

Comparative Study of Central Bank Quantitative Easing Programs

Federal Reserve Bank

Bank of England

Bank of Japan

European Central Bank

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The objective of this report is to provide an in depth analysis of each central banks' quantitative easing program. The banks' main purpose was to alleviate financial market distress. Their non-conventional monetary policy approaches differed in program, structure and timing. This report performs a comparative analysis of these differences.

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This study consists of literature reviews of existing studies and does not provide personal, new or original analysis. It does not represent the views of Columbia University or the Federal Reserve Bank of New York. The views expressed herein should be attributed to the authors and not to the FRBNY, Columbia University, or Professor Richard Clarida. Contact details for the authors are: Gabriel Agostini ga2395@columbia.edu, Juan Pablo Garcia jg3503@columbia.edu, Alvaro P Gonzalez apg2149@columbia.edu, Laura Muller lsm2160@columbia.edu, Jingwen Jia jj2733@columbia.edu, Ali Raza Zaidi arz2114@columbia.edu

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ABBREVIATION

Abbreviation	Meaning
ABCP	Asset-Backed Commercial Paper
ABS	Asset Backed Securities
ABSPP	Asset-Backed Securities Purchase Program
ALM	Asset Liability Management
AMLF	Asset-Backed Commercial Paper Money Market Fund Liquidity Facility
APF	Asset Purchase Facility
APP	Asset Purchase Program
ASEAN	Association of Southeast Asian Nations
ATAF	Term Auction Facility
BLC	Bank Lending Channel
BOC	Bank of Canada
BOE	Bank of England
BOJ	Bank of Japan
CA	Current Account
CB	Central Bank
CBPP	Covered Bond Purchase Program
CDS	Credit Default Swap
CFI	Corporate Finance Instruments
CMBS	Commercial Mortgage Backed Securities
CME	Comprehensive Monetary Easing
CP	Commercial Paper
CPFF	Commercial Paper Funding Facility
CRE	Commercial Real Estate
CREST	Certificateless Registry for Electronic Share Transfer
CSPP	Corporate Sector Purchase Program
CTRF	Contingent Term Repo Facility
DMO	Debt Management Office
DWF	Discount Window Facility
EA	Euro Area
EAPP	Extended Asset Purchase Program
EC	European Commission
ECB	European Central Bank
ECTR	Extended Collateral Term Repo
EFSF	European Financial Stability Facility
EME	Emerging Market Economies
EMIR	European Market Infrastructure Regulation
EONIA	Euro Overnight Index Average
ESM	European Stability Mechanism
ESMA	European Securities and Markets Authority
ETF	Exchange Traded Fund
EU	European Union
Fed	Federal Reserve System
FED	Federal Reserve
FLS	Funding for Lending Scheme
FOMC	Federal Open Market Committee
FRBNY	The Federal Reserve Bank of New York
FRFA	Fixed Rate Full Allotment

FRO	Fixed-Rate Operation
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GPIF	Government Pension Investment Fund
GSE	Government Sponsored Enterprise
GSFF	Growth-Supporting Funding Facility
HBOS	Halifax Bank of Scotland
HM	Her Majesty
HMT	Her Majesty's Treasury
ILTR	Indexed Long Term Repo
JGB	Japanese Government Bond
JREITS	Japan Real Estate Investment Trusts
LHS	Left Hand Side
LSAP	Large Scale Asset Purchase
LSAPP	Large Scale Asset Purchase Programs
LTRO	Long Term Refinancing Operations
MBS	Mortgage-Backed Security
MEP	Maturity Extension Program and Reinvestment Policy
MEP	Maturity Extension Program
MFI	Monetary and Financial Institution
MMF	Money Market Fund
MMIF	Money Market Investor Funding
MMIFF	Money Market Investor Funding Facility
MoU	Memorandum of Understanding
MPC	Monetary Policy Committee
MRO	Marginal Refinancing Operations
NCB	National Central Bank
NIRP	Negative Interest Rate Policy
NLGS	National Loan Guarantee Scheme
OIS	Overnight Index Swap
OMO	Open Markets Operations
OMT	Outright Monetary Transactions
PDCF	Primary Dealer Credit Facility
PNFC	Private Non-Financial Corporations
PSPP	Public Sector Purchase Program
QE	Quantitative Easing
QE1	Quantitative Easing 1
QE2	Quantitative Easing 2
QE3	Quantitative Easing 3
QQE	Quantitative and Qualitative Easing
REER	Real Effective Exchange Rate
REIT	Real Estate Investment Trust
RHS	Right Hand Side
RMBS	Residential Mortgage Backed Securities
SBLF	Stimulating Bank Lending Facility
SEP	Survey of Economic Projections
SFSO	Special Funds Supplying Operation
SGP	Stability and Growth Pact
SIPA	School of International and Public Affairs
SLS	Special Liquidity Scheme

SMF	Sterling Monetary Framework
SMP	Securities Market Program
SOMA	System Open Market Account
SPV	Special Purpose Vehicles
TABSLF	Term Asset-Backed Securities Lending Facility
TAF	Term Auction Facility
TALF	Term Asset-Backed Securities Lending Facility
TLTRO	Targeted Long Term Refinancing Operations
TSLF	Term Securities Lending Facility
UK	United Kingdom
UKEF	UK Export Finance
US	United States
VLTRO	Very Long Term Refinancing Operations
ZLB	Zero Lower Bound

EXECUTIVE SUMMARY

Eight years ago the global financial crisis (GFC) was in full force. The GFC pushed monetary policy makers to formulate effective and creative policy responses. Quantitative easing, commonly referred to as unconventional monetary policy, was the policy response used by all four central banks in this report. The banks are The Federal Reserve Bank (Fed), The Bank of England (BOE), The Bank of Japan (BOJ) and The European Central Bank (ECB).

By the end of 2008, the Federal Reserve had exhausted all traditional monetary measures. As it approached the zero low bound (ZLB) in December 2008, the Fed introduced Large Scale Asset Purchase Programs (LSAPPs) to ease fraught credit conditions and inject liquidity into the financial system. The United Kingdom (UK) faced a similar situation with zero-level policy rates. In March 2009, the BOE began a large-scale purchasing program of UK government gilts. The BOJ was no stranger to QE having introduced it in 2001. In 2013 Japan revisited unconventional monetary policy with the three arrows under Abenomics. In 2015, the ECB announced a €1.1 trillion round of QE lasting up until September 2016.

Unconventional Monetary Policy Overview

The report's intention is to provide a comparative analysis of the Fed, Bank of England, BOJ and ECB's quantitative easing program. This was no straightforward task for two reasons. Firstly, the central banks are at different points in their QE program. Although this report's main timeframe for analysis was post 2012, events prior to 2012 had to be considered. The BOJ and ECB have stepped up their programs and entered negative rate territory whereas the Fed and BOE are determining exit strategies and slowly raising rates. Secondly, the central banks operated in very different economic, political and financial environments.

Japan, having already implemented QE in 2001, entered the crisis with low economic growth, an ageing population and deflation. Although the BOJ carried out asset purchase programs in response to the financial crisis, including the purchasing of corporate bonds, the economy was still struggling. Abenomics' Quantitative and Qualitative easing program was introduced in 2013 to target deflation and in early 2016 the Bank introduced negative interest rates.

The situation in the Eurozone by 2013 was that of large disparities in economic recovery amongst member countries. Unlike the other three central banks, the ECB operated at a regional level with policies affecting all member states. The ECB was also just coming out of the Eurozone sovereign debt crisis. Aggregate slow economic recovery and high unemployment, along with other macroeconomic concerns, led the ECB to reduce deposit rates below the zero bound in June 2014 as well as introduce further asset purchase programs towards the end of the year.

In 2012 the BOE was still very active with QE programs. The BOE expanded its asset purchases to £375 billion in July and launched multiple schemes to encourage lending and thus economic activity. However, the BOE was also beginning to close down programs, such as the Special Liquidity Scheme. The arrival of Governor Mark Carney has seen forward guidance and clarity on the Bank's direction

take centre stage. This brings hope for the communication around the BOEs exit from QE, which is more likely than not going to take place in the near future.

Since 2008 the Fed has played centre stage to national, and often global, economic and financial discussion. It was the first central bank to implement QE with successive rounds of LSAPs in response to the crisis. Unlike the other three central banks, the Fed faced a housing crisis to which it responded with a credit-easing program. By 2012, the Fed announced the third and last of its asset-purchase programs, QE3. On December 15 2015, The Fed was also the first to raise interest rates given improved labor market conditions.

Part One: Conceptual Issues

Chapter one *Unconventional Monetary Policy: Some Conceptual Issues* carries out a literature review of the conceptual foundations and empirical evidence on the effectiveness of unconventional monetary policy. The chapter examines literature on the effects of forward guidance. When rates are near or at the lower bound, central bank's commitment to forecasted interest rates can influence market expectations of future interest rate levels. Portfolio balance, the most commonly used form of justification for large-scale asset purchase programs, is examined. The empirical evidence suggests that portfolio balance has a significant impact on bond yields. Criticism of the portfolio rebalance theory is developed. The chapter concludes with an analysis of international spill overs of unconventional monetary policy, namely high capital flows to emerging market economies.

Part Two: The Four Central Banks

This section focuses on the four central banks and their individual programs. It includes a timeline of major QE events since 2013.

Chapter two *The Federal Reserve System* focuses on the 2007-2012 Large Scale Asset Purchase Programs. These were necessary as a means to ease credit conditions and inject liquidity into the financial system. The chapter briefly covers Fed actions at the peak of the crisis (September 2008). It proceeds to discuss the US financial system's architecture and how it influenced credit easing programs. In November 2008 the Federal Reserve introduced the first of three QE rounds. Seven years later the Fed announced its first rate hike on December 15th 2015.

Chapter three *The Bank of England* briefly covers the BOE's large-scale asset purchase programs between March 2009 to January 2010 and October 2011 to July 2012. The initial large-scale purchases were government gilts. This progressed to include the purchasing of private sector assets as well as commercial paper. The BOE was actively involved in schemes beyond the asset purchase programs. These included the Special Liquidity Scheme (SLS), the National Loan Guarantee Scheme (NLGS) and the Funding for Lending Scheme (FLS).

Chapter four *The Bank of Japan* focuses on a country that is no stranger to QE. In 2001, the BOJ was the first bank to introduce unconventional monetary policy. The chapter proceeds to outline lessons learnt from the 2001 QE and Abenomics. Unlike the other three central banks, the BOJ introduced Quantitative and Qualitative Easing (QQE). Qualitative refers to other assets, including Exchange Traded Funds

(ETFs) and Real Estate Investment Trust (REITs). The BOJ entered negative rate territory in 2016, signalling that the effectiveness of QQE was drawing to an end.

Chapter five *The European Central Bank* examines the ECB's recent QE program. The chapter carries out an in depth analysis of the Eurozone's financial structure. It breaks down the ECB's various monetary approaches, including the Long Term Repurchase Operations (LTROs), the Covered Bond Purchase Program (CBPP), the Securities Market Program (SMP) and the Expanded Asset Purchase Program (EAPP).

Part Three: Comparative Analysis

The report concludes with a comparative analysis of the banks' QE programs. The first section draws similarities and differences between the Fed and the BOE. The second section does this for the Fed and the BOJ and ECB. The section ends with a review of exit strategies across the Banks, and the impact and an effectiveness of QE.

Other Debates: Fiscal Policy and the Role of Central Banks

Fiscal policy has widely been underutilised across the four countries with Japan leading the way with some fiscal spending to spur growth and inflation. Unwillingness, or inability, of governments to introduce countercyclical fiscal policy (increased spending / cutting taxes) made monetary policy the main economic stabiliser during the financial crisis. The Eurozone does not have a fiscal union; so it is not even possible to employ a regional fiscal stimulus to stimulate aggregate demand. In the US, passing fiscal policies is a timely and political process, with a potential for gridlock. Both examples highlight why policy makers may have avoided fiscal as opposed to monetary policies during the crisis years. Time was tight as economies began to enter a free-fall.

Since 2008 central bankers have been at the centre of economic, financial and political debate. Rather than actively trying to seek out additional roles and responsibilities, central banks were essentially thrust into a decision-making role at the center of the crisis. Most economists would agree that central bank's heavy involvement was a requirement during the crisis years to ensure avoidance of a global depression. However, the large scale monetary stimulus has been of some concern in terms of whether it has distorted certain economies and given too much power into the hands of central bankers. Mohamed El-Erian, former IMF economist and former co-CEO of PIMCO and chief economic advisor at Allianz, is vocal in this area, arguing that politicians have become 'too reliant on central bankers as a main source of economic stimulus' and therefore certain reforms were not pushed through.¹

The scope of central bank's roles grew beyond their traditional role as the implementer of monetary policy. There were legitimate concerns that by expanding its work beyond the usual remit, central banks were not only becoming too powerful but were also *exposing* themselves too much. Credit risk is an example of this. By taking on the role as lender-of-last resort, the central bank could expose itself through the purchasing of risky securities or lending to institutions whose collateral was not credit worthy.

¹ The Economist. "[Shifting the Burden](#)." January 23 2016.

PART I: CONCEPTUAL ISSUES

CHAPTER 1: CONCEPTUAL ISSUES IN UNCONVENTIONAL MONETARY POLICY

In response to extreme disturbances in the credit market in the fall of 2008, the Federal Reserve lowered the policy rate target close to zero, announced unprecedented interventions in the bond market, and offered forward guidance to the markets. From November 2008 to 2013 the Fed announced three rounds of asset purchases, totalling over \$3 trillion, to address poor economic activity.

The Federal Open Market Committee (FOMC) justifies using unconventional monetary policy for two reasons. Firstly, for the support of essential credit markets, specifically housing. Secondly to reduce medium and long-term interest rates to stimulate real activity. Soon after the Fed implemented its assets programs, the central banks of other troubled advanced economies (BOJ, BOE, ECB) started or reinitiated their own set of unconventional policies.

Despite the reduction of short and long-term yields following unconventional monetary policy, the efficacy of this policy is subject to debate. The chapter's objective is to review academic discussion on the effectiveness, and through which transmission mechanisms, unconventional monetary policy affects financial markets and real economic activity.

The financial crisis left national economic authorities with limited policies to stimulate the economy. Central banks implemented a set of policies not well understood from the theoretical or empirical point of view. On one hand, central banks increased the amount and quality of information reported to the general public. This was to reduce both the time-inconsistency problem linked to previous inflation outbreaks, but to also affect financial variables.

Central banks believed forward guidance would influence short and long-term yields, increase credit, and spur economic activity. Further, central banks purchased large quantities of long-term assets, including treasuries, agency, and mortgage-backed securities to support credit markets facing severe illiquidity. Monetary authorities alleged that with the bond purchases, investors would replace securities sold to the central bank with riskier assets characterized by similar maturities. The investor's purpose was to return balance back to their portfolio. This rebalancing should reduce yields and stimulate credit, investment, and consumption.

The effectiveness of costly non-conventional monetary policy is subject to debate. Poor economic recovery and outlook in countries already implementing non-standard monetary policies brings into question whether such policies can reactivate economic activity. The debate covers three areas. Firstly, whether further policy implementation can do more harm than good, secondly the magnitude required to influence economic variables, and thirdly the limits and associated risks.

From a policymaker's point of view, determining effectiveness is fundamental for two reasons. Firstly, to understand the conditions for the successful implementation of non-standard policies, their

transmission mechanisms, and the elasticity of response. Secondly, to be aware of the risks involved in non-standard economic policy implementation. Therefore, this chapter reviews the debate highlighting the dangers and the unintended results of executing non-conventional monetary policies.

Complementary to this is the international effects of QE. Loose monetary policy in the developed world generated excess global liquidity. This flooded emerging markets economies (EMEs), causing the appreciation of local currencies, accumulation of financial imbalances, and the distortion of foreign credit markets. Moreover, some commentators suggested that the implementation of these policies contained within themselves a form of protectionism of the troubled advanced economies.

Although the literature primarily agrees that unconventional monetary policy helps to reduce long-term yields and spur economic recovery, questions still remain. Were measures applied to a sufficient scale? What are the transmission channels through which forward guidance and QE operate? Is it possible (and necessary) to complement their effects with other policies? Finally, how will the economy respond to unintended negative consequences and central banks and multilateral institutions responses?

The discussion on non-standard policies' effectiveness is only part of the debate. Ancillary debates question unintended consequences of non-standard measures and the actions required to mitigate their impact. These are beyond the scope of this chapter but for an interesting summary of the involuntary consequences see Rajan (2013).² Recurrent topics of debate are the increase in inequality linked to the implementation of non-standard monetary policies, the overall soundness of the financial industry, and the slow pace in the adoption of structural reforms.

This chapter has four sections. The first section summarizes the established method used by central banks to affect the economy. The second section covers forward guidance. The third section summarizes the debate on QE effectiveness. The fourth section reviews the involuntary international spill overs generated by capital flows and currency depreciation consequences caused by expansionary monetary stimulus.

Conventional Monetary Policy and the Financial Crisis

Conventional monetary policy is the buying and selling of short-term securities to target short-term nominal interest rates. Over the last 40 years economists have agreed on central bank's monetary objectives, namely price stability, and policy tools.

Conventional monetary policy stimulates the economy by modifying asset prices and credit availability. In the first case, due to some degree of price stickiness in the economy, inflation expectations do not react immediately to changes in the policy rate. Therefore, central bank's action can influence real interest rates. These are determinant factor of asset prices. Indeed, stock and bond prices, as well as exchange rates, are the primary asset classes affected by loose monetary policy. The wealth channel states that higher stock and bond prices encourage consumption by increasing households' wealth. In addition, an expansive monetary stance alters the relative amount of foreign currency in the economy and tends to

² Rajan, Raghuram. "[A Step in the Dark: Unconventional Monetary Policy after the Crisis.](#)" BIS Andrew Crockett Memorial Lecture. June 23 2013.

depreciate the local currency. This stimulates exports by making national products more competitive relative to foreign goods.

Credit availability is the other traditional transmission mechanisms of conventional monetary policy. An expansive monetary policy ameliorates the negative effects that asymmetric information frictions have on credit markets. The result is that financial institutions are more willing to lower credit risk standards. Therefore, they offer loans that eventually increase consumption and close the output gap. Corporations also benefit from the increased credit availability by borrowing capital to invest in projects that expand their capacity and induce further increases in aggregate demand.

Despite its proven efficacy, traditional monetary policy has its limitations. The Lehman Brothers' collapse in 2008 and its effect on both financial markets and wider economy pushed monetary authorities to cut the policy rate to its effective lower bound. Additionally, the financial meltdown exacerbated informational asymmetries to the point of shutting down key markets (e.g., MBS). To prevent the economy from entering a freefall, central banks implemented forward guidance and QE.

Forward Guidance

Even before the financial crisis, economists had developed theoretical alternatives to the mainstream monetary practice. The expectation hypothesis argues that bond yields depend on future interest rate expectations and a constant risk term. Based on this hypothesis, Woodford (1999) proposes that monetary policy would be more effective if the central bank committed long term to a certain interest rate level.³ This is because central bank commitment to an interest rate level would have a substantial influence on short-term yields and long-term interest rates. Thus increasing the overall effectiveness of the policy.

Eggertsson and Woodford (2003) examine the effects of forward guidance with a binding ZLB constraint.⁴ The article analyzed a central bank's ability to influence yields by announcing commitment to a certain rate level. The authors conclude that at the ZLB, the optimal policy is to commit to a certain rate level even after the natural interest rate increases. This will increase future inflation, push real interest rates down, and reduce economic downturn.

The effectiveness of forward guidance is subject to two areas of debate. Firstly, the potential excessive confidence that economic agents place on central bank announcements can disrupt financial markets. Morris and Shin (2002) show that under certain conditions, extreme central bank transparency may cause agents to form expectations away from fundamentals.⁵ Secondly, forward guidance can lead central banks to maintain the announced rates even if economic conditions require an adjusted rate. This can cause an inflation overshoot.

³ Woodford, Michael. "[Optimal Monetary Policy Inertia.](#)" The Manchester School, Vol. 67. December 16 2002.

⁴ Eggertsson, Gauti .B. and Michael Woodford. "[The Zero Bound on Interest Rates and Optimal Monetary Policy.](#)" Brookings Papers on Economic Activity, Vol 1. 2003.

⁵ Morris, Stephen., and Hyun Song Shin. "[Social Value of Public Information.](#)" The American Economic Review. Vol. 92(5). December 5 2002.

The perils of measuring the effect of unconventional monetary policy

The effects of unconventional monetary policy are difficult to identify for three reasons. Firstly, historic non-traditional policy usage is low. Therefore, there are minimal events that can be used for benchmarking purposes. Secondly, yields can be impacted by other factors affecting the bond market. Thirdly, the overall state of the economy and unconventional policy can reinforce each other, biasing the estimates and making it difficult to identify causality. Given these issues, researchers are dependent on event studies to determine whether unconventional policy reduced short and long-term yields. Those studies rely on the instantaneous effect that policy announcements have on financial variables to circumvent both the endogeneity and the identification problem.

The event study approach looks into the type, quality and quantity of information in a central bank announcement. For instance, the Fed releases three primary sources of information. These are FOMC statements and other Fed announcements, speeches by the Chairman, and FOMC minutes. If yields change after an announcement, then it would seem that this announcement is the cause for change. The risk is that the announcement contains other information that could impact yield. In this case, the event study approach requires that the statement is subject to inspection. Thornton (2014) takes into account these considerations when analysing the effect of fifty-three QE announcements on long-term yields.⁶ The study finds that none of the statements effectively changed long-term interest rates.

The limitations of forward guidance

Kool and Thornton (2012) test whether forward guidance improves monetary policy effectiveness.⁷ To test the positive effects of a signalling policy, the paper investigates the accuracy of predictions on future interest rates in New Zealand, Norway, Sweden, and the United States. The authors use survey forecasts of market participants and compare the improvement in prediction accuracy before and after the adoption of signalling policies. The authors find weak statistical evidence that forward guidance policies increase the forecasting ability of short-term yields and no evidence of improved predictions of long term interest rates.

In Gavin et al. (2015) the authors examine forward guidance's effectiveness on overall economic conditions both at and away from the ZLB, given ZLB events are endogenous.⁸ The authors find that signalling's positive effect on economic activity depends on the size of the recession and households' expectations on the speed of recovery. This assumes that households believe the economy will recover and leave the ZLB in the short-run otherwise future nominal interest rates will remain at or near zero and signalling will marginally affect the economy.

⁶ Thornton, Daniel. L. "[An Evaluation of Event-Study Evidence on the Effectiveness of the FOMC's LSAP Program: Are the Announcement Effects Identified?](#)" Federal Reserve Bank of St. Louis Working Paper Working Paper Series, No. 2013-033. March 11 2014

⁷ Kool, Clemens, and Daniel Thornton. "How Effective Is Central Bank Forward Guidance." Federal Reserve Bank of St. Louis Working Paper Series. December 2012.

⁸ Gavin, W. T., William Gavin, Benjamin Keen, Alexander Richter, and Nathaniel Throckmorton. "[The Limitations of Forward Guidance](#)." Federal Reserve Bank of St. Louis Working Paper Series, No.2013-038D. Rev. February 2015.

Portfolio Balance

The portfolio balance theory is the most cited theoretical justification for the large-scale asset purchase programs. Tobin and Brainard (1963) and Tobin (1969) initially introduced this concept.⁹ They did this when analysing the impact of non-bank financial institutions (pension funds, insurance companies etc.) on monetary policy effectiveness. Tobin and Brainard (1963) assumed that there is some degree of substitutability between assets with similar attributes (e.g., maturity). Therefore, substitutability can characterize investor portfolios.

The portfolio balance channel is central to non-conventional monetary policy. Treasury purchases reduce public supply and increases the central bank's reserves held by commercial banks and other financial institutions. In a low-interest rate environment, bank reserves and treasuries differ in duration risk. This is zero for bank deposits and positive for long-term securities. If investors treat them as perfect substitutes, further central bank purchases of treasuries will have a null effect on yields. In that case, commercial banks and other financial institutions would passively swap bonds for bank deposits. According to the preferred habitat theory, these assets are not perfect substitutes.

The 'preferred habitat theory,' developed by Modigliani and Sutch (1966) argues that most agents holding treasuries prefer one maturity over multiple.¹⁰ Investors use proceeds from the sale of treasuries to buy other long-term securities and restore balance to their portfolio. The central bank's intervention in bond markets reduces the duration risk. Further, investors that require long-dated assets will demand a lower premium on similar assets. Consequently, the price of risky long-term assets tends to rise and their yields tend to fall. Decreasing yields will encourage more corporate borrowing and investing. The result is that households will perceive a wealth increase, leading to an increase in consumption and overall demand and output.

The empirical evidence

Research finds that monetary intervention has a significant effect on government bond yields. The decline in bond yields and increase in other asset prices can best be explained by a reduction in term or risk premium. This is because of the portfolio balance effects resulting from central bank asset purchases (D'Amico and King, 2010; Gagnon et al., 2011; Joyce et al. 2011a,b, Joyce 2012).¹¹

⁹ Tobin, James. "[A General Equilibrium Approach to Monetary Theory.](#)" *Journal of Money, Credit and Banking*, 1(1). February 1969. Tobin, James., and William Brainard. "[Financial Intermediaries and the Effectiveness of Monetary Controls.](#)" *The American Economic Review*, 53(2). May 1963.

¹⁰ Modigliani, Franco., and Richard Sutch. "[Innovations in Interest Rate Policy.](#)" *The American Economic Review*, 56(2). March 1 1966.

¹¹ 1. D'Amico, Stefania., and Thomas B. King. "[Flow and Stock Effects of Large-Scale Treasury Purchases.](#)" *Finance and Economics Discussion Series (No 2010-52)*. Washington: Board of Governors of the Federal Reserve System. 2010

2. Gagnon, J., Raskin, Matthew Raskin, Julie Remache, and Brian Sack. "[The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases.](#)" *International Journal of Central Banking*, Vol. 7(10). March 2011.

3. Joyce, Michael., Ana Lasasoa, Ibrahim Stevens, and Matthew Tong. "[The Financial Market Impact of Quantitative Easing.](#)" *Bank of England. International Journal of Central Banking*, Vol. 7(3). September 2011a.

4. Joyce, Michael., Matthew Tong, and Robert Woods. "[The United Kingdom's Quantitative Easing Policy: Design, Operation and Impact.](#)" *Bank of England Quarterly Bulletin*, 2011 Q3, Vol. 51(3). September 19 2011.

5. Joyce, Michael, and Matthew Tong. "[QE and the Gilt Market: a Disaggregated Analysis.](#)" *The Economic Journal*. 122(564). 29 October 2012.

The methodology in literature relies heavily on event studies. An issue is the window size used to measure market reaction to monetary stimulus. A narrow window can potentially fail to capture the response of financial markets to central bank announcements. A wide window can incorrectly incorporate other factors that influence the observed variables. Joyce and Tong (2012) observe events after each BOE intervention announcement and conclude that the optimal window depends on the type of intervention of the gilt market, with early statements taking two days to price the effect.

The behavioral critique

Thornton (2012) doubts the magnitude of QE's impact and develops two criticisms.¹² Firstly, empirical tests fail to provide a consistent explanation on how the portfolio balance channel works. Thornton claims that the Fed's LSAP program is small in relation to the size of the long-term bond market. Moreover, the channel requires significant segmentation of the long-end of the Treasury market to work, but further segmentation generates less impact on interest rates, which is the ultimate objective of the policy.

Secondly, Thornton argues that the market segmentation model (developed by Vayanos & Vila (2009)) does not accurately reflect market participants' behaviour.¹³ The author argues that the majority of treasury holders (a large portion of the LSAP program) are pension funds and arbitrageurs that take duration risk in other assets such as mortgage or corporate bonds. In that sense, programs focused only on treasuries would have little effect on long-term yields.

International Spillovers of Unconventional Monetary Policy

The financial crisis caused unprecedented policy interventions across central banks. The policies had significant international effects. Excessive global liquidity generated a surge in capital flows to EMEs countries, supposedly causing; appreciation pressures on local EME currencies, the accumulation of financial imbalances, and the distortion of local credit markets.

To determine the effect of non-conventional monetary policy on international markets, Fratzscher et al. (2013) analyzes both asset prices and investor portfolio decisions in the US and other sixty-five other countries.¹⁴ The paper is closely related to Joyce, Liu and Tonks (2014)'s, which also investigates investor's decision to identify the portfolio balance channel of unconventional market intervention.¹⁵ The authors use data on high-frequency flows into the US and international bonds and equity mutual funds. The article distinguishes between announcements and actual market interventions. Most of the literature investigating the efficacy of unconventional monetary policy relies on the statements of policy responses rather than on the actual market operations. This is because they deem the latter to contain less information. Indeed, arguing the efficient market hypothesis, most authors assure that the market's reaction to the announcement reflects the total effect of the policy.

¹² Thornton, Daniel. L. "[Evidence on the Portfolio Balance Channel of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Working Paper Series, No. 2012-015. June 6 2012.

¹³ Vayanos, Dimitri., and Jean-Luc. "[A Preferred-Habitat Model of the Term Structure of Interest Rates](#)," NBER Working Paper, No. 15487. November 2009.

¹⁴ Fratzscher, Marcel., Marco Lo Duca, Roland Straub. "[On the International Spillovers of US Quantitative Easing](#)," DIW Berlin Discussion Paper No.1304. March 2013.

¹⁵ Joyce, Michael., Zhuoshi Liu, and Ian Tonks. "[Institutional Investor Portfolio Allocation, Quantitative Easing and the Global Financial Crisis](#)," Bank of England working Paper, No. 510. September 12 2014.

The empirical study uses panel data with: 1. Country and time-invariant components; 2. Lagged variables reflecting local and global macroeconomic and financial conditions; and 3. Lagged returns of the domestic market. The authors discuss and recognise two significant empirical issues. Firstly, that monetary policy is endogenous to market conditions. The authors introduce market intervention with time lags and performing two-stage estimations to control for the endogeneity bias. Secondly, market responses to announcements and operations occur at different speeds where the asset price adjustment is immediate whereas portfolio correction is slow. To overcome this issue, the authors include the Fed's policy for two days after a news release if investigating the effects of the announcement and for a week if investigating that of operations.

The authors find a differential effect on financial markets between QE1 and QE2. QE1 policies significantly lowered long-term yields in the US and elsewhere, supported equity prices, and prompted rebalancing investor portfolio outflows from EMEs towards the US. This caused a strong dollar appreciation. QE2 appeared to be ineffective in lowering yields, increased capital flows into EMEs, and caused a sharp dollar depreciation. This empirical evidence suggests the presence of portfolio channel on the Fed's asset purchases programs. While QE1 produced a portfolio rebalancing across countries, QE2 functioned by provoking a rebalance across asset classes.

The authors also find that actual market operations had a comparatively larger effect than announcements. This contradicts the predictions of the efficient market hypothesis. They rationalize this finding in two ways: firstly, that the implementation of unconventional policies were necessary given markets were not functioning correctly. Secondly, market expectations on program's details were incorrect, and only actual program implementation gave the proper information on the dimension and timing of the program. In each case, the authors argue, the initial pricing of the markers was incorrect, and the implementation conveyed valuable information for price formation.

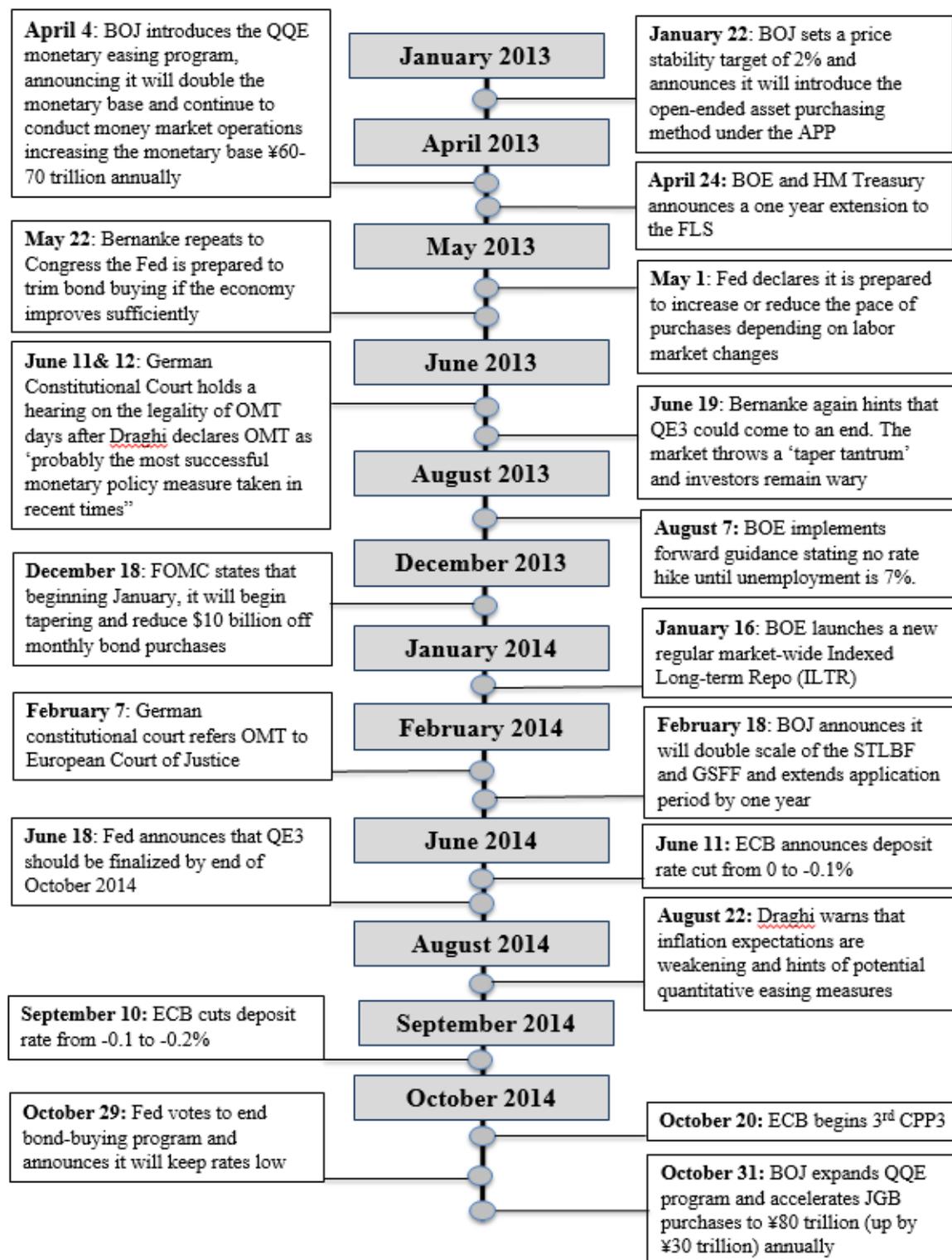
As mentioned above, the paper is interesting because it investigates portfolio decisions and makes a distinction between announcements and the actual market intervention. However, the article fails to address the issue of identification of the policy effects on long-term yields adequately. Though limited to recognize the consequences of the policy on the financial markets, event studies are designed to identify the effects on the markets caused only by the measure under research. In this case, it is possible that the effects captured by the estimates confound the effects of the policy with other events occurred. In other words, in the econometric specification used in the article, a lurking variable may bias the estimates and the conclusions.

Looking Forward

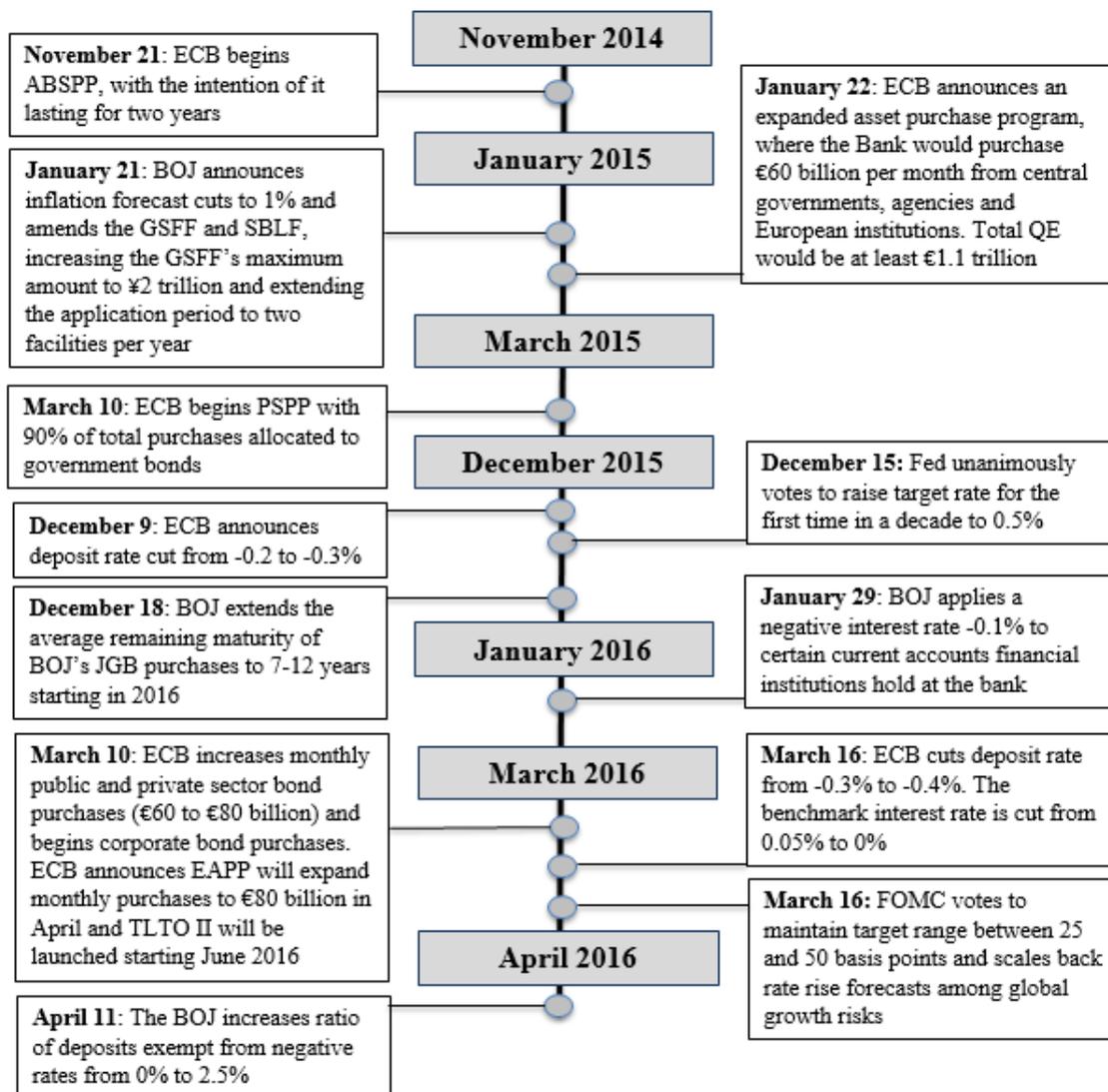
The uneven economic recovery after the financial crisis and the various economic policy responses leaves the economic profession with more questions than answers. The consensus in the literature is that unconventional monetary policy does work. The central banks' courage to act despite uncertainty about the unconventional policy's effectiveness was instrumental to avoiding an economic meltdown. Regardless, policymakers should remain cautious as to the consequences of future market interventions.

PART II: THE FOUR CENTRAL BANKS

QE TIMELINE: 2013-2016¹⁶



¹⁶ Timeline created by authors. For a QE timeline of pre-2013 events see: Fawley, Brett W., and Christopher J. Neely. "Four Stories of Quantitative Easing." Federal Reserve Bank of St. Louis. 2013.



CHAPTER 1: THE FEDERAL RESERVE

When the financial crisis peaked in September 2008, the United States faced a financial system on the verge of collapse and an economy in freefall. Over 250,000 jobs were lost each month. After exhausting traditional monetary policy tools, the Federal Reserve turned to unconventional measures. The focus of this chapter will be on the Large Scale Asset Purchase Programs (LSAPs).

By December 2008 the Federal Funds rate had reached the zero lower bound. Traditional lender-of-last-resort facilities had already been employed. These included the discount window, the Primary Dealer Credit Facility (PDCF), the Term Securities Lending Facility (TSLF) and international swap agreements with global central banks in need of US currency.

Unconventional crisis facilities were implemented to stem panic, bank runs and investor withdrawals from leading financial institutions. These included the Commercial Paper Funding Facility (CPFF), the Asset-Backed Commercial Paper Money Market Fund Liquidity Facility (AMLF), the Money Market Investor Funding Facility (MMIFF) and the Term Asset-Backed Securities Lending Facility (TALF). Studies show that the crisis facilities stabilized asset outflows from key financial institutions and provided liquidity to impaired markets.¹⁷ However, the financial system remained in a severe credit crunch.

The Federal Reserve System embarked on successive rounds of LSAPs to ease credit conditions and inject liquidity more broadly into the financial system. After the financial crisis stabilized, the goals of the LSAPs evolved to include economic growth and labor market recovery. After large and successive rounds of purchases, the Federal Reserve is now determining how to unwind its \$4.5 trillion balance sheet. Though there are multiple paths forward, challenges are associated with including the potential for capital losses.

This chapter reviews the recent history of the Fed's experimentation with LSAP programs, highlighting the challenges faced, lessons learned and the potential paths forward.

