

IMF POLICY PAPER

GLOBAL IMPACT AND CHALLENGES OF UNCONVENTIONAL MONETARY POLICIES

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- The **Policy Paper** on Global Impact and Challenges of Unconventional Monetary Policies prepared by IMF staff and completed on September 3, 2013 to brief the Executive Board on September 13, 2013.
- A **Supplement** on Global Impact and Challenges of Unconventional Monetary Policies—Background Paper.

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GLOBAL IMPACT AND CHALLENGES OF UNCONVENTIONAL MONETARY POLICIES

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SUMMARY AND KEY POLICY MESSAGES

UMP: Effects and spillovers

- Unconventional monetary policies (UMP) comprise two types: policies to restore *market functioning and intermediation*, and policies to provide *support to economic activity* at the zero lower bound (ZLB). UMP was especially successful in restoring market functioning and intermediation early in the global financial crisis, in response to acute shocks. Effects were unambiguously positive domestically and in other countries.
- UMP to support activity at the ZLB on short-term interest rates has reduced long-term rates and had positive effects on economic activity and inflation in UMP countries. Yet, continued UMP of this type is associated with risks: complacency in the reform agenda, financial stability, and central bank credibility. Overall, however, UMP have so far been beneficial on net both for UMP countries and on a global basis.
- Stronger structural, financial, and fiscal reforms are needed in UMP and non-UMP countries to lay the foundation for strong and sustained medium-term growth, and to reduce the burden on UMP. While UMP have been—and remain—critical, they cannot substitute for other policies and reforms of a more structural nature.

UMP: Exit

- Exit from UMP to support market functioning and intermediation should by and large occur seamlessly as markets normalize.
- Exit from policies to support activity, eventually leading to rate hikes, is not yet warranted given current economic conditions. Exit will lead to some normal interest rate changes, both in UMP and non-UMP countries, but there could be additional volatility due to market reactions beyond the control of the central bank. This volatility could have significant spillovers to the rest of the world, with risks to macroeconomic and financial stability. Non-UMP countries should take measures to safeguard their stability in preparation for exit and lay the foundation for sustained medium-run growth. If instability occurs, they should use buffers as well as appropriate policies to limit risks.

Policy coordination and the role of the Fund

- International policy coordination can in principle improve global outcomes by mitigating negative cross-border externalities from UMP.
- The Fund can support UMP policy implementation and exit by providing a global perspective on these policies via surveillance, policy buffers to avoid potential side effects, and objective analysis of the potential gains from international policy cooperation.

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Glossary

| | |
|------|------------------------------------------------------|
| ABS | Asset Backed Securities |
| AE | Advanced Economy |
| BOJ | Bank of Japan |
| CDS | Credit Default Swap |
| CEE | Central and Eastern Europe |
| CFMs | Capital Flow Management Measures |
| CMP | Conventional Monetary Policies |
| DSGE | Dynamic Stochastic General Equilibrium |
| ECB | European Central Bank |
| ELA | Emergency Lending Assistance |
| EME | Emerging Market Economy |
| Fed | The United States Federal Reserve Bank |
| FLS | Funding for Lending Scheme |
| FOMC | Federal Open Market Committee |
| FX | Foreign Exchange |
| GIMF | Global Integrated Monetary and Fiscal Model |
| GSE | Government Sponsored Enterprise |
| LSAP | Large Scale Asset Purchase |
| LTRO | Long Term Refinancing Operation |
| MBS | Mortgage Backed Securities |
| NFA | Net Foreign Assets |
| NPL | Non-performing Loan |
| OMO | Open Market Operations |
| OMT | Outright Monetary Transactions |
| QE | Quantitative Easing |
| QQME | Quantitative and Qualitative Monetary Easing Program |
| SMP | Securities Market Program |
| TAF | Term Auction Facility |
| UMP | Unconventional Monetary Policies |
| ZIRP | Zero Interest Rate Policy |
| ZLB | Zero Lower Bound |

INTRODUCTION

1. This paper takes stock of unconventional monetary policies (UMP) and their impact so far, and looks ahead towards exit and prospects for policy coordination. It synthesizes earlier staff work on UMP,¹ the findings of a substantial and growing academic and central banking literature, as well as further staff analysis contained in the Background Paper. While some widely accepted conclusions have emerged from the large and growing number of studies on UMP, many important questions remain unsettled, as enough time has not elapsed to draw definitive conclusions. In those cases, the paper will pose the relevant questions and provide possible answers, while recognizing the uncertainty that remains.

2. The paper covers four key aspects of UMP, which were selected for their relevance to current policymaking.

- *A characterization and taxonomy of the diverse central bank measures that fall under the UMP heading.* These questions were discussed in IMF 2013a, which considered different UMP instruments, their transmission channels, and effects on interest rates and macroeconomic variables. The paper recalls that the objectives and methods of UMP have varied greatly, not just over time but across countries and regions, and that it is necessary to clearly distinguish them.
- *The available evidence on the effectiveness of UMP.* This section begins by summarizing the domestic macroeconomic (IMF 2013a) and financial stability effects (IMF 2013b) in the countries using UMP. It also examines the effects in other countries, with a focus on the largest countries that did not resort to extensive UMP (thus adding to the treatment in the 2013 Spillover Report (IMF 2013d)).
- *Exit from UMP policies.* Just as entry into UMP involved unprecedented steps, so will exit. Even though exit in most countries is still some ways off, it is not too early to map out some of the issues that are likely to arise and how they might be managed. While the Spillover Report (IMF 2013d) considered the broad global macroeconomic effects of monetary tightening, the focus in this paper is on the practical aspects of policy design and implementation.
- *The role for policy coordination.* There is potential scope for coordination to improve outcomes. The paper concludes with some remarks on the role of the Fund.

¹ Including: “Unconventional Monetary Policies—Recent Experiences and Prospects” (IMF 2013a), which discussed the past and prospective effectiveness of UMP; Chapters 1 and 3 of the April 2013 Global Financial Stability Report (GFSR) (IMF 2013b), which examined possible financial stability risks stemming from UMP; the multilateral analysis contained in the Spillover Report (IMF 2013d) and External Sector Report (IMF 2013c); and Chapter 3 of the April 2013 World Economic Outlook (WEO) (IMF 2013e) on the trade-off between inflation and output.

WHAT ARE UNCONVENTIONAL MONETARY POLICIES?

3. Prior to the crisis, central banks in major advanced economies (AEs) set monetary policy in the context of an established framework. Changes to short-term rates were transmitted into longer-term government bond rates and rates on riskier assets through arbitrage. With prices evolving only sluggishly, these changes in nominal rates were transmitted to real rates, thus affecting real decisions on consumption, saving, investment, and employment. Much of the transmission channel was built on a stable banking system, allowing households and firms to respond to monetary policy impulses by borrowing against future wealth, or lending surplus funds.

4. The crisis impaired market functioning and financial stability and raised the threat of global depression and deflation. Banks lost faith in their counterparties, bringing the interbank market to a halt after the Lehman bankruptcy (with a second hit for European banks in the fall of 2011 at the peak of the sovereign crisis). There were equally devastating effects as investors pulled back from key markets that formerly had been especially liquid. This was the case, for instance, for asset backed securities (ABS) in the United States (U.S.) early in the crisis, and later sovereign bonds in peripheral euro area countries. These market freezes posed acute threats to financial stability and growth, and seriously disrupted the transmission of monetary policy (Adrian and Shin, 2009).

5. UMP in the initial stages of the crisis sought mainly to prevent a financial system meltdown, and then to strengthen financial intermediation. The initial measures had monetary policy implications, but were more akin to central banks' traditional role as lenders of last resort, in that they aimed to combat financial system dysfunction, including runs and multiple equilibria, a collapse of investor confidence, and selling spirals.² The instruments adopted by central banks were unconventional in both their breadth and their scale. Central banks provided liquidity in unprecedented amounts, to a much expanded set of recipients, and with a wider aim, namely to support market functioning.³ These measures also strengthened commercial bank balance sheets.

6. Central banks subsequently took steps to alleviate the drawn-out weakness of financial intermediation, to lower bank and household borrowing costs. These policies included the funding for lending scheme (FLS) in the United Kingdom (U.K.), the purchase of mortgage backed securities (MBS) and agency debt in the U.S., bank covered bonds in the euro area, and a variety of private assets in Japan.

² These market dysfunctions are discussed in Diamond and Dybvig (1983), Gorton (2009), Kiyotaki and Moore (1997), Curdia and Woodford (2011), Gertler and Karadi (2011), Eggertsson (2012), Brunnermeier and Pederson (2009), He and Xiong (2012), Brunnermeier and Sannikov (2012a and 2012b).

³ Liquidity was often provided without limits and at a fixed price—through the term auction facility (TAF) in the U.S., and later long-term refinancing operations (LTROs) in the euro area. Counterparties included securities firms and money market mutual funds, as well as foreign central banks (through swap arrangements). Measures included those taken to support ABS in the U.S., and later sovereign bonds in the euro area, through securities market programs (SMP) and the announcement—though not yet the implementation—of outright monetary transactions (OMT).

7. Monetary policy rates came close to the zero lower bound (ZLB) rather quickly, limiting the conventional monetary options. With the downturn in the real economy and risks of deflation, optimal short-term interest rates became negative. Central banks could thus no longer rely on their traditional instrument—the short-term policy rate—to loosen monetary conditions and provide needed support for demand.

8. Central banks thus adopted a second set of unconventional policies to provide further accommodation at the ZLB. These policies—monetary in nature—were unconventional in their instruments and operational targets. Central banks resorted to expanded forward guidance and, even less conventionally, to bond purchases (especially in the U.S., U.K. and Japan), with the aim of lowering longer-term bond rates and loosening monetary conditions. Forward guidance and bond purchases were intended to signal a shift in policy towards maintaining rates low for a longer period than would have been warranted by central banks' usual reaction functions. In addition, bond purchases aimed to reduce the stock of longer-term bonds in investors' portfolios, inducing them to accept lower returns to hold scarcer assets (alternatively to require lower compensation for risk now partly removed from their portfolios). These transmission channels are described in more detail in IMF 2013a.⁴

9. Thus, the term UMP covers a wide variety of policies deployed across countries and over time, responding to different circumstances and challenges. Conceptually, two main categories of UMP measures can be distinguished from the above: (i) policies to restore market functioning and intermediation, following both acute shocks (mainly in the euro area, the U.K., and the U.S.) and more drawn-out weakness and fragmentation of the financial system (mainly in the euro area and the U.K.); and (ii) policies to provide support to economic activity at the ZLB either through forward guidance on interest rates or by buying bonds (mainly in Japan, the U.K., and the U.S.).⁵ Some measures, notably those to prevent financial system meltdown, were deployed early in the crisis, whereas others came into play at later stages (for example, OMT in the euro area were announced in 2012; and Japan announced Quantitative and Qualitative Monetary Easing (QQME) in 2013). Further details on specific UMP instruments and programs are provided in IMF 2013a.

10. Finally, although UMP is termed “unconventional,” it has many similarities to conventional policy along with important differences. For example, although operational targets and instruments change, the fundamental objectives remain unaltered: to support price and financial stability, and depending on mandates, full employment. Likewise, in the broadest terms, the transmission to the macroeconomy and to other countries via lower longer-term bond rates is similar. In addition, some of the risks from UMP discussed later stem primarily from very accommodative monetary conditions, not directly from the new instruments used by UMP. But there

⁴ Other relevant papers are Gromb and Vayanos (2002), Garleanu and Pederson (2011), Clouse and others (2003), Bernanke (2000), Vayanos and Vila (2009), Greenwood and Vayanos (2010), Joyce and others (2012), Krishnamurthy and Vissing-Jorgensen (2011), D'Amico and others (2011) and Cochrane (2008 and 2011).

