"The financial crisis of 2008 and 2009 will leave a lasting imprint on the theory and practice of central banking. With respect to monetary policy, the basic principles of flexible inflation targeting—the commitment to a medium-term inflation objective, the flexibility to address deviations from full employment, and an emphasis on communication and transparency—seem destined to survive. However, following a much older tradition of central banking, the crisis has forcefully reminded us that the responsibility of central banks to protect financial stability is at least as important as the responsibility to use monetary policy effectively in the pursuit of macroeconomic objectives."

MONETARY POLICY AFTER THE GREAT RECESSION

Edited by
Javier Vallés
Banco de España

SPANISH ECONOMY PAPERS

Funcas
Madrid, Spain
FUNDACIÓN DE LAS CAJAS DE AHORROS

PATRONATO

ISIDRO FAÍNÉ CASAS
JOSÉ MARÍA MENÉNDEZ ÁLVAREZ-CEDRÓN
FERNANDO CONLLEDÓ LANTERO
MARIO FERNÁNDEZ PELAZ
AMADO FRANCO LAHOZ
MÁNUEL MENÉNDEZ MENÉNDEZ
PEDRO ANTONIO MERINO GARCÍA
ANTONIO PULIDO GUTIÉRREZ
VÍCTORIO VALLE SÁNCHEZ

DIRECTOR GENERAL

CARLOS OCAÑA PÉREZ DE TUDELA

Printed in Spain
Edit: FUNDACIÓN DE LAS CAJAS DE AHORROS (Funcas)
Caballero de Gracia, 28, 28013 - Madrid (Spain)

© FUNDACIÓN DE LAS CAJAS DE AHORROS (Funcas)

All rights are reserved. The total or partial reproduction of any of its contents in any mechanical or digital medium is totally prohibited without the written consent of the owner.

ISBN: xxxxxxxxxxxxxx0
ISBN: xxxxxxxxxxxxxx
Depósito legal: M-xxx2014
Prints: Cecabank
# Contents

List of Contributors VII

Introduction and overview 1

## PART I THE “NEW” MONETARY POLICIES IN THE ADVANCED ECONOMIES

Ensuring the transmission of the policy signal: A review of the ECB’s monetary policy from 2007 to 2013 9
*Peter Praet, Philippine Cour-Thirmann and Florian Heider*

UK property market: Experience, risks and policy response 33
*Jon Cunliffe, James Benford, Oliver Burrows and Tracey Wheeler*

Monetary policy after the Great Recession: Japan’s experience 73
*Kazuo Momma and Shuji Kobayakawa*

An overview of recent changes in the Federal Reserve’s monetary policy 101
*David López-Salido*

## PART II SIMILARITIES AND DIFFERENCES AMONG THE POLICIES OF THE FOUR BIG CENTRAL BANKS

The challenges for monetary policy in advanced economies after the Great Recession 137
*Juan Carlos Berganza, Ignacio Hernando and Javier Vallés*

Unconventional monetary policies – recent experiences, impact, and lessons 183
*Ángel Ubide*
PART III      BALANCE OF RISKS AND THE INTERACTIONS WITH OTHER POLICIES

Post-crisis monetary policy: Balance of risks 219
Jaime Caruana, Andrew Filardo and Boris Hofmann

Macroprudential policy after the financial crisis 247
José María Roldán

The relevance of international spillovers 261
Pilar L’hotellerie and Sonsoles Gallego

PART IV      OPEN QUESTIONS IN THE EURO AREA

Virtual unconventional policies. The euro area recovery and the role of ECB policy 295
Huw Pill

Addressing weak inflation: The ECB’s shopping list 311
Gregory Claeys, Zsolt Darvas, Silvia Merler and Guntram B. Wolff
Since 2007, several central banks have reached the zero bound of interest rates. It’s striking that, since then, no two central banks have followed the same strategy in the so called “unconventional policies” sphere. Due in part to the idiosyncrasies of the economies, and in part to the political constraints the central banks have been operating under, central banks have deployed a very different arsenal of tools, including asset purchases, forward guidance, lending schemes, liquidity injections, and exchange rate intervention and pegs. This has given monetary policy a multidimensional character: Central banks have operated on the size of their balance sheets, on their composition in terms of assets, quality, duration, and currency denomination, on the part of the yield curve that they have tried to affect, on the range of counterparties, and on the amount and detail of information about their reaction function and policy intentions that they have chosen to disclose. This paper describes some of these strategies and discusses their effectiveness and lessons for the future.

The main conclusions are: (1) at the ZLB, central banks have eased less than optimal due to fears about both central bank loses and inflation; (2) however, non-conventional policies are not very different from conventional policies, and have been broadly successful when tried with conviction; (3) the “insurance” channel of non-conventional polices is critically important to their effectiveness – at the zero bound, monetary policy must be bold and open ended in order to restore risk aversion to normal levels and provide markets with an outlook based framework to appropriate price assets; (4) the “cost” argument against non-conventional policies is very weak; if anything, central banks should change their arrangements (for example, increase their capital to protect against losses) to manage these costs and be able to be as effective with non conventional policies as they are with conventional policies; (5) central banks should target a bit higher inflation target, to soften the implicit lower bound in real interest rates; (6) forward guidance should focus on what the central bank can control, its reaction function, and shy away to a large extent from interest rate paths; (7) as slack is being absorbed in a recovery, the best way for monetary policy to preserve financial stability is to avoid generating one way bets and time inconsistent policies. Thus guidance should be softened as the economy approaches the steady state.

1 All views expressed here are my own and do not represent, in any way, those of D. E. Shaw & Co.
I. INTRODUCTION

In normal times—defined as interest rates above zero and financial intermediation operating via well-functioning arbitrage—the “conventional” operation of monetary policy involved managing the short term interest rate. Because inflation expectations don’t immediately react one to one to changes in interest rates, central banks also control real interest rates. This interest rate changes would be expected to be transmitted along the yield curve and into private rates, and achieve a constellation of interest rates that would, in principle, deliver the central bank’s growth and inflation forecast via its impact on credit, asset prices, and the exchange rate.

The crisis broke this conventional operation of monetary policies along several lines. First of all, short term interest rates hit zero, depriving the central bank of the “conventional” instrument. Second, the transmission of short term interest rate changes along the yield curve and into private rates was disrupted as some markets ceased to operate and others changed their nature as they became informationally sensitive. Third, Knightian uncertainty increased sharply due to the lack of model to base economic forecasts, generating extreme risk aversion. And fourth, mistrust about the solvency of banking intermediaries became widespread, introducing counterparty risk as a main element of asset pricing. The combination of these failures had created a self-amplifying vicious circle of declining asset prices and force liquidations that had to be arrested.2

The policy response had to address all four failures of the system: Find an alternative instrument to the short term interest rate; fix the transmission mechanism of interest rates, mostly via liquidity injections, and create markets in some assets; restore confidence in the future by providing insurance and minimizing the occurrence of bad equilibria; and restore the solvency of the banking system to eliminate counterparty risk.

