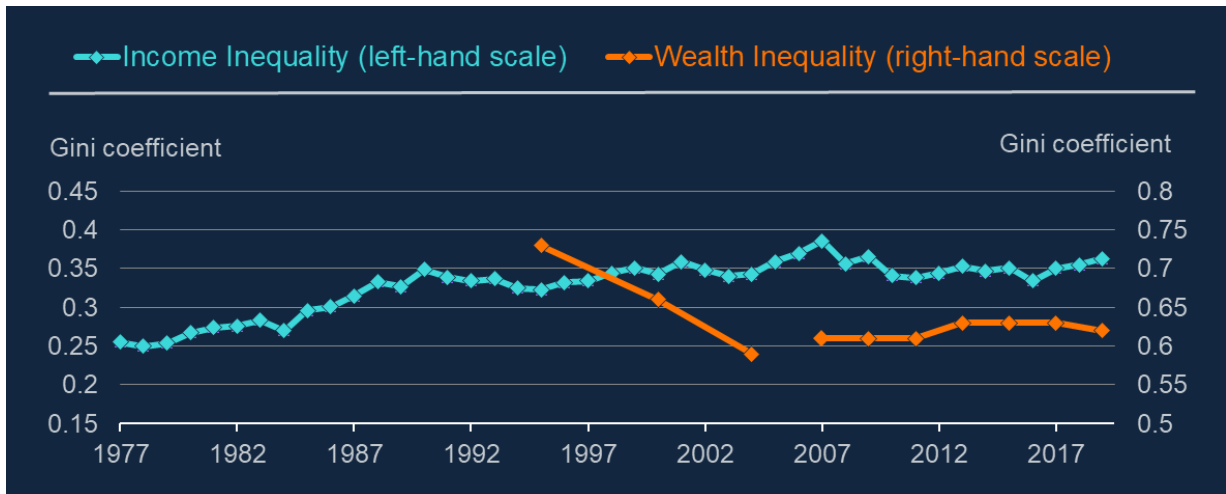
Distributional consequences

As discussed in this article, QE affects both asset prices and economic activity. In theory, this impact can differ across individuals, depending on their asset holdings, debt position and employment. These potential distributional consequences have been an area of contention in the public debate.

QE programmes have been implemented during a period of some longer-term structural changes to the economy which have lowered equilibrium interest rates. Since these trends have implications for asset prices and distributional outcomes, it is difficult to separate any impact that QE may have on wealth distribution from other external factors that do not directly depend on central bank policies.

Nevertheless, research also suggests that the impact of monetary policy on households has been similar in relative (percentage) terms across the entire wealth and income distributions ([Bunn, Pugh and Yeates \(2018\)](#)). However the (absolute) cash impact can vary more across individuals, for instance owing to differences in bond holdings. For example, a 10% increase in the market value of bonds would translate into a higher return in cash terms for investors with higher levels of bond holdings. This effect is not specific to QE, but will also apply to changes in Bank Rate, with households with larger savings benefiting from larger cash returns in absolute terms as a result of changes to deposit rates. However these effects are primarily driven by the pre-existing disparities in the income and wealth distributions of households rather than central bank policies. The Gini coefficient, one common measure of inequality, has been broadly flat for both income and wealth in the UK since the introduction of QE (Chart 20).

Chart 20: Inequality measures



Sources: Income inequality data are ONS data from the Living Costs and Food Survey. Wealth inequality data from 1995 to 2005 are from the BHPS and cover financial and property wealth only. Wealth inequality from 2007 onwards are from the ONS Wealth and Assets survey and cover total wealth (including physical and pension wealth).

Perceptions of Fiscal Dominance

Fiscal dominance arises when there is a perception that the central bank balance sheet is being used to finance the government in a way that is not compatible with the inflation remit. There are a number of institutional safeguards against the risk that government financing considerations in the UK have an undue influence on monetary policy.

The price stability objective – which in the current remit consists of a 2% inflation target – is embedded in primary legislation. Direct accountability of the MPC to Parliament means that monetary policy decisions are free from government influence. In addition, operational mechanisms are in place to ensure that policy decisions are not constrained by the potential implications for the Bank's balance sheet. For example, the government's agreement to indemnify the APF makes it explicit that the balance sheet risk associated with these policies is absorbed by the government.

However, even an incorrect perception of fiscal dominance can undermine a central bank's reputation and credibility, and therefore threaten its ability to meet its inflation target.

An extreme variant of fiscal dominance is when the government simply pays for deficits by 'printing money', where the central bank is forced to print more notes or to expand central bank reserve liabilities that bear no interest cost. That description does not apply to QE programmes because the central bank reserves created in exchange

for longer-dated gilts bear interest at the central bank policy rate. Therefore, at a practical level, QE is rather akin to a swap between short and longer-dated government liabilities.

Throughout 2020, both the UK government and the Bank took exceptional measures to counter the economic fallout of the Covid-19 pandemic. As a result, increases in the MPC's target for asset purchases, and the conduct of these purchases coincided with increases in UK government spending and therefore debt issuance. However, these coincident policy actions do not imply fiscal dominance. Instead this correlation is a natural by-product of fiscal and monetary policy acting countercyclically and independently in response to a sharp deterioration in the economic outlook.^[60] This was also the case in the aftermath of the GFC.

All monetary policy decisions by the MPC are taken with the objective of price stability in mind, regardless of developments in government bond issuance (Box B). And, as discussed in Section 4, a key objective of QE is to ease financial conditions for households and firms by lowering interest rates. Because QE works in large part by lowering gilt yields, it will also reduce the cost of government borrowing. However, this is a by-product rather than the objective of QE.