⁵ Clearly, there is overlap between these two categories of UMP; supporting the financial system also helps boost aggregate demand, for instance. In addition, not all measures occurred at once.

are also clear differences. There is, for example, no equivalent for UMP's use of portfolio balance channels through large scale asset purchases (LSAP), which may imply more direct effects on international capital flows. Also, bond purchases may erode central bank credibility in certain circumstances and complicate exit. Similarities and differences between UMP and its conventional counterpart are pointed out throughout the paper.

EFFECTS OF UMP

A. Effects on UMP Countries

11. In countries using UMP, policies to restore financial market functioning and intermediation were successful at overcoming acute instability. A financial meltdown with massive bank deleveraging and defaults was avoided, both following the Lehman bankruptcy and at the peak of the euro area sovereign crisis in the fall of 2011. The markets that had frozen—interbank, repo, ABS, euro area peripheral sovereign bonds—all regained at least basic function (Sack, 2010). Signs of acute market tensions, notably the breakdown of standard arbitrage relationships, such as covered interest parity, mostly vanished (Mancini-Griffoli and Ranaldo, 2010, or Krishnamurthy, 2010). Central banks successfully avoided a disaster.

12. Policies to restore more drawn-out weakness in financial intermediation were not uniformly effective. Purchases of MBS and agency debt in the U.S. did seem to have noticeably decreased mortgage yields (Hancock and Passmore, 2011). But in the U.K., and especially in euro area countries under market stress, the financial system remains fragmented. Credit as a share of GDP has been contracting (especially non-financial corporate credit), and lending rates have remained stubbornly high relative to bond yields and policy rates. The situation might have been worse in the absence of central bank actions, which have been limited thus far (OMT, for instance, is not activated yet).⁶ While these measures may well have been necessary, their limits in restoring credit flows and lowering lending rates should be recognized in the face of structural problems in the banking sector: high impaired assets, low profitability, inadequate loss absorption capacity, and poor governance and incentives. In addition, significant macroeconomic uncertainties and (to some extent) low demand for new loans cannot be overcome by measures to lower bank funding costs alone.

13. Policies to support demand at the ZLB significantly decreased long-term bond rates, as envisaged. In the U.S., studies suggest 10-year bond yields decreased by between 90 and 200 bps due to the various bond purchase programs (since November 2008). In the U.K., estimates range from 45 to 160 bps (since January 2009), while in Japan they drop by about 30 bps (since October 2010), although Japanese yields started from a lower level.⁷ It also appears that early bond

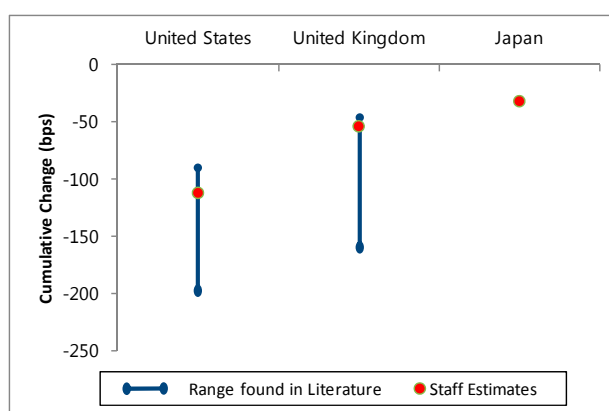
⁶ See IMF 2013a, the IMF's April 2013 GFSR (IMF 2013b) and Goodhart and Ashworth (2013), which highlight, in part, the drop in the money multiplier during the crisis and despite UMP.

⁷ Further details on results and corresponding bond purchase programs can be found in IMF 2013a. Estimates stem from event studies which measure bond market reactions in short time windows following announcements, so as to

(continued)

purchase programs significantly decreased tail risks of severe economic contractions (IMF 2013a; Roache and Rousset, 2013). Though still fresh, evidence is also mounting on the effectiveness of forward guidance in decreasing long-term bond yields, especially when such guidance convinces markets of a deviation from the central bank's "normal" reaction function (Woodford, 2012; Swanson and Williams, 2012; and IMF 2013a). Indeed, the analysis in the Background Paper finds that announcements, including forward guidance on interest rates, had larger effects on expectations of future interest rates than announcements of asset purchases, but that actual asset purchases seem to have had effects in addition to announcements, suggesting the policies worked via somewhat different channels.

Figure 1. Total Cumulative Effects of Bond Purchases on 10-Year Government Bonds



Sources: Literature (see Appendix Table 2, IMF 2013a), Bloomberg, and IMF staff calculations.

Note: Some estimates for the range are derived visually from graphs. Some papers study changes in bond prices over a two-day window following announcements; staff estimates consider a one-day window.

14. Policies to support demand at the ZLB appear to have boosted growth and prevented deflation, although these effects are difficult to measure. The biggest obstacle to obtaining a clear view of the effects on growth and inflation is establishing the proper counterfactual. Despite this caveat, the empirical findings to date support the view that both GDP growth and inflation were raised by bond purchases.⁸ But these results need to be interpreted with caution, as they are often

pick up the direct, and presumably causal, effects of announcements, without having to control for all other determinants of bond yields. Limitations of event study methods are discussed in IMF 2013a. Other papers investigating the effects of bond purchase programs are, in addition to the prior footnote: Gagnon and others (2011), Bauer and Rudebusch (2011), Christensen and Rudebusch (2012), Hamilton and Wu (2011), D'Amico and King (2010), Ueda (2012), Joyce and others (2011), Lam (2011) and Chen and others (2013, forthcoming).

⁸ Detailed findings from the literature as well as staff estimates are summarized in IMF 2013a. Staff analysis and most papers find that domestic GDP growth increases around 2 percentage points in the U.S. and U.K. (generally lasting around two years), although the range is very large (between 0.1 percentage and 8 percentage points). Effects on inflation are as large as 3.6 percentage points, though again within a wide range. The 2013 Spillover Report (IMF 2013d) focuses instead on the positive output gains to the rest of the world: a 100 bps decrease in long-term interest rates brought about by bond purchases is estimated to raise global growth from around 0–1.2 percent depending on the country undertaking UMP. Some of the relevant papers are: Baumeister and Benati (2010), Fuhrer

(continued)

derived from empirical relationships or model calibrations with pre-crisis data, which may not necessarily hold today (see IMF 2013a for further details). Dampening factors that may have reduced the expected impact of monetary policy on growth include a weak banking sector, debt overhang problems in the household and government sectors, as well as greater macroeconomic and policy uncertainty.⁹ While some may point to these arguments as evidence of the limited effects of UMP, the opportunity was provided to use the breathing space offered by UMP to implement further structural, fiscal, and banking sector reforms that require more time, as needed on a country-by-country basis.

Table. Summary of Empirical Studies on the Macro Effects of UMP

| Country | | Effects on GDP growth (pp) | Effects on Inflation (pp) |
|---------|--------------------------------|----------------------------|---------------------------|
| U.S. | Literature and Staff 1/ | | |
| | Median (peak) | 2.6 | 1.5 |
| | Range (peak) | 0.1–6.7 | 0–1.7 |
| | [Duration of effect, quarters] | [2–8] | [4–16] |
| U.K. | Literature and Staff 1/ | | |
| | Median (peak) | 2.4 | 1.5 |
| | Range (peak) | 0.5–8 | 1.1–8 |
| | [Duration of effect, quarters] | [2–4+] | [3–6] |

Source: IMF 2013a.

1/ To make results comparable, estimated impacts have been translated into the equivalent of a 100 bps shock to the spread.

15. UMP may give rise to risks. In large part, these risks stem from monetary policy remaining especially accommodative for a prolonged period (thus not specific to UMP), although some risks emerge directly from the instruments of UMP. Some risks also increase over time. The main risks are:

- The accommodative policy stance provided by UMP (which conventional monetary policy could equally deliver) may be relied upon to do too much, so that the breathing space it offers is not used to enact necessary but difficult reforms. UMP, like its conventional counterpart, cannot resolve structural hurdles nor raise long-term growth. It is thus imperative that UMP be accompanied by necessary reforms to return to a growth path sustained by fundamentals, so that UMP can eventually be unwound. Clearly, some reforms—notably structural reforms—may

and Olivei (2011), Chen and others (2012), Chung and others (2012), Bridges and Thomas (2012), Kapetanios and others (2012), Pesaran and Smith (2012), Lenza and others (2010), Giannone and others (2012), Peersman (2011), Fujiwara (2006), Kamada and Sugo (2006), Kimura and others (2003), as well as Chen, Mancini-Griffoli, Pescatori and Saadi Sedik (2013, forthcoming).

⁹ Rajan (2013) lists other reasons why the growth impact of prolonged UMP might not have had its full effect on growth. In particular, he points to low underlying productivity growth, persistent high unemployment, the need for large supply-side adjustments, particularly unequal sector and regional distribution of the impacts on activity, the possibility that firms could prefer labor saving capital at very low rates, and income effects that could rise relative to the substitution effect of low rates, possibly dampening downward pressure on savings.

take time to affect the real economy, and thus cannot substitute for monetary policy accommodation in the short-term. Yet, other reforms, such as repairing bank balance sheets or ending policy uncertainty with a credible commitment to fiscal sustainability, might have more immediate effects on the macroeconomy (see the October 2012 WEO (IMF 2012)). The evident success of OMT in the euro area in decreasing bond spreads in countries under market stress, thereby alleviating sovereign-bank linkages, might well have taken pressure off needed structural reforms and progress on repairing bank balance sheets and implementing a banking union. But policy challenges also exist elsewhere. In the U.S. and Japan, convincing plans for medium- and longer-term fiscal sustainability remain to be developed. In Japan all three arrows of Abenomics—including plans to put fiscal policy on a sustainable path—need to be used. However, strong and sustainable growth also requires major structural reforms in non-UMP countries to boost global demand and lower imbalances (see the 2013 External Sector Report for a discussion (IMF 2013c)).¹⁰

- Financial stability may be adversely affected if risk-taking behavior driven by persistently accommodative monetary policies (either unconventional or conventional) goes too far. Evidence suggests rising exposure to duration in global bond portfolios and high portfolio allocations to fixed income, especially in AEs. This increases the interest sensitivity of bond portfolios. There is also evidence of riskier positioning by weaker pension funds and insurance companies, and delays in cleaning up bank balance sheets in UMP countries. Also, high-yield and investment grade corporates continue to gradually relevel in the U.S., though corporate credit fundamentals generally remain strong.¹¹ The ability of micro- and macroprudential policies to counter these risks is still uncertain, and may be limited by slow implementation.
- Prolonged asset purchases may also undermine the credibility of central banks, and by extension inflation expectations. This risk stems from the instruments of UMP, especially bond purchases, which could come to be seen as monetary financing of government debts, or may be viewed as necessary to support a weak financial system. Political interference could mount owing to the prospects of diminished central bank profit transfers to the government if there are large losses on growing bond portfolios.

16. Thus far, however, there is no clear evidence that marginal costs from UMP are greater than marginal benefits. That said, it is very difficult to identify this threshold precisely. Even the theoretically plausible case for diminishing marginal benefits is not unambiguously supported by the data.¹² More work in this area is warranted.

¹⁰ Cottarelli and Viñals (2009) suggest a framework within which to analyze the interplay between fiscal and monetary policy, suggesting—at least at the time of writing—that neither one should be reined in too quickly.

¹¹ See the 2013 April GFSR, Chapters 1 and 3 (IMF 2013b), and forthcoming October 2013 GFSR, Chapter 1 (IMF 2013g). Empirical research suggests that easy monetary conditions can increase bank risk-taking behavior (De Nicolo and others, 2010; Jimenez and others, 2009; Ioannidou and others, 2009).