Most major central banks introduced at some stage unconventional measures. The Fed, ECB, and Bank of England (BoE) acted along all the dimensions, as they were at the center of the crisis. The Bank of Japan (BoJ) already had many of the unconventional policies in place, having been at the zero bound for a long period of time, and kept its policy framework mostly unchanged until mid 2013, when it launched QQE. The actions of the Swiss National Bank and Bank of Canada were more limited, as they were in the periphery of the crisis and mostly had to react to the contagion effect. Denmark had a brief period of negative interest rates to contain large capital inflows resulting from fears of euro break up. Restoring the solvency of the banking

---

2 See Ubide (2008) for a detailed discussion of the dynamics of a credit crisis.
system was mostly a government policy, and will not be discussed here. *Table A.1 in the appendix describes the chronology and nature of the measures undertaken by the different central banks, differentiating between actions affecting quantities, interest rates, and guidance.*

**II. THE CONSENSUS VIEW ON MONETARY POLICY AT THE ZERO LOWER BOUND (ZLB) PRIOR TO THE CRISIS**

*The intellectual consensus before the crisis on the risk of deflation and of hitting the zero lower bound, and how to deal with it was largely based on the Japanese experience.* The theoretical research devoted to it was scarce (Benhabib, Schmitt-Grohe and Uribe (2001), Eggertson and Woodford (2003), and Reifschneider and Williams (2000) provide some earlier research on this issue; Bernanke (2002) is a good guide of how central bankers looked at it from the distance, and provides a good benchmark to assess the difference between what he proposed as a theorist and what he was able to deliver as a central banker and practitioner). The studies related to the BoJ experience suggested that QE had not had a major impact, beyond its signaling effect, mostly because the BoJ leadership had not been very enthusiastic about it, putting more emphasis on the moral hazard it created for fiscal consolidation and the need for supply reforms to lift potential growth. As QE was presented as “temporary,” it had little effect (see, for example, Ugai (2007), Krugman (1998, 2000) and Eggertsson and Woodford (2003)).

*In addition, the ZLB was seen mostly as an intellectual curiosity that would only happen following a policy mistake (as the Japanese situation was assessed to be).* A key reason behind this assessment was the “curse of the Great Moderation” – because all the research was based on the Post War period, when shocks were “small” and non-persistent, all the conclusions in the literature were limited to a specific subset of possible macroeconomic paths. This “curse of the Great Moderation” explains why the crisis was essentially “impossible” based on the economic projections performed with models estimated with data available until 2007 (see Potter, 2011) and why the economics and central banking profession had to improvise as events unfolded. This also explains why markets, lacking a model and a set of credible outlooks to base its risk management on, overshoot while preparing for the worst possible scenario. Macroeconomic expectations became unanchored. This was compounded by the incentive structure of analysts and pundits – who looked wiser the gloomier they were and the most catastrophic scenarios they could imagine; it had been clear that risk management failures had been a failure of imagination,

---

3 See Bernanke (2000) and Ito and Mishkin (2006).
of imagining a Lehman type of scenario, and thus there was a premium in considering the implausible.

The policy prescription that arose from the pre-crisis literature was that, facing the possibility of hitting the ZLB, policy should be eased aggressively precisely to avoid hitting the ZLB (the opposite of the strategy of “keeping the powder dry” advocated in some places) and then keep rates low for longer than a standard policy rule would suggest in order to avoid a relapse into the ZLB (see, for example, Reinhart (2004)). The underlying assumption was that policy at the ZLB would be less efficient and its impact largely unknown (and, based on the Japanese experience, possibly very small).

At the same time, even though the consensus in the literature had long shifted away from linking inflation to money growth, when the moment came to expand the central bank balance sheets by large amounts the monetarist critique suddenly reappeared (see, for example, the caution expressed in Bullard (2010)) and worries about high inflation became a central part of the debate. Ironically, skepticism about unconventional policies came from both sides, because they may not work and because they may work too well, generating a reluctant intellectual consensus to embark in nonconventional policies at the beginning of the crisis. This skepticism was central to explain the central bank actions during the crisis, as we discuss below.

III. THE OPERATION OF MONETARY POLICY. IS THERE ANY DIFFERENCE BETWEEN CONVENTIONAL VERSUS NON CONVENTIONAL

At all times, central banks operate by changing the monetary base (currency and bank reserves) to affect some interest rate. This can be done in two ways: Buying from and selling bonds to the public or borrowing from and lending money to the public. The difference between the two options is a time dimension – buying and selling make the impact “permanent,” lending and borrowing make the impact “transitory.” Of course, both can be equivalent by choosing the appropriate time horizons and techniques.

In normal times monetary policy operates via changes in the short term interest rate, which shifts the term structure of real interest rates. These changes in real interest rates affect the economy via two main channels: Asset prices and credit conditions. The asset price channel is well understood: Changes in real interest rates shift asset prices and affect investment and consumption decisions. The credit channel assumes that changes in real interest rates affect some financial
frictions—adverse selection and moral hazard—that influence borrowing and lending decisions. This effect is more pervasive during downturns, as “good” borrowers become more risk averse and borrow less while “bad” borrowers gamble for resurrection. Banks know this worsening of the pool of borrowers and become more reluctant to lend. By easing financial conditions and raising asset price levels, central banks can improve the solvency of borrowers and reduce these frictions, thus softening the tightening of lending standards.\(^4\) Thus monetary policy can affect both asset valuations and attitudes towards risk.

The only difference between conventional and unconventional monetary policy is that unconventional policy has to operate via changes in longer term interest rates. This adds an extra dimension because real long term interest rates are a combination of average expected short term rates, the term premium, and expected inflation. Unconventional policies, both asset purchases and forward guidance, operate by potentially affecting some or all of these three elements. Expected short term rates are affected by changes to the policy reaction function, either via explicit forward guidance or via the signaling effect of asset purchases. Term premia are affected mostly by the scarcity and duration effect of asset purchases, although forward guidance can contribute via its impact on reducing term premia in the front end of the curve.\(^5\) Inflation expectations are affected by the overall message that monetary policy offers, including asset purchases, guidance, and commitment to achieve the monetary policy goals.

IV. THE CONCEPTUAL DEBATE ON ASSET PURCHASES

In principle, asset purchases should not affect asset prices beyond the assets being purchased, because the price of an asset should only depend on its own risk adjusted expected returns. There are, however, a few additional channels through which asset purchases may have an impact beyond affecting its own price:\(^6\)

1. **Signaling channel** – because it takes time to implement a program of asset purchases, it credibly commits the central bank not to change direction

---


\(^5\) There is an increasing body of literature that argues that conventional monetary policy also affects term premia via its impact on risk taking (see, for example, Gilchrist, Lopez Salido and Zakrajsek (2013)).

\(^6\) There is an additional channel through which asset purchases may affect the economic outlook, namely the exchange rate. But this is not specific to asset purchases, it is just a reflection of changes in relative interest rates.
of policy at a minimum during the time it takes to implement the purchases. Thus purchases can be both a complement to forward guidance (reinforcing it) and a substitute (the length of the ECB’s LTROs at fixed rate was considered as a subtle way to signal rates on hold during that period).

2. **Scarcity/portfolio rebalancing channel** – by becoming a dominant player and reducing the supply of a particular asset, asset purchases create a situation where investors will bid up the price of the asset. If the price is high enough, investors may opt to shift to other assets and rebalance their portfolio. Typically the central bank buys the safest assets, with the intention to force private investors to shift towards riskier assets. This channel typically requires some segmentation—as described, for example, in preferred habitat models—whereby some agents (for example pension funds, insurance companies or sovereign wealth funds) are constrained in the assets they can hold and thus arbitrage is limited (see Bernanke, Reinhart and Sack (2004) and Vayanos and Vila (2009)). In principle, bond purchases would affect only the risk free component of asset prices while lending would affect the term premium of all assets that can be posted as collateral.

3. **Duration channel** – by buying long maturity bonds in large amounts, the central bank makes investors’ portfolios safer because there is less overall exposure to interest rate risk. Ceteris paribus, this would increase the price of risky assets.

4. **Insurance channel.** The central bank communicates that it is ready to ease policy as much as needed to achieve its objectives. This changes the overall level of risk of the economy and reduces the tails in the scenarios used for risk management, thus improving the demand outlook, boosting asset prices, softening lending standards, and lifting inflation expectations and reducing real rates. This channel has been largely overlooked in the debate and yet it is likely the most powerful and unique to nonconventional policies.

An additional point of debate is the discussion about whether asset purchases operate via stock or flow effects. The stock theory argues that asset purchases operate via adjustments to the price of the asset once the new supply/demand balance is known (in other words, when the announcement of new asset purchases is made, markets reevaluate the new supply/demand equilibrium and fix the price accordingly; all the impact is on announcement). The flow theory argues that asset purchases operate by injecting money in the system with each purchase, money that then is channeled into another asset (in other words, the announcement has no impact, while each purchase has an impact). The economic theory and empirical evidence sides mostly with the
stock theory, although the flow could have some impact at the micro level and carry information about the total final stock of purchases (for example in the case of tapering of QE3). It’s noticeable that the critics of asset purchases belong mostly to the flow camp, arguing that the money just goes to inflate stock prices, bypassing the real economy, and when asset purchases end, stock prices will deflate to the pre-asset purchase level.

