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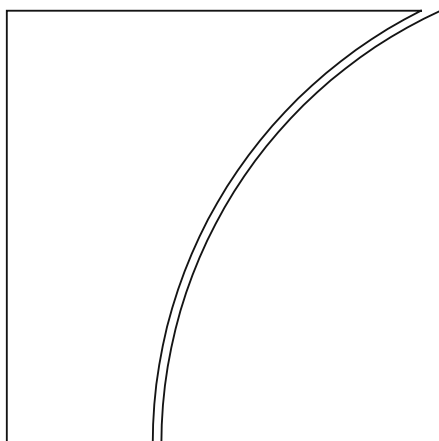
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Unconventional monetary policy tools: a cross-country analysis

Report prepared by a Working Group chaired by
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Preface

The Great Financial Crisis and its aftermath presented central banks with unprecedented challenges. Policymakers' response included the introduction of new tools. Central banks implemented different combinations of what have been labelled unconventional monetary policy tools (UMPTs) and adapted their operations to the circumstances in their jurisdictions.

After a decade of experience with UMPTs the Committee on the Global Financial System (CGFS) mandated a working group co-chaired by Frank Smets (European Central Bank) and Simon Potter (Federal Reserve Bank of New York) to take stock of central banks' experience and to draw lessons for the future.

The following report presents the working group's summary of central banks' shared understanding of the efficacy of UMPTs. It focuses on four sets of tools: negative interest rate policies, new central bank lending operations, asset purchase programmes, and forward guidance. It reviews the experience with these tools across countries, as well as the way that they were sequenced and coordinated.

The report concludes that, on balance, UMPTs helped the central banks that used them address the circumstances presented by the crisis and the ensuing economic downturn. The report identifies side effects, such as dis-incentives to private sector deleveraging and spillovers to other countries, but does not consider them sufficiently strong to reverse the benefits of UMPTs. The report also discusses whether, and under what circumstances, these tools could be useful in the future.

I hope that this important report can serve as a resource for policymakers looking to learn from the experience of the past years as they consider ways to maintain and enhance the efficacy of monetary policy in the future.

Philip Lowe

Chair, Committee on the Global Financial System
Governor, Reserve Bank of Australia

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Executive summary

In pursuit of their mandates and consistent with existing legal frameworks, central banks introduced new policy instruments and made changes to their monetary policy frameworks to deal with the global financial crisis (GFC) and its aftermath. They implemented different combinations of what have been labelled unconventional monetary policy tools (UMPTs) and adapted their operations to the circumstances in their jurisdictions. After a decade of experience with UMPTs, and with many of these tools still in place, this report summarises the shared understanding of central banks on their use, effectiveness and unintended side effects. The report also discusses whether, and under what circumstances, these tools could be useful to central banks in the future, but it does not address issues related to the broad strategic design or calibration of monetary policy. Topics such as the choice of policy objectives and targets, as well as how UMPTs fit into the overall design, or how to determine the appropriate policy stance, are beyond the scope of this report.

The overall message is that UMPTs helped central banks that deployed them address the circumstances presented by the crisis and the ensuing economic downturns and that, despite the challenges these instruments pose, they are valuable additions to the central banking toolbox. The use of UMPTs evolved in stages and with some degree of experimentation, broadly pursuing two main objectives: (i) addressing disruptions in the monetary policy transmission chain (DTC events); and (ii) providing additional monetary stimulus once the main conventional instrument (the policy rate) was constrained by the effective lower bound (ELB). The assessment of central banks is that UMPTs were effective in terms of both these objectives but that they also have their limits. Their effectiveness is significantly enhanced when deployed in the context of a strategy that encompasses other types of public policy, in addition to monetary policy, in order to mitigate their side effects and boost their effectiveness.

The focus of the report is on four sets of tools: negative interest rate policies (NIRP), new central bank lending operations (LO), asset purchase programmes (APP), and forward guidance (FG). It includes a high-level description of the four types of UMPT, the context in which they were deployed, and how they compare with conventional monetary policy tools. The main message from this comparison is that many of the tools were, in some respects, not fundamentally different from tools central banks had used in the past. What set this period apart was the broad use of these tools and the scale of their deployment, which marked an important departure from conventional policy as understood prior to the GFC.

The report reviews the experience with various UMPTs across countries, as well as the way that they were sequenced and coordinated. The assessment of the tools' performance draws on different inputs: (i) a novel survey of central banks' experiences; (ii) the related academic and central-bank literature assessments of UMPTs; and (iii) the views of a panel of academics and market participants. Overall, the main message is that UMPTs provided policymakers with additional policy space and flexibility, effectively addressing the GFC's most pernicious consequences and helping central banks pursue the achievement of their mandates when conventional policy was constrained. The positive assessment from central banks is particularly motivated by the responsiveness of financial conditions (eg yields, term structure, credit volumes etc) to UMP. This response first stabilised and then stimulated the macro economy, albeit unevenly and with some delay. Risks of deflation were avoided

as the public's inflation expectations did not become unmoored to the downside, but actual inflation responded only slowly and persistently undershot central bank objectives.

The discussion of the experience with individual tools offers a more detailed assessment:

- **Negative interest rate policies:** As the macroeconomy deteriorated, some central banks decided to set negative policy rates, some motivated by the need to avert a deflationary currency appreciation. They found that, overall, this strategy was effective in dealing with ELB events: long-term yields adjusted downwards in line with expectations of future short-term rates, thus providing the desired expansionary stimulus. Although side effects, such as the compression of bank interest margins, were detected, they have not posed a major problem for banking stability to date because of offsets from other sources of income and the eventual recovery of bank portfolio values, including the declines in non-performing loans. That said, the potential longer-term effects of a prolonged period of negative rates on intermediaries cannot be fully assessed on the basis of current experience.
- **Lending operations:** Central banks expanded their liquidity facilities to deal with both DTC (in the early stages of the crisis, abundant liquidity to financial intermediaries was crucial in bypassing impairments in the interbank and money markets) and problems related to the ELB (LOs aimed more explicitly at providing stimulus when interest rates were constrained). Interventions included extending the maturity of the typical lending operations, expanding the set of eligible collateral and the set of counterparties, changing the lending terms (eg fixed rate full allotment) and imposing explicit conditions on loans to ensure the desired ultimate outcome (eg bank lending to non-financial private firms). LOs supported credit flows to the private sector and helped stabilise market expectations of interest rates, but may have not been immune to side effects such as some inefficient allocation of credit and a weakening of the private sector's incentive to reduce excessive leverage.
- **Asset purchase programmes:** The richness of LO programmes is matched by the variety of APPs for dealing with both DTC and ELB problems. Together these programmes accounted for large increases in central banks' balance sheets. and aimed mainly at lowering long-term yields and thus easing broad financial conditions. In some cases (mainly relating to the purchase of private assets), they supported asset valuations affected by fire sales, or provided additional funds to ultimate borrowers by incentivising the securitisation of loans. Overall, APPs proved to be very effective tools in all jurisdictions, although their performance was not uniform, prompting central banks to adapt their operations or complement them with other, at times, novel UMPTs. Concerns regarding the risk of weakening the quality of central bank balance sheets, excessive suppression of premia in asset valuations, temporary scarcity effects in repo markets, spillovers in the form of boosting commodity prices and private sector leverage in EMEs, were not assessed as sufficient to negate the positive contribution of APPs in addressing weakness in aggregate demand.
- **Forward guidance:** In a period of heightened uncertainty about the economic outlook and the ability of central banks to deal with the challenges – especially when rates reached the ELB – FG played an indispensable role. FG served to clarify central banks' intentions with respect to future policy rate settings and to

communicate their commitment to the pursuit of their mandates. FG also gave meaning to other, individual UMPTs and served as the connecting material that joined different UMPTs together into an overall package. As many UMPTs involved unprecedented operations or the simultaneous deployment of several tools, FG was used to enhance the clarity of policymakers' strategic intentions. Experience shows that FG was overall quite effective, albeit sometimes challenging to design and not without the occasional mishap. A key challenge with FG in exceptional conditions has been balancing the trade-offs between clarity of message, credibility of follow-up action and flexibility of future policy response to changing circumstances.

The complex unfolding of the GFC and the concomitant weight of the UMP interventions required central banks to deal with important timing issues and to design operations in order to maximise synergies. Furthermore, the deployment of multiple tools was a key factor in mitigating the side effects that each tool could have produced in isolation. To a large extent, sequencing and coordination could not be based on experience and had to be adjusted in line with an improving understanding of UMPTs and their effects.

Legitimate concerns have emerged in the public debate of possible side effects of UMPTs. The report discusses some of them in connection with the analysis of each tool's effectiveness, distinguishing between side effects that fall within the statutory scope of central banks and those that may affect other policymakers, economic agents or countries. Among the latter, international policy spillovers are given particular prominence, even if there was not always agreement concerning their impact. On balance, the report concludes that the side effects have been limited to date, although it is too early to fully assess some of the longer-term implications.

Looking forward, the report argues that the positive experience with UMPTs speaks for their inclusion in central banks' toolbox as instruments to be used as appropriate and depending on the specific circumstances. It recognises that a full assessment of their effects will not be possible until central banks have made further progress in unwinding them. That said, based on the experience so far, the report presents some scenarios that could require future UMP interventions. Without providing an exhaustive list, the report highlights the possibility of usefully deploying UMPTs in the context of scenarios such as the presence of domestic aggregate demand shocks, or spillovers from abroad to small open economies, or disruptions in financial markets that impair the transmission of monetary policy. The report suggests that a number of trends will arguably increase the future frequency of interest rates reaching the ELB, despite prudential reforms that have increased the robustness of the financial system, reducing the likelihood of financial crises. These trends include the apparent secular decline in equilibrium real interest rates, demographic developments, financial innovation and globalisation. The implications of at least some of these supply side developments can be better addressed directly through structural and fiscal policies, which would reduce the risk of overburdening monetary policy. There may also be situations, other than ELB events, where UMPTs might provide an appropriate course of action for central banks in the pursuit of their mandated objectives.

Embedding UMPTs in central banks' frameworks requires them to be tailored to the specific legal framework and needs of each jurisdiction. The report argues that communicating to the public that central banks are willing and, in particular, able to use unconventional tools may enhance their effectiveness and even reduce the need

to actually deploy them: for example, by reducing the risk of market panics and forestalling adverse self-fulfilling dynamics and strengthening the anchoring of inflation expectations. At the same time, it is important for central banks to preserve flexibility and readiness to address novel manifestations of systemic crises. If UMPTs are to be used, decisive action becomes a key element of their successful implementation, as undue hesitation could be misunderstood by the public either as a lack of willingness to use UMPTs, or a lack of adequate policy tools.

This approach of decisive action through UMPTs is predicated on transparency and readiness to act, but it does run the risk of eroding incentives for the private sector to maintain adequate buffers against financial stress. Likewise, it might induce a bias toward inaction among other policy authorities, such as regulatory, prudential and fiscal policymakers, if they believe the burden of policy interventions can be left to the central bank, thus raising unfounded expectations that the central bank may resort to UMPTs against all types of adverse outcome. The use of UMPTs by central banks would be more effective if other policy agencies are prepared to deal in a timely way with financial vulnerabilities as they arise, reducing the risk that UMPTs will be needed in the first place. Similarly, the action of other policy agencies, alongside the central bank, in addressing large systemic crises after they materialise would avoid an overreliance on UMPTs and help central banks to pursue their respective mandates.

Introduction

In pursuit of their mandates and consistent with legal frameworks, central banks undertook innovative policy actions to deal with the global financial crisis and its aftermath. Central banks introduced new instruments and made changes to their monetary policy frameworks in order to address the challenges posed by the crisis and the economic environment that ensued. They implemented different combinations of *unconventional monetary policy tools* (UMPTs) and adapted their operations to the prevailing circumstances in their jurisdiction. Ten years after the start of the global financial crisis (GFC), it is worth taking stock of central banks' accumulated experience with these innovations and the guidance it may give for the design and conduct of policy going forward.

The Committee established a Working Group (WG) to produce a report that summarises the shared understanding of central banks on these issues. The WG had two concrete **objectives**. The first objective was to review the lessons learned from the use of unconventional policy tools over the past 10 years. This entailed providing an overview of central banks' assessment of their effectiveness, the challenges they pose, and the unintended side effects associated with their use. The second objective was to discuss whether and how these tools can be useful to central banks in the future; that is, whether they enhance central banks' ability to meet their policy goals, including in the presence of impaired monetary transmission or when constrained by the effective lower bound on nominal interest rates. This report presents the common understanding of central banks on these two sets of issues, highlighting and explaining, at the same time, the differences in terms of the experiences and assessments across countries. It complements a report by the Markets Committee that focuses more on the impact of large central bank balance sheets on market functioning.¹ That said, broader questions regarding the overarching strategic design of monetary policy – the choice of policy objectives, targets, calibration and the horizon for policy evaluation – as well as how UMPTs fit into that design, are beyond the scope of this report.

This report represents an important step in collecting and analysing central bankers' experience with UMPTs. However, given the unprecedented scale of the policy intervention and the possible changes in incentives that could give rise to yet unobserved forms of moral hazard, it can only be an intermediate evaluation at this point. Many tools are still in use, the process of withdrawal is ongoing or not yet started, and the tools' long-run impact cannot be known with certainty. At the same time, a critical aspect of the overall official sector response to the GFC was the strengthened regulation and supervision of financial firms, which is designed to reduce moral hazard and, thus, help mitigate some possible side effects of UMPTs.

The WG's analysis is based on a number of inputs. First, the WG collected information directly from central banks through a survey of their use and their assessment of unconventional policy tools.² Second, the group summarised analytical work conducted both in central banks and in academia assessing the performance of unconventional tools. Finally, the group gathered views of a selected panel of

¹ Markets Committee (2019).

² The survey was coordinated with the Markets Committee and provided information for both reports (see above).

academics and market participants in a roundtable organised at the Federal Reserve Bank of New York.

The report is organised in three main sections. The first provides an overall frame for the report: it briefly sets out the pre-crisis operating framework for monetary policy and highlights the ways in which tools employed in the past 10 years were “unconventional” by departing from this general framework.

The following two sections focus respectively on the two main objectives of the project. Section 2 outlines the features, timing and experience with UMPTs based on the survey of central banks. It further offers a cross-country analysis of the effectiveness of the new tools, including how central banks assess them. In this respect, the report relies extensively on analyses developed at central banks as well as in the academic literature. Section 3 considers the extent to which UMPTs should be regarded as permanent components of the central banks’ policy toolbox. In doing so, the report takes into account the recent findings on structural changes to the economic and financial environment that can affect the frequency of events requiring the use of UMPTs (eg fall in the natural rate of interest, changes in financial globalisation, and increased importance of financial factors in driving economic fluctuations).

Finally, a set of annexes contains material that summarises the sources of information for the report, including more detailed evidence derived from the survey of central banks conducted by the WG.

1. Why unconventional monetary policy tools?

The GFC marked the transition from what many had labelled the period of “Great Moderation” to that of the “Great Recession”.³ The stress experienced by the financial sector starting in the summer of 2007 put an end to several years of robust growth for the world economy, which had also been accompanied by moderate inflation rates across most advanced market economies. Across a number of countries, financial intermediation ground to a halt, with the peak of the stress manifesting in the final quarter of 2008. Unemployment shot up and inflation dropped below central banks’ target levels (Graph 1), as economic activity receded sharply.⁴ The recovery from the deep recession was also uncharacteristically slow in many jurisdictions, with tepid economic growth, sluggish employment growth and subdued inflation. The challenges posed to monetary policy during this period were severe and pushed central banks to resort to actions that departed from their established policy frameworks.

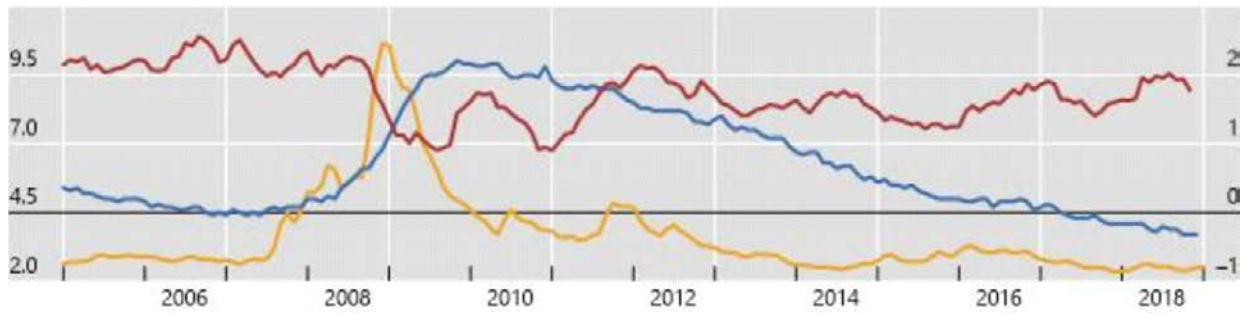
³ In general, the literature refers to the Great Moderation as the period between the early 1980s and the GFC, during which aggregate volatility fell across many countries (Bernanke (2004) and McConnell and Perez-Quiros (2000)).

⁴ Ollivaud and Turner (2015) put the estimate of the median loss in potential output for OECD countries that experienced a banking crisis between 2007 and 2011 to about 5.5% of GDP (compared with a counterfactual of no crisis) and to more than 10% for some smaller European economies. Eichhorst et al (2010) perform similar calculations for employment.

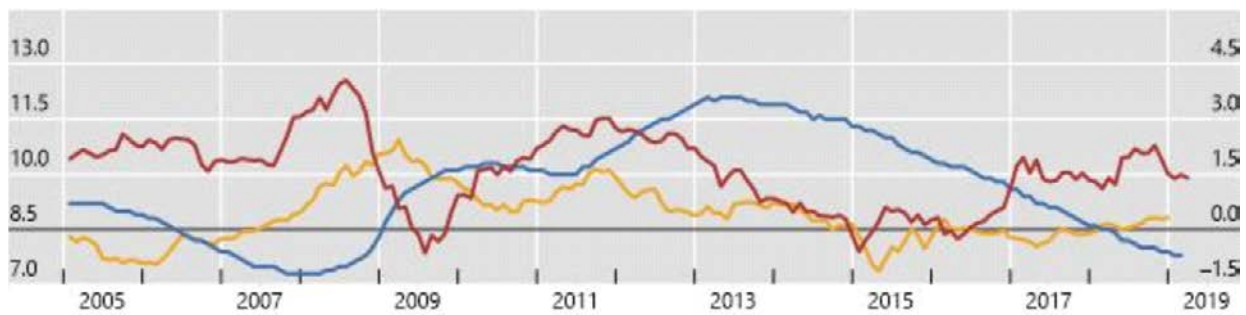
Macroeconomic and financial conditions

United States

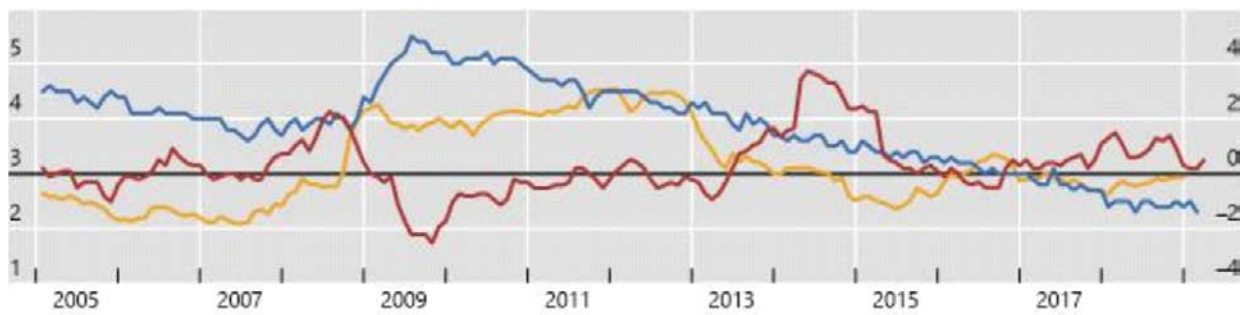
Graph 1



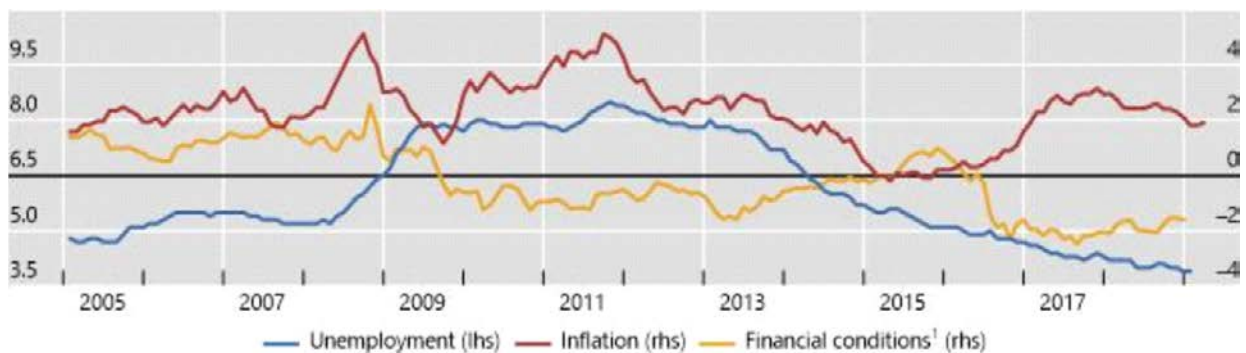
Euro area



Japan



United Kingdom



— Unemployment (lhs) — Inflation (rhs) — Financial conditions¹ (rhs)

¹ For the United States, Chicago Fed's National Financial Conditions Index; for other countries, Goldman Sachs Financial Conditions Index.

Sources: Bloomberg; Datastream; national data; BIS.

The set of policy interventions introduced during this period has been labelled as *unconventional* monetary policy in order to distinguish it from the typical (*conventional*) pre-GFC policy measures. This section starts with a brief outline of the conventional framework. Against this background, it then describes the various types of unconventional tool. An observation emerging from this description is that the tools themselves were not completely new as there had been historical precedents for their use, and some of them related to the central bank's ability to provide liquidity through the issuance of reserves. What was really different about unconventional policy were the combinations of monetary policy actions, the unprecedented scale of operations and the purposes for which many tools were used. Both the scale of their deployment, and the purposes to which these tools were put, placed central banks in an unconventional role vis-à-vis the private market and raised concerns about their effects on the incentives of market participants and other public institutions.

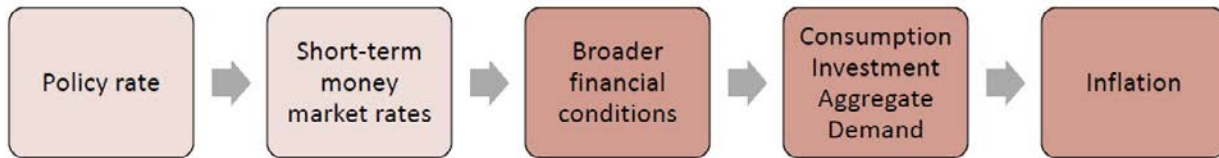
Conventional monetary policy

Monetary policy is guided by the central banks' statutory objectives, primarily keeping inflation close to a target level (in most advanced economies set near a 2% annual rate) over the medium term, and in some cases also pursuing an employment objective. Over the pre-crisis period, most central banks followed broadly similar strategies to conduct monetary policy, with some differences in their operational frameworks. The main tool of conventional monetary policy was the control of a short-term interest rate: changes in this policy rate and the public's expectations of its future settings, affected financial conditions (ie the availability and cost of funding) and, further down the transmission channel, affected the macroeconomy (ie aggregate spending, output and inflation).

At the operational level, central banks' frameworks were generally characterised by reserve scarcity, with central banks using relatively small shifts in the supply of reserves to steer the policy rate towards its target. Open market operations were conducted with a pre-specified set of counterparties, smaller in some cases (eg as in the Federal Reserve System) and larger in others (eg as in the Eurosystem). Despite some differences in terms of the eligible collateral in open market operations, central banks bore limited credit risk by lending against safe collateral (typically government bonds) or at appropriate haircuts.

Expectations about future policy influence market prices and affect broad financial conditions. Central banks have placed considerable weight on communicating how they react to changes in the economic outlook. Depending on the private sector's understanding of this reaction function, expectations often adjusted even in the absence of explicit communication from the central bank about its future actions. In this way, a credible policy strategy focusing on keeping inflation near its target level over the medium term helped to anchor private sector inflation expectations, which in turn helped to stabilise the economy.