¹² This is especially true of measures to support aggregated demand, such as asset purchases. Diminishing returns should arise, in theory, for two reasons: (i) signaling beyond a certain horizon loses credibility, and (ii) long-term

(continued)

B. Effects on Non-UMP Countries

17. Non-UMP countries, including many emerging market economies (EMEs), benefited from UMP early on. The picture is clearer with early policies to support market functioning and intermediation. A severe financial sector meltdown, and a major recession in UMP countries, would have had dire consequences globally.¹³

18. Subsequent benefits and costs, especially to financial stability, are more difficult to ascertain. In part, this is due to the difficulty of establishing a counterfactual. To some extent, models can be used to overcome this hurdle. Yet, some effects that UMP can have on other countries are not well captured by standard models.

- On the one hand, most general equilibrium models suggest that aggressive monetary accommodation in UMP countries in response to a negative shock is beneficial for non-UMP countries, leading to higher global growth. Also, the proper monetary policy response in non-UMP countries limits their currency appreciation and further helps support growth (Box 1). In addition, non-UMP countries benefit from lower costs of capital and sovereign financing (lower bond yields), and higher equity prices, as observed in the data (Box 2).
- On the other hand, financial stability can be undermined during a prolonged period of capital inflows and cheap foreign financing (see Box 1 and Rajan, 2013). In this respect, UMP appears similar to conventional monetary policy, although some differences emerge. Lower interest rates in AEs tend to induce capital flows to countries offering higher returns, independently of how the cut in rates came about. Indeed, in the UMP period, interest rates in AEs have been predictably low for an unusually long time, which may have accentuated the effect of interest rate differentials on capital flows. Moreover, bond purchases in particular might have induced further capital outflows than would be warranted just by lower interest rates, due to portfolio rebalancing effects, with investors seeking to replace their government bond holding with equivalent bonds in non-UMP countries.¹⁴ Chapter 2 of the Background paper discusses how recent advances in modeling can illustrate how financial stability can be eroded through nonlinearities in the transmission mechanism, while Chapter 3 finds a strong common element over the UMP period in flows to bond markets in emerging markets.

19. The strong capital flows generated by accommodative monetary policies, which contributed to some useful rebalancing of global demand, have also given rise to policy challenges in recipient countries.¹⁵ When markets are thin, capital inflows can cause large and

bond yields reach their own ZLB. However, empirical support for diminishing returns is yet unclear, as suggested in IMF 2013a. See also BIS (2013).

¹³ IMF 2013a points to the substantial negative spillover effects of the Great Depression in Latin America.

¹⁴ See Fratzscher and others, 2013, and the Background Paper for evidence on the latter channel.

¹⁵ The link between UMP and capital flows is summarized in Box 2 and is explored in more details in the Background Paper, as well as the 2013 External Sector Report (IMF 2013c) and Spillover Report (IMF 2013d). The capital flows out of AEs and into EMEs that occurred mainly in the latter period of UMP can be mostly explained by push factors such

(continued)

rapid currency appreciation, which can inflict longer-lasting harm on export sectors through hysteresis and by lowering returns from net foreign assets (NFAs). Financial instability may also result from rapid credit expansion induced by UMP, asset price bubbles, and higher leverage (especially in foreign currency). Finally, stability may also be compromised if the capital inflows are followed at a later stage by rapid flow reversals (more on this later). Policymakers should allow exchange rates to respond to changes in fundamentals but may need to guard against risks of disorderly adjustment. Countries have also perceived a trade-off between tightening monetary policy in response to a cyclical upturn, which could accentuate exchange rate appreciation, and maintaining a looser monetary policy stance, which might raise inflation and undermine financial stability. And while micro- and macroprudential policies are available and should be used, they need to be part of a broader sound policy mix to be fully effective against excessive leverage and financial fragility. The risks posed by exit from UMP and a turning of the cycle are discussed later in this paper.

as global risk appetite and monetary policy conditions in AEs. Ostry, Chamon and Ghosh (2012), as well as Ostry and others (2010), discuss various aspects of capital flows management, including foreign exchange (FX) intervention and capital controls.

Box 1. Macroeconomic Spillovers from UMP—Model Simulations

This box summarizes a scenario analysis using two types of models: a standard multi-country Dynamic Stochastic General Equilibrium (DSGE) model and a DSGE model allowing for non-linear dynamics in credit cycles and capital flows. The former is covered in more detail in the 2013 Spillover Report (IMF 2013d). The effects of conventional and unconventional monetary instruments are not assumed to differ in these models.

The IMF's Global Integrated Monetary and Fiscal Model (GIMF) is a multi-country model with optimizing behavior by households and firms, and selected price frictions. GIMF explicitly models bilateral trade flows and their relative prices for each region, including exchange rates. The international linkages in the model allow the analysis of policy spillovers at the regional and global level. The standard production version comprises six regions, though the model has been simplified into two regions for this analysis: G-3 (United States, the euro area, and Japan) and emerging economies (emerging Asia and Latin America). More details are provided in the 2013 Spillover Report (IMF 2013d).

A counterfactual is established by assuming monetary policy is unable to respond for a period of two years to an adverse aggregate demand shock because the nominal policy interest rate is constrained by the ZLB.

Relative to this scenario, GDP in emerging markets returns to baseline faster when the G-3 respond with aggressive rate cuts, as implied by quantitative easing (QE). The G-3 response increases domestic GDP and with it demand for emerging market exports. However, this channel is partially offset by relative appreciation in emerging market currencies stemming from a positive interest rate differential versus the G-3.

The positive effect on GDP in emerging markets is noticeably greater if capital inflows to emerging markets resulting from quantitative easing are assumed to reduce corporate risk premium, thereby lowering the cost of capital for emerging market firms. Consequently, real investment rises notably and the larger capital stock leads firms to demand more labor. The resulting increase in household income raises private consumption expenditure and real GDP in emerging economies rises above baseline prompting a tightening in monetary policy to constrain domestic demand and re-anchor inflation at the target. The policy tightening leads to further currency appreciation, which slows the recovery in exports.

Finally, GIMF simulations suggest that growth outcomes in EMEs do not differ much in level whether they resist appreciation pressures or not (it is assumed that tools other than monetary policy are used to prevent currency appreciation). However, the composition of growth is different: more export-driven when appreciation is resisted and more domestic demand-driven when appreciation is allowed.

The second model, discussed in more detail in the Background Paper, instead tries to illustrate how financial instability can arise from strong capital inflows and later outflows. The model allows for non-linear dynamics by introducing several amplification mechanisms: pro-cyclicality in lending, capital buffers and asset price valuations, as well as non-diversifiable credit risk and unhedged exposure to foreign currency lending. The model is broadly calibrated on small open economies typical of emerging Europe and can be used to illustrate both growing financial instability during a phase of capital inflows and sharp contractions following capital outflows. This second aspect is investigated further below when discussing exit.

As capital flows into a country, lower borrowing costs and a stronger currency spur credit and increase asset prices. In turn, higher asset prices and the stronger currency lower agents' loan-to-value ratios, especially if loans are in foreign currency. As a result, agents demand further credit, which banks are willing to provide. Moreover, banks decide to hold ever lower capital buffers as they deem borrowers to be safer. Together, these developments boost consumption, investment, and in particular imports, worsening the current account and, in equilibrium, attracting further inflows. Financial vulnerabilities mount as credit grows rapidly, bank capital buffers diminish, household leverage increases, asset prices rise, and the currency appreciates.

This scenario is not inevitable, however. An economy with less foreign currency debt and a more resilient financial sector (reflecting inter alia stronger prudential policies) would not experience the same degree of amplification and hence vulnerability to crisis when capital flows reverse.

Box 2. Spillovers from UMP on Asset Prices in the Rest of the World

While most of the literature focuses on the domestic effects of UMP, a growing number of studies has examined the spillovers to non-UMP countries (Fratzscher and others, 2013; Glick and Leduc, 2013; Chen and others, 2012; Chinn, 2013; Neely, 2012; Bauer and Neely, 2013; Moore and others, 2013; as well as IMF 2013d). These papers focus on spillovers from U.S. UMP, using both high-frequency event studies and full-fledged empirical models. The Appendix Table provides further details. Additional work of IMF staff is summarized in the Background Paper.

Overall, these studies find that *UMP in the U.S.* had substantial spillover effects to other advanced and emerging economies. UMP not only stimulated the U.S. economy, but also boosted a broad range of asset prices globally: especially equities, but also government and corporate bonds, and credit default swap (CDS) spreads. As discussed in the April 2013 GFSR (IMF 2013b), external factors accounted for two-thirds of the local currency yield compression in EMEs since 2008 with domestic improvements explaining the remainder. With respect to LSAP, some studies (including work by IMF staff) find that spillover effects of LSAP 1 were different from those of LSAP 2 and later programs, suggesting that global macroeconomic and market conditions matter (and the nature of the two policies being quite different, as discussed earlier in this paper). LSAP 1 triggered portfolio rebalancing out of EMEs into the U.S., while markets still sought a safe haven, and was associated with the appreciation of the U.S. dollar. By contrast, LSAP 2 and later programs such as LSAP 3 triggered rebalancing in the opposite direction and were associated with a depreciation of the U.S. dollar. Staff work suggests these outflows might have reduced the effects of asset purchases as demand for bonds decreased contemporaneously with lower supply. Exchange rate responses seem to have been of the same order of magnitude than following monetary policy surprises in the pre-crisis period. Staff estimates further find that capital tended to flow into EMEs following surprise announcements, especially when these also involved explicit forward guidance. Generally, though, capital flows following actual purchases seem to have been stronger than those following announcements of asset purchases. More details are provided in the Background Paper.

UMP by the European Central Bank (ECB) may have also had a significant, and largely positive, impact on the central and eastern European (CEE) region. Some CEE countries appear to have benefited directly: for instance, in the final quarter of 2008, the ECB established agreements on repurchase transactions with Hungary and Poland in order to provide support to central bank operations with a view to euro liquidity provision (ECB 2010). The CEE region has also benefited from a stronger trade with the euro area. Moreover, the banking systems in the CEE region are mostly dominated by euro parent banks, which have benefited from the ECB's unconventional measures (Asmussen, 2013; Bakker and Gulde, 2010, provide an assessment of credit growth in CEE countries leading up to and following the crisis).

UMP in Japan—QQME—had strong financial spillovers.¹ In the near-term, these policies might have had negative spillovers to some trade competitors via the exchange rate channel. However, assuming that all three arrows of Abenomics are pursued vigorously, the higher growth in Japan in the long run, and easier global financial conditions, should more than offset the effect of exchange rate appreciation and generate positive spillovers on net (IMF 2013f).

¹ The QQME announcement in April 2013 led to an appreciation of foreign currencies vis-à-vis the Japanese yen of about 3 percent, a widespread fall in foreign equity prices of around 2 percent (IMF 2013a).

20. In the period up to the Federal Reserve's first tapering announcement in May 2013, non-UMP countries managed fairly well in the face of capital inflows, although risks have lately begun to emerge in some countries as the cycle has started to turn. Case studies of 13 of the largest non-UMP countries, which include both EMEs and some AEs, find that no country has exhibited wide-spread or acute macroeconomic or financial instability in the period up to the Federal

Reserve's first tapering announcement in May 2013 (Box 3). Banking systems appear to have remained mostly stable, with adequate loss-absorbing buffers despite rapid credit growth and rising current account deficits in some cases. This is a testament to these countries' macroeconomic management before and during the crisis, and the actions they have taken to make their financial systems more secure—including macroprudential measures and, in some cases, capital controls. On the whole, countries with stronger macroeconomic and policy fundamentals have done better. However, signs of instability have been emerging in some countries and sectors, especially as expectations of UMP exit in the U.S. have started to rise (more on the role of exit below, see also Rajan, 2013).