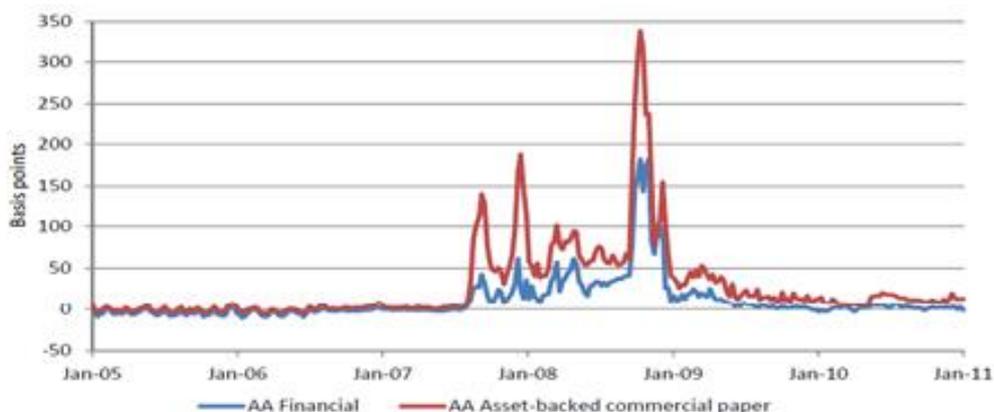
Crisis and the Limits of Convention

By the fall of 2008, the Federal Reserve had reached the limit of conventional monetary policy options. Funding costs and spreads for commercial paper (CP), a popular market used for short-term funding, were rising (see Figure II.1.1). This is because structured financial products (such as MBS) that backed CP instruments became difficult to value. Banks were increasingly reluctant to lend to each other fearing funding sources for counterparties would dry up before loan maturities. By October 2008, the Fed had eased conditions on its discount-window lending facility and PDCF. The Fed introduced the Term

¹⁷ Duygan-Bump, Burcu, et al. "[How Effective Were the Federal Reserve Emergency Liquidity Facilities? Evidence from the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility.](#)" Federal Reserve Bank of Boston. Working Paper No. QAU10-3. April 29 2010.

Auction Facility (TAF) in an effort to combat these trends and provide liquidity to the interbank funding market. At their peak, liquidity provisions reached a combined total of approximately \$600 billion.¹⁸

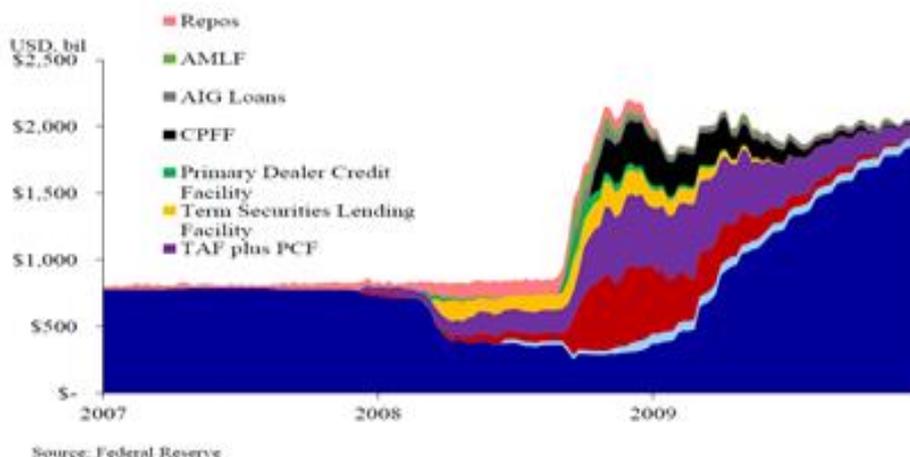
Figure II.1.1: One Month Commercial Paper – OIS Spreads



Source: Fleming, Michael J, Federal Reserve Bank of New York, [“Federal Reserve Liquidity Provision during the Financial Crisis of 2007-2009”](#), 2012.

After Lehman Brothers’ default, financial conditions tightened and the Fed’s conventional liquidity measures proved insufficient. A wide range of crisis liquidity facilities opened to both bank and nonbank financial institutions that perform bank-like functions. Facilities for primary dealers included the TSLF and the PDCF. Facilities for the nonbank financial institutions included the AMLF, CPFF and MMIFF. Liquidity provisions spiked significantly after Lehman’s collapse leading to an expansion in the Fed’s balance sheet (see Figure II.1.2).

Figure II.1.2: The Federal Reserve’s Domestic Portfolio



Source: The Burning Platform. [“Worst Case Scenario=73% down from here.”](#) March 30 2016.

¹⁸ Carlson, Mark., Burcu Duygan-Bump, and William Nelson. [“Why Do We Need Both Liquidity Regulations and a Lender of Last Resort? A Perspective from Federal Reserve Lending during the 2007-09 U.S. Financial Crisis.”](#) Finance and Economics Discussion Series 2015-011. Washington: Board of Governors of the Federal Reserve System. February 10 2015.

During the same period, the Fed’s target policy rate (Federal Funds Rate) was reduced to the zero-lower-bound. By December 2008, the policy rate hovered between 0 and 25 basis points, 400 basis points lower than just a year prior (see Figure II.1.3).

Figure II.1.3: US Federal Funds Rate



Source: [Trading Economics](http://www.tradingeconomics.com)

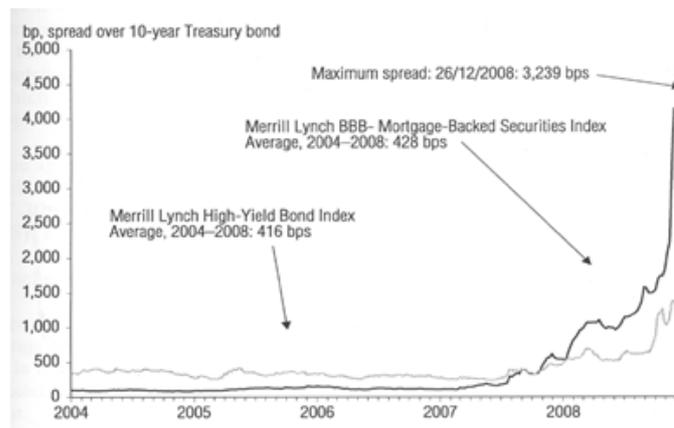
Easing the Fed Funds Rate to the ZLB partially offset the tightening of financial conditions as lower short-term interest rates helped reduce lending rates. However, widening credit spreads, restrictive lending standards and dysfunctional credit markets worked in the opposite direction of monetary easing and resulted in tighter financial conditions.¹⁹

Despite the success of monetary easing to the ZLB and the provision of crisis liquidity facilities, the measures were not enough to stabilize key credit markets. This was particularly true in the market for MBS, where the average MBS spread over the 10-year Treasury exceeded 3,000 basis points by late December 2008 (see Figure II.1.4).

The continued severity of conditions, particularly within the housing market, warranted further measures. In an effort to further support the functioning of credit markets, the Fed engaged in Large Scale Asset Purchases of longer-term securities. Since the ZLB had been reached at the short end of the yield curve, purchases would be an added means to stimulate investment decisions by pushing down the long end of the curve.

¹⁹ Bernanke, Ben. "[The Crisis and the Policy Response](#)." The Stamp Lecture. London, London School of Economics. January 13 2009.

Figure II.1.4: Widening spread between MBS and high-yield bonds



Source: Barth, Li, Phumiwasana, "[The Credit Crunch and Yield Spreads](#)", RBS Reserve Management Trends 2009.

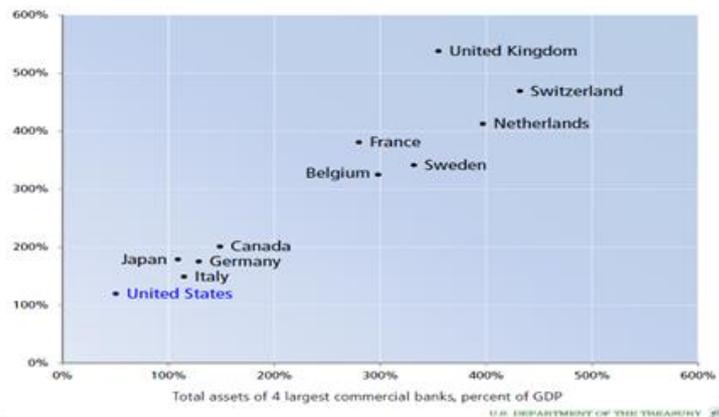
US Financial System Architecture and the Case for “Credit Easing”

With its first LSAP in December 2008, Chairman Bernanke made it clear that the program’s goal was qualitatively different from expanding the monetary base through the targeting of bank reserves, as had been attempted previously by BOJ. Rather than focusing on the Fed’s balance sheet liabilities, QE would follow a “credit easing” approach that “focuses on the mix of loans and securities that it holds and on how this composition of assets affects credit conditions for households and businesses.”²⁰

The choice to enter a credit easing program rather than a pure QE regime was due to the US financial system’s idiosyncratic structure. Unlike other advanced economies’ financial systems, the US financial system was heavily relies heavily on non-bank financial institutions and capital markets as a source of finance financing sources. In terms of assets, the US commercial banking system is both smaller and less concentrated than its leading counterparts abroad as a percentage of GDP (see Figure II.1.5).

²⁰ Bernanke, Ben. "[The Crisis and the Policy Response](#)." The Stamp Lecture. London, London School of Economics. January 13 2009.

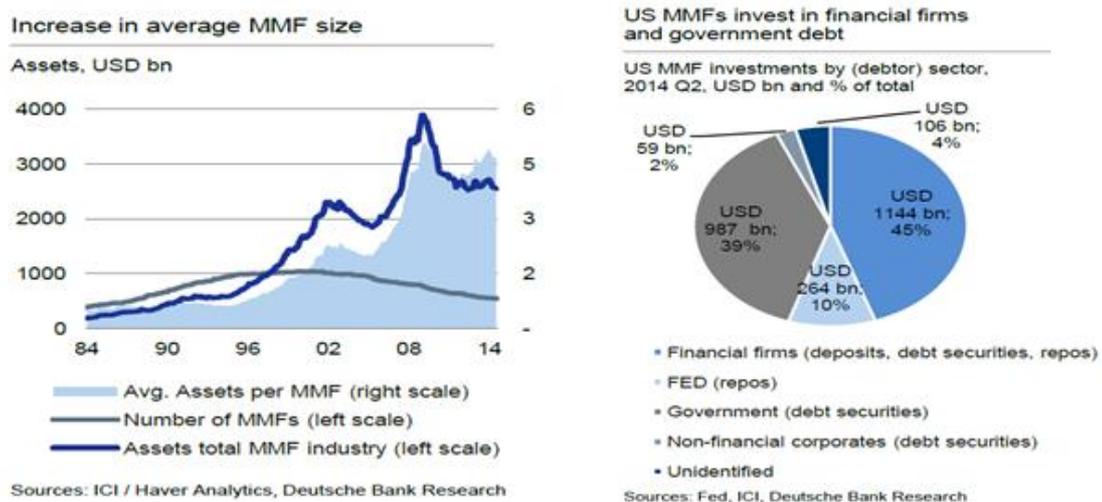
Figure II.1.5: Total assets of commercial banks, percentage of GDP



Source: The Department of the US Treasury, “[The Financial Crisis Response in Charts](#)”, 2012

The comparatively smaller role played by banks in the US financial system indicates that nonbank financial institutions play a relatively greater role in financial intermediation and credit markets. In 2014, \$25 trillion of \$38 trillion total credit market assets were held by nonbank financial institutions, representing roughly two-thirds of total credit market assets.²¹ Furthermore, between 2000-2010, nearly 70 percent of all sources of financing came from capital market sources rather than bank lending.²² Heavy reliance on capital markets across a wide range of financial institutions made the US financial system particularly dependent on functional credit markets.

Figure II.1.6: Money Market Funds



Source: Mai, [Money Market Funds, an Economic Perspective](#), Deutsche Bank, 2016

Capital markets in the US are deep, and the nonbank financial institutions that participate in them are diverse. However, money market funds (MMFs) are a useful proxy to illustrate the extent to which

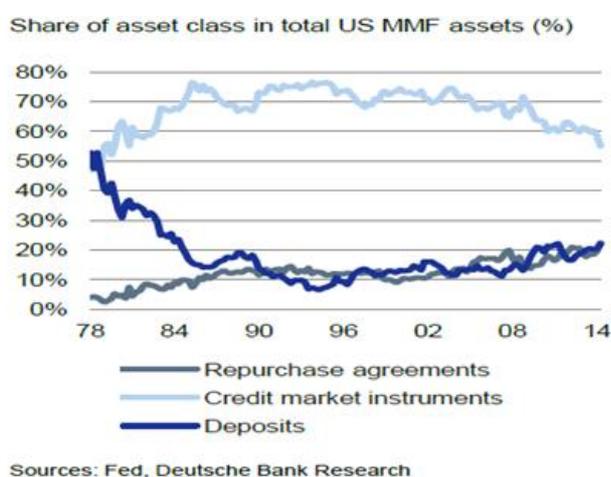
²¹ Fischer, Stanley. "[Speech: The Importance of the Nonbank Financial Sector](#)." Conference: Debt and Financial Stability--Regulatory Challenges. Frankfurt. March 27 2015.

²²“[ESGB Study, Financial Systems in Europe, US](#).” The European Savings and Retail Banking Group.

financial intermediation takes place outside the traditional US banking sector given their size and interdependence with traditional banks. MMFs are similar to banks in that they perform financial intermediation and maturity transformation. They offer short-term investments and provide short-term funding to wholesale borrowers. A nearly \$4 trillion market in 2008 (see Figure II.1.6 left), roughly half of their investments were channelled into financial firms (see Figure II.1.6 right).

Around the same time, over 70 percent of MMF investments were in credit market instruments, normally on a very short term basis (see Figure II.1.7). As soon as confidence in the assets they were funding started to dry up, investors withdrew from MMFs, lending rates to banks increased and term funding shortened until it dissipated. The investor withdrawal was so large that the MMF market contracted by roughly \$1 trillion during the crisis (see Figure II.1.6 left).

Figure II.1.7: US MMFs invest mostly in debt securities



Source: Mai, [Money Market Funds, an Economic Perspective](#), Deutsche Bank, 2016

Widening credit spreads was an issue in the capital-market-reliant US financial system for both banks and nonbanks. As subprime assets fell and spreads widened in 2007, money market funds stopped rolling over commercial paper credit. These funded the assets on bank balance sheets. As overnight funding markets shrunk, banks were left to fund entities that banks sponsored (hedge funds, bankruptcy-remote Special Purpose Vehicles (SPV)).

Credit Easing programs targeting key markets facing severe credit crunch yielded broader impact than purchases of government treasuries alone. As Bernanke explained, “one dollar of longer-term securities purchases is unlikely to have the same impact on financial markets and the economy as a dollar of lending to banks, which has in turn a different effect than a dollar of lending to support the commercial paper market.”²³

Given the importance the housing market and MBS in the US monetary transmission mechanism, purchases geared towards repairing the housing wealth channel would have a greater impact than blind

²³ Bernanke, Ben. "[The Crisis and the Policy Response](#)." The Stamp Lecture. London, London School of Economics. January 13 2009.

purchases of less significant longer-term securities. Falling house prices negatively affected both banks and the household sector through separate channels. As bank balance sheets suffered and the view of MBS turned to that of suspicion, short term funding from the nonbank financial sector dried up and liquidity crunch led to financial crisis. On the household side, falling prices meant declining equity, higher defaults and more foreclosures. “Credit easing,” rather than an expansion of bank reserves through pure QE, was specifically designed to reverse these trends by putting upward pressure on MBS prices and lowering long-term rates in the key housing market.

Crisis, QE and Recovery

A wide range of macroeconomic and financial system challenges confronted the Federal Reserve and the US economy between 2008 and 2012. This period was characterized by financial and economic freefall at worst, to sluggish growth and fears of a “double-dip” recession at best. As the challenges evolved, the size, composition and goals of the individual LSAP programs did too.

Although the crisis liquidity facilities may have prevented a deeper financial crisis, unconventional measures were necessary to stabilize the financial system and reinvigorate the economy. In the fall of 2008, yield spreads widened significantly for all major US financial firms, and spreads between MBS and the 10-year Treasury reached historical highs.²⁴ The liquidity backstops provided by the crisis facilities helped stabilize withdrawals and outflows from financial institutions, but widening spreads, high risk premia and severe liquidity crunches continued to plague the financial system.²⁵

Quantitative Easing 1 (QE1)

On November 25, 2008, the Federal Reserve expanded unconventional monetary policy and announced plans to purchase \$100 billion in GSE debt and \$500 billion in agency-backed MBS. The program was an effort to “reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally.”²⁶ Continued declines in equity and housing wealth coupled with worsening credit conditions prompted an expansion of the program in March 2009. Purchases were expanded to include an additional \$750 billion of agency MBS, \$100 billion of GSE debt and \$300 billion in long-term treasury securities in.²⁷

The combined total of QE1 purchases conducted between December 2008 and March 2010 totalled \$1.725 trillion worth of securities. By the time QE1 drew to a close, the Fed’s balance sheet had doubled, “22 percent of \$7.7 trillion stock of longer-term agency debt, fixed-rate agency MBS, and Treasury

²⁴ Barth, James R., Tong Li, and Triphon Phumiwasana. "[The Credit Crunch and Yield Spreads.](#)" RBS Reserve Management Trends 2009.

²⁵ Duygan-Bump, Burcu, et al. "[How Effective Were the Federal Reserve Emergency Liquidity Facilities? Evidence from the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility.](#)" Federal Reserve Bank of Boston. Working Paper No. QAU10-3. April 29 2010.

²⁶ Federal Reserve Bank, "[11 /25/2008 FOMC Release.](#)" November 25 2008

²⁷ Federal Reserve System, "[3 /18/2009 FOMC Press Release.](#)" March 18 2009.

securities outstanding at the beginning of the LSAPs” had been removed from the private sector, and nearly 80% of the purchases had been directly linked to housing market credit.²⁸

Quantitative Easing 2 (QE2)

On August 10, 2010, the Fed announced that it would maintain the size of its balance sheet by reinvesting principal payments from GSE debt and MBS into longer-term Treasuries. In addition to the extra monetary accommodation, the FOMC stated it was “prepared to provide additional accommodation if needed to support the economic recovery,” signaling the strong possibility of a second round of QE. In a move that was largely anticipated by the market, the FOMC announced on November 3, 2010 that it would purchase an additional \$600 billion in long-term Treasuries in order to “promote a stronger rate of recovery and to help ensure that inflation, over time, is at levels consistent within its mandate.”²⁹

QE2 differed from QE1 as it was expected by market participants at the time of announcement. In a CNBC “Fed Survey” of economists, fixed-income and equity fund managers conducted on November 1, 2010 showed that 99 percent of the 83 survey respondents expected a QE announcement at the end of the November FOMC meeting, only differing on the size of the purchase program.³⁰ Thus, by the time QE2 was officially announced, the market had largely adjusted its prices, diminishing the impact of QE2 on asset prices and long-term interest rates.

“Operation Twist”

By 2011, global financial conditions deteriorated and real economic activity was weaker than anticipated. On September 21, 2011, the Fed announced the Maturity Extension Program and Reinvestment Policy (MEP). It would purchase \$400 billion in long-term Treasuries and “sterilize” them by selling an equivalent amount of short-term Treasuries. “Operation Twist,” as it is commonly referred to, would remove duration risk from the private sector and “twist” the longer end of the yield curve while leaving the size of the monetary base unchanged. It was explicitly designed “to put downward pressure on longer-term interest rates” in an attempt to stimulate real economic activity. At the same time, the FOMC announced that they would modify their reinvestment policy and reinvest maturing MBS and GSE debt back into MBS rather than Treasuries in an effort to further “support conditions in mortgage markets.”³¹

MEP Extensions and Intro to Quantitative Easing Round 3

Labor market recovery, already on a weak trajectory, began to slow in the first half of 2012, prompting the FOMC to extend “Operation Twist” to the end of year at its June 2012 meeting. Originally intended to terminate in June, the additional purchases and sales roughly totalled \$267 billion by the end of December 2012. At that time, the program was limited by a lack of short-term Treasuries to sell in the open market. At the time of close, there were no holdings of T-bills or very short term notes on the Fed balance sheet.³²

²⁸ Gagnon, Joseph., Matthew Raskin, Julie Remache, and Brian Sack. “[Large-Scale Asset Purchases by the Federal Reserve: Did They Work?](#)” Federal Reserve Bank of New York Economic Policy Review. 17(1). May 2011.

²⁹ Federal Reserve Bank, “[11/3/2010 FOMC Press Release](#).” November 13 2010.

³⁰ Liesman, Steve. “[How Much Will the Fed Decide to Ease on Wednesday?](#)” CNBC. November 1 2010..

³¹ See the 9/21/2011 FOMC Release (Table 1A)

³² Rosengren, Eric S. “[Lessons from the US Experience with Quantitative Easing](#).” The Peterson Institute for International Economics and Moody's Investors Service's 8th Joint Event on Sovereign Risk and Macroeconomics, February 5 2015.

Despite the extension of “Operation Twist,” labor market conditions and economic recovery continued to be sluggish, prompting further Fed action. On September 13, 2012, the FOMC announced the third, widely anticipated round of QE, or QE3. Unlike the previous LSAPs, QE3 committed to \$40 billion MBS purchases per month rather than a predetermined program amount. Furthermore, the FOMC designated that “it will continue its purchases of agency MBS, undertake additional asset purchases, and employ its other policy tools as appropriate until such improvement [in the labor market] is achieved,” signaling its new commitment to an open-ended and “state-contingent” program rather than a “time-contingent” one.

On December 12, 2012, the FOMC announced that it would continue the purchase of longer-term Treasuries under the MEP at a pace of \$45 billion per month, but without sterilizing them with the sale of short-term Treasuries. This effectively expanded QE3 purchases to \$85 billion per month.

2013 - Present

The “Taper Tantrum”

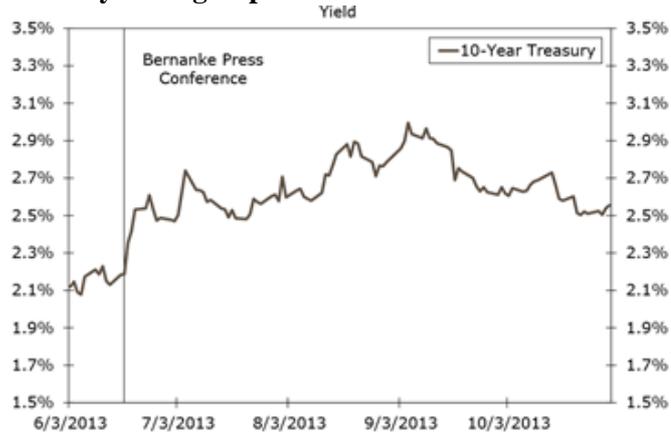
Positive economic news received in the spring of 2013 and Fed Chairman Bernanke’s May 2013 testimony to Congress led to speculation that the Fed would likely slow the pace of its purchases by year end. Unemployment had decreased by half a percentage point since summer 2012 and monthly job gains had increased compared to a year prior. The testimony sparked a selloff in bonds as investors anticipated an exit from highly accommodative monetary policy. This pushed yields on 10-year and 30-year Treasuries up 11 and 9 basis points respectively.³³

Bernanke’s testimony was a precursor to the June 19th press conference in which the Chairman stated that, “the Committee currently anticipates that it would appropriate to moderate the pace of monthly purchases later this year” conditional on the continued inflow of good economic news and labor market progress.³⁴ The surprising announcement was news to financial markets and triggered a major selloff in fixed income assets, as shown by the spike in 10-year Treasuries (see Figure II.1.8).

³³ Eddings, Cordell, and Susanne Walker. ["U.S. 10-Year Yield Tops 2% as Bernanke Says Fed May Taper Buys."](#) Bloomberg. May 22 2013.

³⁴ Bernanke, Ben. ["Transcript of Chairman Bernanke's Press Conference."](#) June 19 2013.

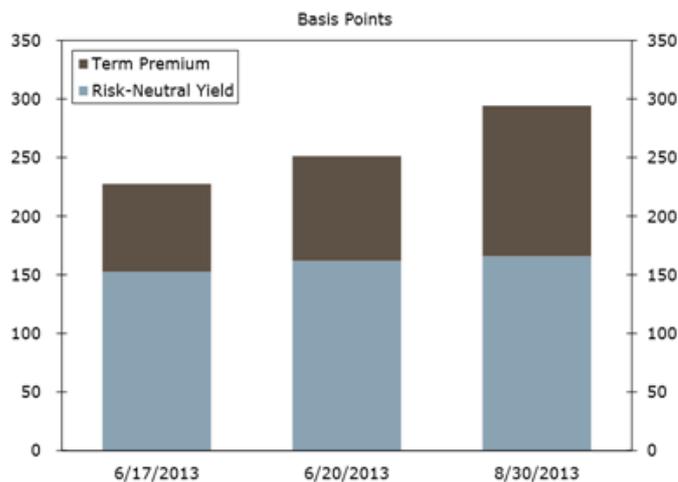
Figure II.1.8: 10-Year Treasury during Taper Tantrum



Source: Silvia, John E., and Alex V. Moehring. “[Case Study of the Taper Tantrum and Term Premiums](#).” Wells Fargo Securities. August 4 2015.

A decomposition of the yield-curve reveals that a majority of the hike in yield came as a result of an increase in term premium (see Figure II.1.9). This indicated that investors required extra compensation on the belief that short-term rates were not going to change as previously expected.

Figure II.1.9: 10-Year Treasury Taper Tantrum Decomposition



Source: Silvia, John E., and Alex V. Moehring. “[Case Study of the Taper Tantrum and Term Premiums](#).” Wells Fargo Securities. August 4 2015.

The rise in yields as a result of increased term premia is counter to the goal of the Fed’s QE program to lower long-term rates via a reduction in term premia. This has important implications for future conduct of monetary policy operations. Since short and long-term bonds are not perfect substitutes and investors demand a term premium to hold longer term bonds, the term premium functions as the price of duration risk and is determined by forces of supply and demand. Thus, it is likely that the earlier-than-anticipated reduction in expected demand for long-term bonds via QE3 purchases caused the term premium to increase.³⁵

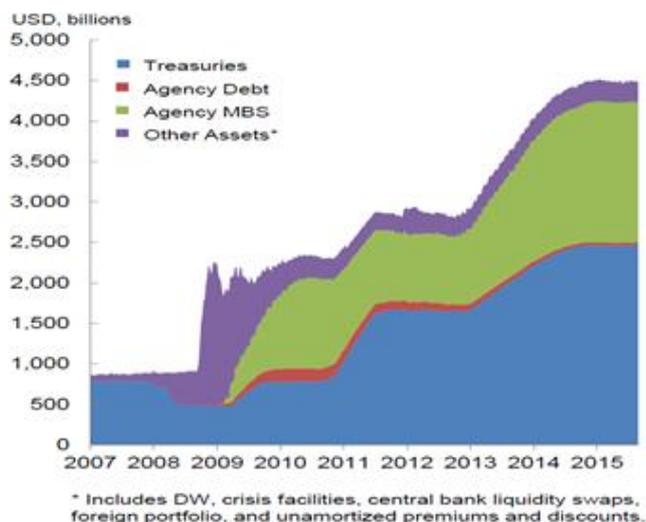
³⁵ [Ibid.](#)

The “taper tantrum” episode highlights two important lessons for future LSAP program efforts. The first is that the strong market reaction to the earlier-than-expected tapering is similar to the strong market reaction (in the opposite direction) to the unexpected QE programs. This suggests that the QE programs did in fact have the desired impact on asset prices and real economy. The second lesson for policymaking highlights the importance of the composition of LSAP programs and communication of their schedule to the public. This ensured that monetary policy goals (lower term premia) did not conflict with market outcomes (higher term premia).

The Taper:

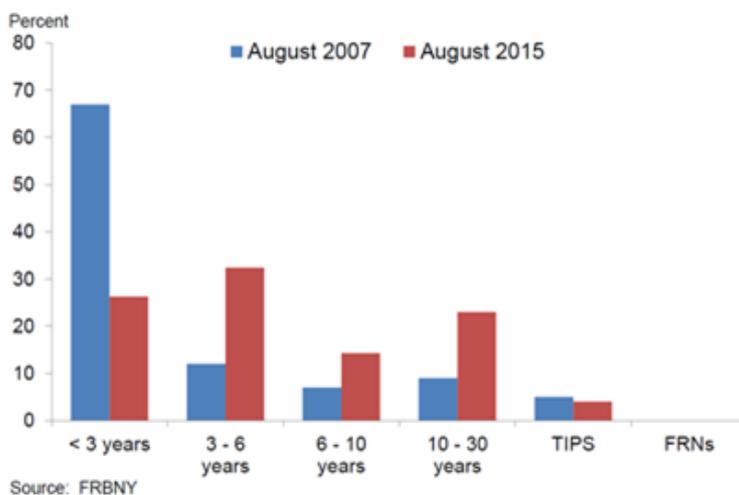
On December 18, 2013, the FOMC officially announced that it would “modestly reduce the pace of its asset purchases” given improved economic and labor market conditions. In January 2014, it began making monthly purchases of \$35 billion in Agency-MBS (down from \$40 billion) and \$40 billion in long-term Treasuries (down from \$45 billion). Unlike the summer “taper tantrum”, financial markets and interest rates did not react as strongly to the announcement of the taper program. This is because market participants had expected it before the end of 2013 and reflected it in asset prices. The Fed used forward guidance to make the point that “asset purchases are not on a preset course,” and as such, they remain “contingent on the Committee’s outlook for the labor market and inflation,” maintaining the state-contingent approach to policy. Nonetheless, after every FOMC meeting in 2014 purchases were reduced by \$5 billion for each type of security until the final round of purchases on October 19, 2014. Figure II.1.10 below shows the expansion of the balance sheet over the length of the QE programs by type of asset.

Figure II.1.10: Assets



Source: Chen, “[The Evolving Balance Sheet of the Federal Reserve: From LSAPs to Normalization.](#)” FRBNYC, 2015

Figure II.1.11: SOMA Treasury Holdings by Maturity/Sector



Source: Chen, "[The Evolving Balance Sheet of the Federal Reserve: From LSAPs to Normalization.](#)" FRBNYC, 2015

The First Rate Hike:

On December 15, 2015, the FOMC unanimously voted to raise the target by 25 basis points, leaving the corridor between 0.25 percent and 0.5 percent. The rationale behind the rate hike included "considerable labor market conditions" in 2015. It explicitly widened the number of macroeconomic variables that the FOMC will consider when "determining the time and size of future adjustments" to the target rate. In addition to the traditional focus on labor market conditions and inflation measures, "readings on financial and international developments" were also incorporated. In an effort to continue to hold down short-term interest rates, it signalled that there would likely be only "gradual increases" in the policy rate.³⁶

The Path Forward and Global Downside Risks:

On January 27, 2016, the FOMC decided to leave the Fed Funds Rate unchanged for the second time since the initial December 2015 hike. Chairwoman Janet Yellen alluded to the rationale behind the recent decision to maintain rates during her semi-annual testimony to Congress when stating that "financial conditions in the United States have recently become less supportive of growth," citing declining equity prices, higher borrowing rates for risky borrows and an appreciating dollar.³⁷

Concerns about the impact of weak global growth intensified after market volatility rose and oil prices fell in January and February of 2016. The FOMC maintained rates for a second time on March 25, 2016. This reiterated that policy is "not on a present course."³⁸ Adding to concerns about growth prospects and the economy in 2016, the FOMC slashed its rate hike forecasts from four to two, with market speculation that there not be any hikes at all.³⁹

³⁶ See the 12 /15/2015 FOMC Release (Table 1A)

³⁷ Yellen Semi-Annual Testimony to Congress Feb 2016

³⁸ See the 3/25/2016 FOMC Release (Table 1A)

³⁹ Gillespie, Patrick. "[Fed Slashes Rate Hike Forecast on Darker Economic View.](#)" CNNMoney. March 16 2016.

Impact and Effectiveness: Did the LSAPs Work

Measuring the Impact

A wide and growing body of literature has attempted to quantify the impact of the successive rounds of Fed LSAP programs on long-term interest rates in order to inform future policymaking efforts. However, given that long-term interest rates can be affected by a variety of factors, a degree of imprecision is always present in identifying the impact of the LSAP program.

The majority of literature uses the event study approach to measure the impact of the LSAP purchases on long-term yields, but they come with caveats. The most common approach is to calculate the changes in long-term yields around very narrow time windows (normally one day) in order to isolate the announcement effects of the LSAP programs. However, these studies rely on the assumption that no other major announcement takes place on that day that would influence bond yields in any direction significantly. They also rely on the assumption that efficient market theory holds. That is, when new information becomes available to the market, via FOMC announcements or official speeches, prices adjust accurately and accordingly.

A general theme emerges across the wide body of event-study literature that points to a statistically significant reduction in long-term bond yields, albeit with diminishing returns for successive rounds of QE. In their widely referenced study, Gagnon et al. (2010) study the interest rate changes across a set of securities of various maturities in a two-day window following the announcement of QE1. They find that 10-year Treasuries and 30-year Agency MBS experienced a cumulative reduction of 91 and 113 basis points, respectively, across all ten announcements of planned policy action.⁴⁰ Meaning and Zhu (2011) find that the reduction for 10-year Treasuries is on the order of 80 basis points.

Krishnamurthy and Vissing-Jorgensen (2012) employ similar techniques using intraday rates in addition to daily rates and extend their analysis to QE2, yielding similar results and a much smaller basis point reduction of roughly in 10-year Treasuries.⁴¹ Nellis (2013) contributes further to the work by incorporating QE3 events prior to the suggestion of “tapering.” He finds that “QE2 and QE3 were not effective in reducing the 10-year Treasury yield, and only QE3 effectively reduced the 30-year MBS yield.”⁴² However, more rigorous research on the impact and effectiveness of QE3 has yet to be conducted.

Figure II.1.12 illustrates changes in the 10-year Treasury yields around the time of announcements of the three major QE programs. On the day of the November announcement for QE1, the 10-year Treasury fell 24 basis points and an additional 12 basis points the following day. On the day of the March announcement of additional purchases, the 10-year Treasury rate fell 51 basis points. As mentioned previously, QE2 was widely expected and thus priced into the market by the time of official announcement. As such, after falling 14 basis points on the day of announcement, it trended upwards,

⁴⁰ Gagnon, Joseph., Matthew Raskin, Julie Remache, and Brian Sack. “[Large-Scale Asset Purchases by the Federal Reserve: Did They Work?](#)” Federal Reserve Bank of New York Economic Policy Review. 17(1). May 2011.

⁴¹ Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. “[The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy.](#)” Working paper no. 17555. The National Bureau of Economic Research. October 2011.

⁴² Nellis, Daniel. “[Measuring the Change in Effectiveness in Quantitative Easing.](#)” Issues in Political Economy. Vol. 22. 2013.

likely due to increases in expected inflation. QE3 was implemented in an environment of historically low interest rates. Following Bernanke’s Jackson Hole Speech, where he hinted at a third round of QE, rates fell, but then spiked after the official announcement, only to settle on a downward path once again (see Figure II.1.12). From the financial crisis through the announcement of QE3, long-term rates fell over 200 basis points.

Figure II.1.12: Rate response to Jackson Hole Speech



Source: Rosengren, Eric S, “[Lessons from the US experience with QE.](#)” The Peterson Institute for International Economics and Moody's Investors Service's 8th Joint Event on Sovereign Risk and Macroeconomics, February 5 2015

Channels of QE

As discussed previously, literature suggests that one of the main channels by which long-term rates have been reduced in the US is through portfolio rebalancing. As the theory goes, a large scale purchase of a particular asset changes the relative supply and relative price of the asset. This occurs because of investor preferences for a particular security or duration. For example, pension funds normally invest in long-term assets in order to better align with their long-term obligations. As such, if long-term Treasuries or MBS are drained from the market, the reduction of the stock of those assets creates a scarcity that pushes up prices on those particular assets.

A similar effect takes place in terms of duration. As a program like QE1 takes the duration risk associated with 30-year MBS out of the market, the relative supply of duration risk (and associated risk premium) is removed. This should result in a reduction of yields.

D’Amico et al. (2012) identify and decompose the portfolio rebalancing effects on Treasuries after the announcement in August 2010 that the Fed would begin to reinvest maturing agency debt into longer-term Treasuries. At first, both 10 and 14 year Treasuries experienced price increases. However, after a second announcement specifying that the reinvested Treasuries would be concentrated in 2-10 year maturities, there was a price reversal of about 20% for 10-year Treasuries while there was a reversal of close to two-thirds for 14-year Treasuries. They conclude that the larger reversal in the 14-year Treasuries was a mostly a result of the scarcity channel as investors anticipated a reduction in supply around that

maturity. On the other hand, they conclude that the price increase that remained was the result of a removal of duration-risk from the market.⁴³

The other main channel by which long-term rates are reduced is through the Fed “signalling” its commitment to maintain short-term interest rates low for an extended period of time. Thus, statements issued by the FOMC after meetings that included the language about economic conditions being “likely to warrant exceptionally low levels of the federal funds rate for an extended period” likely changed expectations for short-term rates significantly into the future. It does so conveying to market participants the depth of the crisis as well as the Fed’s understanding that very easy monetary policy would be necessary for the foreseeable future.⁴⁴

Though not conclusive, some research suggests that the Fed LSAPs exhibit diminishing returns and that the phenomenon can be attributed to less dysfunctional market conditions and flatter yield curves at the time of implementation. Thus, Miles and Schanz (2014) argue that the LSAPs are particularly effective when undertaken in times of severe financial stress because of the “limits to arbitrage” that investors can undertake in stressed conditions, amplifying the effect of the purchases.⁴⁵ In other words, portfolio balancing effects become less significant when markets function more properly. Additionally, Martin and Milas (2012) argue that QE1 was introduced when 10-year Treasury yields exceeded three percent whereas QE2 and QE3 were both introduced when the same rate was less than three percent (as shown in the figure above). Though it may be easy to push the yield curve down when rates are relatively high, it may not be as easy when rates are already relatively low.⁴⁶

The Real Economy

Though the reduction of long-term interest rates was the immediate goal of the program, the deeper goal of the program is to ease financial conditions and impact the real economy. Research that utilizes the existing event study framework generally demonstrate that LSAPs have been effective in easing financial conditions, but provide imprecise estimates on QE programs effects on the US economy. On average, the event studies demonstrate that a 20-25 basis point reduction in long-term rates is associated with a roughly \$500 billion purchase program.⁴⁷ Expressed somewhat differently, Jari Stehn (2016) has recently estimated that an LSAP program worth 1% percent of GDP can reduce 10-year Treasury yields by 5bp.⁴⁸ However, given the number of assumptions necessary to model the impact of an LSAP program on the macroeconomy, the numbers have a degree of imprecision.

⁴³ D'Amico, Stefania., and Thomas B. King. “[Flow and Stock Effects of Large-Scale Treasury Purchases.](#)” Finance and Economics Discussion Series (No 2010-52). Washington: Board of Governors of the Federal Reserve System. 2010

⁴⁴ Bauer, Michael D., and Glenn D. Rudebusch. “[The Signalling Channel for Federal Reserve Bond Purchases.](#)” Working paper no. 2011-21. Federal Reserve Bank of San Francisco, Apr. 2013

⁴⁵ Miles, David K., and Jochen Schanz. “[The Relevance or Otherwise of the Central Bank's Balance Sheet.](#)” Center for Economic Studies & Ifo Institute. Working paper no. 4615. January 2014.

⁴⁶ Milas, Costas, and Christopher Martin. “[Quantitative Easing: A Sceptical Survey.](#)” The Rimini Centre for Economic Analysis. Working paper no. 12-73.

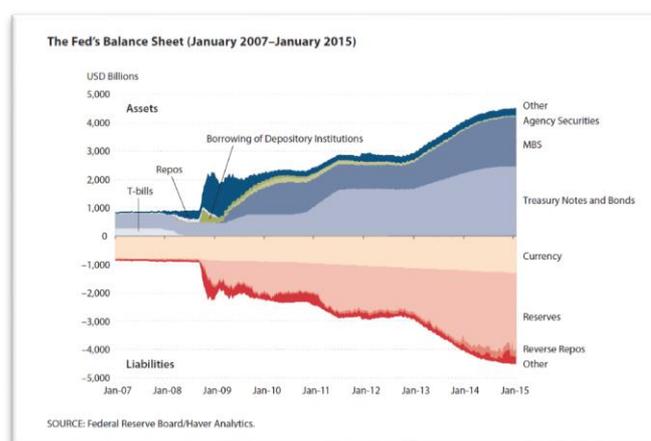
⁴⁷ Rosengren, Eric S. “[Lessons from the US Experience with Quantitative Easing.](#)” The Peterson Institute for International Economics and Moody's Investors Service's 8th Joint Event on Sovereign Risk and Macroeconomics, February 5 2015.

⁴⁸ Hatzius, Jan, Jari Stehn, and Karen Reichgott. “[Printing Presses Before Helicopters.](#)” Goldman Sachs, Economics Research. 25 March 2016.

Balance Sheet Evolution and Unwinding Scenarios

Over the course of LSAP and crisis facility implantation, the Fed’s balance sheet more than quadrupled from \$900 billion to \$4.5 trillion. The balance sheet grew from 6.1 percent of GDP to 25.3 percent. The majority of expansion of the balance sheet took place *after* the Great Recession had officially ended in June 2009. In addition to a general expansion of the balance sheet, there was also a lengthening of the average maturity of the portfolio. In December 2007, the balance sheet consisted almost entirely of Treasuries, 32.1 percent of which were short-term T-bills. By December 2014, the Fed had sold all of its short term securities. 41 percent of the securities in its portfolio are long-term MBS while 58.1 percent are long-term Treasuries (see Figure II.1.13).