Box D: Cash flow arrangements between the APF and HM Treasury

By Simon Dolan, Tom Horn, Swanand Kant and Rhys Phillips (Markets Directorate).

Asset purchases carried out as part of QE programmes are conducted through the APF – which operates via a subsidiary of the Bank indemnified by HMT.^[61] The assets held in the APF generate a range of cash flows which drive consequent cash transfers between HMT and the APF. This box explains the cash transfer arrangements, with a focus on the primary factors that affect the size and direction of cash flows. This consolidates and builds on details provided in earlier Bank publications and speeches, and provides an updated analysis of cash flow transfers to date.^[62]

The APF was established in January 2009 to purchase high quality assets on behalf of the Bank as part of the MPC's policy of QE. Through these purchases, the APF owns a large number of gilts that pay regular coupons. This coupon income flows into the APF and is used to pay for interest expenses (since the APF's purchases are

funded by a loan from the Bank, with interest charged at Bank Rate) plus operating costs, as well as offsetting any difference between the purchase and redemption (or sale) value of gilts.

Since 2009 the APF's activities have generated positive net cash flows, totalling £126bn (February 2022). The Bank and HMT agreed in 2012 that this accrued cash should not accumulate in the APF. Instead it was agreed to transfer coupon payments, net of interest and operating costs, plus any difference between the purchase and redemption (or sale) value of gilts, to HMT. To date a cumulative £120bn of cash transfers have been made from the APF to HMT. These transfers are in essence a transfer from one part of the public sector balance sheet to another which, as set out at the time, helps to facilitate more efficient cash management across the public sector as a whole.

When this arrangement was put in place it was recognised that payments **from** HMT to the APF were likely to be needed in the future.^[63] While coupon payments have outweighed other costs through the life of the APF so far, that will not continue indefinitely. The APF is explicitly a temporary facility, and as it reduces in size coupon income will shrink and the impact of maturities (or sales) will grow. As explained below, the future path of cash flows is primarily dependent on the path of Bank Rate, the speed of APF unwind, and the evolution of market prices for gilts. This is monitored carefully by the Bank and HMT as part of the APF risk control framework, under which the Bank is responsible for managing risks in the APF and for providing information to allow HMT to monitor the operation and financial performance of the facility.^[64]

This means that the **current** cumulative cash position is not indicative of an expected 'net financial gain over the lifetime of the portfolio, since at some point the portfolio's cash position will change – effectively starting to unwind previously positive flows.

However, as discussed previously the aggregate amount of cash transferred between the APF and HMT by the time the APF is closed will be the same as the net financial gain or loss on the APF's activities as a whole.

Additionally, while it is useful to understand the possible size and timing of transfers to and from the APF, the narrow accounting definition of lifetime financial gain or loss is not a measure of the total impact of the APF on the public sector accounts. That is for two reasons as discussed in previous publications. ^[65] First, it does not take into account the effect of asset purchases on the value of the government's liabilities, or their impact on the government's ongoing financing costs. And, second, it does not include the effects on government tax and spending of the fall in yields and boost to economic activity caused by asset purchases. Taken together these factors mean that

the impact of an asset purchase scheme should be judged by the degree to which it meets its aims — to improve corporate credit conditions and to boost nominal spending in order to meet the inflation target in the medium term – rather than a narrow financial metric.

The structure of the APF

The APF has always been intended to be a temporary facility that would buy assets as directed by the MPC, but that would later be unwound when conditions permitted.

Due to the large scale of asset purchases – currently totalling £867bn, comprising £847bn of gilts and £20bn of corporate bonds – the APF is fully indemnified by HMT. [66] This means that any lifetime financial losses made as a result of the asset purchases are borne by HMT rather than the Bank, and likewise any gains over the life of the APF are owed to HMT.

A high-level picture of the movements of cash and assets in the APF is shown in Chart 21. Asset purchases for monetary policy reasons are funded via a loan from the Bank, with interest charged at Bank Rate. Funds are invested in a portfolio of interest-bearing assets, primarily gilts plus a small proportion of corporate bonds, purchased from the private sector. These assets generate interest income from the coupons they pay. When assets mature (or if they are sold) the APF receives cash proceeds which may be either reinvested or used to repay part of the loan from the Bank.

Initially it was envisaged that any cash flows over the life of the facility would accumulate on the APF's balance sheet. But, as it became clear that the scale and likely duration of the facility had increased, in November 2012 it was agreed to establish a process for the ongoing quarterly transfer of cash between the APF and HMT. This meant that the APF would not accrue a large positive (or negative) cash position at any time, instead transferring cash to (or from) HMT. Each quarter the cash balance in the APF is evaluated with any excess transferred to HMT, leaving a buffer for expenses expected over the period ahead. Vice versa, any shortfall would be addressed by a transfer in the opposite direction.

In effect this means that the APF pays away any realised gains to HMT, in the knowledge that the arrangement will be reversed as and when necessary. Because of this arrangement, cash flows during the life of the APF can be seen as accounting transfers from one part of the public sector balance sheet to another. Any ultimate gain, or loss, on APF activities will only be fully apparent once the scheme is unwound.[67]

During the period that the APF remains in operation, the indemnity granted by HMT fully covers all realised and unrealised gains and losses on the portfolio. The transfer of cash flows is in effect a partial ongoing settlement of this arrangement, broadly

reflecting the realised portion of these gains or losses. Any unrealised gains or losses, such as from mark-to-market movements in the value of assets owned by the APF, are not settled: rather for accounting purposes they continue to be balanced by an offsetting amount on the APF's balance sheet representing the theoretical amount due to or from HMT under the indemnity. This amount – which is reported in APF annual reports - fluctuates with market prices and does not reflect any near-term cash flow requirement.