The transmission chain of conventional monetary policy from the policy rate to financial conditions includes links related to short-term funding markets, to longer-maturity bonds and bank funding and lending markets, exchange rates and equity markets (see Graph 2). This transmission chain operates best when a number of conditions are met. First, there must be room for the policy rate to move in the desired direction and not be constrained by its lower bound. Second, different funding markets



must work efficiently with sufficient arbitrage between overnight rates and the rest of the interest rate term structure, so that funding conditions for different types of agent move in synch with changes to the policy rate. Third, the public's inflation expectations must be well anchored. When this is the case, a temporary deviation of inflation from the target in either direction is less likely to trigger inflationary or deflationary spirals, thus making it easier for monetary policy to achieve its objective.

During the "Great Moderation" period, these conditions were largely satisfied. As a result, changes in the policy rate translated into changes in real interest rates and in broad financial conditions that, in turn, affected interest-sensitive spending and the economy more broadly. In many jurisdictions this also meant that monetary policy became the tool that was most relied upon for macroeconomic stabilisation, with fiscal policy oriented more to medium-term growth and efficiency issues. This configuration was abruptly disrupted by the GFC, which forced many central banks to respond by departing from the conventional framework, putting them at the centre of a wide range of policy debates.

Unconventional monetary policy tools

In the midst of the crisis, many central banks faced an impaired financial sector and soon appeared to run up against the limits of what they could achieve with conventional tools.⁵ At first, financial conditions did not respond sufficiently to reductions in policy rates. Later on, conventional policy easing ran into the constraints of the effective lower bound. Against this backdrop, central banks gradually introduced a set of policy measures that have come to be collectively known as *unconventional monetary policy tools*.⁶

⁵ Hubrich and Tetlow (2015) provide empirical evidence on the weakness of conventional monetary policy in times of financial crisis.

⁶ Policymakers were not entirely unprepared to tackle GFC-type events. In the past, a number of economies had experienced similar, albeit more localised situations. Also the economics literature in the early 2000s had discussed aspects of unconventional monetary policy in response to policy rates becoming constrained by the lower bound on nominal interest rates. For example, Bernanke and Reinhart (2004) proposed three strategies to stimulate the economy when the policy rate is at or near

Unlike conventional monetary policy, unconventional measures targeted something other than short-term interest rates. Some were designed to affect term spreads (or, equivalently, long-term risk-free rates), while others were directed at influencing liquidity and credit spreads (or, equivalently, interest rates on various non-risk-free instruments). Some tools aimed at restoring liquidity conditions and asset valuations in the financial system as a means of supporting the monetary policy transmission mechanism (Bindseil (2016)). With these tools, central banks became intermediaries for a larger range of financial activities. They stepped in to fill the gap created by the receding activity of private sector participants, thereby also affecting participants' incentives.

The use of UMPTs evolved in stages, with some degree of experimentation, broadly pursuing two main objectives: (i) addressing problems in the monetary policy transmission mechanism; and (ii) providing additional monetary stimulus once policy rates could not be reduced further. In real time, as several UMPTs were often deployed together, the precise distinction between these two objectives was not always clear. Even so, for analytical clarity, this report maintains this distinction in discussing central banks' assessment of the effectiveness of the tools and their potential use in the future.

Disruptions in the transmission channels of monetary policy took various forms. They included reduced activity in unsecured and secured interbank markets in response to elevated fears about counterparty risk, and greater segmentation between those markets that involved participants with access to central bank liquidity and those that did not, impeding the pass-through of policy rate changes to broader money market conditions. Borrowers saw their funding capacity shrink in line with declines in the value of their collateral due to large drops in asset prices (eg due to fire sales or non-fundamental factors). Disruptions also emerged as intermediaries in credit markets were forced to deleverage in response to financial losses during the crisis. To address these disruptions, central banks deployed a number of UMPTs: some tools were designed to bypass the traditional money market channels (eg various types of asset purchase), and others to directly affect credit conditions by providing ample liquidity to banks and other financial institutions (eg longer-term lending operations, fixed rate full allotment).

The need to use alternative tools also arose when central banks could no longer provide monetary stimulus through traditional means, because their policy rates had reached levels regarded as their *effective lower bound* (ELB). The ELB is determined by the combination of two factors, which can differ across financial systems. First, the cost of holding cash (the difference between the convenience of holding cash and the cost of storing it) sets a floor under how far the net return on lending funds can fall. Second, the response of financial intermediaries to very low rates might block their further transmission to funding rates in the economy. The profitability of financial intermediaries – which depends in large part on interest rate spreads (lending minus borrowing rates) and interest income in general – might deteriorate at very low interest rates. This would be the case if, as interest rates on money and capital markets turn negative, retail deposit rates are not lowered below zero because banks fear that customers would switch into cash, while bank lending rates continue falling. In theory, there exists a "reversal rate" threshold, below which falling policy

zero: shaping market expectations of future policy rates, altering the composition of the central bank's balance sheet and altering its size.

rates would elicit contractionary market adjustments and limit the supply and/or increase the cost of credit.⁷

The remainder of this section provides a brief overview of the types of UMPT discussed in the report. Tools are classified into four categories: negative interest rate policy, expanded lending operations, asset purchase programmes and forward guidance. As elaborated below, the tools were in several respects not fundamentally different from what central banks had used in the past. What set this period apart was the breadth of use and the scale of the tools' deployment, which marked an important innovation with respect to the conventional policy framework as understood prior to the GFC.

Negative interest rate policy (NIRP)

The adoption of negative policy interest rates in the aftermath of the GFC was new. Before the financial crisis, it was widely perceived that policy rates must be positive, even if close to zero, and hence the reference to a zero lower bound for monetary policy.⁸ Differences in the ELB level across countries, prior to the GFC, were mainly seen as reflecting different levels of the switch-to-cash and reversal rates as determined by structural characteristics of financial systems.⁹ With the notable exception of zero interest rates introduced by the Bank of Japan in February 1999, this perceived lower bound had rarely been reached in the post-World War II era. As central banks pushed interest rates below zero, it was recognised that the effective bound may be lower, but not necessarily the same across jurisdictions.

Negative policy rates were unconventional in the sense that they imply that the owner of excess reserves incurs a cost for placing them with the central bank, overturning the usual pattern of interest payment flows in a monetary economy. They also implied a one-time broadening in perceptions of the range of possible rates, thus influencing the formation of agents' future rate expectations. Their implementation required some adjustment of the operational details of the policy framework.

Expanded lending operations (LOs)

The second group of tools consisted of expanded lending operations to financial intermediaries. In many jurisdictions, lending is an integral part of the central bank's toolkit, consisting of short-maturity operations designed to facilitate the implementation of interest-rate policies.¹⁰ The break with the conventional use of central bank lending in the GFC's aftermath related to the characteristics of these operations. Central banks created new, or extended existing lending facilities to provide ample liquidity to a wider array of financial institutions at the same time, under considerably looser conditions (mostly by allowing lower-quality collateral), for longer horizons (from weeks to years), and possibly at a lower cost. By avoiding a breakdown of funding markets that would have exacerbated the deleveraging

⁷ See Brunnermeier and Koby (2018) for a discussion of how the reversal rate relates to bank profits and capital position.

⁸ Switzerland in the early 1970s offers an example of CB experience with negative rates, albeit not of the main policy rate. At the time, the Swiss National Bank (SNB) required banks to levy a negative 2% rate on non-residents' Swiss franc accounts, with the aim of limiting capital inflows.

⁹ McAndrews (2015) discusses how the structure of financial markets affects the effective lower bound.

¹⁰ Central banks also have facilities to provide liquidity assistance to individual banks experiencing stress, but the supply of emergency liquidity assistance is outside the scope of this report.

process, LOs helped strained financial intermediaries to provide credit to the real economy, overcoming bottlenecks in the policy transmission. At later stages, LOs were also enacted as direct lending stimulus measures by making some programmes conditional on intermediaries undertaking specific activities (eg lending to non-financial firms). While LOs were not necessarily novel from a qualitative perspective, their scope, duration and size were unprecedented.

Asset purchase programmes (APPs)

The third group of tools consisted of central banks' large-scale purchases of assets other than short-term treasury bills, typically funded by the creation of central bank reserves. Of course, the open market purchase of domestic sovereign debt has long been a hallmark of central banking. But large-scale purchases of longer-term and private sector assets during the GFC to directly influence asset prices were relatively novel and controversial. Purchases of private assets were deemed by some to lie beyond the scope of central banks' mandates and to expose them to inappropriate financial risks. Moreover, critics argued that – like many of the novel LOs – APPs represent a form of credit allocation and as such also fall outside the scope of monetary policy.

The typical rationale for central banks' use of large-scale asset purchases was their impact on asset prices. Purchases of government and private sector debt reduce relevant interest rates and associated risk premia, and thus potentially bypass impaired links in the transmission chain, lowering borrowing costs for the real economy. Purchases that remove safe assets from investors' portfolios can, through a substitution effect, stimulate demand for riskier assets, relaxing financial conditions, with the expectation that this will stimulate aggregate spending.

Forward guidance (FG)

The fourth type of unconventional tool is forward guidance. It consists of providing information concerning future policy actions to influence policy expectations. Most central banks routinely communicate their intentions regarding future settings of short-term policy rates. However, FG as a UMPT was aimed at shaping private sector expectations about future policy in ways that departed from past communication styles. It was directed at signalling central banks' willingness to pursue extraordinary policy actions for an extended period of time. It also went beyond foreshadowing the path of the policy rate and was applied to, and coordinated with, the use of other UMPTs such as lending operations and asset purchase programmes.

Some central banks had used FG well before the crisis. The Bank of Japan introduced FG in April 1999, two months after having lowered its policy rate to zero, by announcing that it would continue with the zero interest rate policy "until deflationary concern [was] dispelled" (Hayami (1999)). For the Riksbank, FG has been part of its conventional policy toolkit since 2007, when it began publishing its repo rate path to increase policy transparency. In the early 2000s the Federal Reserve engaged in FG by communicating its intention to keep policy rates low for an "extended period" (Meade et al (2015)).¹¹

The success of FG depends critically on the ability of central banks to effectively communicate their intentions and to support the credibility of their announcements.

¹¹ FG has sometimes been used in response to one-time calamitous events such as the Fed's response to the October 1987 Black Monday crash in the stock market and the September 2001 attack.

Central banks face trade-offs in the choice between two styles of FG. The first style is *general* in character. It involves the communication of policy intentions regarding the setting of instruments, in connection with the economic forecast, but without making explicit commitments about specific policy actions.¹² As such, it gives policymakers room to manoeuvre in the presence of unforeseen events, but at the risk that their pronouncements are discounted by market participants who doubt policymakers' ability or willingness to follow through with concrete actions.

The second class of FG entails explicit *conditional commitments* to maintain an announced policy path either for a certain period (calendar-based FG), or until a specific state of the economy is achieved (outcome-based FG). Such commitments can substantially influence market expectations and reduce uncertainty, but at the cost of diminished flexibility.¹³ A calendar-based policy has the advantage of being contingent on an easily understood measure (a date) while an outcome-based policy has the advantage of relating the stance of policy more or less directly to a desired outcome. To some, the commitment inherent in FG of this style is necessary when the central bank feels the need to communicate a marked departure from its former monetary policy strategy (Evans (2017)).¹⁴ As discussed in the next section, the trade-off between clarity of message, credibility of follow-up action and flexibility of future policy response is arguably the main challenge in designing and implementing FG.

2. Experience with unconventional monetary policy tools

This section summarises the assessment of UMPTs based on the information gathered by the survey of central banks, and distilled from the extant literature, as well as on contributions by academics and market participants to a workshop on this topic organised by the WG. In particular, the first four subsections assess the UMPTs individually, while the fifth addresses questions related to their coordination and sequencing. While the report highlights common views, experiences could differ to some extent across jurisdictions. Moreover, some central banks have announced new measures or made changes to existing ones after the WG had conducted the survey. The assessment in this report is thus based on the information as of spring 2019, with several measures still in place, implying that a full assessment, eg of the potential implications of prolonged very low interest rates, is not yet feasible.

¹² The academic literature often describes this style of FG as *Delphic*, in the sense of presenting the central bank's outlook for the economy and being discretionary (preserving flexibility) by not being very precise about future actions.

¹³ The literature refers to this style of FG as *Odyssean*, in the sense of representing a (conditional) commitment of policy.

¹⁴ Moessner et al (2017) suggest that one advantage of state-based FG is that it enables the public to distinguish shifts in FG that are driven by changes in economic outlook from those stemming from changes in monetary policy preferences. This allows the central bank to demonstrate over time a commitment to a communicated policy direction.

2.1 Negative interest rate policy

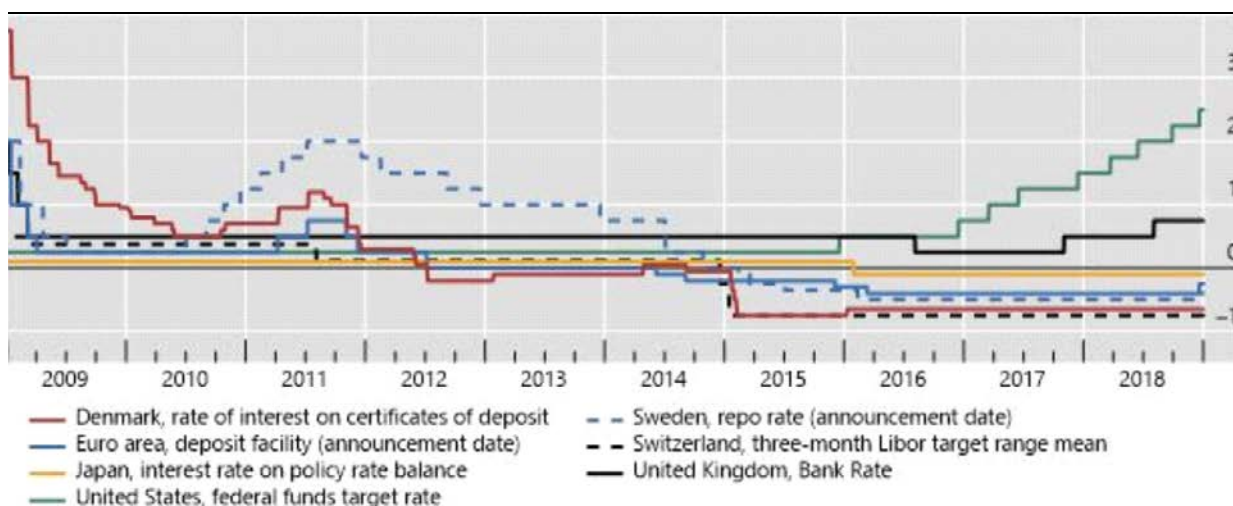
According to the WG's survey of central banks, the introduction of NIRP in the aftermath of the crisis was aimed at providing stimulus to the economy in accordance with monetary policy objectives. The Riksbank was the first central bank to introduce negative rates, in July 2009 (Graph 3).¹⁵ Facing a similarly challenging macroeconomic environment, the European Central Bank (ECB), the Danmarks Nationalbank (DN), the Swiss National Bank (SNB) and the Bank of Japan (BoJ) introduced negative rates between mid-2014 and early 2016. The technical implementation of negative policy rates was done largely within existing operational frameworks, although some modifications were needed. The SNB had to change its terms of business to implement negative policy rates. Other central banks conducted reviews of their IT systems, documentation and accounting rules.¹⁶

In some cases, the central banks' announced objective was to counter contractionary currency appreciation pressures in the context of bilateral pegs or floors on their exchange rates. The Swiss case is arguably the one where negative interest rates were most explicitly tied to the exchange rate. To reduce the pressure on the exchange rate, during a period in which the SNB had committed itself to a minimum conversion rate against the euro, the bank announced the introduction of negative interest rates (-0.25%) on sight deposit account balances in December 2014 (effective 22 January 2015). In mid-January 2015, with persistent pressure on the franc, the SNB discontinued the minimum exchange rate. The SNB further lowered the interest rate on sight deposit accounts to -0.75% and announced its willingness to intervene in the foreign exchange (FX) market as necessary to achieve its goal of price stability.

Policy interest rates

In per cent

Graph 3



Sources: Macrobond; national sources.

¹⁵ On 8 July 2009, the Riksbank lowered the overnight deposit rate to -25 bp in order to keep the interest rate corridor symmetrical at +/-50 bp.

¹⁶ Overviews of the operational implementation of NIRPs are given by Arteta et al (2018), Bech and Malkhozov (2016) and Jobst and Lin (2016).

By contrast, the ECB's decision to cut rates below zero was motivated solely by the aim of further easing monetary policy in order to ensure the solid anchoring of long-term inflation expectations (Praet (2018)). In June 2014, the ECB reduced the deposit facility rate to -0.1% . The deposit facility rate was subsequently lowered a further 10 basis points in September 2014, December 2015 and March 2016, ultimately bringing the rate to -0.4% . In January 2016, the BoJ also applied a negative interest rate of -0.1% to current accounts that financial institutions held with it.

To mitigate the potentially negative effects of NIRPs on bank profits outlined in Section 1, some central banks introduced exemptions on negative rates on bank reserves. The design and calibration of the exemptions were related to the size of excess reserves, which themselves were influenced by other unconventional policies such as asset purchases and FX interventions.¹⁷ The DN, BoJ and SNB have used combinations of exemption thresholds in computing the negative remuneration on reserves. Hence, the average remuneration rate on central banks' liabilities has varied not only with the different policy rates, but also with the exemption schemes.¹⁸

Assessment

Overall, in responding to the survey questions, central banks judged that negative policy rates contributed to the achievement of their policy goals and that their side effects have been contained. Nonetheless, they noted that their experience so far involved modestly negative interest rates: transmission effects could be weaker, or side effects stronger, should more deeply negative rates be implemented. Central banks viewed the impact of negative rates as primarily working through the same channels as does conventional monetary policy: by lowering market rates and easing financial conditions more broadly. However, in some countries the direct effect of NIRP was somewhat limited by the diminished pass-through of rate declines to bank deposit rates and, in some cases, bank retail lending rates. Even so, a second indirect effect, operating through changes in public perceptions of the level of the ELB and the associated demonstration of central bank commitment to policy objectives, might also have been powerful (Praet (2016)).

Effects of NIRP on financial conditions

Thus far, negative rates have been fairly effective in reducing money market rates.¹⁹ Moreover, lowering rates past the previously perceived ELB should elicit a weakening

¹⁷ Bech and Malkhozov (2016) provide details of the design and remuneration schedules. They report that, in mid-February 2016, the average rates were lowest at the Danish and Swedish central banks at just above -50 basis points. In comparison, the average rate at the SNB was around -25 basis points, despite the fact that the (marginal) interest rate on excess reserves was lower. When the ECB moved its deposit facility rate into negative territory, it continued to remunerate minimum required reserves at the Main Refinancing Operations rate, while the totality of excess reserves was remunerated at the deposit facility rate. Due to the small size of required reserves, the average interest rate over total bank reserves de facto equals the negative rate on the deposit facility.

¹⁸ These thresholds related mainly to minimum reserve requirements (eg SNB) or some other magnitude set by the central bank (eg in the case of the DNB which uses both an aggregate and an individual threshold). The BoJ adopted a three-tier system in which individual balances are paid a positive, a zero, and (at the margin) a negative interest rate, respectively.

¹⁹ See for example Arteta et al (2018); Ball et al (2016); IMF (2016); Viñals et al (2016); Grisse and Schumacher (2017); Turk (2017); Eisenschmidt and Smets (2018); and Xia and Wu (2018). Nonetheless, the ECB noted that its first move into negative territory may have been associated with delayed

of the domestic currency with positive effects on inflation and aggregate activity. Khayat (2015) finds empirical support for this channel for Denmark and the euro area, a result consistent also with the Swiss experience (Jordan (2016)).

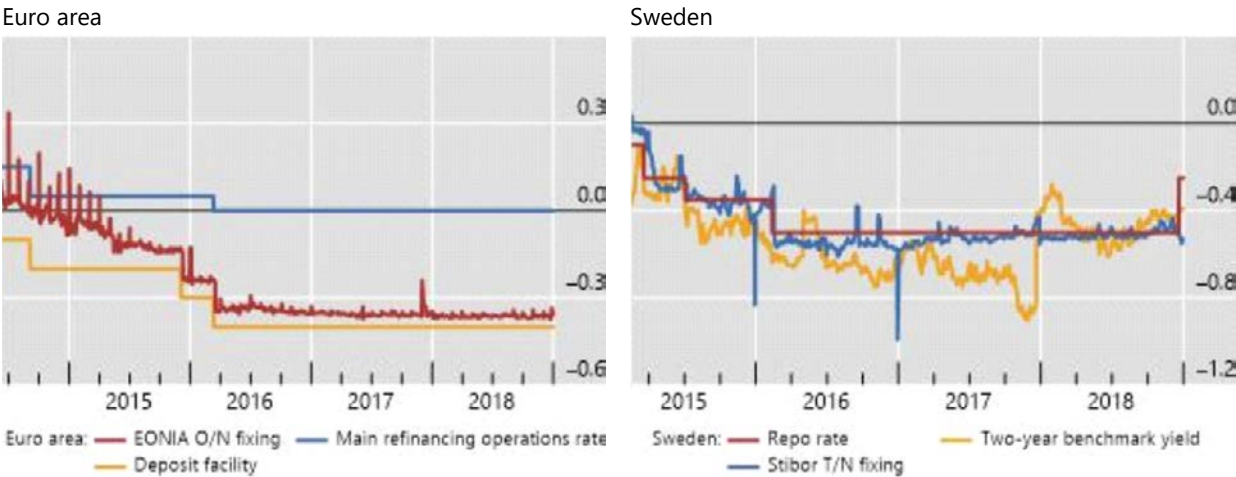
While the pass-through of negative policy rates to most market rates appears to have become more or less complete (Ball et al (2016); Jobst and Lin (2016)), this has been less true of bank deposit rates (Graph 5; Eisenschmidt and Smets (2018); de Sola Perea and Kasongo Kashama (2017)). Retail deposit rates appear to have a floor at zero. The switch-to-cash level discussed in Section 1 explains why negative rates have been fully transmitted only to certain types of deposit, typically the accounts of large companies and municipalities, because they face a higher cost of holding cash than retail depositors. Information from Swedish banks suggests that some of the banks partially compensated for the inability to lower deposit rates by increasing fees for the services provided to customers (Sveriges Riksbank (2016)).

The effect of NIRP on banks' lending rates and volumes depended, among other things, on their business model and funding model (eg deposit-based vs capital/wholesale market-based). Controlling for this heterogeneity poses an empirical challenge. Some research has found that NIRP did not lead to a change in pass-through of policy rates to lending rates (Eisenschmidt and Smets (2018)), while others have found evidence to the contrary (Eggertsson et al (2017)). Evidence for the euro area suggests that not only have rate cuts been successfully passed on to

Key policy-controlled interest rates, interbank overnight and short rates and two-year benchmark government bond yields

In per cent

Graph 4



Each figure starts on the day prior to the NIRP announcement. Note that the government bond yields are benchmarks and not zero-coupon yields.