Box 3. Macroeconomic and Financial Outcomes in Non-UMP Countries

Non-UMP countries, both AEs and EMEs, have coped fairly well with capital inflows in the period up to the Fed's first tapering announcement in May 2013. It is important to note that case studies cannot distinguish the effects of UMP from other factors affecting economic outcomes. The main alternative is model-based analysis (Box 1), but this requires defining an appropriate counterfactual, which is not straightforward. And econometric work that finds significant financial market spillovers of UMP (Box 2) cannot be extended to provide reliable estimates of the impact of UMP on broader economic performance, whether domestically or abroad.

The case studies cover 13 of the largest non-UMP countries, accounting for nearly 40 percent of global GDP. Details on each country are provided in the Background Paper, as well as in the IMF's April and (forthcoming) October 2013 GFSRs (IMF 2013b and 2013g).

In these countries, capital inflows after the crisis generally exceeded their peak during the 2000–07, with the composition shifting to portfolio and debt flows. Although UMP may have contributed to the increase in flows, it is not possible to establish causality. Indeed, capital inflows had been on an increasing trend starting in the early 2000s in Australia, Brazil, Canada, China, Indonesia, Mexico, Thailand, and Turkey. While capital inflows in India, Russia, and South Africa after the crisis have not returned to their pre-crisis levels, they are still larger than in the early 2000s. Since 2011, there are signs that capital inflows are moderating in many of the countries under study, and indeed it appears that some countries have seen net outflows in the first half of 2013.

During the period in question, no country has seen significant overheating or wide-spread financial instability, though signs of instability have emerged in certain markets. Asset prices have increased rapidly in many cases, along with corporate leverage and foreign exchange exposure. For example, real estate prices have been buoyant in some cities of Brazil, Canada, China, and Thailand; stock prices rebounded sharply in China, Indonesia, Mexico, Russia, Thailand, and Turkey; and rapid credit expansion was observed in Brazil, China, and Turkey, also in foreign currency denominated debt (April 2013 GFSR, Chapter 1 (IMF 2012b)). There are also signs of growing sensitivity to higher global interest rates and market volatility across asset classes, along with a slowing in the gradual improvement of credit profiles of emerging market corporates (April and forthcoming October 2013 GFSRs, Chapters 1 (IMF 2013b and 2013g)). In recent months, some of these developments have been partly reversed. Also, banking systems appear to remain broadly sound, possibly reflecting steps to strengthen regulatory and supervisory frameworks.

While some countries have experienced external instability, in no case are exchange rates greatly overvalued, to the extent of severely damaging the export sector, nor are current account deficits especially large (figures are given in the 2013 External Sector Report (IMF 2013c)). Earlier this year, currencies were overvalued and current accounts were weaker than implied by medium-term fundamentals in Brazil, Canada, South Africa, and Turkey, although significant exchange rate adjustments occurred subsequently. On the other hand, further appreciation and current account adjustment is warranted in countries such as China and Korea.

The countries in the sample adopted various policies to manage the risks from increased capital flows. Some countries responded within their existing policy frameworks, notably Australia, Canada, Mexico, and Poland: they allowed the exchange rate to appreciate, with no or limited intervention, and eased monetary policy in a manner consistent with their inflation objectives. In addition, many EMEs intervened in FX markets to manage exchange rate volatility or stem appreciation. Capital flow management measures (CFMs) were introduced in Brazil, Indonesia, and Korea, while extensive capital controls continue to be maintained by China and India. Other policy reactions included capital outflow liberalization in South Africa and Thailand. Both AEs and EMEs actively used micro- and macroprudential measures to deal with excessive credit growth and potential vulnerabilities in the financial sector.

EXIT FROM UMP

21. Exit challenges will vary according to the type of UMP used. The earlier discussion distinguished between two broad groups of UMP: those to restore market functioning and intermediation, and those to support activity at the ZLB. In the first case, the UMP instruments can be withdrawn once the financial sector has stabilized sufficiently, while in the second case exit is a response to broader economic conditions, notably inflation and financial stability. In both cases, central banks have tools to facilitate a relatively smooth exit, although market reactions cannot be perfectly anticipated or controlled.

22. Exit from UMP to restore market functioning and intermediation will, in some cases, be driven by markets; and in others will involve policy decisions. The measures taken to support acute market dysfunction in particular included pricing structures and optionality that motivated counterparties to withdraw from the facilities when they regained access to (cheaper) market funding sources.¹⁶ In these cases, market participants determine the timing of exit. As for measures taken to support the more drawn-out weakness in financial intermediation, central banks will have to decide when to exit. At this point, solvent banks still reliant upon liquidity facilities (presumably few in number) would need to obtain funding elsewhere (in the euro area, from their national central bank's emergency lending assistance (ELA) facility) or shrink their balance sheets.¹⁷ Similarly, withdrawing from schemes targeted at improving intermediation in specific sectors (such as the Bank of England's (BOE) FLS) will require an assessment of when credit conditions in those sectors have eased, allowing borrowers sufficient access to credit at rates deemed acceptable for the risks involved. At this point, exit would entail scaling back extension of credit through the facility and then allowing outstanding credits to roll off.¹⁸

23. The central bank's decision to start the exit process from UMP to support activity at the ZLB will need to be conditioned on economic developments. The standard prescription is to begin exit (start tightening the monetary policy stance) when warranted by the inflation forecast and the output gap as long as financial stability is not a concern. As discussed in the April 2013 WEO, Chapter 3 (IMF 2013e), perhaps more weight can be placed on the output gap in current conditions given a flatter Phillips curve, as long as inflation expectations remain stable (Figure 2). However, measuring the output gap after an extended crisis period is challenging, as potential output might

¹⁶ This was the case for a number of measures used by the U.S. Federal Reserve Bank (the Fed) in 2007–08 (see IMF 2013a for details), and in part for the ECB's full-allotment LTROs, with banks having run down outstanding amounts from a peak of €1.1 trillion to €695 billion over the last few months. In the case of the ECB, overnight market rates are currently quoted around 40 bps below the policy rate, although clearly not all banks can access these rates. The ECB's open market operations are still offered with full allotment, which means that banks' demand determines the volume of aggregate liquidity.

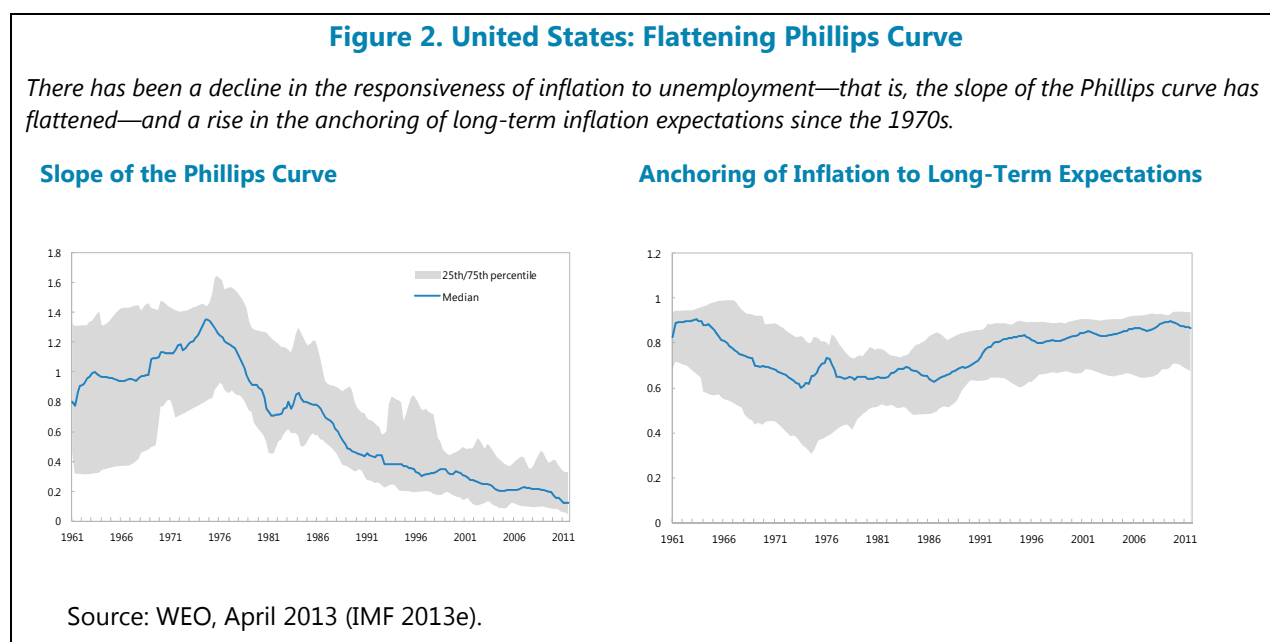
¹⁷ The April 2013 GFSR, Chapter 3 (IMF 2013b) discusses pitfalls from ending market support too early, or too late.

¹⁸ If the facility was designed as a credit enhancement (namely an asset swap), there would be no liquidity impact upon exit.

have decreased. If this fact remains unrecognized, monetary policy accommodation could well turn inflationary (see, for instance, Rajan, 2013).

24. However, financial stability considerations may complicate the timing of exit.

- Earlier exit than motivated by inflation and output gap considerations may be warranted if accommodative monetary conditions risk undermining financial stability and micro- or macro-prudential measures face limits.
- Policymakers could be tempted to delay exit to avoid some of its possible consequences, such as a rise in sovereign financing costs (fiscal dominance), or in banks' non-performing loans (financial dominance); but this could backfire if market participants believe the delay will lead to higher inflation later on.



25. Exit from UMP to support activity at the ZLB will involve a number of phases, some overlapping. The aim is to return to conventional monetary policy, where central banks determine only the short-term rate, and withdraw from the use of balance sheet instruments, but this will happen slowly. The vast excess reserves created by asset purchases in some countries, as well as the complications from selling such assets, make the exit from UMP more challenging than a tightening of policy following past periods of low interest rates. Accordingly, market reactions and the economy's response to tightening financial conditions remain uncertain. To illustrate the operational complexity of the process, exit is likely to entail the following phases:

- *Adjustment of forward guidance on the future path of policy rates and asset purchases followed by an actual, gradual reduction (tapering) of asset purchases.* The timing of changes to forward guidance is not straightforward. On the one hand, central banks will strive to prepare markets.

But on the other hand, they will be reluctant to risk undercutting their initial guidance that rates will remain lower for longer.

- *Increases in policy rates.* Short-term policy rate increases might occur while or even before a substantial amount of excess reserves has been drained.¹⁹ In this period, which could last years, market rates would be guided by the central bank's overnight deposit rate.²⁰
- *Shrinking the central bank balance sheet.* Reducing asset holdings may be appropriate to help drain excess reserves, although this is not essential to increasing interest rates. Box 4 provides some further details on the operational aspects of the exit process, as well as the link between the size of the central bank's balance sheet and its ability to guide market interest rates.

¹⁹ In the U.S., commercial bank reserves currently are around US\$1.9 trillion versus pre-crisis norms of US\$20–50 billion.

²⁰ In order for higher rates on central bank deposits to be passed through to market rates efficiently, with minimal lag, some excess reserve balances must be withdrawn. The significant additional liquidity provided by bond purchases has flooded money markets, dulling the competition for funds that normally ensures a tight relationship between the rates at which the central bank transacts with commercial banks and general market rates. Indeed, some money market rates routinely sit below the floor defined by the central bank's deposit facility: in the U.S., Switzerland and the euro area, for instance. Removing excess liquidity through the issuance of either short-term or long-term instruments can help to prepare the ground for policy rate hikes, and—once liquidity conditions are relatively tight—to ensure that these are transmitted to market rates. Further discussion can be found in Bech and Klee (2009).