The modality of asset purchases matters to understand the channel through which policy works and its likely impact. As Table 1 shows, the difference central banks have adopted many different strategies, combining purchases and lending, private and public assets.

The Fed has focused mostly on asset purchases, with different strategies: QE in fixed quantity along the curve (QE1 and QE2); QE in fixed quantities

7 This is what Chairman Bernanke said at the April 25, 2012 FOMC Press Conference, in response to a question: “There’s some disagreement, I think, about exactly how balance sheet actions by the Federal Reserve affect Treasury yields and other asset prices. The view that we have generally taken at the Fed in which I think—for which I think the evidence is pretty good is that it’s the quantity of securities held by the Fed at a given time, rather than the new purchases, the flow of new purchases, which is the primary determinant of interest rates.” http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20120425.pdf
at selected maturities (Operation Twist); QE Open Ended (QE3). The ECB has focused mostly on lending (LTROs), creating an endogenous supply of liquidity; asset purchases were small and sterilized (SMP). The BoJ did both purchases and lending. On purchases, to the long standing Rinban operation it added the Asset Purchase Program (fixed quantity, short maturity JGB purchases), and then QQE (open ended, longer maturity JGB purchases). Lending programs are mostly fixed quantity and targeted at specific sectors. The BoE also did both purchases (QE in fixed quantities, purchasing longer term gilts from non banks, and no tapering at the end) and lending (the FLS, fixed quantity and targeted). The Swiss National Bank focused on foreign exchange intervention and then the EURCHF floor, as they had not enough domestic bonds to do QE and fight deflation.

Why so many different strategies? Because it was a process of learning by doing and testing instruments that had not been used before, addressing specific problems and navigating the different constraints each central bank faced. A key worry of all central banks when they started to expand their balance sheets was to ensure the public and markets understood they would be ready to exit and contain inflation in an effective manner. For example, the “small” size of the Fed initial packages and its combination with a discussion of exit strategies (which dampened their impact); the ECB’s insistence on the self-absorbing nature of LTROs, as an explanation of why it was a better policy than QE; the BoE’s decisions on QE on a three month horizon basis. As more information was collected about the impact of these new policies, central banks become bolder in their application (Fed and BoJ moved, for example, to open ended QE). Another worry was that despite the fact that central banks do not need capital to operate, there was concern about eventual loses that could potentially impact the independence of the central banks. For example, the Fed’s debate on the cost/benefit of QE,\(^8\) the BoE’s decision to obtain an explicit indemnity from the Treasury for its QE program; the ECB’s request for a commitment from the governments to be recapitalized if any loses were to arise from the SMP program; the BoJ’s long standing reluctance to buy JGBs of maturities longer than 2 yrs for fear of heavy losses were interest rates to increase sharply; or the tremendous pressure on the Swiss National Bank because of the accounting loses derived from its fx intervention to defend the EURCHF peg. There was also a worry about interfering with credit allocation, which explains why CBs mostly shied away from private asset purchases once the acute phase of the crisis was over. In fact, BoJ’s ETF and REIT purchases are designed specifically not to interfere with market pricing.

\(^8\) See Carpenter et al. (2013).
V. FORWARD GUIDANCE: RATIONALE AND VARIATIONS

The key argument in favor of forward guidance is that central banks don’t have superior knowledge about how the world works, but should be able to explain how they think, and this is the key to successful monetary policy. That implies setting clear goals, commit to achieve the goals, adopt clear policy actions to achieve the goals, and provide full accountability as regards the achievement of the goals.⁹

A simple policy rule can, during tranquil times, provide a good approximation to a goal oriented monetary policy strategy. But it is very likely to be a very incomplete, if not erroneous, description of a goal oriented policy at the ZLB for two reasons. First, it would fail to describe the policy intentions completely, because interest rates can’t go below zero (for example, the rule described in Taylor (1999) would have suggested interest rates in the US at -5 percent in 2009, see Ruddebush (2009)) and large shocks very likely generate big and time varying changes in the deep parameters of the reaction function – for example the neutral real interest rate. Forward guidance, with a fuller and more complete description of the policy strategy, is a way to overcome these shortcomings. Second, forward guidance is necessary because the policy prescription at the zero bound –namely to cut rates aggressively and then keep interest rates “lower for longer” than a standard policy rule would prescribe– basically implies shifting to another reaction function, or at least shift to a different loss function for a given reaction function because of the asymmetric nature of risks at the ZLB, and the central bank needs to educate markets (and, when operating by committee, its own committee members) on the new strategy.

Forward guidance was already used in normal times pre-crisis, in speeches, statements and monetary policy reports. The Fed introduced it after cutting rates to 1 percent in August 2003, as a replacement to the biases it had been used to signal the likely direction of rates: “In these circumstances, the Committee believes that policy accommodation can be maintained for a considerable period.” As the Fed became more convinced the next move in rates would be up, this guidance shifted in January 2004 into “the Committee believes that it can be patient in removing its policy accommodation” and in May 2004 into “the Committee believes that policy accommodation can be removed at a pace that is likely to be measured.” In other words, the Fed provided guidance about the timing of the beginning of the rate hiking cycle and about its pace. The Bank of England provided guidance with the Inflation Report’s inflation forecasts under constant and market rates (with BoE watchers focusing on the difference between the two to assess whether the BoE agreed or not with market pricing).

⁹ See Evans (2014) for an elaboration.
The ECB became fond of its “traffic light” (essentially variations of the word “vigilance”) system to preannounce interest rate increases.

As with asset purchases, central banks started using forward guidance timidly and were not very successful initially. For example, despite some verbal guidance from the Fed (“some time”), markets were consistently pricing the return to positive rates about 6-12 months after cutting rates to zero. Markets had no history to base their outlook on, and thus were using past historical experience as a guide. Table 2 shows the different strategies adopted by the different central banks.

The Bank of Canada introduced in April 2009 an innovation via calendar guidance, suggesting rates on hold until a specific moment in time (the second quarter of 2010). Once the Bank of Canada hiked rates (in April 2010, a quarter before the time implied by the calendar guidance), the new guidance focused on two elements: The likely gradual pace of rate hikes, by stressing the large amount of slack in the economy and the long time it would take to absorb it; and
the likely lower end point of the hiking cycle, by stressing that the neutral rate was lower than in the past and that interest rates would be below neutral when slack was reabsorbed and inflation at target because of persistent headwinds.

The **Fed** started with some fuzzy temporal guidance in December 2008, signaling low rates for “some time,” which then became low rates for an “extended period” in March 2009. As the euro area crisis got deeper, the Fed shifted to calendar guidance in August 2011, signaling rates on hold until at least late 2013. This calendar guidance was modified twice, first in January 2012 (rates on hold until late 2014) and then in September 2012 (rates on hold until mid 2015). Dissatisfaction with calendar guidance led, in December 2012, to the adoption of state contingent guidance defining an “area of inaction” based on macroeconomic variables: The unemployment rate above 6.5 percent, inflation between one and two years ahead below 2.5 percent, and inflation expectations well anchored. As the economy approached the point where the thresholds were about to be breached, the guidance reverted to a more qualitative stance – rates on hold “well past” the moment when the unemployment rate will cross 6.5 percent. In March 2014, the Fed replaced the thresholds with qualitative guidance (similar to that adopted by the BoE, see below) about the likely timing of the lift off, the pace of rate hikes, and the terminal point. This guidance was supplemented by the “dots chart” in the SEP. Therefore, the Fed has used a belt and suspenders approach, with calendar and state contingent language combined with explicit rate guidance.\(^\text{10}\)

The **ECB** has used more vague forms of forward guidance. It was first used in the Summer of 2012, with ECB President Draghi now famous “whatever it takes,” intended to neutralize the “redenomination risk,” and was crystallized in the launching of the conditional OMT program. There were no details about how it would work, but it successfully contained the increase in periphery spreads (the “insurance” channel). The ECB adopted interest rate guidance in July 2013 by stating that rates would stay on hold or lower “for an extended period of time,” but providing little information about the underlying state contingent rule underneath the “extend period.” In March 2014 the ECB expanded the forward guidance by introducing the concept of “slack” as an argument to keep rates low even as the recovery takes hold (see Praet (2014)). Implicitly, this tried to break with the past reaction function where increases in the PMIs to above average levels would lead to rate increases.