Chart 21: Schematic view of the main APF cash flows



For simplicity, the remainder of this box focuses on the APF's gilt holdings as the predominant driver of its cash position, though the same principles apply to its much smaller holdings of corporate bonds.

Factors affecting the cash position of the APF

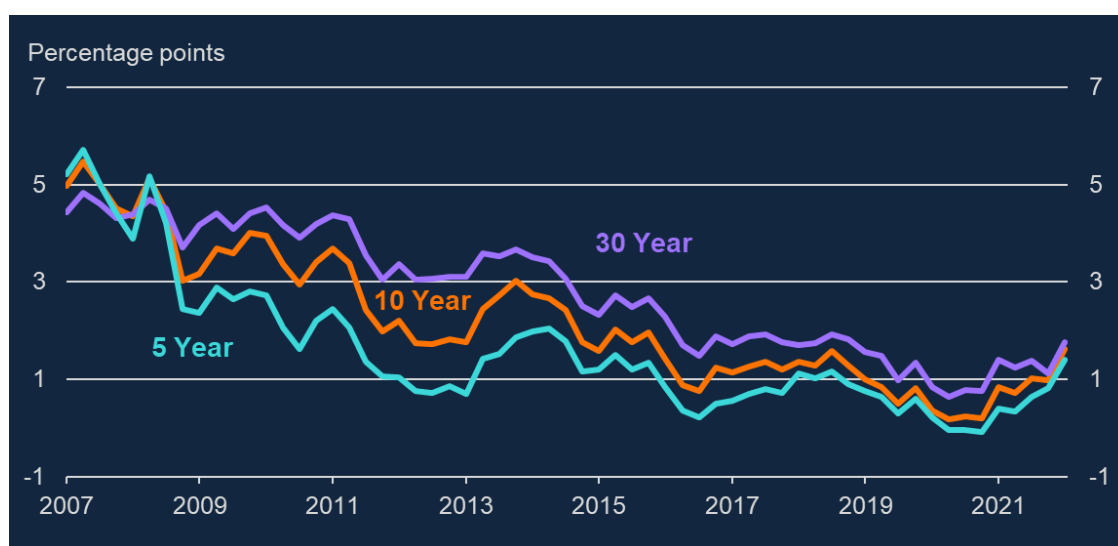
A number of factors drive the cash position of the APF as shown in Table C. The cash position at any point reflects the realised impact of the coupon income received; the level of Bank Rate, which determines the interest due on the loan; and the point in the APF's life cycle – specifically whether the income from maturing bonds is to be reinvested into new purchases to maintain the portfolio's size, and whether assets are being sold.

Table C: Main APF cash flows

Cash into the APF	Cash out of the APF
Loan from Bank of England	Cost of purchasing assets
Coupon income	Loan interest at Bank Rate
Proceeds from redemptions (or sales)	Loan repayments

Over the course of the Bank’s QE programmes, gilt yields have generally been on a downward trajectory as shown in Chart 22 below.

Chart 22: UK gilt yields since Q1 2007



Sources: Bloomberg Finance L.P. and Bank of England calculations.

As a result, the prevailing market prices for gilts – and therefore the price paid by the APF in its auctions – have tended to be above their face values: representing the opportunity for the holder to receive a higher coupon relative to the market rate. The impact on the APF’s cash position of maturing bonds is particularly important in these circumstances, as the transfer arrangement reveals a timing mismatch.

By way of illustration: a conventional gilt will have a fixed maturity date, coupon and face value – for instance, the UKT 5% 2025 gilt matures on 03 July 2025 and pays £5 coupon annually on face value of £100. Where the fixed coupon is higher than prevailing market yields at the time of purchase (as it typically has been in APF purchases), a premium is paid upfront in recognition of higher income over the life of the bond. In our example, if the prevailing market yield were lower than 5%, the purchase price would be higher than £100 – say £120. This is known as a purchase ‘above par’. In this case the APF is spending more than the face value of a bond in exchange for a higher coupon income over time, which means higher cash positions are accumulated while the APF owns the bond. However, that higher income is eventually offset by the fact that when the bond matures the APF gets back less than was spent at purchase – since only the face value of the bond (£100 in our example) is repaid. This means that a proportion of the higher coupon income received must be put toward paying back the £120 loan used to fund the purchase.