Box 4. The Ability of Central Banks to Control Short-Term Market Rates

Pre-crisis, banks in most AE countries were structurally short of reserve money (“liquidity”), and central banks supplied the shortfall via Open Market Operations (OMO), at or close to the policy rate. Individual banks could source their funding from the central bank, the interbank and repo markets, or the wider money markets (by issuing certificates of deposits, for instance). Arbitrage across these markets—by borrowing where funds were cheap and lending where they were dear—pulled interest rates from these various markets close to each other.

Looking ahead, central banks may face somewhat greater challenges in controlling market interest rates. UMP operations, by expanding central bank assets, have left these markets with a large surplus of liquidity. In the U.S., reserve balances total around US\$1.9 trillion versus pre-crisis norms of US\$20–50 billion. In the U.K., reserve balances are nearly £300 billion compared with £20 billion. In the euro area, excess reserves were some €165 billion (as of August 6, 2013) compared with virtually zero pre-crisis.¹ This extra liquidity has dulled competition for funds, loosening the relationship between the rates at which the central bank transacts with commercial banks and general market rates. While interbank rates are currently guided by the central bank’s interest on excess reserves (the policy rate floor), wholesale market rates have varied below this (as has been the case in the U.S. and Switzerland): non-banks cannot access the central banks’ deposit rate, and the stronger banks which attract deposits require a spread to cover overheads and regulatory costs. Bech and Klee (2009) explore this issue further.

This does not mean that policy will be ineffective. Central banks can easily increase interbank rates by raising their own deposit rates. They can do this independently of the size of their balance sheet. But uncertainty remains as to their ability to keep wider market rates as closely aligned with the policy rate as pre-crisis. A gap, possibly varying in time, may continue to exist between the policy rate and other targeted market rates. The transmission of monetary policy may thus become marginally less predictable.

Restoring a tight link between the interbank rate and other market rates will likely require a substantial amount of excess reserve balances to be withdrawn. Doing so may well take years. Even then, the exact amount of reserves that needs to be withdrawn is uncertain. Future demand for reserve balances will be a function of the spread between their remuneration rate and opportunity cost, as well as the perceived need for precautionary balances (and reserve requirements, where imposed). Some degree of iteration and market discovery will be necessary to estimate demand for reserves.

These issues are known to central banks. A range of instruments is available to drain surplus liquidity—if it is necessary to do so before the portfolios run off—including term deposits, repo, and issuance of central bank securities. Some liquidity-draining operations will need to pay a higher rate than the targeted short-term market rate (banks would have no incentive to lock up liquidity if there were no return), but this need not be substantially higher. The Federal Reserve (which cannot issue securities) has conducted a number of test reserve-draining operations. One of these, the Term Deposit Facility, is open to all depository institutions. The other, utilizing reverse repos, involves a wider counterparty list—including government sponsored enterprises (GSEs) and fund managers—and so greater arbitrage opportunities. If these instruments turn out to be insufficient, central banks could always resort to the active sale of assets on their balance sheets.

¹ Excess reserves are defined as bank current account balances in excess of required reserves..

26. In simple models, exit does not imply any significant increase in the volatility of long-term rates. If the timing of exit is correctly anticipated, the subsequent path of short rates clearly expressed (and deemed appropriate to hit the inflation target), and the path of asset sales credible, long rates would make a one-time jump. Some volatility may arise due to the inability to signal short-term rates beyond a reasonable forecasting horizon, but this effect would be small.

27. In practice, exit is likely to be bumpier. Potential reasons for increased volatility in long-term rates are listed below, while Box 5 reviews some of the sources of instability in past exit episodes:

- *Uncertainty about the future path of policy rates due to limitations of forward guidance.* The path for future interest rates is clouded by uncertainty as to central banks' policy plans. In a classic problem of time inconsistency, central banks may leave rates lower for longer than usual (one of the arguments made for UMP) and then be expected to tighten at a pace faster than suggested by past cycles, in order to catch up to their usual rate path. Possibly reflecting such uncertainty, following the May and June 2013 tapering announcements by the Fed, expectations of short-term bond rates shifted markedly, even though there was no change in forward guidance. Finally, concerns about the timing of exit, as expressed earlier, may also add to the noise around short rate expectations.
- *Uncertainty about the ability of the central bank to perfectly control short-term market rates during exit in an environment of substantial excess liquidity, as discussed in Box 4 (notably diminished competition for funds).* Monetary policy should remain effective, though perhaps somewhat less predictable. Yet, if liquidity absorbing instruments were insufficient, central banks may have to engage in earlier sales of assets.
- *Uncertainty about the effects of asset sales on prices.* The relationship between asset quantities and prices is not sufficiently well understood, and both announcement and actual sale effects should be expected, as seen with asset purchases. For this reason, central bank communication should emphasize a path for interest rates, not for precise quantities of sales.
- *Recent changes in structural market liquidity could further exacerbate the above problems.* Reduced market liquidity could hamper price discovery and lead to a more fragmented market with higher credit costs, reducing credit intermediation and tightening financial conditions. In particular, broker-dealer inventories of fixed income instruments have steadily declined since 2007, particularly for corporate bonds, following efforts to reduce market leverage and a shift in funding and trading models. Smaller inventories have most likely reduced dealers' ability to act as a shock-absorber during market stress. Some nonbank entities have emerged as agents matching buyers and sellers, but not enough to compensate for retrenching broker-dealer intermediation capacity. In addition, changes in the leverage and duration exposure of bond investors could further amplify the impact of higher interest rates and volatility.²¹

28. The primary tool to contain instability is communication. Forward guidance is one component of a communications strategy, notably emphasizing that short-term (policy) interest rate increases will reflect the economic outlook and will not be unduly rapid (for example, in an effort to catch up after "low for longer"). In this regard, recent forward guidance by the Federal Reserve and

²¹ Stein (2013) discusses the difficulty of forecasting market dynamics and the role these may have in affecting bond rates at the time of exit. Stop-losses, margin calls, counterparty risk perceptions, and fund redemptions can all amplify upward spirals in bond yields. The forthcoming October 2013 GFSR, Chapter 1 (IMF 2013g) also discusses the role of market dynamics in the exit process at some length.

the BOE about economic thresholds has set the market up for incremental adjustments as the economy makes progress, although there is the risk that thresholds may need to be reconsidered as the recovery progresses. The Federal Reserve has already defined key elements of the mechanics of its exit strategy, and has revised its original plan as its balance sheet continued to grow. Broader communication on exiting UMP would also be useful, including guiding principles for asset sales, and a clear discussion of the risks to the recovery from exiting too early compared to the risks to domestic and global financial stability from exiting too late. While there is always a risk that communicating such concerns could undermine market stability, the larger fear is that insufficient communications will create market surprises.

29. If volatility and overshooting in bond yields were severe, tactical asset purchases could in principle be used if prices stray too far from fundamentals.²² However, the effectiveness of such outright intervention efforts to smooth the exit process might be low unless long rates are substantially misaligned, which is difficult to determine. There would also potentially be high costs, notably if the central bank found itself needing to intervene heavily and continuously; and a risk of market confusion, especially if the central bank is simultaneously tightening short-term rates and purchasing assets to hold down longer-term yields.²³

²² The U.S. Federal Reserve has previously indicated just this possibility.

²³ While central banks have indicated that long-term yields, and risk premia, are judged too high, none has specified a target level for yields. To introduce yield curve targets during exit would be difficult, and would likely delay market normalization.

Box 5. Exiting from Previous Periods of Monetary Easing: United States and Japan

In 1994, the U.S. Federal Reserve quickly increased short-term interest rates by 300 bps from a historically low level. In 2004–06, the Fed once again tightened policy significantly but more gradually. In 2000, the BOJ began then quickly aborted an exit from its Zero Interest Rate Policy (ZIRP). In 2006–08, the BOJ exited from its QE policy by allowing short-term assets to roll off its balance sheet as they matured. These episodes may have some lessons for today’s discussion of exit from UMP, as follows.

Communication is crucial to managing the impact on markets. Providing guidance to markets can help reduce the potential for overshooting. In 1994, the Fed provided little forward guidance, and there was a pronounced and front-loaded reaction to tightening. By contrast, during the larger 2004–06 tightening, a more gradual and more telegraphed approach was used,¹ and the market reaction was much milder. Similarly, Japan’s exit from QE in 2006 produced little bond market impact, as the BOJ precisely communicated its intentions both during the entry into, and during the exit from QE.

Exiting too early, and without clear criteria, can be risky as a fragile outlook can change. In August 2000, the BOJ attempted an early exit from their ZIRP by raising their call rate target from zero to 25 basis points. Yet, the economic recovery proved short lived: the BOJ cut rates again in February 2001 and engaged in its QE policy in March 2001. The move in August was controversial, given the lack of clear criteria to exit, and the fragility of the recovery and negative rate of inflation.

Tying the pace of tightening and asset sales to economic and market conditions is helpful. The BOJ in 2007 announced a process for selling the equities bought during the QE period. This process was designed to avoid disrupting markets. Part of the communication strategy was to link the pace of equity sales to financial market conditions to give markets comfort that liquidity would not be strained by the sales (which in addition were conducted through an agent to emphasize their separability from the BOJ’s other policy responsibilities). This approach was initially a success, although ultimately the BOJ did not complete the sales as financial market conditions deteriorated in 2008 following the failure of Lehman. While the BOJ’s experience shows that it is possible to sell assets without disrupting markets, central bank balance sheets are much larger today.

Unwinding is facilitated by short balance sheet maturity. The BOJ was able to shrink its balance sheet by 20 percent in only four months because many liquidity injection programs had built-in sunset clauses and most assets were of short maturity (commercial paper and treasury bills purchased had a maximum maturity of less than 150 days). New liquidity injections were halted once the expiration date arrived and asset maturities quickly drained liquidity.²

Impact on Financial Markets from Selected Tightening Cycles

| | Basis Point Change from Beginning of Tightening Cycle to: | | | | | |
|--------------|-----------------------------------------------------------|--------------|----------------------|--------------|--------------------|--------------|
| | Federal Reserve 1994 | | Federal Reserve 2004 | | Bank of Japan 2006 | |
| | Mid-cycle | Total | Mid-cycle | Total | Mid-cycle | Total |
| 2-yr | 160 | 307 | 82 | 237 | -5 | 2 |
| 10-yr | 127 | 189 | -77 | 51 | -14 | -15 |
| 2–10 yrs | -34 | -119 | -159 | -186 | -9 | -17 |
| Equity index | -6.5 percent | -2.1 percent | 4.9 percent | 12.0 percent | 10.0 percent | 20.7 percent |
| FX index | -2.7 percent | -8.4 percent | -0.4 percent | -3.9 percent | -1.3 percent | -5.2 percent |

Sources: Federal Reserve Bank of St Louis FRED database, BOJ, BOE, and IMF staff estimates.

Note: The BOJ’s exit from the ZIRP in 2000 is not shown in the above table due to the brevity of the rate hike.

¹ Bernanke (2004) provides a discussion of the benefits of gradualism in the conduct of monetary policy implementation <http://www.federalreserve.gov/boarddocs/speeches/2004/200405202/>.

² See Shiratsuka (2010) and Yamaoka and Syed (2010) for a thorough discussion of the BOJ’s 2006 exit strategy.

30. Actions to promote an orderly exit should help counter global market disruptions, although there could still be significant international spillovers. In UMP countries not exiting, expected short-term rates might rise due to business cycle correlations (stronger growth from countries exiting and weaker currencies). Risk premia might also rise, reflecting greater policy and market uncertainty (this would be especially problematic in countries with still weak growth, although forward guidance can help decrease policy uncertainty). In non-UMP countries, currencies will depreciate (to balance changes in relative bond returns) and bond yields might rise (if monetary policy is expected to tighten due to a boost from growth in UMP countries, while term premia might rise due to repricing of risk, or changes in liquidity premia).