Figure II.1.13: The Fed’s Balance Sheet (January 2007- January 2015)



Source: Williamson, Stephen. [Monetary Policy Normalization in the United States](#).” Federal Reserve Bank of St. Louis Review. Second Quarter 2015.

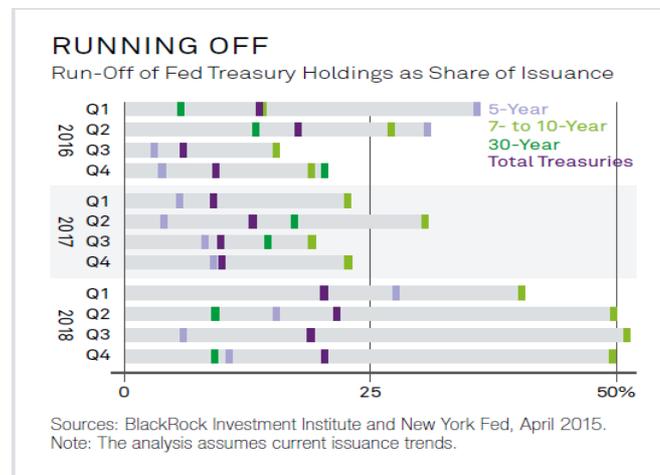
On September 17, 2014, the FOMC released its updated “Policy Normalization Principles and Plans” in an effort to address the operational and economic challenges involved with a large and non-traditional expansion of the Fed’s balance sheet. Firstly, the FOMC is committed to reducing the size of the balance sheet in a “gradual and predictable manner” by ceasing its reinvestment of principal payments of maturing securities. Secondly, the Fed does not plan to unwind the balance sheet through the active sale of agency MBS. Although “limited sales might be warranted in the longer run” and would be communicated to the public in advance. Lastly, the FOMC indicated its plan to return to its traditional holding of primarily treasury securities.⁴⁹

A passive management of the balance sheet, one that ceases to reinvestment principal payments on maturing securities, is a possible route for unwinding, but comes with caveats. First, a passive approach to unwinding the Fed’s balance sheet will wind up being jagged, due to the heavy concentration of both treasury and MBS at particular maturities. For example, an April 2015 BlackRock report on the Fed’s entire Treasury portfolio indicates that the maturing 5-year Treasuries are equivalent to 35 percent of gross issuance in the first half of 2016, while maturing seven to 10-year Treasuries equal half of the gross issuance in 2018 (see Figure II.1.14). Overall, roughly one-third of the Fed’s US Treasury portfolio (\$785

⁴⁹ Federal Reserve Bank, “Press Release”, FRB: Federal Reserve Issues FOMC Statement on [Policy Normalization Principles and Plans](#), September 2014.

billion) comes due by the end of 2018.⁵⁰ Given the large and clustered nature of the maturing securities, passive management of the balance sheet could be the economic equivalent to abrupt tightenings of monetary policy as reserves are drained in large and uneven quantities.

Figure II.1.14: Running Off



Source: Watt, Koesterich, Reider, Boivin, “[When the Fed Yields: Dynamics and Impact of US Rate Rise.](#)” BlackRock Investment Institute, 2015.

An active management of the unwinding of the Fed balance sheet can be implemented in a variety of ways, but similar to passive management, comes with its own unique challenges. One proposal has suggested that the Fed “taper” its balance sheet in a similar manner to QE3 in order to signal it’s a smooth process to the markets. Thus, it could commit to reinvestment 80 percent of principal and coupon payments at the next meeting and 60 percent after that. A second proposal is a Fed commitment to small, weekly sales (on the order of \$4-5 billion) of shorter-term treasuries to help smooth out the unwinding process and slowly drain excess liquidity from the financial system.⁵¹ Despite the relatively straightforward nature of the proposals, a mismanagement of the programs or an inability to communicate them effectively to the public may result in “an outsized market reaction.” A concern that has risen in FOMC discussion.⁵²

A tool that may alleviate uncertainty regarding the unwinding of the balance sheet includes the addition of Balance-Sheet Forecasts to the FOMC’s Survey of Economic Projections (SEP).⁵³ Since 2007, the Federal Reserve has published quarterly economic projections for growth, inflation, unemployment and the Federal Funds rate over a three year horizon in order to provide firms and households with more forward-looking information so that they may engage in better economic decisionmaking.⁵⁴ Since the Fed’s balance sheet holdings influence prices and yields for Treasuries and MBS, different projections

⁵⁰ Watt, Ewen C., Russ Koesterich, Rick Reider, and Jean Boivin. “[When the Fed Yields: Dynamics and Impact of US Rate Rise.](#)” BlackRock Investment Institute. May 2015.

⁵¹ [Ibid](#)

⁵² See the 3/18/2015 FOMC Release (Table 1A)

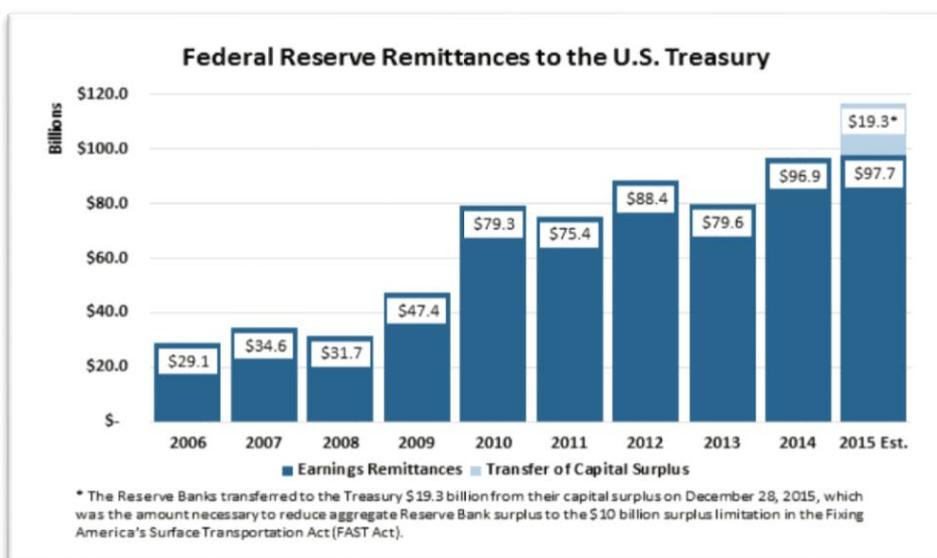
⁵³ Matheny, Ken. Adding Balance-Sheet Forecasts to the FOMC’s Survey of Economic Projections. Rep. N.p.: Macroeconomic Advisers, 2016.

⁵⁴ Rudebusch, Glenn D. “[Publishing FOMC Economic Forecasts.](#)” Federal Reserve Bank of San Francisco Economic Letter. 18 Jan. 2008.

for the balance sheet can have material impact on growth, inflation, unemployment and the appropriate target rate. For example, a reinvestment policy that continues indefinitely would likely bring about higher growth and inflation projections as well as higher target rates in a shorter time frame. Given the relationship between the balance sheet and the policy rate, the addition of a balance sheet projection regarding the overall size, composition and risks over a medium-horizon may yield more certainty and transparency to economic decisionmakers.⁵⁵

Given FOMC hesitation to change reinvestment policy and embark on an active or passive unwinding of the Fed balance sheet, the more immediate question is whether or not rate normalization will bring about capital losses for the Federal Reserve. The Federal Reserve earns interest on the assets it holds in its portfolio and pays interest on its liabilities. This includes reserves, sending the remainder as remittances to the Treasury. As seen in Figure 1.15 below, Fed remittances have not been trivial, particularly since the expansion of the SOMA portfolio as a result of QE beginning in 2009.⁵⁶ According to projections used by Williamson (2014), in the worst-case scenario, remittances to the Treasury would likely return to pre-crisis levels.⁵⁷ Furthermore, given the size of previous remittances to the Treasury in recent years, the Fed could record a deferred asset on its balance sheet. This would be effectively treated as a negative liability to the Treasury until the balance returns to normal.

Figure II.1.15: Federal Reserve Remittances to the US Treasury



Source: Federal Reserve Bank, “Federal Reserve Board Announces Reserve Bank Income and Expense Data and Transfers to the Treasury for 2015.” January 11 2016.

⁵⁵ Matheny, Ken. Adding Balance-Sheet Forecasts to the FOMC's Survey of Economic Projections. Rep. N.p.: Macroeconomic Advisers, 2016.

⁵⁶ Federal Reserve System. Federal Reserve Board Announces Reserve Bank Income and Expense Data and Transfers to the Treasury for 2015. 11 Jan. 2016.

⁵⁷ Williamson, Stephen. Monetary Policy Normalization in the United States.” Federal Reserve Bank of St. Louis Review. Second Quarter 2015.

Lessons learned

The Federal Reserve's recent experimentation with QE reveals the challenges involved with unconventional monetary policy and the lessons learned. First, the asset side of the Fed's balance sheet matters with regards to quantitative easing. Purchases that are geared towards key credit markets in disarray significantly ease the financial conditions within those markets. Second, successive rounds exhibit some level of diminishing returns, meaning that future programs may have to be given a cost-benefit analysis. Third, there are many paths forward to unwind the balance sheet, but each come with their own challenges and caveats. Providing a balance sheet forecast in the SEP may alleviate some of the complexity.

Figure II.1.16: Summary of Federal Reserve QE Programs

Program	Announcement Date	Targeted End Date	Targeted Total Purchase	Composition of Purchases	Program Details as Announced
Quantitative Easing 1 (QE1)	25-Nov-08	Over Several Quarters	Agency Debt: Up to \$100 bil Agency MBS: Up to \$500 bil	Agency Debt and Agency MBS	Purchase up to \$100 bil of agency debt and up to \$500 bil of agency MBS. Purchases are expected to take place over several quarters.
	18-Mar-09	Treasury Securities: September 30, 2009 Agency Debt and MBS: December 31, 2009	Agency Debt: Additional \$100 bil Agency MBS: Additional \$750 bil Longer-Term Treasuries: \$300 bil	Agency Debt, Agency MBS, and Longer-Term Treasury Securities	Total purchases of agency MBS will now be up to \$1.25 trillion, and agency debt up to \$200 bil. Purchase up to \$300 bil of longer-term Treasury securities over next 6 months.
Quantitative Easing 2 (QE2)	3-Nov-10	30-Jun-11	\$600 bil	Longer-Term Treasury Securities	Purchase \$600 bil of longer-term Treasury securities by the end of the second quarter of 2011, a pace of about \$75 bil per month.
	21-Sep-11	30-Jun-12	\$400 bil	Longer-Term Treasury Securities	Purchase, by the end of June 2012, \$400 bil of Treasury securities with remaining maturities of 6-30 years and sell an equal amount of Treasury securities with remaining maturities of 3 years or less.
Maturity Extension Program (Operation Twist)	20-Jun-12	31-Dec-12	Account Limited by Remaining Shorter-Term Treasury Securities	Longer-Term Treasury Securities	Purchase Treasury securities with remaining maturities of 6-30 years at the current pace and sell or redeem an equal amount of Treasury securities with remaining maturities of 3 years or less.
	13-Sep-12	None Given	None Given	Agency Debt and Longer-Term Treasury Securities	Purchase agency MBS at pace of \$40 bil per month and continue Twist through yearend, increasing holdings of longer-term securities in aggregate by \$85 bil.
Quantitative Easing 3 (QE3)	12-Dec-12	None Given	None Given	Agency Debt and Longer-Term Treasury Securities	Purchase agency MBS at a pace of \$40 bil per month and longer-term Treasury securities initially at a pace of \$45 bil per month after Twist ends at yearend.

Source: Rosengren, Eric S. "[Lessons from the US Experience with Quantitative Easing.](#)" The Peterson Institute for International Economics and Moody's Investors Service's 8th Joint Event on Sovereign Risk and Macroeconomics. February 5 2015.

CHAPTER 2: THE BANK OF ENGLAND

This chapter focuses on post 2011 time frame and measures taken by Bank of England and HMT.

As the financial crisis unfolded in summer of 2007, central banks focused on providing liquidity through various liquidity support operations. The intention of these policies was to unblock interbank markets and ease funding conditions. Various central banks around the globe, including Bank of England (BOE), expanded their normal lending operations to banks by lending at longer horizons and by broadening the eligible collateral accepted. As the crisis intensified, central banks got involved more directly to relieve the pressure on the illiquid markets. As policy rates were almost zero, BOE looked for additional measures to further ease of monetary conditions. It included, start of its own program of asset purchases financed by central bank money in early 2009 comprising almost exclusively of government debt. The Bank of England, also specifically targeting credit markets, began purchasing commercial paper and later corporate bonds through this specially created Asset Purchase Facility.

The significance of this commonality of asset purchase by various central banks lead to increase in central banks' balance sheets. Besides, balance sheet expansion, central banks also adopted further unconventional measure of focusing on forward guidance to markets about the future path of policy rates with aim to bring volatility and long term interest rates lower. In this chapter, we look for how Quantitative Easing (QE) and other unconventional monetary policies worked where central banks went beyond their scope to help the markets. We will also look at the economic impact of these unconventional monetary policies as well, such as Asset Purchase Facility (APF) buying government bonds, Funding for Lending Scheme, Forward Guidance etc. We will finish by impact on the macro-economy of these pressure relief measures taken by the BOE.

Background

After the 1930's depression, 2008 meltdown can be deemed as a great recession. The fiscal and monetary authorities of many countries responded with a variety of conventional and non-conventional measures aimed at mitigating these effects on financial stability and respective real economies. The global financial crisis that began in Summer of 2007, and intensified in fall 2008 following the collapse of Lehman Brothers, led to many central banks cutting policy rates to levels close to zero and adopting a variety of unconventional monetary policy measures. These measures included making large-scale asset purchases (LSAPs) financed by central bank money reserves mostly referred to as quantitative easing (QE), and substantially expanding the availability of central bank credit to the financial sector. The Bank of England Monetary Policy Committee (MPC) voted to start purchasing gilts financed by the issuance of central bank reserves in March 2009.

Figure II.2.1: UK Interest Rate



Source: [Trading Economics](http://www.tradingeconomics.com)

This policy was aimed at boosting the level of activity in the economy. Under normal circumstances, monetary policy operates through the interest rate set by the MPC of the Bank of England. However, interest rates had been cut from 5.75 percent in July 2007 to just 0.5 percent in March 2009, leaving little scope for further cuts. As conventional monetary policy was constrained in this way, the Bank of England had to adopt an unconventional QE monetary policy to increase money supply in the economy. Also, despite this substantial loosening in policy, the MPC judged that without the additional measures the effect on nominal spending would be too weak to meet the 2 percent CPI inflation target in the medium term. Therefore, MPC announced that it would begin a program of large-scale purchases of public and private assets using central bank money. The aim of the policy was to inject money into the economy in order to boost nominal spending and thus help achieve the inflation target. The program started as a sterilized intervention, though later changed to unsterilized balance sheet expansion by increasing reserves as crisis escalated.

The Bank of England's asset purchases were overwhelmingly focused on purchasing a large amount of UK government bonds/gilts. These asset purchases can be categorized into two distinct episodes. Between January 2009 and January 2010, the Bank purchased £200 billion of assets, mostly medium and long-dated gilts mainly 3 to 5 years and 25+ years to accommodate the increased size of the purchases. Second episode of purchases began in October 2011 till July 2012 setting the ceiling of APF expansion to £375 billion. In addition to this, BOE was authorized to purchase up to £10 billion in private assets financed by Treasury issuance. These asset purchases represented nearly 30 percent of the amount of outstanding gilts held by the private sector at the time crisis began and around 14 percent of annual nominal GDP. Combined with earlier liquidity support measures to the banking sector, these purchases increased the size of the Bank's balance sheet relative to GDP almost threefold compared with the pre-crisis period. Buying gilts (UK government bonds) increases the amount of money in the economy. Hoping the results

will boost the economy by encouraging banks to increase lending and consumers to increase spending as asset prices rise⁵⁸ (Joyce, Tong and Woods-2011).

This BOE chapter provides an overview of policies and instruments used by BOE at the height of the crisis between 2008 and 2011, and focuses more in detail actions taken since start of 2012 with the policies, instruments and tools i.e. combination of conventional and unconventional, utilized to manage the economy through the latter half of this crisis.

Role of Central Bank & Monetary Policy (BOE Sterling Framework)

Aim and Objectives

Bank of England's goal and purpose is to foster the people's good by maintaining sound monetary policies, hence financial stability in the economy. BOE is assigned with two main tasks i.e. to implement the monetary policy committee's (MPC) decision in order to attain the inflation target, and reduce the cost of disturbance or volatility to the liquidity and payment services supplied by various banks within United Kingdom (UK) and other financial institutions. BOE can perform these tasks because it is the lender of the last resort and the sole supplier of central bank money in the UK. Central bank (CB) money shows up as liability on the bank's balance sheet and CB provides focal point of monetary policy transmission mechanism and of the payment and the liquidity services offered by the banking system (Red Book, 2015).⁵⁹

Central Bank Money

Central bank plays an underlying role in the implementation of the monetary policy. The bank compensates on reserve balances held by respective banks while establishing a benchmark short-term risk free rate. The rate is called Bank rate or overnight rate. Therefore, changes in Bank rate influence the money markets, deposits and loans and financial asset pricing including exchange rates. The MPC sets policy in terms of Bank rate, however, can utilize other measures to control the effectiveness of its control, money supply and objectives. CB facilitates the payments among banking while providing liquidity services to the economy as well (Red Book, 2015).⁶⁰

Role of financial Markets

Financial markets are heavily dependent on CB guidance. As BOE implements the monetary policy, though operating in limited number of markets, possesses an influence of triggering down effects of its measures as most markets are interconnected by nature (Red Book, 2015).⁶¹

Implementing monetary policy under reserve averaging

The bank particular pays attention to interbank rates as transactions are settled directly or indirectly by transfer between reserves at the BOE. This has been suspended since March 2009, however, when it is

⁵⁸ Joyce, Michael., Matthew Tong, and Robert Woods. "[The United Kingdom's Quantitative Easing Policy: Design, Operation and Impact](#)," Bank of England Quarterly Bulletin, 2011 Q3, Vol. 51(3). September 19 2011.

⁵⁹ Bank of England. "[The Red Book: The Bank of England's Sterling Monetary Framework](#)." June 2015.

⁶⁰ [Ibid.](#)

⁶¹ [Ibid.](#)

active, reserve average scheme sets the reserves rate and sets to help reserve targets depending on individual banks liquidity needs. The bank also provides supply of reserves that banks need to meet their collective targets (Red Book – 2015).⁶²

Liquidity Insurance

Since the bank is the supplier of money, it provides a back stop for liquidity thus providing liquidity insurance, not only to banks, but also to other financial institutions, individuals, credit worthy institutions and the rest of the banking system as a whole. The provision of liquidity insurance by a central bank always has the potential to encourage more risk taking but CB has other measures to control that. The BOE can also, at times, provide support to capital markets in need in either secondary markets or as needed in unusual circumstances. Bank provides 3 different types of liquidity insurance facilities i.e. Indexed Long Term Repo; Discount Window Facility and Contingent Term Repo Facility (Red Book – 2015).⁶³

Counterparties

Institutions participation in the Bank's operations is largely voluntary and it is possible to engage in some operations without participating in all. BOE makes sure that Bank's facilities are widely available to the whole banking sector, including building societies. BOE provides liquidity insurance operations to the banking sector, as banks have crucial role to play in the payment system and are subject to liquidity risks at the same time. As long as legal and operational requirements are met, it is presumed that all banks and societies would have full access to borrow in SMF facilities against eligible collateral (Red Book – 2015).⁶⁴

Collateral

The Bank lends against collateral it holds of sufficient quantity to protect itself from counterparty credit risk. Any unforeseen event, and counterparty fails to repay, Bank can sell or retain the collateral to make good on any loss it may face. BOE has a broad collateral's list and extends in principle to any asset deemed effectively and efficiently managed (Red Book – 2015).⁶⁵

Risks faced by UK Financial Center

Economic crisis of 2008 lead UK into recession while revealing shaky foundations in the banking and financial sector. Many high profile institutions became casualties to the financial turmoil.

Dysfunctional Financial Markets

When the crisis erupted, a lack of transparency led to a loss of confidence. Financial institutions worldwide had to concede as the value of their loan portfolios substantially eroded quickly. Greater use of financial instruments and the development of sophisticated financial techniques added to the uncertainty and the lack of transparency. It was increasing clear that problems within banking system

⁶² [Ibid.](#)

⁶³ [Ibid.](#)

⁶⁴ [Ibid.](#)

⁶⁵ [Ibid.](#)

were deeply rooted in structural weaknesses in banks' balance sheet developed in the prior booming decade. Weaknesses included such as i) inflated aggregate balance sheets, ii) expansion into assets whose underlying value, credit quality and liquidity were uncertain, iii) liability structures reliant on sustained availability of cheap funding and asset liability mismatches. Loss of confidence in money markets just added to the downside spiral.

With news emerging of Northern Rock seeking emergency funding from Bank of England lead to the run on the bank. In February 2008, government announced that struggling Northern Rock is to be nationalized for a temporary period. Crisis deepened with the fall of Lehman and assistance given to Freddie Mac and Fannie Mae in rescue efforts to save them from asset liability mismatch due to fall in mortgage prices. In the UK, the Bradford and Bingley Building Society was effectively nationalized in late 2008 and then partially sold to the Spanish Group Santander Bank. Also, late in 2008, the UK Government partially nationalized the struggling Royal Bank of Scotland Group, initially taking a 58 percent stake, but eventually by late 2009 raising this to some 84 percent. The UK Government also effectively forced the UK's largest mortgage lender, Halifax Bank of Scotland (HBOS), which was in deep trouble, into the Lloyds TSB group and, in January 2009, took a 43.4 percent stake in the combined business. Other UK banks, such as Barclays and HSBC, although not nationalized, were forced to raise capital by new share issues to preserve their capital ratios (Dimsdale – 2009).⁶⁶

As global markets and individual countries plunge into similar problems, this all resulted in tightening in credit markets. Interbank lending rates remained stubbornly high (showing the banks' lack of confidence in each other's financial security), which in turn lead to a severe reduction in both personal and corporate credit and a rapid downturn in the housing and construction markets. As global growth slowed down due to high Oil prices, recession was inevitable and we saw the plunge (Lars Rohde - 2011).⁶⁷

Credit Conditions Tightened

Bank of England conducts a quarterly Credit Conditions Survey on regular basis. In 2008 Q3, at the height of the crisis, survey details suggested the credit conditions had already tightened since the mid of 2007 and market expected to tighten further over coming months. UK commercial property prices had declined to roughly 24 percent from the peak of the June 2007, and as prices continue to fall, more loans entered into negative equity. As the credit availability start to get tighter due to risk of more defaults, this pushed more commercial property businesses to refinance or default. Corporate bond spreads/Credit spreads rose sharply reflecting the increase in expected default losses since the start of the crisis.

After BOE's quantitative measures and global central banks response to crisis in various parts of the world, tensions again renewed in UK in bank funding since mid-2011 leading to increase in concerns over bank credit supply. External risk factors increased pressure on credit availability, pricing and on spreads. Bank's funding costs rose and risks to bank funding increased in summer of 2011. This led to a tightening in credit conditions. UK banks entered the crisis with a heavy reliance on wholesale sources

⁶⁶ Dimsdale, Nicholas H. "[The Financial Crisis of 2007–9 and the British Experience.](#)" Volume 4, Issue 1. The Oxonomics Society (Published by Wiley-Blackwell) 2009. Accessed: April 14 2016

⁶⁷ Rohde, Lars. "[Lessons from the Last Financial Crisis and the Future Role of Institutional Investors.](#)" OECD Journal: Financial Market Trends. September 4 2011.

of funding and inadequate capital on their books. Credit tightness post 2010 attributed more to rise in banks funding cost and the impact was more felt by medium size enterprises and households.

Liquidity Pressure

The 2008 crisis resulted from excessive risk-taking following a prolonged period of macroeconomic stability, combined with financial innovation. Problems arose initially with rising defaults in the US market for subprime mortgages, which induced a breakdown in the market for asset backed securities in mid-2007. The drying up of the money market threatened the liquidity of several UK banks, notably Northern Rock as mentioned earlier, while falling asset prices undermined their solvency.

There were two kinds of liquidity pressure which we saw in UK markets i.e. Market liquidity risk and funding liquidity risk. The most extreme form of market liquidity risk is that when dealers shut down bids, which happened in a number of markets at peak of crisis such as those for certain asset-backed securities and convertible bonds. UK also experienced an extreme funding liquidity risk since banks were short on capital, so they scaled back their trading that required capital, and also scaled back the amount of capital they lent to other institutions. The two forms of liquidity are linked and can reinforce each other in liquidity spirals where poor funding leads to less trading, this reduces market liquidity, increasing margins and tightening risk management, thus further worsening funding problems.

Globalization has also linked markets worldwide. These linkages across markets increase investors' and corporates' access to capital markets and their ability to invest and obtain funding by encouraging cross-border lending and foreign currency-denominated loans. However, they also mean that a liquidity problem in one corner of financial markets can cause liquidity to decline in other markets, in turn leading to a contraction in aggregate supply of credit and a decline in economic activity. This risk can materialize when markets are unable to absorb sudden changes in demand or supply of assets, and order imbalances. Such market illiquidity often causes increased volatility and higher execution costs for investors. A case well experienced in crisis of 2008 and adverse conditions in 2011 again in UK (Kapadia et al. – 2012).⁶⁸

The steps and measures introduced by BOE in response to the crisis following the failure of Lehman Brothers helped to stabilize the British banking system. Recapitalization gave banks the capital they needed to remain in operation, while loan guarantees helped to ease conditions in the money market.

Summary of 2008-2011 QE Programs

As Fed and BOJ started to engage more actively, BOE was initially reluctant to engage in quantitative easing effort or credit easing in 2008. Between January and March 2009, HM Treasury announced the establishment of Asset Purchase Facility (APF) supervised and operated by Bank of England. The Bank coordinated two programs specifically in asset purchase facility to ease specific credit conditions and more traditional QE for monetary stimulus. However, the initial asset purchase was financed by short term gilts so the BOE's monetary base or liability did not increase i.e. Purchases were sterilized.

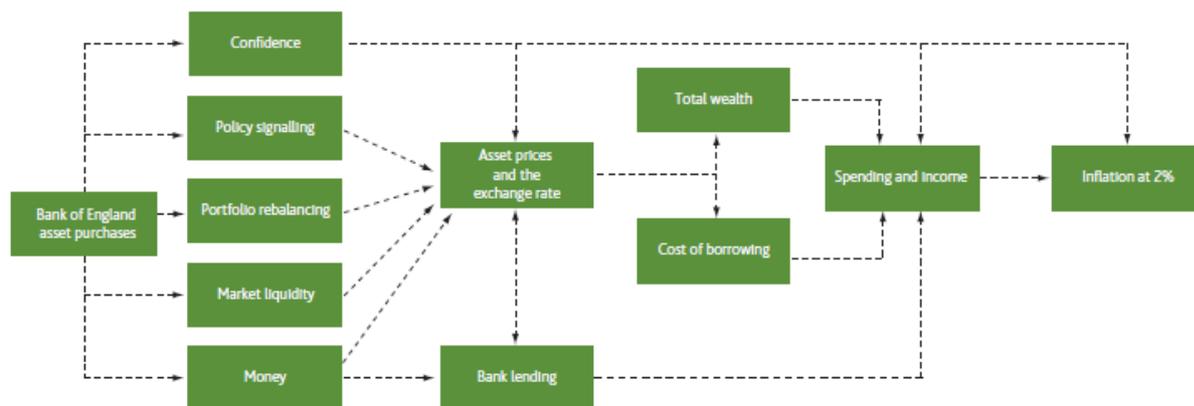
⁶⁸ Kapadia, Sujit., Mathias Drehmann, John Elliott, and Gabriel Sterne. "[Liquidity Risk, Cash-flow Constraints and Systemic Feedbacks.](#)" Bank of England. Working Paper No. 456. June 2012.

After the January’s 2009 announcement of the private asset purchase program, BOE was authorized to buy up to £50 billion in “high quality private sector assets” to “increase the availability of corporate credit, by reducing the illiquidity of the underlying instruments”. Treasury operated to sell (issued) pound for pound equivalent in short term gilts to finance the purchases of these assets. Approach was conducted to keep the Banks’s Balance sheet sterilized. In similar manner, BOE purchased corporate bonds through a reverse auction i.e. potential counterparties bid on the price at which they would sell assets to the BOE (Fawley, Neeley – 2013).⁶⁹

The Bank also expanded to include purchase of commercial paper (CP) at a fixed spread above the local risk-free OIS (Overnight Index Swap) rates, which established price as a floor for high quality CP as well. With the announcement of establishment of Asset Purchase Facility (APF) in March 2009 by BOE, asset purchases were explicitly administered by APF and it increased the target of up to £75 billion increase in monetary base. Later announcements, as seen in below chart, expanded to £200 billion in total. This can be referred to as first episode of quantitative easing or QE1. The Bank directed QE purchases towards deep and liquid markets in medium and long term gilts. To increase the monetary base by equivalent amount i.e. unsterilized, the BOE financed all new APF purchases by issuing money (reserves) rather than issuing gilts. Earlier held short term gilts were allowed to mature without renewal and, by end of 2009, reserves backed all asset held in APF.

Figure II.2.2: QE Transmission Channels

QE transmission channels



Source: Joyce, Tong, Woods, “[The United Kingdom’s quantitative easing policy: design, operation and impact.](#)” The Bank of England, 2011.

In second episode or QE2, during the severe stress lead by European sovereigns, the Bank of England joined the Fed and ECB to further stimulate economy and provide liquidity and credit easing. Also, as future forecast predicted a sharp fall in inflation expectations for a longer horizon, and the Bank would undershoot its inflation target of 2 percent, the BOE, in October 2011, increased the QE/APF target from £200 billion to £275 billion. This was the first time Bank increased in nearly two years after QE1. Later the Bank increased again the target to £325 billion of asset purchase in February 2012, and revised to increase one more time to £375 billion in July 2012. The last of the increase and since then have held the

⁶⁹ Fawley, Brett W., and Christopher J. Neely. “[Four Stories of Quantitative Easing.](#)” Federal Reserve Bank of St. Louis. 2013.

assets constant with maturing gilts being reinvested to maintain expanded monetary base. The last increase were mainly to support UK's shrinking GDP numbers and forecast.⁷⁰

Since then, the Bank has taken several other measures to accommodate monetary and credit easing but did not increase monetary base any further. The aim of these actions has been to boost the supply of money and credit in order to raise the rate of growth of nominal spending to a level consistent with meeting the inflation target in the medium term.

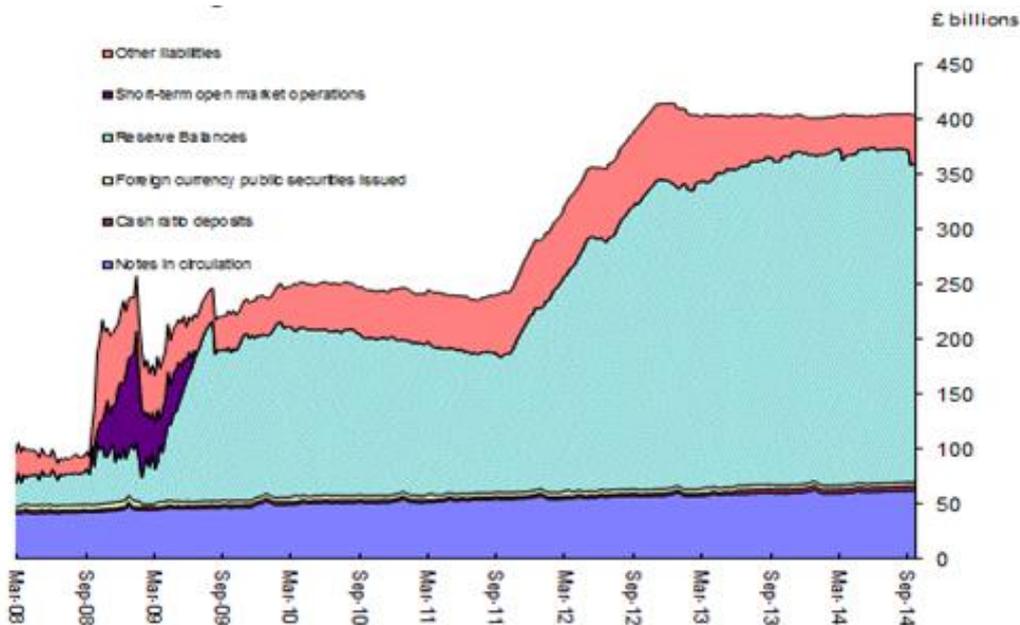
Important Announcements				
Program	Date	Amount bn (£)	Events	Description
APF	Jan-09	+50	Treasury Statement	APF established: The BOE will purchase up to £50 billion of high quality private sector assets financed by Treasury issuance.
APF	Feb-09		BOE Inflation Report	The BOE views a slight downside risk to meeting the inflation target, reiterates APF as a potential policy instrument.
APF	Mar-09	+25	MPC Statement	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 the new purchases.
APF	May-09	+50	MPC Statement	QE expanded: The BOE expands QE program to £125 billion in assets.
APF	Aug-09	+50	MPC Statement	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 and more.
APF	Nov-09	+25	MPC Statement	QE expanded: The BOE will purchase up to £200 billion in assets.
APF	Feb-10		MPC Statement	QE maintained: The BOE maintains the stock of asset purchase financed by the issuance of reserves at £200 billion; new purchases of private assets will be financed by Treasury issuance.
APF	Oct-11	+75	MPC Statement	QE expanded: The BOE will purchase up to £275 billion in assets financed by reserve issuance; the ceiling on the private assets held remains at £50 billion.
APF	Nov-11		Treasury Statement	Maximum private assets purchases reduced: HM Treasury lowers the ceiling on APF private asset holdings from £50 to £10 billion.

Source: Table created by author

The charts below represent the Bank's balance sheet from March 2008 to September 2014.

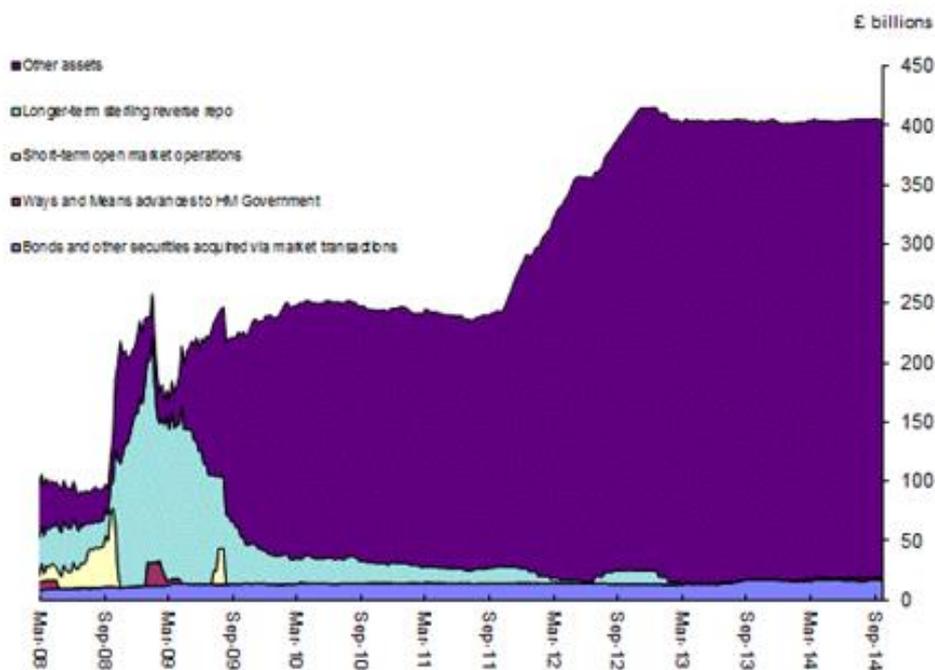
⁷⁰ Bank of England, "[Market Operations Timeline](#)." Accessed: 14 March 2016.

Figure II.2.3: Bank of England consolidated balance sheet (Liabilities)



Source: Bank of England, [The Bank of England Balance Sheet](#), 2014

Figure II.2.4: Bank of England consolidated balance sheet (Assets)



Source: Bank of England, [The Bank of England Balance Sheet](#), 2014

Unconventional Monetary Policy (post 2011)

Economic conditions deteriorated with the start of 2012 in United Kingdom. Many economic indicators worsened especially the three main headline indicators i.e. GDP, Unemployment and CPI. Unlike the prior decades of relative growth and slowdown under BOE watch, the UK economy was subjected to significant and substantial disturbances during the past few years, including, not only the global financial crisis and the attendant need for significant private and public sector balance sheet repair, but also the consequences of the continuing adjustment within the euro area as well as several noteworthy cost shocks. The weakness of output growth was, in part, due to the cost shocks eroding the real purchasing power of households and reducing consumer spending. It also reflected the continued pain of the global financial crisis, which has depressed domestic demand through various channels, including the effects of heightened uncertainty. The crisis has also had serious repercussions for economic activity elsewhere, which has lowered demand for UK exports, especially from the euro area, as well as weighing on UK domestic demand through financial and confidence channels.

Quantitative Easing (holdings as of now)

The table below shows the outstanding stock of holdings (on a settled basis, net of any redemptions) for each facility. For the corporate facilities, it also identifies how purchases were funded. These data are as at close Thursday 7th April 2016.

Purchases financed by	Issue of Treasury bills and the DMO's cash management operations	Creation of central bank reserves
Gilts	n/a	£374,907mn
Corporate Bonds	£0mn	£0mn
Secured Commercial Paper	£0mn	£0mn

Note: Commercial Paper - The scheme was withdrawn by the Bank on 15 November 2011. Note: Credit guarantee scheme - No operations were conducted, and the scheme was withdrawn by the Bank on 15 November 2010. Source: [Bank of England](#)

Continuance of important announcements (2012 onwards)

Program	Date	Amount bn (£)	Events	Description
ECTR	Dec-11		BOE	The Bank announced the introduction of Extended Collateral Term Repo (ECTR) Facility .
SLS	Jan-12		BOE	The Special Liquidity Scheme (SLS) was introduced in April 2008 to improve the liquidity position of the banking system by allowing banks and building societies to swap their high quality mortgage-backed and other securities for UK Treasury Bills for up to three years. Although the drawdown period for the SLS closed on 30 January 2009, the scheme remained in place for a further three years. The SLS officially closed on 30 January 2012.
APF	Feb-12	+50	MPC Statement	QE expanded: The BOE will purchase up to £325 billion in assets.
NLGS	Mar-12		DMO	The National Loan Guarantee Scheme (NLGS) was launched on 20 March 2012 to help businesses access cheaper finance by reducing the cost of bank loans under the scheme by 1 percentage point.
ECTR	Jun-12		BOE	The Bank announced the activation of Extended Collateral Term Repo (ECTR) Facility which is a contingency liquidity facility designed to respond to actual or prospective market-wide stress of an exceptional nature. ECTR auctions for at least £5bn are to be held at least once a month until further notice.
APF	Jul-12	+50	MPC Statement	QE expanded: The BOE will purchase up to £375 billion in assets.
FLS	Jul-12		BOE / Treasury	The Bank and Treasury launch the Funding for Lending scheme. Draw down window opens up on August 1st 2012. Designed to incentivize banks and building societies to boost their lending to UK households and non-financial companies.
CGS	Oct-12		DMO	The Credit Guarantee Scheme became operational on 13 October 2008 and closed to new issuance on 28 February 2010. The Scheme closed when the final guarantee expired on 26 October 2012.
Remit Change	Mar-13		BOE	The inflation target was reconfirmed at 2 percent measured by the 12-month increase in Consumer Price Index (CPI).
FLS	Apr-13		BOE	The Bank and Treasury announce an extension of one year to the Funding for Lending Scheme (FLS) until Jan 2015 with incentives to boost lending skewed towards small and medium sized enterprises (SMEs).
Forward Guidance	Aug-13		BOE	The Bank announced in august meeting on more forward guidance. Not to raise rates until unemployment above 7%.
Liquidity Insurance	Oct-13		BOE	The BOE announced changes to its approach to providing liquidity insurance to the banking system.
FLS	Nov-13		BOE	The Bank and Treasury announced changes to the terms of the FLS extension to re-focus the incentives in the scheme towards supporting business lending in 2014.
ILTR	Jan-14		BOE	The BOE launched a new regular market-wide Indexed Long-term Repo (ILTR) operation against Level A, B and C collateral with maturity of six months.
SMF	Jun-14		BOE	The Bank of England widened access to its Sterling Monetary Framework to accept broker-dealers deemed critical to the stability of the UK Financial system (designated investment firms) and central counterparties that operate in the UK markets and are either authorized under EMIR or recognized by ESMA.
UKEF	Jul-14		UKEF/BOE	UK Export-Finance guaranteed debt capital market notes issued under pro forma documentation and processes that have been agreed between UKEF and BOE became eligible for the Bank of England's Sterling Monetary Framework.
Rate			BOE	The BOE has maintained the 0.5% Overnight rate since then with some operations still in place and other facilities closed.

Source: Table created by author.