The **BoE** adopted a state contingent guidance in August 2013, with an unemployment threshold (7 percent) and inflation knockout (inflation not

\(^{10}\) The SEP, however, remains an imperfect instrument as it reveals discrepancies around a modal forecast, not uncertainty around a baseline case, and it is not based on a homogeneous set of forecasts.
higher than 2.5 percent 18-24 months out) and an innovation, a financial stability knockout (based on a decision by the Financial Policies Committee). The intention was to stress the large amount of slack and thus that a period of rapid growth would not lead, as in the past, to increases in interest rates. As the unemployment rate approached 7 percent, the BoE moved in February 2014 to qualitative guidance—a late lift off and an eventually gradual hiking process due to the large amount of slack, and guidance on a lower neutral rate—aided by the inflation forecasts in the Inflation Report. As in the Fed’s case, a belt and suspenders approach to guidance.

The BoJ had been using forward guidance as a key policy tool for a long time, and introduced two variations during the crisis. During 2010-13, the BoJ’s strategy was defined as “comprehensive monetary easing,” with two main elements: Forward guidance on interest rates (rates at zero until inflation reached 1 percent inflation) supported by JGB purchases with maturity up to 3 years via its Asset Purchases Program (APP). In April 2013, the BoJ shifted its strategy to QQE (qualitative and quantitative easing), comprising: A change in the instrument from interest rate to base money growth, an increase in the maturity of the JGBs purchases (average maturity now between 6 and 8 years), forward guidance linked to asset purchases, and a higher inflation rate with a temporal dimension (2 percent inflation to be reached in 2 years). In addition to this time-defined guidance, the BoJ added an open ended second layer of guidance—the BoJ would continue to do QQE for as long as needed to maintain

![FIGURE 1](image-url)

**FIGURE 1**

**AMOUNT OF INTEREST RATE INCREASES EXPECTED OVER 36 MONTHS**

Rates on hold through mid 2013

*Source: Bloomberg.*
2 percent inflation in a “stable” manner, with “stable” likely to be a function of medium term inflation expectations.

**Forward guidance at the zero bound is effective for two main reasons.** First, because the central bank considers that the time horizon over which rates will be on hold is longer than it has been standard in the past and/or can be communicated with standard tools (for example, the inflation forecast published in the BoE’s Inflation Report was effective to communicate rates on hold over two years, but not beyond); and second, because the central bank considers that the past is not a good guide for the future, and wants to communicate it is jumping to a different reaction function because the trade between inflation and growth has changed. When clearly communicated, the anchoring effect of the central bank guidance has been very powerful. If, however, the guidance merely reflects the fact that weaker conditions warrant rates on hold for longer it can backfire, as the public could interpret it as the central bank acknowledging a weaker outlook but doing nothing about it (see Woodford 2012 for an elaboration of this point). Figure 1 shows how the Fed guidance was effective in this regard: The amount of rate increase priced over the subsequent 36 months remained high until mid 2011, but dropped significantly when the Fed introduced the calendar based guidance.

*In the Fed’s case,* Femia, Friedman and Sack (2013) show that forward guidance changed market expectations about the level of unemployment, for

---

**FIGURE 2**

**IMPLIED VOLATILITY IN US FIXED INCOME (MOVE INDEX)**

![Image of implied volatility in US fixed income](https://via.placeholder.com/150)

*Source: Bloomberg.*
a given level of inflation, that will lead to the first rate hike, thus generating an easier policy stance. English, Tetlock and Lopez Salido (2013) show that the threshold guidance has allowed the Fed to approximate an optimal control rule, which is welfare improving with respect to an inertial Taylor Rule, and better filter the signal from the noise as far as the direction of monetary policy (for example by neutralizing the impact of hawkish dissenting commentary). Figure 2 shows that uncertainty about the future path of rates, measured from options markets, had fallen to the lowest levels ever in April 2013.

In the BoE case, despite the tremendous forecasting mistake of the unemployment rate, the threshold guidance prevented a massive increase in market interest rates when growth accelerated, which would have happened if markets had followed the pre-crisis rule based on the relationship between PMIs changes or quarterly GDP growth and interest rates. The acceleration in job creation and the decline in the unemployment rate in 2013Q3 and Q4 was the fastest in recent history. The threshold system allowed the BoE to communicate clearly the difference between levels and rate of growth (as, despite the fast rate of growth, the level of GDP is still below pre-crisis levels), to provide insurance against a situation of inflation stickiness due to fees and regulated prices, and to also generate discipline and unity of message inside the MPC, at a time when discrepancies could have been very damaging. This allowed the BoE to move to the second phase of guidance, transitioning from signaling what it would not do (raise rates until threshold crossed) to what it would do (raise rates gradually), while rates barely moved.

In the ECB case the effectiveness has been more limited, although it has successfully stabilized short term rates. Differently from Fed and BoE, the ECB has not sent clearly a message of shifting to an easier reaction function. It has just confirmed that the inflation outlook has weakened and therefore the expected rate path should be coherent with this weakness. In other words, the ECB’s guidance did not ease policy, it just prevented, by signaling an easing bias, a tightening from the global sell off in interest rates resulting from the Fed tapering and from the increase in money market rates stemming from the repayment of the LTROs. The ECB’s guidance has been passive easing (intended to offset an undue tightening), rather than active easing intended to increase the amount of accommodation (to some extent, this is the same concept as the ECB’s decision to use self-reabsorbing LTROs rather than QE).

As the exit approaches and central banks move into the new phase of “fuzzy” forward guidance (providing information on the macro forecast, the likely timing of the lift off, the pace of hikes, and the neutral rate), a question

---

11 See Broadbent (2013) for an elaboration of this point.
arises: Why not providing the full rate path? The reason is that “fuzzy” guidance approximates better the concept of guidance being a conditional forecast, not a promise. A very precise guidance could look like a promise. At the depth of a crisis it makes sense, because of the need to lower risk aversion (the “insurance” channel of policy) and the “certainty” that rates will be at zero during that period. When the economy is recovering, there is less need to commit and less certainty. Thus the degree of fuzziness must be proportional to the cyclical situation. It has become clear that central banks are not better forecasters than the consensus, and thus this “fuzzy” guidance is a good balance between providing useful information and avoiding losing credibility as detailed forecast go awry. In addition to the terrible unemployment rate forecasting performance of the Fed and the BoE, the experience of central banks who publish interest rate paths shows a large forecast error beyond 4 quarters ahead. The noise to signal ratio is high, thus raising the question of whether more transparency is always welfare improving. Given this experience, it may be better just to try to describe the reaction function – what the central bank can control – and let markets insert their own forecast. In addition, this fuzzy forward guidance can be very effective with corporates and households. What corporates want to know in order to hire and invest is not the precise path of interest rates, but that the central bank is ready to do what it takes to deliver strong growth and that average interest rates over the next few years won’t be too high. Again, the insurance channel of monetary policy.