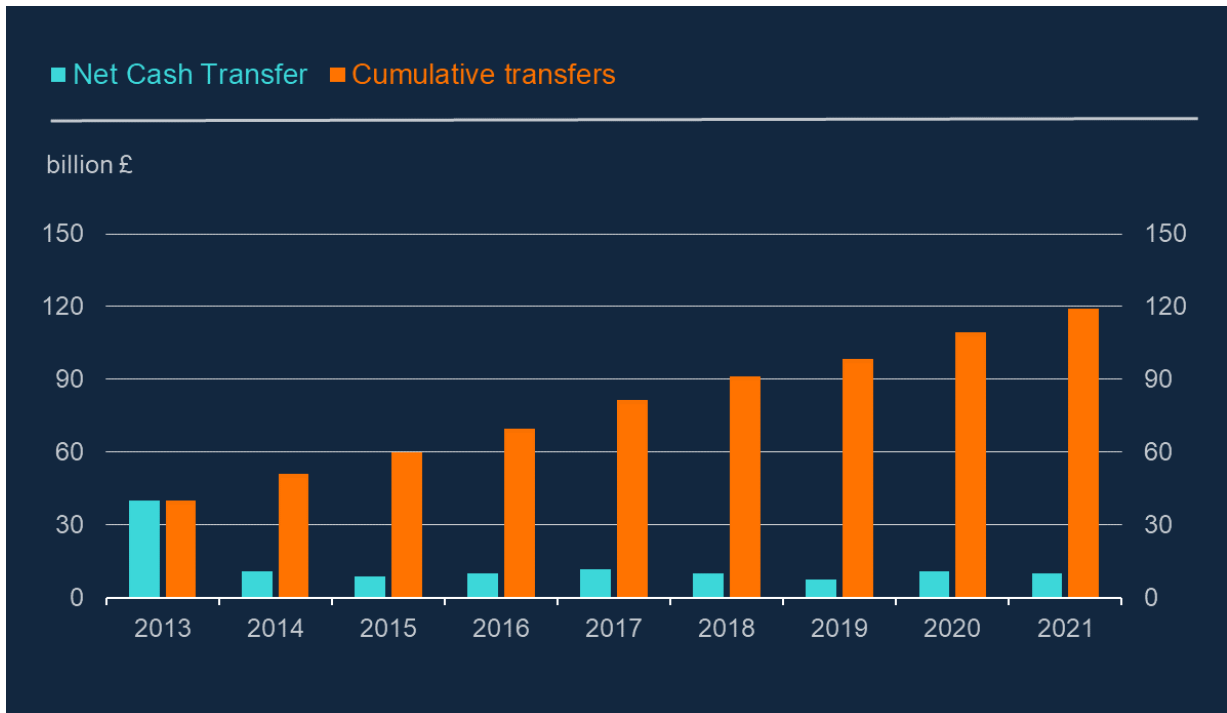
Over the time the APF holds the bond it is likely that the additional income accrued will exceed the shortfall at maturity – meaning that no loss is necessarily realised over the holding period as a whole. However, since the majority of the net cash position is transferred between the Bank and HMT on a quarterly basis, the ‘pot’ of cash built up to absorb the difference between maturity value and purchase price is largely held by HMT. The shortfall when these bonds mature must be met either by coupon income from other bonds or by a transfer of cash back into the APF from HMT. But this does not imply an overall loss on the purchase.

Cash transfers between the APF and HM Treasury since 2009

The size of the APF gilt portfolio, which determines both the amount of interest paid by the APF and the coupon income received, has increased over time. That, in addition to Bank Rate remaining low, has meant that coupon income has exceeded the interest paid by the APF in every year of its existence so far.

In total the facility’s positive cash position as of February 2022 stood at £126bn. Reflecting the agreement between the Bank and HMT, cash transfers have been made to HMT worth a cumulative total of £120bn as shown in Chart 23.

Chart 23: Cumulative and net cash transfer to HMT (£bn)

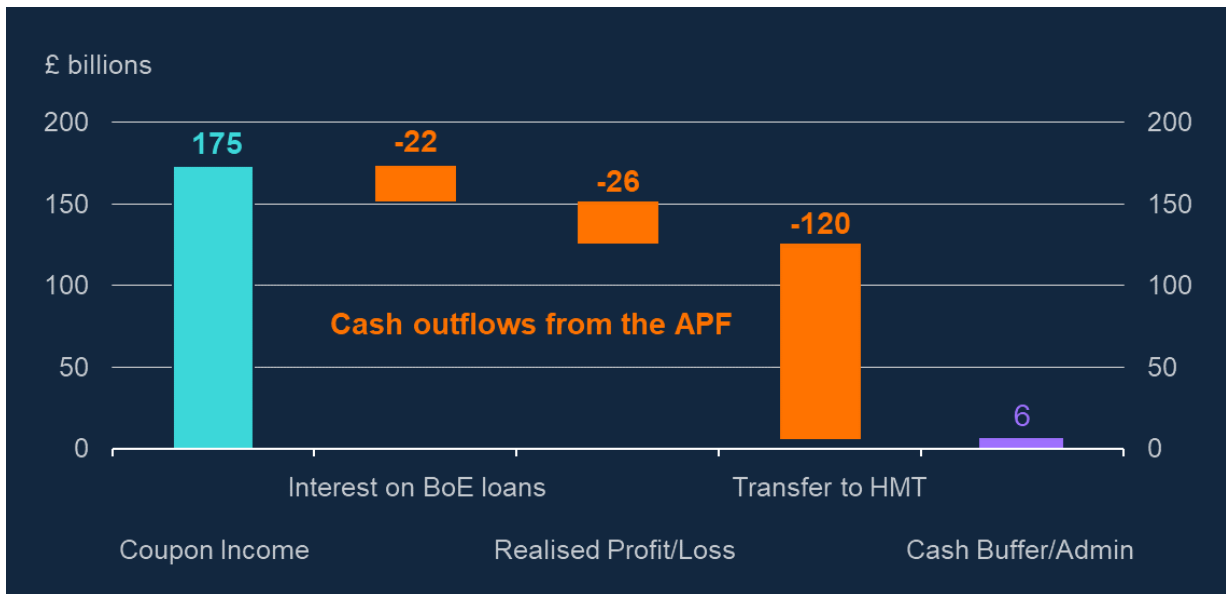


Sources: ONS and Bank calculations.

Chart 24 shows the breakdown of coupon income and interest expenses in the APF that account for the cash position.

Chart 24: Components of realised cash flows in the APF (as of February 2022)

(a)



Source: Bank of England calculations.

(a) Figures may not sum exactly due to rounding.

Determinants of future cash flows

Many of the factors that have led to an accumulation of cash in the APF can be expected to reverse over time as the portfolio begins to unwind.

At a simple level the two primary factors that affect the evolution of cash transfers are the size of the APF and the level of Bank Rate.

Size of portfolio

As discussed above, when bonds held in the APF mature, any difference between the purchase price and face value of the bond is recognised in the cash position. So far, shortfalls at maturity have been more than offset by wider coupon income on other owned bonds. As the portfolio shrinks due to the cessation of reinvestments, there will likely come a point at which ongoing coupon income from other bonds would be insufficient to meet those shortfalls.