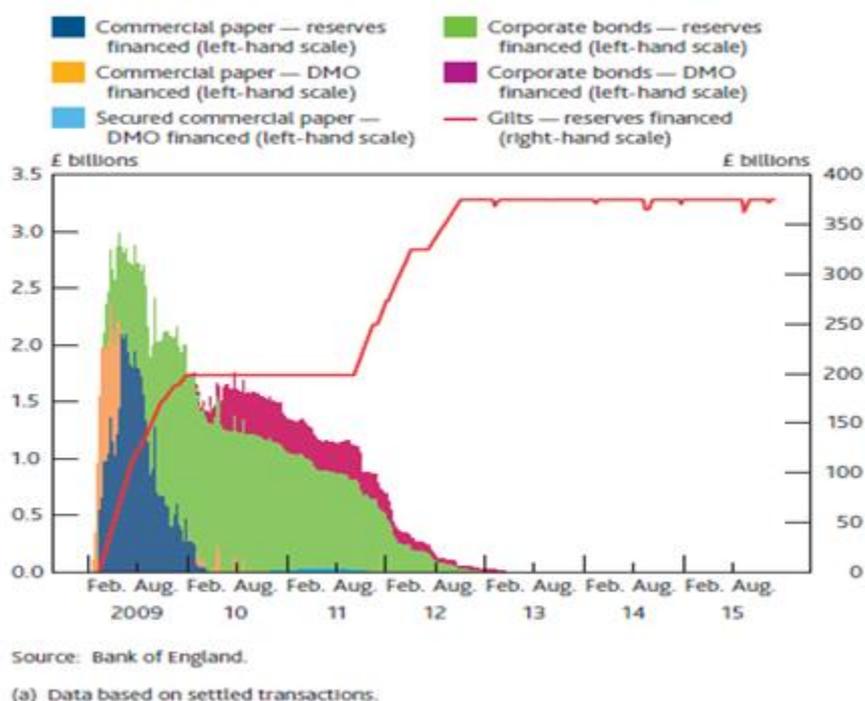
The BOE responded, what we referred as QE2 earlier, with more aggressive asset purchases to increase the quantity of the program and push further monetary stimulus into the economy. At the same time, the Bank also revealed other programs to directly target the certain aspects of the economy for faster recovery and confidence.

Quantitative Easing/Asset Purchase

i. Asset Purchase Facility

As BOE expanded the balance sheet by end of 2011 in its second episode, the Bank joined the Fed and ECB again to further stimulate economy and provide liquidity and credit easing in 2012 twice. Also, as future forecast predicted sharp fall in inflation expectations for a longer horizon, and the Bank understood that it would undershoot its inflation target of 2 percent, the Bank increased again the target to £325 billion of asset purchase in February 2012 from £275, and revised to increase one more time to £375 billion in July 2012. The last of the increases were mainly to support UK’s shrinking GDP numbers and spur growth and confidence. The below chart clearly indicates expansion in APF as commercial paper and corporate bonds wended down.

Figure II.2.5: Cumulative net asset purchases by Type: Amount outstanding



Source: Bank of England: “[Asset Purchase Facility Quarterly Report](#).” 2015 Q4.

ii. Special Liquidity Scheme

The Special Liquidity Scheme (SLS) was initially introduced in April 2008 to help improve the stress in the financial markets and enhance liquidity position of the banking system by allowing banks and building societies to exchange their high quality mortgage backed and other securities for UK bills for up to 3 years in the amount of £185 billion of face value. Roughly, 32 number of banks and building

societies accessed the scheme during its initial offer. The total nominal value of securities held by the Bank as collateral in the scheme amounts to approximately £287bn.⁷¹

The Scheme was constructed to finance part of the overhang of illiquid assets on banks' balance sheets by exchanging them for more liquid tradable assets temporarily. Although the drawdown period for the SLS closed on 30 January 2009, the scheme remained in place for a further three years. The SLS officially closed on 30 January 2012. All drawings under the Scheme were repaid before the Scheme closed.

iii. National Loan Guarantee Scheme

The National Loan Guarantee Scheme (NLGS) was inaugurated in March 2012 by Debt Management Office (DMO) to help businesses access cheaper finance by reducing the cost of bank loans under the scheme by 1 percentage point.⁷² With government guarantee on the unsecured loans, NLGS was offered to banks who signed up for the scheme. Banks passed the entire benefit that they received from the guarantee through cheaper loans.

As Funding for Lending scheme (FLS) by BOE was launched, banks choose to deliver credit easing through that facility. The NLGS is not currently open for new guarantees, but in the event that stressed market conditions re-emerge, HM Treasury would consider whether to reopen the scheme.

iv. UKEF

UK Export Finance (UKEF) guaranteed debt capital market notes issued under pro forma documentation and processes that have been agreed between UKEF and the Bank of England to be eligible for the Bank of England's Sterling Monetary Framework (SMF).⁷³ The Bank also expects to be able to agree processes with UKEF that will allow future UKEF-guaranteed loans to be made eligible in SMF.

v. Broker-Dealer and Central Counterparties

Sterling Monetary Framework was widened to include broker-dealers and center counterparties as they play an important role in the financial services to the real economy and are exposed to significant liquidity risks as well, like any other financial institution in UK. Designated investment firms/ broker-dealers deemed critical to the stability of the UK financial system (designated investment firms) and CCPs that operate in UK markets and are either authorized under European Market Infrastructure Regulation (EMIR) or recognized by European Securities and Markets Authority (ESMA), are eligible to apply for participation in the SMF, including the Discount Window Facility.

Funding for Lending Scheme

As the economic growth slow down significantly. The Bank of England and Treasury initiated the Funding for Lending (FLS) Scheme in July of 2012 to encourage lending to households and private non-financial corporations (PNFCs). The aim was to offer funding to banks and building societies for an

⁷¹ Bank of England. "[Special Liquidity Scheme](#)." February 3 2009.

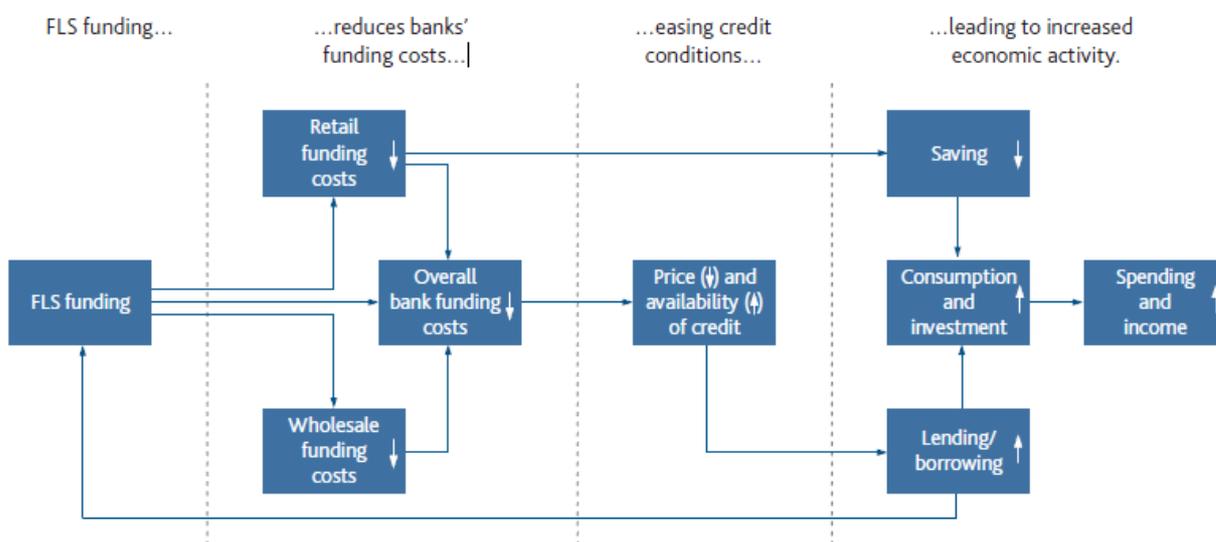
⁷² Debt Management Office. "[Guarantee Schemes](#)." UK Debt Management Office. April 14 2016.

⁷³ Bank of England. "[News Release - Bank of England Announces Expansion of Eligibility of Securities Guaranteed by UKEF as Collateral in the Bank's Facilities](#)." April 7 2014.

extended time and relieve the credit and liquidity pressure. Supposedly encouraging them to supply more credit utilizing cheaper funding available if they were to lend more. This will lead to easier access to bank credit thus boosting consumption and investment by both households and businesses.

This was believed to be achieved by providing funding to banks and building societies for an extended period of time at lower than market rates with both in price and quantity of funding provided linked to their performance in lending. The problem was the high funding cost for the banks in that period. The scheme was designed to reduce funding costs so that they can make loans cheaper and more easily available. Access to the scheme was directly linked to how much each bank and building society lends to the real economy. Those that increased lending were able to borrow more under the scheme, and do so at a much lower cost than those that scaled back their loans.

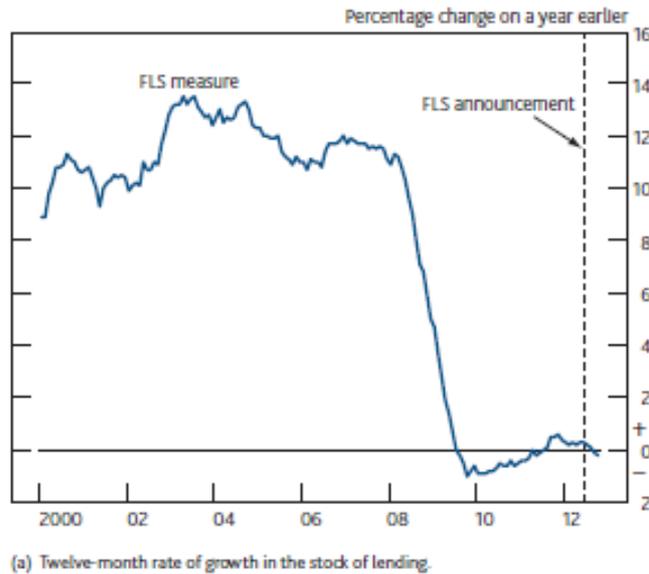
Figure II.2.6: Transmission mechanism of FLS



Source: Bank of England, “[Funding for Lending Scheme: Quarterly Bulletin](#).” 2012 Q4

Despite BOE’s extremely accommodative stance of monetary policy, output was broadly flat in 2010-2011. And prior to the announcement of the FLS, lending to UK households and PNFCs by banks had been broadly flat for over last three years as reflected in chart below.

Figure II.2.7: Twelve month rate of growth in the stock of lending



Source: Bank of England, "[Funding for Lending Scheme. Quarterly Bulletin.](#)" 2012 Q4

Multiple factors caused cost of funding to rise, however, the intensification of the euro crisis in 2011-12 was the leading cause thus affecting the increase in the interest rates on loans. As BOE realized the heightened level of risk aversion in markets, funding costs would have likely remained higher for a significant amount of time and FLS was a direct policy solution to the threat to the UK economy. An overview of how FLS should work in the economy is described in the transmission mechanism diagram above. When banks pay a higher interest rate on the funding, the higher are the interest rates on loans made available to households and businesses including mortgages, personal and business-related loans. FLS was launched to tackle the root of the problem to provide loans to banks as a cheap source of funding relative to the market. This was supposed to bring ease in the cost of the other sources of bank funding as well, for example by reducing the need for participating banks to issue debt in public markets. Together, lower overall bank funding costs should allow banks to increase the availability of credit by cutting loan rates. In other words, FLS aims to reduce borrowing costs by going directly through the banking sector, benefitting those who are reliant on banks as a source of finance.

Forward Guidance

Forward guidance, when the rates are at the zero lower bound, is to clarify the central bank's intended future policy rate path. This works similarly to additional stimulus when the central bank communicates that policy rates will remain lower for longer than priced into the markets. Conventional monetary policy primarily influences the economy through its effects on interest rates. Forward guidance operates through a similar interest rate channel, however, doesn't require a change in the current target rate to be affected. Bank statements that policy rates will remain exceptionally low in the future can reduce both components of long-term rates, i.e. the term premium and the expected path of future interest rates. Forward guidance can also reduce uncertainty, thereby lowering interest rate volatility as well. This type of policy guidance reduces the term premium by reducing the risk of future policy rates unexpectedly rising and guides the market for future interest rate expectations. A lower term premium can stimulate the economy by

lowering the credit premium on private debt, which decreases borrowing costs for businesses and households (Filardo, Hofmann – 2014).⁷⁴

Forward guidance can also lower long-term interest rates by lowering the expected path of short-term interest rates. Past policy actions suggest that when the economy slows, the BOE will lower future policy rates to stabilize the economy. When the policy rate is at its effective lower bound, policy rates cannot be much of a help any further. Instead, the Bank can issue statements about how long the policy rate will remain exceptionally low. If the announced duration of low interest rates is longer than the public expects, a fall in the future path of interest rates then causes an immediate decline in longer-term rates. However, this change in policy stimulates the economy mainly depends on how the market interprets the forward guidance. The potential usefulness of BOE's forward guidance depended on the following criteria:

- Commitment of BOE
- Clear communication for guidance
- Interpreted in the way intended by the Bank.

In August 2013, BOE became verbally more active in forward guidance stating with more state contingent⁷⁵ guidance to markets for better clarity and transparency. For forward guidance to be effective, it must be seen as a credible commitment of the BOE, i.e. the public must believe that the central bank will deliver on its guidance. The arrival of Gov. Carney in mid-2012 with his prior reputation as head of Central bank of Canada really helped in this aspect. He laid the ground work to bring more openness, clarity and transparency on economic outlook and policy responses. Goal was to bring inflation back to 2 percent within 18-24 months, but the then economic environment suggested it would take longer to achieve the target. Forward guidance allowed to convey the message that MPC sees inflation expectations lower and rate projectile shifting to be more gradual than market anticipated.

Clear communication for guidance is also a very important aspect in conducting forward guidance. Clarity about monetary policy intentions can easily lead to better outcome as it lowers the economic and financial uncertainty and also helps individuals and businesses to make better informed decisions. The MPC used regular communication to show to public how it seeks to maintain price stability and support growth and employment objectives of the government. BOE attempted to use the forward guidance for expansion without jeopardizing price and financial stability.

Forward guidance can be divided into three sub-categories explaining the approach and target:

- Open-ended guidance:* It provides qualitative information about the future path of monetary policy. Such a guidance allows a high degree of flexibility in responding to unanticipated developments.
- Time-contingent guidance:* This kind of guidance is time dependent and provides an indication of when monetary policy is likely to change such as Bank will not change policy until certain date in future and it is relatively easily understood by the markets.

⁷⁴ Filardo, Andrew, and Boris Hofmann. "[Forward Guidance at the Zero Lower Bound.](#)" Bank of International Settlements. March 9 2014.

⁷⁵ Bank of England. "[Monetary Policy Trade-offs and Forward Guidance.](#)" 2013.

- iii) *State-contingent guidance*: It provides an indication of the economic conditions that might lead to a change in monetary policy in future, such as BOE will not respond until unemployment rate crosses the 7 percent threshold. It is a great way linking forward guidance to economic condition helping explain how, why and when MPC will respond.

Indexed Long Term Repo (ILTRs)

Indexed Long Term Repos were launched in January 2014 to further facilitate liquidity in UK financial sector. ILTR is held on regular monthly basis and aimed at banks, building societies and broker-dealers with a predictable need for liquid assets to accommodate liquidity. The normal maturity is six months and the Bank will normally fund via an ILTR operation once a calendar month. It facilitates liquidity for firms and duration is long enough to provide ease in market stress situations. ILTR rate charged is indexed to the Bank Rate. And it enables counterparties to participate without having to take risk on the future path of Bank Rate decisions and reduces exposure to market risk.

The auction for the ILTR is intended to be extremely flexible. Set up consists of two automatic responses which are built into each ILTR operation. First, greater proportion of funds is lent against a particular collateral set as the clearing spread for that collateral set increases comparatively to the other collateral allotment. Secondly, as the pattern of bids perceived in the auction suggests a greater demand for liquidity insurance, the greater the total quantity of funds made available.

Participants are able to borrow against three collateral sets i.e. Levels A, B and C as explained below. Participants are *encouraged* to report and deliver to the Bank in advance any collateral levels of A and B which they intend to use in the ILTR operation. Level C requires a bit more scrutiny and securities *must* be delivered to the Bank in advance of the operation and all loan collateral *must* be pre-positioned.

- i) Level A Collateral: ⁷⁶ Following list of securities with respective characteristics are eligible as Level A collateral:
- Gilts (including gilt strips): A gilt is a sterling denominated security issued into CREST by HM Government.
 - Sterling Treasury bills: Treasury bills are sterling denominated unconditional obligations of the UK Government.
 - HM Government euro, US dollar and Canadian dollar denominated marketable debt: Euro, US dollar and Canadian dollar denominated marketable debt issued by HM Government.
 - Bank of England securities: Bank of England securities are debt securities issued by the BOE.
 - Sovereign and Central Bank debt: Sterling, euro, US dollar and Canadian dollar denominated securities (including associated strips) issued by the governments and central banks.

Note: More information is available on Bank of England website

- ii) Level B Collateral: ⁷⁷ Following list contains some of securities eligible as Level B collateral:
- Certain Sovereign and Central Bank debt
 - Major International Institution's bonds

⁷⁶ Bank of England. "[Indexed Long-Term Repo Open Market Operations.](#)" Indexed Long-Term Repo Open Market Operations. 2013.

⁷⁷ [Ibid.](#)

- G10 Government guaranteed agency
- For complete list, please follow link below.

Note: More information is available on Bank of England website

iii) Level C Collateral⁷⁸: Following list contains some of securities eligible as Level C collateral:

- UK and EEA residential mortgage-backed securities (RMBS – not covered in Level B)
- UK, US and EEA covered bonds (not covered in Level B)
- UK, US and EEA asset-backed securities (ABS – not covered in Level B)
- UK, US and EEA commercial-backed securities (CMBS – not covered in Level B)
- For complete list, please follow link below.

Note: More information is available on Bank of England website

Extended Collateral Term Repo Facility (ECTRF)/Contingent Term Repo Facility (CTRF)

In December 2011, the Bank announced the introduction of Extended Collateral Term Repo (ECTRF) Facility to provide liquidity insurance to the markets as a measure to deal with euro area crisis. In Jun 2012, the Bank announced the activation of ECTRF which is a contingency liquidity facility designed to respond to actual or prospective market-wide stress of an exceptional nature. The Bank's both Indexed Long-term Repos (ILTRs) and Extended Collateral Term Repo (ECTRF) facility also affect the level of reserves in the market, however, they are primarily liquidity insurance operations, and are not used to steer the level of reserves for monetary policy purposes. The Bank can choose to activate, at its discretion, to provide support to the banking system in the event of potential or actual system-wide stress. It uses an auction mechanism to provide six month liquidity against collateral pre-positioned for the Discount Window Facility (DWF) (the widest collateral eligible in the SMF). This facility was activated as a precautionary measure in light of potentially turbulent future market conditions arising as a result of ongoing troubles in the Eurozone and perhaps also pending bank credit downgrades. The first operation was fully allotted. Subsequent auctions have seen some further usage, indicating that banks are willing to access the facility, but not all the reserves on offer have been bid for. This reduction in demand is perhaps unsurprising given that banks are not currently constrained by their sterling liquidity given the large amounts of excess reserves being provided by the MPC's QE policy.

Establishment and use of ECTRF/CTRF⁷⁹ by BOE was again to smooth out the liquidity operations and stress in the market. In late 2013, BOE renamed ECTRF to Contingent Term Repo Facility (CTRF)⁸⁰. All collateral accepted in the Extended Collateral Term Repo (ECTRF) facility was also accepted in the ILTR, therefore, the ECTRF facility was re-named as the CTRF. Following an extended period of no demand, with healing market conditions, CTRF auctions were stopped, although the CTRF will remain a permanent part of the liquidity insurance facilities offered by the Bank. The contingent nature of the CTRF allows the Bank to provide liquidity against the full range of eligible collateral at any time, term and price it chooses, in response to actual or prospective exceptional market wide stress. Those

⁷⁸ [Ibid.](#)

⁷⁹ Bank of England. "[Extended Collateral Term Repo Facility.](#)" Quick reference guide.

⁸⁰ Bank of England. "[Market Notice: Indexed Long-Term Repo Operations and Contingent Term Repo Facility.](#)" Market Notice. January 16 2014.

institutions eligible to participate in the auctions are banks and building societies that are signed up to the Bank's Discount Window Facility. The Bank expects ECTR operations to use the full range of eligible collateral comprising Levels A, B and C as explained earlier. All DWF securities and loan collateral is eligible in ECTR operations.

Effects of Unconventional Monetary Policy

There is great literature been written on the impact and effects of quantitative easing or unconventional monetary policy adopted by major central banks; in this section, we attempt to present the literature review, policy effects, impacts and conclusions driven out of those analysis. We will concentrate on few big topics such as Investor portfolio rebalancing and allocation, Funding for lending scheme and credit ease, Forward guidance and tradeoffs, Lending channel and direct or indirect effects on Pensioners and Savers due to BOE's large scale asset purchasing activity.

a) QE/Asset Purchase & Investor Portfolio Allocation

The goal of the monetary policy was to achieve low and stable inflation, however, given the current economic conditions in last 8 some years, central banks now have a much greater focus on financial stability in addition to targeting inflation (and/or employment). To have greater financial stability and strengthening of capital adequacy and liquidity by using greater arsenal of policy instruments with macro-prudential tools, UK created a Financial Policy Committee to run macro-prudential policy alongside MPC.

The Bank of England overwhelmingly bought gilts/UK bonds from the non-bank private sector through its QE operations. These purchases were not designed to handle the liquidity problem, but more so, to affect the yields (prices) on a wide range of assets particularly on bonds issued to finance lending to households and companies. The aim to target yields was a special one. To generate an impact from QE, portfolio switches (allocation balancing) were expected to happen. Central banks, through varying the supplies of different maturities or durations and liquidity could influence the pattern of yields on different assets due to imperfect substitutability.

Also, there are studies done on the effects of QE on yields of different maturities especially taking into account the time effect. Below figures clearly shows the impact with gilts lower by 104 basis points after QE1 announcement. It also lists further QE response and effects on corporate bonds as well.

Figure II.2.8: Reaction of yields to QE announcements



Figure II.2.9: Summary of asset price movements

Asset	QE1: total of £200bn purchases over 6 announcements (Feb 09, Mar 09, May 09, Aug 09, Nov 09, Feb 10).		QE2: total of £170bn purchase announcements (Oct 11, Feb 12, July 12, Nov 12).	
	Change around QE1 announcements	Change 4 March 2009 – 24 January 2010	Change around QE2 announcements	Change 2011 – 2012
Gilts (5-25 year spot rates)	-104bp	-9bp	-20p	-45bp
Corporate yields (investment grade)	-69bp	-390bp	-7bp	-200bp
Corporate yields (high yield)	-151bp	-138bp	-11bp	-54bp
FTSE All-Share	-3%	+46%	+4%	+6%
Sterling ERI	-4%	+4%	1%	+6%

Source: Bank of England, “[Unconventional monetary policies: Why, what and how.](#)” 2013.

In a separate study done by Glick and Leluc (2011), found that that US QE1 which reduced 10 year US bond yields by 107 basis points, also lead to decline in foreign bond yields.⁸¹ They estimate that US QE1 reduced UK gilts by around 46 basis points. Keptanios et al. (2012) report that the effects of QE on GDP and inflation arise after 6 to 9 months and one year, respectively.⁸² On average, QE in UK raised CPI inflation by at 1.2 percentage points and boosted GDP by almost 1.4 percent. In one another study conducted by Jens Christensen and Glenn Rudebusch, both of Federal Reserve Bank of San Francisco, stated in their outcome of how US announcements of LSAPs effected the yields on U.K gilts as seen below.

⁸¹ Glick, Reuven, and Sylvain Leduc. "Central Bank Announcements of Asset Purchases and the Impact on Global Financial and Commodity Markets." Journal of International Money and Finance 31.8 (2012): 2078-101. Federal Reserve Bank of San Francisco. December 2011.

⁸² Kapetanios, George., Haroon Mumtaz, Ibrahim Sevens, Konstantinos heodoridis. “Assessing the economy-wide effects of quantitative easing.” The Economic Journal. No. 122, F316-F347. 2012.

Figure II.2.10: Changes in U.K. Gilt yields on U.S. LSAP announcement dates prior to U.K. QE program.

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Nov. 25, 2008	-8	4	14	-1	-16
II Dec. 1, 2008	-26	-35	-42	-33	-23
III Dec. 16, 2008	-15	-20	-24	-24	-24
IV Jan. 28, 2009	1	0	-3	-4	2
Total net change	-49	-51	-56	-62	-61

Changes in U.K. Gilt Yields on U.S. LSAP Announcement Dates Prior to U.K. QE Program.

All changes are measured in basis points.

Figure II.2.11: Changes in U.K. OIS rates on U.S. LSAP announcement dates prior to U.K. QE program.

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Nov. 25, 2008	-6	-14	-17	-15	-15
II Dec. 1, 2008	-32	-30	-32	-32	-30
III Dec. 16, 2008	-33	-31	-27	-19	-18
IV Jan. 28, 2009	0	-4	-6	-6	-5
Total net change	-71	-80	-81	-72	-68

Changes in U.K. OIS Rates on U.S. LSAP Announcement Dates Prior to U.K. QE Program.

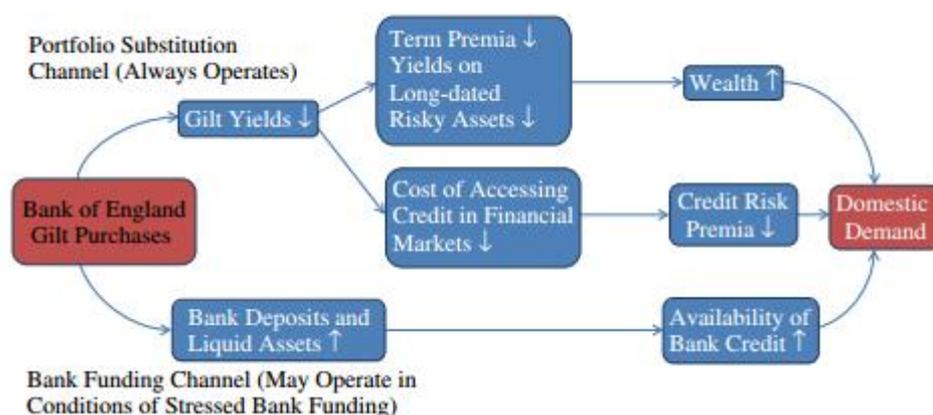
All changes are measured in basis points.

Source: Federal Reserve Bank, "[Federal Reserve Bank of San Francisco: WP 2012-06](#)." 2012.

However, Michael Joyce (Joyce et al – Q3 2011) in his Bank of England quarterly bulletin, breaks down the approximately 125 basis points effect of 200 billion pound of unanticipated purchases into a split between about 45 basis points on OIS rates (Signaling Channel) and 80 basis points on gilt-OIS spreads (Portfolio Balance channel).⁸³

In order to understand how QE performs, portfolio rebalancing needs to be understood in light of portfolio substitution channel and bank funding channel (see figure below).

Figure II.2.12: Channels or impacts of Bank of England Gilts purchases on domestic demand
Channels or the impact of Bank of England's Gilts purchases on domestic demand



Source: The Economic Journal, "[QE and Unconventional Monetary Policy](#)." 2012.

Increase in asset prices and decline in yields makes it easier for many companies to raise funds, thus easing credit crunch conditions. They, in return, generate capital gains for households who are the ultimate owners of those risky assets, thus boosting their wealth. If households consume part of that

⁸³ Joyce, Michael., Matthew Tong, and Robert Woods. "[The United Kingdom's Quantitative Easing Policy: Design, Operation and Impact](#)." Bank of England Quarterly Bulletin, 2011 Q3, Vol. 51(3). September 19 2011.

increased wealth, or companies invest some of the extra funding raised on capital markets, GDP and demand starts to move higher. This is the portfolio rebalancing channel of asset purchases.

Objectives of the QE policy under BOE was clear, however, there has been more debate over how the policy was expected to work. The MPC has often emphasized the portfolio balance channel as a key element in the transmission of the Bank's asset purchases to the rest of the economy during the financial crisis. According to this mechanism, purchases of financial assets from the nonbank private sector i.e. insurance companies and pension funds, financed by central bank money initially increase broad money holdings and push up asset prices, as those who held sold assets to the central bank while rebalance their portfolios into riskier assets. This then stimulated the expenditure by increasing wealth and lowering borrowing costs for households and companies.

As the top part of above figure displays Portfolio Substitution, the lower half explains the process of Bank Funding Channel. This channel is designed to help improve the availability of the bank credit. As banks get more concerned about their ability to refinance themselves, the less likely they are to grant loans to households and businesses. As Bank of England purchases gilts owned by non-banks, banks' deposits rise as do reserve balances at the central bank. That should lead to bank's reserve holdings to exceed its demand for liquidity, it is likely banks will be more willing to expand lending, thus create a domino effect of enhanced lending the economy.

In conclusion, the effects of QE had a positive impact. Recovery has been painfully slow suggesting either recession has been stronger than anticipated, or worse, QE has failed to deliver on its task. However, slower growth can be attributed to external factors as much as other factors influencing the recovery. The majority consensus held by many is that unconventional monetary policy does work i.e. asset purchases has lowered yields and longer term interest rates and these lower yields in turn have had a positive and impact on the UK's economy (Joyce, Miles, Scott, Vayanos - 2012).⁸⁴

At the same time portfolio allocation has played a deep role as well. Up to this point, most researched has been about Bank side of how portfolio balancing channel works, however, it would be very interesting to see from the investor's side the effect of portfolio rebalancing measures and their response (Joyce, Liu, Tonks - 2014).⁸⁵

To measure the effects of QE, it is not simple enough to have an action and response evaluation that as BOE expanded the balanced sheet and heavily bought gilts financed by reserves had a direct impact on the yields of the assets or bonds in particular. If QE worked through a portfolio balance channel then one can expect that institutional investors reduced their holdings of gilts compared to prior holdings and that they would have increased their demand for riskier assets. This raises a difficult question of inferring what would have happened in the absence of QE to begin with i.e. the 'counterfactual'. In order to generate a plausible counterfactual, it is clearly important to allow for a range of other factors that may have been relevant in driving portfolio allocation. However, data indicates that for major players such as insurers and pension funds, affect has varied but positive. Depending on the risk appetite of these

⁸⁴ Joyce, Michael, David Miles, Andrew Scott, and Dimitri Vayanos, [Quantitative Easing and Unconventional Monetary Policy – An Introduction](#). The Economic Journal, Vol. 122, Issue 564, pp. F271-F288. 29 October 2012.

⁸⁵ Joyce, Michael., Zhuoshi Liu, and Ian Tonks. "[Institutional Investor Portfolio Allocation, Quantitative Easing and the Global Financial Crisis](#)." Bank of England working Paper, No. 510. September 12 2014.

institutions, rebalancing had varied affects. In the case of insurers, the substitution from gilts was more pronounced for companies that showed less risk aversion. For pension funds, the exchange of gilts was more pronounced for those funds that were better funded (Joyce, Liu, Tonks - 2014).⁸⁶

We can look at data available to examine the BOE's QE policy during financial crisis affected the investment behavior of insurance companies and pension funds by looking to answer four questions as stated below:

1. *Did a significant fraction of the Bank's asset purchases come from institutional investors?*

As reflected in data, 1/5 of the Banks QE gilt purchases appeared to have come from institutional investors.

2. *Did institutional investors increase their net investment in risky assets more than they would otherwise have done as a result of QE?*

Investors did reduce their net investment in gilts and increased their net investment from gilts into riskier assets mainly corporate bonds. Linkages though are not so clear.

3. *Did institutional investors increase their asset allocation towards risky assets more than they would otherwise have done as a result of QE?*

Better funded Pension funds did reallocate, however, mainly into corporate bond and no evidence of shifting into equities. Results for Insurers were less pronounced.

4. *To what extent were any resultant changes in portfolio allocation uniform across different types of institutional investor?*

There was no evidence of allocation uniform across different types of institutional investors.

In conclusion, the overall results do show evidence consistent with the Bank of England's QE policy result that some rebalancing of portfolio did materialize (Joyce, Liu, Tonks - 2014).⁸⁷

b) Impact of Funding for Lending Scheme

If policy target rate and money supply are the conventional ways of managing liquidity, inflation and growth, and QE is considered the "conventional-unconventional" than definitely Funding for Lending Scheme can be deemed as "unconventional-unconventional" measure taken by BOE and HM Treasury. FLS was set up to provide banks with a means by which they could fund at a discount relative to comparable market rates at the time it was introduced. The effectiveness of the FLS depended on the extent of that discount relative to what those market rates would have been in its absence. The FLS was introduced to tackle the elevated level of bank funding costs prior to its establishment. The FLS offered banks a cheaper source of funding for an extended period, thus transforming cheap funding into lower interest rates on loans to households and companies. Moreover, the scheme encourages banks to increase lending by allowing them to borrow more funding at more attractive rates as they lend more. An important part of the transmission mechanism of the FLS is the response of other bank funding costs. This reduction in the cost of bank finance should also supplement the reductions in the cost of capital

⁸⁶ [Ibid.](#)

⁸⁷ [Ibid.](#)

market issuance caused by the BOE's asset purchases under APF. Easier credit conditions should cause consumption and investment to increase, boosting economic activity within the country. However, the cost of funds accessed through the FLS is likely to be just one of many influences on credit conditions over the next few years to come. Other factors such as balance sheet constraints facing banks, global macroeconomic developments, and credit demand, will also influence the effectiveness of the FLS and it is hard to find the direct impact of the scheme (Churm, Radia – 2012).⁸⁸

Churm and Joyce (2015) did an extensive paper on QE2 and FLS impact. There is no easy way to estimate the impact of FLS on banks and financial institutions marginal funding costs (Churm, Joyce, Kapetanios, Theodoridis – 2015).⁸⁹ Three main reasons dominate the struggle in parsing the information.

1. There is no established way to measure the marginal cost of funding for a bank currently. Banks have several funding options with various interest risks, but also have indirect costs i.e. fees, cost of collateral and corresponding liquidity requirements, which are often unknown. Several proxies can be used to estimate but it would not give an accurate estimate of marginal funding costs.

2. Another complicated issue is how to measure the reaction or identification of response. The timing of FLS impact on the market funding costs is not clear. While there was an immediate response following the announcement of FLS, it is not at all obvious that study can capture all of the impact through a one or two day event window, particularly when the details of the scheme gets digested operationally and implemented. However, looking over a longer horizon movements in funding costs are likely to be contaminated by other influences in that period especially when euro area wheels were coming off and ECB and FED involved in drastic QE measures.

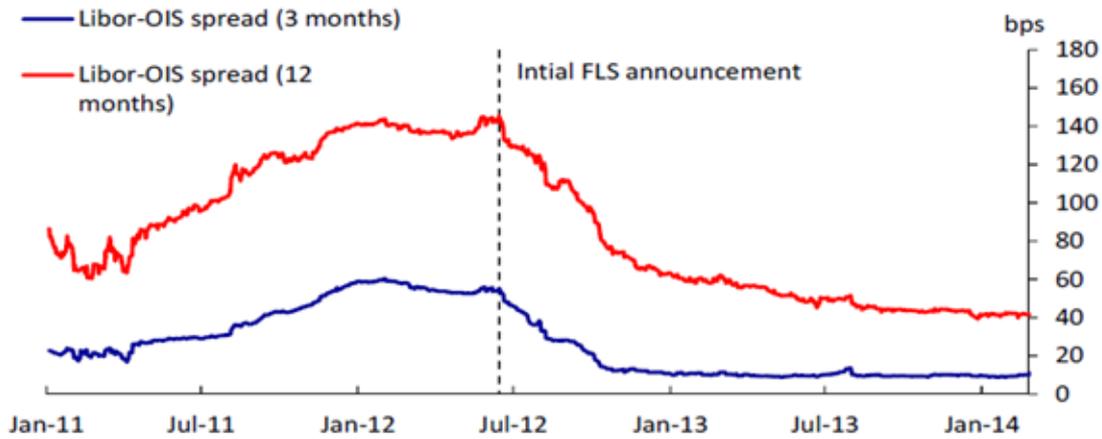
3. A third important hindrance is the FLS embedded incentives to lend through the funding offered directly to participants. As banks change loan prices for numerous unobservable reasons or due to market volatility, it is extremely hard to accurately identify these effects and test whether FLS participants changed their behavior as a result.

As a fact, BOE gives details that banks drew around £42 billion from the first phase of FLS, which is consistent with when taken into account of lowered funding costs. BOE credit conditions survey also reflected similar ease in funding cost and FLS played a role in reducing the cost of loans. Another good visible observation on longer period is the Libor-OIS spread reflecting funding cost. With the FLS announcement on June 15th 2012, Libor rates and spreads fell sharply on that morning as reflected in the chart and table below.

⁸⁸ Butt, Nicholas, Rohan Churm, Michael F. McMahon, Arpad Morotz, and Jochen F. Schanz. "[QE and the Bank Lending Channel in the United Kingdom.](#)" Warwick Economics Research Paper Series. October 2015.

⁸⁹ Churm, Rohan, Michael Joyce, George Kapetanios, and Konstantinos Theodoridis. "[Unconventional Monetary Policies and the Macroeconomy: The Impact of the United Kingdom's QE2 and Funding for Lending Scheme.](#)" Staff Working Paper No. 542. Bank of England. August 2015.

Figure II.2.13: Libor-OIS Spreads



Source: Bank of England, “[Working paper 542](#).” 2015.

Figure II.2.14: Bank Spreads

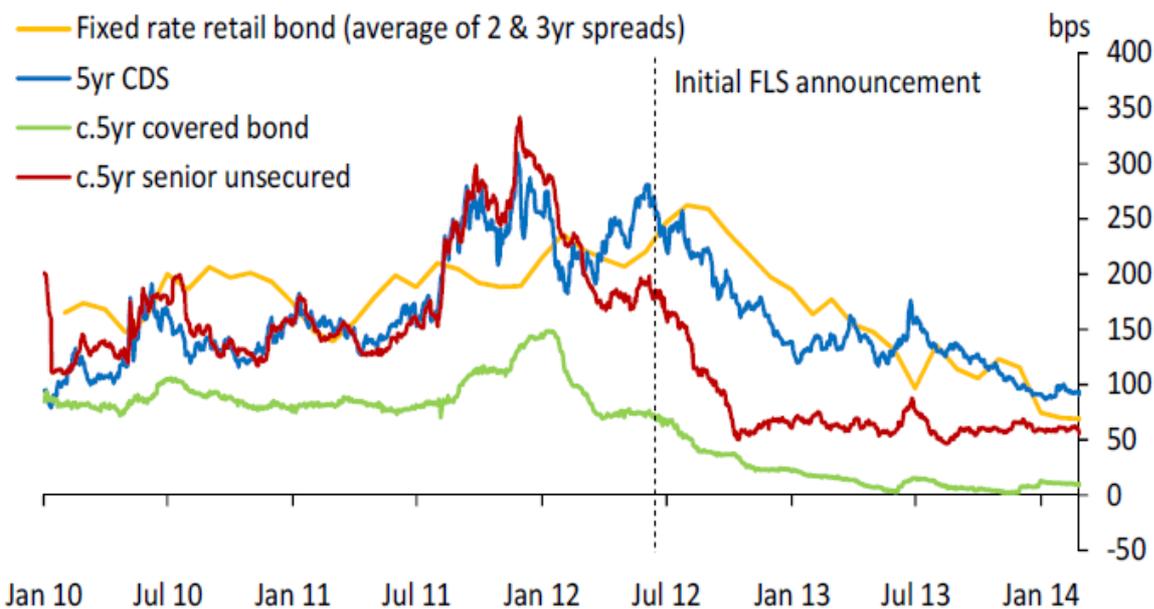
Instrument	FLS announcement		Draghi 'whatever it takes' speech			
	31/12/11	14/06/12	25/07/12	30/09/12	31/12/12	24/02/2014
UK bank B6 average CDS	254.25	262.90	250.46	196.39	138.32	92.28
UK bank B6 average						
Senior Unsecured	296.17	183.52	156.55	88.17	65.51	59.28
CDS + 3m Libor	362.26	361.90	326.36	256.08	189.82	144.46
3m Libor-OIS spread	58.76	55.25	36.15	21.44	10.75	144.46

Source: Bank of England, “[Working paper 542](#).” 2015.

Other proxy to pay attention to observe the effects of FLS on funding cost is the fall in UK bank’s senior unsecured debt i.e. CDS spreads. An average of CDS for the 6 largest UK banks fell from 263 basis points (bps) as of cob 14 June 2012, to 138bps by the end of the year (Churm, Joyce, Kapetanios, Theodoridis – 2015).⁹⁰

⁹⁰ [Ibid.](#)

Figure II.2.15: Bank funding spreads expressed using covered and senior unsecured bond spreads over swap rates



Source: Bank of England, “[Working paper 542](#).” 2015.

Since announcement was June 15th with scheme opening on Aug 1st and first drawdown actually occurring in September, the net effect can be spread over time and very hard to determine FLS response to high funding cost. Not to mention famous Draghi speech on Aug 26th of “Whatever it takes” further complicating the impact to determine. One reasonable method to measure the impact was mentioned in Mervyn King speech on Oct 23 2012 at South Wales Chamber of Commerce, where he stated that funding spreads on bank unsecured debt in the UK had fallen more than those of US and European counterparts. Statement makes some assumptions to assess but still provides a basic way to gauge the impact.