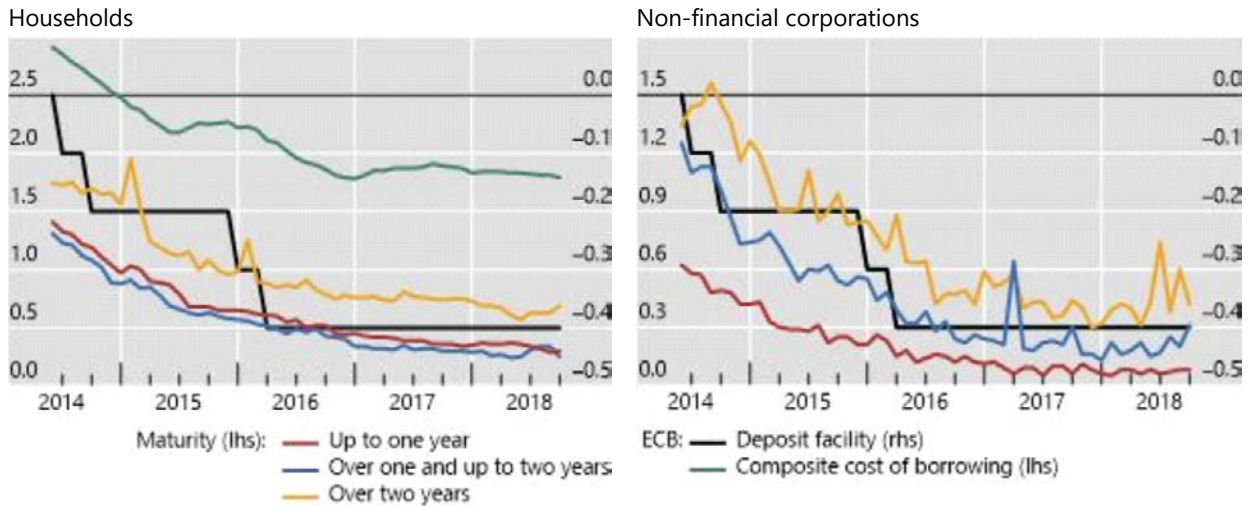
Sources: Macrobond; national sources.

transmission: the initial cut in the policy rate to negative values in June 2014 was not completely transmitted to money market rates (such as the EONIA) until May 2015; all rate cuts after May 2015 did pass through immediately to the EONIA (Graph 4, left-hand panel).

New euro-denominated deposits from euro area residents from households and non-financial corporations and ECB composite cost of borrowing for households

In per cent

Graph 5



Source: ECB Statistical Data Warehouse, interest rate statistics.

lending rates, but loan volumes have also increased (Eisenschmidt and Smets (2018)).²⁰ In addition, it can be argued that some of the contraction in the supply of funds may come as a consequence of a surge in capital outflows from an economy where rates are very low or negative.²¹

According to the BoJ's Comprehensive Assessment, the NIRP introduced in Japan, in combination with Quantitative and Qualitative Monetary Easing (QQE), has pushed down short- and long-term interest rates substantially.²² The combination of these policy measures was judged to have been an effective means for the BoJ to exert influence on the entire yield curve. Similar observations are true for the joint use of NIRP and large-scale asset purchases in the euro area (Section 2.5).

In general, NIRP together with other UMPTs, had a reasonably strong impact in terms of lowering short- and long-term government bond yields, with yields becoming negative in a number of countries. Unconventional monetary policies also helped lower yields on corporate debt. At the same time, they may have helped to boost stock prices to levels that could be characterised as frothy by some valuation

²⁰ In Switzerland, on the contrary, after the SNB implemented negative policy rates an increase in mortgage rates was observed. It has been argued that banks increased mortgage rates to generate additional income to pay the negative interest on their SNB accounts and to cover the increased costs of hedging interest rate risk (Danthine (2018)). However, mortgage rates came back down over time as a result of competition, particularly from the non-bank sector.

²¹ See Cavallino and Sandri (2019).

²² At the September 2016 Monetary Policy Meeting, the BoJ conducted a comprehensive assessment of the developments in economic activity and prices as well as the policy effects since the introduction of QQE (Bank of Japan (2016)).

benchmarks.²³ That said, low interest rates, and by extension NIRP, may be less effective when confronted with deflationary forces, such as those associated with high levels of private sector indebtedness or with excess capacity in the real sector, to the extent that they may delay balance sheet adjustment, or when the prolonged compression of interest rate margins is no longer counterbalanced by higher asset valuations and declines in non-performing loans, thus constraining banks' profits and willingness to lend (see below).²⁴

Effects of NIRP on financial institutions

The channels through which prolonged very low or negative interest rates affect banks are numerous and complex; thus it is not surprising that the aggregate impact is ambiguous and probably differs across financial institutions and jurisdictions. In line with the evidence discussed above, negative rates may reduce the spread between lending rates and deposit rates, shrinking net interest margins and bank profitability, but intermediaries may temper this effect by shifting their portfolios towards riskier assets and/or by raising fees. Very low rates also push up asset prices, allowing banks to book profits on their security holdings and raise the value of collateral at their disposal. The improvement in overall economic conditions induced by lower rates may help borrowers to meet their debt obligations and banks to reduce loan loss provisions.

A number of studies have found that net interest margins were compressed by low (not necessarily negative) rates, and that these difficulties became worse over time (BIS (2018). Borio et al (2017), Claessens et al (2018)). Others have found that the benefits to other components of banks' income can offset the margin compression.²⁵ Altavilla et al (2017) argue that low policy rates and a flatter yield curve are not associated with lower bank profits when macroeconomic and financial conditions are taken into account. Other studies find some detrimental net effects of negative interest rates on loan-deposit margins and on banks' profitability (ECB (2016, p 71)).

Survey respondents did acknowledge that net interest margins could be squeezed by low rates but in general they did not see this as reducing the effectiveness of NIRP. The BoJ also noted a decline in the functioning of the short-term money market and the Japanese government bond market, which could in part be due to NIRP, but also in part a result of other UMPTs. Finally, there have been no clear signs of cash hoarding, possibly due to the limited pass-through to retail deposit

²³ Acharya and Plantin (2018) argue that monetary easing (not only NIRPs) can drive up stock prices by providing incentives for excessive maturity transformation. By contrast, Dell'Ariccia et al (2017) argue that the trade-off between price stability and financial stability is not too stark. See also Svensson (2017).

²⁴ Some evidence from the euro area, however, points to bank loans responding positively to NIRP. Demiralp et al (2017) found that banks in the euro area, in particular those with a high share of deposits, responded to NIRP by expanding lending to non-banks. Altavilla et al (2019) find similar effects.

²⁵ See, for example, Basten and Mariathan (2018). Martínez Pagés (2017) finds that in Spain, where variable rate mortgages are prevalent, banks have responded to negative interest rates (and the resulting drop in interbank reference rates) by charging higher spreads over interbank rates for new loans. López et al (2018) warn that strategies to increase non-interest income might not be sustainable. The balance sheet structure of banks matters for pass-through, including bank reliance on deposits (Heider et al (2018); Amzallag et al (2018)), excess liquidity (Demiralp et al (2017); Basten and Mariathan (2018)) and capital ratios (Arce et al (2018)).

rates (Ball et al (2016), Jobst and Lin (2016)). Graph 6 does not show any large shift in the share of large-denomination notes in overall circulation coinciding with the introduction of negative rates.

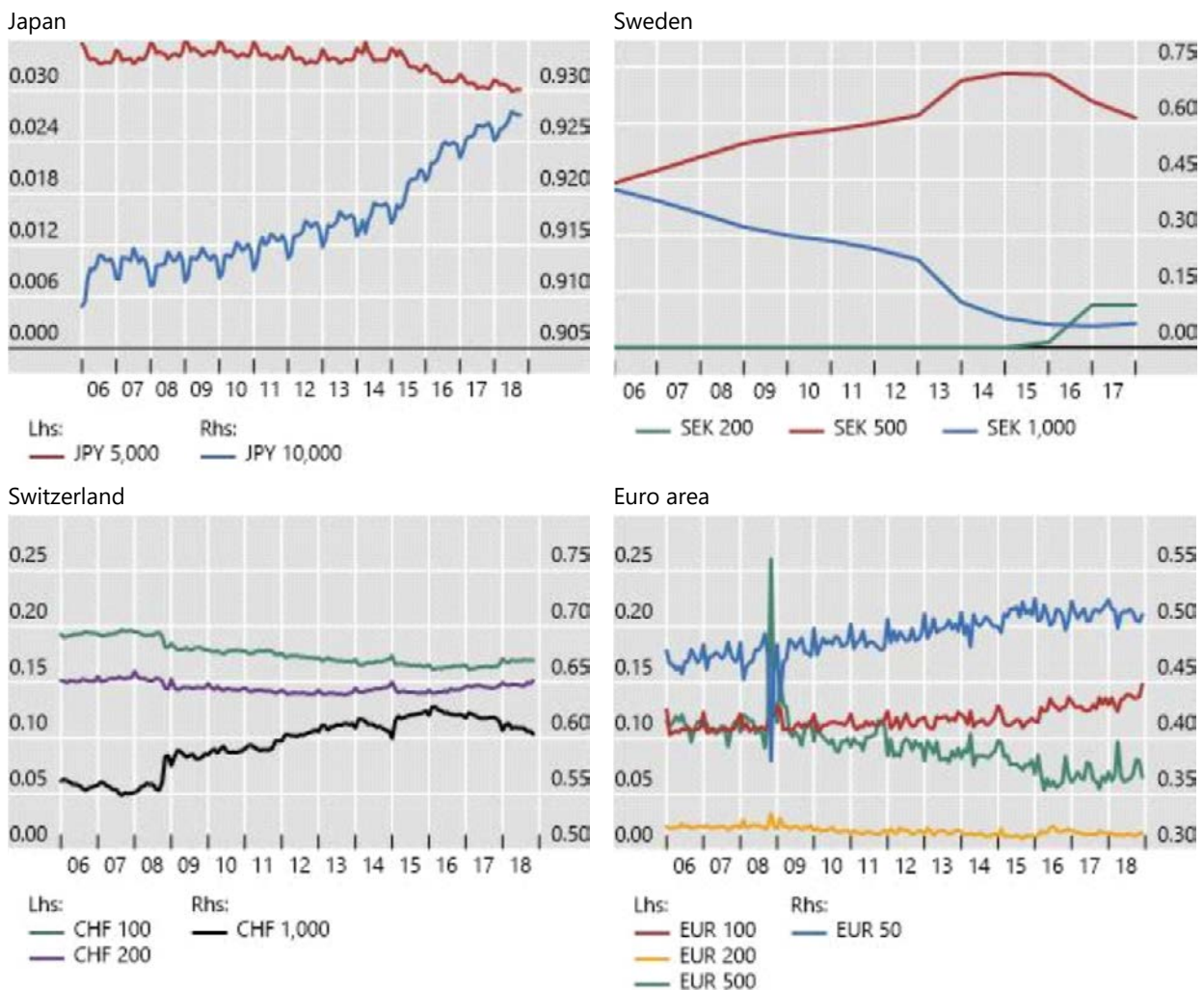
2.2 Lending operations with financial institutions

In the survey, 13 central banks reported that they introduced new lending measures, or adjusted existing ones in 2007 and 2008, to address issues with market functioning, and in particular to mitigate liquidity strains or to reduce credit spreads mostly in short-term money markets.²⁶ These early measures accounted for the majority of the

Value of largest-denomination banknotes in circulation in the euro area, Japan, Sweden and Switzerland

As percentage of value of total banknotes

Graph 6



Sources: Bank of Japan; ECB; Sveriges Riksbank; Swiss National Bank.

²⁶ Annex Table 3 lists the central banks responding to this part of the survey and outlines the main characteristics of the measures.

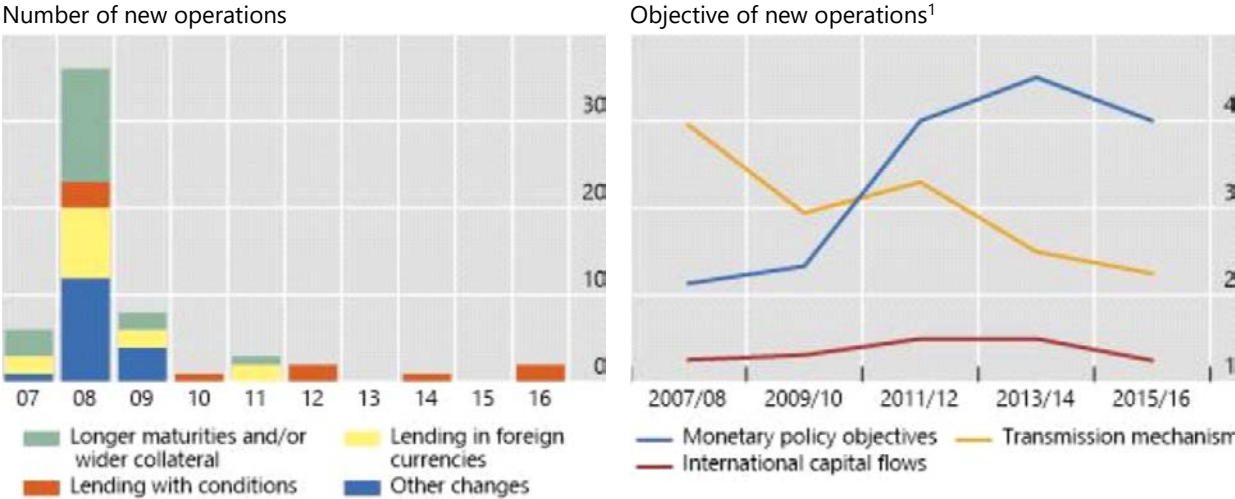
new LOs reported in the survey (Graph 7, left-hand panel). In some cases, the “temporary” changes introduced during the crisis ended up being precursors to permanent changes. As for lending measures intended to provide monetary accommodation, they were mainly introduced at a later stage (2010–16), in particular by the ECB, the Bank of England (BoE), and the BoJ. These measures comprised a broad range of longer-term refinancing operations (Graph 7, right-hand panel).

When liquidity in money markets dried up towards the end of 2007, central banks responded by initiating measures to facilitate financial institutions’ access to liquidity. In particular, central banks increased the frequency of repo auctions, provided funds at longer maturities, created new liquidity facilities, increased the range of collateral accepted, broadened the set of institutions that could participate in operations and changed allotment procedures (see Box A for more details and Annex Table 1 for a summary of the various changes).

Several central banks established backstop facilities that offered financial institutions the opportunity to turn to the central bank to obtain liquidity in the event they were unable to fund themselves in the market at sufficiently low rates. In contrast to other newly established facilities, such as longer-term LOs, backstop facilities were designed to diminish in use to zero as market conditions normalised. Although many of these backstop facilities were not used intensively, the reporting central banks perceived them as effective instruments for addressing funding market stress. The Federal Reserve (Fed), for instance, launched its Term Securities Lending Facility Options Programme (TOP) in July 2008, which offered primary dealers the option of obtaining additional liquidity through its newly established Term Securities Lending Facility (TSLF) in times of high liquidity demand, such as at quarter-end dates. The Fed’s Primary Dealer Credit Facility (PDCF) imposed a usage fee that increased every 45 business days to discourage borrowers from using it as a permanent source of

New lending operations

Graph 7



¹ All lines show the average importance on a scale from 1 (least important) to 5 (most important) that responding central banks attached to different objectives for lending operations after the global financial crisis. The blue line comprises “inflation below central bank’s objective” and “limited capacity to meet MP objectives solely through adjustments in short-term interest rates”. Yellow line: “strained liquidity or other breakdown in market functioning in asset markets and/or banking systems” and “excessive term/risk premia in certain market segments”. Red line: “capital inflows and outflows”.

Source: CGFS Survey of central banks’ use of UMPTs, question 3.5.

funding (Adrian et al (2009)). The Bank of Canada (BoC) established the Term Loan Facility (TLF) and the Term Purchase and Resale Agreement (TPRA) for Private Sector Instruments as backstop facilities. Both offered access to collateralised funding during the height of the crisis in 2008 and 2009 but had relatively low take-up, in line with their purpose as a backstop.

Several central banks also broadened the set of institutions that could access central bank liquidity, directly or indirectly, to ensure that liquidity was passed on. They both expanded the set of eligible direct counterparties for specific central bank operations, and enhanced the availability of central bank liquidity indirectly, in ways that preserved existing market structures and prevented a possible disintermediation in money markets. Additionally, most central banks broadened the range of collateral that was eligible for their regular repo operations and LOs, or reduced the haircut on eligible collateral, or both (see Box A for details). Most of these measures were designed to facilitate banks' access to central bank reserves within the regular liquidity facilities and LOs.

Some central banks also offered new facilities to swap less liquid assets against Treasury securities, to provide certain financial institutions with liquid assets that could then be used as collateral to obtain cash in private repo markets. The Fed's TSLF, from March 2008, and the BoE's Special Liquidity Scheme (SLS), from April 2008, are two prominent examples.

In addition to alleviating tangible market stress, funding and lending schemes also played an important role in providing monetary accommodation. There were several variants of such schemes, which can be categorised as programmes aimed at: (i) alleviating uncertainty about the future evolution of the policy rate; (ii) improving funding conditions of banks through favourable pricing; and (iii) incentivising credit creation through longer-term lending with conditions.²⁷

Assessment

In general, the surveyed central banks assessed their adjusted or newly established LOs as effective. The measures they undertook helped ease liquidity strains, restore the monetary transmission channels, and alleviate pressures in bank funding markets. These tools also took effect by reducing uncertainty about the future availability of liquidity, which would otherwise have hindered the market supply of funds. These positive developments reduced liquidity and term premia, and eased funding conditions for non-financial corporations and households. In the view of the surveyed central banks, the associated expansion of credit provision to the real economy was essential for providing increased monetary stimulus, even when rates were constrained by the ELB. Furthermore, easier central bank collateral policy helped reduce credit spreads in times of distressed markets for collateral and thereby mitigated the likelihood of a credit crunch, especially in the context of fragmented money markets in the euro area.²⁸

²⁷ There were also schemes designed to reduce funding uncertainty at the longer maturity favoured by certain classes of investors. These included the ECB's LTRO and the RBA's longer-term repo operations. However, only the ECB described its operations as having been introduced particularly with monetary policy objectives in mind.

²⁸ The BoE noted that the offered collateral swap in the SLS was effective yet insufficient to restore funding conditions for banks. As a result, the BoE introduced the Discount Window Facility in October

Implementation of LOs across countries

The implementation of LOs varied across countries along a number of dimensions. For example, the BoC switched from a biweekly to a weekly schedule for its newly established TPRA facility in October 2008 and changed to an auction format for the operation to aid the price discovery process. The BoE increased the frequency of its long-term repos from monthly to weekly in September 2008. The Bank of Korea (BoK) started conducting long-term and non-regular repurchase agreements in October 2008, whereas the BoJ started raising the frequency of its funds-supplying operation and CP repo operations.

At the short end of the maturity spectrum, the Reserve Bank of New Zealand (RBNZ) and the BoC extended the term of their overnight repos from one day to 30 days. The BoC later offered additional funds at a three-month maturity. The Reserve Bank of Australia (RBA) and the SNB offered funds at maturities from six to 12 months. The ECB followed a more sequential approach regarding its longer-term refinancing operations (LTRO), gradually increasing the offered maturity from three months to three years between 2008 and 2011 (see also Section 2.3). The BoJ introduced the Special Funds-Supplying Operations to Facilitate Corporate Financing in December 2008, which provided unlimited amounts up to the total collateral value. The BoJ also introduced fixed rate funds-supplying operations at a three-month maturity in December 2009 and at a six-month maturity in August 2010.

The BoC, BoJ, Bank of Mexico (BoM), RBNZ and the Fed created new liquidity facilities in order to increase the flexibility with which institutions could access liquidity, provide lending at favourable conditions, broaden the set of eligible counterparties, and mitigate the traditional reluctance of counterparties to have recourse to such facilities, owing to “stigma” (Fleming (2012) gives a detailed account of the Fed’s measures).

For LOs implemented by the ECB and the SNB, one key departure from the past consisted of enacting a fixed-rate full allotment (FRFA) procedure.

Central banks differed also in terms of collateral eligibility. The BoC, for example, accepted asset-backed securities as collateral for its newly established TPRA and for Standing Liquidity Facilities. The BoE started accepting AAA-rated residential mortgage-backed securities (RMBS) and covered bonds in its long-term repo in December 2007, while the BoJ accepted floating rate, inflation-indexed and 30-year government bonds in its regular repo operations and broadened the range of eligible asset-backed commercial paper in its CP repo operations as of October 2008. Between August 2007 and December 2008, the RBNZ expanded its set of eligible securities in several steps to include bonds of supranational agencies, state-owned enterprises, corporations and mortgage-backed securities. Some central banks also accepted for their repo operations, at least temporarily, non-mortgage loan portfolios (BoC), loans to non-financial corporations (Riksbank) and bank debentures (BoK) as collateral. The Bangko Sentral ng Pilipinas (BSP) lowered the haircuts on collateral for its regular repo operations. The ECB lowered the minimum required rating for different classes of assets, including with its Additional Credit Claims programme (ACC) in December 2011, while also adjusting haircuts to their default risks.

A further element of departure from conventional lending operations consisted of broadening the set of counterparties, or designing the operations in order to reach a broader set of financial institutions. For example, the BoK granted 12 additional securities companies access to its repo operations, which increased the number of eligible counterparties from 21 to 33. Similarly, the BoC allowed Large Value Transfer System (LVTS) participants to access its TPRA from October 2008. Furthermore, the BoC created a new facility, the TPRA for Private Sector Money Market Instruments, in October 2008, which allowed money market participants to access liquidity by submitting bids through the BoC’s network of primary dealers. The Fed, with its Commercial Paper Funding Facility (CPFF) allowed US issuers of commercial paper who were having difficulty securing short-term funding to obtain central bank liquidity by placing commercial paper with a Fed-operated special purpose vehicle operated (see Adrian et al (2011) for a description of the facility and the market malfunctioning it was intended to address).

2008. For the effects of collateral policies on funding spreads, see Fleming et al (2010), Cassola and Koulischer (2016) and Barthélémy et al (2017). Cahn et al (2017a) find a positive effect of collateral expansion on lending. Koulischer and Struyven (2014) and Del Negro et al (2017) find a significant impact of collateral swaps on output and inflation. Mayordomo et al (2015) find that fragmentation significantly decreased after the ECB expanded the list of eligible collateral, see also Koulischer (2015).

LOs varied also in terms of pricing and other incentives. For example, the SNB lowered the spread for its liquidity-shortage financing facility (discount window) from 200 basis points to 50 basis points above market rates in 2008, mainly to reduce any stigma associated with the use of the facility. The BoJ lowered the minimum fee rates applied to its Security Lending Facility from 1% to 0.5%. Some programmes linked favourable pricing, or borrowing allowances, to the provision of bank credit to firms and households – including banks’ investments in firms, in the case of the BoJ’s Loan Support Programme in 2012 – also with a view to providing more monetary economic stimulus. This was the case, for instance, with the Fed’s Term Asset-Backed Securities Lending Facility, the Riksbank’s Loans against Corporate Certificates, and the BoK’s Aggregated Ceiling Lending Facility. The common features of these programmes included their relatively long maturities, sometimes up to four years, and the incentives to redirect lower funding costs to the real economy, in particular to non-financial firms. Along these lines the BoE, the BoJ and the ECB banks’ borrowing incentives were linked to lending performance, with favourable conditions regarding price and/or volume (eg the Funding for Lending Scheme (FLS) and Term Funding Scheme (TFS)), and maturity (eg the first and second targeted long-term refinancing operations (TLTRO-I and TLTRO-II)), intended to ensure that financial institutions would pass through their lending to private sector borrowers, targeting specific sectors or borrowers in some cases. The BoJ provided loans with the aim of stimulating bank lending and supporting private financial institutions’ efforts to strengthen the foundations for economic growth, while different iterations of the BoE’s FLS, first introduced in 2012, focused on different areas of the economy, including SMEs. The BoE’s TFS, announced in August 2016, had yet another primary objective in aiding the pass-through of a Bank Rate cut at low rates. The ECB excluded loans to households for house purchases from the eligible volumes when allocating liquidity or lowering the pricing, in order to avoid potentially contributing to a real estate bubble. Based on the experience with the very long-term refinancing operations (VLTROs), the conditions attached to the ECB’s TLTROs were also designed to limit banks’ incentives to use central bank liquidity to fund large expansions of (riskier) sovereign bond portfolios. ^① Finally, several of the schemes were extended or modified to ease conditions further.

^① See for example Bats et al (2018), Deutsche Bundesbank (2014). Buiter and Rahbari (2012) argue that, through the LTROs, the ECB has in fact been acting as a sovereign lender of last resort to euro area governments. Archarya and Steffen (2015) find evidence that the LTROs lowered funding risk for banks in vulnerable euro area countries but induced them to hold more domestic sovereign bonds, thus strengthening the bank-sovereign nexus. Van der Kwaak (2017) finds smaller effects of central bank long-term lending compared with a bank recapitalisation by the fiscal authority on output in a DSGE model.