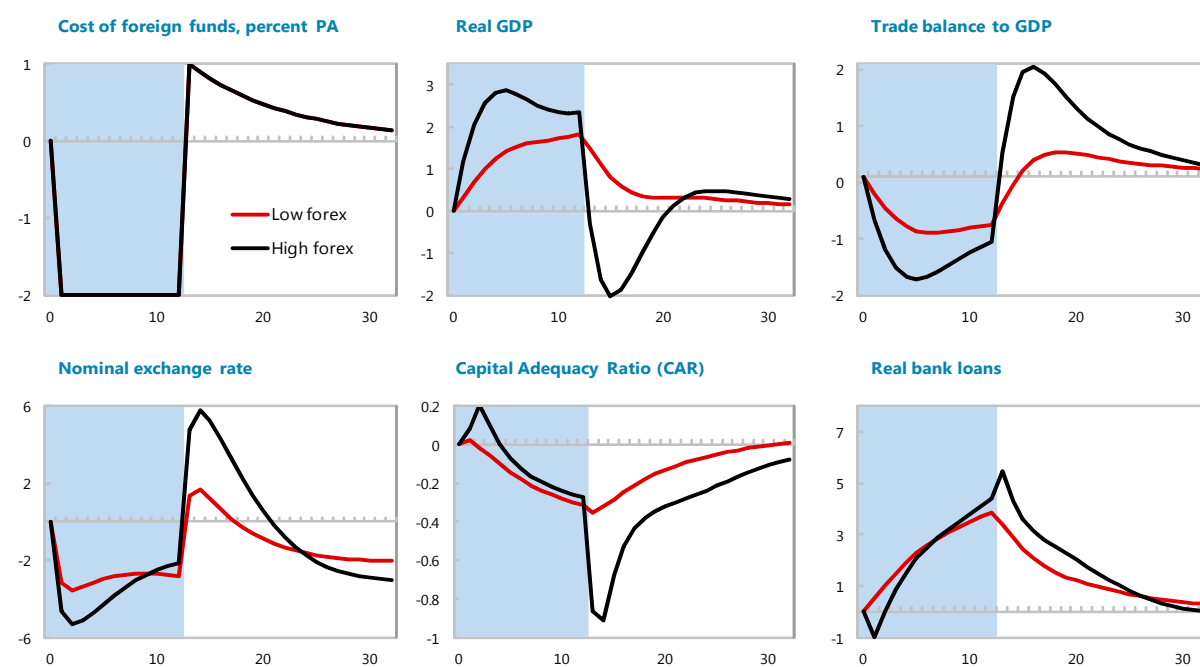
31. Some capital flow reversal and higher borrowing costs are to be expected, but further volatility could emerge, even if exit is well managed by UMP countries. Higher bond rates will induce portfolio rebalancing out of non-UMP countries, and this shock could be amplified owing to the usual market imperfections, which are likely to be most acute in EMEs that have received large capital inflows. A repricing of risk could induce a run by investors holding speculative positions, especially if these are highly leveraged using short-term funding. In addition, thin markets could amplify price movements and kick off sale spirals. Foreign exchange exposure would further amplify asset price movements, as investors struggle to deleverage and close positions.

32. Further amplification could come from the financial system, where stability could be undermined as non-performing loans rise, capital buffers shrink, and funding evaporates. Moreover, contagion effects could both amplify and broaden asset price movements and capital outflows as investors contemporaneously flock out of EMEs (Forbes and Rigobon, 2002). The co-movement in capital flows was noticeably higher following announcements of Fed tapering than following earlier announcements of asset purchases (details are given in the Background Paper). Box 6 illustrates the potential amplification of shocks during exit using the non-linear DSGE model introduced in Box 1. As is typical in stretched markets, the bust appears much more abrupt than the boom during which the seeds of financial instability are sown.

Box 6. Exit and Financial Instability, an Illustration from a Non-Linear DSGE Model

The non-linear model introduced in Box 1 offers insights into the sharp adjustments that can result from a sudden reversal of capital flows as a result of endogenous amplification mechanisms. An unexpected rise in foreign interest rates, as might occur during exit from UMP, leads in the first instance to the depreciation of the domestic currency and a sharp decrease in asset prices, in anticipation of a future drop in output. Both reduce real incomes and wealth through higher import prices, but also through a jump in the domestic currency value of foreign currency debt. As consumption decreases and debt rises, non-performing loans increase. This further reduces banks' capital, inducing these to charge higher lending rates in order to avoid falling below minimum capital requirements. The downturn in lending further undermines consumption and investment, and fuels a vicious circle, resulting in a sharp drop in growth and a spike in the current account surplus. As before, however, such an outcome is not inevitable. Measures to limit foreign currency debt and strengthen the financial system can be helpful, inter alia by preventing stretched valuations and household and corporate leverage.

Some of the key variables in model are shown below, as they respond first to capital inflows, and then to capital outflows. The general dynamics of variables should be emphasized more than their exact values, as data on large shocks are insufficient to precisely calibrate the model in these cases. Two economies are considered for the simulations: one with a high degree of foreign exchange rate liabilities and one with low exposure. Further details are provided in the Background Paper.



Source: IMF staff estimates.

33. In practice, the effects of exit on non-UMP countries will depend on their exposure and resilience. “Exposure” refers to the likelihood of market volatility and capital outflows in a given country, following tapering in UMP countries. And “resilience” captures the ability of a country to withstand potential market volatility and capital outflows. Both factors are described in more detail in Box 7. Based on the review of various indicators of exposure and resilience (see also the Background Paper), it would seem that the more developed non-UMP economies (Australia—higher resilience, as well as Canada and Korea—lower exposure) as well as other EMEs with higher

resilience and/or lower exposure are expected to fare relatively well following a U.S. exit. Other countries appear more vulnerable (due to both higher exposure and lower resilience), and some are more borderline cases between these two extremes.

Box 7. Non-UMP Countries' Exposure and Resilience to Market Volatility and Capital Outflows

The effect of exit on non-UMP economies will depend on two main factors. Each can be gauged by various indicators suggested below. The list of indicators could be longer, and different indicators are more or less appropriate for different countries. Thus, any conclusions should be taken with a grain of salt. Nonetheless, the study of these indicators does help suggest which countries might want to step up their efforts in preparing for an eventual exit from UMP in AEs. The Background Paper provides details.

- “*Exposure*” refers to the likelihood of market *volatility* and capital outflows in a given country, following tapering in UMP countries (the U.S. in the empirical evaluations). Four measures of exposure are used: (i) sovereign credit ratings (these are positively correlated with the risk of capital outflows through contagion effects); (ii) empirically estimated correlations of a country’s 10-year bond rates with those of the U.S. (the correlations are estimated by a regression on days of Federal Open Market Committee (FOMC) announcements, to minimize endogeneity biases, using daily data from January 1, 2003 to May 20, 2013, with all variables in first differences); (iii) cumulative changes of countries’ 10-year bond rates on days of Fed tapering announcements (May 22 and June 19, 2013); and (iv) extent of capital outflows following recent U.S. tapering announcements.
- “*Resilience*” captures the ability of a country to withstand potential market volatility and capital outflows. Three broad indicators are used: (i) domestic market conditions (a composite of market size, turnover, and the ability of domestic investment funds to supplant foreign investors); (ii) reliance on foreign funding, especially of short-term maturity (which is a proxy for the potential damage from capital outflows); and (iii) room for policy maneuver to respond to capital outflows and higher interest rates (further decomposed into: room for currency depreciation relative to fundamentals, foreign exchange reserves to potentially stem excessive depreciation, appropriateness of higher interest rates relative to inflation and the output gap, room for fiscal policy to withstand higher funding costs and support the financial sector if necessary, and banking sector strength).

34. There are several policy options for non-UMP countries facing spillovers from UMP exit. Which actions should be taken will vary with country circumstances. Affected countries should proactively take steps to enhance fundamentals, as this will provide more room for policy maneuver later.

- When capital flows weaken or reverse, central banks will have to rely on their credibility and active communication to convince markets of their focus on stable inflation and orderly markets, with a monetary policy response that is appropriate to the cyclical position. This will be key to mitigating flight to quality and the associated increases in risk premia. Some countries may be able to access central bank foreign exchange swap lines to help cope with market turbulence.
- Exchange rates should be allowed to respond to changing fundamentals, but there may be a need to guard against risks of disorderly adjustment. Some intervention to smooth current market volatility may be appropriate in countries with adequate reserves, but this should not forestall underlying external adjustment for those economies where external deficits exceed levels warranted by fundamentals and desired policies.

- To the extent that micro- and macroprudential policies have been used to limit the financial stability risks associated with earlier inflows, these might be reversed, but only if doing so would not endanger financial stability.²⁴

POLICY COORDINATION AND THE ROLE OF THE FUND

35. International policy coordination with respect to UMP may help to improve global outcomes under some conditions. Given the degree of interconnectedness of today's economies and financial markets, spillovers, both good and bad, are inescapable. Generally, what is good for each large, advanced economy is good for the rest of the world (and vice versa). But there can be both positive and negative spillovers. For example, UMP may have negative externalities on non-UMP countries. In turn, non-UMP countries might take measures to offset the externalities, resulting in losses in UMP countries. This would result in suboptimal outcomes in both UMP and non-UMP countries. In this case, international policy coordination can in principle lead to improved economic outcomes globally (that is, to Pareto improvements).²⁵ Establishing the case for international policy coordination thus presupposes that a suitable constellation of externalities exists, that these can be identified and measured, and that problems related to incomplete/asymmetric information across countries can be overcome.²⁶

36. Policy coordination to ensure that cross-border policy spillovers are appropriately internalized remains a desirable objective.

- UMP measures to support market functioning and financial intermediation, especially following acute shocks, typically have positive (not negative) cross-border externalities. As discussed earlier, non-UMP countries unambiguously benefited from policies that restored market functioning and financial system stability. Exit from such policies, once their goals have been achieved, would also most likely not have negative externalities.
- UMP measures to support aggregate demand at the ZLB have helped to raise global growth, but may also have negative externalities if they lead to financial distortions and the associated buildup of macroeconomic and financial stability risks, for example via excessive capital flows to non-UMP countries. Policy coordination may thus be warranted in this case

37. More work is needed on these questions, all the more so as there are widely divergent perceptions both in the economic literature and across countries. There is no consensus on the size and sign of the externalities from various policies, neither when it comes to the use of UMP to

²⁴ CFMs to restrain outflows should only be used in crisis or near-crisis conditions.

²⁵ It is important to note that simple cross-border spillovers such as changes in exchange rates or other prices are not sufficient to establish the case for international policy coordination—there must be true externalities that affect economic welfare.

²⁶ Ostry and Ghosh (2013), as well as Ostry, Ghosh and Korinek (2012), explore the issue of policy coordination in greater detail.

support aggregate demand at the ZLB (or exit from such policies), nor when it comes to the measures, such as capital inflow controls, that non-UMP countries might take in response.²⁷ In particular, it is not known at what point the positive effects of UMP on global growth would be outweighed by the financial stability risks.²⁸

38. Coordination, if warranted, would have several facets. UMP economies would be encouraged to alter their internal policy mix, as discussed earlier. While in the short term this is unlikely to take much pressure off monetary policy to provide accommodative conditions, needed structural, fiscal and banking sector reforms would certainly allow UMP to be unwound earlier rather than later. Coordination would also involve reforms in non-UMP countries to foster rebalancing and strengthen conditions for sustainable medium-term growth. Together, these reforms would be beneficial for global growth.²⁹ But coordination would also involve greater collaboration in adopting regulatory and macro-prudential policies designed not to solve a problem at home but help others deal with a problem they cause. Also, collaboration would be beneficial in preparing the terrain for exit, for instance as by setting up foreign exchange swap lines and providing other central banks with sufficient advanced warning on exit prospects.