However, there is growing concern and opinion held by majority that FLS has failed to deliver on its tasks. That opinion is held by some within BOE and, to larger extent, by external think tanks and independent researchers. FLS may have had positive impact on households but it lacked to deliver to small and medium enterprises (SMEs). Businesses are still hurting and cannot access capital at ease even when they have excellent business plans. Researchers are quoting Bank’s data that despite participated by many lenders, including tax payer backed Lloyds and Royal Bank of Scotland, receiving £15.6 billion in cheap loans lending is still shrinking. £2 billion of net lending decreased to small businesses in 2014 and net lending declined by £14 billion to large corporations.⁹¹ Overall, the numbers reflecting lending to SMEs have not been encouraging in last two to three years leading to a widely held opinion that FLS has failed to deliver.

In conclusion, the results are uncertain and difficult to distinguish the effects of FLS on its own. On one hand, BOE research gives plausible lead to favorable impact of FLS on the UK economy, and on the other, data is showing shrinking numbers in lending to SMEs. Business surveys still reflect hardships for

⁹¹ Chu, Ben. “[Funding for Lending Scheme Fails to Deliver for Small Firms](#).” The Independent. Independent Digital News and Media. February 26 2015. Accessed: April 13 2016.

small businesses obtaining credit and reduction in net borrowing by UK companies further decreased in 2015.⁹²

c) Effectiveness of Forward Guidance

Since the crisis, forward guidance has become a key element of the monetary tool used by several central banks, especially the major central banks in the world. The Federal Reserve, the Bank of Japan, the ECB and the Bank of England have all provided forward guidance about future policy rates in various forms such as quantitative, qualitative, contingent etc. This section reviews and draws on the academic literature and speeches by committee members the effects of guidance on the expectations about the future path of policy rates.

Depending on how forward guidance has been utilized, the results have varied. Research done on Canada's time-contingent guidance have found the results with stronger effects. Chang and Feunou (2013)⁹³ paper clearly indicates the Bank of Canada's (BOC) forward guidance reduced uncertainty about the future path of interest rates in Canada. They measured uncertainty by looking at implied volatility computed from options on interest rate futures, and realized volatility computed from intraday prices of interest rate futures. He (2010) did another study of effects for Canada and US monthly interest rates, inflation and unemployment with time contingency in place.⁹⁴ He showed that Canadian one-year Treasury bill rates and one-year forward three-month rates were generally lower than what the model would have implied after April 2009 forward guidance attempt, while the difference between actual rates and the model-implied rates for the United States over the same period were smaller. In excess, He also found that the interest rates on longer dated government bond yields were lower than their model-implied values, and the differences got even smaller as the maturities lengthen. The findings do have some caveats to be considered, but overall does give some indication of effects of forward guidance (HE – 2010; Chang and Feunou - 2013).

Another study of Campbell, Evans, Fisher and Justiniano (2012) explored the effects of the FOMC's open-ended and time-contingent guidance and can avoid time dependency expectations for markets by utilizing state-contingent forward guidance.⁹⁵ The authors used factor analysis approach and utilized Fed Funds futures and Eurodollar futures and their reaction on the days FOMC issued guidance details.

They assumed that forward guidance does not affect expectations for the current month but affects them at other future dates, explained the impact of changes in market participants' expectations of future policy that are independent of changes in the current policy rate. They found a significant effect on longer-term Treasury bond rates and corporate bond yields. Again, those results are not controlled and many other factors could have influenced as well (Campbell, Evans, Fisher and Justiniano – 2012).

⁹² Hopkins, Kathryn, James Hurley, Dan Matthews, and Sam Shaw. "[Funding Britain's Growth.](#)" Raconteur. Issue No. 0311. April 16 2015.

⁹³ Chang, Bo Y., and Bruno Feunou. "[Measuring Uncertainty in Monetary Policy Using Implied Volatility and Realized Volatility.](#)" Working Paper 2013-37. Bank of Canada. October 2013.

⁹⁴ He, Zhongfang. "[Evaluating the Effect of the Bank of Canada's Conditional Commitment Policy.](#)" Bank of Canada Discussion Paper 2010-2011. August 2010.

⁹⁵ Campbell, Jeffrey R., Charles L. Evans, Jonas D. M. Fisher, and Alejandro Justiniano. "[Macroeconomic Effects of Federal Reserve Forward Guidance.](#)" Brookings Papers on Economic Activity. Spring 2015.

Martin Weale, external member of the MPC, gave a speech in Dec 2013 at National Institute of Economic and Social Research center.⁹⁶ He lays an impressive framework to describe the effects of forward guidance. In his speech, he mentions the BOC statement at April 2009 that “the target overnight rate can be expected to remain at its current level until the end of the second quarter of 2010”, and in the United States the FOMC stated in September 2012 that “exceptionally low levels for the federal funds rate are likely to be warranted at least through middle of 2015” can be described as time-contingent policies. These statement may include their own knockout caveats, such as the then Bank of Canada Gov. Carney statement that the policy was “conditional on the outlook for inflation” (Carney, 2013)⁹⁷. The BOE implemented a state-contingent policy of threshold-based forward guidance, linking the maintenance of prevailing low policy rate levels to a quantitative threshold for the unemployment rate i.e. greater than 7 percent with three knockout criteria including a quantitative threshold for inflation projections 18–24 months ahead i.e. 2.5 percent as well as anchored medium-term inflation expectations and the absence of financial instability risks (Weale – 2013).

Weale suggests the benefits of the state-contingent forward guidance can benefit in much better policy response. If the policy provides a stimulus much stronger than expected, the unemployment will fall faster to the threshold of seven 7 percent than expected. The BOE can respond without needing to break a promise to avoid a ride to disaster and lose market confidence. Equally, if supply conditions are different from what forecasted, may be because productivity growth turns out different, BOE can react accordingly. Two pieces of evidence on the effect of forward guidance on expected future rates were discussed by Weale are as below:

➤ *Impact of forward guidance on interest rates*

- Immediate effects on rates

It is hard to explore the effects of forward guidance, however, in the immediate short time frame right after policy announcement can provide some insight of how market behaved. Analysing the interest rate future prices trading actively in market is one way to help draw conclusions. Below table shows the movement in the implied 3 month future Libor rate at various maturities associated with the Funding for Lending Scheme and forward guidance date announcements. The table attempts to indicate the statistical significance of the movements as well.

⁹⁶ The Bank of England. “[Forward Guidance and Its Effects.](#)” Speech by Martin Weale, National Institute of Economic and Social Research London. December 11 2013.

⁹⁷ Carney, Mark. “[Monetary Policy after the Fall.](#)” Eric J. Hanson Memorial Lecture. University of Alberta. May 1 2013.

Figure II.2.16: Libor Futures: Level reaction to monetary policy announcements (percentage points)

Event	Date	1m	3m	6m	12m	24m	36m
FLS – Mansion house speech	14/06/2012		-0.31***	-0.31***	-0.28***	-0.35***	-0.33***
Forward Guidance – IR Publication	07/08/2013	0.01	0.01	-0.02	-0.02	0.00	0.02

Significant at ***1%, **5%, *10%. Percentiles of the empirical distribution.

Source: Bank of England. [“Forward Guidance and Its Effects.”](#)

Speech by Martin Weale, National Institute of Economic and Social Research London. December 11 2013.

FLS was established to provide cheap funding costs to the banks alternative to the interbank market, and it is pretty obvious that Libor rates drastically fell after the announcement. However, forward guidance did not have material effects on interest rates at the time of the announcement, but on a longer horizon, ignoring other variables, rate path was lowered and reflected sharply by improved growth prospects.

- Immediate effects on uncertainty

According to economic theory changes in uncertainty about both future interest rates and future growth in output have similar effects to changes in the rate of interest. Forward guidance was intended to reduce uncertainty about future interest rates by making it transparent the criteria of MPC policy setting. Options (tradable derivatives) include uncertainty risk premia and price of options on Libor can help induce the reaction of uncertainty on different maturities.

Figure II.2.17: Libor Futures: Volatility reaction to monetary policy announcements

Event	Date	1m	3m	6m	12m	24m	36m
FLS – Mansion house speech	14/06/2012		21.40%	3.16%	-28.74%***	-7.29%**	-9.98%***
Forward Guidance – IR Publication	07/08/2013	-16.25%	-29.52%***	-22.61%***	-6.61%	-1.68%	-1.27%

Significant at ***1%, **5%, *10%. Percentiles of the empirical distribution.

Source: Bank of England. [“Forward Guidance and Its Effects.”](#)

Speech by Martin Weale, National Institute of Economic and Social Research London. December 11 2013.

As FLS had a major impact on uncertainty in short term, in contrast, forward guidance had a little impact as may be market participants expected little change on bank rate in near future. However, 3 months to 6 months had most impact as it gave clarity to participants on MPC’s outlook and rate projectile thus reducing term premium. The effect attenuated at longer maturities. This suggest policy achieved the aim of reducing uncertainty.

➤ *Market intelligence on forward guidance*

Weale mentions that the ease with which the Libor curve can be used to indicate expected future rates and volatility should not lead to the neglect of other indicators of the effects of forward guidance. He argues that the profile of expected future rates is about quarter percentage point lower than it would be in the absence of forward guidance up to two years in future. In other words, Weale states that an expectation of rates on hold for one quarter longer than the market participants' expectation in a year's time has a much bigger impact than a delay in rate rise from the present to the next quarter. So delaying a rate rise from one year ahead to two years ahead has a substantial impact at the present (Weale – 2013).⁹⁸

So in conclusion, the literature review assesses the effectiveness of forward guidance points to different outcomes depending on several variables and time horizon. Theory suggests that the effect should be powerful, provided that the policy leads to markedly lower expectations of the future path of interest rates, however, market data suggest time can play a decent role in its effects. Forward guidance policy is more state dependent than time dependent, we believe looking a longer horizon should provide better effectiveness.

d) Did it contribute: Bank Lending Channel

It is interesting to analyse the effects of QE on Bank Lending Channel (BLC). We review research presented by Buttz, Churmz, McMahon, Morotzz and Schanz (2015) about the QE and the effects on BLC.⁹⁹ They specifically concentrated on asset purchase effects, and did not include programs such as Funding for Lending Scheme, National Loan Guarantee Scheme, or Special Liquidity Scheme. As described by them, BLC can be considered as a supplementary channel of monetary policy which leads banks to increase their supply of lending. Although, such a channel is not necessary for QE to boost demand and inflation, it is nevertheless valuable to understand the unconventional monetary policy to assess whether there was an effect. The BLC captures the idea that expansionary monetary policy leads to a shift out in banks' lending supply schedules. This becomes important as banks improved the capital positioning and were in position to lend more (Buttz, Churmz – 2015).

Joyce and Spaltro (2014) wrote a paper with similar linkages and effects on lending.¹⁰⁰ Controlling for macro variables and other factors like capital, a minor positive relationship was found between total deposits and lending using pre-crisis data for UK banks. They do not reject statistically a null hypothesis that the relationship was unchanged after the onset of the financial crisis in 2008. Though, this paper looks for relationship between deposits and lending, but approach is different. First, they use data during the QE period to directly estimate whether QE had an effect on bank lending. Second, they use an identification strategy to try to shed light on a causal relationship. Third, rather than examining total deposits, they focused on wholesale OFC (Other financial corporations) deposits with direct impact from QE purchases (Joyce and Spaltro - 2014).

⁹⁸ The Bank of England. "[Forward Guidance and Its Effects.](#)" Speech by Martin Weale, National Institute of Economic and Social Research London. December 11 2013.

⁹⁹ Butt, Nicholas, Rohan Churm, Michael F. McMahon, Arpad Morotz, and Jochen F. Schanz. "[QE and the Bank Lending Channel in the United Kingdom.](#)" Warwick Economics Research Paper Series. October 2015.

¹⁰⁰ Joyce, Michael, and Marco Spaltro. "[Quantitative Easing and Bank Lending: A Panel Data Approach.](#)" Working Paper No. 504. August 2014.

Research findings lead to the result that changes in OFC deposits were not correlated with changes in lending. This result is despite controlling for bank specific effects and system wide changes in credit provision and holds across a variety of different specifications. They rejected the hypothesis that QE gave rise to a traditional BLC. QE was intended to effect through portfolio rebalancing channel which will give rise to deposits is consistent with the idea that there was no BLC effect from QE.

Buttz, Churmz, McMahon, Morotzz and Schanz (2015) conclusion was that there was no evidence suggesting that QE did not boost bank lending and it remain consistent with other studies mentioned by the author which showed QE boosting aggregate demand and inflation.

e) Pensioners and Savers

Monetary policy changes, especially the expansion via QE, will undoubtedly have a distributional implications. In theory most of the distributional effects typically should balance out over the course of a policy cycle as some groups benefit relative to others as interest rates are increased or vice versa, and reversed action as interest rates are lowered.

However, one thing to keep in mind is that due to financial crisis and large scale asset purchases, there are implications for pension providers, because developments for these companies will affect the pensions provided to the individuals participating in these schemes as they retire. The savers may benefit from high equity prices and bond pricing realizing wealth effect, however, interests they receive would have been much lower. Therefore, some individuals who are likely to have been adversely affected by the direct effects of QE depends on the composition of holdings and assets. Many households have received lower interest income on their deposits. Changes in Bank Rate, cut to almost zero to revive economy, have been the dominant influence on the interest households receive on bank deposits and pay on bank loans. Asset price increase is more heavily skewed to benefit rich among the group which may be a very small beneficiary though.

A typical fully funded pension scheme should see rise in asset value due to rise in asset prices, but at the same time fall in gilt yields raised the value of the pension fund's liabilities.¹⁰¹ On the contrary, few of the pension schemes did get negatively affected, as though assets and liabilities rose concurrently, but the ones in substantial deficit ballooned the gap even further (BOE Quarterly Bulletin – 2012).

Appointment of Governor Carney

The appointment of Mark Carney (2012) to the Governor of Bank of England did come as a surprise. Mr. Carney possesses an outstanding professional track record. In fact, he enjoyed a strong support from Ed Balls, the shadow chancellor at that time and from the UK Government as well. However, the main reason Chancellor Osborne appointed the first foreign governor of the Bank in its 318-year history was because of his previous job experience as governor of the central bank of Canada. Mr. Carney pioneered exactly the creativity and bravery that the Chancellor was looking for in his next hire.

Mr. Carney utilized forward guidance in his previous role by telling Canadian markets that rates will remain at low level for a longer horizon (more than a year), a time contingent guidance as described

¹⁰¹ Bank of England. "[The Distributional Effects of Asset Purchases.](#)" July 2012.

earlier. This aspect, upon his hiring, whether the Governor would need to reinforce his similar words with something stronger gave UK markets a confidence boost needed at the time of deep crisis. Mr. Carney announced a new setting for the Bank, on top of its existing target to keep inflation low, by using forwards guidance, he gave extra support to the economy even if there were a short-term upward effect on prices, while sticking to the firm commitment to low inflation in two or three years' time. Inflation was a concern in that period but future expected forecast showed reduction in levels to come.

Indemnification

Bank of England with HM Treasury created APF as a wholly-owned subsidiary of the Bank of England, as mentioned earlier in the chapter. It was established in January 2009 to purchase high-quality private sector assets on behalf of the Bank, in order to improve conditions of the markets and to increase the availability of corporate credit. However, Bank of England ran a risk of purchasing all these assets and suffer a loss in future negative cash flows. For this purpose, HMT was keen to protect BOE's efforts to revive economy yet suffer substantial losses. The APF was fully indemnified by HM Treasury (HMT) meaning that any financial losses as a result of the asset purchases were borne by HMT, and any gains were owed to HMT as well. Initially, it was assumed that payments due under the indemnity would be settled when the asset purchase scheme ended; however, as the scale and duration of the scheme have since increased several times significantly, on 9 November 2012, it was agreed to alter this arrangement and establish a process for ongoing quarterly transfers between the APF and HMT.

The indemnification is an interesting case as no other major central bank has the legal contract with their treasury counterpart as Bank of England does with HMT. This is not to say that if ECB, Fed or BOJ end up with negative cash flows or balance sheet shortfalls, respective governments would not assist in cash flows but does leave an open ended question. To begin with, each of those banks took these drastic measures in accordance with the approval of their respective parliaments. Therefore, indirectly these central banks are protected but BOE shows an alertness on negative cash flows and its protection.

Financial Conditions/Economic Growth

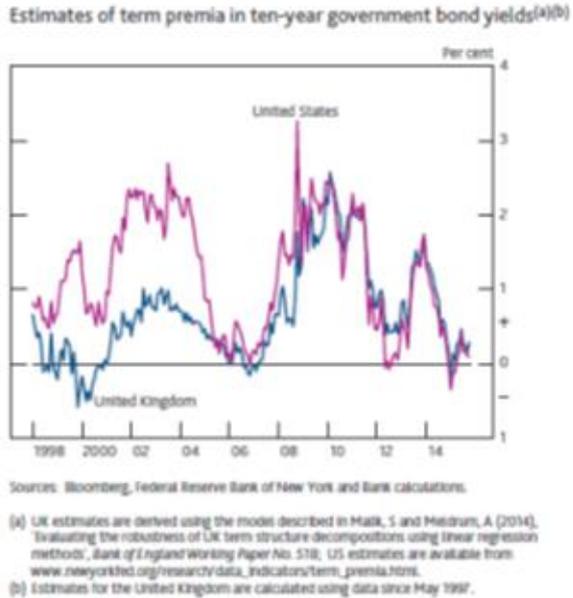
a) Ease of Financial Stress

Economic growth in UK have materially progressed gradually as compared to 2011/2012 time frame. Unemployment has come down significantly in last 4 years. Inflation has decreased to around 0.5 percent which helps BOE have expansionary monetary policy in place, but also puts their target of 2 percent annual inflation at a much harder task. As seen below in two figures, both corporate bond liquidity risk premia have come down a lot since 2012 peaks, and term premia in government bonds are at almost lows as well.

Figure II.2.18: Corporate bond liquidity risk premia have increased, but are still low



Figure II.2.19: Term premia in government bonds are low



Source: Bank of England, "[Financial Stability Report](#)," Dec 2015.

b) Exit Strategy and Rate Hike expectations

A speech labelled as “Goodbye ambiguity, hello clarity” given by Minouche Shafik (University of Warwick; Feb 2015), Deputy Governor for Markets and Banking of the Bank of England, provides insights to us on the thought process of BOE of winding down QE and the parameters satisfying the so-called ‘exit strategy’ from its quantitative easing programs.¹⁰²

One thing which clearly points out by that speech is that BOE’s emphasis on clarity and guidance to the market. Since Governor Carney arrival, two things have the most significant transformation the way BOE conducts its operations i.e. First, forward guidance to reduce volatility and uncertainty from the market, and secondly, the clear communication of the Bank’s direction. Both he championed at his previous role as Governor of Bank of Canada through the turmoil times of 2008 crisis. Ms. Shafik states that ‘ambiguity is rarely constructive’ tells us that BOE, may be through the past experiences, have realized that policy remains most effective when it is clearly communicated. Taking that stance into account, BOE will be very transparent, clear and utmost forth coming in relaying to markets in its intention about exiting from its quantitative easing and several related programs (Shafik – 2015a).

I quote Ms. Shafik here from that speech to give us signal of how they will approach exit strategy, and not when. She said, “Someday we will also need to exit QE (though that will not come at least until Bank Rate has reached a level from which it could be materially cut were more stimulus required). Such a decision will be taken in pursuit of our inflation target. But I can assure you that this will be done in an

¹⁰² Shafik, Minouche. "[Goodbye Ambiguity, Hello Clarity: The Bank of England’s relationship with financial markets](#)." Speech at The University of Warwick. February 26 2015.

orderly and clearly communicated fashion to avoid undue disruption in financial markets, including through close coordination with the Debt Management Office.” (Shafik – 2015a).

Deputy Governor Shafik gave another speech titled “Treading carefully” at Institute of Directors on December 14, 2015 carefully articulating the approach of BOE on exiting the quantitative programs. Given the better than expected data, sterling futures reflected first hike in rates last year to be in first quarter of 2016.¹⁰³ Which itself has delayed several times now. In her opinion, market is returning to normality. She highlights three key points of uncertainty which somewhat plays role in the Bank’s decision to raise rates. Those are:

- Proceeding with caution
- Considering all the outcomes
- Retaining flexibility

The Bank of England is still learning of how post crisis economy behaves and the new normal intricacies developing after massive balance sheet expansion. She wants to be convinced that wage growth is sustained at a level consistent with inflation returning to target before Bank starts to discuss raising rates. However, Bank wants to keep flexibility in either direction as Bank manages economy post crisis. MPC focuses on the Bank Rate as the marginal tool of monetary policy given it is more flexible in nature than QE. In other words, there is a very good chance that they may hold assets to maturity and gradually wind down by not reinvesting in gilts (Shafik – 2015b).

Risks

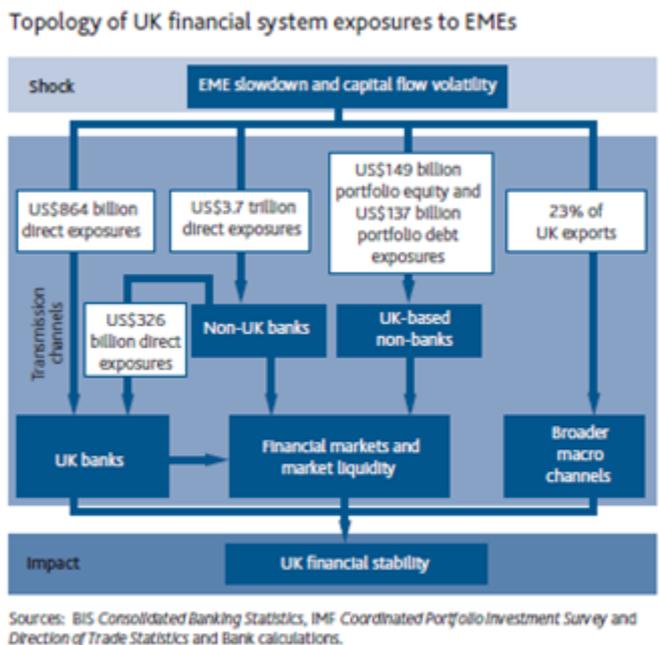
There are several internal and external risks faced by UK financial system. Eurozone sovereign risk has relatively come down from its acute level, however, risk has shifted its stance from advanced economies to emerging market economies. Global asset prices are vulnerable to sharp decline as growth forecasts in emerging countries are on downward revision spiral. As a consequence, they remain at risk to a sharp increase in long term interest rates, thus magnifying the impact of liquidity and confidence. UK does have some risks emerging internally as well which can directly or indirectly effect the financial system. Commercial real estate activity is on the rise on a bubble like symptoms and UK current account deficit remains high by historical standards. We look into these risks further more below:

a) Emerging Market Economies

As one of the leading financial center in the world, UK’s has deepened its links with emerging market economies (EME). The EMEs play an important role in global economy and are financially integrated into the UK’s economy. UK owned bank have substantial exposure to EMEs through direct lending to households and firms as well as indirect holdings of assets on their balance sheet. Below chart explains the exposure and flow of activities, which can have material effect on UK’s economy.

¹⁰³ Shafik, Minouche. "[Treading Carefully](#)." Speech at the Bank of Canada. December 14 2015.

Figure II.2.20: The U.K. is linked to EMEs through several channels



Source: Bank of England, “[Financial Stability Report](#).” Dec 2015.

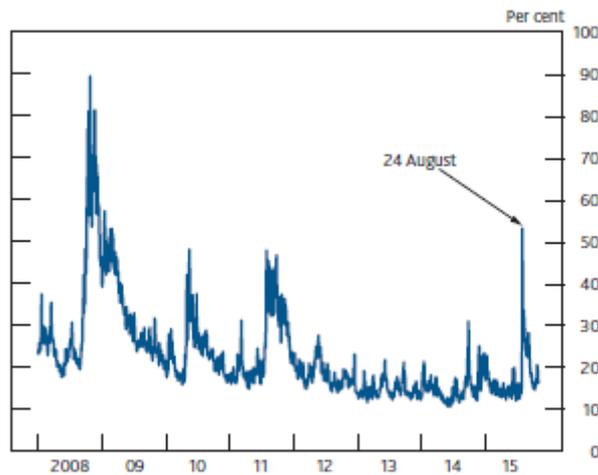
In summary, UK has substantial rise in private sector debt in emerging market economies since the crisis. One of the biggest example is HSBC Bank focus on Asian economies as it sees global growth driven out of the East. As the outlook of EME growth deteriorates further, it makes elevated debt levels more difficult to service, and as prospects rise of U.S. interest rate increase, capital outflow from EME to US have contributed to more volatile conditions. Tighter financial conditions with more capital controls and exchange rate depreciation have put more pressure on firms particularly those with foreign currency borrowing creating difficulties for them to service debt (Financial Stability Report – 2015).

b) Financial Market Fragility

As BOE looks for more normality in the economy, financial market prices are vulnerable to sharp increases in market interest rates or risk premia i.e. the compensation that investors demand for holding risky assets may be compressed in some market segments. The events of last August episode are a clear reminder that any market correction could be amplified by thin market liquidity. Also, a sustained illiquidity in financial markets can threaten the financial stability. Below graph shows the implied equity market volatility sharp increase in August 2015.

Figure II.2.21: Implied equity market volatility reached levels not seen since 2009

Highest intraday level of option-implied equity volatility of the S&P 500 index (VIX)^(a)



Source: Chicago Board Options Exchange.

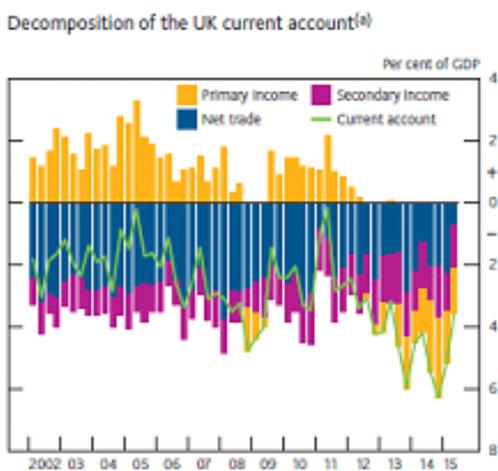
(a) Series shows the highest value of the VIX index on each day. The VIX is a measure of market expectations of 30-day volatility as conveyed by S&P 500 stock index options prices.

Source: Bank of England, “[Financial Stability Report](#).” Dec 2015.

c) UK Current Account

Since 2012, UK current account (CA) deficit has substantially increased by historical standards. This may lead to a sudden adjustment in capital flows and/or depreciation of the exchange rate, with adverse consequences for UK financial stability. Though, the CA deficit has narrowed in later half of 2015, but still remains a source of fragility and a concern for UK financial system. However, UK’s external balance sheet is more resilient as shown below as external liabilities has been falling as share of GDP.

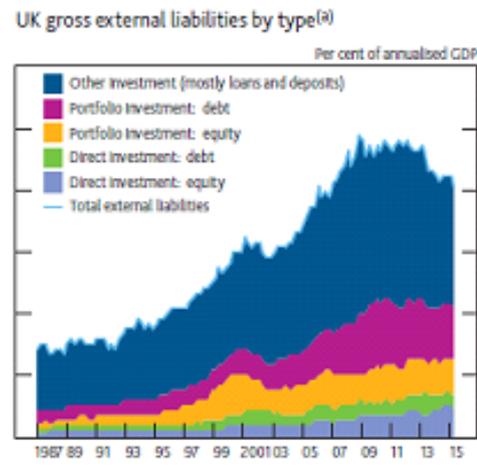
Figure II.2.22: U.K. current account deficit has widened since 2011



Sources: ONS and Bank calculations.

(a) Primary income mainly consists of compensation of employees and net investment income. Secondary income consists of transfers.

Figure II.2.23: The United Kingdom’s external liabilities as a share of GDP had been falling



Sources: ONS and Bank calculations.

(a) Derivatives are excluded.

Source: Bank of England, “[Financial Stability Report](#).” Dec 2015.

d) UK Property Markets

Increased competition in the housing markets due to rising property prices does create implications for UK financial sector. UK house price inflation has picked up as seen the graph below. Housing market activity is also picking up from the low levels driven by the buy-to-let-sector in mortgage lending.

Figure II.2.24: UK house price inflations has picked up

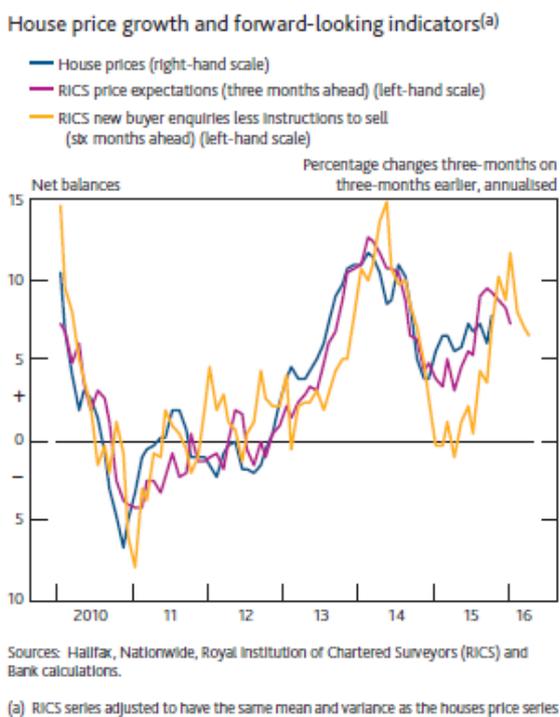
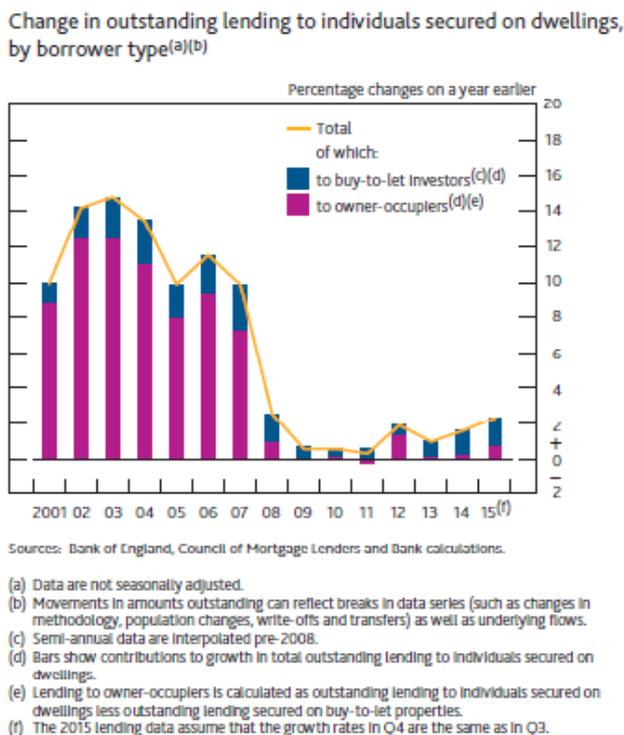


Figure II.2.25: Mortgage lending growth has been driven by buy-to-let lending

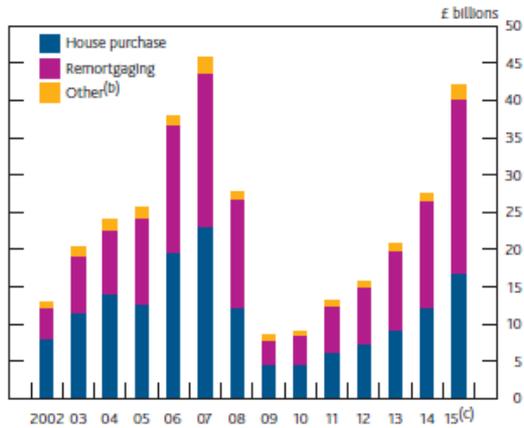


Source: Bank of England, “[Financial Stability Report](#).” Dec 2015.

The flow of buy-to-let lending is at its pre-crisis peak and compared to lending to owner-occupiers, borrowers may be more sensitive to rising interest rates risks. This could create more risks for UK financial system.

Figure II.2.26: The flow of buy-to-let lending is Near its pre-crisis peak

Gross advances of buy-to-let lending, split by purpose^(a)

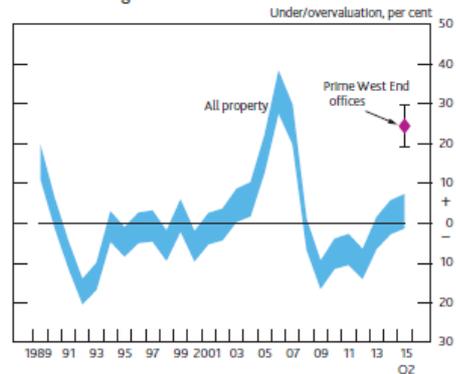


Sources: Council of Mortgage Lenders and Bank calculations.

- (a) Sterling. Non-seasonally adjusted annual data. There is a step change in 2005 H1 as a large lender submitted buy-to-let data to the Council of Mortgage Lenders for the first time.
- (b) This category includes other lending and further advances.
- (c) The 2015 data assume that the growth rates in Q4 are the same as in Q3.

Figure II.2.27: An investment valuation approach Indicates some parts of the CRE market are overvalued

Extent of under/overvaluation of commercial real estate prices in the United Kingdom^(a)



Sources: Association of Real Estate Funds (AREF), Bloomberg, Investment Property Forum, MSCI and Bank calculations.

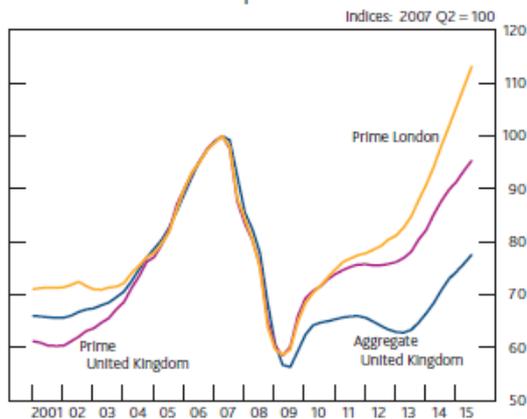
- (a) Investment valuations are based on assuming property is held for five years with the cash flows from the rent and sale discounted. It is assumed that the property is sold at a rental yield (in line with long-run averages fifteen years). The sale proceeds and rental income are discounted by the ten-year gilt yield plus a risk premium. The swathe represents varying assumptions on the average through the cycle risk premium, given the inherent uncertainty in measuring it; the lower end of the range is from a survey of investors from AREF and the higher end is a risk premium derived from the long-run relationship between gilt yields and property yields. For more details see Crosby, N and Hughes, C (2011), The basis of valuations for secured commercial property lending in the UK, Journal of European Real Estate Research, Vol. 4, No. 3, pages 225-42.

Source: Bank of England, “[Financial Stability Report](#).” Dec 2015

UK’s commercial property prices have risen very strongly in recent years as well and continue to rise especially in prime markets and in London, outpacing rents resulting in rental yields falling to very historical standards. If rates were to rise, commercial property valuations will look stretched and adds to another risk to UK financial stability.

Figure II.2.28: Strong growth in assets under management of commercial real estate open-ended funds continues

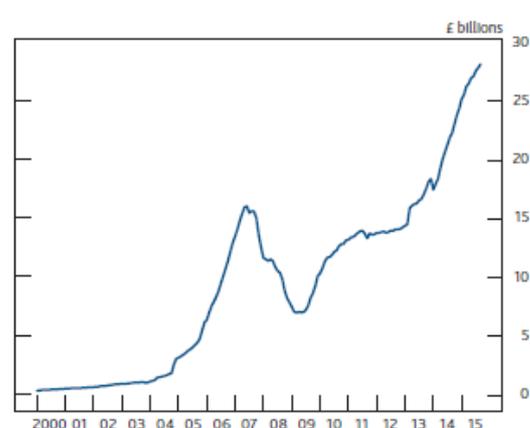
UK commercial real estate prices



Sources: MSCI and Bank calculations.

Figure II.2.29: Prices have risen strongly in recent years

Assets under management in open-ended funds investing in commercial real estate



Source: The Investment Association.

Source: Bank of England, “[Financial Stability Report](#).” Dec 2015.

e) Brexit

BOE is unlikely to do anything until referendum uncertainty is over on 23 June much like elections in US later this year and Fed reluctance to take any step until new government takes office. In the case of BOE, referendum does create a risk if UK votes to opt out. Those risks are beyond the scope of this paper, but does create financial stability risks on the horizon for BOE.

Constraints

One of the major constraints faced by BOE when purchasing under APF was the size of the asset market they were willing to buy. Few of the MPC members wanted to expand the asset buying programs beyond gilts and corporate bonds. Legally, BOE is authorized to do so by Chancellor of Exchequer with facilitates in place.

Bank of England received lot of resistance on balance sheet expansion as UK's asset markets were thin, especially UK issued corporate bonds, as BOE will end up buying a huge portion of the market. Therefore, economically and politically it did not seem to be the right action back then. Buying securitized bank loans will also lead to similar issue. Portfolio rebalancing effect should neutralize any effect but concern was felt that BOE will have a more than strong effect on a thin market. Another issue BOE faced was the assets held by troubled banks at the time of the crisis and how to evaluate them.

No other material constraint has been indicated in the literature worthy enough to be mentioned as a big concern. Most political pressure came from the opposition, but it can be disregarded as more to do with gaining public sympathy and votes, rather than solving the actual economic problem.

So in conclusion, Quantitative Easing did play a part in providing stimulus to the economy by bringing short and long term yields lower and supporting price action. It targeted specific markets or sectors such as credit, banking, liquidity and help ease the stress of the financial sector.

Figure II.2.30: Summary of BOE QE Programs (created by Author)

Program	Announcement Date	Targeted End Date	Targeted Total Purchase	Composition of Purchases	Program Details as Announced
Quantitative Easing 1 (QE1)	Jan-09	Total of £50bn of outright purchases	£50 billion	Initially, high quality private sector assets, but later converted to Gilts by issuing reserves.	APF established: The BOE will purchase up to £50 billion of high quality private sector assets.
	Mar-09	None: Ceiling of outright purchases raised	£25 billion	Gilts	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.
	May-09	None: Ceiling of outright purchases raised	£50 billion	Gilts	QE expanded: The BOE expands QE program to £125 billion in assets.
	Aug-09	None: Ceiling of outright purchases raised	£50 billion	Gilts	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 and more.
	Nov-09	None: Ceiling of outright purchases raised	£25 billion	Gilts	QE expanded: The BOE will purchase up to £200 billion in assets.
Quantitative Easing 2 (QE2)	Oct-11	None: Ceiling of outright purchases raised	£75 billion	Gilts	QE expanded: The BOE will purchase up to £275 billion in assets financed by reserve issuance; the ceiling on the private assets held remains at £50 billion.
	Nov-11	Reduced	From £50 billion to £10 billion: only approx 2bn of CP & Corp Bonds utilized and later converted into gilts	Mainly Commercial Paper and Corporate Bonds	Maximum private assets purchases reduced: HM Treasury lowers the ceiling on APF private asset holdings from £50 to £10 billion.
	Feb-12	None: Ceiling of outright purchases raised	£50 billion	Gilts	QE expanded: The BOE will purchase up to £325 billion in assets.
	Jul-12	None: Ceiling of outright purchases raised	£50 billion	Gilts	QE expanded: The BOE will purchase up to £375 billion in assets.

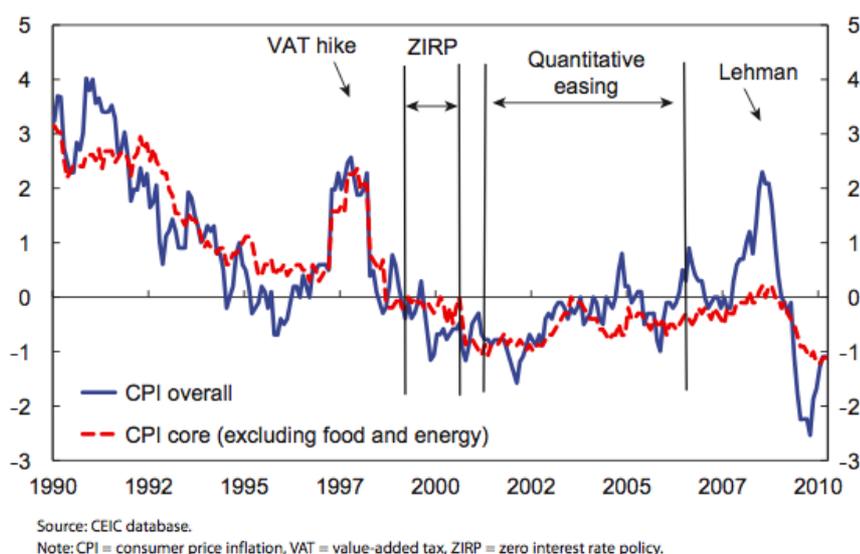
CHAPTER 3: THE BANK OF JAPAN

Bank of Japan has a long history in Quantitative Easing. This chapter reviews the recent history of the BOJ's experimentation with quantitative easing, highlighting the lessons learned and challenges faced. There are two sections. The first section reviews the BOJ's past experience since the Lost Decade and introduces Abenomics. The second section focuses on the first arrow of Abenomics - Quantitative and Qualitative Easing since 2013, showing the design and scheme, impact and effectiveness and constraints as well.

From the Lost Decade to Abenomics

The last 20 years have not been easy for Japan. The Lost Decade – a ten to fifteen year period of low economic growth and deflation – was followed by the global financial crisis in 2008 and the great earthquake in 2011. Japan was mired in mild deflation, low GDP growth, high public debt, population aging and large fiscal deficit.