Measures to provide increased monetary stimulus or support pass-through were also largely judged as successful. Evidence confirms that these programmes supported stronger economic growth and higher inflation.²⁹ In particular, studies using micro-data for France, Italy and Spain suggest that the ECB’s long-term refinancing operations (LTROs) increased credit supply to non-financial corporations in these countries, while the targeted LTROs (TLTROs) were associated with faster lending growth and lower lending rates to firms.³⁰ Similarly, the BoE’s FLS is perceived to have reduced funding costs, which in turn fed through to quoted terms and the availability of credit to the real economy (Bank of England (2012)). Moreover, the TFS helped the transmission of the policy rate cut by mitigating its side effects on banks’ profitability.

²⁹ See eg Boeckx et al (2017) and Casiraghi et al (2016). However, the effects were heterogeneous across euro area countries, with countries with more fragile banking systems or more affected by the crisis benefiting less (Jäger and Grigoriadis (2017); Burriel and Galesi (2018)). Cahn et al (2017b) find that liquidity injections through extended-maturity LTROs in 2008 and 2009 played a key role in averting a major credit crunch in the euro area.

³⁰ See Andrade et al (2018); Carpinelli and Crosignani (2017); Darracq-Paries and De Santis (2015); Fratzscher et al (2016); Garcia-Posada and Marchetti (2016) and ECB (2017, p 42). That said, core euro area countries in less need of expansionary stimulus benefited less from these measures (ECB (2017, p 42)).

Schemes like the one operated by the Riksbank (see Box A) had the intended effect of anchoring policy rate expectations, as well as reducing funding costs, and the BoC judged its TPRA to have been an effective tool in reinforcing its commitment to low rates. One- and three-month Canadian Dealer Offered Rate (CDOR)-OIS

Box B

Global shortage in USD liquidity

During the GFC, many countries faced US dollar shortages as domestic banks had expanded their balance sheets rapidly between 2000 and 2007, financed in large part in the FX swap markets. As a result, they were exposed to foreign currency funding risk. The sharp increase in funding costs and, in some cases, complete lack of access to interbank and FX swap markets following the Lehman bankruptcy, meant that the effective maturity of banks' dollar funding shortened, while that of their dollar assets lengthened, as many assets became difficult to sell in illiquid markets. The widening mismatch of asset and liability maturities resulted in an intense global US dollar shortage.^①

In response to mounting pressures in bank funding markets, the Federal Open Market Committee announced in December 2007 that it had authorised dollar liquidity swap lines with the ECB and the SNB to provide liquidity in US dollars to overseas markets. These swap agreements were subsequently extended to include a total of 14 central banks by October 2008, allowing them to obtain and distribute US dollars to banks in their respective jurisdictions (FOMC (2013)).^② While these swap lines lapsed in February 2010, re-emerging stress in dollar funding markets led to the establishment of a new network of bilateral swap arrangements in May 2010 between the BoC, BoE, BoJ, ECB, Fed and SNB, and these were subsequently converted into standing facilities with no pre-set limits in October 2013 in order to provide a "prudent liquidity backstop" in case of future global financial strains.^③

Various central banks also entered into regional swap arrangements to distribute their respective currencies across borders. While the US dollar was the most common currency in swaps, other currencies were also used in bilateral swaps, for instance, the Swiss franc to address funding pressures in eastern Europe. Swap lines were also important for emerging market economies (EMEs), even though agreed lines were smaller than those provided to advanced economies.^④ The establishment of such swap arrangements provided an important signal while acting as a backstop facility (Obstfeld et al (2009)).

Central banks assessed the FX swap lines as effective in reducing elevated risk premia in bank funding markets and bank funding pressures in the debt markets (RBA); normalising the funding conditions of trade companies (Central Bank of Brazil (BCB)); reducing the dollar funding cost of financial and non-financial companies (BoJ); providing a positive signalling effect (BoM); stabilising the foreign exchange market and improving domestic banks' foreign currency borrowing conditions (BoK); and reducing interbank rates as well as the implicit rate of US dollar borrowing (Riksbank).

In general, the regular US dollar auctions by the ECB, BoJ, SNB and BoJ based on access to the dollar swap lines reduced both the level and the volatility of FX swap spreads (Baba and Packer (2009)), even when the auctions acted purely as a backstop. The swap lines also helped avert more extensive distressed selling of US dollar-denominated assets, and possibly mitigated volatility in the interbank money market rate and depreciation pressure on currencies vs the US dollar.^⑤

^① Analysis of banks' funding patterns suggests that overall US dollar short-term funding needs were substantial at the onset of the crisis (McGuire and von Peter (2009)). ^② The Fed extended loans to foreign central banks, collateralised by foreign currencies, which, in turn, made these funds available through US dollar auctions in their respective jurisdictions. ^③ FOMC, "Federal Reserve and other central banks convert temporary bilateral liquidity swap arrangements to standing arrangements", press release, 31 October 2013. ^④ For instance, a bilateral swap arrangement between India and Japan – aimed at addressing short-term liquidity difficulties and supplementing the existing international financial arrangements – was instituted in June 2008, which enabled both countries to swap their local currencies (either Japanese yen or Indian rupee) for US dollars for an amount up to USD 3 billion. ^⑤ Ivashina et al (2015) find that those euro area banks that were most dependent on wholesale dollar funding cut their lending the most. Bahaj and Reis (2018) provide evidence that US dollar swap lines significantly reduced the US dollar funding risk for banks with access to these swap lines. Coffey et al (2009) estimate that the announcement of swap lines reduced the deviations from covered interest rate parity (CIP) by an average of 5 basis points.

spreads decreased and remained low on announcement of the conditional monetary policy commitment and extended TPRA.³¹

In general, the longer-term schemes appear to have been implemented in a calmer market environment, consistent with the aim of supporting the real economy rather than market functioning.³²

For the lending schemes that have been terminated, there have been no apparent signs of market disruptions (BoJ, ECB), possibly an indication that market functionality had been restored. An additional mitigating factor could be the environment of high excess liquidity, which may have cushioned the impact of the end of specific programmes.

Finally, and despite the observed lower-than-expected take-up of some facilities, most central banks judged that stigma was not a major impediment, with the caveat that it is not always easy to distinguish stigma from other considerations motivating banks' demand for funds.³³ Some central banks took measures to reduce stigma effects. With the introduction of the TAF, the Fed took measures to overcome the stigma associated with the more traditional use of discount window facilities such as the Primary Credit Facility.³⁴ Other measures taken to reduce stigma effects include favourable prices and conditions (eg SNB discount window, Riksbank US dollar swap line, Primary Credit Facility in the United States), conducting deferred auctions (eg TAF in the United States) or adjusting communication to encourage participation (eg BoJ US dollar swap lines). The BoE made changes to its facilities in 2013, following a review of changes since the crisis with the specific aim of reducing stigma, in particular increasing the availability and flexibility of liquidity insurance, providing liquidity at longer maturities, against a wider range of collateral, at lower cost and with greater predictability of access. Stigma did not seem to be an issue among the operations that focused on monetary policy accommodation.

In general, most of the measures were assessed to have had limited side effects. Adverse side effects reported by the central banks included financial institutions becoming excessively dependent on central bank liquidity, potential disintermediation in financial markets (Güntner (2015)) and the build-up of excessive credit. For example, in the euro area there is some evidence that weakly capitalised banks resorted more to central bank liquidity, pledged riskier collateral and used loans to buy risky assets such as distressed-sovereign debt (Altavilla et al (2017);

³¹ See also Wu (2011) for the United States.

³² According to Iyer et al (2014), central bank liquidity provision did not prevent a credit supply reduction to firms between 2007 and 2009 in Portugal. According to the Riksbank's reply to the survey, the demand for lending against corporate certificates implemented since end-2008 in Sweden was less than anticipated, partly due to banks' lack of appetite to expand their balance sheets and bear additional risks at the time.

³³ In order to access the BoC's TPRA for Private Sector Money Market Instruments, potential counterparties had to submit bids through primary dealers which, in some cases, may have been a competitor. The ECB's TLTRO-I required an early repayment of the acquired loans if the associated conditions – related to future lending volumes – were not met. The Riksbank reported that banks used only 1% of the total refinancing volume on offer in exchange for loans to non-financial corporations, which indicates that, despite the favourable refinancing conditions, banks were not willing to take on the additional credit risk associated with corporate certificates.

³⁴ See Armantier et al (2015), in particular for the TAF. Nevertheless, Krishnamurty et al (2014) find indications of stigma for the Primary Dealer Credit Facility (PDCF), similar to the stigma associated with discount window borrowing, on which the PDCF was modelled. The Fed's TSFL, which like the TAF had an auction facility, was used notably more than was the PDCF.

Drechsler et al (2016)). Low capitalisation levels may also reduce the effectiveness of such lending measures (Boeckx et al (2017)). Section 3.2.3 provides further perspectives on side effects.

2.3 Large-scale asset purchase programmes (APPs)

In the survey, seven central banks reported the use of large-scale APPs: the BoM, BoE, BoJ, ECB, Fed, Riksbank and SNB. Most of them carried out several APPs over the period 2008–17, with programmes exhibiting different characteristics to serve a variety of objectives. As was the case with other types of UMPT, asset purchases were implemented either to address disruptions in the transmission mechanism of monetary policy or to provide additional monetary stimulus, or both.

Programmes aimed at addressing disruptions in the transmission channels (DTC) were announced during the crisis and its immediate aftermath; that is, between 2008 and 2012. They encompassed interventions in a wide range of market segments, including covered bank bonds, corporate bonds, commercial paper, agency debt, agency MBS and public sector bonds.³⁵ The choice of assets was determined by the nature and severity of each financial market disruption and the relevance of the asset class for the transmission of monetary policy. About half of these programmes featured a fixed (set in advance) amount of purchases to be carried out over a pre-specified calendar period; examples include the Fed's first Large-Scale Asset Purchase programme (LSAP1) and the ECB's first Covered Bond Purchase Programme (CBPP1). The other programmes were more flexibly designed with the pace and termination of purchases calibrated to market conditions, as exemplified by the ECB's Securities Markets Programme (SMP) and the BoE's Commercial Paper Facility (CPF).

Programmes more explicitly aimed at monetary accommodation were announced as central banks exhausted the space of conventional monetary instruments, with about 18 programmes launched between 2009 and 2016. During this period, six central banks purchased mostly public sector-issued securities, although in some cases programmes also encompassed corporate and covered bank bonds, commercial paper, agency MBS and other asset-backed securities (ABS), real estate investment trusts and exchange-traded funds. In general these operations implied an expansion of the balance sheet of the central bank. Some monetary accommodation programmes were launched with a fixed amount of purchases and a pre-committed end, such as the Fed's LSAP2, but others were more flexible. The BoE's quantitative easing programmes, while initially fixed in size, could in principle be extended by the MPC. Even more explicitly, more recent programmes have tended to begin with a monthly pace of purchases that was made contingent on the economic and inflation outlook. Examples include the ECB's APP, the Fed's LSAP3 and the BoJ's Quantitative and Qualitative Monetary Easing (QQE) including the additional yield curve control (YCC).

On average, APPs aimed at providing monetary accommodation had very different characteristics than those designed to improve market functioning. They were much larger and they lasted longer.³⁶ In addition, they involved assets with an

³⁵ See Annex Graphs 1 and 2 and Annex Tables 1 and 2 for the classification of programmes.

³⁶ Monetary accommodation programmes amounted, on average, to 15.2% of countries' nominal GDP, and in some cases (eg the BoE's QE rounds, the BoJ's QQE programme and the SNB FX purchases)

average duration (about eight years) of twice that of assets purchased in the course of DTC programmes (below four years).

Assessment

Central banks reported in the survey that a number of channels through which APPs can operate – ie portfolio re-balancing, signalling, bank lending, liquidity (premium) and direct pass-through – played a role in transmitting UMP interventions.³⁷ To the extent that asset purchases have contributed to a change in interest rate differentials or if foreign currency-denominated assets were purchased, an exchange rate channel could also be observed.

According to central bank survey responses, the effects of programmes targeting market functioning were mostly in terms of lower risk premia and improved market conditions. The effectiveness of the ECB's SMP, despite initial strong market reactions, was seen as ultimately hampered by its limited and temporary nature, its conditionality on uncertain policy commitments, and the preferred creditor status demanded by the ECB (Pill and Reichlin (2018)).

APPs that were intended to provide additional monetary accommodation were also generally perceived as effective, but to varying degrees. The ECB's expanded APP, an outcome-based programme, was considered effective in easing financial conditions, eliminating emerging deflation risks and more generally supporting progress towards a sustained adjustment in the path of inflation towards its inflation aim. The Fed regarded all four of their APPs as at least moderately successful, but LSAP2 and the MEP were judged as less successful than the others. Some of the reasons cited in survey responses to explain the lower effectiveness of the Fed's LSAP2 and MEP programmes were their reliance on purchases of Treasuries, unlike LSAP1 which had a substantial agency MBS component, and a fixed volume of purchases, in contrast to the open-ended, outcome-based nature of LSAP3. All four rounds of the BoE's QE were regarded as effective in influencing financial markets, albeit to different degrees. The BoJ programmes have not led to higher inflation expectations despite creating extremely accommodative financial conditions and pushing up actual inflation and GDP to some extent. The SNB's FX interventions were deemed very effective in ensuring price stability (see Box C).

An extensive academic literature suggests that asset purchases influenced financial conditions markedly, primarily in terms of interest rates for borrowers and, to a lesser extent, in terms of the availability of credit from banks.

Based on a set of 37 studies, estimated effects on government bond and corporate bond yields range between slightly positive values and reductions of more than 100 basis points (Graph 8).³⁸ The Fed's LSAP1 is estimated to have lowered

they reached approximately 90% of the central banks' balance sheet (see Annex Graph 2). By comparison, programmes aiming at DTC disruptions amounted to 1.2% of countries' nominal GDP (the largest was the Fed's agency MBS purchases amounting to 8% of GDP). The average central bank holdings of the respective asset class corresponded to about 10% of their balance sheets and to 9.8% of the eligible asset universe.

³⁷ Annex Table 2 shows through which channels each programme was expected to exert its effects on financial conditions and the economy more broadly.

³⁸ Yield effects can be divided into stock, or announcement, effects and flow effects. Estimates of flow effects suggest that they are smaller than stock effects and short-lived. See D'Amico and King (2013) for LSAP1, Eser and Schwaab (2016) for SMP, Arrata and Nguyen (2016) and De Santis and Holm-

10-year Treasury yields by around 90–120 bp, and the effect of LSAP2 and MEP was put at around 30–40 bp (Kuttner (2018)). The impact of the early rounds of ECB's APP was estimated to be around 50 bp for long-term sovereign bond yields (Altavilla et al (2015); De Santis (2015)), while more recent estimates put the overall compression of yields at around 100 bp for the 10-year tenor (Hammermann et al (2019)). Estimates of the decline in 10-year gilt yields due to the BoE's QE1 and QE2 range from 50 to almost 100 bp (Joyce et al (2011); Haldane et al (2016); Christensen and Rudebusch (2012)). For the BoJ's QQE, event studies suggest a 10–25 bp decline in long-term Japanese government bond yields (Lam (2011); Hausman and Wieland (2014)).³⁹ Effects on exchange rates range from slight appreciations following the

Box C

Spillovers to small open economies: the cases of Switzerland and Sweden

Asset purchases in larger economies may spill over into small open economies. This box describes the experience of the Swiss National Bank and Sveriges Riksbank with asset purchases in more detail. Starting as early as 2009 in the aftermath of the financial crisis, the Swiss franc strongly appreciated, triggering several policy actions by the SNB. In response to the growing divergence in monetary policy stances between the main advanced economies since mid-2014, both central banks reacted with a set of measures to stabilise the domestic economy and dampen appreciation pressures, although in different ways.

Reacting to an undue tightening of monetary conditions and increased deflationary risks, the SNB decided in March 2009 to lower interest rates yet further and to increase the supply of liquidity with long-term repos. It also decided to purchase Swiss franc bonds issued by domestic private sector borrowers and to buy foreign currency in order to prevent the Swiss franc from appreciating further. When the upward pressure on the Swiss franc intensified in summer 2011, the SNB set a minimum exchange rate of CHF 1.20 per euro on 6 September 2011, announcing that it was prepared to purchase foreign currency in unlimited quantities. And large purchases were, indeed, necessary to enforce the minimum exchange rate, eg at the peak of the euro area debt crisis.

In January 2015, the SNB concluded that the minimum exchange rate was no longer sustainable, as it could only have been enforced with foreign currency purchases of a rapidly increasing magnitude. Since then, the SNB has been willing to intervene in the FX market only as necessary. It also lowered the rate on bank reserves to –0.75%.

Working through the exchange rate channel, the SNB's interventions have been successful in fighting an excessive appreciation of the Swiss franc and in reducing its overvaluation. This has helped stabilise economic conditions and thereby prices, thus alleviating deflationary risks. Besides the actual purchases, communication has worked well as a signalling device in times of increased uncertainty, eg around the Brexit vote.

Amid low inflation and concerns about declining inflation expectations, in February 2015 the Riksbank decided to cut the repo rate to –0.10% and started buying government bonds to support inflation and inflation expectations. The QE programme was extended in several steps and, at the end of September 2018, the holdings amounted to SEK 340 billion, accounting for 7.6% of GDP.

While the Riksbank's programme was not directly implemented in the FX market, it affected financial conditions and the macro economy by reducing premia in the government bond market, lowering other yields through a portfolio channel, weakening the exchange rate, and providing stimulus through a higher liquidity surplus.

Despite the different operational characteristics, both the Riksbank's and the SNB's measures were influenced and to some extent shaped by global conditions in financial markets, the monetary policy stance in surrounding large economic areas, and their repercussions on exchange rates.

Hadulla (2017) for APPs. Evidence for the United Kingdom is provided by Joyce and Tong (2012). McLaren et al (2014) show that BoE's QE interventions remained effective over the various vintages, at least concerning their impact on sovereign bond yields.

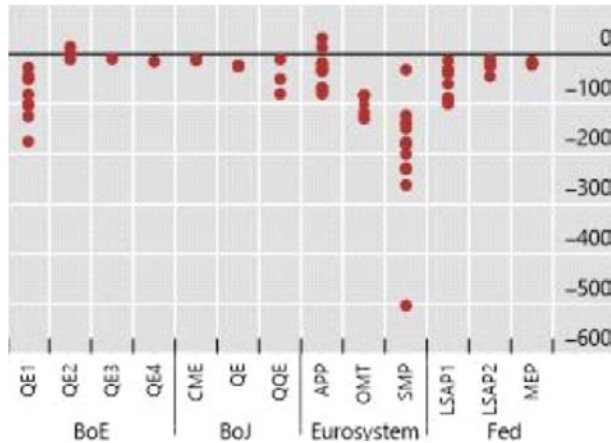
³⁹ Using a regression-based analysis, Bank of Japan (2016) estimates a larger impact on the 10-year JGB of around 90 bp.

Effects on financial conditions¹

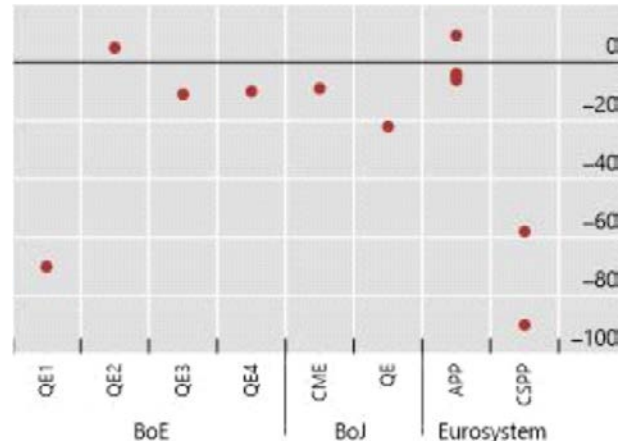
In basis points

Graph 8

Government bond yields



Corporate bond yields



¹ The estimates for BoJ programmes often rely on fewer events than do other studies.

Source: Study group calculations.

Comprehensive Monetary Easing (CME) to depreciations of 4–6% for QE1, LSAP1 and the ECB’s APP and QQE.

The impact on credit availability is not as clear-cut. Bank lending generally seems to have increased during APPs in the United States (Rodnyanski and Darmouni (2017)), in the euro area (Tischer (2018)), and in Japan (Bank of Japan (2016)); there is less evidence for the United Kingdom, at least during QE1 (Butt et al (2014)).⁴⁰ According to counterfactual simulations, euro area bank lending rates to non-financial corporations might have been 70 bp higher without the ECB’s unconventional measures (Hartmann and Smets (2018)), although the impact of asset purchases is difficult to disentangle from that of other unconventional measures. Moreover, micro-data analysis suggests that the impact of central bank purchases on bank lending varies across banks, depending, among other things, on their size (Joyce and Spaltro (2014)) and/or on their holdings of the assets sought by the central bank (Rodnyanski and Darmouni (2017)).

Large-scale APPs can potentially affect financial conditions more broadly than in the immediately targeted market segment.⁴¹ In particular, they seem to lower lending rates more effectively if they target assets that are closely related to private credit

⁴⁰ According to the ECB Bank lending survey, the ECB’s asset purchases contributed to the net easing of terms and conditions and had a positive impact on bank lending (ECB (2018)). Saito et al (2014) show that lower interest rate risk related to government bond holdings following the BoJ’s purchases of long-term government bonds contributed to bank lending in Japan, more than offsetting the possible negative impact of asset purchases on banks’ interest rate spreads. Bowman et al (2015) find a positive but small impact of the BoJ’s QE on lending.

⁴¹ See eg Gagnon et al (2011), Joyce et al (2014) and Joyce et al (2011) suggesting a close to full or full pass-through to corporate bond yields.

conditions.⁴² The ECB's CSPP, for instance, induced a significant easing in financing conditions that went beyond the eligible bonds, triggering lower corporate bond spreads more generally, increasing corporate bond issuance, and encouraging banks to shift their lending towards NFCs without access to bond-based financing.⁴³

A number of alternative approaches have been used to estimate the macroeconomic effects of asset purchases. Overall, the effects have been estimated as positive for both output and inflation, but these assessments are subject to a high degree of uncertainty, depending in part on the specific methodology adopted (see Annex 2).⁴⁴ In particular, estimates of the peak response of real GDP and inflation based on a set of 25 studies using mostly DSGE and VAR models range between 0 and 4 percentage points, with the largest numbers for QQE in Japan and LSAP1 in the United States (Graph 9).⁴⁵

In their responses to the survey, central banks highlighted some side effects of APPs on the functioning of financial markets (see also Markets Committee (2019)). Some central banks reported concerns about the observed functioning of government bond markets. Examples of problems reported include lower trading volumes and a decrease in the volatility of yields (BoJ), a deterioration in market liquidity and lower turnover (Riksbank), or price dislocation for specific bonds (BoE), particularly when the central bank has accumulated a large share of the respective securities. Such scarcity effects were successfully addressed by introducing securities lending programmes and caps on central bank holdings of individual securities. In general, securities lending tends to have mitigated price dislocation for specific bonds on the repo market.

Other central banks worried about declining *money market activity*, such as falling trading volumes in unsecured and secured markets. Other concerns included widening spreads between rates – for example in repo markets in the United States. Markets

⁴² Hancock and Passmore (2011) and Krishnamurthy and Vissing-Jorgensen (2013) eg find that the Fed's QE2, while lowering Treasury bond yields, had limited effects on mortgage lending rates as the purchases were ineffective in lowering MBS yields.

⁴³ See eg De Santis et al (2018) and Arce et al (2017). For example, De Santis et al (2018) also suggest that the ECB's CSPP led to a shift in favour of euro-denominated corporate bonds.

⁴⁴ Chen et al (2012) estimate the median of the effect of LSAP2 at about 1% and the 80% probability interval between negative values and 6%. Belke et al (2017) and Thornton (2014) find no discernible effect of LSAP1 on interest rate differentials between the United States and other countries following LSAP1, which raises doubts about its effectiveness under the assumption that the effects on domestic interest rates should be stronger than those on foreign interest rates. The Federal Reserve staff's briefing to the March 2013 FOMC meeting estimated that a \$500 billion purchase programme could be expected to reduce the 10-year Treasury yield by about 20 basis points and raise GDP by 0.4%, given economic conditions at the time; (Federal Reserve Board (2013)). Engen et al (2015) document sizeable effects on interest rates from APPs but note that effects on aggregate expenditure are slow to materialise because private agents' expectations adjusted sluggishly. Pattipeilohy and van den End (2017) report that the impact of asset purchases on inflation expectations has been positive only in Japan, negligible in the euro area and even negative in the United States and United Kingdom. Weale and Wieladeck (2016) using a monthly VAR model find that "an asset purchase announcement of 1% of GDP leads to a statistically significant rise of 0.58% (0.25%) and 0.62% (0.32%) rise in real GDP and CPI for the US (UK)". Using a time-varying parameter VAR, Baumeister and Benati (2013) estimate that "compressions in the long-term yield spread exert a powerful effect on both output growth and inflation". Burriel and Galesi (2016) estimate a global VAR that takes into account cross-country interdependencies and their estimates, implying that a QE shock equivalent in size to 1% of euro area GDP has a peak impact on real GDP and HICP of 0.16% and 0.12%, respectively, with substantial heterogeneity in country-specific effects.