The interaction between asset purchases and guidance has only recently been properly understood. The impact of the Bernanke’s comments in May 2013 about the possibility of tapering QE3 later in the year revealed that asset purchases were a very important complement to forward guidance. As markets sold off due to the tapering talk and aggressively brought forward the beginning of the rate hiking cycle, it became clear that the Fed’s sequencing strategy – first taper, then reinforce forward guidance as needed – was wrong, and that forward guidance had to be reinforced first to replace the positive impact on guidance of asset purchases (see the sharp increase in uncertainty about the future path of rates, Figure 2). To make it simple, markets believe that for as long as central banks are buying assets they won’t think about rate hikes – and therefore the period during which asset purchases are undertaken is taken as a “guarantee” of rates on hold (the signaling channel of asset purchases). Once asset purchases are over, the uncertainty about guidance increases, no matter how strong the language – because the central bank can always change its mind. In fact, the Fed seems to have recognized this and, in the post threshold guidance, anchored the timing of the first hike as a “considerable time” after the end of QE.
VI. HAS UNCONVENTIONAL POLICY BEEN EFFECTIVE?

There is a strong debate about whether or not unconventional policies have been effective. The skeptics argue that they have just inflated asset values and that once the money flow ends asset values will deflate. In this view, only structural policies work and there is little that cyclical policies can do to offset the impact of a financial crisis [see, for example Hall (2013) Jackson Hole paper]. The prevailing view is that they have worked, in a rather conventional way, by lowering real interest rates, and have contributed to softening the impact of the crisis. Precise measurement of the impact of specific policies always has the problem of a counterfactual, and there are different ways to define “effectiveness.”

The simplest way to assess effectiveness is to look at the evolution of long term real interest rates –the main instrument of non conventional monetary policy – and of inflation expectations – the main objective of monetary policy. Figure 3 shows the evolution of 10 year real interest rates (defined as 10 yr rates minus 10 yr expected inflation from inflation swaps) in the US, UK and the euro area (the euro area constructed as the GDP weighted average of euro area individual rates). It seems clear that, by this metric, the Fed and the BoE have eased policy aggressively, while the ECB has been very cautious. In fact, during 2010-2011 the stance of policy tightened in the euro area, while it was eased in the US and the UK.

![Figure 3: The Evolution of 10 Yr Real Rates](source: Bloomberg)
Unconventional monetary policies - Recent experiences, impact, and lessons

FIGURE 4

INFLATION TERM STRUCTURE

Source: Bloomberg.

FIGURE 5

JAPAN 5Y5Y INFLATION

Source: Bloomberg.
In terms of ensuring the stability of inflation expectations at mandate consistent levels, there have been different degrees of success. The Fed and the BoE have been successful in maintaining inflation expectations well anchored around levels compatible with their mandate, while the ECB seems to have failed and allowed medium term inflation expectations to shift lower, as markets expect a very long period of below target inflation (see Figure 4, which shows the term structure of forward 1yr inflation across the main central banks). The BoJ’s objective was a bit different, aiming not at stabilizing but at increasing inflation expectations. The preliminary evidence shows a successful increase in inflation expectations to above 1 percent (see Figure 5), even if it is difficult to assess the true extent of it because of the distortionary impact of the consumption tax hike.

IMF (2013) provides a very detailed summary of the wide literature that evaluates the precise impact of non conventional policies on asset prices, growth, and inflation, using mostly event studies or econometric analyses. The main conclusion is that policies aiming at restoring the functioning of disrupted markets (for example TALF, QE1, fx swaps, LTROs) have been very effective, with market functioning broadly restored. The assessment of policies aimed at lowering long term interest rates is more varied, with estimates for the cumulative impact on long term rates of the different bond purchasing programs showing declines in the range of 90-200bps in the US, 45-160bps in the UK and around 30bps in Japan. Asset purchases have also been successful.
via the “insurance” effect, reducing tail risks - as evidenced by the normalization of stock market uncertainty implicit in the VIX index (see Figure 6), the lower probabilities of large exchange rate swings implicit in fx option risk reversals, the lower probability of deflation implicit in the skewedness of inflation forecasts. As far as the impact on growth and inflation IMF (2013) suggests that the evidence is also positive, showing that growth in the US and the UK increased by an average of about 2 percentage points over 2 years (with a range between no impact and about 8 percentage points), while the impact on inflation was about 1.5 percentage points, with a similarly wide range.

There has been plenty of debate about QE being an attempt at debasing currencies, and achieve competitive devaluations. The reality is that there are many factors which affect exchange rates and the broad trends have not validated this view (see Figure 7). The sharp depreciation of sterling happened before QE started and reflected a downward reassessment of the sterling equilibrium rate. The USD has moved in a broad range, but it is now about 20 percent stronger than in 2008 in real effective terms. The Euro was at risk of breaking up, and thus monetary policy was just a minor contributor to its evolution. The only case where there has been an intentional targeting of the currency is the yen, but that was a correction of a sharp overvaluation.

Overall, the evidence points increasingly towards very little difference between conventional and unconventional policies. For example, Glick and Leduc...
(2013) and Rosa and Tambalotti (2014) show that the impact of unconventional policies, once they are properly calibrated in terms of conventional policy equivalents, has been very similar to the impact of conventional policies in terms of their effect on asset prices, including the dollar.

VII. LESSONS LEARNED

The depth of the crisis and the variety of policy responses has generated a fertile ground for experimentation and learning. There are a few lessons that can be drawn for the future. The first one is that the difficulties experienced during the crisis and the current low levels of inflation suggest that at the ZLB central banks ease less than optimal (the amount of QE that would have been needed to achieve the level of the fed funds suggested by applying Taylor (1999) would have been in the 5-6tr range) and therefore the recovery takes longer than it should, potentially damaging potential growth via hysteresis effects. It also seems clear that the odds of hitting the zero bound are much bigger than it was thought when inflation targeting was designed 20 years ago. And there is the possibility that we could be entering a long period of higher productivity growth and low wages due to technological progress and robotics and wider income inequality.

Central banks should prepare for a situation where unconventional policies may well become the norm, rather than the exception, and adapt their policy frameworks accordingly. Central banks should explain in detail to the public that there is little difference between conventional and unconventional policies, that they are legal and within the mandate, and strengthen the institutional settings to be able to operate free from political interference. In Ubide (2014) we argue that this would require increase central bank capital levels to avoid worries about losses, explain in much more detail the reaction function to increase effectiveness, and aim for a somewhat higher level of inflation to reduce the odds of reaching the zero bound and facilitate the reduction in real rates.

The second lesson is that there is a tension between the value of clear and transparent communications and the low predictability of key macro variables, such as inflation and unemployment. This communication challenge suggest a dual strategy: First, move towards a monetary policy strategy based on simple, well defined, and clearly accountable objectives, such as the Fed’s statement of long term policy goals (see FOMC (2012)) and the new BoJ QQE strategy. The imprecise ECB’s definition of price stability remains a bit of an anachronistic outlier. Second, describe the reaction function and its deep parameters as the main communication tool, while de-emphasizing the macro forecast as
“illustrative” – an example of an outlook that the central bank sees plausible and “likes” (achieves the mandate objectives in a balanced manner), rather than the best possible forecast. This would also imply focusing less on the baseline forecast and more on the possible alternative paths – something the Riksbank, for example, has been doing for a long time and that the BoE now has started to introduce in the Inflation Report – as a way to educate markets on the likely reaction of the central bank to changes in the macro outlook.

The third lesson is that the debate on the interplay between monetary policy, conventional or not, and financial stability remains wide open and it’s likely to intensify as the period of low interest rates continues. Conceptually, monetary policy should address the residual macro risks that regulation, micro and macro prudential can’t address. But defining these residual risks is challenging. Assessing asset mispricing is complex and there is no obvious reason why central banks should know better than markets. In addition, because innovation and financial development are an integral part of economic growth, one should caution against Type II errors in bubble spotting. Macro measures of leverage, such as credit/GDP, have given plenty of false signals, and monetary policy is difficult to calibrate for such a slow moving variable (Stein (2014)). Leverage should be taken care of by regulation and macroprudential policies, including horizontal assessments and stress tests.