Likewise, in the event that the MPC were to choose to sell assets from the portfolio in the future, a similar effect would arise from any difference between the purchase price and the sale price. The pace of any sales and the evolution of market prices for gilts, would therefore also impact the cash flow profile.^[68]

Bank Rate

Changes in Bank Rate affect APF cash flows in two ways.

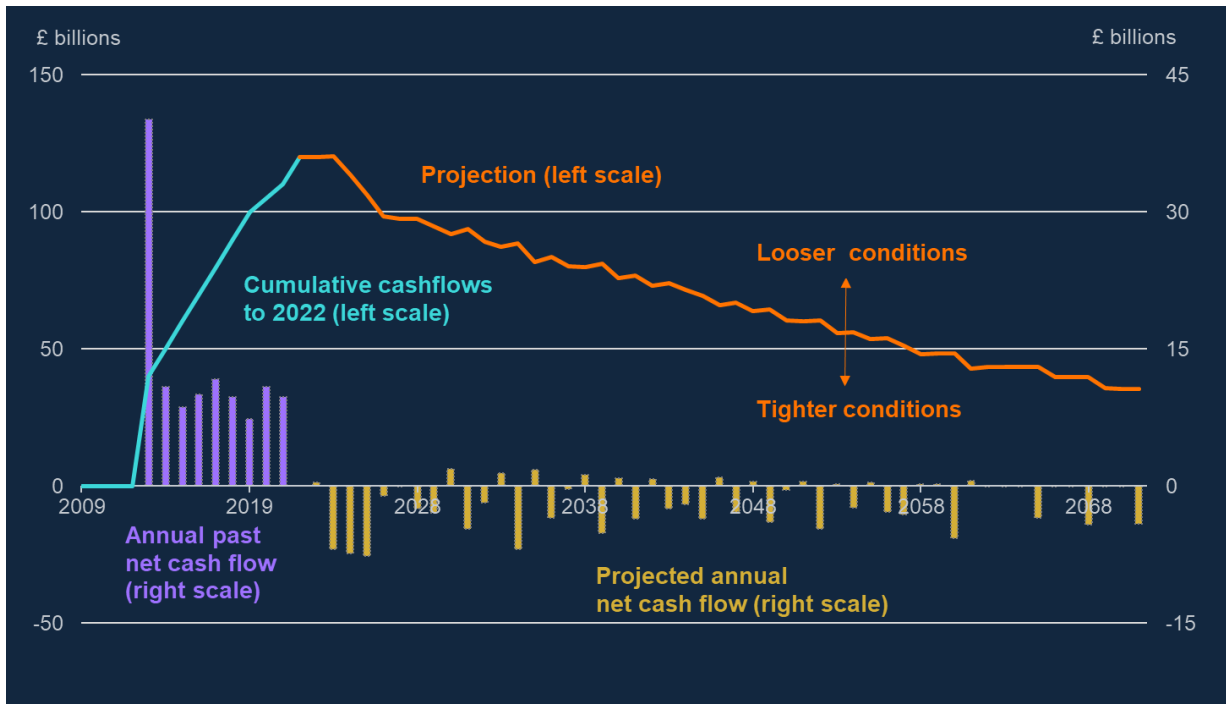
First, Bank Rate affects the interest payment the APF must make on the loan from Bank. In simple terms if the APF owns a basket of fixed income assets, then a rising Bank Rate means there is a smaller (or, indeed, negative) surplus of income once interest on the Bank of England loan is paid.

Second, Bank Rate affects the level of the yield curve, which will impact on the price received should gilts be sold from the APF to the private sector.

Chart 25 below shows a projection of APF cash flows based on the market path for Bank Rate as of 06 May 2022, and the MPC's prevailing policy to no longer reinvest the proceeds from maturing bonds.^[69] These future cash flows are uncertain and highly sensitive to the assumptions used, so the chart does not represent an expected outcome but provides a useful means of illustrating the broad profile and how it could change under different conditions. For instance, at its [May 2022 meeting](#) the MPC asked Bank staff to work on a strategy for UK government bond sales but has not yet made a decision on whether to commence sales, so these are not accounted for in the chart below.

In order to provide further transparency on these cash flow projections on a regular basis, the Bank will in future publish an updated version of Chart 25 alongside each APF Quarterly Report, beginning from Q3 2022.

Chart 25: Cumulative APF cash flows (actual and stylised projection) (a) (b) (c)



Sources: ONS and Bank calculations.

(a) The chart shows actual and projected cash flows between the APF and HMT. The projection assumes that Bank Rate follows the path implied by the OIS curve (as of 6 May 2022), ceasing of reinvestments of proceeds from maturing gilts and corporate bond sales to be completed no earlier than towards the end of 2023 as per MPC guidance from the **February 2022 meeting**.

(b) Cumulative cash flows to 2022: to date the APF has transferred a cumulative £120bn to HMT.

(c) Projection: Under the current market-expected path for Bank Rate; and given the MPC's decision to cease reinvestments of proceeds from maturing gilts and corporate bond sales to be completed no earlier than towards the end of 2023, annual cash flows are expected to fluctuate, with cumulative cash flows reducing relatively slowly over time. However, cash flows could change faster or slower, depending on the actual path of Bank Rate, and whether the APF reduces in size faster (due to sales) or slower (e.g. if reinvestments are resumed).

Conclusion

Since 2009, the APF's activities have generated positive net cash flows of £126bn. The Bank and HMT agreed in 2012 that this accrued cash should not accumulate in the APF, so the majority of this has been transferred to HMT, with the recognition, reiterated in subsequent exchanges of letters, that reverse payments from HMT to the APF could be needed in the future. These transfers are, therefore, in essence a temporary transfer from one part of the public sector balance sheet to another.