⁴⁵ Annex 2 analyses which features of the programmes and the economies are associated with stronger estimated macroeconomic effects.

Committee (2019) offers a detailed discussion of the interaction of large central banks' balance sheets and market functioning in bond and money markets.

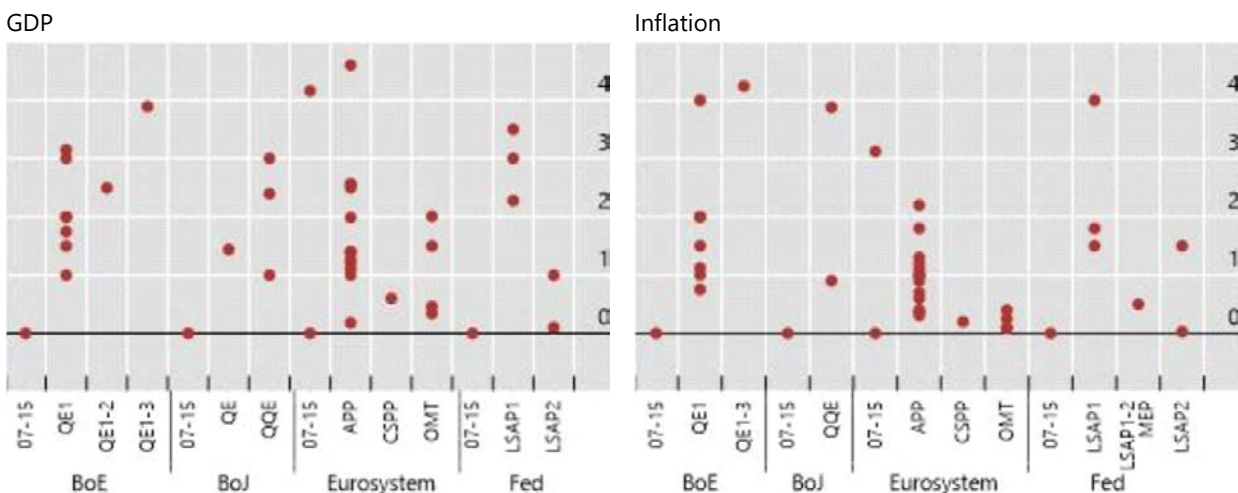
Overall central banks considered the side effects of asset purchases to have been limited so far and thus offset by their positive effects. In particular, the evidence on APPs (and LOs) affecting market prices, especially yields, is favourable. The evidence on how unconventional monetary policy more generally affected output and inflation, while also generally favourable, is more mixed and subject to more uncertainty.

An additional side effect of large-scale APPs – and, for that matter, all changes in monetary policy stance in major economies – relates to financial spillovers to other jurisdictions (see also Box C). Countries on the receiving end of capital flows have generally reported moderate to significant spillovers linked to the use of UMPTs in the major economies. In Brazil, Barroso (2017) estimates that more than 50% of capital inflow is accounted for by US quantitative easing policies, prompting a policy response in terms of macroprudential measures and regular FX intervention. Given Hong Kong's currency board system, UMPTs in the United States led to a nearly fivefold increase in the monetary base between 2008 and 2015, and to a large build-up of foreign reserves. The resulting substantial asset price inflation necessitated multiple rounds of countercyclical macroprudential measures to contain the risk of overheating. Similarly, the economies of the ASEAN-4 (Indonesia, Malaysia, the Philippines and Thailand) saw considerable capital inflows following the GFC (75% higher in the period early-2009 to May 2013, as compared with early-2005 to mid-2008). The exchange rate appreciated substantially on average against the US dollar, while interest rates fell significantly. More accommodative financial conditions fuelled an average increase in stock prices of about 220% between March 2009 and May 2013, and official reserves increased markedly (by about 70% in the same period).

Effects on GDP and inflation¹

In percentage points

Graph 9



¹ 07-15 stands for the effect of a central bank's balance sheet evolution between 2007 and 2015 from Pattipeilohy and van den End (2017). Eurosystem estimates contain values for individual countries from the euro area. Please see the Annex for the complete list of papers.

Source: Study group calculations.

Disruptive spillovers were also associated with the ending (or even just the expectations of a reversal) of APPs. The taper tantrum episode, which started in May 2013, was arguably a manifestation of spillovers associated with the expectation of a reversal of APPs. It had significant adverse effects on financial markets for several EMEs, as sell-offs in bond markets weakened currencies and triggered a flight of capital from equity markets. With the exception of this episode, however, the ASEAN-4 economies have managed to contain spillovers from foreign UMP interventions through a mix of policy tools. In particular, macroprudential measures (eg foreign currency reserve requirements, LTV ratios and limits on real-estate loan exposures) have proved to be effective in moderating credit growth and capital account imbalances.

Additional considerations regarding possible side effects are discussed in Section 3.2.3.

2.4 Forward guidance

During the GFC, the BoC, BoE, BoJ, ECB, Fed and Riksbank adopted FG. The Fed and the BoC introduced FG early on, in December 2008 and April 2009, respectively; the ECB and the BoE followed, in July and August 2013. For the Riksbank, methods for providing FG regarding the repo rate were unchanged from before the GFC, but new FG was added for asset purchases and foreign exchange interventions. Since 1999, the BoJ has used FG mostly on occasions that it eased policy.

FG was adopted during the GFC largely in support of an accommodative stance. All of the six responding central banks, with the exception of the BoE, wanted to ease monetary policy because inflation was below target; in the United States and United Kingdom, depressed output or employment was also an explicit concern. Responding central banks reported that FG, as applied to future settings of policy rates, worked through reducing long-term interest rates, both by inducing expectations of lower future short-term policy rates and by reducing uncertainty around future policy rates and hence lowering term premia.

FG was used also to address strained market liquidity (BoC, Fed and Riksbank) and excessive term premia (BoE, BoJ, ECB, Fed and Riksbank). The ECB initially also saw FG as a means to insulate the euro area yield curve from adverse international spillovers, and as a tool to reduce uncertainty about its future use of APPs.

Survey respondents thought that FG applied to APPs worked more directly on term premia – only partly by reducing uncertainty – and thus lowering long-term rates. Through these channels, FG increased asset prices, and hence financial wealth and consumption, and encouraged business fixed investment.

The way in which FG was carried out changed over time. Early in the GFC, statements tended to be relatively vague, eg avoiding specific reference to calendar- or state-contingent actions; over time, FG became more concrete and was related, first, to calendar dates – which sometimes required adjustment – and then later to economic conditions. As the crisis wore on with protracted low inflation, slow growth and policy rates mired at their lower bound, some central banks made increasing use

of more or less explicit commitments in their FG.⁴⁶ For example, the ECB initially provided neither calendar- nor outcome-based conditions when it introduced FG for the policy rate in July 2013. However, the ECB's FG regarding its APP in October 2014 was calendar-based and by 2015 the ECB included outcome-based guidance connecting policy actions to the expected intended future path of inflation.⁴⁷ In the Fed's case, FG on policy rates became connected with guidance on APPs beginning in 2014, and similarly for the ECB somewhat later.⁴⁸ In June 2018, after announcing the gradual termination of its net asset purchases, the ECB began using both calendar-based and outcome-based FG directly for the expected path of key policy rates. FG also became more outcome-based at the BoJ in conjunction with the adjustment in the policy framework, for example when the Bank announced QQE with YCC in 2016. More broadly, there was a movement toward increasingly concrete and explicit FG that seems to have been motivated by a mixture of the perceived need for stronger policy action and experience – in particular, the absence of significant negative side effects over the intervening period. The BoE began FG relatively late, adopting outcome-based FG from the outset, in August 2013.⁴⁹

Of the six responding central banks, only the Fed introduced a new vehicle for engaging in FG during the crisis. In particular, the initiation in January 2012 of FOMC participants' projections for the federal funds rate contained in the *Summary of Economic Projections* gained prominence as a tool for communicating policy intentions.

Assessment

On the whole, the surveyed central banks suggested that FG worked reasonably well. For FG applied to policy rates, the expected path of policy rates shifted down and flattened, and uncertainty was reduced.⁵⁰ For FG applied to APPs, the evidence is less

⁴⁶ The FOMC's FG, for example, became increasingly explicit, substituting "for an extended period" on 18 March 2009 to the previous "for some time" language, followed by reference to specific calendar dates: eg "at least through mid-2013," or "beginning in August 9, 2011, and running until December 12, 2012;" or referring to quantitative targets, eg FG became state-based in the FOMC statement of December 2012, indicating that the exceptionally low range for the federal funds rate would be appropriate "at least as long as the unemployment rate remains above 6½ percent, inflation between one and two years ahead is ... no more than a half percentage point above ... 2 percent ...".

⁴⁷ In January 2015, the ECB announced an APP in which "the combined monthly purchases of public and private sector securities will amount to €60 billion, and will in any case be conducted until we see a sustained adjustment in the path of inflation which is consistent with our aim of achieving inflation rates below, but close to, 2 percent over the medium term."

⁴⁸ Following the "taper tantrum" of 2013, and as the unemployment rate in the United States approached more rapidly than expected the 6.5% level specified in its December 2013 guidance, Fed language concerning the federal funds rate was linked to its balance sheet policy. For example, the Committee's March 2014 statement said "it likely will be appropriate to maintain the current target range for the federal funds rate *for a considerable time after* the asset purchase programme ends..." (Federal Open Market Committee (2014) emphasis added). Similarly, the ECB linked FG regarding the reinvestment of principal payments from its APP to the first policy rate increase.

⁴⁹ Besides specifying a threshold of 7% for the unemployment rate, the BoE's FG included "knockout" conditions relating to inflation projected 18 to 24 months ahead, medium-term inflation expectations, and financial stability. When unemployment fell below 7% more rapidly than expected, the BoE shifted the focus to a broader range of indicators of resource utilisation.

⁵⁰ In particular, the BoE reported that private agents' uncertainty regarding future levels of the Bank's policy rate was reduced. See eg Carney (2018).

clear, in particular for the United States, while the ECB reported signs of reduced uncertainty about future policy rates.⁵¹

Central banks suggested that trade-offs were apparent in the specificity of FG, especially outcome-based FG. Some saw the need to specify knockouts (or “escape clauses”) or threshold-based policy strategies, the latter providing the option, but not the obligation, to adjust policy when the threshold condition is satisfied. However, these central banks noted that clearly communicating thresholds was challenging. In real time, central banks saw risks of being misunderstood. For example, Broadbent (2017) stressed that the BoE’s MPC did not commit the Bank unconditionally to any fixed path for interest rates in relation to the BoE’s FG.

Research studies generally suggest that FG was effective in reducing yields, but they find differences in the degree of effectiveness. Swanson (2018a,b) finds that the effects of the Fed’s FG were generally comparable with those of changes in the policy rate. Similarly, the ECB’s FG was found to have the largest impact on bonds of intermediate maturities (Leombroni et al (2018)). There are, however, certain instances where FG appears to have had only limited effects, as for example, in Sweden after 2009. This may have been because the information in the FG was already largely contained in Riksbank’s regularly published reports (Woodford (2013)). FG at the ELB also reduced short-term interest rate volatility (Filardo and Hofmann (2014); Chang and Feunou (2011)) and FG in the United States reduced interest rate uncertainty, independent of effects on the expected levels of rates (Swanson (2018a)).⁵²

Finally, there is FG that is intended to minimise the likelihood of adverse tail events, as exemplified by ECB President Mario Draghi’s 2012 “whatever it takes” remark. By all accounts, this announcement had an immediate and lasting effect on the euro area economic outlook (Alcaraz et al (2018)). The remark’s outsized effect, and the critical timing at which it occurred, point to the possible role that monetary policy in general, and FG in particular, can play in ruling out adverse self-fulfilling outcomes, at least in some circumstances.⁵³ Coming as it did at a time of heightened

⁵¹ Distinguishing between the effects of the FG from the APPs themselves is thorny; for this reason, many authors decide to include only FG as applied to future settings of policy rates. As for the effectiveness of FG as applied to APPs, much of the debate centres on the duration of the effects. See eg Swanson (2018a) and references therein. Hattori et al (2016) find that unconventional monetary policy announcements substantially reduced option-implied equity market tail risks and interest rate risks. Most of the impact derives from forward guidance rather than asset purchase announcements.

⁵² Studies finding an effect of FG at the ELB include He (2010) and Woodford (2013) (for Canada); Campbell et al (2012), Kool and Thornton (2012), Filardo and Hofmann (2014) and Swanson (2018a,b) (for the United States); Filardo and Hofmann (2014), Coenen et al (2017) and Andrade and Ferroni (2018) (for the euro area). Standard DSGE models tend to grossly overstate the impact of FG compared with the effects found in empirical studies (Del Negro et al (2013)).

⁵³ President Draghi’s remark signalled the determination of the ECB, within its mandate, “to have a single monetary policy in the euro area, to maintain price stability in the euro area and to preserve the euro So *unfounded fears* of reversibility [of the euro] would be dissipated” (Draghi and Constâncio (2012) emphasis added). Thus the remark had an impact by shifting expectations towards a positive outcome without introducing a concrete commitment to a specific action. It was akin to a policy intervention in the bank run model of Diamond and Dybvig (1983) without the commitment of deposit insurance. The ECB’s OMT programme can be regarded as delivering in part on the ECB President’s promise, giving a concrete indication of the actions that would be taken in case of the emergence of “unfounded fears”.

uncertainty, the remark substantially reduced the importance of redenomination risk in market participants' expectations.⁵⁴

Overall, central banks noted few adverse side effects that would not also be associated with conventional expansionary interventions. One incident of note, however, was the "taper tantrum" in the United States that began in May 2013. Market participants apparently mistook Fed communications regarding adjustments to its APP as a signal of the stance of monetary policy as a whole. This experience underlined for Fed officials the need for simplicity and persistence in communicating the FOMC's intentions. A smaller-scale example of the same phenomenon was the rise in market volatility surrounding the ECB's October 2014 communication on the key operational details of two additional APPs involving asset-backed securities and commercial bonds, which were seen as lacking in detail (Coenen et al (2017)).⁵⁵

An important question, noted by some respondents to the survey, regards the nature and quantity of public communication by central banks. One possible effect of overreliance on FG may be to reduce the incentive of private sector agents to independently form their own forecasts of economic developments. This can lead to herding behaviour, with market participants relying on central banks' views on the outlook for their own business decisions. Properly done, FG contains information about the central bank's economic outlook and about how that outlook influences the future stance of policy. Distinguishing between these two elements is a challenging task for market participants and, by extension, it also complicates the design of effective FG. The effectiveness of FG depends critically on central bank credibility: hence, its use should not undermine it. It might be advisable, from this perspective, for central banks to avoid making commitments on which they are not reasonably confident they can deliver.

2.5 Sequencing and coordination of UMPs

According to the central banks' responses to the Survey of UMPTs, the sequence in which UMP tools are deployed matters for their effectiveness.⁵⁶ In the GFC's early phases, sequencing and coordination among UMPTs was dictated mainly by events. The use of tools directed at repairing the transmission mechanism preceded the employment of tools aimed at achieving a more expansionary monetary policy stance. For example, LOs initially addressed liquidity shortages, and later – through conditional lending schemes – provided further monetary policy accommodation. LOs also started to be coordinated with (or substituted by) other types of unconventional tool. The degree of coordination intensified as policy rates reached their ELBs. In coordinating the UMPTs, FG clearly plays a special role, as all the other tools rely on some form of communication concerning the nature of the announced

⁵⁴ This class of FG can be thought of as an exercise in equilibrium selection in dynamic games, or as an attempt to rule out off-equilibrium paths. Loosely speaking, some of the backstop technologies can serve in approximately the same role, albeit in a slightly different context.

⁵⁵ A decline in market functioning in Japan that was initially associated with the BoJ's yield-curve control programme was addressed by allowing greater fluctuations in JGB yields.

⁵⁶ Seven AE central banks (BoC, ECB, BoJ, Riksbank, SNB, BoE and Fed) and two EME ones (BCB and BoM) responded to this section of the survey. Hubrich and Tetlow (2015) provide empirical evidence on the weakness of conventional monetary policy during a financial crisis.

policy intervention and, in particular, the horizon over which it will be enacted. At the same time, LOs and APPs provided markets with concrete evidence of central banks' willingness to follow through on their FG announcements providing for a prolonged period of low policy rates. For example the ECB's VLTROs and TLTROs did so through their longer maturities and low rates. APPs, resulting in an expanded central bank balance sheet, lowered the perceived probability of a policy rate hike. As a further by-product, APPs enhanced the effects of LOs by raising the value of intermediaries' assets and potentially increasing their willingness to lend.

The experience reported by the ECB sheds some light on central banks' efforts to appropriately sequence and coordinate UMPT measures, particularly very low rates, FG and APPs. First, beginning in March 2016, the ECB made explicit its deployment strategy: it recalibrated the APPs, introduced the TLTRO-II programme, and started to give consistent indications about the likely sequencing of adjustments to net asset purchases, key policy rates and reinvestments. Instruments were also linked together. FG on policy rates was linked to the end of net asset purchases: prior to April 2018 key interest rates were expected to remain at existing (or lower) levels "for an extended period of time and well past" the horizon of the net asset purchases. However, in June 2018, reflecting an anticipation that net asset purchases would terminate by the end of 2018, the ECB announced that key policy rates were expected to "remain at their present levels at least through the summer of 2019". Similarly, the horizon of the reinvestment policy has been explicitly linked to the end of net asset purchases since October 2017 and to the first rate hike since June 2018. All these tools were found to interact in various ways. Negative rates also supported the effectiveness of long-term LOs, since the minimum achievable rate for TLTRO-II was equal to the deposit facility rate. By reducing funding costs to the banking system, APPs and interest rate cuts interacted with TLTROs, bringing additional funding relief for banks participating in the operations; this in turn lowered their lending rates by more than those of non-participating banks. By supporting reduced bank funding costs, TLTROs may have also supported the effectiveness of negative rates.

A further example of UMPT coordination is provided by the BoE decision, in August 2016, to further cut the Bank rate to 0.25%, a new low level. The TFS was announced at the same time to reinforce the pass-through of the cut in the Bank rate, as well as by the announcement of a new APP, including both government and corporate bonds. All these interventions were seen as mutually reinforcing.

The comprehensive set of measures enacted by the BoJ from 2010 onwards – namely the CME and the various QQE vintages – were directed simultaneously at multiple intermediate targets, including lengthening low-for-long policy rate expectations, lowering long term rates and risk premia and, from 2013 onwards, raising inflation expectations.

In the Riksbank's experience, low rates, together with fixed rate liquidity provision, interacted to ease credit conditions (by reducing liquidity risk premia) and enhance the credibility of FG regarding the interest rate forecast. The Riksbank's internal analyses also show that interest rates on longer-term interest-bearing instruments, such as government and mortgage bonds, fell when the Riksbank published a forecast of a low repo rate path over a long period of time and at the same time announced a fixed-rate loan. The largest effects observed were on bonds with maturities of up to two years, where rates fell in total by up to 40 basis points.

Negative rates and the willingness of the SNB to conduct FX interventions complemented and reinforced each other. With interventions, banks' reserves

increased, leading to an increase in the negative interest payments the banks had to make. This discouraged banks and hence their customers from shifting FX funds into Swiss francs.

Sequencing of UMPTs is relatively little discussed in the literature. In a pre-GFC analysis of monetary policy tools to use in a low-interest rate environment, Bernanke and Reinhart (2004) argue that neither communication about future policy rates nor changing the composition of the central bank's balance sheet requires the policy rate to be at zero, and that the appropriate sequence of policy actions depends on the perceived cost associated with very low overnight rates. Among these costs, they note the possibility that the public might perceive a near-zero rate as a signal that monetary policymakers have run out of tools. Brunnermeier and Koby (2018) argue that asset purchases should be undertaken only after standard interest rate policies are exhausted. They point out that a policy rate reduction can induce an increase in asset values on banks' balance sheets, and a revaluation of their securities portfolios could help banks offset any negative effect on profits stemming from the contraction in interest rate margins. This channel can lower the "reversal-rate" threshold and preserve the effectiveness of policy rate cuts. In contrast, by first reducing the quantity of longer-term (higher-yielding) assets on a bank's balance sheet, APPs could accelerate the emergence of a reversal rate, and should thus be implemented only when short-term rates cannot be lowered further.

Curdia and Ferrero (2013) provide some evidence of mutual reinforcing effects of asset purchases and FG that rely on the interaction of the signalling and the portfolio rebalancing channels. In the light of relatively scant direct evidence that market segmentation is quantitatively important – a premise for the portfolio rebalancing channel to be effective – their analysis finds that the stimulus provided by APPs depends on their interaction with FG through signalling.

Similarly, the credibility of a central bank's FG may be considerably enhanced if the bank has an APP in place at the same time. Ehrmann et al (2018), building on previous analysis by Coenen et al (2017), assess the effectiveness of FG in a panel of countries by looking at the response of Treasury yields to macro news. If FG is effective in managing expectations about the future course of monetary policy, then Treasury yields at certain maturities should generally be less responsive to news (as documented, among others, by Swanson and Williams (2014)). The paper finds substantial differences in the effectiveness of FG in reducing the responsiveness of bond yields to news, depending on the form of FG (time-contingent, state-contingent etc), but finds that these differences are unequivocally reduced when there is also an APP in place. Titzck and van den End (2019) find evidence of interaction effects between different dimensions of balance sheet policies on bond yields and the exchange rate. Specifically, they find that bond yields and the exchange rate are affected by a joint shock to the size of the central bank's balance sheet and the duration of its asset holdings.

Inui and Kaihatsu (2016) analyse in a theoretical model yet another interaction between forward guidance and asset purchases. They argue that income uncertainty arising from incomplete markets limits traditional intertemporal substitution effects, thereby reducing the effectiveness of forward guidance after a negative demand shock. In this context, asset purchases – which are associated with positive wealth effects – can reduce households' precautionary savings, restoring the strength of intertemporal substitution effects from FG on policy rates.

Coordination of unconventional monetary policy with other policies

UMPTs were not the only tools deployed by policymakers during the GFC to deal with the financial and economic contraction. A number of structural, fiscal, microprudential and macroprudential policies were also introduced. While all these measures were broadly directed to overlapping objectives, some of them could interact negatively, while others might engender synergies.⁵⁷ A case in point is the interaction between APPs involving sovereign securities that are intended to induce scarcity in particular segments of this market, and public debt management policies involving the issuance of the same class of securities, which can thereby reduce their scarcity. Similarly, the effectiveness of fiscal expansions has often been associated with the ability of central banks to commit to low-for-long policies, as documented by the literature on fiscal multipliers (eg Christiano et al (2011); Woodford (2011)). On the macroprudential side, measures aimed at increasing the perceived creditworthiness of financial intermediaries helped to repair the transmission channel of monetary policy, thereby allowing for a more effective monetary policy stimulus.

The survey reveals that, while explicit coordination of UMPTs with macroprudential policy or fiscal policy was deemed effective, in practice it occurred only in a few countries. The BoE adjusted prudential policies to support the effectiveness of UMP tools and to mitigate the potential negative consequences of incurring financial constraints because of increased liquidity provision to banks. In August 2016, for example, the BoE coordinated monetary policy with both macroprudential policies (reduction in countercyclical capital buffers) and microprudential policies (exclusion of reserves from the leverage ratio).⁵⁸

The BoE also coordinated explicitly and in advance with the Treasury on the design and implementation of some UMPTs. Specifically, QE and the funding programmes were supported by the Treasury's indemnity to mitigate risks to the central bank's balance sheet. Similarly, the BoC worked closely with the Department of Finance and other domestic bodies that coordinate actions on financial sector policy to monitor the liquidity conditions and risk management of major financial institutions. The BoJ coordinated monetary policy with fiscal and structural policies by issuing joint statements, with each institution remaining responsible for its own targets. Although they did not explicitly coordinate on the implementation of particular UMPTs, the US Treasury supported in various ways the policies of the Federal Reserve during the crisis, notably with the establishment of a Supplementary Financing Programme (SFP).⁵⁹ The BCB and BoM also coordinated monetary policy with their respective fiscal authorities.