A useful way to think about monetary policy and financial stability is in terms of stabilizing the “macro Value at Risk (VaR).” VaR is a function of leverage and uncertainty. When uncertainty is within “normal” levels, monetary policy should focus on stabilizing inflation and maximizing GDP growth while macroprudential, supervision and regulation should focus on ensuring that credit, broadly defined, does not become excessive as a share of GDP and underwriting standards remain proper. A crisis typically leads to an increase in uncertainty to “abnormal” levels, and the main objective of policy should be the stabilization of uncertainty and risk aversion (see Ubide (2009)). Kocherlakota (2014) and Stein (2014) have recently argued along similar lines using a mean-variance approach, suggesting that policy makers should care not only about the level of inflation and unemployment and also about their variability. The “insurance channel” of non conventional policies aims at lowering uncertainty and restoring risk taking – via open ended QE combined with threshold based forward guidance that “insure” the delivery of economic outcomes.

Thus promoting risk taking via the insurance channel is an integral part of monetary policy at the ZLB. The key therefore is the open ended nature: The most successful strategies –LTROs, OMT, QE3, QQE, Swiss National Bank’s floor – all were unlimited (the BoE’s QE could also be considered unlimited, as it was reviewed at every meeting based on the inflation forecast). There is some
logic to it. When a central bank starts an easing cycle, markets immediately price the whole easing cycle, and they can do it because there is past experience and a notion of neutral rate that serves as guidance. With QE there is no such guidance, markets don’t know who to calibrate the amount of easing they should be pricing. If, however, QE is open ended and based on economic outcomes, if credible markets can price those outcomes.

The unanswered question is how to assess if the stance of policy could be becoming excessively loose from this standpoint. The provision of “certainty” should be proportional to the distance to the growth and inflation targets. The closer to the targets, the less need to focus on stabilizing risk aversion and the less insurance is needed. As the economy normalizes, policy should be wary of offering one way bets or using time inconsistent policies as part of the “insurance channel.” Systemic crises happen when paradigms are broken, and monetary policy should avoid creating those situations. Monetary policy at the ZLB is selling an option to the markets, an economic put. But it is critical that this insurance is properly priced: If the policy that the central bank adopts is time inconsistent, it may backfire later on, as the economy will not be ready to withstand the increase in volatility that the time inconsistent policy may generate when the central bank reneges from its promises. The current Fed stance is a potential example. Because of its aggressiveness, the Fed’s stance of policy is both fully believed by markets (the market is priced along the dots and moves when the dots change, as the market reaction to the March 2014 meeting shows) and potentially time inconsistent if the dots represent an approximation to an optimal control strategy. Time will tell.

BIBLIOGRAPHY

BALL, L. (2013), The Case for 4 Percent Inflation, Voxeu.org


12 In Ubide (2009), I argue that the crisis was initially caused because three paradigms, which were essential for asset pricing, were broken: (1) house prices can’t decline; (2) securitized assets are informationally insensitive; and (3) repo has no counterparty risk. A fourth broken paradigm was added later, namely (4) the euro area break up risk.


### TABLE A.1

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

**PANEL A:** Important Announcements by the Federal Reserve

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/11/2008</td>
<td>QE1</td>
<td>LSAPs announced: Fed will purchase $100 billion in GSE debt and $500 billion in MBS.</td>
<td>The Fed cuts the federal funds rate from 1% to 0.00-0.25%; expects low rates &quot;for some time.&quot;</td>
</tr>
<tr>
<td>01/12/2008</td>
<td>QE1</td>
<td>First suggestion of extending QE to Treasuries.</td>
<td>Fed expects low rates for &quot;an extended period.&quot;</td>
</tr>
<tr>
<td>16/12/2008</td>
<td>QE1</td>
<td>First suggestion of extending QE to Treasuries by FOMC.</td>
<td></td>
</tr>
<tr>
<td>28/01/2009</td>
<td>QE1</td>
<td>Fed stands ready to expand QE and buy Treasuries.</td>
<td></td>
</tr>
<tr>
<td>18/03/2009</td>
<td>QE1</td>
<td>LSAPs expanded: Fed will purchase $300 billion in long-term Treasuries and an additional $750 and $100 billion in MBS and GSE debt, respectively.</td>
<td></td>
</tr>
<tr>
<td>12/08/2009</td>
<td>QE1</td>
<td>LSAPs slowed: All purchases will finish by the end of October, not mid-September.</td>
<td></td>
</tr>
<tr>
<td>04/11/2009</td>
<td>QE1</td>
<td>LSAPs downsized: Agency debt purchases will finish at $175 billion.</td>
<td>Fed defines &quot;low rates of resource utilization, subdued inflation trends, and sable inflation expectations&quot; as conditions for the &quot;extended period.&quot;</td>
</tr>
<tr>
<td>10/08/2010</td>
<td>QE1</td>
<td>Balance sheet maintained: The Fed will reinvest principal payments from LSAPs in Treasuries.</td>
<td></td>
</tr>
<tr>
<td>27/08/2010</td>
<td>QE2</td>
<td>Bernanke suggests role for additional QE &quot;should further action prove necessary.&quot;</td>
<td></td>
</tr>
<tr>
<td>21/09/2010</td>
<td>QE2</td>
<td>FOMC emphasizes low inflation, which is &quot;likely to remain subdued for some time before rising to levels the Committee considers consistent with its mandate.&quot;</td>
<td></td>
</tr>
<tr>
<td>12/10/2010</td>
<td>QE2</td>
<td>FOMC members &quot;sense&quot; is that &quot;[additional] accommodation may be appropriate before long.&quot;</td>
<td></td>
</tr>
<tr>
<td>15/10/2010</td>
<td>QE2</td>
<td>Bernanke reiterates that Fed stands ready to further ease policy.</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX

### TABLE A.1 (continued)

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

**PANEL A:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>22/06/2011</td>
<td>QE2</td>
<td>QE2 finishes: Treasury purchases will wrap up at the end of the month, as scheduled; principal payments will continue to be reinvested.</td>
<td>Fed expects low rates 'at least through mid 2013.'</td>
</tr>
<tr>
<td>09/08/2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21/09/2011</td>
<td>Maturity Extension</td>
<td>Maturity Extension Program ('Operation Twist') announced: The Fed will purchase $400 billion of Treasuries with remaining maturities of 3 years or less; MBS and agency debt principal payments will no longer be reinvested in Treasuries, but instead in MBS.</td>
<td>Fed expects low rates 'at least through late 2014.'</td>
</tr>
<tr>
<td>25/01/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20/06/2012</td>
<td>Maturity Extension</td>
<td>Maturity Extension Program extended: The Fed will continue to purchase long-term securities and sell short-term securities through the end of 2012. Purchases/sales will continue at the current pace, about $45 billion/month.</td>
<td></td>
</tr>
<tr>
<td>22/08/2012</td>
<td>QE3</td>
<td>FOMC members 'judged that additional monetary accommodation would likely be warranted fairly soon…'</td>
<td></td>
</tr>
<tr>
<td>13/09/2012</td>
<td>QE3</td>
<td>QE3 announced: The Fed will purchase $40 billion of MBS per month as long as 'the outlook for the labor market does not improve substantially…in the context of price stability.'</td>
<td>Fed expects low rates for a 'considerable time after economic recovery strengthens' and 'at least through mid-2015.'</td>
</tr>
<tr>
<td>12/12/2012</td>
<td>QE3</td>
<td>QE3 expanded: The Fed will continue to purchase $45 billion of long-term Treasuries per month but will no longer sterilize purchases through the sale of short-term Treasuries.</td>
<td>The Fed expects low rates to be appropriate while unemployment is above 6.5 percent, inflation is forecasted below 2.5 percent and longer term inflation expectations well anchored.</td>
</tr>
<tr>
<td>22/05/2013</td>
<td>QE3</td>
<td>“If we see continued improvement, and we have confidence that that is going to be sustained, in the next few meetings we could take a step down in our pace of purchases,”</td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX**

TABLE A.1 (continued)

THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS

**PANEL A:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/06/2013</td>
<td>QE3</td>
<td>'Taper shock' as Bernanke says Fed could begin to reduce its $85 billion a month of bond purchases by the end of the year if the economy continues to improve.</td>
<td></td>
</tr>
<tr>
<td>18/09/2013</td>
<td>QE3</td>
<td>FOMC decides NOT to start tapering QE3</td>
<td></td>
</tr>
<tr>
<td>18/12/2013</td>
<td>QE3</td>
<td>'Tapering' begins, reducing the speed of asset purchases: beginning in January, asset purchases will slow by $10 billion per month, split evenly between MBS and Treasuries.</td>
<td></td>
</tr>
<tr>
<td>19/03/2014</td>
<td>QE3</td>
<td>Fed replaces thresholds with new guidance: rates on hold for a &quot;considerable time&quot; after end of tapering, hiking process will take a &quot;balanced approach&quot;, rates will be below neutral when slack has been absorbed and inflation at target.</td>
<td></td>
</tr>
</tbody>
</table>

**PANEL B:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/03/2008</td>
<td>LTRO</td>
<td>LTRO expanded: 6-month LTROs are announced.</td>
<td></td>
</tr>
<tr>
<td>15/10/2008</td>
<td>FRFA</td>
<td>Refinancing operations expanded: All refinancing operations will be conducted with fixed-rate tenders and full allotment; the list of assets eligible as collateral in credit operations with the Bank is expanded to include lower-rated (with the exception of asset-backed securities) and non-euro-denominated assets.</td>
<td></td>
</tr>
<tr>
<td>07/05/2009</td>
<td>CBPP/</td>
<td>CBPP announced/LTRO expanded: The EB will purchase €60 billion in euro-denominated covered bonds; 12-month LTROs are announced.</td>
<td>ECB lowers the main refinancing rate by 0.25% to 1% and the rate on the marginal lending facility by 0.5% to 1.75%.</td>
</tr>
<tr>
<td>10/05/2010</td>
<td>SMP</td>
<td>SMP announced: The ECB will conduct interventions in the euro area public and private debt securities markets; purchases will be sterilized.</td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX

**TABLE A.1 (continued)**

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

**PANEL B:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2010</td>
<td>CBPP</td>
<td>CBPP finished: Purchases finish on schedule; bonds purchased will be held through maturity.</td>
<td>ECB raises main refinancing rate for the first time since 2008, by 0.25% to 1.25%.</td>
</tr>
<tr>
<td>07/04/2011</td>
<td>Rate hike</td>
<td></td>
<td>ECB raises main refinancing rate by 0.25% to 1.5%.</td>
</tr>
<tr>
<td>07/07/2011</td>
<td>Rate hike</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/10/2011</td>
<td>CBPP2</td>
<td>CBPP2 announced: The EB will purchase €40 billion in euro-denominated covered bonds.</td>
<td>ECB lowers the main refinancing rate by 0.25% to 1% and the rate on the marginal lending facility by 0.25% to 1.75%.</td>
</tr>
<tr>
<td>08/12/2011</td>
<td>Rate cut/LTRO</td>
<td>LTRO expanded: 36-month LTROs are announced; eligible collateral is expanded.</td>
<td></td>
</tr>
<tr>
<td>05/07/2012</td>
<td>Rate cut</td>
<td></td>
<td>ECB lowers main refinancing rate by 0.25% to 0.75%, a record low.</td>
</tr>
<tr>
<td>02/08/2012</td>
<td>OMT</td>
<td>ECB President Mario Draghi indicates that the EB will expand sovereign debt purchases. He proclaims that “the euro is irreversible.”</td>
<td></td>
</tr>
<tr>
<td>06/09/2012</td>
<td>OMT</td>
<td>OMTs announced: Countries that apply to the European Stabilization Mechanism (ESM) for aid and abide by the ESM’s terms and conditions will be eligible to have their debt purchases in unlimited amounts on the secondary market by the ECB.</td>
<td></td>
</tr>
<tr>
<td>02/05/2013</td>
<td>Rate cut</td>
<td></td>
<td>ECB lowers the main refinancing rate by 0.25% to record low of 0.5%.</td>
</tr>
<tr>
<td>04/07/2013</td>
<td>Forward Guidance</td>
<td></td>
<td>The ECB &quot;expects the key ECB interest rates to remain at present or lower levels for an extended period of time.&quot;</td>
</tr>
<tr>
<td>07/11/2013</td>
<td>Rate cut</td>
<td></td>
<td>ECB lowers the main refinancing rate by 0.25% to new record low of 0.25%.</td>
</tr>
</tbody>
</table>
## APPENDIX

**TABLE A.1 (continued)**

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

### PANEL B:

**Important Announcements by the European Central Bank**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>13/02/2014</td>
<td>Forward Guidance</td>
<td>The ECB “firmly reiterates its forward guidance: rates at present or lower levels for an extended period of time.</td>
<td></td>
</tr>
<tr>
<td>13/03/2014</td>
<td>Forward Guidance</td>
<td>ECB introduces concept of “slack” to suggest rates on hold even after recovery takes hold.</td>
<td></td>
</tr>
</tbody>
</table>

### PANEL C:

**Important Announcements by the Bank of England**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/01/2009</td>
<td>APF</td>
<td>APF established: The BOE will purchase up to £50 billion of “high quality private sector assets” financed by Treasury issuance.</td>
<td>The BOE cuts policy rate from 1% to 0.5%; the ECB cuts policy rate from 2% to 1.5%</td>
</tr>
<tr>
<td>11/02/2009</td>
<td>APF</td>
<td>The BOE views a slight downside risk to meeting the inflation target, reiterates APF as potential policy instrument.</td>
<td></td>
</tr>
<tr>
<td>05/03/2009</td>
<td>APF</td>
<td>QE announced: The BOE will purchase up to £75 billion in assets, now financed by reserve issuance; medium- and long-term gilts will comprise the ‘majority’ of new purchases.</td>
<td></td>
</tr>
<tr>
<td>07/05/2009</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £125 billion in assets.</td>
<td></td>
</tr>
<tr>
<td>06/08/2009</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £175 billion in assets; to accommodate the increased size, the BOE will expand purchases into gilts with remaining maturity of 3 years or more.</td>
<td></td>
</tr>
<tr>
<td>05/11/2009</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £200 billion in assets.</td>
<td></td>
</tr>
<tr>
<td>04/02/2010</td>
<td>APF</td>
<td>QE maintained: The BOE maintains the stock of asset purchases financed by the issuance of reserves at £200 billion; new purchases of private assets will be financed by Treasury issuance.</td>
<td></td>
</tr>
<tr>
<td>06/10/2011</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £275 billion in assets financed by reserve issuance; the ceiling on private assets held remains £50 billion.</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX

### TABLE A.1 (continued)

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

**PANEL C:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>29/11/2011</td>
<td>APF</td>
<td>Maximum private asset purchases reduced: HM Treasury lowers the ceiling on APF private asset holdings from £50 billion to £10 billion.</td>
<td></td>
</tr>
<tr>
<td>09/02/2012</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £325 billion in assets.</td>
<td></td>
</tr>
<tr>
<td>05/07/2012</td>
<td>APF</td>
<td>QE expanded: The BOE will purchase up to £375 billion in assets.</td>
<td></td>
</tr>
<tr>
<td>07/08/2013</td>
<td>Forward Guidance</td>
<td></td>
<td>The MPC will not raise rates at least until the unemployment rate crosses 7%, subject to the following conditions: the CPI forecast does not exceed 2.5%, medium-term inflation expectations are sufficiently well-anchored, and financial stability is not impaired.</td>
</tr>
<tr>
<td>12/02/2014</td>
<td>Forward Guidance</td>
<td></td>
<td>“Despite the sharp fall in unemployment, there remains scope to absorb spare capacity further before raising the Bank Rate. When the Bank Rate does begin to rise, the appropriate path… is expected to be gradual. Even when the economy has returned to normal levels of capacity and inflation is close to target, the appropriate level of Bank Rate is likely to be materially below the 5% level set on average prior to the financial crisis.</td>
</tr>
</tbody>
</table>