Figure II.3.1: Inflation and Deflation in Japan (1990-2010)



Source: Botman, Danninger and Schiff, "[Can Abenomics Succeed? Overcoming the Legacy of Japan's Lost Decades.](#)" International Monetary Fund, Washington DC, 2015.

a) Monetary Policies Before 2013

Japan was the first central bank to implement QE. In March 2001, the BOJ introduced QE, together with a change in the operating target from the short-term interest rate to the current account balance. The BOJ expanded purchases of long-term Japanese government bonds. In March 2006, the BOJ exited QE. However, following the global financial crisis, the BOJ increased purchases of government bonds under a clear policy commitment to a zero interest rate. From October 2010, the BOJ introduced a new asset purchase program under its Comprehensive Monetary Easing policy. The purchases comprised private sector financial assets – corporate bonds, commercial paper, exchange-traded funds and real estate investment trusts (REITs) – in addition to government securities.

However, these policies didn't act as effectively as the authority expected. Japan was still struggling.

b) Lessons from Monetary Policy during the Lost Decade

We draw lessons in four broad areas. First, the experience during the Lost Decade suggests that a policy rule with a higher inflation target and more aggressive monetary easing in response to economic slack would have substantially improved the economy's performance. Leigh (2010) suggests that a higher inflation target would have warded off deflation and prevented zero interest rates during 1993-1995.¹⁰⁴

Second, the QE policies had a statistically significant impact on bond yields, risk sentiment, and equity prices, but no notable effect on the exchange rate, inflation expectations, or economic activity. Lam (2011) conducts event studies to show the impact of monetary easing on financial markets¹⁰⁵, while Ueda (2011)¹⁰⁶ and D'Amico and King (2010)¹⁰⁷ separately find no evidence that the BOJ's policy actions had an impact on the exchange rate or inflation expectation. Lam (2011) also points out that including private risky assets in the program was a key factor supporting assets prices and if the target purchase level had been expanded, it would have further supported asset prices.

Third, communication and forward guidance is important for the monetary policy transmission channel. As Ito and Mishkin (2006)¹⁰⁸ note, communications were weak when quantitative easing was introduced in March 2001, with no indication why the policy change would be effective. Especially in light of previous statements by BOJ officials that such policies might not be helpful and could result in balance sheet risks. Also, the BOJ clarified that its aim for CPI was to show an inflation rate of around zero percent or an increase year-on-year. This change too was not explained, which led to a decline in the credibility of the bank according to some observers.

Forth, efforts to end deflation and revive growth have been criticized for lacking sufficient monetary and fiscal policy coordination. As noted in Eggertsson (2006)¹⁰⁹, on the surface it might appear that there has been monetary-fiscal coordination in Japan that nonetheless was ineffective in ending deflation: the BOJ maintained interest rates near zero, while the budget deficit ballooned and the gross public debt started to exceed 150 percent of GDP by the mid-2000s.¹¹⁰

c) Introduction of Abenomics

Abenomics was launched in 2013. The comprehensive approach can be summarized by three policy arrows. The first arrow is an aggressive monetary policy by the BOJ to end deflation. The second arrow, flexible fiscal policy, means stimulus should be followed eventually by fiscal consolidation. The success depends on Prime Minister Shinzo Abe and his cabinet, with strong input from the Ministry of Finance.

¹⁰⁴ Leigh, Daniel. "[Monetary Policy and the Lost Decade: Lessons from Japan](#)" International Monetary Fund. October 2009

¹⁰⁵ Lam, Raphael.W., "[Bank of Japan's Monetary Easing Measures: Are They Powerful and Comprehensive](#)." November 2011.

¹⁰⁶ Ueda, Kazuo. "[The Effectiveness of Non-Traditional Monetary Policy Measures: The Case of the Bank of Japan](#)." Center for Advanced Research in Finance. October 2011.

¹⁰⁷ D'Amico, Stefania., and Thomsas B. King. "[Flow and Stock Effects of Large-Scale Treasury Purchases](#)." Finance and Economics Discussion Series (No 2010-52). Washington: Board of Governors of the Federal Reserve System. 2010

¹⁰⁸ Ito, Takatoshi., and F.S. Mishkin. "[Two Decades of Japanese Monetary Policy and the Deflation Problem](#)." NBER East Asia Seminar on Economics. Vol.15. University of Chicago Press, 131-202. September 2006.

¹⁰⁹ Eggertsson, Gauti .B. and Michael Woodford. "[The Zero Bound on Interest Rates and Optimal Monetary Policy](#)." Brookings Papers on Economic Activity, Vol 1. 2003.

¹¹⁰ Arslanlp, Serkan., and Dennis Botman. "[Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing](#)." International Monetary Fund. August 2015.

The third arrow, growth strategy, innovation, and structural reform, depends fundamentally on the positive responses of Japanese businesses as investors and innovators, and households as consumers and workers. The second and third arrows are deeply interrelated since good growth and sufficient private demand are essential to achieve fiscal consolidation.

The idea was this: An escape from deflation triggered by monetary easing and fiscal stimulus would lower real interest rates and stimulate investment, consumption, and—with the yen at least temporarily weaker—exports. Structural reforms would boost confidence in the near term and ensure that higher growth was sustained over the longer term. Lower real funding costs and higher growth would improve debt dynamics. And a credible medium-term fiscal plan would curtail risks of a government bond rate spike and allow for a measured pace of adjustment. Complementarities among policies would be the key—all three arrows would be required for success.

The lessons learned were taken onboard by the first arrow of Abenomics. For the first lessons, the BOJ adopted a higher inflation target supported by the Quantitative and Qualitative Easing framework. For the second, the central bank embarked on an unprecedented asset-purchase program and changed the composition of asset purchases. In terms of the third lesson, the BOJ further strengthened forward guidance. Finally, in terms of policy coordination, the BOJ and the government worked more closely.

Abenomics First Arrow: Monetary Easing

This section will introduce the BOJ’s monetary easing policies in detail since April 2013.

Change of Role and Objective of the BOJ in 2013

In January 2013, the government and the BOJ issued the joint statement on overcoming deflation and achieving sustainable economic growth. The action showed that BOJ would work more closely with the government to set monetary policies.

What’s more, The BOJ further strengthened forward guidance and communication by clarifying the price stability objective and its relation to monetary policy: it stated that it is committed to continue with easing until 2 percent inflation is achieved in a stable manner.

Design and Scheme

Table II.3.1: Important Announcements made by the BOJ since 2013

Date	Program	Event	Brief Description
1/22/2013	CME	Statement on Monetary Policy	The BOJ introduces the “open-ended asset purchasing method” (i.e., to purchase assets without setting any termination date) under the APP Set the price stability target at 2 percent in terms of the year-on-year rate of change in CPI
4/4/2013	QQE	Statement on Monetary Policy	The BOJ opens “Quantitative and Qualitative Monetary Easing”, targeting a doubling of the monetary base by 2014 to around 54 percent of GDP. The BOJ terminates the Asset Purchase Program. ¥50 trillion JGBs, ¥1 trillion ETFs and ¥30 billion J-REITs annually

2/18/2014	SBLF GSFF	Statement on Monetary Policy	The BOJ doubles the scale of SBLF and GSFF ¹¹¹ , and extends the application period for these facilities by one year
10/31/2014	QQE	Statement on Monetary Policy	The BOJ expands QQE program, accelerating JGBs purchase, extending the average remaining maturity of JGBs purchase and tripling ETFs and J-REITs purchase. 80 trillion yen JGBs, 3 trillion yen ETFs and 90 billion yen J-REITs annually
1/21/2015	SBLF GSFF	Statement on Monetary Policy	The BOJ makes amendments to GSFF and SBLF. It increases the maximum amount outstanding of its fund-provisioning to 10 trillion yen and extends the application period for two facilities by one year
12/18/2015	QQE	Statement on Monetary Policy	The BOJ extends the average remaining maturity of the Bank's JGB purchases will be extended to about 7-12 years from the beginning of 2016 and broadens the type of assets eligible to serve as collateral for central-bank loans.
1/29/2016	QQE with a negative interest rate	Statement on Monetary Policy	The BOJ applies a negative interest rate of minus 0.1 percent to part of the current accounts that financial institutions hold at the Bank.
4/11/2016	QQE with a negative interest rate	Statement on Monetary Policy	The BOJ increases the ratio applied to the portion of deposits exempt from negative rates to 2.5 percent from the initial zero.

Introduction of QQE in April 2013 (QQE1)

In April 2013, the BOJ announced its new Quantitative and Qualitative Easing framework to achieve 2 percent inflation in a stable manner with a time horizon of about two years. The central bank targeted a doubling of the monetary base – its new operational target from the uncollateralized overnight call rate – by 2014 to around 54 percent of GDP. It also changed the composition of asset purchases, with greater emphasis on longer-dated government securities and expanding purchases of risk assets such as commercial paper, corporate bonds, exchange-traded funds and Japanese REITs.

The Bank envisioned the following mechanism of QQE when it was introduced (Figure II.3.2).¹¹²

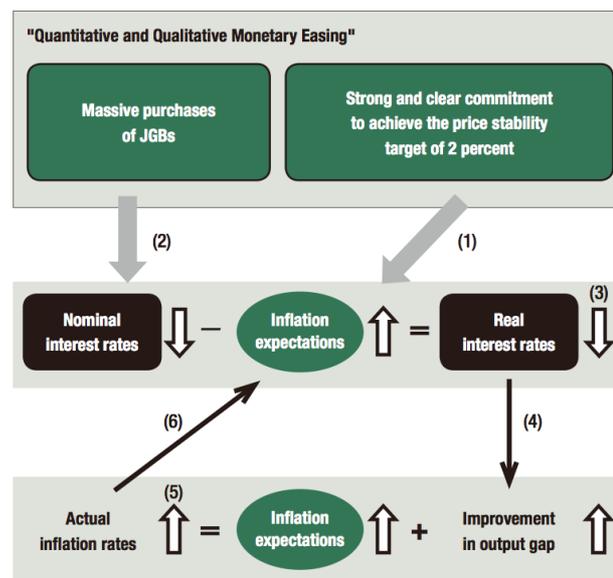
1. Conversion of the deflationary mindset and a rise in people's inflation expectations will be realized through the Bank's implementation of large-scale monetary expansion under two types of its commitments; namely, a strong and clear commitment to achieving the price stability target of 2 percent at the earliest possible time, with a time horizon of about two years, and a commitment to continue with QQE as long as it is necessary for maintaining that target in a stable manner.
2. Downward pressure will be put on nominal interest rates across the entire yield curve through massive purchases of JGBs.

¹¹¹ Under the SBLF, financial institutions are able to borrow funds from the Bank up to an amount that is twice as much as the net increase in their lending. Under GSFF, the maximum amount of the Bank's fund-provisioning under the main rules doubles from 3.5 trillion yen to 7 trillion yen.

¹¹² Bank of Japan Monetary Affairs Department, "[Quantitative and Qualitative Monetary Easing: Assessment of Its Effects in the Two Years Since Its Introduction.](#)" Bank of Japan. May 2015.

3. Real interest rates will be lowered due to the effects of (1) and (2).¹¹³
4. The decline in real interest rates will stimulate private demand, which will lead to an upturn in the economy and to an improvement in the output gap.
5. With the output gap improving, together with a rise in people's inflation expectations as described in (1), actual inflation rates will rise.
6. As the actual inflation rate increases, people's inflation expectations will increase further.
7. Meanwhile, on the financial front, asset prices such as stock prices and exchange rates will be formed reflecting, or in anticipation of, the aforementioned movements in the economy and prices.
8. Moreover, due to the strengthening of investors' preference for risky assets -- portfolio rebalancing effects -- not only positive effects on the prices of such assets but also those on the quantitative side of finance, including an increase in lending, can be expected.¹¹⁴

Figure II.3.2: Mechanism of Quantitative and Qualitative Easing



Source: Monetary Affairs Department, “[Quantitative and Qualitative Monetary Easing: Assessment of Its Effects in the Two Years Since Its Introduction](#),” Bank of Japan, 2015.

Expansion of QQE in October 2014 (QQE2)

On October 31, 2014, the BOJ further expanded its QQE program. The BOJ decided to accelerate its purchases of Japanese government bonds to an annual pace of 80 trillion yen (compared to around 50

¹¹³ Under QQE, the Bank has also purchased exchange-traded funds (ETFs) and Japan real estate investment trusts (J-REITs). These purchases can be considered to be reinforcing the whole process of QQE mainly through the strengthening of steps (7) and (8).

¹¹⁴ Among these steps, steps (1) through (6) in the mechanism of QQE can be rephrased by using terminologies for the standard framework of macroeconomics. Step (1) corresponds to a price stability target of the central bank, which normally refers to a situation where inflation is anchored to the target. Step (2) corresponds to monetary policy conduct, which normally refers to a monetary policy reaction function that controls short-term interest rates. Step (3) corresponds to the Fisher equation. Step (4) corresponds to the IS curve. Step (5) corresponds to the Phillips curve. Steps (1) and (6) correspond to inflation expectation formation.

trillion yen before), extend the average remaining maturity of JGBs purchases to around 7–10 years (an extension of about three years at most), and triple its purchases of exchange-traded funds and Japanese real estate investment trusts. The BOJ’s move was aimed at maintaining momentum in formulating inflation expectations. Specifically, long-term expectations stopped increasing during 2014 and were hovering around 1 percent.

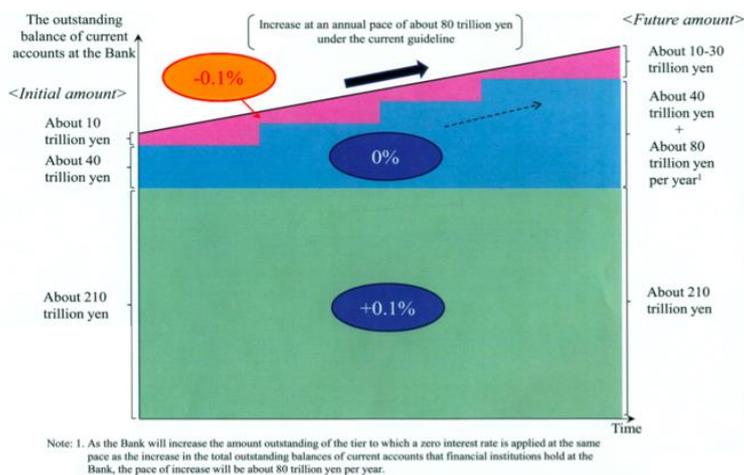
In April 2015, mainly because of the sharp fall in oil prices, the BOJ delayed the timing for achieving the 2 percent inflation target to around the first half of FY2016 while continuing to emphasize that it will continue QQE until the 2 percent inflation target is achieved in a stable manner.

QQE with negative interest rate in January 2016

Under QQE, the BOJ created an enormous amount of excess reserves and was set to continue to do so. When the BOJ started QQE in April 2013, current account deposits (basically reserves) stood at ¥58.1 trillion; the total on Jan. 31, 2016 was ¥259.3 trillion. Meanwhile, minimum reserve requirements, which were ¥7.9 trillion when the BOJ launched QQE, were still about ¥9 trillion in early 2016.¹¹⁵

In January 2016, aiming to exploit the normal logic and transmission channel of monetary easing: lower borrowing costs for those generating activity in the real economy, namely businesses, households, and the government, the BOJ introduced negative -0.1 percent deposit rates (before, it was +0.1 percent), shifting from based money targeting to rates and base money targeting. While the quantity and quality of assets target remain unchanged, the BOJ applied three tier system on interest rate (+0.1 percent, 0 percent, and -0.1 percent) on reserves. The initial amount of the reserves, to which a negative interest rate would be applied, was about 10 trillion yen (about 4 percent of total current account balances) and the size would increase over time as the BOJ expanded balance sheet. The BOJ also forecasted that the 2 percent target will be met in the first half of financial year 2017, more than four years after the launch of QQE.

Figure II.3.3: Framework of the Three-tier System



Source: The BOJ Governor Kuroda gave a speech on “The Battle Against Deflation” and provided the graph in Columbia University on April 13, 2016.

¹¹⁵ Source: Bank of Japan

The BOJ could, if it wanted to, impose a negative interest rate on all reserves, both required and excess ones. But a negative interest rate on reserves was just a tax on banks. It seemed a bit strange for a central bank to simultaneously create reserves, forcing the banks in aggregate to hold them, and impose a tax on those holdings. The BOJ did not want to tax the banking system. So it chose to impose a negative interest rate at the margin.¹¹⁶

On April 11, 2016, the BOJ increases the ratio applied to the portion of deposits exempt from negative rates to 2.5 percent from the initial zero, therefore reducing the share of funds financial institutions keep at the BOJ that subject to negative interest rate policy.

This regime shift means a few important things. First, BOJ effectively admits that they have reached limits of their QQE, both technically (as already owning 30 percent of JGBs) and economically (as QQE fails to achieve its goal of ending deflation and securing low stable inflation). Second, next easing will likely be via rate cuts further. The size of QQE will likely be unchanged.

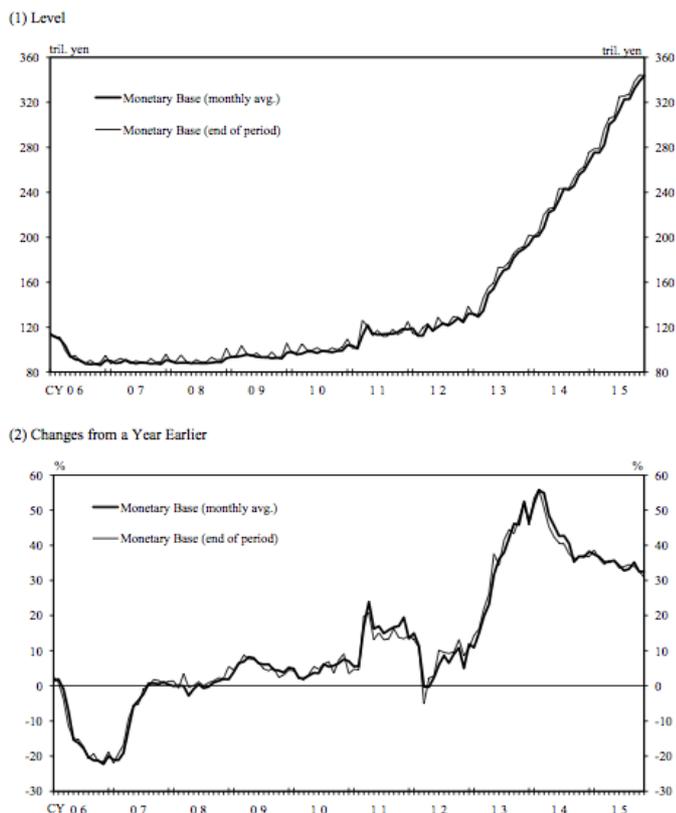
Impact and Effectiveness

Evidence of transmission mechanism under QQE1 and QQE2

The monetary base (average amounts outstanding) has increased significantly as asset purchases by the Bank of Japan have progressed, and the year-on-year rate of growth has been in the range of 30-35 percent (Figure II.3.4).

¹¹⁶ Paul J Sheard, Negative Interest Rates: Why Central Banks Can Defy “Time Preference”, Standard & Poor’s ratings services, New York, February 2016

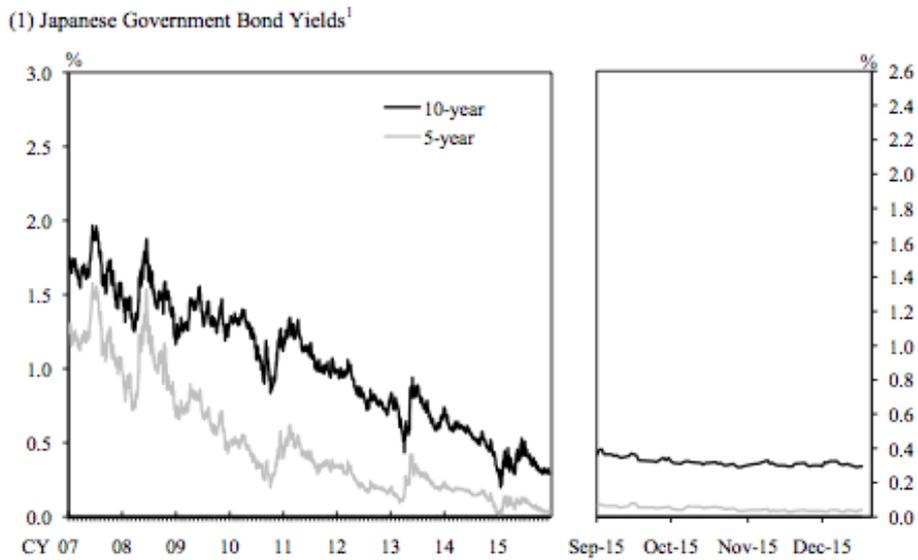
Figure II.3.4: Monetary Base



Source: Bank of Japan, "[Monthly Report of Recent Economic and Financial Development](#)," December 2015.

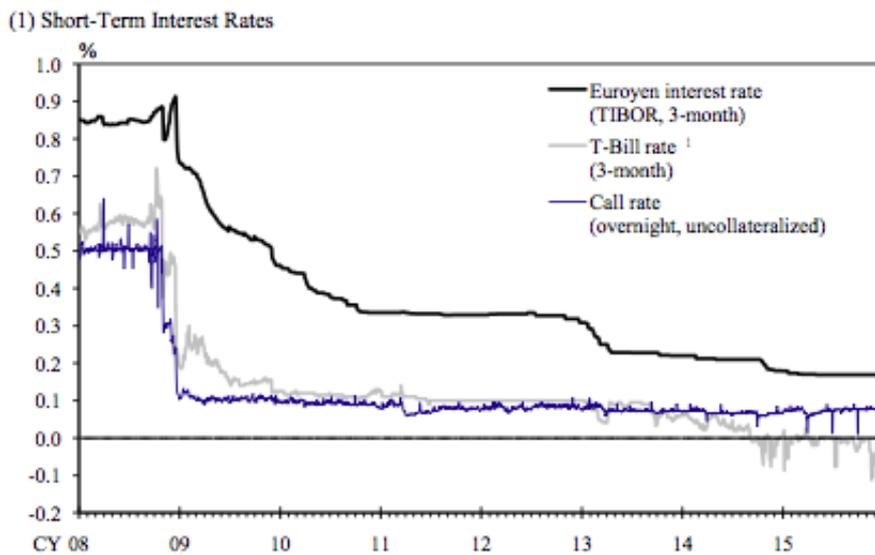
In terms of the interest rate channel, Japan's QQE1 and QQE2 have achieved the desired results. JGB bond yields have declined and remained relatively stable. The 10-year JGB bond yields hovered around 0.3 percent at the end of 2015 (Figure II.3.5). What's more, in money markets, interest rates have been stable at low levels. The overnight call rate (uncollateralized) has been below the 0.1 percent level (Figure II.3.6). These developments have been passed through to the real lending rate (Figure II.3.7). Financing conditions for firms continues to improve.

Figure II.3.5: Long-term Interest Rate



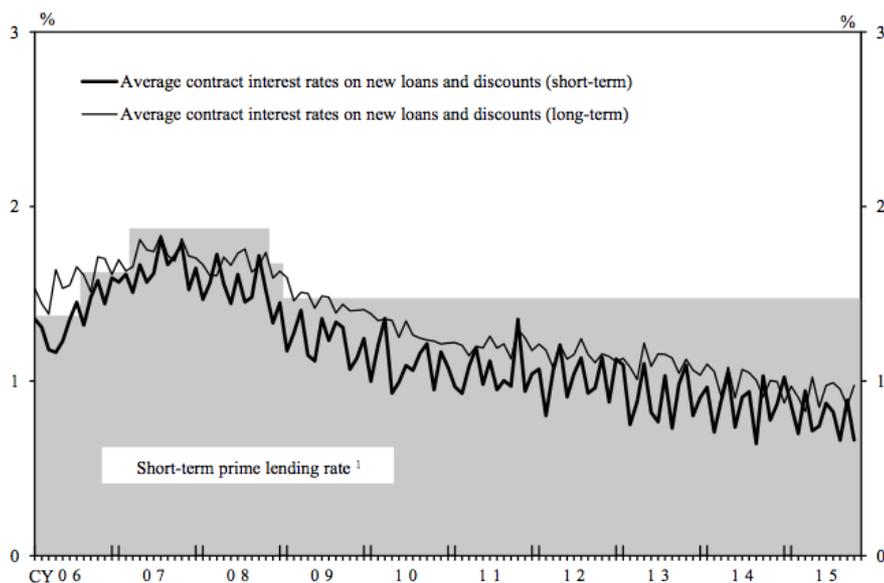
Source: Bank of Japan, "[Monthly Report of Recent Economic and Financial Development](#)," December 2015.

Figure II.3.6: Short-term Interest Rate



Source: Bank of Japan, "[Monthly Report of Recent Economic and Financial Development](#)," December 2015.

Figure II.3.7: Lending Rate

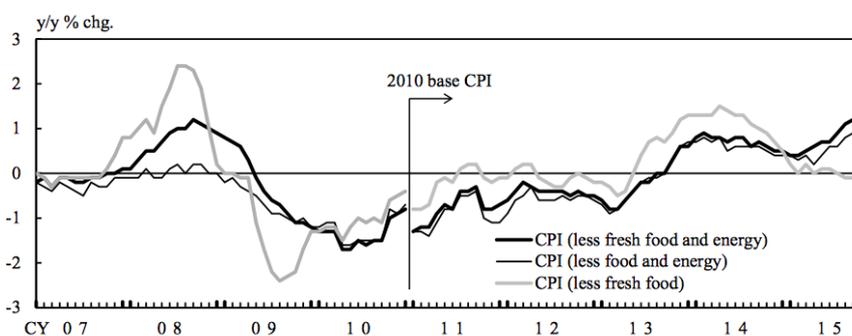


Note: 1. Data are at end of period.

Source: Bank of Japan, “[Monthly Report of Recent Economic and Financial Development](#),” December 2015.

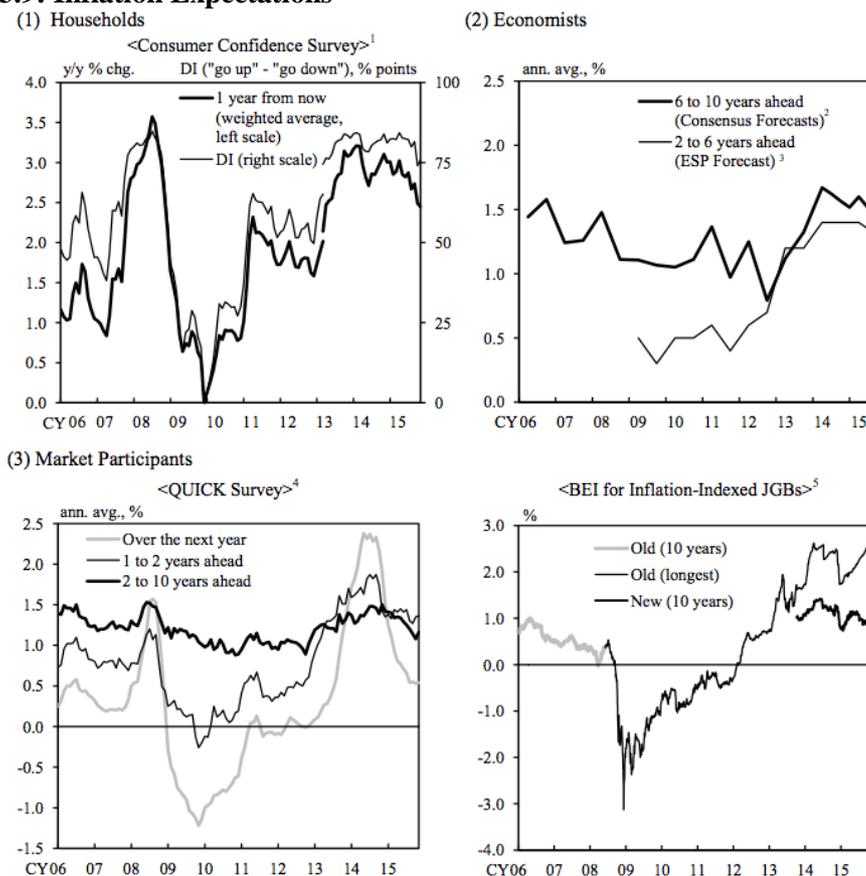
In terms of the expectations channel, progress has been mixed. CPI (less fresh food) became positive once QQE was implemented and rose to a peak 1.5 percent in April 2014. However, it has fallen rapidly then. By July 2015 it had dropped to zero, and in August was minus 0.1 percent (Figure II.3.8). Furthermore, different measures of inflation expectations have declined since mid-2014 and recently stabilized at around 1 percent (Figure II.3.9). But, as the BOJ points out, the collapse in oil prices, a relative price shift that is clearly beyond any central bank's control, has put severe downward pressure on headline inflation. The latest reading for CPI inflation, excluding fresh food and energy, is 1.3 percent year-on-year and shows an upside trend.

Figure II.3.8: CPI



Source: Bank of Japan, “[Monthly Report of Recent Economic and Financial Development](#),” December 2015.

Figure II.3.9: Inflation Expectations



Source: Bank of Japan, "[Monthly Report of Recent Economic and Financial Development](#)," December 2015.

Progress on portfolio rebalancing remains modest. Under QQE1 and QQE2, domestic banks have been the main sellers of JGBs to the central bank. All together, Japanese banks sold about ¥30 trillion of JGBs between March 2013 and September 2014, covering almost all the BOJ's net JGB purchases from the market above the net issuance of JGBs during the same period. All of Japan's top three banks reduced their JGB portfolios during this period.¹¹⁷ Since the expansion of QQE, domestic banks' holding of JGBs continue decreasing at a dramatic speed (more than 10 percent) (Figure II.3.10). At the same time, domestic bank lending has accelerated only modestly since the launch of QQE, rising by about 2.5 percent for commercial banks by end-2015 (Figure II.3.10). Banks accumulate significant excess reserves (Figure II.3.11). Credit growth remained subdued.

Meanwhile, Japanese banks continued to expand their overseas loan portfolios, which now exceed \$500 billion for the first time in more than 15 years. Most of the rise in overseas loans reflects expansion into Association of Southeast Asian Nations (ASEAN) countries, including Indonesia and Thailand. About 60 percent of external loans are financed through external deposits; the rest are financed through foreign-currency-denominated bonds and short-term lending instruments, such as foreign exchange swaps, to hedge exchange rate risk.¹¹⁸

¹¹⁷ Arslanlp, Serkan., and Dennis Botman. "[Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing.](#)" International Monetary Fund. August 2015.

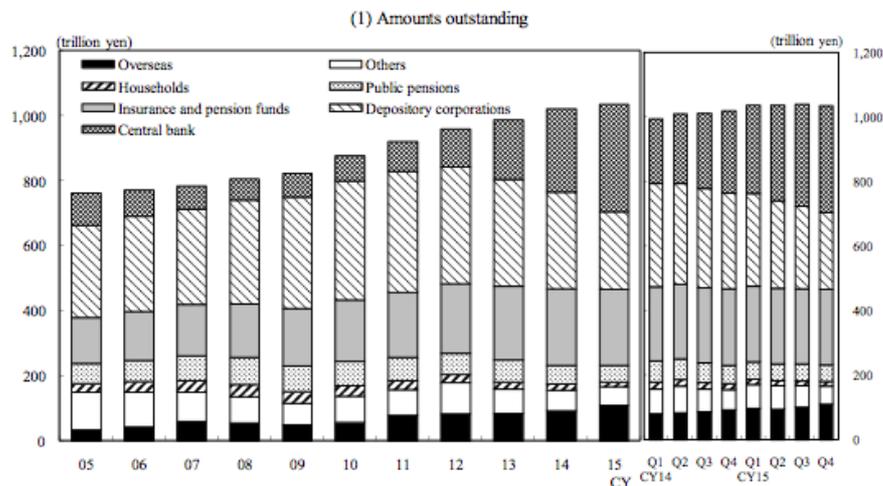
¹¹⁸ [Ibid](#)

Similar to commercial banks, public pensions have decreased their holdings of JGBs since the introduction of QQE. The percentage of their holding amounts outstanding in December-end 2015 was around merely 5 percent.

In contrast, insurance and private pension funds maintained a strong appetite for JGBs between March 2013 and September 2015 while they started to decline the holdings since then (Figure II.3.10). Outward portfolio investment by insurance companies was relatively limited. However, they have risen for public and private pension funds, spurred by the shifts in the asset allocation targets of the largest pension fund—the Government Pension Investment Fund (GPIF)—from JGBs to foreign securities.¹¹⁹ The maturity extension of JGB purchases under QQE2 leads to more JGB sales by Japanese insurance companies and pension funds that predominantly hold long-term JGBs. Since, unlike banks, these institutional investors cannot hold excess reserves at the central bank, they provide fresh liquidity to new parts of the financial system, such as real estate, corporate bonds, and equities, stimulating more portfolio outflows by institutional investors (Figure II.3.12).

¹¹⁹ [Ibid](#)

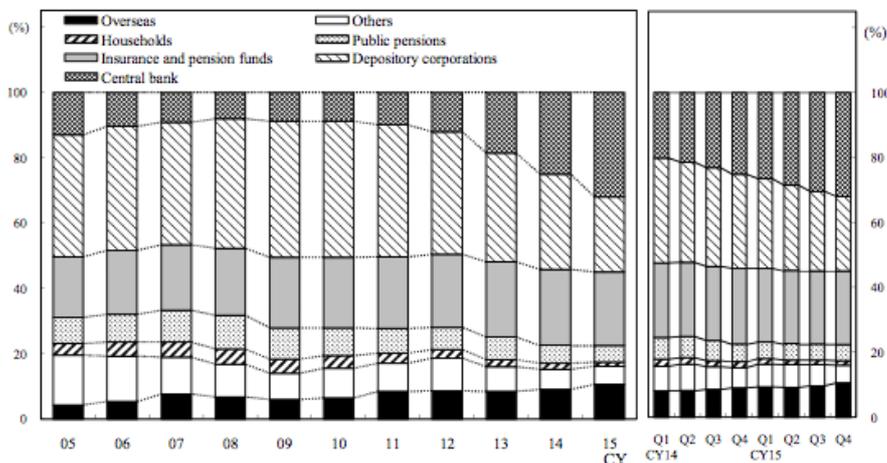
Figure II.3.10: Government Bonds and Treasury Bills held by Sectors



(2) Changes from a year earlier

	2014				2015				Amounts outstanding in December-end 2015 in trillion yen (percentage ratio in parentheses)
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Amounts outstanding (End of period, trillion yen)	996	1,011	1,013	1,021	1,038	1,037	1,040	1,036	
Total	2.7	4.2	3.3	3.4	4.3	2.7	2.7	1.5	1,036 (100.0)
Central bank	57.2	43.8	37.0	39.5	36.6	37.3	35.3	29.5	331 (32.0)
Depository corporations	-12.6	-7.5	-8.3	-9.7	-10.3	-13.0	-17.0	-19.9	238 (23.0)
Insurance and pension funds	1.8	3.8	2.7	4.4	2.2	1.5	0.8	-1.1	234 (22.6)
Public pensions	-3.4	-5.1	-9.7	-17.1	-19.2	-19.8	-16.2	-8.8	52 (5.0)
Households	-13.1	-10.8	-12.1	-13.9	-19.7	-24.4	-25.1	-26.3	14 (1.3)
Overseas	-0.6	2.7	10.5	11.0	20.3	13.9	16.4	18.1	110 (10.6)
Others	1.0	-4.3	-9.7	-15.5	-3.9	-12.0	-5.0	-9.2	57 (5.5)

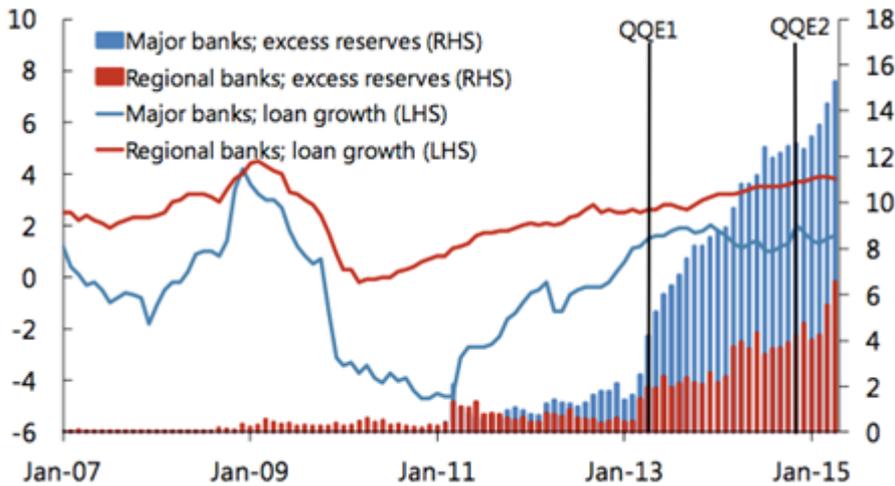
(3) Composition



Notes: 1. Government bonds and treasury bills are the sum of "Treasury discount bills" and "Central government securities and FILP bonds." They include those issued by "Fiscal Loan Fund" (in the public financial institutions sector) together with those issued by "Central government" (in the general government sector).

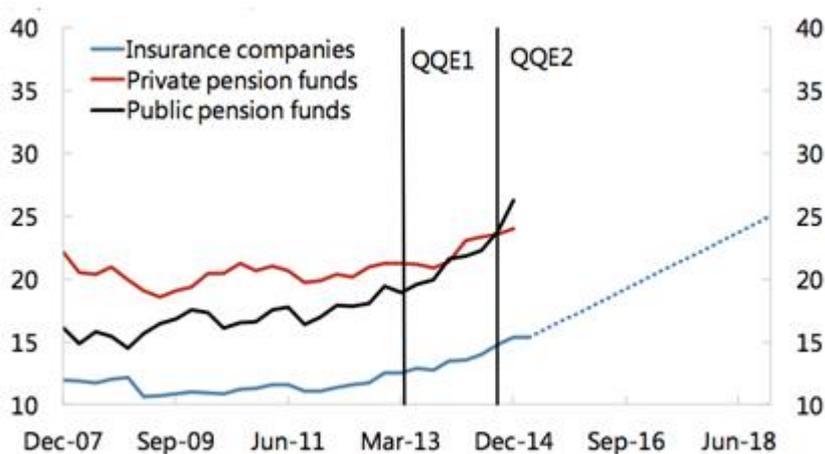
Source: Bank of Japan, "Flow of Funds for the Fourth Quarter of 2015," April 5 2016.

Figure II.3.11: Japanese Banks: Excess Reserves and Domestic Lending
(excess reserves as a percent of bank assets; year-over-year percent changes in loans)



Source: Arslanlp and Botman, [Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing, International Monetary Fund](#), August 2015.

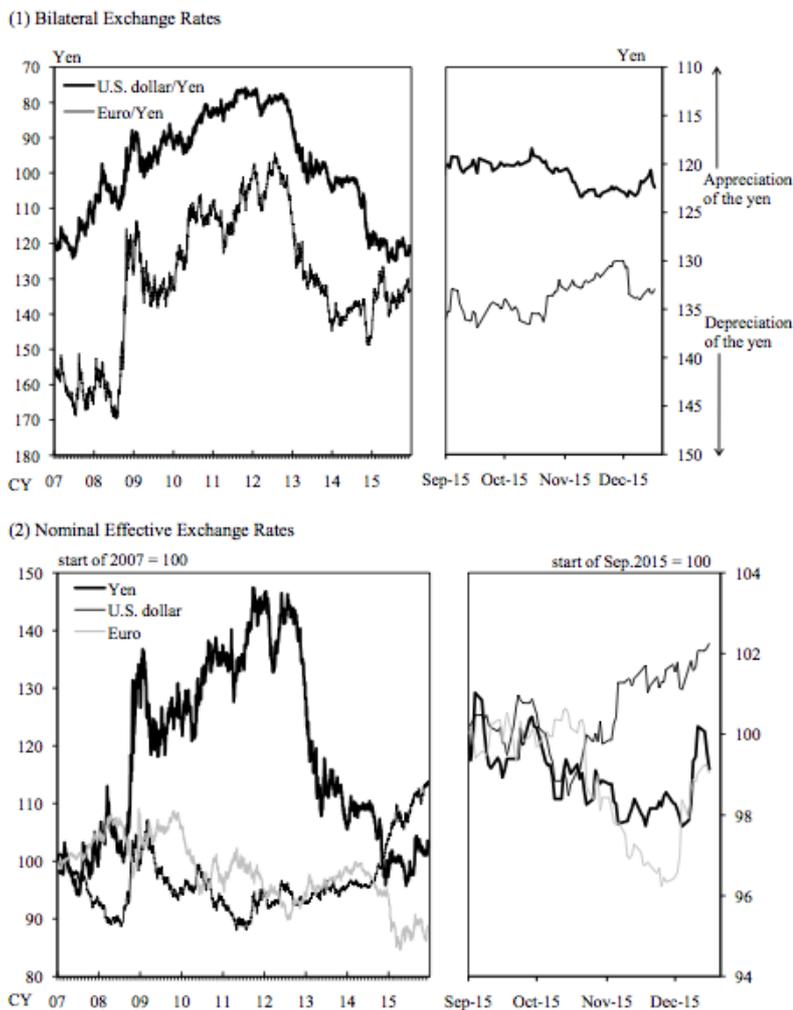
Figure II.3.12: Japanese Institutional Investors' Foreign Security Holdings
(in percent of total assets)



Source: Arslanlp and Botman, [Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing, International Monetary Fund](#), August 2015.