Additionally, the BCB plays a major role in monitoring and acting to ensure financial stability. This is achieved through macroprudential interventions either

⁵⁷ Using a DSGE model of a two-region monetary union, Arce et al (2016) show that, in the context of a crisis scenario *cum* binding ELB, positive synergies may be enjoyed in both regions from the *joint* implementation of interest rate forward guidance, a fiscal expansion in the region with sufficient policy space for it, and structural reforms in the region without such fiscal space.

⁵⁸ Aikman et al (2018) show that deploying countercyclical capital buffers may be better than using only the interest rate in a situation of domestic financial instability.

⁵⁹ Established in September 2008, the SFP comprised a series of special Treasury bill auctions, of which the proceeds were maintained in an account at the New York Fed. Its purpose was draining reserves from the banking system, hence offsetting the reserve impact of the Fed's lending and liquidity initiatives.

directly or through the national monetary council, of which the BCB's Governor is a member. (IMF (2013)).

3. Lessons for the future

The review of UMPTs in the previous section points to a broadly positive assessment of their effectiveness in dealing with the GFC and its aftermath. The tools have provided stimulus to the real economy and helped to avoid the un-anchoring of inflation expectations once policy rates reached the ELB. They provided additional policy space when conventional monetary policy was constrained, thereby forestalling deflationary risks and supporting economic recoveries. They are also seen as effective in overcoming impairments in the transmission channels of monetary policy and in containing risk premia in stressed markets, thus contributing to economic and financial stability. At the same time, the analysis contained in Section 2 underlines that there is no "best practice" for the use of UMPTs in all circumstances or jurisdictions. The appropriate use of UMPTs depends critically on each different legal, institutional and policy environment.

Looking forward, this experience suggests that central banks would benefit from maintaining a suite of unconventional tools as a complement to their conventional toolbox. However, the specific tools, the sequence of their deployment, and the coordination with other policies will depend on a number of factors specific to each jurisdiction's circumstances and institutional characteristics. These factors include the scenarios confronted by central banks, the features of the economic and financial environment in which policy is conducted, the legal framework under which the central bank operates, the constraints on the efficacy of conventional tools, and the central bank's ability to manage the side effects of unconventional tools. In particular, clarity in the way that UMPTs fit within the existing legal framework where monetary policy operates is an important determinant of the efficacy of the tools themselves and their market impact.

This section begins by presenting scenarios that appear relevant from today's vantage point (Section 3.1). They cover two sets of situations where UMPTs have been used since the GFC: the emergence of the ELB constraint, and various disruptions in the transmission channels of monetary policy. They illustrate situations in which the use of unconventional tools would be beneficial in the future, without implying that they should be the first course of action, or that they should be used in isolation. By the same token, central banks may also find the deployment of UMPTs useful even outside the circumstances of these two types of disruptive scenario.

Section 3.2 discusses how coordination of monetary policy with other policies (in particular, macroprudential and fiscal policies) could, on the one hand reduce the likelihood that these scenarios materialise, thus reducing the need to resort to UMPTs, and on the other hand, enhance the effectiveness of both conventional and unconventional policy. The discussion also covers the virtues of integrating UMPTs within the central bank's monetary policy framework and addresses a number of issues of which central banks should be aware in deploying UMPTs. These include limits to the scalability of tools, potential negative spillovers and undesirable side effects that may arise from their prolonged use. The discussion highlights the importance of avoiding overreliance on UMPTs in a way that creates the impression that either monetary policy can be the only active field of public policy, or that

policymakers may feel compelled to deviate from the pursuit of their mandated goals in order to accommodate fiscal or private sector choices.

3.1 The use of UMPTs: under what circumstances and how often?

As noted above, the scenarios that could induce central banks to deploy UMPTs in the future may include varying degrees of disruption to the transmission of monetary policy (DTC) and/or constraints imposed by the ELB. The scenarios described below are broadly illustrative but are not meant to be comprehensive. Central banks may decide to deploy UMPTs in other situations where they judge that these tools can complement conventional instruments in achieving their mandated objectives.

Broadly speaking, the two types of problem, ELB and DTC, do not necessarily materialise together. In particular, scenarios involving the ELB often relate to contractions in economic activity, accompanied by disinflationary pressures, which may require central banks to provide more accommodation than they can achieve by lowering the policy rate to the ELB. In turn, DTC scenarios reflect problems in financial intermediation that impair the transmission of policy. From a narrow perspective, DTC problems may impede the pass-through of the policy rate to the short-term interbank and other money market rates that constitute the very first stage of the transmission mechanism. From a broader perspective, DTC problems may impair the pass-through of money market rates to general financial conditions (eg bank lending rates, sovereign yields etc), to aggregate demand and, ultimately, to inflation.

The next two subsections present some stylised ELB and DTC scenarios. They provide examples of each kind of scenario, and discuss the economic and structural drivers that give rise to the scenarios and can affect their likelihood.

3.1.1 ELB scenarios

Given what appears to be a lower structure of nominal interest rates in the 21st century, many central banks will be experiencing policy rates, even in expansions, that are low compared with those of the second half of the 20th century. More formally, the natural real rate of interest (r^*) can be defined as the real rate consistent with inflation being at the central bank's target level and output being at its potential level (see eg Woodford (2003); Laubach and Williams (2003)), ie the real rate that the central bank typically seeks to engender in the medium term.⁶⁰ To provide accommodation, a central bank would typically steer the real policy rate below its estimate of r^* , by setting the appropriate level for the nominal policy rate.

Scenarios involving the ELB constraint feature an unfavourable combination of a relatively low level of r^* and low short-term inflation expectations. This combination can emerge for a number of reasons, the most typical of which are negative demand (equivalently, positive saving) shocks. In this respect it is useful to think of r^* as comprising a longer-run, or trend component ($\text{trend-}r^*$), and a shorter-term component. While both components are important for the likelihood of ELB episodes, they are typically influenced by different factors that deserve different policy considerations. The trend component is affected by secular factors that determine the long-run balance between desired investment and desired savings, and in the

⁶⁰ Typically central banks have medium-term horizons for their goals. This implies that they do not aim to engender a real rate equal to r^* at each point in time, but only in the medium and long term.

recent debate the estimated declines in trend- r^* have been associated primarily with three factors. One factor relates to demographic shifts: an increase in desired savings in anticipation of a longer retirement period in line with longer life expectancy, generally depresses trend- r^* .⁶¹ A second factor refers to a slowdown in trend productivity growth.⁶² The third factor relates to the secular increase in the demand for liquid and safe assets, which depresses the returns of government securities relative to those of risky assets.⁶³

In the shorter run, r^* fluctuates around its trend in response to cyclical forces (shocks). During the GFC, for example, r^* fell sharply, driven by disruptions in the financial sector and overall uncertainty, which dramatically reduced desired spending. Under these circumstances, the problem of tracking r^* when setting the nominal policy rate could be exacerbated by a sharp decline in inflation expectations, highlighting the importance of firmly anchoring the latter.

The discussion below considers two potential channels through which the ELB scenario could materialise. The first pertains to domestic demand (saving) shocks, while the second relates to the effect of foreign shocks (spillovers) on small open economies (SOEs).

1. Domestic demand shocks

An unanticipated fall in aggregate demand (ie an increase in relative saving) will depress nominal interest rates, but the risk that rates drop to the ELB depends clearly on the magnitude and persistence of the shock, the level of r^* , and prevailing inflation expectations. Furthermore, once the ELB is reached, the inability of the central bank to provide stimulus to the economy through conventional means could engender further contractions in inflation, and possibly in r^* itself.

In a severe ELB scenario, the economy is confronted with a *large negative demand shock* that lowers r^* well into negative territory. This large shock could imply that the necessary accommodative stance cannot be best achieved with conventional tools alone. Using a broader range of UMP interventions would thus be warranted. This scenario could emerge because of a domestic demand shock, but it could also materialise in the context of a globally synchronised downturn and/or against the backdrop of unwinding macroeconomic and financial imbalances.

The limited ability of a central bank to adopt a sufficiently expansionary stance with its conventional tools could give rise to deflationary forces if the shock leads to un-anchoring of longer-term inflation expectations. A severe negative demand shock could also reinforce the secular decline in the trend- r^* . This effect could materialise as a consequence of policy errors or delays. If, for example, the central bank does not provide sufficient stimulus in response to a severe shock, the short-run demand deficiency could become entrenched (eg through hysteresis effects) and drag down long-run potential growth (eg Summers (2014)). In an extreme scenario, tail risks of

⁶¹ This effect typically offsets the decline in savings due to the increase in the dependency ratio. Several studies point to a decline in trend- r^* of at least one percentage point (Carvalho et al (2016), Gagnon et al (2016), Lisack et al (2017)).

⁶² See Gordon (2015). The decline in the demand for capital was also exacerbated by changes in risk perceptions following the financial crisis (Kozlowki et al (2018) Brand et al (2018)).

⁶³ See Del Negro et al (2017, 2018). The demand for safe and liquid asset is germane to the global saving glut hypothesis, as advanced to explain the large capital inflows to the United States after the Asian emerging market crisis in the late 1990s (Bernanke (2005); Caballero et al (2017)).

deflation could materialise, depressing aggregate demand, as consumption and investment could retreat sharply.

It is conceivable that central banks may find it useful to deploy UMPTs in response to relatively *mild negative demand shocks* that raise the prospect of an impending ELB event. This might be the case if they judge that there are policy gains from a pre-emptive expansionary action. In this case, central banks might choose to cut rates more rapidly than they otherwise would have – and more rapidly than the public might expect – were they not facing the risk of being constrained by the ELB. As long as the real rate implied by the policy action remains below r^* , the stance of monetary policy would be expansionary, increasing the likelihood of an upward correction of inflation expectations. This may be advisable, even if such a move would leave less space for further moves, should further negative shocks emerge. In other words, policymakers may choose to sacrifice the opportunity to reap potential benefits associated with improved business sentiment in response to future interest rate action in order to provide greater stimulus overall. However, because the public could misinterpret the rapid decline in the policy rate as the signal that the incipient contraction is more severe than is actually the case, such a scenario presents central banks with a noteworthy communication problem. So while this scenario may not require the use of central bank balance-sheet policies, it would require adroit use of FG, before the policy rate sinks to the ELB, in order to manage expectations effectively.⁶⁴

It should be noted that monetary policy is not the only policy tool available to confront large contractions and, in principle, may not even be the most appropriate. Under these circumstances, fiscal tools might have more traction and, potentially, fewer side effects. That said, if fiscal authorities were unable to react with sufficient promptness and vigour to the economic contraction, a decisive monetary intervention could forestall a spiralling deterioration of economic conditions.

2. *Spillovers to SOEs*

In SOEs, pressures that can bring interest rates to the ELB are heavily influenced by global economic and financial conditions (eg Kearns et al (2018)). For example, aggressive easing of monetary policy in a major economy can lead to large capital inflows to an SOE as investors seek assets yielding more attractive returns. SOEs perceived as safe havens are quite likely to be subjected to such pressures and, because of the small size of their capital markets, they may face adverse consequences such as a sharp appreciation of the exchange rate (which could destabilise domestic price dynamics) or a surge in the supply of credit (which could generate domestic imbalances). The policy rate required to deter these excessive capital inflows could be well below the ELB. Central banks in SOEs may have not only

⁶⁴ See Reifschneider and Williams (2000) on why it is not optimal for a central bank to “keep its powder dry” in the presence of an incipient ELB event. An example of policy along these lines is the asymmetric rule of Chung et al (2019), who study monetary policy options at the ELB using the Fed’s FRB/US model. Although more time is spent at the ELB under such a rule than under standard rules, economic outcomes are somewhat better. All of the simulations ran by these authors are based on model parameters and shocks estimated on macroeconomic data over the past five decades and the binding ELB is defined under the assumption that no other UMPTs are enacted. Kiley (2018), extending the analysis of Kiley and Roberts (2017) by including QE in the CB policy toolkit, finds that QE can improve economic performance significantly when the policy rate is at the ELB.

to cut rates to the ELB but also to resort to unconventional policies (possibly in conjunction with other policies, such as macroprudential measures).

This kind of pressure was observed during the GFC (see Section 2, esp. Box C). One could expect these episodes to increase in frequency as major economies find themselves at the ELB more often. That said, some of the spillovers from the use of UMPTs in major economies took the form of credit booms in other (smaller) economies, necessitating the use of restrictive measures (see discussion in Section 3.2.3 below).

Likelihood of ELB scenarios

The two key determinants of the likelihood of ELB scenarios are the level of r^* and the size of potential shocks relative to the distance between r^* and the ELB.

In a mechanical way, the lower the level of r^* , the greater the likelihood that a given shock may drive rates close to the ELB. Numerous studies have used a variety of term structure and macroeconomic models, as well as different methodologies to provide estimates of r^* .⁶⁵ Most studies find that the decline in the natural rate started in the 1980s, and accelerated at the inception of the GFC. For example, Holston et al (2017) estimate that the level of r^* for four large economies (China, the euro area, the United Kingdom and United States) was between 2 and 3% before the GFC. Using their methodology, as of Q4 2018, estimates range between -0.26 and 1.4% . Several researchers have used historical data since the 19th century to provide a longer-horizon perspective on global trends in interest rates (Del Negro et al (2018); Hamilton et al (2016); Borio et al (2017)).

Despite large statistical uncertainty surrounding point estimates of r^* ,⁶⁶ and differing views on the relative importance of structural forces driving its decline,⁶⁷ the consensus is that, in most economies, trend- r^* is between 1 and about 2 percentage points lower today than on average in the past quarter century. The low levels of trend- r^* narrow the scope for conventional monetary policy, since negative shocks that push down r^* could require policymakers to reduce the policy rate to a level below the ELB. To provide a perspective from one jurisdiction, during the previous three recessions in the United States, the FOMC cut the target federal funds rate by about 5 percentage points on average. With the long-run nominal federal funds rate currently estimated to be between $2\frac{1}{2}$ and $3\frac{1}{2}\%$,⁶⁸ the FOMC would be more likely

⁶⁵ See for example Table 1 in the Bank of England Inflation Report, August 2018, p 40.

⁶⁶ Fiorentini et al (2018) estimate the dynamics of r^* since the 1890s in 17 advanced economies using an approach that considerably reduces the uncertainty around the estimates compared to other methods.

⁶⁷ Holston et al (2017) attribute the decline primarily to a decline in trend growth, and also find significant co-movement in the declining trends of the economies considered, suggesting that global factors influence r^* . Del Negro et al (2017) attribute at least a third of the estimated decline in the US natural rate to an increase in the “convenience yield” (as per Krishnamurthy and Vissing-Jorgensen (2011)). Extending the analysis to several countries, Del Negro et al (2018) find that the increased demand for safe and liquid assets is also the primary driver of the decline in global real rates.

⁶⁸ This is the range of FOMC participants’ assessment of the longer-run federal funds rate in the March 2019 SEP. Assuming that expected inflation is anchored at the 2% target, this range reflects an estimated range of r^* between 0.5 and 1.5%.

constrained by the ELB in a future downturn than it was in the pre-GFC period. Other central banks would face a similar situation.⁶⁹

The likelihood of ELB episodes depends not only on the level of the natural rate but also on the nature and amplitude of the economic shocks that can push rates lower. A key factor in the link between shocks and changes in the policy rate is the form of the assumed monetary policy rule. Kiley and Roberts (2017), using both a DSGE model and the Fed's FRB/US model, estimate that with an r^* of 2% and a simple Taylor-type policy rule, the ELB frequency in the United States would be about 20%. With an r^* of 1% instead, and the same policy rule, the ELB frequency would be about 40% (with each episode lasting on average 10 quarters).

Broadly consistent with this finding, Chung et al (2019) estimate the probability of the ELB binding in the United States at some point over the next decade to be about 20–40%, assuming a longer-run natural rate of 0.9–1.5% and a simple Taylor rule. However, under an asymmetric rule where the central bank eases more rapidly at the onset of a recession, the probability of being at the ELB would increase to 35–50%.

It must be noted that a low policy rate elicited by a lower trend- r^* may be problematic for reasons independent of the likelihood of ELB episodes. Low rates driven by trend declines in r^* may end up amplifying the financial cycle without commensurate gains for the real economy. This point, which is discussed further in Section 3.2.3, relates to the calibration of the overall policy stance, and the use of macroprudential policies, rather than to the use of UMPTs *per se*.

3.1.2 DTC scenarios

A second set of circumstances that might call for the use of UMPTs are disruptions to various links in the chain of transmission from monetary policy actions to macroeconomic outcomes.

This section presents three generic DTC scenarios. The first describes problems in the money markets, which are the ones most closely linked to central bank operations and interventions. The second relates to actual, or perceived, deterioration in balance sheets of financial intermediaries that result in a contraction in the supply of credit to the real economy. The third focuses on actual or perceived strains in the government's balance sheet resulting in abnormal valuations in sovereign debt and/or anomalies in currency markets. In the latter two scenarios, in addition to the rationale for possible use of UMPTs, there is also scope for other types of policy intervention. As discussed in Section 3.2 below, the further away the disruption is from the initial links of the transmission chain, the more important and necessary it is to justify whether the intervention is a central bank task. These scenarios are indicative and they are neither mutually exclusive (real world situations can combine features of several scenarios) nor an exhaustive list of DTC situations.

1. Money market stress

As highlighted in Section 1, money markets are the first link in the transmission chain of monetary policy. Stress can arise in the interbank market (where participants are

⁶⁹ The Bank of Canada estimates the equilibrium nominal rate to be between 2½ and 3½% while the Bank of England puts it at 2 to 3%, based on an estimate of trend- r^* of 0–1%. Both central banks underwent cumulative reductions of their official rates of around 4 percentage points in each previous downturn.

institutions with access to central bank liquidity) due to market segmentation, to uncertainty about counterparties' creditworthiness, or to the quality of collateral that backs some transactions.

Disruptions in the interbank market relate mainly to the availability and circulation of liquidity. As liquidity ceases to flow seamlessly through the interbank market, the link between the policy rate and other money market rates weakens. This problem, in turn, reverberates across non-bank financial institutions that play an important role in the funding of both banks and the real economy. The pass-through of policy rates to non-interbank rates can also be disrupted by increased dispersion of traded rates within the same market, sharp reductions in term interbank activity, lower counterparty limits in unsecured markets, and higher haircuts in the secured segment. This segmentation of markets may hamper central banks' ability to steer interest rates relevant to broader financial markets. In such circumstances, targeted unconventional central bank operations could be a remedy.

If left unresolved, these disruptions could bring about an alignment of market perceptions with a "worst case" scenario (eg insufficient liquidity in the banking system), giving rise to the risk that negative market beliefs become self-fulfilling. The likelihood of such an adverse cycle developing depends, among other things, on a number of structural factors such as the business models of banks (eg deposit-based vs market-based funding) and the standard (conventional) operational framework of the central bank (structural liquidity deficit or surplus). It thus calls for policy interventions that are tailored to the specificities of each jurisdiction, and possibly coordinated with non-monetary tools, especially as the interventions may entail risks of moral hazard for indebted private sector entities (see Section 3.2).

2. Impairment to the credit channel

Even if money markets function smoothly, obstructions to the transmission mechanism may arise from an unwarranted rise in bank funding costs that disrupts the bank-lending channel. An increase in bank funding costs can limit the ability of banks to pass on reductions in policy rates leading to higher cost and lower availability of credit to their borrowers.⁷⁰ A number of factors can cause such a scenario. Often the source of the banks' vulnerabilities is linked to excessive risk-taking in the past combined with a large unanticipated fall in the value of their assets. Shortfalls in banks' capital positions can in turn lead to deleveraging and asset fire sales that affect the whole sector and possibly lead to a widespread increase in funding costs. Historically, this deleveraging process has been a key characteristic of financial crises, including the GFC. Impairments in the bank credit channel can also come from a sudden, significant drop in the exchange rate or a speculative attack on government debt, as discussed in the next section.

Weakening balance sheets, fire sales and capital outflows could also occur in the non-banking, or shadow banking sectors, particularly if these are subject to lighter regulatory and supervisory scrutiny. In financial systems where these sectors play a significant role in the transmission of monetary policy, a carefully directed use of

⁷⁰ See, among others, Kishan and Opiela (2006) and Albertazzi and Marchetti (2010).

UMPTs can help raise the valuations of financial institutions' assets, thereby boosting their capital positions and mitigating the deleveraging process.⁷¹

In these scenarios the difficult task confronting central banks is to distinguish situations of genuine systemic disruption from situations where distress is confined to particular institutions. In the former, an intervention with a general tool such as monetary policy is warranted. In the latter, a more targeted intervention might be more appropriate and effective. It is also important to distinguish liquidity or funding problems from solvency problems, which are most adequately addressed by recapitalisation and prudential or resolution measures.

3. *Sovereign debt and currency anomalies*

Another scenario involving disruptions to the transmission mechanism relates to abnormal valuations of sovereign debt or large unwarranted movements in the domestic currency. While, in principle, these events can be driven by different factors, they often arise at the same time and are therefore discussed together.

Although collapses in sovereign debt prices and/or the exchange rate are the more common and pernicious forms of disruption, sharp movements in the opposite direction can also be harmful to the transmission of monetary policy.

The first case typically results from a serious deterioration of the government's fiscal position – or market participants' perception of such – which affects its creditworthiness. In extreme cases, these perceptions lead to sharp falls in sovereign debt prices and yield spikes that reverberate across the financial system. This "contagion" to other asset classes can work through a number of channels. For one, sovereign difficulties translate into a higher "country risk" that affects all domestic borrowers and other assets priced off the government yield curve. In addition, declines in sovereign debt prices can spread through investors' portfolio rebalancing.

The disruption to the transmission mechanism could be particularly severe if there is an interaction between government and private balance sheets that can lead to self-reinforcing market dynamics. For example, a deterioration of banks' balance sheets may create expectations of government bailouts. As higher contingent liabilities weaken the perceived fiscal position, the prices of government securities could fall to reflect higher credit risk. This further impairs the balance sheet of banks with large government bond holdings, requiring even larger bailouts, and so on.⁷² In the extreme, concerns about fiscal sustainability could even be self-fulfilling: sovereign spreads could rise far enough to trigger defaults even if both the public and private sectors are fundamentally solvent. In this instance, central bank asset purchases could play a useful role in forestalling the self-reinforcing dynamics and preventing the disruptive self-fulfilling dynamic from materialising, as long as they do

⁷¹ See Gertler and Karadi (2011) for a model where central bank asset purchases help to relax banks' capital constraints in a financial crisis.

⁷² See Farhi and Tirole (2017) for a model where sovereign-bank "doom loops" amplify concerns about domestic sovereign credit worthiness or domestic banks' health concerns. For models where the doom loop arises due to multiple equilibria, see eg Cooper and Nikolov (2018) and Brunnermeier et al (2016).

not act as a cover for fundamental creditworthiness problems that must be addressed through adjustments in government finances.⁷³

Sudden and large depreciations of the domestic currency can also significantly impair the transmission mechanism. This is typically the case when domestic financial intermediaries (as well as households or non-financial firms) have significant borrowing in foreign currencies. The ensuing deterioration of their balance sheets can disrupt the credit channel along the lines described above.

Finally, a possible constellation (especially common among developing economies) involves a simultaneous sudden downward repricing of sovereign debt and mounting depreciation pressure on the domestic currency (Reinhart (2002)). One related example is the redenomination risk that may emerge in multi-country monetary unions with independent fiscal authorities. Sovereign yields of a member state could rise due to a perceived risk of it leaving the union and redenominating its liabilities into a new currency. Especially in those cases in which the crisis is prompted by non-fundamental fears, rapid UMP interventions can forestall spiralling adverse outcomes. However, it is important that UMPTs focus exclusively on domestic economic objectives so as to not create the impression that they are a means of manipulating the exchange rate and bring about a competitive devaluation.

Likelihood of DTC scenarios

The likelihood of the scenarios just described is influenced by a number of factors. For example, one would expect that the considerable changes in the policy and regulatory landscape that have taken place since the GFC have reduced the frequency of those extreme scenarios. More stringent capital requirements, greater use of macroprudential policy, and a more robust supervisory framework should improve banks' resilience in the face of adverse shocks, and contribute to lowering the chances of disruptions to the credit channel. Increased awareness of the importance of sound public finances, encoded into fiscal rules in some jurisdictions, should improve the outlook for financial stability.