**PANEL D:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/12/2008</td>
<td>SFSOs</td>
<td>The BOJ will operate a facility through the end of April to lend an unlimited amount to banks at the uncollateralized overnight call rate and collateralized by corporate debt.</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX

### TABLE A.1 (continued)

THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS

PANEL D:

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/12/2008</td>
<td>Outright JGB/CFI purchases</td>
<td>Outright purchases expanded: The BOJ Increases monthly JGB purchases (last increased October 2002) from ¥1.2 trillion to ¥1.4 trillion; they will also look into purchasing commercial paper.</td>
<td>The BOJ lowers the target for the uncollateralized overnight call rate from 0.3% to 0.1%.</td>
</tr>
<tr>
<td>22/01/2009</td>
<td>Outright CFI purchases</td>
<td>Outright purchases announced: The BOJ will purchase up to ¥3 trillion in commercial paper and ABCP and is investigating outright purchases of corporate bonds.</td>
<td></td>
</tr>
<tr>
<td>19/02/2009</td>
<td>Outright CFI purchases</td>
<td>Outright purchases expanded: The BOJ will extend commercial paper purchases and the SFSOs through the end of September (previously end of March) and will purchase up to ¥1 trillion in corporate bonds.</td>
<td></td>
</tr>
<tr>
<td>18/03/2009</td>
<td>Outright JGB purchases</td>
<td>Outright purchases expanded: The BOJ increases monthly JGB purchases from ¥1.4 trillion to ¥1.8 trillion.</td>
<td></td>
</tr>
<tr>
<td>15/07/2009</td>
<td>Outright CFI purchases/ SFSOs</td>
<td>Programs extended: The BOJ extends the SFSOs and outright purchases of corporate paper and bonds through the end of the year.</td>
<td></td>
</tr>
<tr>
<td>30/10/2009</td>
<td>Outright CFI purchases/ SFSOs</td>
<td>Status of programs: Outright purchases of corporate finance instruments will expire at the end of 2009 as expected, but the SFSOs will be extended through 2010:Q1; ample liquidity provision past 2010:Q1 will occur through funds-supplying operations against pooled collateral, which will accept a larger range of collateral.</td>
<td></td>
</tr>
<tr>
<td>01/12/2009</td>
<td>FROs</td>
<td>Facility announcement: The BOJ will offer ¥10 trillion in 3-month loans against the full menu of eligible collateral at the uncollateralized overnight call rate.</td>
<td></td>
</tr>
<tr>
<td>17/03/2010</td>
<td>FROs</td>
<td>Facility expansion: The BOJ expands the size of the FROs to ¥20 trillion.</td>
<td></td>
</tr>
<tr>
<td>21/05/2010</td>
<td>GSFF</td>
<td>GSFF announcement: The BOJ will offer ¥3 trillion in 1-year loans to private financial institutions with project proposals for &quot;strengthening the foundations for economic growth.&quot;</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX

### TABLE A.1 (continued)

THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS

**PANEL D:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/08/2010</td>
<td>FROs</td>
<td>Facility expansion: The BOJ adds ¥10 trillion in 6-month loans to the FROs.</td>
<td></td>
</tr>
<tr>
<td>05/10/2010</td>
<td>CME</td>
<td>APP established: The BOJ will purchase ¥5 trillion in assets (¥3.5 trillion in JGBs and Treasury discount bills, ¥1 trillion in commercial paper and corporate bonds, and ¥0.5 trillion in ETFs and J-REITs).</td>
<td>The BOJ sets the target for the uncollateralized overnight call rate at around 0 to 0.1%.</td>
</tr>
<tr>
<td>14/03/2011</td>
<td>CME</td>
<td>APP expanded: The BOJ will purchase an additional ¥5 trillion in assets (¥0.5 trillion in JGBs, ¥1 trillion in Treasury discount bills, ¥1.5 trillion in commercial paper, ¥1.5 trillion in corporate bonds, ¥0.45 trillion in ETFs, and ¥0.05 trillion in J-REITs).</td>
<td></td>
</tr>
<tr>
<td>14/06/2011</td>
<td>GSFF</td>
<td>GSFF expanded: The BOJ makes available another ¥0.5 trillion in loans to private financial institutions for the purpose of investing in equity and extending asset-based loans.</td>
<td></td>
</tr>
<tr>
<td>04/08/2011</td>
<td>CME</td>
<td>(¥2 trillion in JGBs, ¥1.5 trillion in Treasury discount bills, ¥0.1 trillion in commercial paper, ¥0.9 trillion in corporate bonds, ¥0.5 trillion in ETFs, and ¥0.01 trillion in J-REITs); 6-month collateralized loans through the FROs are expanded by ¥5 trillion.</td>
<td></td>
</tr>
<tr>
<td>27/10/2011</td>
<td>CME</td>
<td>APP expanded: The BOJ will purchase an additional ¥5 trillion in JGBs.</td>
<td></td>
</tr>
<tr>
<td>14/02/2012</td>
<td>CME</td>
<td>APP expanded: The BOJ will purchase an additional ¥10 trillion in JGBs.</td>
<td></td>
</tr>
<tr>
<td>13/03/2012</td>
<td>GSFF</td>
<td>GSFF expanded: The BOJ makes available another ¥2 trillion in loans to private financial institutions, including ¥1 trillion in U.S.-dollar-denominated loans and ¥0.5 trillion in smaller-sized (¥1 million-¥10million) loans.</td>
<td></td>
</tr>
<tr>
<td>27/04/2012</td>
<td>CME</td>
<td>APP expanded/FROs reduced: The BOJ will purchase an additional ¥10 trillion in JGBs, ¥0.2 trillion in ETFs, and ¥0.01 in J-REITs. The BOJ also reduces the availability of 6-month FRO loans by ¥5 trillion.</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX

### TABLE A.1 (continued)

**THE CHRONOLOGY AND NATURE OF THE MEASURES UNDERTAKEN BY THE DIFFERENT CENTRAL BANKS**

**PANEL D:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Program</th>
<th>Asset Purchases/Lending News</th>
<th>Interest Rates/Guidance News</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/07/2012</td>
<td>CME</td>
<td>APP expanded/FROs reduced: The BOJ will purchase an additional ¥5 trillion in Treasury discount bills and reduced the availability of FRO loans by ¥5 trillion.</td>
<td></td>
</tr>
<tr>
<td>19/09/2012</td>
<td>CME</td>
<td>APP expanded: The BOJ will purchase an additional ¥5 trillion in JGBs and ¥5 trillion in Treasury discount bills.</td>
<td></td>
</tr>
<tr>
<td>30/10/2012</td>
<td>CME/SBLF</td>
<td>APP expanded/SBLF announced: The BOJ will purchase an additional ¥5 trillion in JGBs, ¥5 trillion in Treasury discount bills, ¥0.1 trillion in commercial paper, ¥0.3 trillion in corporate bonds, ¥0.5 trillion in ETFs, and ¥0.01 trillion in J-REITs. Through the SBLF it will fund up to 100 percent of depository institutions' net increase in lending to the nonfinancial sector.</td>
<td></td>
</tr>
<tr>
<td>20/12/2012</td>
<td>CME</td>
<td>APP expanded: The BOJ will purchase an additional ¥5 trillion JGBs and ¥5 trillion in Treasury Discount bills.</td>
<td></td>
</tr>
<tr>
<td>04/04/2013</td>
<td>QQE</td>
<td>The 2x2x2x2 strategy: the BOJ announces that it will achieve 2 percent inflation in 2 years by doubling the monetary base by December 2014 and doubling the duration of the JGBs it purchases. APP is terminated and will be absorbed into aforementioned JGB purchases.</td>
<td>QQE will continue for as long as needed to achieve 2 percent inflation in a sustained manner</td>
</tr>
</tbody>
</table>
PART III

Balance of risks and the interactions with other policies