As the APF begins to unwind, quarterly cash flows arising from the APF will shrink and, later, change direction. The timing of these changes will depend on a range of factors.

This is monitored carefully as part of the APF risk control framework between the Bank and HMT, The data on cash transfers between APF and HMT will also continue to be published in the APF annual reports on the Bank's website and on the Office for National Statistics (ONS) website.

In any case, the eventual size of the net payments to or from HMT should not be used as a measure of the success of asset purchases, or of the impact of the scheme on the public sector accounts as a whole. The scheme should instead be judged by the degree to which it meets its aims – to improve corporate credit conditions and boost nominal spending in order to meet the inflation target in the medium term.

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1. The modern history of QE started in 2001 with the Bank of Japan's first QE programme, which involved purchasing government bonds in exchange for central bank reserves. See [Haldane et al. \(2016\)](#).
 2. [IEO evaluation of the Bank of England's approach to quantitative easing](#).
 3. The APF is operated via a subsidiary of the Bank of England known as the Bank of England Asset Purchase Facility Fund (BEAPFF), which carries out QE-related asset purchases and is indemnified by HM Treasury.
 4. The main securities purchased by the Bank have been UK conventional government bonds, but in principle QE need not be restricted to government debt. The Bank has also bought corporate bonds and a large share of the Federal Reserve's QE purchases consisted of Mortgage-Backed Securities (MBS).
 5. The US Federal Reserve had announced its own asset purchase programme in November 2008. Initially the Fed announced it would buy housing agency debt and Mortgage-Backed Securities, but in March 2009 the programme was expanded in size and extended to include purchases of Treasuries as well. This programme is sometimes referred to as LSAP (Large-Scale Asset Purchase Programme) 1.
 6. Corporate bonds and commercial paper were bought and sold in 2009, with the objective of addressing corporate market illiquidity.
 7. The importance of using various tools in a package was also emphasized by the [2019 BIS paper on unconventional monetary policy tools](#)
 8. See e.g. [Haldane et al. \(2016\)](#). In addition to market stress, other potential sources of state-contingency include, for example, proximity to the perceived lower bound for yields.
 9. See [Bernanke \(2020\)](#)
 10. The main assumption underlying this theory is that different assets are not perfect substitutes (see, for example, Tobin ([1958](#) [1996](#) and, more recently, [Vayanos and Vila \(2021\)](#) . However, according to some other studies, the relevance of the portfolio balance channel may not require this condition to hold. See for example Harrison ([2011](#) [2017](#)), [King \(2015\)](#) and [Gertler and Karadi \(2011\)](#) for alternative ways in which QE can affect asset prices without the need for imperfect substitutability between assets.
 11. See for instance [Vayanos and Vila \(2021\)](#)
 12. For a summary of how QE affects the balance sheets of the Bank of England (through the APF), commercial banks and the institutions selling assets, see [McLeay, Radia and Thomas, Bank of England Quarterly Bulletin, 2014 Q1](#).

13. In principle, asset prices may react to some degree to any news that affects the expected path of future purchases. Therefore the impact on yields might reflect not only the announced purchases but also any anticipation of future purchases that have yet to be announced.
14. See also [Joyce and Tong \(2012\)](#) and [McLaren et al. \(2014\)](#)
15. For the US, see for instance [Gagnon et al. \(2011\)](#) [Krishnamurthy and Vissing-Jorgensen \(2011 2013\)](#), [Greenwood and Vayanos \(2014\)](#) [D'Amico et al. \(2012\)](#), [Swanson \(2011 2021\)](#), [Bauer and Rudebusch \(2014\)](#) [Li and Wei \(2013\)](#) and [Hartley and Rebucci \(2020\)](#) The literature on the euro area is more limited as the ECB started its asset purchase programs only in 2015; see for instance [Eser et al. \(2019\)](#) [Altavilla et al. \(2021\)](#) [Billio et al. \(2020\)](#) and [Corradin et al. \(2021\)](#)
16. Interpreting these daily yield reactions needs some care, as in some cases there were other non-QE related events that moved yields intraday. These confounding factors seem particularly important in QE2 and QE3. It should also be noted that news about QE may affect the yield curve even in the absence of an announced programme. In February 2009, for example, following the Inflation Report press conference there was a large move in the yield curve in the expectation that a future QE programme would be introduced (see e.g. [Joyce and Tong \(2012\)](#)).
17. See e.g. [Bernanke \(2020\)](#) for a review of the arguments and the evidence.
18. As [Bernanke \(2020\)](#) argues, any impact of QE via a liquidity channel could be transitory in theory, but there is no obvious reason why this should be true for signalling or portfolio balance effects, for which there is more empirical support (Section 5).
19. See e.g. [Mamaysky \(2018\)](#) and [Greenwood et al. \(2018\)](#)
20. See, for example [Swanson \(2021\)](#) [Wright \(2012\)](#) [Gambetti \(2020\)](#) [Rebucci and Hartley \(2020\)](#) [Eser et al. \(2019\)](#) [Wiedelak and Pascual \(2016\)](#) and [Neely \(2014\)](#) for estimates of QE persistence in the US and euro area.
21. One way to illustrate this effect is to calculate a 'shadow' path for Bank Rate that would have been needed to deliver the impact on long yields from QE announcements. Depending on the estimate, this suggests that the £200bn QE1 programme was comparable to a 150-200bps Bank Rate cut. See [Wu and Xia \(2016\)](#) [De Rezende and Ristiniemi \(2020\)](#), [Joyce, Tong and Woods \(2011\)](#).
22. The empirical findings vary significantly depending on the methodologies that are used. [Krishnamurthy and Vissing-Jorgensen \(2011\)](#), [Bauer and Rudebusch \(2014\)](#) [Christensen and Rudebusch \(2012\)](#) and [Lloyd \(2020\)](#) find that signalling explains between 30% and 70% of the yield impact of the Fed's first two QE programmes (LSAP1 and 2). Similarly, [Kaminska and Zinna \(2020\)](#) find that the decrease in long-term US rates during the LSAP1 was mainly due to lower policy rates expectations, whereas the fall in long-term rates during LSAP2 and LSAP3 is mainly explained by lower term premia.
23. In particular, [Kaminska and Mumtaz \(2022\)](#) demonstrate the existence of QE-specific channel of the monetary policy that works explicitly through term premia and can be linked to the local supply.
24. "Rolling substitutions in financial markets: did quantitative easing in 2020 lead to portfolio rebalancing?" forthcoming as Bank Underground post.
25. [Joyce and Tong \(2012\)](#) find that both the local supply and duration risk channels dominated during QE1, albeit with some variability across different announcements.
26. [D'Amico and King, 2013](#) Some studies point to important local supply effects in the euro area as well, albeit results are sometimes weaker – possibly because of the relatively calmer market conditions during which the first ECB QE programmes were conducted ([De Santis and Holm-Hadulla \(2019\)](#) [Arrata and Nguyen \(2017\)](#) and [Altavilla et](#)