At the same time, the likelihood of DTC events still depends on many factors outside the control of central banks, such as fiscal policies, institutional reforms and financial innovations. Regarding the latter, even with more robust financial regulation and supervision, the rapid emergence of new financial instruments and technologies, and of intermediaries subject to less regulation (eg shadow banks and fintech firms) could give rise to new types of DTC situation.⁷⁴ This may call for a more flexible approach to UMP interventions in the future, such as one that could target problems in the non-bank financial sector or less-traditional financial markets, provided that such flexibility can be delivered in a manner consistent with legislated mandates and legal frameworks. Finally, while international financial integration provides greater economic opportunities and prosperity, it weakens the ability of domestic policymakers to affect local conditions, as the transmission channel of monetary policy becomes increasingly dependent on foreign conditions and policies. This could

⁷³ See eg Corsetti and Dedola (2016) and Camous and Cooper (2018). For a discussion of how UMP announcements (of ECB President Draghi's "whatever it takes" kind) can achieve an implicit recapitalisation of banks and thus address the sovereign-bank nexus, see Brunnermeier (2015).

⁷⁴ As more regulation of specific financial sectors may also foster the growth of other less regulated ones, the scope of regulation and supervision matters in this regard.

in part offset efforts to increase the resilience of the domestic economy and hence increase the likelihood of disruptive scenarios.

3.2 What role for UMPTs in adverse scenarios?

The discussion in Section 3.1 indicates that scenarios where central banks may use UMPTs could arise in the future and, possibly, more often than in the past. The ELB is likely to remain a prominent challenge for central banks, and despite the post-crisis reforms to strengthen the financial system, disruptions in the monetary transmission mechanism may recur. Properly embedding UMPTs in a monetary policy framework could bolster the central bank's credibility by demonstrating its willingness and ability to use UMPTs, ultimately reducing the likelihood of having to use them. The experience with UMPTs to date has reduced the uncertainty regarding their impact and eased fears of adverse side effects, in particular on market functioning (see Markets Committee (2019)). The experience of the past decade has shown that central banks can pursue their mandates even in particularly adverse scenarios, with greater experience and knowledge of how to effectively deploy UMPTs, thus boosting their credibility.

At the same time, it should be recognised that UMPTs are not without constraints, nor are they perfect substitutes for conventional policy tools in all circumstances. For example, although interest rates can be lowered into negative territory, the cost of holding cash may impose a lower bound. Similarly, risk considerations, asset availability, and legal and political constraints may affect central banks' capacity to expand their balance sheets.⁷⁵ In addition, limits to the deployment of balance sheet policies might arise from the fact that unwinding a large-scale balance sheet programme can take considerable time.

Central banks have proved their readiness to adjust and expand their tools in order to achieve their mandate amid extraordinary circumstances, but it is important that other authorities cooperate in creating more policy space in the future. For example, concerning ELB scenarios, structural reforms that boost productivity and the growth potential of the economy can raise the equilibrium real interest rate and thereby reduce the likelihood of reaching a binding lower bound on policy rates.

As for DTC scenarios, central banks have the advantage that they can often respond quickly and thereby prevent or alleviate negative externalities, adverse self-fulfilling dynamics and/or the breakdown of market and funding liquidity. However, monetary policy tools cannot solve the underlying solvency problems that often give rise to such DTC scenarios: it is typically the responsibility of other policy areas to put in place measures to limit the frequency and/or severity of such scenarios. As discussed, DTC scenarios often arise from the impaired balance sheets of financial intermediaries or deteriorating public finances, coupled with negative macroeconomic shocks. Prudential policies directed at strengthening the balance sheets of the financial sector can lower the likelihood of DTC, making a central bank intervention less necessary. Macroprudential policies may also benefit economies that face volatile capital flows resulting from monetary policy actions elsewhere (Eichengreen and Gupta (2015)). Similarly, prudent fiscal policies reduce the likelihood that stretched government balance sheets may give rise to DTC scenarios, a risk particularly pronounced in monetary unions. For example, governments and

⁷⁵ For example, most central banks face limits on the type of assets that they can purchase.

prudential authorities can alleviate problems resulting from stressed bank balance sheets by recapitalising or resolving banks in an orderly way.

Support from other policies also enables monetary policy – conventional or unconventional – to stimulate the economy more effectively. For example, prudential policies, by fostering resilience in the financial system, can create policy space as monetary policy does not need to use its interest rate tool to address financial stability risks. Effective micro and macroprudential regimes are also essential to ensure that UMPTs do not engender excessive risk-taking by financial institutions.⁷⁶ Bank regulation can ensure responsible lending when lending operations are conducted on favourable terms. At the same time, macroprudential policy can add to the stimulus provided by monetary policy, for example by releasing countercyclical capital buffers in stress situations. Likewise, fiscal authorities can support monetary policy in addressing negative demand shocks through the use of discretionary policy actions at critical phases of the business cycle, or through the incorporation of automatic stabilisers.⁷⁷

The rest of this section elaborates first on the desirability that UMPTs be properly embedded as elements of a monetary policy framework (subsection 3.2.1). It then discusses why the specific design of the UMPTs and the conditions under which they will be used depend on the shocks to the economy, the structure and health of the financial system, and the overall political and institutional framework (subsection 3.2.2). Finally, the last subsection (3.2.3) argues that the willingness to use UMPTs will also depend on how possible side effects are managed.

3.2.1 Integrating UMPTs into the monetary policy framework

As noted above, UMPTs are useful additions to the central bank's monetary policy toolbox and can be employed in a range of circumstances that include ELB and DTC scenarios. To maximise policy effectiveness and to avoid generating unnecessary policy uncertainty – especially when employing multiple tools – it is important to provide timely and informative communications to the public. Central bank messages regarding the role and use of UMPTs can help manage expectations in a manner that is amenable to the goals of monetary policy. Transparency and credibility are central for keeping long-run inflation expectations well anchored. And policy effectiveness depends critically on public's confidence that the central bank has effective tools and the wherewithal to use them in pursuing its objectives.

As with conventional monetary policy, communication of the central bank's intentions and objectives regarding the use of UMPTs plays an important role in coordinating agents' expectations and stabilising economic outcomes. In addition, communication can be a tool in itself when it is understood that it signals a particular policy direction – potentially reducing the need for actual policy action. This channel is particularly important when the transmission mechanism may be disrupted by potentially self-fulfilling negative dynamics. In this case, communication about possible action can pre-empt the need for central banks' intervention by forestalling

⁷⁶ See, for example, Altavilla et al (2019).

⁷⁷ Another aspect of coordination with fiscal authorities in the context of a large balance sheet programme is the clear and unconditional support of the fiscal authority in the event of sustained losses by the central bank due to UMPTs (Del Negro and Sims (2015)). A similar situation can arise with purchases of riskier assets or large-scale FX interventions.

such self-fulfilling dynamics (eg if the central bank commits to providing liquidity if interbank lending rates or sovereign bond yields are excessively high due to non-fundamental factors). Given the importance of communication, the simplicity of tools and the repeated communication of their purpose are also key considerations in the design and implementation of UMPTs.

Given that the appropriate use of UMPTs will depend on the specific circumstances, central banks need to strike a balance between, on the one hand, communicating as clearly as possible on their use, and on the other hand, maintaining flexibility to adjust the tools if necessary. While a strong commitment to future policies, as in the case of FG, might enhance the effectiveness of UMPTs, it imposes a credibility cost if the central bank needs to deviate from its earlier commitments (for instance, if the contingencies to which policy actions were linked do not materialise as originally expected). Also, if private agents and governments expect the central bank to intervene whenever risk spreads increase, the ensuing moral hazard and a mispricing of risk may adversely affect financial stability. The effective use of other policies (such as financial sector supervision, regulation and resolution) would contribute to the preservation of the benefits from a transparent and predictable monetary policy framework, while minimising the risk of moral hazard.

When faced with ELB or DTC scenarios, demonstrating the willingness and ability to act swiftly and decisively, possibly also using new variants of UMPTs, would likely help forestall adverse outcomes, especially in the presence of pronounced downside economic risks. While policy gradualism is often advocated in the face of uncertainty, excessive caution in reacting to a severe negative shock could have adverse effects if it results in un-anchoring long-term inflation expectations, or in a higher risk of a prolonged period of depressed interest rates and low inflation, or in damaging the credibility of the central bank. Also in the context of a mild negative demand shock (as discussed in Section 3.1), which by itself is unlikely to un-anchor long-run inflation expectations, lowering the policy rate quickly and decisively may prove effective.

Acting promptly and decisively seems especially advisable in the case of a DTC scenario, before problems in the financial intermediation sector develop into a systemic crisis. Restoring market functioning should be of primary importance in such circumstances because even conventional policies will be less effective in addressing a shortfall in demand. For example, a sudden re-pricing of risk may cause banks to deleverage excessively and thus reduce lending to firms and households. At the same time, the decisive use of UMPTs needs to be communicated adroitly to avoid inadvertently conveying negative sentiments regarding the health of the economy more broadly.

Finally, the process of unwinding UMPTs can prove challenging, especially with respect to communication of the overall policy stance when multiple tools are in use. Central banks need to weigh the risk of unwinding UMPTs too early or too quickly, against that of keeping them in place for too long. The more a central bank can establish its credibility in advance, whether through a track record of successful policy actions, or through the legal framework and political support for the prompt and decisive use of UMPTs, the better the trade-off it will face in critical times.

3.2.2 Adapting UMPTs to the specific context

The proper design and sequencing of UMPTs depends on the origins of the shocks affecting the economy. Different shocks disrupting the monetary transmission may

require different monetary policy tools. Consequently, UMPTs are more effective if they are tailored to the structure of the economy, the legal and institutional specificities in a particular jurisdiction, and the economic shocks prompting their use.⁷⁸ Political economy issues regarding the appropriate size of the central bank's footprint in financial markets and broader institutional arrangements, such as the division of responsibilities between the central bank and other agencies, also play a role and may determine the appropriate sequencing and combination of tools as well as the country-specific UMP strategies. It is, therefore, not possible to provide a general menu of interventions appropriate for particular scenarios. Furthermore, the same effect can be achieved through different specific sets of tools in different jurisdictions. Hence, rather than offer specific prescriptions, the exposition presents examples meant to capture the broad picture.

In ELB scenarios, the central bank may wish to tailor the UMP response to the nature of the shock. For example, asset purchases and very low or negative interest rates can effectively address severe negative demand shocks in the domestic economy. The class of domestic assets that are purchased could be tied to the origins of the shock, such as the housing market. In the case of SOEs, if the shock originates in volatile capital flows, FX interventions can be effective in countering deflationary pressure at the ELB, since they directly address the cause of the problem.

In the case of DTC scenarios, the nature of the disruption will largely determine what kind of UMPTs are appropriate. For example, impediments to monetary transmission caused by a global shortage of funding in a given currency could be remedied by central bank currency swap lines, as in the GFC. By contrast, excessive sovereign bond spreads that may lead to a fragmentation of financial markets and lending conditions could be addressed by contingent commitment to purchase government bonds, as was done in the euro area.

The broader policy framework will shape the design of the policy instruments. For instance, if the source of DTC problems is stress in specific market segments that leads to a shortage of good-quality collateral, central banks with a narrow collateral framework can deviate from standard operating procedures and choose to temporarily accept broader collateral in liquidity operations. Similarly, if the pass-through of central bank liquidity to the money market is disrupted, central banks that typically interact only with a limited set of counterparties could give balance sheet access to a wider range of financial institutions. In a monetary union without a fiscal union, such as the euro area, the design of an asset purchase programme needs to be tailored to the broader policy framework by setting up safeguards to account for the absence of a common safe asset.⁷⁹

3.2.3 Managing the side effects of UMPTs

The survey also collected the central banks' assessment of the side effects of unconventional policy "other than those associated with traditional monetary policy

⁷⁸ For instance, it may be relevant whether the central bank mandate includes objectives for output growth and employment or for financial stability. Although a broader mandate could allow for more flexibility in communication without leaving the impression that the central bank's ultimate mandate is being ignored, it could make anchoring inflation expectations more difficult.

⁷⁹ For an overview of the debate on the European safe assets see European Commission (2017).

tools". By side effects, the survey and this report aim to capture any effects of UMP that were not intended by the policymaker, because they either reduce the effectiveness of the policy action (and thus the ability to achieve the mandated objectives), or have undesired spillovers either domestically or abroad.⁸⁰ In both cases, side effects can potentially lead to public criticism of the way the central bank aims to achieve its mandate. While the central bank will take into account the first kind of side effect when calibrating the use of UMPTs, the second kind might be outside its mandate and perhaps not easily addressed by the central bank alone.

The immediate side effects mentioned by central banks in the context of UMPTs were related to potential disintermediation in financial markets, excessive dependence on central bank funding, a compression of interest rate margins with potential implications for bank profitability, and excessive risk-taking. Many of these side effects are also associated with the prolonged use of accommodative conventional policy. Nevertheless, owing to the frictions related to the ELB, along with the direct intervention in financial markets and the impact of central banks' balance sheet expansion, the side effects of UMPTs could be quantitatively more important than those associated with conventional monetary policy. Moreover, some of the side effects of UMPTs might turn out to be qualitatively different from those of conventional policy. For example, the effect of large market interventions on private sector incentives could take time to materialise, or may become stronger, the longer UMPTs remain in place. More granular data, over longer periods, may be needed to evaluate this issue. Overall, however, the assessment of central banks to date is that these side effects have been limited and manageable, and that the net effect of UMP interventions has been uncompromised.

Moreover, in designing and fine-tuning past UMP interventions central banks have successfully employed a number of measures that can mitigate, if not eliminate, the kind of side effect that might limit the effectiveness of their actions (see also Markets Committee (2019)). For example, large APPs, while effective in lowering long-term yields, generated a scarcity of high-quality assets in repo markets, which was addressed by the introduction of securities lending facilities. Due to the risk of disintermediation, the traditional counterparty policy was broadened as much as possible (see Section 2.2 and Box A). Another example is offered by the experience of the BoJ, which adapted its yield curve control framework by introducing a fluctuation range for the 10-year JGB (ie allowing yields to move upward and downward to some extent around the target of zero percent), in order to encourage trading on the sovereign bond market and secure its functioning. In the euro area, the OMT programme, which was geared at addressing redenomination risk, included clear conditionality to alleviate moral hazard problems vis-à-vis the government. As a further example, liquidity facilities were designed as a backstop, such that only

⁸⁰ The academic literature has argued that the side effects of UMPTs are the necessary consequence of the disruptions that create the need to deploy them. Alla et al (2016) argue that unconventional policy instruments must work through some friction and therefore create welfare costs that go beyond the inflation and/or output gap components of a typical central bank's loss function. The use of the unconventional instrument should therefore weigh the welfare costs associated with the distortion against the benefits of better stabilising output and inflation. Harrison (2017) does this in the context of a New Keynesian model with a portfolio balance friction that generates welfare costs. The model implies that the policymaker does not use QE away from the ELB; and if necessary unwinds its balance sheet position slowly.

fundamentally sound institutions in need would use them, subject to appropriate collateral or conditionality.

While so far central banks have judged that the side effects of low or negative interest rates on *financial stability* are contained and manageable, it is possible that they might become more severe if the policy remains in place for a longer period. One example is the effect of persistently low or negative interest rates and a flattening of the yield curve on bank profitability and lending. As discussed, this debate relates to the concept of the reversal rate, which may be positive or negative, depending on factors such as the prevalence of fixed vs floating rate debt contracts, or the degree of bank capitalisation.⁸¹ In addition, the reversal rate may change over time, creeping upwards as banks adjust asset holdings in response to the low interest rate environment. A persistent flattening of the yield curve can also put pressure on bank profits. It should also be noted that other financial institutions, besides banks, may also face problems during a period of persistently low rates, for example, pension funds and life insurance companies (CGFS (2018)). Aware of these risks, central banks have complemented negative rate policies with interventions, such as tiering or lending operations on very favourable terms designed to mitigate the impact on the resilience of financial intermediaries.

Similarly, while the so-called *risk-taking channel* of monetary policy enhances the effectiveness of interest rate cuts when there is excessive risk aversion, a protracted period of low interest rates and abundant liquidity may over time induce excessive risk-taking in financial intermediaries. The abundant evidence on the existence of a risk-taking channel of monetary policy suggests that risk-taking incentives are also present in conventional policy interventions.⁸² Such behaviour is thought to facilitate the economic recovery, but the possible cost of heightened financial fragility in the longer term needs to be carefully monitored.

In situations where low interest rates persist for long periods and liquidity is abundant, *allocative efficiency* may be compromised. Reducing or slowing deleveraging could be an important intermediate objective of central banks in times of crisis. Nevertheless, there is a risk that financial resources become misallocated in favour of less-productive (“zombie”) firms, particularly in economies where there are strong, long-standing lending relationships between banks and firms. While the risk

⁸¹ Eggertsson et al (2017), observe that there is a zero lower bound on retail deposit rates offered by banks and show that, once deposit rates are zero, further policy rate cuts are ineffective at lowering both deposit and lending rates. Negative interest on reserves tends to reduce bank profitability and, to the extent that this impairs bank intermediation, it depresses economic activity. Cavallino and Sandri (2019) argue that for EMEs the reversal rate moves in response to global financial conditions.

⁸² The literature on monetary policy and risk taking is vast. For example, Frame and Steiner (2018) find evidence on US QE policies “consistent with crowding out [effects on] private investment and “reaching for yield” behaviour by financial institutions”. Nakashima et al (2019), using Japanese data, find that conventional interest rate cuts also “stimulate lending to risky firms from banks with a higher leverage ratio”. Some evidence of an “incubation period” for the risk-taking kind of side effects of UMPTs is provided by Colletaz et al (2018). However, CGFS (2018) finds evidence of only limited additional risk-taking among banks in the post-GFC period. A number of papers document the risk-taking channel of conventional monetary policy, eg Altunbas et al (2014) find evidence that low interest rates increase banks’ risk. Jiménez et al (2014) find that a “lower *overnight interest rate* induces lowly capitalized banks to grant more loan applications to ex ante risky firms and to commit larger loan volumes with fewer collateral requirements to these firms, yet with a higher ex post likelihood of default. A lower *long-term interest rate* and other relevant macroeconomic variables have no such effects” (emphasis added).

of resource misallocation is arguably a more general issue with prolonged periods of accommodative monetary policy, it might be more severe with certain types of unconventional policy, such as targeted lending schemes and private sector asset purchases that direct credit towards particular sectors of the economy. Schemes of this nature may mitigate unwanted developments such as an overinvestment, or a concentration of specific assets, in the banking sector, but they do constitute a direct intervention in private decision-making. If misguided, they can lead to an evergreening of loans and an inefficient allocation of resources. A number of papers provide some evidence of this side effect in some jurisdictions as a consequence of UMP interventions.⁸³ The macroeconomic importance of these effects is unclear and hard to assess at this point but, in principle, a serious misallocation of credit could lower the economy's growth potential and potentially feed back into lower equilibrium interest rates. A caveat in terms of the generalised use of UMPTs is that they remain largely untested in the context of deployment in EMEs, with some research suggesting that more caution may be warranted in this case.⁸⁴

Another consideration is whether the systematic use of UMPTs in response to DTC scenarios might increase *moral hazard* in private or government borrowing decisions. When financial investors expect the central bank to intervene whenever asset valuations collapse, their perceptions of downside risks may change and they consequently might increase their risk-taking.⁸⁵ A similar strategic consideration may apply to governments, which because of political incentives (eg electoral cycles) may tend to adopt an unduly lax fiscal policy stance on the expectation that the central bank will be accommodative. In addition, large purchases by central banks of sovereign debt at low interest rates can be seen as an opportunity for governments to further postpone fiscal consolidation, even in the post-crisis period.⁸⁶ So far it is difficult to detect such systematic moral hazard effects, although they may materialise over time. As discussed above, a well designed fiscal framework and micro- and macroprudential policies, can play an important role in mitigating such effects, while the use of monetary policy, including UMPTs, for reasons other than achieving the central bank's mandates should be avoided.

Side effects of UMP that affect other (domestic or foreign) agents, and cannot be easily mitigated by central banks themselves, may lead to a political backlash, with potential adverse consequences for central bank independence. One example pertains to the distributional effects of UMP. In particular, asset purchases have often been alleged to have increased income or wealth inequality. In the early phases of the euro area crisis, for example, a heated debate arose about the effects of low policy

⁸³ Banerjee and Hofmann (2018) and Acharya et al (2019) discuss the relationship between so-called "zombie" firms, on the one hand, and low interest rates and unconventional monetary policy, on the other.

⁸⁴ Jacome et al (2011) analyse a panel of Latin American EMEs and conclude that in the case of emerging markets UMP may fuel further macroeconomic instability and higher chances of a currency crisis.

⁸⁵ Bornstein and Lorenzoni (2018) point out that this result is not necessarily warranted by economic theory, and that countercyclical policies can mitigate the problem of over-borrowing.

⁸⁶ Focusing on all non-standard measures adopted by the ECB between 2007 and 2015, Hachula et al (2016) found that an unconventional monetary policy expansionary shock led to a rise of primary fiscal expenditure in the euro area. The important distinction between monetary policy backstops and bailouts, in engendering moral-hazard behaviour, has been stressed by Corsetti and Dedola (2016). They point out that in theory monetary expansions that rule out non-fundamental shocks need not induce governments to adopt an opportunistic fiscal strategy.

rates on the income of savers and on the expected returns of pension funds. Another source of political tensions was the concern that policy interventions might be biased in favour of financial asset holders and banks in particular. That said, most of the evidence gives a more nuanced perspective. Indeed, it suggests that inequality could actually have lessened as a consequence of successful expansionary policy interventions relative to the alternative of no policy action. While UMP is likely to have reduced income inequality through its beneficial effect on economic growth and the labour market, the effects on wealth inequality are less clear-cut and depend to a large extent on the distribution of home ownership in the economy.⁸⁷

The latter type of side effects, were they to materialise, could only be addressed by other policy areas, in particular fiscal policies. For the central bank, the best way to deal with this kind of side effect might be to embed UMPTs into the monetary policy framework, communicating transparently about their use and their expected benefits, as well as having a clear mandate.

Finally, another type of side effect that typically falls beyond central banks' domestically oriented mandates relates to *international policy spillovers*. Some observers have suggested that the scale of UMP interventions and the ensuing "monetary tsunami" affecting, in particular, EMEs, differentiates this outcome from what would occur under conventional policy. The recent expansion of major central banks' balance sheets was associated with a substantial increase in net private financial flows to EMEs (both direct and portfolio investments), which have been a persistent source of external sector and financial vulnerability for many of these economies. At the same time, EMEs witnessed a reversal of flows when major central banks announced that balance sheet expansion would come to an end or took steps towards unwinding UMPTs. Some observers suggest that UMPTs have thus helped to amplify the financial cycle in several EMEs with reasonably open capital accounts.

The findings of research on this topic are mixed. Some studies emphasise the unique character of UMPTs in this respect, whereas other studies find no difference between conventional and unconventional monetary policies as regards international spillovers.⁸⁸ Extraordinarily expansionary monetary policies (whether conventional or unconventional) affect foreign economies mainly through large capital flows, large exchange rate movements and adjustments in the domestic cost of finance. For countries seeking monetary expansion, these spillovers from foreign accommodative policies can be welcome, at least insofar as interest rates can be lowered enough to contain appreciation pressure, and the domestic financial sector is resilient enough to cope with volatile capital flows. Nevertheless, for countries not in need of accommodative policies, foreign UMP interventions constitute a possible risk to

⁸⁷ A number of papers study the overall distributional effects of monetary policy, reaching different conclusions. For example, Doepke and Schneider (2006) discuss the distributional effects of inflation, and thus indirectly of monetary policy; Coibion et al (2017) discuss explicitly the distributional effects of monetary policy and show that "Contractionary monetary policy systematically increases inequality in labour earnings, total income, consumption and total expenditures." An overview of the effects of monetary policy with a focus on the GFC is provided by Domanski et al (2016) and a recent survey is provided by Colciago et al (2018). Lenza and Slacalek (2019) find that expansionary QE policies reduce inequality more significantly than does conventional policy; Bivens (2015) and Hohberger et al (2019) concur. Doepke et al (2015) focus on the effects of a sustained increase in inflation and arrive at a more equivocal conclusion. Casiraghi et al (2018) report larger benefits of UMP for low-income households. Similar evidence is provided by Ampudia et al (2018) for the euro area. Bunn et al (2018) find small effects from UMP on income and wealth inequality in the United Kingdom.