Finally, QQE1 and QQE2 have contributed to the weakening of the yen and supported confidence, helping to reverse the large output gap that existed at end-2012 and the overvaluation of the real exchange rate prior to Abenomics. As of December 2015, the exchange rate has depreciated dramatically since September 2012 (Figure II.3.13).

Figure II.3.13: Exchange Rate

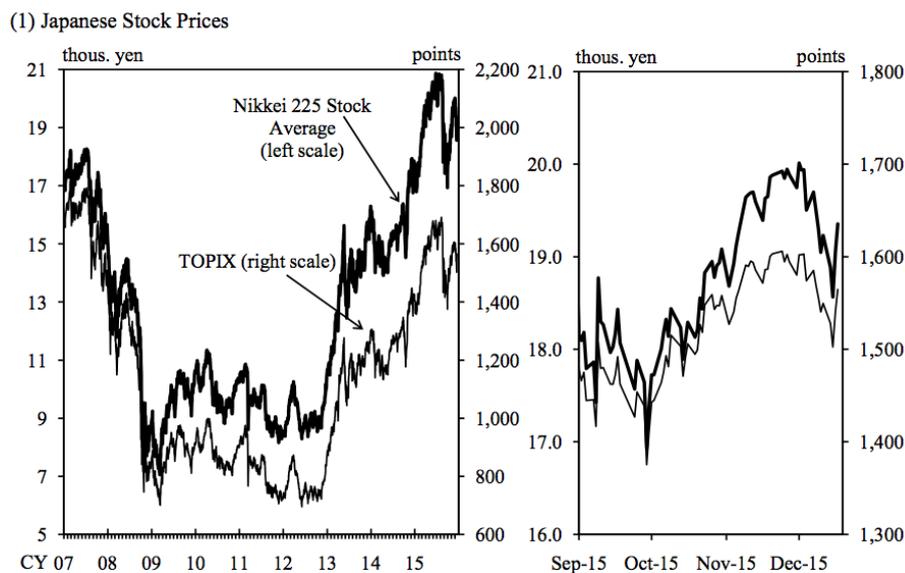


Source: Bank of Japan, [Monthly Report of Recent Economic and Financial Development](#), Tokyo, December 2015

Further, stock prices have more than doubled since the launch of QQE. The Nikkei index rose from 14,000 points to around 19,000 points at the end of last year. It even soared past the 20,000 mark at some points during the period (Figure II.3.14). The rise is driven by increased profitability of large corporations on the back of yen depreciation, lower corporate income tax rates, recent corporate governance reforms, and increased buybacks by companies. The portfolio allocation shift by the GPIF towards equities and other riskier assets and the BOJ's additional purchases of ETFs may have also contributed to this outcome. However, the positive wealth effects from the stock price rally contribute in a limited way given the relatively small share of equity holdings by households.¹²⁰

¹²⁰ [Ibid](#)

Figure II.3.14: Stock Price



Source: Bank of Japan, “[Monthly Report of Recent Economic and Financial Development](#),” December 2015.

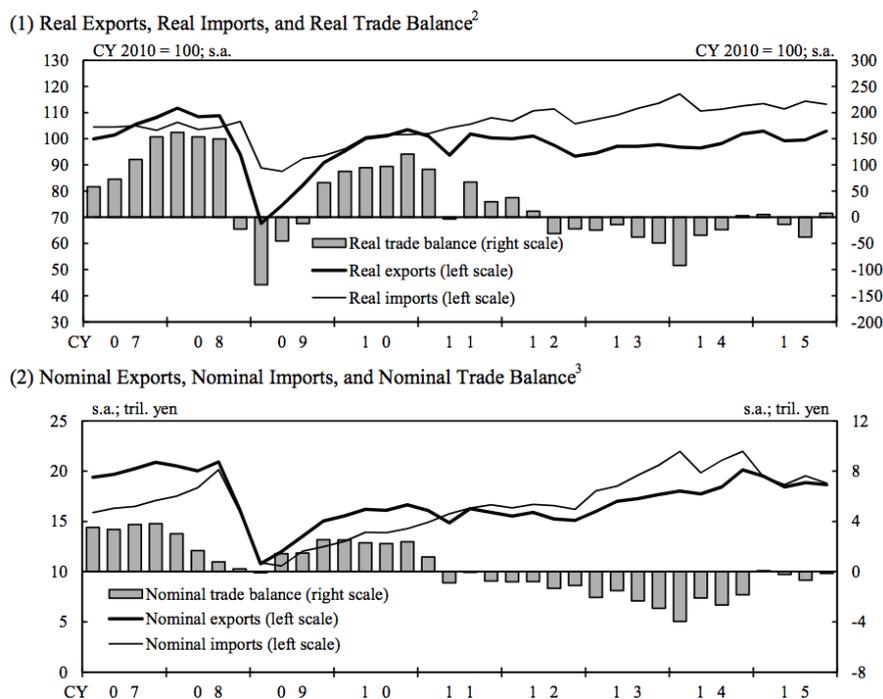
At the same time, transmission to the real economy and inflation has been weaker than expected. Japan's GDP only grew 0.4 percent in 2015, following zero percent growth in 2014 and 1.4 percent expansion in 2013. Its economy shrank 1.4 percent in the fourth quarter of 2015. The country's annual trade balance has been in negative territory since 2011, with the trade deficit reaching 2.8 trillion yen in 2015, a result already mitigated by the fall in oil prices in the international market. What's more, salaries for ordinary Japanese workers have dropped. The average monthly wage dropped 0.9 percent in 2015 from the year before, while the average household expenditure declined 4.4 percent year-on-year in December 2015. This indicates that Japan has gradually been trapped in a vicious cycle, with prices rising and incomes declining under Abe's monetary easing.¹²¹

The reasons behind are complex. First, exports did not respond strongly to the weaker yen (Figure II.3.15). As IMF suggests, offshoring, a substitution of production at the source of overseas demand for exports, seems to be the main culprit. Over the last two decades, Japanese firms have expanded abroad to exploit labor cost differentials and rising demand in host countries. The pace of offshoring accelerated since the global financial crisis, partly due to large yen appreciation and uncertainty about energy supply after the 2011 earthquake. As a result, overseas investment now accounts for about 25 percent of total manufacturing investment, while domestic production capacity declined by about 4 percent since 2011. In 2014, exports by Japanese overseas subsidiaries (to countries excluding Japan) exceeded exports from Japan by more than 40 percent. In addition, with deepening of global supply chains, more Japanese firms that used to export intermediate goods have expanded abroad and some intermediate good supplies are now sourced from local suppliers in host countries. This explains the broad decline in Japanese value-added embedded in other countries' gross exports since mid-2000s.¹²²

¹²¹ Jiao Kun, [Limitations of Japan's QE program Exposed](#), Global Times, February 23, 2016.

¹²² IMF. “[2015 Article IV Consultation – Press Release; Staff Report; And Statement by the Executive Director for Japan.](#)” Country Report 15/197. July 2015.

Figure II.3.15: Exports and Imports

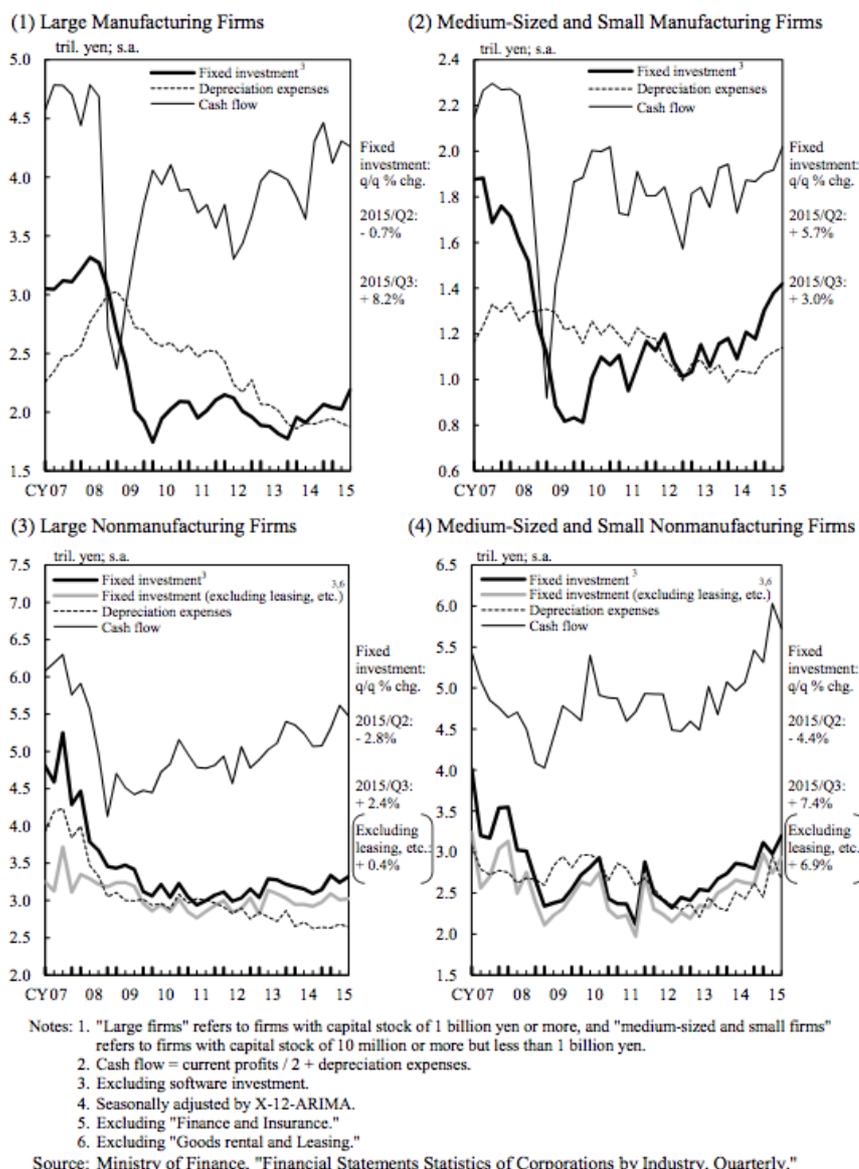


Source: Bank of Japan, “[Monthly Report of Recent Economic and Financial Development](#),” December 2015.

Second, credit demand remained tepid, reflecting weak investment in Japan (Figure II.3.16) in turn related to the uncertain outlook for domestic demand. The easing policies are designed to inject more funds into the market, but firms are usually not willing to increase investment through borrowing as the structure of the real economy has not improved. Also, large manufacturing firms continued to have ample cash holdings implying a limited need for borrowing, while household borrowing remained broadly flat.¹²³

¹²³ Arslanlp, Serkan., and Dennis Botman. “[Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing](#).” International Monetary Fund. August 2015.

Figure II.3.16: Business Fixed Investment by Industry and Size



Source: Bank of Japan, "[Monthly Report of Recent Economic and Financial Development](#)," December 2015.

Overall, monetary easing cannot tackle the structural problems facing Japan's economy. Issues such as an aging population, a weak domestic market and erosion of Japanese firms' competitiveness in the global economic system cannot be simply solved by monetary easing.

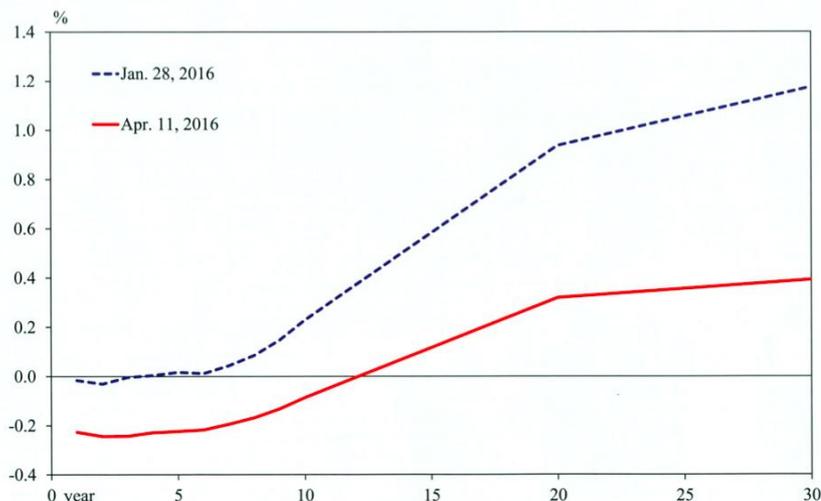
Evidence of transmission mechanism under QQE with a negative interest rate

BOJ's move to negative interest rate was a massive surprise to the market. The policy had immediate effects on financial markets, even before it actually started on February 16.

In terms of interest rate channel, the 10-year JGB yield halved from around 23 bps to around 10 bps on the day of the announcement and fell below 5 bps in trading the next day. In mid March, about 70 percent of government bonds have a yield of zero or below, meaning investors are paying to hold the debt. As of April 11, JGB yields at all maturities have largely decreased (Figure II.3.17). The bond market is hurt,

with 69 percent of traders in February saying market function has declined compared with three months ago, according to a BOJ survey¹²⁴. What's more, the average rate on all new loans at the nation's banks plunged to a record-low 0.793 percent in February.¹²⁵ Japan's three biggest banks have cut their deposit rate to a record low of 0.001 percent.

Figure II.3.17: JGB Yield Curve



Source: Bloomberg

The value of the BOJ's latest surprise move may be as much in its signaling effect, and effect on the public's expectation, as its measurable or tangible monetary easing effect. For the BOJ and for Governor Kuroda to win its battle to end deflation and to restore operational price stability, it is imperative that the central bank succeeds in continuing to shift the public's inflation expectations toward its 2 percent inflation target and to counter any tendency for the ground won in that long hard battle to be lost. However, Japanese companies cut their forecasts for inflation for the next five years from April 2016, indicating that even after adopting a negative-rate policy, the Bank of Japan is struggling to persuade businesses that sustained price gains will take hold. Companies project 1.2 percent of inflation at this time in five years, down from 1.4 percent estimated in December, according to a BOJ Tankan report for March released Monday. In three years, they expect 1.3 percent price growth, and 0.8 percent in one year.¹²⁶

Evidence on Portfolio rebalancing is disappointing. In theory, negative rate helps portfolio rebalance because bond prices will have to go up across the whole of the yield curve to restore equilibrium, in the sense of making financial institutions indifferent between holding reserves yielding minus 10 bps and holding bonds of the respective various maturities. However, the so far evidence shows that the money market and loan market are destroyed. All 11 companies running money-market funds stopped accepting new investments and money from the funds is moving to deposits.¹²⁷ The freeze in Tokyo's market for overnight loans extends into a third month as the policy makes it harder for brokers to price and process transactions. The outstanding balance in the interbank call market tumbled to a record low 2.97 trillion yen (\$27 billion) on March 31, according to Tanshi Kyokai data going back to 1988.¹²⁸ Further, with

¹²⁴ [Survey on February 2016](#), Bank of Japan, Tokyo, March 2016.

¹²⁵ Gareth Allan and Shingo Kawamoto, [Negative Rates Failed to Boost Japan Bank Lending in March](#), Bloomberg, April 2016.

¹²⁶ Toru Fujioka, [Japan Inc. Inflation Expectations Decline as Confidence Wanes](#), Bloomberg, April 3 2016.

¹²⁷ Toru Fujioka and James Mayger, ["The effects of a month of negative rates in Japan"](#) Bloomberg, March 13 2016.

¹²⁸ Mogi, Chikako and Saburo Funabiki, ["BOJ Negative Rate Risk Destroying Loan Market As Freeze Deepens."](#) Bloomberg, April 3 2016.

concerns that deposit rates may go below zero, sales of safes are surging. The number of 10,000 bills in circulation in 2015 rose at the fastest pace in more than a decade, which may suggest households are hoarding cash.¹²⁹

The so far effect on exchange rate is confusing. The yen depreciated about 2 percent on the news immediately. But the policy hasn't provided a lasting weakening to the currency. In early April, the yen extends gains beyond the key 110 per dollar rate to its strongest level since October 2014. It seems improbable because JGBs bond yields are negative for many maturities, ostensibly diminishing the allure of the nation's currency. The rise in the yen is troublesome because it sets up more disinflation and export drag in a major economy where aggressive policy stimulus has already been tried.

Last, the effect on stock market is not lasting as well. Japan's stock market rose for two days in a row following the BOJ's announcement about adopting negative interest rates, but since the beginning of February, the Nikkei index has tumbled to around 16,000 points.

Constraints and Limitations

The Bank of Japan is running out of government bonds to buy. First, the central bank's target of 80 trillion yen (\$733 billion) in government bond purchases per year is an amount that's more than double the pace of new bond issuance planned by the Ministry of Finance and about 16 percent of gross domestic product.¹³⁰ Second, there is a "minimum" level of demand for JGBs from banks, pension funds, and insurance companies due to collateral needs, asset allocation targets, and asset-liability management (ALM) requirements. As such, the sustainability of the BOJ's current pace of JGB purchases may become an issue. The IMF estimates the Bank of Japan may have to reduce its purchasing program by 2017 or 2018 due to the lack of bonds.¹³¹

¹²⁹ Toru Fujioka and James Mayger, [The effects of a month of negative rates in Japan](#), Bloomberg, March 13 2016.

¹³⁰ Kawa, Luke. "[Japan is Fast Approaching the Quantitative Limits of Quantitative Easing](#)." Bloomberg, April 6 2016.

¹³¹ Arslanlp, Serkan., and Dennis Botman. "[Portfolio Rebalancing in Japan: Constraints and Implications for Quantitative Easing](#)." International Monetary Fund. August 2015.

Figure II.3.18: Summary Table of BOJ QE Programs (created by Author)

Program	Announcement Date	Targeted End Date	Targeted Total Purchase	Composition of Purchases	Program Details as Announced
SFSO	2-Dec-08	31-Mar-09			Lend an unlimited amount to banks at the collateralized overnight call rate and collateralized by corporate debt
	19-Feb-09	30-Sep-09			Extend the program through the end of September
	15-Jul-09	31-Dec-09			Extend the program through the end of the year
	30-Oct-09	31-Mar-10			Extend the program through 2010:Q1
	19-Dec-08	None given	JGB: 1.4 trillion yen monthly	JGBs	Increase JGB purchases from 1.2 trillion yen to 1.4 trillion yen; look into purchasing commercial paper
Outright JGB/CFI purchases	22-Jan-09	31-Mar-09	Commercial paper and ABCF: 3 trillion yen	Commercial paper, ABCF	purchase up to 3 trillion yen in commercial paper and ABCF; investigate outright purchases of corporate bonds
	19-Feb-09	30-Sep-09	corporate bonds: 1 trillion yen	corporate bonds	extend commercial paper purchases through the end of September; purchase 1 trillion yen in corporate bonds
	18-Mar-09	None given	JGB: 1.8 trillion yen	JGBs	increase monthly JGB purchases to 1.8 trillion
	15-Jul-09	31-Dec-09			extend commercial paper and bonds purchases through the end of
	1-Dec-09	None given			offer 10 trillion yen in 3-month loans against the full menu of eligible collateral at the uncollateralized overnight call rate
FROs	17-Mar-10	None given			expand the size to 20 trillion yen
	30-Aug-10	None given			add 10 trillion yen in 6-month loans
	19-Sep-12				reduce the availability of 6-month FRO loans by 5 trillion yen
	30-Oct-12				reduce the availability of 6-month FRO loans by 5 trillion yen
	5-Oct-10	None given	JGB and treasury discount bill: 3.5 trillion yen; commercial paper and corporate bond: 1 trillion; ETF and J-REIT: 0.5 trillion yen	JGBs treasury discount bills, commercial papers, corporate bonds, ETFs and J-REITs	establish APP; purchase 5 trillion yen in assets
CME	14-Mar-11	None given	JGB: 0.5 trillion yen; Treasury discount bill: 1 trillion yen; Commercial paper: 1.5 trillion yen	JGBs treasury discount bills, commercial papers	Expand APP; purchase an additional 5 trillion yen in assets
	4-Aug-11	None given	JGB: 2 trillion yen; Treasury discount bill: 1.5 trillion yen; Commercial paper: 0.1 trillion yen; Corporate bond: 0.9 trillion yen; ETF: 0.5 trillion yen; J-REIT: 0.01 trillion	JGBs treasury discount bills, commercial papers, corporate bonds, ETFs and J-REITs	Expand APP/FROs; purchase an additional 5 trillion yen in assets; expand by 5 trillion yen 6 month-collateralized loans

	27-Oct-11	None given	JGB: 5 trillion yen	JGBs	Expand APP: purchase an additional 5 trillion yen in JGBs
	14-Feb-12	None given	JGB: 10 trillion yen	JGBs	Expand APP: purchase an additional 10 trillion yen in JGBs
	27-Apr-12	None given	JGB: 10 trillion yen; ETF: 0.2 trillion yen; J-REIT: 0.01 trillion yen	JGBs, ETFs and J-REITs	Expand APP: purchase an additional 10 trillion yen in JGBs, 0.2 trillion yen in ETFs, 0.01 trillion yen in J-REITs
	12-Jul-12	None given	Treasury discount bill: 5 trillion yen	Treasury discount bills	Expand APP: purchase an additional 5 trillion yen in treasury discount bills
	19-Sep-12	None given	JGB: 5 trillion yen; Treasury discount bill: 5 trillion yen	JGBs, treasury discount bills	Expand APP: purchase an additional 5 trillion yen in JGBs and 5 trillion yen in treasury discount bills
	30-Oct-12	None given	JGB: 5 trillion yen; Treasury discount bill: 5 trillion yen; Commercial paper: 0.1 trillion yen; Corporate bond: 0.3 trillion yen; ETF: 0.5 trillion yen; J-REIT: 0.01 trillion	JGBs, treasury discount bills, commercial papers, corporate bonds, ETFs and J-REITs	Expand APP: purchase an additional 10.01 trillion yen in assets
	20-Dec-12	None given	JGB: 5 trillion yen; Treasury discount bill: 5 trillion yen	JGBs, treasury discount bills	Expand APP: purchase an additional 5 trillion yen in JGBs and 5 trillion yen in treasury discount bills
	22-Jan-13	None given			Introduce the "open-ended asset purchasing method" (ie, to purchase assets without setting any termination date) under the APP; Terminate APP
GSFF	4-Apr-13				Offer 3 trillion yen in 1-year loans to private financial institutions
	21-May-10	None given			Expand another 0.5 trillion loans
	14-Jun-11	None given			Double the scale of GSFF to 7 trillion yen, and extend the loan application period for one year
	18-Feb-14	None given			Extend the loan application period by one year
	21-Jan-15	None given			Fund up to 100 percent of depository institution's net increase in lending to the nonfinancial sector
SBLF	30-Oct-12	None given			Double the scale (ie, financial institutions are able to borrow funds from the Bank up to an amount that is twice as much as the net increase in their lending), and extend the loan application period
	18-Feb-14	None given			Increase the maximum amount of GSFF to each financial institution from 1 trillion yen to 2 trillion yen and the maximum amount outstanding of its fund-provisioning from 7 trillion yen to 10 trillion yen, and extend the loan application period by one year
	21-Jan-15	None given			Purchase different kinds of assets, targeting a doubling of the monetary base by 2014
QQE	4-Apr-13	None given	JGBs: 50 trillion yen annually ETFs: 1 trillion yen	JGBs, ETFs and J-REITs	Expand QQE: accelerate JGBs purchase, extending the average remaining maturity of JGBs purchase and triple ETFs and J-REITs purchase
	9-Oct-14	None given	JGBs: 80 trillion yen annually ETFs: 3 trillion yen	JGBs, ETFs and J-REITs	Expand QQE: accelerate JGBs purchase, extending the average remaining maturity of JGBs purchase and triple ETFs and J-REITs purchase
	18-Dec-15	None given	JGBs: 80 trillion yen annually ETFs: 3 trillion yen	JGBs, ETFs and J-REITs	Expand QQE: accelerate JGBs purchase, extending the average remaining maturity of JGBs purchase and triple ETFs and J-REITs purchase
	29-Jan-16	None given	JGBs: 80 trillion yen annually ETFs: 3 trillion yen	JGBs, ETFs and J-REITs	Expand QQE: accelerate JGBs purchase, extending the average remaining maturity of JGBs purchase and triple ETFs and J-REITs purchase
QQE with a negative interest rate	11-Apr-16	None given	JGBs: 80 trillion yen annually ETFs: 3 trillion yen	JGBs, ETFs and J-REITs	Increase the ratio applied to the portion of deposits exempt from negative rates to 2.5 percent from the initial zero

CHAPTER 4: THE EUROPEAN CENTRAL BANK

Overview: The Last Central Bank to Implement QE

The European Central Bank introduced unconventional monetary policy eight years after the Federal Reserve and the Bank of England. The ECB announced the Public Sector Purchase Program (PSPP) in January 2015 as a main component of the Expanded Asset Purchases Program (EAPP). The PSPP was in addition to an already diverse set of policies implemented by the ECB in response to the financial crisis.¹³² The existing policies included liquidity facility extensions and asset purchase programs. The policy's design and implementation had different objectives. After 2013, the Eurozone faced slow economic recovery, high levels of unemployment, decreasing inflation, and more concerning, a fall in future expected inflation. Consequently, the ECB reduced the deposit rate below the zero bound in June 2014.

Structural setup and events within the Euro area somewhat restricted the timing, design and implementation of the ECB's unconventional monetary policies. The strategy and structure of the ECB's policies are very different when compared to those of the Fed, BOJ and BOE. The ECB's behaviour is governed by a strict legal framework, historical factors and institutional fundamentals such as the inflation and price stability mandate, the Bundesbank experience of 1930s etc. These three areas further impacted the ECB's interaction with fiscal institutions. To accurately analyse the ECB's QE policy, it is important that we consider the setup of Eurozone's bank infrastructure.

This chapter will look into four areas. Firstly, it describes the Eurozone's structural setup and how it shaped monetary policy before the financial crisis and subsequent QE programs. Secondly, it covers the evolution of monetary policy set by the ECB, from the traditional monetary instruments through to unconventional measures. This will highlight the difference between the transmission channels of monetary policy set by the ECB to those of the other central banks. Thirdly, the chapter will analyse the main characteristics of the EAPP framework. Emphasis will be placed on the PSPP. Lastly, the chapter will describe the development and the effects of the ECB's recent QE program, with a focus on the relationship between announcements and market reactions.

Structural Considerations for QE

The ECB's monetary policy behavior is determined by its internal and external factors. For example, internal factors are legal and institutional whereas an external factor comprises of the Eurozone's financial market structure. The chapter will present these factors' key features and determine how they might have influenced the ECB's decision making ability.

¹³² Please refer to the QE timeline (2013 onwards) in Part II for specific date details

The Eurosystem

The Eurosystem is made up of the ECB and Eurozone member National Central Banks (NCBs).¹³³ Unlike the BOJ and BOE, the ECB is not a unitary monetary authority. Given the European Union's unique historical, political and government structures, the ECB was purposely designed to independently determine monetary policy under the policy direction of the Governing Council of the ECB.¹³⁴ Further, the Eurozone system exploits existing competencies of the NCBs. These competencies include the NCBs' institutional set-up, infrastructure, expertise and operational capabilities.

The power struggle between diversity and country representation in the Governing Council and the ECB's independence can impact policy decision. Legally the European Union (EU) states that the ECB, NCBs or any member of their decision making bodies cannot seek or take instructions from EU institutions, bodies, offices or agencies nor from any government of a member state.¹³⁵ With this in mind, the ECB needs to balance multiple stakeholder interests and ensure that its policies avoid political opposition in the Council. At the same time, the ECB wants to remain independent and avoid any political influence during policy design and implementation. This task can be challenging given the politics within the Euro area. ECB has faced various challenges pre and post crisis and it overcame them by being strategic and independent such as the approval of the Outright Monetary Transaction (OMT) program. Even after receiving explicit opposition from the German government and their parliament.

The ECB is responsible for defining the Eurosystem's policies and to ensure the implementation of its monetary policy operations across the NCBs.¹³⁶ NCBs share potential profit and losses as a result of Eurosystem operations. The share of NCB representation in the ECB is determined by NCBs relative population size and gross domestic product.¹³⁷ Monetary operations is distributed according to the size of economy, therefore making monetary policy effective proportionally to each respective country. Gains are accumulated in a reserve fund, with a ceiling of 100 per cent of the capital. This works as a buffer and provides a built-in safeguard if Eurosystem ends up experiences losses.

The structure of the shared profits (and losses) is an important institutional aspect to have shaped the ECB's unconventional monetary policy. As ECB accumulates asset under its asset purchase program, it takes the risk of negative cash flows and any loss occur due to these holdings. The buffer works on losses and ECB prevents itself from negative balance outcomes.¹³⁸ Comparatively speaking, BOE has the indemnification granted from HMT. In the Eurozone, the share of the losses incurred by the NCB is assumed by the member state treasury. Therefore, any unconventional monetary policy by the ECB must take into account if each member state can operate in a shared profit and loss scheme.

¹³³ According to the treaty of the European Union (EU), all the Central Banks of the EU are considered part of the Eurosystem even if they do not perform monetary policy inside the Eurozone. For the purpose of this paper we will use the term NCBs for the National Central Banks of the Euro area.

¹³⁴ The Governing Council of the ECB is formed by 6 member of the board and 19 member of each country of the monetary union. For more information about the Governing Council, see: [European Central Bank](#).

¹³⁵ European Union. [Treaty on the Functioning of the European Union](#).

¹³⁶ For more details about the roles in the Eurosystem, see: [European Central Bank](#). April 2009.

¹³⁷ The capital of the ECB is €10.8 billion at January 2015. <https://www.ecb.europa.eu/ecb/orga/capital/html/index.en.html>

¹³⁸ Central banks are protected from insolvency because they are able to create money. They can therefore operate with negative equity. However, a central bank that generates losses could have its credibility and efficacy affected in the long term. See Bunea et. al. (2016).

Another point to consider is the legal framework that the ECB operates in. The ECB's single mandate is to ensure price stability, particularly with an inflation target i.e. "below, but close to, two percent."¹³⁹ Furthermore, the ECB is prohibited to finance public entities, such as sovereign or local governments. This is important given the aforementioned risk share structure and the potential moral hazard behaviour of a government funded by the ECB. Receiving cheap funding or other debt capacity measures could engender fiscal imprudence. Therefore, an ECB asset purchase program that includes government debt should consider this limitation during the design process. Especially, when a distributional impact can be significant.

Lombardi and Moschella's study proposes several design policies for ECB's asset buying programs.¹⁴⁰ They argue that the policies should aim to reduce deviations away from the price stability. Also, it should explicitly clarify the "strict interpretation" of prohibition measures against direct financing to sovereign governments.¹⁴¹ ECB has included a similar feature that clarifies these legal restrictions in each program involving government debt.

The interaction between monetary and fiscal policy influences ECB's policy. If the central bank wants to maintain low inflation, interest rate policy can limit fiscal authorities' ability to finance government debt. This is particularly complicated in the Euro area. This is no fiscal union as equivalent of ECB's monetary role in the euro zone. Although, there have been discussions to establish an integrated fiscal authority, the European Union's Stability and Growth Pact lays the current framework by which Eurozone member fiscal behaviour should abide by.¹⁴² This measure indirectly helps ECB's stance of price stability. This feature monitors indirectly the fiscal behaviour of the member countries.

The ECB's unconventional policies have features reflecting monetary and fiscal combination. There has been a debate on the ECB's fiscal role and the consequent fiscal effects of monetary policies. This is especially true with ECB and the European Commission role after the implementation of the Securities Market Program (SMP). Regardless, monetary authorities are restricted to consider a mechanism that implicitly, or explicitly, pushes domestic governments to achieve fiscal discipline. This is what occurred when the OMT program was designed as an evolution of the SMP.¹⁴³

Private Financial Structure

The Eurozone's financial market structure enhanced certain monetary transmission channels over others. It further determined the design, implementation and effectiveness of monetary policy. The Euro area's financial system structure has shaped the ECB's unconventional monetary policies. On the other hand, some policy designs have benefitted some financial markets. In the last few years, the most important

¹³⁹ Bank of England. "[Monetary Policy.](#)"

¹⁴⁰ Lombardi, Domenico., Manuela Moschella. "[The government bond buying programmes of the European Central Bank: an analysis of their policy settings.](#)" Journal of European Public Policy. Vol 3, issue 6. August 14 2015.

¹⁴¹ [Ibid.](#)

¹⁴² The SGP allows a maximum fiscal deficit of 3% of GDP and a Debt to GDP ratio as much as 60 per cent. The SGP was part of the Convergence Criteria of the Maastricht Treaty who established the economic conditions to be fulfilled by the countries in order to enter the monetary union. (Ngai, 2012)

¹⁴³ Lombardi, Domenico., Manuela Moschella. "[The government bond buying programmes of the European Central Bank: an analysis of their policy settings.](#)" Journal of European Public Policy. Vol 3, issue 6. August 14 2015.

feature of the Eurozone's financial sector is the dominance of banks. This was certainly true with the financial fragmentation suffered after the sovereign debt crisis as the role of collateral assets to expand the markets restricted monetary policy scope.

The Euro area's financial market is bank dependent. Credit institutions are the main financial intermediaries and the initial, and probably only, source of funding for the economy. More than 75 percent of the external funding for companies and households are from the banking sector.¹⁴⁴ The average size of the banking sector in the Euroarea is almost 300 percent of GDP. After monetary and financial institutions (e.g., banks and saving banks), the Euroarea's financial corporations are the second most important financial institution in terms of size. This is particularly evident in the Netherlands, Belgium and Ireland (see Figure II.4.1, panel (a)).

The dispersion of the banking sector's relevance across Eurozone member states is important. For most economies (particularly Germany, France, Italy and Spain) the banking sector is between 170 and 350 percent of GDP. In Luxembourg's case the banking sector is more than 1,600 per cent of GDP. In Ireland, this number fell from almost 900 percent (2008) to below 300 percent (2014) after the banking crisis and restructuring of their financial system (see Figure II.4.1, panel (b)).

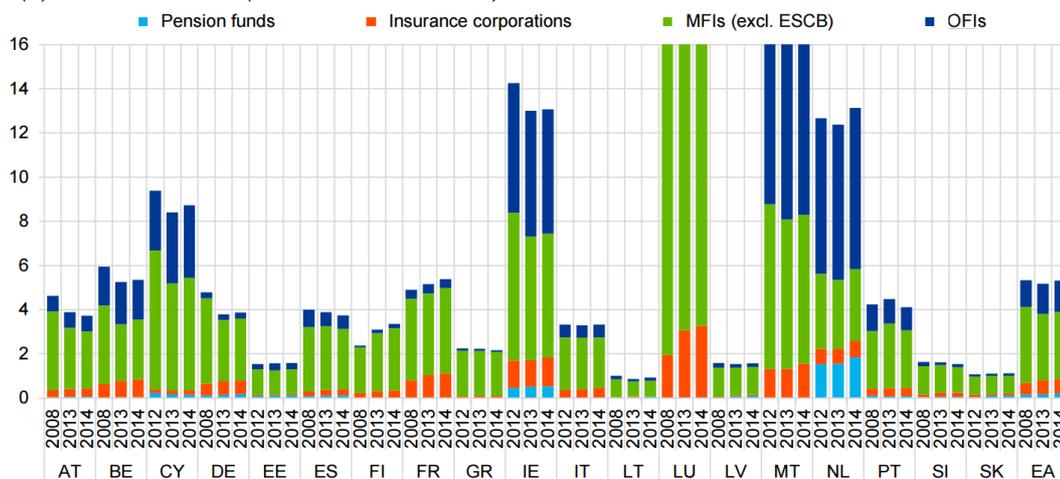
The banking sector was affected the most after the financial crisis. This was especially true for the interbank lending channel, and thus the diminishing monetary policy power of the ECB. The initial unconventional monetary policies were designed to solve the banks' liquidity problem and rehabilitate the channels. Many financial institutions were restructured, merged or even went bankrupt. However, because of these unusual consequences, the results today means a more concentrated market with more solvent institutions (see Figure II.4.2). At the same time, banking credit was substituted in part by private debt issuance of major corporations. This increased the private share of the bond markets previously dominated by public debt issuance (see Figure II.4.3).

¹⁴⁴ Cour-Thimann, Philippine and Winkler, Bernhard. European Central Bank. [The ECB's Non-Standard Monetary Policy Measures: The Role of Institutional Factors and Financial Structure](#), 2013.

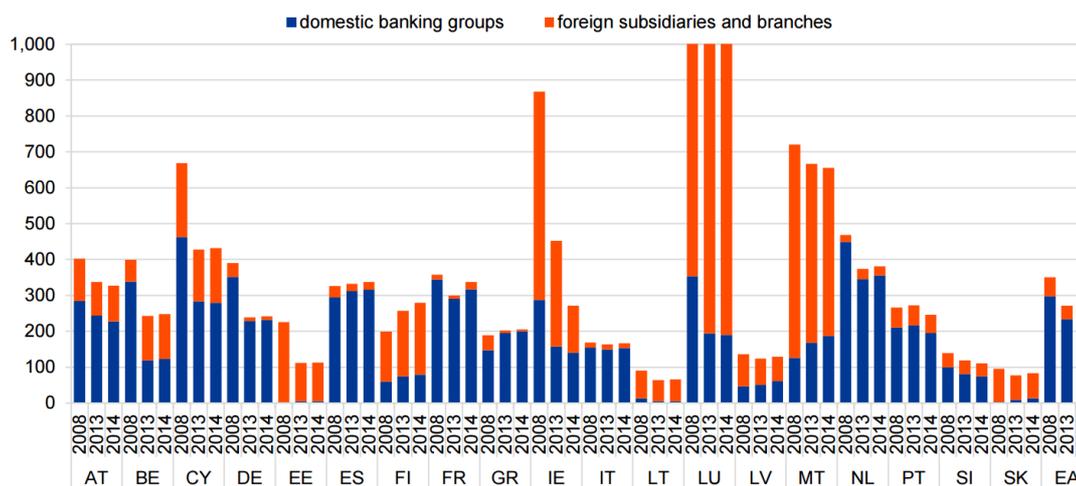
Figure II.4.1: Size of the Euro area financial and banking sectors, 2008, 2013 and 2014*

2014*

(a) Financial sector (ratio assets over GDP)



(b) Banking Sector (percentage of GDP)



*AT: Austria, BE: Belgium, CY: Cyprus, DE: Germany, EE: Estonia, ES: Spain, FI: Finland, FR: France, GR: Greece, IE: Ireland, IT: Italy, LT: Lithuania, LU: Luxembourg, LV: Latvia, MT: Malta, NL, Netherlands, PT: Portugal, SI: Slovenia, SK: Slovakia and EA: Euro area.

Source: European Central Bank. [“Report on Financial Structures.”](#) October.2015.

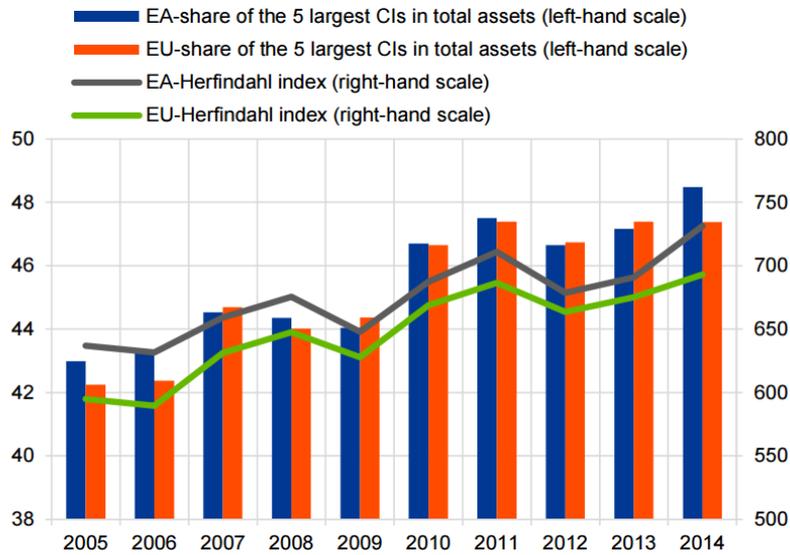
The banking sector is still in the process of deleveraging. This is in order to comply with new regulatory supervision and legislation in the Euro area. The results of banking restructuring in Ireland, Greece and Spain are showing positive signs, however, their counterparts in Germany and Italy show instability and capital needs.¹⁴⁵ The interdependence of monetary policy, economic activity and the banking sector is important when considering unconventional monetary design in the Eurozone. Therefore, it is fundamental to address whether the current lending inability of the banking channel is because banks are

¹⁴⁵ Gordon, Sarah [“Problems with Italy’s banking system a threat to its neighbours.”](#) The Financial Times. 20 April 2016; Shotter, James. [Deutsche seeks to allay fears on meeting coupons.](#) 8 February 2016.

in process of repairing their balance sheets, or whether the after effects of the crisis are severe resulting in high unemployment and adversely affecting corporate and retail demand for credit.