39. Achieving coordination requires the right incentives. First, countries will need to see clear and visible medium-term net benefits from coordination. Second, UMP might be conditioned on the implementation of other needed reforms. Neither of these incentives is fully in place. There is notably little prospect that central banks might seek to impose conditions for their liquidity assistance on governments, except for possibly OMT. However, central banks may be able to impose conditions on banks to speed up their repair and reform.

40. The Fund stands ready to support the membership in navigating UMP and its exit. In so doing, the Fund could help to strengthen the incentives for coordination (see below). In addition to policy papers that focus on UMP issues—such as this one—Fund surveillance can help illuminate the underlying issues involved in UMP policies in a number of ways. Multilateral products such as *the World Economic Outlook* and *Global Financial Stability Report* provide a global perspective on the two main issues associated with UMP policies: prospects for growth and for financial stability. In addition, the Fund's new surveillance framework allowing a more integrated analysis of policy spillovers to and from the rest of the world is well-designed to deal with complex global policy

²⁷ The available evidence suggests that the multilateral effects of capital controls are limited, unless such controls become pervasive. See IMF (2011) and Ostry, Ghosh, and Korinek (2012).

²⁸ There are significant issues involved in making this determination. First, it is difficult to judge when the marginal costs of such policies exceed the marginal benefits. Second, it is unclear what different policy mix would provide equal support for aggregate demand. And third, there may not be the political will to alter the policy mix. In fact, as discussed earlier in some detail, the relative success of UMP in supporting growth in the short-term may have reduced incentives to use the available breathing space to implement the more difficult reforms.

²⁹ The 2013 Spillover Report (IMF 2013d, Box 1) argues that a different policy mix could raise global growth, with global GDP about 3 percent higher than in the baseline after 10 years.

issues such as UMP. Finally, new Fund reports on Spillovers and on External Sector Assessments provide further analysis of the impact of UMP and link the bilateral and multilateral perspectives.

41. Fund lending facilities also provide an avenue for preventing and alleviating some of the risks from UMP. While there is consensus that UMP implementation and exit should be smooth, it is prudent to examine how to minimize potentially damaging side effects should they occur. In addition to exchange rate flexibility and macroprudential policies, policy buffers such as reserves and swap lines can help defuse potential financial market instabilities. Fund facilities such as the Flexible Credit Line are an important element that can be used to build such buffers. In addition, should such instability strike, more traditional Fund lending arrangements can help to alleviate the impact of balance of payments problems on members. Finally, technical assistance can also support implementation of domestic policy initiatives in areas such as macroprudential policies.

42. Finally, Fund analysis can help oil the wheels of economic cooperation and coordination. In addition to providing a forum for discussion of mutually advantageous international policy options, Fund analysis (borrowing from the earlier metaphor) can assist in providing the case for such cooperation by illuminating potential gains from coordinated action. More specifically, Fund analysis can provide an independent and rigorous approach to exploring spillover effects—both positive and negative—of policies. Such analysis can then be used to suggest areas where policy cooperation might usefully be explored. In addition to discussions at the Fund, such analysis can provide a global perspective to other forums where policy cooperation is on the agenda. For example, in the G-20 Mutual Assessment Process, thematic annexes on key multilateral policy issues could further enhance the dialogue on how to achieve rapid and sustainable growth for the world as a whole.

References

- Adrian, Tobias and Hyun Song Shin, 2009, "Money, Liquidity and Monetary Policy," *American Economic Review* (papers and proceedings), Vol. 99, pp. 600–605.
- Asmussen, Jörg, 2013, "CEEs and the Crisis: Current Challenges and Benefits," Speech at the IIF Central and Eastern Europe CEO Conference.
- Bakker, Bas and Anne-Marie Gulde, 2010, "The Credit Boom in the EU New Member States: Bad Luck or Bad Policies?" IMF Working Paper, 2010/130.
- Bauer, Michael D. and Christopher Neely, 2013, "International Channels of the Fed's Unconventional Monetary Policy," Working Paper Series 2012-028B, Federal Reserve Bank of St. Louis.
- Bauer, Michael D. and Glenn D. Rudebusch, 2011, "The Signaling Channel for Federal Reserve Bond Purchases," Working Paper Series 2011–21, Federal Reserve Bank of San Francisco.
- Baumeister, Christiane and Luca Benati, 2010, "Unconventional Monetary Policy and the Great Recession: Estimating the Impact of a Compression in the Yield Spread at the Zero Lower Bound," European Central Bank Working Paper Series, 1258, Frankfurt: European Central Bank, October.
- Bank for International Settlements (BIS), 2013, "83rd BIS Annual Report 2013–13," June.
- Bech, Morten and Elizabeth Klee, 2009, "The Mechanics of a Graceful Exit: Interest on Reserves and Segmentation in the Federal Funds Market," Staff Report, No. 416, Federal Reserve Bank of New York.
- Bernanke, Ben, 2000, "Japanese Monetary Policy: A Case of Self-Induced Paralysis?" In *Japan's Financial Crisis and Its Parallels to U.S. Experience*, ed. Adam S. Posen and Ryoichi Mikitani. Washington, D.C., Institute for International Economics, 2000.
- Bernanke, Ben, 2004, "Gradualism," Remarks at an Economics Luncheon co-sponsored by the Federal Reserve Bank of San Francisco and the University of Washington, Seattle, Washington, May 20.
- Bridges, Jonathan and Ryland Thomas, 2012, "The Impact of QE on the UK Economy—Some Supportive Monetarist Arithmetic," Bank of England Working Paper No. 442.
- Brunnermeier, Markus K. and Lasse Pedersen, 2009, "Market Liquidity and Funding Liquidity," *Review of Financial Studies*, Vol. 22, pp. 2201–38.

- Brunnermeier, Markus K. and Yuliy Sannikov, 2012a, "The I Theory of Money," Working Paper, Princeton University.
- , 2012b, "Redistributive Monetary Policy," presented at the Jackson Hole symposium, August 2012.
- Chen, Jiaqian, Tommaso Mancini-Griffoli and Tomas J. Mondino, 2013, "Effectiveness and Channels of Bond Purchase Programs," IMF Working Paper, forthcoming.
- Chen, Jiaqian, Tommaso Mancini-Griffoli, Andrea Pescatori and Tahsin Saadi Sedik, 2013, "Macroeconomic Effects of Large Scale Asset Purchase: Do Channels of Transmission Matter?" IMF Working Paper, forthcoming.
- Chen, Qianying, Andrew Filardo, Dong He and Feng Zhu, 2012, "International Spillovers of Central Bank Balance Sheet Policies," forthcoming BIS Paper.
- Chinn, Menzie D., 2013, "Global Spillovers and Domestic Monetary Policy—The Impacts on Exchange Rates and Other Asset Prices," mimeo.
- Christensen, Jens H. E. and Glenn D. Rudebusch, 2012, "The Response of Interest Rates to U.S. and U.K. Quantitative Easing," *The Economic Journal* 122(564): pp. 385–414.
- Chung, Hess, Jean-Philippe Laforte, David Reifschneider, and John C. Williams, 2012, "Have We Underestimated the Likelihood and Severity of Zero Lower Bound Events?" *Journal of Money, Credit and Banking*, Vol. 44 supplement (February), pp. 47–82.
- Clouse, James, Dale Henderson, Athanasios Orphanides, David Small, and Peter Tinsley, 2003, "Monetary Policy when the Nominal Short-Term Interest Rate is Zero," *The B.E. Journal of Macroeconomics*, Vol 1, page 12.
- Cochrane, John, 2011, "Inside the Black Box: Hamilton, Wu and QE2," Mimeo, Chicago Booth School of Business.
- Cochrane, John, 2008, "Comments on 'Bond Supply and Excess Bond Returns' by Robin Greenwood and Dimitri Vayanos," Comments given at the conference "Beyond Liquidity: Modeling Frictions in Finance and Macroeconomics," May 9–10, 2008.
- Cottarelli, Carlo and José Viñals, 2009, "A Strategy for Renormalizing Fiscal and Monetary Policies in Advanced Economies," IMF Staff Position Note, September 22, 2009.

- Curdia, Vasco and Michael Woodford, 2011, "The Central-Bank Balance Sheet as an Instrument of Monetary Policy," *Journal of Monetary Economics* Vol. 58(1), pp. 54–79.
- D'Amico, Stefania and Thomas B. King, 2010, "Flow and Stock Effects of Large Scale Treasury Purchases," Federal Reserve Board, Finance and Economics Discussion Series, No. 2010–52, September.
- D'Amico, Stefania, William English, David López-Salido, and Edward Nelson, 2011, "The Federal Reserve's Large-Scale Asset Purchase Programs: Rationale and Effects," *Economic Journal*.
- De Nicolò, Gianni, Giovanni Dell'Ariccia, Luc Laeven, and Fabian Valencia, 2010, "Monetary Policy and Bank Risk Taking," IMF Staff Position Note 10/09.
- Diamond, Douglas and H. Philip Dybvig, 1983, "Bank Runs, Deposit Insurance and Liquidity," *Journal of Political Economy* 91, pp. 401–19.
- Eggertsson, B. Gauti, 2012, "Was the New Deal Contractionary?" *American Economic Review*, American Economic Association, Vol. 102(1), pp. 524–55, February.
- European Central Bank, 2010, "The Impact of the Financial Crisis on the Central and Eastern European Countries," ECB Monthly Bulletin, July 2010.
- Forbes, Kristin J. and Roberto Rigobon, 2002, "No Contagion, Only Interdependence: Measuring Stock Market Comovements," *The Journal of Finance*, Vol. 57, No. 5, pp. 2223–2261.
- Fratzscher, Marcel, Marco Lo Duca and Roland Straub, 2013, "On the International Spillovers of U.S. Quantitative Easing," Discussion Papers of DIW Berlin 1304, DIW Berlin, German Institute for Economic Research.
- Fuhrer, C. Jeffrey and Giovanni P. Olivei, 2011, "The Estimated Macroeconomic Effects of the Federal Reserve's Large-Scale Treasury Purchase Program," Federal Reserve Bank of Boston Public Policy Briefs No. 11–2.
- Fujiwara, Ippei, 2006, "Evaluating Monetary Policy when Nominal Interest Rates are Almost Zero," *Journal of the Japanese and International Economics*, 20(3), pp. 434–453.
- Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack, 2011, "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases," *International Journal of Central Banking*, Vol. 7(1), pp. 3–43.