⁸⁸ See for example Curcuru et al (2018b).

domestic financial and economic stability. Countries with pre-existing vulnerabilities, including limited fiscal space or an excessively indebted private sector, are more likely to suffer from foreign spillovers.

While central banks pursue local mandates, volatile capital flows can negatively affect global financial stability and generate spill-back effects to the domestic economy via financial or trade channels, thereby impinging on the achievement of the domestic mandate. Central banks therefore need to take such effects into consideration when deciding on monetary policies, including UMPTs and their design features. They also need to communicate their policies as clearly and transparently as possible to minimise disruptive spillovers. A number of recent analyses have highlighted these risks and the potential options to address them by using a richer set of policy tools (eg macroprudential) and by enhanced international cooperation.

Concluding remarks

Overall, UMPTs have proved to be an effective addition to central banks' policy toolkit, as they have been broadly successful in addressing DTC scenarios and in averting the most pernicious consequences of ELB scenarios. So far, the side effects have been contained and did not compromise the overall effectiveness of the interventions. In particular, most of the domestic side effects could be addressed by appropriately fine-tuning and coordinating the various UMP instruments. Of course, most of the central banks that implemented UMPTs have yet to unwind them, given the need for continued stimulus. This means that a complete assessment of their effects can only be made at a later stage.

The effectiveness of UMPTs depends critically on the specific circumstances of their use, including the public's belief about their effectiveness, their implementability and scalability, and thus it depends on the credibility of the central bank in general. Most UMPTs operate, at least in part, through the expectations of financial market participants and of private sector decision-makers more generally. It follows that the public's understanding of the purposes and uses of UMPTs is important, as is a conducive legal and institutional framework.

Expectations management is a key consideration in the design, as well as in the actual implementation of monetary policy at all times, and even more in times of crisis. An important aspect of expectations management is to embed monetary policy tools, including unconventional tools, within a coherent monetary policy framework designed around achieving the central bank's objectives across a wide range of circumstances. As scenarios in which UMPTs would need to be employed will likely arise again, using them in the context of a well designed framework will increase their effectiveness and lessen undesirable side effects.

To foster the credibility of the overall monetary policy framework, it is important that UMPTs are used in a manner that accords with the prevailing circumstances and country context. This includes the legal and institutional environment within which the central bank operates. Policymakers should also be conscious of the potential risks of prolonged use of UMPTs, including political economy concerns as well as the implications for moral hazard in the private and public sectors and for financial stability. All told, UMPTs are more effective when accompanied by appropriate supervisory, prudential and fiscal policies and embedded in a broader policy framework that avoids placing a disproportionate burden on the central bank.

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Annex 1 Sources of information

A key part of this report summarises cross-country experiences with UMPT. The main source of information is a novel survey, covering 23 central banks and focusing on the UMP instruments and related procedures that were deployed before and, in particular, during and after the GFC. The survey was coordinated with the Markets Committee WG on large central bank balance sheets and market functioning to keep the surveying of members on closely related topics to a minimum.

The central bank survey (CBS) comprised six sections. Each of the first four covered a distinct instrument: Forward Guidance (FG), Effective Lower Bound and Low Rates (ELB), Lending Operations with financial intermediaries (LO), and Asset Purchases (AP). A fifth section dealt with the coordination and sequencing of UMP interventions. The sixth section related to central banks' balance-sheet expansions and market functioning, as a source of information for the Market Committee WG.

The five sections covering UMP operations were all broadly structured in a similar way. The questions concerned the time and conjunctural circumstances surrounding the adoption of UMP; the specific form taken by the UMP interventions; their stated motivation; their perceived and measured effectiveness; their side effects; and the internal research and analysis regarding UMP effectiveness.

In an effort to gather further insights and hear different perspectives, the WG used the opportunity of its second face-to-face meeting to organise a panel discussion with academics and private sector representatives. The session was hosted by the New York Fed on 4 February 2019. The academic participants were Jonathan Wright, Joseph Gagnon, Markus Brunnermeier, Thomas Philippon and Annette Vissing-Jorgensen. The market participants came from both banking and non-banking firms: Richard Barwell (BNP Asset Management), Matt King (Citigroup), Angel Ubide (Citadel Investment Group) and Krishna Guha (Evercore ISI). Participants were asked to offer their thoughts on a set of questions related to the topics of interest of the project. Questions were targeted to the specific panellists' background. The active discussion among the panellists and the members of the WG added colour to the summary of the existing literature in terms of shaping the assessment of UMPTs.

Annex 2 Asset purchase programmes

This annex focuses on asset purchase programmes (APP). It, first, provides a glossary table with the various programmes implemented by different central banks (Annex Table 1). It then outlines the methodologies used in the literature that assesses the effectiveness of such programmes and, finally, provides a table showing the transmission channels for APPs as described in central banks' responses to the survey.

List of the asset purchase programmes				Annex Table 1
Central bank	Asset purchase programme	Acronym	Announcement date	Group
Eurosystem	Covered bond purchase programme 1	CBPP1	5/2009	(i)
	Securities Market programme	SMP	5/2010	(i)
	Covered bond purchase programme 2	CBPP2	10/2011	(i)
	Outright Monetary Transactions	OMT	8/2012	(i)
	Asset-backed securities purchase programme	ABSPP	9/2014	(ii)
	Covered bond purchase programme 3	CBPP3	9/2014	(ii)
	Public sector purchase programme	PSPP	1/2015	(ii)
	Corporate sector purchase programme	CSPP	3/2016	(ii)
Sveriges Riksbank	Quantitative Easing	QE	2/2015	(ii)
Bank of England	Asset purchase facility – commercial paper	APF1 - CP	1/2009	(i)
	Asset purchase facility – corporate bonds	APF2 – CB	1/2009	(i)
	Asset purchase facility –Secured commercial paper	APF3 – SCP	7/2009	(i)
	Quantitative Easing 1	QE1– gilt	3/2009	(ii)
	Quantitative Easing 2	QE2 – gilt	10/2011	(ii)
	Quantitative Easing 3	QE3 – gilt	7/2012	(ii)
	Quantitative Easing 4 -	QE4 – gilt	8/2016	(ii)
Swiss National Bank	Quantitative Easing 4 – corporate bonds	QE4 – CB	8/2016	(ii)
	Foreign exchange interventions	FX	3/2009	(ii)
Federal Reserve System	Bond purchases	Bond	3/2009	(i)
	Agency Discount Notes	ADN	9/2008	(i)
	Large-scale asset purchases 1	LSAP1 (agency debt)	11/2008	(i)
	Large-scale asset purchases 1	LSAP1 (agency MBS)	11/2008	(i)
	Large-scale asset purchases 1	LSAP1 (Treasuries)	3/2009	(i)
	Large-scale asset purchases 2	LSAP2 (Treasuries)	11/2010	(ii)
	Maturity Extension programme	MEP	9/2011	(ii)
	Large-scale asset purchases 3	LSAP3 (agency MBS)	9/2012	(ii)
	Large-scale asset purchases 3	LSAP3 (Treasuries)	12/2012	(ii)

Central bank	Asset purchase programme	Acronym	Announcement date	Group
Bank of Japan	CP purchase	CPs purchase	1/2009	(i)
	Corporate bond purchase	CBs purchase	2/2009	(i)
	Comprehensive Monetary Easing	CME	10/2010	(ii)
	Quantitative and Qualitative Easing	QQE	4/2013	(ii)
	Quantitative and Qualitative Easing with yield curve control	QQE with yield curve control	9/2016	(ii)
Bank of Mexico	Foreign exchange interventions	2 FX	10/2008	(i)
	Purchases of agency debt IPAB	IPAB purchases	10/2008	(i)
	Foreign exchange interventions	2 FX	3/2009	(i)

Note: BOJ conducted QE in the 2001–06 period, but this programme is not included in this chapter.

Sources: Survey of central banks

Methodologies to assess the effects of asset purchases

The literature that estimates the effects of APPs on financial markets relies on two types of methodology: event studies and time-series analysis.

Event studies emphasise the forward-looking nature of financial markets and estimate the impact of purchase programmes on asset prices in a narrow window around the policy announcement. Event studies, however, rely on strong assumptions. First, they posit that all changes in asset prices observed over the event window are only attributable to the programme announcement, which might be questionable if central banks announced a set of different measures at the same time. Moreover, the observed market reaction could be driven by a reassessment of the macroeconomic outlook by market participants following the release of the central bank's views. Greenlaw et al (2018) question the sizeable impact of Fed's LSAP programmes found in event studies on this ground. Second, these studies assume that the announcement of APPs is unexpected. When the policy announcement was anticipated, some studies relied on a larger set of events in order to capture the effects on yields that showed up before the actual announcement (eg Altavilla et al (2015)). Results, however, might be very sensitive to the selection of events. Moreover, estimates derived from event studies are often not robust to the length of the event window.⁸⁹ Event studies can also hardly address the persistence of the effects. The observed change in asset prices may underestimate (eg in case markets do not adjust immediately to the programme announcement) or overestimate (in case the initial impact fades out quickly) the more lasting effects of central bank asset purchases.

A second set of studies is based on **time series analysis**.⁹⁰ These studies rely on more information than event studies do, but need to impose more assumptions on the data to identify the impact of asset purchases on yields. They usually assume that

⁸⁹ While Meaning and Zhu (2011), for instance, suggest a 50 bp decline in gilt yields following the announcement of the BoE's QE1 (one-day event window), Joyce et al (2011) report a 100 bp decline (two-day event window).

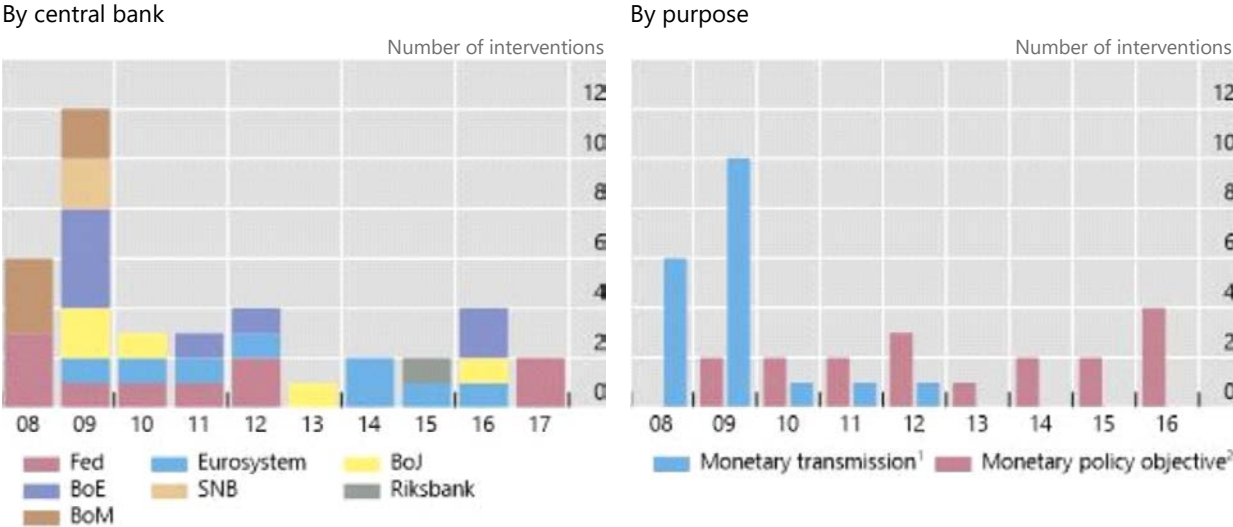
⁹⁰ This type of financial indicator is usually regressed on the stock of central bank asset holdings and macro control variables, such as measures of slack, inflation and interest rate volatility (eg Gagnon et al (2011)).

the model's parameters are stable by using data from times in which lower bound constraints were not binding and there was no distress in financial markets. Other studies estimate the impact of asset purchases using high-frequency data for the purchase period.⁹¹ While such analysis is based on "in sample" data, the high frequency approach can hardly control for any macroeconomic determinants of asset yields. This is a potentially serious drawback at the effective lower bound, when short-term interest rates are no longer able to account for macroeconomic conditions. Other researchers employ vector-autoregressive (VAR) models encompassing the returns and portfolio shares of various assets as endogenous variables, and inflation and activity indicators as exogenous variables that are subject to similar trade-offs between the validity of statistical inference and the ability to control for macro factors. VAR analyses suggest that the initial effects may fade relatively quickly.⁹²

Constructing a valid counterfactual to measure the macroeconomic effects of asset purchases proves difficult. To overcome the issue, some authors have estimated VAR models and identified asset purchase announcement shocks imposing zero or sign restrictions (eg Weale and Wieladeck (2016)). Others have translated the estimated effect on financial conditions into effects on inflation and output (eg Baumeister and Benati (2013)). Others use estimated DSGE models enriched with preferred habitats that induce financial market segmentation (eg Chen et al (2012)).

Number of central bank asset purchase programmes over time

Annex Graph 1



¹ Programmes aiming to ease tensions in financial markets and to restore the monetary transmission mechanism. ² Programmes adopted to provide additional monetary stimulus.

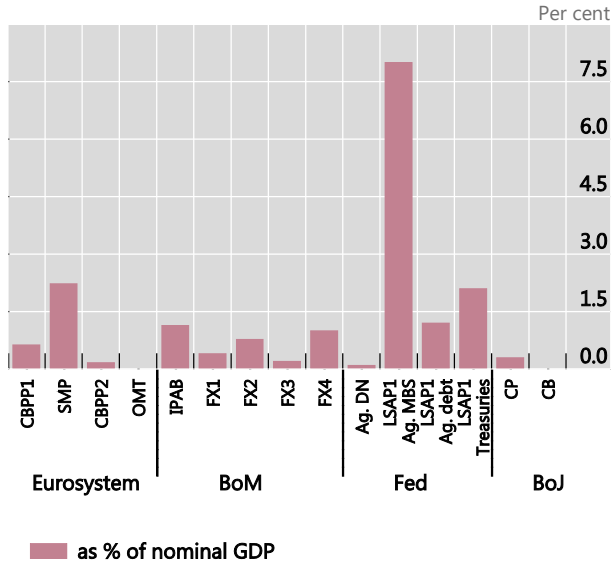
Source: National submissions to CGFS/MC survey.

⁹¹ D'Amico and King (2013), for instance, regress the change in asset yields since the start of the sample on the Fed's QE1 asset purchases and purchases of substitute assets.

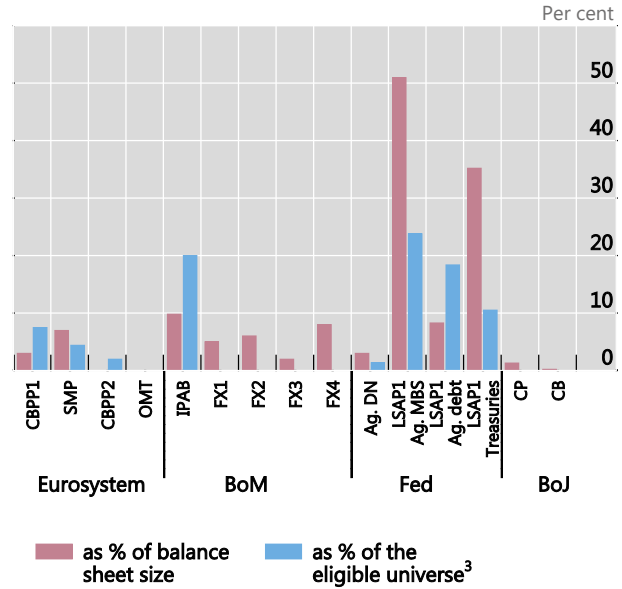
⁹² Joyce et al (2011), for instance, find that the BoE's QE1 lowered long-term gilt yields by approximately 85 bp, but the impulse responses unwind rapidly and the effect after six months declines to 32 bp.

For market functioning programmes¹:

Amount of assets purchased

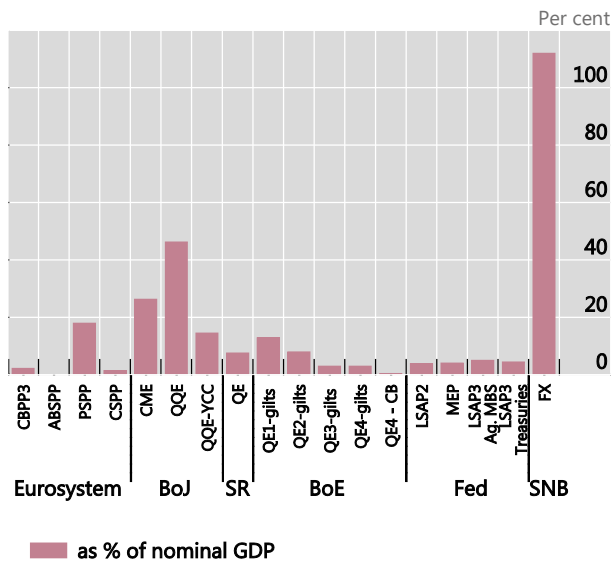


Central bank holdings of assets²

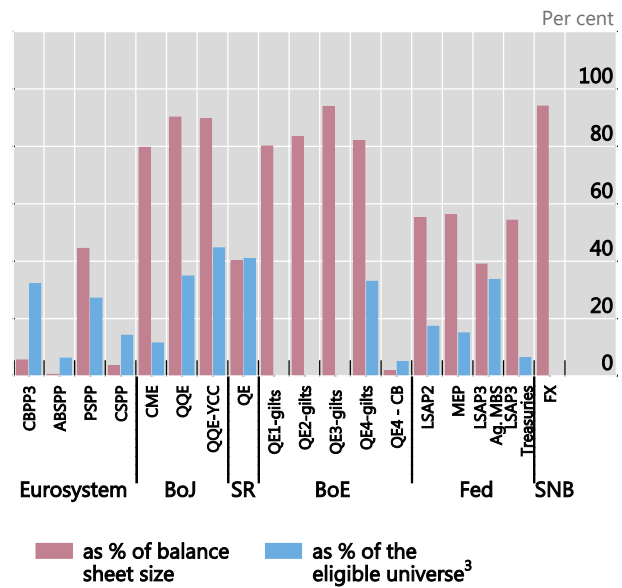


For monetary accommodation programmes:

Amount of assets purchased



Central bank holdings of assets²



¹ Data for BoE APF programmes, SNB bond purchases are not available from the survey; data for BoJ programmes are partially available. ² Holdings after purchases at the end of each programme or through June 2018 if programmes are ongoing. ³ Fed eligible universe is total marketable treasury debt held by the public; ECB eligible universe is iBoxx index market value for asset class; BoJ and BoE eligible universes are not available; SR eligible universe is in proportion of the outstanding stock of Swedish nominal and inflation-linked government bonds.

Source: National submissions to CGFS/MC survey.

Main transmission channels of asset purchase programmes

Annex Table 2

	Programme	Group	Assets purchased	Bank lending/ quantity	Direct pass- through	Liquidity (premium)	Portfolio balance	Signa- ling
Bank of England	APF 1	(i)	Commercial paper		✓	✓		
	APF 2	(i)	Corporate bonds	✓		✓		
	APF 3	(i)	Secured commercial paper		✓			
	QE 1 & 2	(ii)	Government bonds	✓			✓	✓
	QE 4	(ii)	Government bonds, corporate bonds	✓	✓	✓	✓	✓
Bank of Japan	CP	(i)	Commercial paper		✓	✓		
	CB	(i)	Corporate bonds		✓	✓		
	CME	(ii)	Government bonds, commercial paper, corporate bonds, ETF and REIT	✓	✓	✓	✓	✓
	QQE	(ii)	Government bonds, commercial paper, corporate bonds, ETF and REIT	✓			✓	✓
	QQE with YCC	(ii)	Government bonds, commercial paper, corporate bonds, ETF and REIT	✓			✓	✓
Eurosystem	ABSPP	(ii)	ABS		✓		✓	✓
	CBPP 1 & 2	(i)	Covered bonds		✓		(✓)	(✓)
	CBPP 3	(ii)	Covered bonds		✓		✓	✓
	CSPP	(ii)	Corporate bonds		✓		✓	✓
	OMT	(i)	Government bonds			✓	✓	✓
	PSPP	(ii)	Government bonds, bonds issued by agencies and European institutions		(✓)		✓	✓
	SMP	(i)	Government bonds			✓		
Sveriges Riksbank	QE	(ii)	Government bonds	✓		✓	✓	✓
Swiss National Bank	FX	(ii)	Foreign exchange				✓*	✓*
	Bond	(ii)	Corporate bonds, covered bonds			✓		
US Federal Reserve System	LSAP1	(i)	Agency MBS, agency debt and government securities				✓	
	LSAP2	(ii)	Government securities				✓	
	LSAP3	(ii)	Government securities, agency MBS				✓	✓
	MEP	(ii)	Government securities				✓	
	ADN	(i)	Agency discount notes			✓		

Source: September 2018 CGFS/MC survey among member central banks. Note: Brackets denote channels central banks consider of lower importance (at programme level). No evidence on the transmission channels for the Bank of Mexico's foreign exchange interventions and purchases of securities issued by the deposit insurance public agency. *: The Swiss National Bank referred to exchange rate effects (see main text below).

Annex 3 Lending operations

Lending operations										Annex Table 3
	Programme	Group	Dates	Longer term	Collateral	Frequency	Size	Counterparties	Pricing/fees/haircuts	Link to lending
Reserve Bank of Australia	LTR	(i)	Oct 2008	✓	✓					
Central Bank of Brazil	USD lending for MFI's funding trading companies	(i)	Oct 2008		✓					✓
Bank of Canada	TPRA	(i)	Dec 2007	✓	✓	✓	✓		✓	
	TLF	(i)	Nov 2008		✓					
	SLF	(i)	Mar 2008		✓					
Eurosystem	Fixed rate full allotment	(i)	Aug 2007				✓			
	LTRO	(ii)	Dec 2011	✓						
	TLTRO	(ii)	Sep 2014	✓						✓
	TLTRO II	(ii)	Jun 2016	✓						✓
Bank of Japan	SLF	(i)	Oct 2008		✓				✓	
	CP repo	(i)	Oct 2008		✓	✓	✓			
	Fixed rate funds	(i)	Dec 2009	✓			✓		✓	
	Special funds corporate financing	(i)	Dec 2008		✓		✓		✓	
	Fund-provisioning measure to facilitate strengthening of the foundations for economic growth	(ii)	Jun 2010	✓			✓		✓	✓
	Loan support programme	(ii)	Dec 2012	✓			✓		✓	✓
Bank of Mexico	Interest rate swap auction	(i)	Nov 2008							
	Additional LF	(i)	Oct 2008							
Reserve Bank of New Zealand		(i)	Aug 2007		✓					
		(i)	Aug 2008	✓						
	TAF	(i)	Nov 2008	✓						
Bangko Sentral ng Pilipinas		(i)	2008		✓					✓
Bank of Korea		(i)	Oct 2008	✓	✓			✓		✓
Sveriges Riksbank		(i)			✓					
Swiss National Bank	Fixed rate full allotment	(i)	Oct 2008				✓			
	Discount window	(ii)	Jan 2009						✓	
	LTR	(ii)	Mar 2009	✓						

Lending operations (continued)										
	Programme	Group	Dates	Longer term	Collateral	Frequency	Size	Counterparties	Pricing/fees/haircuts	Link to lending
Bank of England	LTR	(i)	Dec 2007	✓	✓	✓				
	SLS	(ii)	Apr 2008	✓						
	FLS	(ii)	2012	✓						✓
	TFS	(ii)	Aug 2016	✓						✓
US Federal Reserve System	Primary Credit	(i)	Aug 2007	✓					✓	
	TAF	(i)	Dec 2007	✓						
	Primary dealer credit facility	(i)	Mar 2008		✓					
	TSLF	(i)	Mar 2008	✓	✓					
	AB CP MMMF LF	(i)	Sep 2008							✓
	CP FF	(i)	Oct 2008					✓		
	TAB SLF	(i)	Nov 2008		✓					
	TSLF options	(i)	Jul 2008		✓					

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