al. (2021)

27. While the magnitude of the fall in yields will partly reflect the size of each QE programme, these results are robust to controlling for the amount of QE news in each announcement.
28. The presence of a large ‘backstop’ buyer should reduce the liquidity risk of holding to a bond. And if QE leads to portfolio rebalancing, this can also stimulate trading – both for purchased assets and for potential substitutes. These effects should be localised on purchased bonds or their substitutes, and concentrated during auction time. A related but distinct channel is for asset purchases to support dealers’ balance sheets during periods of market stress, which can improve liquidity more generally (see Section 7).
29. There are no reserve requirements in the UK. Instead banks face liquidity requirements, which are a function of the liquidity of their assets and the stability of their liabilities. All else equal, larger holdings of reserves will thus relax liquidity requirements.
30. **Butt et al. (2014)**, **Miller and Wanengkirtyo (2020)**, **Giansante et al. (2021)** In contrast, there is evidence for a significant bank-lending channel of QE for the US. However, the Fed’s purchase programme included Mortgage-Backed Securities (MBS), which represent a large share of the assets of some US banks. Since MBS tend to be relatively less liquid, QE had more scope to ‘unclog’ banks’ balance sheet and stimulate lending. In line with this, the one Fed programme that only included Treasury purchases does not appear to have stimulated bank lending (**Darmouni and Rodnyansky (2017)**). In contrast to QE, there is evidence that the Bank’s lending schemes, which explicitly intended to support credit supply by reducing banks’ funding costs, significantly stimulated bank lending in the UK (Benetton et al. (2022))
31. **Joyce et al. (2011)** **Haldane et al. (2016)**, **Joyce, Tong and Woods (2011)**.
32. **Joyce et al. (2011)** **Haldane et al. (2016)**, **Kenourgios et al. (2015)** **Glick and Leduc (2012)** focus on exchange rate impact QE announcements in the UK. **Swanson (2011)** **Powell (2018)** **Bernanke (2015)** study the international effects of Fed’s asset purchases. **Dedola et al. (2021)** and **Bluwstein and Canova (2016)** study the effect of unconventional monetary policies on the exchange rate in the euro area.
33. In order to link the data in chart 9 to the GDP and inflation numbers shown in text, the numbers for QE1 in the chart must be multiplied by 13, which is the size of QE1 purchases compared to GDP in percentage points.
34. Typically, Dynamic Stochastic General Equilibrium (DSGE) models only allow for QE to impact term premia. Vector Autoregression (VAR) models can potentially encompass a broader range of channels, depending on the identification scheme they use.
35. **Fabo et al. (2021)** report estimates for the impact of QE on inflation and GDP across 54 studies published by academics and central bankers. The authors find that studies published by central banks tend to find larger effects on output and inflation.
36. The sudden increase in dollar funding needs associated with the US dash-for-cash resulted in a sharp appreciation of the dollar. As a result, UK ICPFs faced margin calls on the foreign exchange derivatives they held to hedge their dollar-denominated asset holdings, increasing the pressure to sell their most liquid assets including gilts (**Czech et al. (2021a)**).
37. There are clear signs that US dealers were “overwhelmed” by the demand for liquidity (**Duffie (2020)**). In the UK, limited dealer activity seems due to self-imposed risk appetite limits (**Czech et al. (2021b)**).
38. In and of themselves, higher bid-ask spreads are unlikely to explain the substantial surge in gilt yields over the same period (**Vissing-Jorgensen (2021)**). Instead, these were two symptoms of the growing imbalance between the demand and supply of liquidity.
39. See for instance **Bahaj and Reis (2020)** for evidence of the financial market impact of swap lines during the Covid-19 pandemic.