- Garleanu, Nicolae and Lasse Heje Pedersen, 2011, "Margin-Based Asset Pricing and Deviations from the Law of One Price," *Review of Financial Studies*, Society for Financial Studies, Vol. 24(6), pp. 1980–2022.
- Gertler, Mark and Peter Karadi, 2011, "A Model of Unconventional Monetary Policy," *Journal of Monetary Economics* Vol. 58(1): pp. 17–34.
- Giannone Domenico, Michele Lenza, Huw Pill and Lucrezia Reichlin, 2012, "The ECB and the Interbank Market," *Economic Journal*, Royal Economic Society, Vol. 122(564), pp. F467–F486, November.
- Glick Reuven and Sylvain Leduc, 2013, "The Effects of Unconventional and Conventional U.S. Monetary Policy on the Dollar," Working Paper Series 2013–11, Federal Reserve Bank of San Francisco.
- Goodhart, Charles A. E. and Jonathan P. Ashworth, 2013 "QE: A Successful Start May be Running into Diminishing Returns," *Oxford Review of Economic Policy*, 28 (4). pp. 640–670.
- Gorton, Gary, 2009, "Information, Liquidity, and the (Ongoing) Panic of 2007," *American Economic Review*, Vol. 99(2), pp. 567–72.
- Greenwood, Robin and Dimitri Vayanos, 2010, "Price Pressure in the Government Bond Market," *American Economic Review*, American Economic Association, Vol. 100(2), pp. 585–90, May.
- Gromb, Denis and Dimitri Vayanos, 2002, "Equilibrium and Welfare in Markets with Financially Constrained Arbitrageurs," *Journal of Financial Economics*, Elsevier, Vol. 66(2–3), pp. 361–407.
- Hamilton, James D. and Jing Cynthia Wu, 2011, "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment," Working Paper, University of California, San Diego, April 2011.
- Hancock, Diana and Wayne Passmore, 2011, "Did the Federal Reserve's MBS Purchase Program Lower Mortgage Rates?" *Journal of Monetary Economics*, Vol. 58, No. 5, pp. 498–514.
- He, Zhiguo and Wei Xiong, 2012, "Dynamic Debt Runs," *Review of Financial Studies*, Vol. 25(6): pp. 1799–1843.
- International Monetary Fund, 2013a, "Unconventional Monetary Policies—Recent Experience and Prospects," May.

- , 2013b, 2013 GFSR, April.
- , 2013c, 2013 External Stability Report, July.
- , 2013d, 2013 Spillover Report, July.
- , 2013e, 2013 WEO, April.
- , 2013f, 2013 Article IV Consultation with Japan.
- , 2013g, 2013 GFSR, October (forthcoming).
- , 2012, 2012 WEO, October.
- , 2011, "The Multilateral Aspects of Policies Affecting Capital Flows," October.
- Ioannidou, Vasso, Steven Ongena and Jose-Luis Peydro, 2009, "Monetary Policy, Risk-Taking, and Pricing: Evidence from a Quasi-Natural Experiment," Discussion Paper 2009-31 S, Tilburg University, Center for Economic Research.
- Jiménez, Gabriel, Steven Ongena, José Luis Peydró, and Jesús Saurina, 2009, "Hazardous Times for Monetary Policy: What do Twenty-three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-taking?," Banco de Espana Working Papers 0833, Banco de Espana.
- Joyce, Michael, David Miles, Andrew Scott, and Dimitri Vayanos, 2012, "Quantitative Easing and Unconventional Monetary Policy—an Introduction," *The Economic Journal*, 122, pp. F271–F288.
- Joyce, Michael, Ana Lasasosa, Ibrahim Stevens, and Matthew Tong, 2011, "The Financial Market Impact of Quantitative Easing in the United Kingdom," *International Journal of Central Banking*, Vol. 7(3), pp. 113–161.
- Kamada, Koichiro and Tomohiro Sugo, 2006, "Evaluating the Japanese Monetary Policy under the Non-Negativity Constraint on Nominal Short-Term Interests Rates," September.
- Kapetanios, George, Haroon Mumtaz, Ibrahim Stevens and Konstantinos Theodoridis, 2012, "Assessing the Economy-wide Effects of Quantitative Easing," Bank of England Working Paper No. 443.

- Kimura, Takeshi, Hiroshi Kobayashi, Jun Muranaga, and Hiroshi Ugai, 2003, "The Effect of the Increase in the Monetary Base on Japan's Economy at Zero Interest Rates: An Empirical Analysis," pp. 276–312.
- Kiyotaki, Nobuhiro and John Moore, 1997, "Credit Cycles," *Journal of Political Economy*, Vol. 105, pp. 211–48.
- Krishnamurthy, Arvind, 2010, "How Debt Markets Have Malfunctioned in the Crisis," *Journal of Economic Perspectives*, 24(1): pp. 3–28.
- Krishnamurthy, Arvind and Annette Vissing-Jorgensen, 2011, "The Effects of Quantitative Easing on Interest Rates," *Brooking Papers on Economic Activity* 43(2): pp. 215–287.
- Lam, W. Raphael, 2011, "Bank of Japan's Monetary Easing Measures: Are They Powerful and Comprehensive?" IMF Working Paper, WP/11/264.
- Lenza, Michele, Huw Pill, and Lucrezia Reichlin, 2010, "Monetary Policy in Exceptional Times," Working Paper Series 1253, European Central Bank.
- Mancini-Griffoli, Tommaso and Angelo Ranaldo, 2010, "Limits to Arbitrage During the Crisis: Funding Liquidity Constraints and Covered Interest Parity," Swiss National Bank Working Paper.
- Moore, Jeffrey, Sunwoo Nam, Myeongguk Suh and Alexander Tepper, 2013, "Estimating the Impact of U.S. LSAPs on Emerging Market Economies' Local Currency Bond Markets," Federal Reserve Bank of New York Staff Report No. 595.
- Neely, Christopher, 2012, "The Large-Scale Asset Purchases Had Large International Effects," Working Paper 2010-018D, Federal Reserve Bank of St. Louis.
- Ostry, Jonathan D., Karl Habermeier, Marcos Chamon, Atish R. Ghosh, Mahvash S. Qureshi, and Dennis B.S. Reinhardt, 2010, "Capital Inflows: The Role of Controls," IMF Staff Discussion Note 10/04, February.
- Ostry, Jonathan D. and Atish Ghosh, 2013, "Why Don't We See More International Policy Coordination? What Should Be Done?" draft paper, IMF, August.
- Ostry, Jonathan D., Atish Ghosh, and Anton Korinek, 2012, "Multilateral Aspects of Managing the Capital Account," IMF Staff Discussion Note 12/10, September.

- Ostry, Jonathan D., Marcos Chamon and Atish Ghosh, 2012, "Two Targets, Two Instruments: Monetary and Exchange Rate Policies in Emerging Market Economies," IMF Staff Discussion Note 12/01, February.
- Peersman, Gert, 2011, "Macroeconomic Effects of Unconventional Monetary Policy in the Euro Area," Working Paper Series 1397, European Central Bank.
- Pesaran, M. Hashem and Ron Smith, 2012, "Counterfactual Analysis in Macroeconometrics: An Empirical Investigation into the Effects of Quantitative Easing," IZA Discussion Papers 6618, Institute for the Study of Labor (IZA).
- Rajan Raghuram, 2013, "A Step in the Dark: Unconventional Monetary Policy after the Crisis," Adrew Crockett Memorial Lecture, BIS June 23.
- Roache, Shaun and Marina Rousset, 2013, "Unconventional Monetary Policy and Asset Price Risk," IMF mimeo.
- Sack, Brian P., 2010, "Managing the Federal Reserve's Balance Sheet," Remarks at 2010 CFA Institute Fixed Income Management Conference, Newport Beach, California.
- Shiratsuka, Shigenori, 2010, "Size and Composition of the Central Bank Balance Sheet: Revisiting Japan's Experience of the Quantitative Easing Policy," Monetary and Economic Studies, Institute for Monetary and Economic Studies, Bank of Japan, Vol. 28, pp. 79–106, November.
- Stein, Jeremy C., 2013, "Comments on Monetary Policy," Remarks at the C. Peter McCoolough Series on International Economics, Council on Foreign Relations New York, June 28.
- Swanson, Eric T., and John C. Williams, 2012, "Measuring the Effect of the Zero Lower Bound on Medium- and Longer-Term Interest Rates," Federal Reserve Bank of San Francisco Working Paper No. 2012–02, May 2012.
- Ueda, Kazuo, 2012, "The Effectiveness of Non-traditional Monetary Policy Measures: the Case of the Bank of Japan," The Japanese Economic Review, Vol. 63(1).
- Vayanos, Dimitri and Jean-Luc Vila, 2009, "A Preferred-Habitat Model of the Term Structure of Interest Rates," NBER Working Papers 15487, National Bureau of Economic Research.
- Woodford, Michael, 2012, "Methods of Policy Accommodation at the Interest-Rate Lower Bound," presented at the Jackson Hole symposium, August 2012.
- Yamaoka, Hiromi and Murtaza Syed, 2010, "Managing the Exit: Lessons from Japan's Reversal of Unconventional Monetary Policy," IMF Working Paper WP/10/114.

Appendix Table. Spillover Effects of UMP: Selected Literature Review

| Authors | Sample Period/ Frequency | Methodology | Spillovers to | Channels of Spillovers | Main Findings |
|----------------------------------------|------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| United States | | | | | |
| Fratzscher, Lo Duca, and Straub (2013) | January 2007- December 2010 Daily | Regressions (announcements and actual purchases) | 65 EMEs and AEs | Net inflows (into bonds or into equities) and prices (equity and bond) | Fed measures in the early phase of the crisis (QE1) were highly effective in boosting bond and equity prices, especially in the U.S., and led to U.S. dollar appreciation. Conversely, QE2 boosted equity prices worldwide and led to U.S. dollar depreciation. Yet Fed policies functioned in a pro-cyclical manner for capital flows to EMEs and in a counter-cyclical way for the U.S. QE1 triggered a portfolio rebalancing across countries out of EMEs into the U.S., while QE2 triggered rebalancing in the opposite direction. |
| Glick and Leduc (2013) | November 2008- January 2013 intraday | Event studies | U.K., Canada, euro area, and Japan | Exchange rate | The U.S. dollar depreciated significantly following unconventional monetary policy surprises. A one standard deviation surprise easing in unconventional policy leads to a roughly 40 basis point (bp) decline in the value of the dollar within 60 minutes. The magnitudes are comparable to those for federal funds rate surprises in the pre-crisis period. |
| Neely (2012) | November 2008- January 2010 Daily and intraday | Event studies | Canada, U.K., Japan and Germany | Exchange rate and 10-year nominal yields | The LSAP program significantly reduced the 10-year nominal yields of Australia, Canada, Germany, Japan, and the United Kingdom and also depreciated the U.S. dollar versus the currencies of those countries. |
| Chen, Filardo, He, and Zhu (2012) | 1995-2012 Daily and Monthly | Event studies and global VECM model | Major advanced economies and a number of emerging economies in Asia and in Latin America | Various channels: Real and financial variables | In the short run, U.S. quantitative easing policy not only stimulated the U.S. domestic economy, but also boosted asset prices globally and helped stabilise the financial markets following the global financial crisis. In particular, it had an expansionary impact on a broad range of assets across the world, including equity prices, government and corporate bond yields and CDS spreads. The US term spread shock affects all variables: real GDP, inflation, stock prices, bank credit, foreign exchange pressure and money growth. |
| Chinn (2013) | 2008M09- 2013M03 Monthly | VARs | Major advanced economies and Brazil, Russia, India and China | Exchange rates and money base (proxy for central bank policies) | An increase in the money-base/GDP ratio weakens the dollar at horizons of two to three months. |
| Bauer and Neely (2013) | 1995-2009 Daily | Event studies/Dynamic term structure models | Australia, Canada, Germany, and Japan | Yields (Expected short-term interest rates and term premia) | Overall, signaling effects were likely a significant driving force for the sizable LSAP effects in the U.S. and Canada. It is also plausible that they contributed to some extent to the decrease in yields in Australia and Germany but portfolio balance (PB) effects probably played a more important role. In Japan, signaling effects were absent and PB effects were modest. |
| Moore, Nam, Suh, and Tepper (2013) | 2004-2010 Quarterly | Panel analysis | 10 EMEs | Foreign investment in EMEs' government bond markets and bond yields | U.S. LSAPs increased portfolio flows into many emerging market economies. A 10 basis point decrease in the U.S. 10-year Treasury yield pushes up the foreign share in government bond markets of the EM countries in our sample by an average of 0.4 percentage points, which in turn causes their government bond yields to fall by roughly 1.7 basis points. |
| Source: Authors. | | | | | |