40. [Froemel et al. \(2021\)](#) The Market Notice provided additional details about the unusual pace and the redefined gilt maturity sectors of the programme that the Bank would purchase evenly across.
41. Intraday estimates could also reflect the other news in the announcement including the Bank Rate cut. As Chart 14 shows, yields at short maturities also fell sharply by around 15 bps – in line with the Bank Rate cut.
42. In general, liquidity is complicated to measure because, as stated by [Baker \(1996\)](#) “there is no single unambiguous, theoretically correct or universally accepted definition of liquidity”.
43. Transaction based measures are obtained from the MiFID II database, maintained as the ‘Market Data Processor’ (MDP) database by the Financial Conduct Authority, to analyse NBF1 volumes in the UK gilt and corporate bond markets. The data have been cleaned for research purposes by Bank of England staff. The MiFID II data cover all EU trading activity in both markets for bonds issued in the UK.
44. See e.g. [Duffie \(2020\)](#) [Schnabl \(2021\)](#) and [FSB \(2021\)](#)
45. [Vissing-Jorgensen \(2021\)](#) shows that this effect is more likely to have been caused by the Fed’s purchases rather than a change in the outlook. Indicators of Treasury market liquidity improved following the acceleration of Fed purchases, before falling more dramatically after the Fed announced it would buy Treasuries ‘in the amount needed’ ([Vissing-Jorgensen \(2021\)](#) [Fleming et al. \(2021\)](#) .
46. [Hartley and Rebucci \(2020\)](#)
47. The ECB March 2020 announcements seem to have pushed down peripheral sovereign bond yields through a decrease in default, redenomination and segmentation risk premia, as opposed to the usual term premia and expectation channels ([Corradin et al. \(2021\)](#) .
48. These identification challenges explain perhaps the lack of international evidence for the macroeconomic impact of the March 2020 asset purchase programmes. One exception is the forthcoming Staff Working Paper, “Equity Volatility and Corporate Defaults”, by Ampudia et al. (2022), who find that the ECB’s PEPP mitigated the impact of Covid-19 on corporate bankruptcies.
49. The likely size of the market of eligible bonds was around £150bn at the time.
50. [Czech et al. \(2021\)](#) discuss the UK situation. For evidence on bond outflows, see [Falato et al. \(2020\)](#) for the US and [Breckenfelder and Ivashina \(2021\)](#) for the EU. Lower corporate bond inventories can create the risk of a feedback loop, where the prospect of poor liquidity lowers expected bond prices, further increasing outflows. In line with this, in the Euro Area mutual funds connected to more constrained dealers faced larger outflows than other funds ([Breckenfelder and Ivashina \(2021\)](#) .
51. While the impact of corporate bond purchases is hard to isolate, [Liang \(2021\)](#) concludes that the response of central banks helped to improve market functioning, although less quickly than for government bonds. In line with this, shortly after the launch of the Fed corporate bond purchase facilities, US dealer corporate bond inventories rebounded strongly, and transaction costs fell sharply ([Kargyar et al. \(2020\)](#) . The announcement of these schemes also had a strong effect on bond yields and mutual fund valuations, although this could partly reflect other Fed schemes ([Boyarchenko et al. \(2020\)](#) . Similarly, following the announcement of the PEPP, the value of corporate bond mutual funds rebounded strongly and outflows fell sharply –particularly for funds more exposed to constrained dealers ([Breckenfelder and Ivashina \(2021\)](#) .
52. Some of the models that were used in this context are discussed by [Bridges and Thomas \(2012\)](#) and [Cloyne et al. \(2015\)](#).
53. In 2009, before that evidence became available, staff used a money approach to evaluate the potential impact of QE through a portfolio balance channel. One way of estimating this impact was to evaluate the impact of QE on the deposit holdings of ICPFs, and use estimates of their demand for money to estimate the potential change in asset prices

necessary for them to hold that additional money and fewer gilts. This approach provided similar asset price impacts to the event studies from [Joyce et al. \(2011\)](#). For more details on this approach see [Bridges, Rossiter and Thomas \(2011\)](#), [Bridges and Thomas \(2012\)](#) and [Butt et al. \(2012\)](#).

54. The fact that asset purchases have increasingly been used alongside other policy measures has also made it more challenging to draw direct inferences from the historical evidence.
55. [Gagnon and Jeanne \(2020\)](#) formalise that argument.
56. In the March 2009 meeting minutes, the MPC ‘noted that these asset purchases were likely to be most effective if they were purchased from the domestic non-bank financial sector rather than from banks. Domestic non-bank institutions were likely to use some of the proceeds from asset sales to buy other assets. [...] this preference for buying assets from institutions other than banks meant that the Bank would focus its purchases on medium and long maturities, because short-maturity gilts were more likely to be held by banks and overseas central banks.’
57. In contrast to the Bank, central banks like the ECB or Fed have sometimes used ‘open-ended’ programmes by announcing a target for monthly purchases, without necessarily committing to an end point. The ECB’s APP has a monthly target with a conditional end date; the Fed’s LSAP2 was closed-ended but LSAP3 was open-ended with a monthly target.
58. The stock effect is determined by the expected future path of the stock and so, for a given target stock, the pace will also matter insofar as agents discount the future.
59. [Bank of England response to the Lords Economic Affairs Committee’s report on Quantitative Easing](#)
60. See [Broadbent \(2020\)](#) for a more detailed discussion.
61. Known as the Bank of England Asset Purchase Facility Fund (BEAPFF).
62. For example, see [McLaren and Smith \(2013\)](#)
63. The details were set out in an [exchange of letters in November 2012](#) between the Governor and the Chancellor.
64. These arrangements are confirmed in exchanges of letters between the Governor and Chancellor; for example, in [March 2020](#).
65. see [McLaren and Smith \(2013\)](#)
66. This indemnity was established at the inception of the APF, as set out in an [exchange of letters in January 2009](#) between the Governor and the Chancellor.
67. See [McLaren and Smith \(2013\)](#).
68. The direction in which the yield curve can move in a scenario when a central bank is actively selling is uncertain. One hypothesis is that if asset purchases lowered yields, the reverse should occur when those assets are sold. An alternative view is that current yields may already reflect the potential for future asset sales.
69. At its [February 2022 meeting](#), the MPC agreed that Bank should cease to reinvest any future maturities falling due from its stock of UK government bond purchases.

Share your thoughts with us at QuarterlyBulletin@bankofengland.co.uk.