Figure II.4.2: Banking market concentration. 2005 to 2014

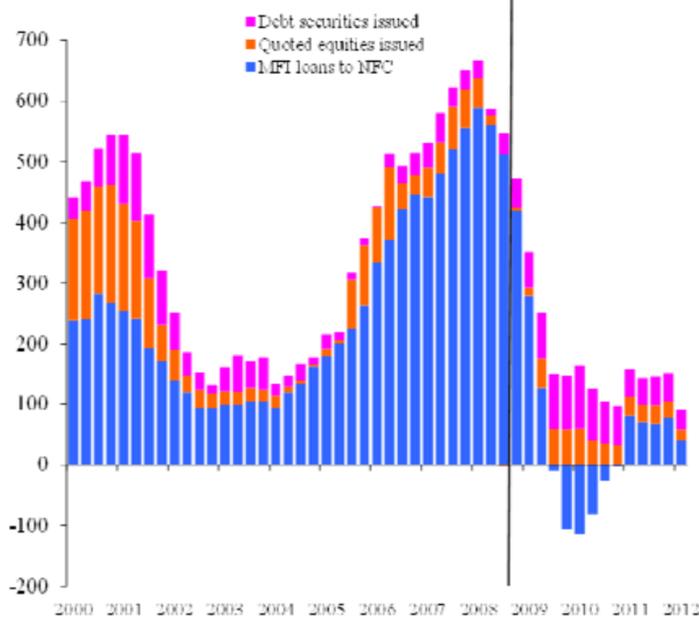
(percentage, index)



Source: European Central Bank. "[Report on Financial Structures](#)." October.2015.

Figure II.4.3: Bank Funding and Net Issuance of Debt Securities for Euro Area Non-financial Corporations. 2000-2012

(four-quarter flows in EUR billions)

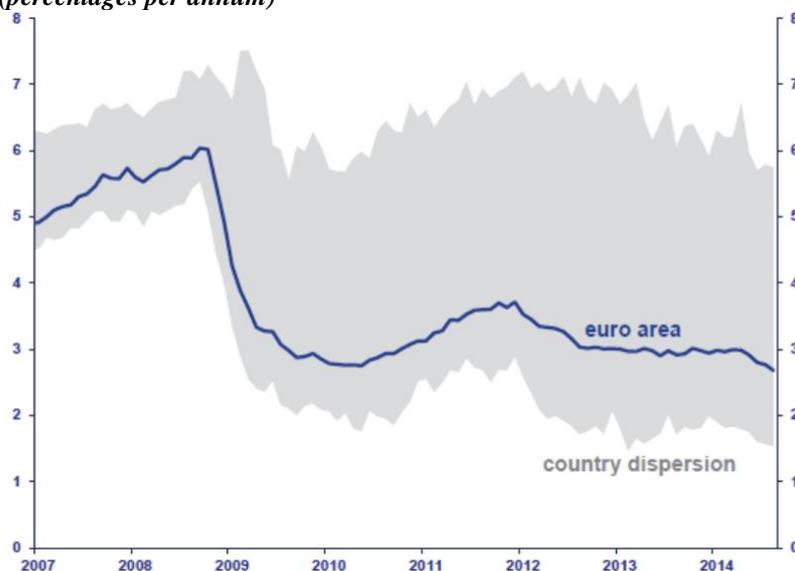


Source : Cour-Thimann, Philippine and Winkler, Bernhard, "[The ECB's Non-Standard Monetary Policy Measures: The Role of Institutional Factors and Financial Structure](#)." European Central Bank, 2013.

Each individual country’s financial sectors in the Eurozone is a challenge for the ECB. The ECB has to ensure that it impacts all member states in similar way as per its economic integration mandate. However, fragmentation within the Euro area was evident during the crisis. This was seen amongst the so called ‘peripheral countries’ suffering from fiscal deficit and public debt in 2010. Cross debt holdings across banks and sovereigns in different Eurozone member states presented the perfect conditions for contagion. The contagion was evident between both banks and governments both within and between countries. The result was a fragmented market. Eurozone members had different debt levels, resulting in banking flows from distressed economies to the rest of the Euro area (periphery to the core countries (see Figure II.4.4). This prompted ECB to establish a second wave of monetary policies i.e. SMP, OMT.

The availability of assets in the Euro zone was significant in shaping the asset purchases. The relative size of the financial instruments available was determined by both the ECB’s eligibility criteria, the banking sector and the role of sovereign debt. When the ECB introduced unconventional monetary policy, good quality collateral was a requirement. This quality requirement limits the scope for unconventional monetary actions. Since the financial crisis, the criteria for quality has been relaxed somewhat to reduce restrictions on ECB funding. Further, the ECB uses this criteria to determine the overall size of the asset market available for purchase since the initial purchase programs.

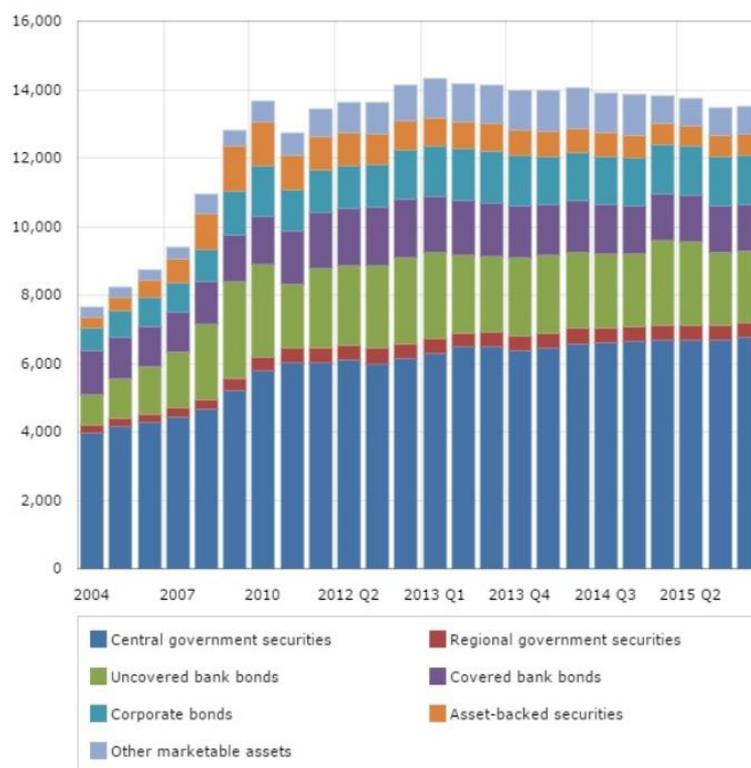
Figure II.4.4: Total cost of bank lending to non-financial corporations. 2007 to 2014*
(percentages per annum)



*Latest data. August 2014. The country dispersion is calculated as min/max over 18 euro area countries. The indicator is calculated by aggregating short and long-term rates using a 24 months moving average of new business volume.

Source: Collignon, Stephan. “[Unconventional Monetary Policy and Financial Market Fragmentation in the Euro Area](#)”. European Parliament. November 2014.

Figure II.4.5: Eligible Marketable Assets
(EUR billion)*



*Latest data: 2015Q4.

Source: European Central Bank. "[Eurosystem Collateral Data](#)."

The interaction between banking sector activity and the monetary policy collateral requirements impacted debt issuances in the Euro area. Financial integration in the Eurozone was fundamental to determining eligible assets for the purchase programs. All sovereign bonds were eligible since the Eurozone's inception, independent of the risk associated with them. The criteria's initial purpose was for integration across the Eurozone. The debt crisis revealed the flaw by revealing the varying degrees of risk associated with different member state's sovereign issuances. Government bonds make up the largest portion of eligible marketable assets. In Q4 of 2015, the total outstanding amount was around €6.7 trillion. This was followed by the uncovered banking bonds (€2.1trillion), corporate bonds (€1.4 trillion) and covered bonds (€1.3 trillion). The asset backed securities are a relatively small market of €0.6 trillion (See figure II.4.5).

Monetary Policy of the ECB Before the EAPP Program

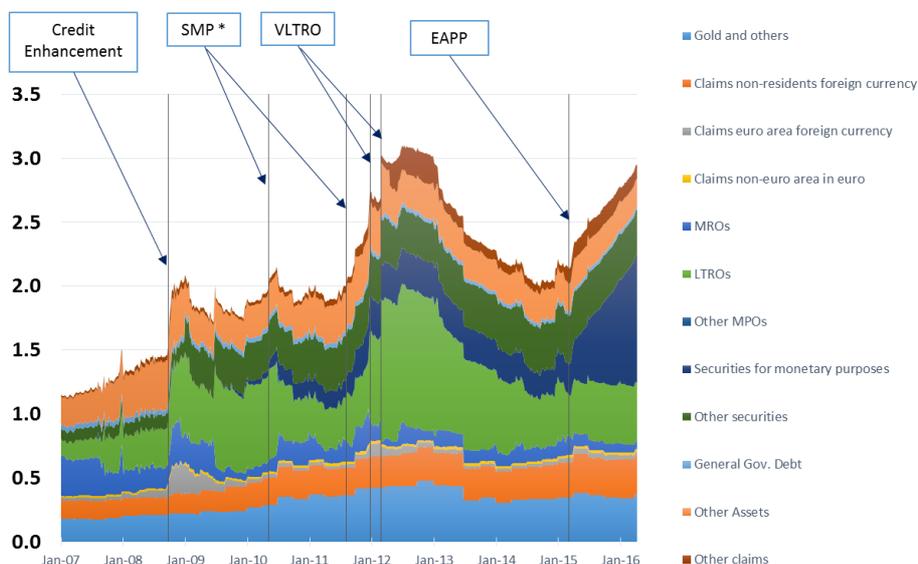
a) Conventional monetary policy previous to the Financial Crisis

Prior to the financial crisis, conventional monetary policy was the approach favoured by central banks. This section provides a brief overview of the ECB's monetary policy measures before the EAPP was implemented.

The ECB uses a combination of three policy instruments: policy interest rates, open market operations and minimum reserve requirements. In terms of policy rates, the ECB provides two standing facilities; the Marginal Lending Facility (MLF) and the Deposit Facility. Both have an overnight maturity and are available to the banks who seek to increase or reduce their liquidity. The Deposit Facility is used to extract liquidity from the banks at below-market rates. The MLF provides liquidity at rates that are traditionally above market rates. For this reason, the facilities are primarily used when the banking sector does not have access to the inter-bank markets. Other than the amount of collateral required by the ECB, there are no limits to these facilities. The facilities establish floor and ceiling limits to the inter-bank market, creating a corridor framework for the inter-bank money market rate called Euro Overnight Index Average (EONIA).

The ECB can further provide liquidity and manage the market rates with Open Market Operations (OMOs) i.e. buying or selling financial assets.¹⁴⁶ The ECB's main OMOs are the Main Refinancing Operations (MROs), with a weekly maturity for short term needs, and the Longer term Refinancing Operations (LTROs), with an initial maturity of 3 months.¹⁴⁷ Both operations are executed by reverse transactions through repurchase agreements and they require the counterparty to provide eligible collateral. Figure II.4.6 shows the high number of MROs relative to all OMOs before mid-2007.

Figure II.4.6: ECB Balance Sheet
(€ Trillion)



*The SMP indicated the start of Greek, Portuguese and Irish bonds buyout and later the Spanish and Italia bond buyouts.

Source: European Central Bank.

The Minimum Reserve Requirement (MRR) is the last instrument to be discussed. The MRR requires that banks hold mandatory deposits with the NCB. The required amount fluctuates but hovers around 2

¹⁴⁶ Those operations are executed mostly by NCBs, but the ECB can also perform operations.

¹⁴⁷ The maturity and structure of the LTROS has being changing since 2008 to facilitate long term credit.

percent of total bank liabilities. Their imposition is meant to create a structural demand for ECB funds and to help stabilize interest rates.¹⁴⁸

To conduct monetary policy, the ECB offers a fixed amount (or allotment) of liquidity to the market and banking sector. Interest rates are determined endogenously and are dependent on the demand for funds in the context of fixed supply. Liquidity needs made the ECB change revamp this mechanism to a fixed rate-full allotment, discussed in further detail below.

Since the financial crisis, the ECB started a series of measures to improve liquidity in the inter-bank lending channel. The policies included a strong and rapid reduction of policy rates, modifications of the standing facilities, and the introduction of measures to enhance credit. After the crisis, the ECB started a series of unconventional monetary policies. These included asset purchases for different purposes. Both sets of measures will be detailed in the next section.

b) Interest rate reduction and Unconventional Measures

In May 2009, the ECB moved the benchmark interest rate down by 325 basis points from 4.25 to 1.0 percent. Between April and July 2011 the ECB increased the rate by 50 basis points to 1.5 percent. Jean Claude Trichet, then ECB president, justified the increase on improved inflation expectations of around 2.6 percent. Trichet wanted to avoid the formation of asset bubbles after the successive measures of liquidity provision during the crisis (See Figure III.1.1 for ECB's rate changes). After Mario Draghi was appointed as the ECB's President in November 2011, rates were reduced to 1 percent. Between 2012 and 2014, the policy rate was reduced further by 95 basis points to 0.05 percent.

In response to deflationary pressures, Draghi announced the ECB's deposit facility rate would reach the zero lower bound in June of 2014. The negative rate has since been lowered on four occasions, the most recent being in March 2016. This decision will be analysed in the following section on the ECB's asset purchase programs.

Along with the interest rate reduction, the ECB introduced a credit enhancement facility to re-establish inter-banking channels. It consisted of five key areas:

- i. Implemented full allotment auctions of liquidity at fixed rates (October 2008), changed the fixed allotment auctions of money, made endogenous the amount on liquidity to a fixed rate;
- ii. Widened the range of assets eligible as collateral to allow more flexibility for banks to obtain loans from the ECB (December 2008);
- iii. Extended the term maturity of the LTROs from 3 to 6 months (November 2008);

¹⁴⁸ The minimum reserve requirement has another prudential objective. This is to maintain high quality assets as a proportion of the liabilities in order to cover, or provide insurance, in case of a bank run or the need to make payments. Currently, this prudential objective is covered by a more complex framework that include a Deposit Guarantee Fund, financial regulation and economic surveillance. (Gray, Simon. "[Central Bank Balances and Reserve Requirements](#)." IMF. February 2011)

- iv. Realized swaps agreements with other central banks, particularly the Fed, to provide liquidity in foreign currency (September 2008);
- v. Began the covered bond purchase program (CBPP), purchasing covered bonds issued by banks (July 2009).

The timing of these credit enhancement policies was important. This was because the main objective at that time was to re-establish the inter-banking channel. Up until that point, the ECB's main policy objectives were to recover the banking channel of the monetary transmission mechanism and provide liquidity to the system. This resulted in the balance sheet growing from €1.4 to €2.0 trillion in the fourth quarter of 2008.

c) LTROs evolution

The LTRO facility has undergone the most modifications, gradually adapting to the need of the market. From May to June 2008, the Credit Enhancement scheme was double in length from 3 to 6 months and then double again to 12 months. After the beginning of the crisis, its purpose was primarily to provide certainty and liquidity to a dry interbank lending market.

In 2011, the ECB increased the credit program announcing LTROs with a maturity of 36 months. This became known as the Very-Long Term Refinancing Operations (VLTRO). The ECB performed two VLTRO auctions; the first in December 2011 (lending €490) and another in February of 2012 (€540). During this time, the number of banks receiving allocations rose from 523 to 800 banks.

The VLTROs had a variety of unintentional effects. First, banks increased their deposits at the ECB, which had an interest rate of 0.25 percent. Thus, the extra liquidity did not create the intentional credit expansion in the interbank market or the non-financial sector.¹⁴⁹ Second, it facilitated carry trade operations using cheap money to buy higher assets returns. This included the medium term sovereign debt of the distressed periphery. Finally, the VLTRO operation helped banks in the deleveraging process and promoted a short-term effect on sovereigns. However, it did so without repairing overall credit market financial condition. The ECB's balance sheet expanded greatly under the VLTROs, increasing the ECB's asset holdings from €2.4 to €3.0 trillion (Figure II.4.6). In June 2016, the ECB will expand its refinancing operations and introduce Targeted Long Term Refinancing Operations (TLTROs).

d) CBPP and CBPP2

The Covered Bond Purchasing Program was introduced after earlier programs finished short of their desired effects. Covered Bonds are debt instruments collateralised by cash flows from mortgages or public sector loans. CBPPs were introduced three times and their purchases were intended to be held until maturity. The program features were similar but the purchase amounts differed. In 2008, the covered

¹⁴⁹ Duarte, Cristiano Boaventura., André de Melo Modenesi. "[The Euro Area's Experience with Unconventional Monetary Policy.](#)" World Economics Association (WEA). Conferences, The European Crisis. 1st October-1st December, 2015.

bond market grew from €1.5 to €2.4 trillion as banks used covered bond's longer terms to cover maturities mismatches.¹⁵⁰

The first phase, or CBPP1, took place from July 2009 to June 2010. The ECB announced that it would buy €60 billion covered bonds. 27 percent in the primary market and 73 percent in the secondary market. The program maturities ranged from 3 to 7 years, with an average of 4.1 years. The program's objectives were to promote lower interbank market rates, reduce funding restrictions for credit institutions and expand credit to the non-financial sector.

The CBPP was not introduced as a QE program. Instead, it was introduced as a part of the credit enhancement framework. However, the operation was not sterilized. At the time, Trichet announced that the ECB expected the purchases to automatically sterilize because they would substitute the LTRO facilities. Thus, the size of the ECB's balance sheet should not change, implying that this was not a QE measure.¹⁵¹ €150 billion in new covered bonds were issued following the program's implementation. It is important to note that the program did not cause a yield increase in peripheral markets affected by the sovereign crisis.¹⁵²

The second phase of CBPP2 began in November 2011. The sovereign crisis was still roiling international debt markets, prompting the ECB to reduce rates again. The initial intention to purchase €40 billion covered bonds was not possible because of restrictions on the program. Instead, €16 billion was bought out with 36 percent in the primary market and 64 percent in the secondary market, concluding in October 2012. In CBPP2, purchases were made only from institutions with over €300 million instrument issuances.¹⁵³ The third covered bond purchase program started in July 2014.

e) Securities Market Program

In response to the sovereign debt crisis and the Greek debt restructuring, the ECB announced the SMP in May 2010. The program was designed to buy sovereign debt in order to reduce the interest rates of stressed countries' debt and alleviate the stress on bank lending channels. The program's official intention was not to support bond issued by particular member states, but to "ensure depth and liquidity in those market segments which are dysfunctional (...and) to address the malfunctioning of securities markets and restore an appropriate monetary policy transmission mechanism."¹⁵⁴ The statement reflects the intention to solve issues in the monetary channel given the monetary area's financial fragmentation.

The program was fully sterilized and did not increase the ECB's balance sheet. The SMP purchased bonds only in the secondary markets within a set time frame and at the ECB's discretion. There was no initial target amount. The purchase amounts were not announced prior to purchase. Therefore, the market

¹⁵⁰ Fawley, Brett W., and Christopher J. Neely. "[Four Stories of Quantitative Easing.](#)" Federal Reserve Bank of St. Louis. 2013

¹⁵¹ Jean Claude Trichet. Introductory statement with Q&A. [European Central Bank](#). June 2009; and Fawley & Neely (2014).

¹⁵² Duarte, Cristiano Boaventura., André de Melo Modenesi. "[The Euro Area's Experience with Unconventional Monetary Policy.](#)" World Economics Association (WEA). Conferences, The European Crisis. 1st October-1st December, 2015.

¹⁵³ The CBPP1 had a minimum of €100 million.

¹⁵⁴ Press Release. [European Central Bank](#). May 2019.

could only infer purchase occurrences after the purchase execution. This was a direct consequence of the ECB's legal and institutional restrictions mentioned above. If purchases could not be anticipated, governments that received the program benefits were unable to alleviate fiscal deficits or public debt in the long run. Nonetheless, there were many critics of the program who argue that it was not aligned with the fiscal austerity agreements and was illegal according to the EU's legal framework.

The SMP's sterilization process was intricate in its application. The ECB offered banks interest-bearing deposits equal to the amount of government bonds the ECB has on its balance sheet. This drained money from the financial markets but was only temporary and had to be repeated on a weekly basis. The ECB balance sheet ECB increased during the two waves of the SMP and fuelled added opposition to the program (Figure II.4.6, in the blue area under "Securities for monetary purposes").

Between May 2010 and February 2011, the program purchased only Greek, Irish and Portuguese debt. These were some of the most affected economies during the European sovereign debt crisis. In August 2011, the ECB resumed its purchase of only Spanish and Italian bonds. Their sovereign bond's debt yields were affected both by internal problems and contagion from the other economies.

The SMP was terminated in September of 2012 with the last purchase taking place in February 2012. The program was completed before its official end due to opposition pressure from Eurozone member governments, led by Germany. They objected on the grounds that the SMP program indirectly alleviated the fiscal situation of the peripheral economies. Thus, purchases were seen as a subsidy to fiscally troubled governments like Spain and Italy. The necessity for a new intervention to control rising yields led the ECB to introduce the Outright Monetary Transactions program (OMT). The OMT came about as a result of political pressures, and ultimately froze the operation of the SMP program. Although the OMT differed to the SMP it was not exempt from criticism.¹⁵⁵ The OMT program was part of a package of broader institutional, fiscal, communication and regulatory measures. These measures assured that the sovereign debt purchases committed to deficit reduction.

f) Outright Monetary Transactions and verbal interventions

The OMT was a sovereign debt purchase program that began operations in August 2012, just a few weeks after Draghi's poignant point of doing "whatever it takes to save the Euro." The opening of the program eased Italian and Spanish sovereign debt yields. The OMT was introduced around the same time that the ESM replaced the EFSF as an institutional lender of last resort. The ESM's focus was on sovereigns in the Eurozone. Notably, Spain signed the Memorandum of Understanding (MoU) to receive contingent funds to restructure their banking sector.

When compared to the SMP, the OMT's design had new features but maintained others. It preserved the sterilization of the purchases, the restriction to buy sovereigns only in the secondary market, and ECB discretion over scope and timings of buyouts. New elements placed restrictions on the sovereign debt purchases duration between 1 and 3 years, and gave treatment of creditors to *pari passu* with other

¹⁵⁵ For a debate about the design towards the Euro area institution see Lombardi & Moschella (2016)

creditors. This avoided crowding out what the SMP generated because of its creditor seniority. An important new feature was the required signing of an MoU with the European Commission that included an economic reform program to preserve the fiscal sustainability of the signing country.

Nonetheless, Germany rejected the program and took the case to national courts, and eventually the European Court of Justice. They claimed that the OMT directly funded sovereign governments and was therefore was illegal. The case eventually reached an agreement in favour of the ECB in July 2015. The court's decision statement read that "The programme for the purchase of bonds on secondary markets does not exceed the powers of the ECB in relation to monetary policy and does not contravene the prohibition of monetary financing in member states."¹⁵⁶

Programs in Operation Since June 2014: Negative Rates and EAPP

a) Background

A decrease in volatility in the European markets occurred after the above programs and communication policies. The process was helped by the positive effects of support packages to peripheral economies (Ireland, Portugal and Spain), liquidity received by banks from the VLTRO, and the recapitalization of the banking sector after the prudential regulation. Further positive aspects included a decline in sovereign yields, a restoration of the interbank lending channel and discussion away from the disintegration of the Eurozone.¹⁵⁷

Nevertheless, problems started to appear. The first issue was the lending channel. Although the financial sector received plenty of liquidity, risky assets were still embedded in the balance sheets of the banks. Therefore, the financial institutions were in a deleveraging process without transmitting liquidity into the non-financial sector. The premature repayment of more than €1 trillion VLTROs contracts was a sign of banking reactivation.¹⁵⁸ The VLTRO returns also increased the interbank rate (EONIA) to the roof of the interest rate corridor.¹⁵⁹

Deflation was another primary concern. Deflation is a natural adjustment to regain competitiveness for a country in a monetary union, with a *de facto* fixed exchange rate, pulling down the salaries and

¹⁵⁶ InfoCuria - Case-law of the Court of Justice. [Judgement of the Court](#). 16 June 2015.

¹⁵⁷ 1. Duarte, Cristiano Boaventura., André de Melo Modenesi. "[The Euro Area's Experience with Unconventional Monetary Policy](#)." World Economics Association (WEA). Conferences.

2. Claeys, Grégory. "[The \(not so\) unconventional monetary policy of the European Central Bank since 2008](#)." Monetary Dialogue discussions Economic and Monetary Affairs Committee. European Parliament. July 8 2014.

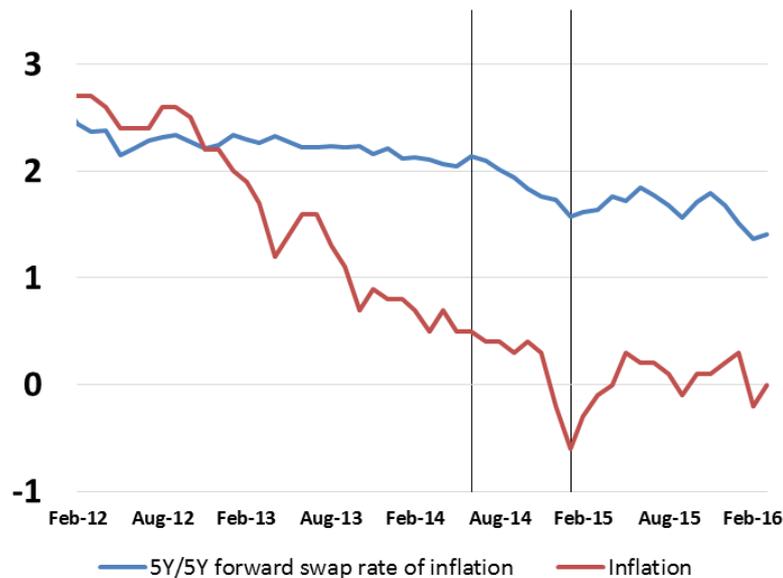
3. Rodriguez, Carlos, and Carlos A. Carrasco. "[ECB Policy Responses between 2007 and 2014: a chronological analysis and a money quantity assessment of their effects](#)." FESSUD. Working Paper Series No. 65. September 2014.

¹⁵⁸ The capital requirements to the financial institutions by the ECB (based on Basel III regulation) require an amount of capital over Risk Weighted assets. Then a financial institution could increase the ratio increasing capital or, alternatively, reducing its exposure to risk assets which is called deleveraging.

¹⁵⁹ Rodriguez, Carlos, and Carlos A. Carrasco. "[ECB Policy Responses between 2007 and 2014: a chronological analysis and a money quantity assessment of their effects](#)." FESSUD. Working Paper Series No. 65. September 2014.

generating unemployment.¹⁶⁰ Moreover, the deflationary spell seemed to be more permanent than a temporary phenomenon affected by declines in oil prices. The issue was that low rates of inflation undermined productive activity, thus slowing output growth. Further, because of non-tradable goods in the Eurozone, every country had different inflation rates. Specifically, inflation started to fall in late 2011, reaching minus 1 percent on January 2015. Expected inflation 5 year forwards fell below 2 percent annually in August of 2014 for the first time. This meant that the ECB became less effective in anchoring expectations to their long-term target (Figure II.4.7).¹⁶¹

Figure II.4.7: Eurozone Inflation rate*
(annual percent change)



*The vertical lines represent the time of the introduction of negative rates in June 2014 and the EAPP in January 2015.

Source: Bloomberg. Graph created by Author

To increase inflation, re-anchor expected inflation to 2 percent, as well as restore the interbank channel, the ECB restarted its unconventional measures. This time, the ECB would introduce a Negative Interest Rate Policy (NIRP) and reduce its deposit facility rate in negative territory while simultaneously modifying the LTROs.¹⁶²

In September of the same year, the ECB announced the implementation of two asset purchase programs: The Asset Backed securities Purchase Program (ABSPP) and the third phase of its Covered Bonds Purchase Program (CBPP3). Given the use of covered bonds and the presence of illiquid asset-backed

¹⁶⁰ Collignon, Stephan. "[Unconventional Monetary Policy and Financial Market Fragmentation in the Euro Area](#)". European Parliament. November 2014.

¹⁶² In June of 2014 the ECB suspended the weekly fine-tuning operations sterilizing the liquidity injected by the SMP being the last operation allotted on June 10th, 2014¹⁶², to avoid a further negative impact on the market of a sterilization process.

securities on the balance sheet of the banks, the programs' goals were to address specific markets and open the channels of credit. The purchase programs' other objective was to reallocate risk away from the banking system and instead to the ECB. However, the size of these programs was not enough to push up measures of inflation, at least when compared to the programs applied by the other major central banks.

In January 2015 the average negative inflation was -0.6 percent in the Eurozone. As a result, the ECB announced a new sovereign debt public purchase program. The program was a part of the existing ABSPP and CBPP3 framework and included monthly buyouts of €60 billion.

b) Negative interest rates

In July 2012, the ECB reached the ZLB. The deposit facility reflected a negative real interest rate and remained at that level until 2014. At the time, inflation continued to decrease, impacting the real interest rate and diminishing the effectiveness of policy. The threat of deflation required policy action and the responses of the ECB were very similar to those of the other leading central banks. The policy focus began to shift toward QE.¹⁶³

The experience with the SMP and OMT program highlighted the difficulties with structuring a QE program. A fundamental issue was sovereign bond purchases in a monetary union with nineteen countries. There was much speculation both in the press and academic articles as to the design and announcement date of a (potential) QE program.¹⁶⁴ In May 2014 Mario Draghi mentioned a probable easing in the next ECB meeting of June.

Considering the Eurozone's bank-centric structure and the fact that financial institutions were not lending out the extra liquidity and excess reserves, an alternative to negative rates seemed plausible. In June 2014, the ECB reduced the deposit facility rate from 0 to -0.10. In September 2014, the deposit was further reduced to -0.20 (Figure 1.1 (Part III) Main Policy Rates across all four central banks). This measure was announced together with the TLTROs, signalling to the market that credit needed to be re-established.

The program's initial impact was positive to both market variables and perceptions. The ECB acted in accordance with its mandate (long term inflation targeting) whilst ensuring that it did not violate Eurozone principles. However, both the negatives rates and TLTROs alone were not sufficient for a market that required QE to avoid stagnation. The economy continued to show that deflation was not abating even with a negative rate policy. A bigger stimulus was necessary, leading to the introduction of the EAPP.

¹⁶³ Spiegel, Peter., and Claire Jones. "[IMF Calls on ECB to consider quantitative easing.](#)" Financial Times. June 18 2014.

¹⁶⁴ Muenchau, Wolfgang. "[Europe's drifters wait but inflation never comes.](#)" Financial Times. June 8 2014.

c) TLTROs

A new feature of this type of LTRO is that the amount of credit facility received by the financial institution was to be a function of the increase in credit to the non-financial sector.¹⁶⁵ The ECB's intention was to include economic incentives in the program so that credit lend to the real sector. Thus, it signalled the ECB's realization that the deleveraging process suffered by the banks would not consistent with its provision of loans to the market and, as such, needed to be addressed.¹⁶⁶

The ECB will hold eight TLTRO quarterly operations until June 2016. They will mature in September 2018. In the first two auctions, the ECB fixed a maximum initial TLTRO borrowing allowance for each institution. This was equal to 7% of the total outstanding loans (as of April 30 2014) to the Euro area's non-financial private sector. Credit received by financial institutions in the subsequent operations would be equal to the changes in credit to non-financial corporations granted since 2014. Twenty-four months after the TLTRO, counterparties can repay any part of the amounts they were allotted in six-month windows. Banks who cannot overcome the historical figures one month before the last operation in May 2016 will have to return the funds in September 2016. Otherwise they can retain the funds until the maturity date¹⁶⁷.

Initially, the facility's interest rate was the MRO rate at the time of the operation, plus a fixed spread of 10 basis points. The spread was eliminated after the first two auctions.

d) CBPP3 and the ABSPP

The CBPP3 started in October 2014 and will last until September 2016. In January 2015 the purchasing amount was clarified in the new EAPP framework. The ECB will buy €10 billion per month and the purchases would be a combination of both covered bonds and ABS (of the ABSPP). As of March 16 2016, the CBPP3 had purchased €165 billion.

The ABSPP program began in November 2014 and has a two year lifespan. The program aims to support banks with the issuance of new credit. It encourages the securitization of credit and the sales of ABS to the market in order to further fund new assets. As of March 16 2016, the program's outstanding amount was €19 billion. The small amount can be attributed to the low quantity of eligible ABS in the current market. ABSPP and CBPP3 are not sterilized nor do they increase the ECB's balance sheet. Further, there is some debate as to whether they constitute as QE given the ECB decision to leave the purchase program amount open-ended and demand driven.¹⁶⁸

e) The PSPP and the EAPP

In January 2015, the Eurozone's annual inflation rate was -0.6 percent and expected inflation for the next five years is 1.5 percent. (Figure II.4.7). The asset purchase programs and the negative interest rates were not creating the conditions to improve the deflationary situation. As the ECB's Vice President explained,

¹⁶⁵ Home or mortgages loans are excluded.

¹⁶⁶ Wyplosz, Charles. "[Is the ECB doing QE?](#)" VOX. September, 12 2014.

¹⁶⁷ For more detail about TLTRO, see: [European Central Bank](#).

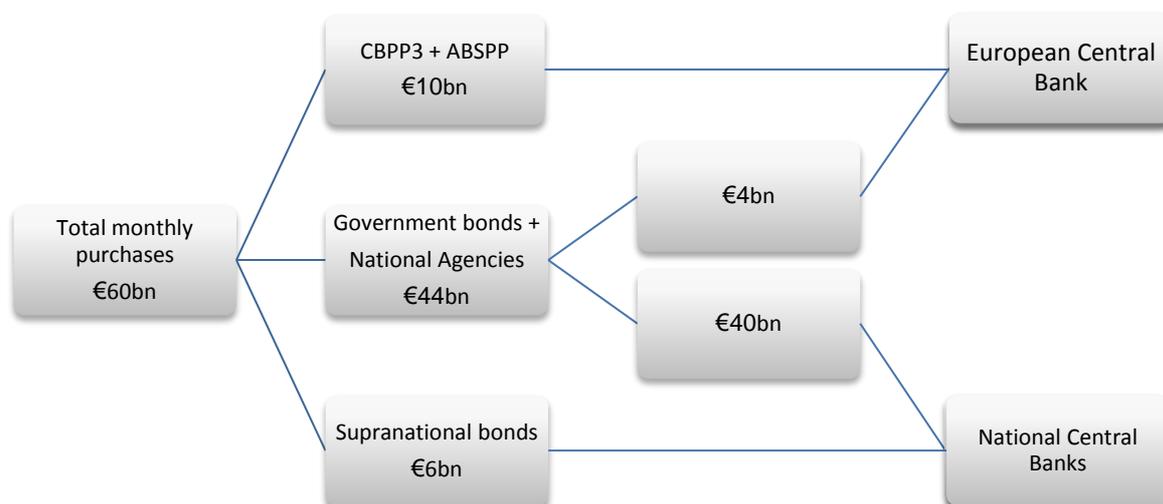
¹⁶⁸ Wyplosz, Charles. "[Is the ECB doing QE?](#)" VOX. September, 12 2014.

“Previous non-standard measures were mainly aimed at redressing impairments in the monetary policy transmission mechanism and fostering a regular pass-through of the monetary policy stance. Their implications for the ECB’s balance sheet were accommodated in a merely passive way to satisfy the liquidity demand created by banks.” Then, he added, “...with the new measures implemented since June 2014 [referring to the CBPP3 and ABSPP], the Governing Council is more actively steering the size of the ECB’s balance sheet towards much higher levels in order to avoid the risks of too prolonged a period of low inflation.”¹⁶⁹

On January 22nd 2015, the ECB announced the Expanded Asset Purchase Program (EAPP), which included a massive Public Sector Purchase Program (PSPP). The PSPP was about a €50 billion monthly purchase plan of government, national agency and supranational institution’s debt with maturity from 2 to 30 years.¹⁷⁰ Under the already existed asset purchase programs, ABSPP and CBPP3, together with the PSPP, the ECB cumulatively planned to purchase €60 billion monthly.¹⁷¹

For the sharing of hypothetical losses, the PSPP of the EAPP will cover 20 percent of the purchases by the Eurosystem capital key. The risk embedded in the rest of the buyouts was assumed directly by each NCB and the respective treasury. The ECB tried to avoid an unnecessary transfer of risk from riskier sovereign bonds to the countries who assumed a greater share of the potential losses (Germany, France etc.) Figure II.4.8 is for a description of the purchases.

Figure II.4.8: Distribution of the Asset purchases under the EAPP



¹⁶⁹ IMF. “[Legacies, Clouds, Uncertainties.](#)” World Economic Outlook. October 2014.

¹⁷⁰The bonds should be eligible for collateral by the ECB.

¹⁷¹ In October 2014 50% of the market was expecting a program such as PSPP. Panel remarks. Victor Constancio. [European Central Bank](#). August 2015.

- Implementation will be decentralized. The buyouts are made by the NCBs and the ECB, and for the ABSPP the ECB is using private agencies.
- In principle, a 33 percent of the EAPP purchases will be subject to loss sharing. The loss sharing are applicable to the CBPP3 and the ABSPP buyouts (€10 billion), the supranational bonds (€6 billion) and to €4 billion of the €44 billion allocated for government bonds. However, as the CBPP3 and ABSPP are a remainder of the PSPP in the EAPP, normally is more corrected to assure that a 20 percent of the buyouts of the PSPP will be risk shared. That is the supranational bonds (€6 billion) and the €4 billion of national government and agencies purchases by the ECB.
- The 44 billion in Government bonds and National Agencies will be allocated by country according the shares of the capital key¹⁷².

Source: Gregory Claeys, Alvaro Leandro, Allison Mandra. [“European Central Bank Quantitative Easing: the Detailed Manual.”](#) March 2015.

To avoid leaving the impression that it was influencing debt restructuring or appearing to fund or condemn a particular member, the ECB restricted that the PSPP has a buyout limit of 25 percent of total issuance.¹⁷³ If the currently holding was more than 25 percent of a single country’s sovereign debt, the limit was up to 33 percent of total debt.¹⁷⁴ The restrictions limit the purchasing capacity of the program. Currently, the Eurosystem has reached most of the small economies’ limits.¹⁷⁵

Similar to the previous programs, the program emphasised on involving sovereign purchases and aimed to achieve the ECB’s mandate, whilst adapt to the Eurozone’s financial market structure. Figure II.4.9 summarizes the challenges faced by the Eurozone when designing a QE program. It outlines where the EAPP aims to overcome these challenges. Given past experience with the OMT and SMP, the ECB was especially cautious of direct funding to governments and cross fiscal risks. The EAPP maintained purchases of bonds only in the secondary market and the risk of buyouts was assumed by each NCB and indirectly by the respective sovereign.

¹⁷² For an updated list of agencies and supranational institutions, see [European Central Bank](#). April 2015.

¹⁷³ In debt issued with Collective Action Clauses (CAC), a restructure of the debt must count with the 75% of the debt holder’s adherence. The CAC are included in the post 2012 debt issued in the European Union.

¹⁷⁴ Although this limit is higher than the ideal 25% for CAC, it is concentrated in bonds that are prior to the issuance of CAC bonds, like the case of the bond acquired under the SMP. Greek bonds in hands of the ECB are the only that surpass the 25% issuance limit.

¹⁷⁵ Claeys, Grégory. [“The \(not so\) unconventional monetary policy of the European Central Bank since 2008.”](#) Monetary Dialogue discussions Economic and Monetary Affairs Committee. European Parliament. July 8 2014.

Figure II.4.9: Structural Factors and EAPP design

Consideration	Challenge	Design solution
Structural	Prohibition to directly fund sovereign governments and avoid fiscal behaviour moral hazard	Secondary Market Purchases
		Only 33% of the purchases are risk-shared
	Avoid influencing a potential debt restructuring	25% limit of bond issuance for CAC bonds, 33% limit to bonds issued previous to CAC.
		Bonds must have a minimum investment grade rating (BBB- or equivalent)
Monetary	Expand the Balance Sheet	Monthly purchases of €60 billion.
		Unsterilized interventions
	Affect the long term interest rates and term premium	Duration of bond purchases from 2 to 30 years
		Explicit buyouts amounts previously announced
		Extension of the program for 2 years until March 2017
		Bonds bearing less than the deposit rate are not included

Source: European Central Bank. Table created by Author.

The ECB is faced with the combined threat of deflation and inability to fulfil the price stability mandate. The financial structure of the Eurozone and its eligibility criteria indicate that a sovereign purchase program is essentially the only means available to impact the markets given the deepness of public sector debt (Figure II.4.5).

Effects of the Policy Framework After June 2014

A priority for QE is to manage inflation. The channels for transmission are similar to those described in part I. According to the ECB, the objective is “not to expand the monetary base and through the monetary multiplier increase the monetary aggregate, instead the expansion of the balance sheet is a consequence of the monetary expansion through the aforementioned channels.”¹⁷⁶ Below explains the four main transmission channels.

¹⁷⁶ Assessing the new phase of unconventional monetary policy at the ECB, Victor Constancio. [European Central Bank](#). August 2015.

- i. *Signalling channel*: The ECB's commitment to monetary policy in the long term can impact medium term inflation expectations. Forward guidance statements go to that direction; and the long term extension of the EAPP for two years.
- i. *Credit channel*: Lowering the effective cost and easing credit to the non-financial private sector, i.e. TLTRO, expand liquidity conditional to credit; EAPP buyouts in the secondary market provided the agents with liquidity to buy other assets or extend credit.
- ii. *Portfolio rebalancing*: The asset purchases increase the price of the objective assets, therefore reducing the associated interest rate. This channel is distinctive to QE programs (EAPP) because the ECB is buying assets from the market dominated by financial institutions. This action extracts and moves the risks from the private sector balance sheet to the ECB.
- iii. *Exchange rate channel*: The monetary stimulus increases the relative supply of the currency generating a depreciation that finally has a pass-through on inflation. This effect could be of a great importance in the Euro area, given the changes in the Euro after the reduction of the rates in 2014. However, the fact that the Euro area countries trade mostly with each other reduces the final impact of depreciation.

It is interesting to see the evolution of some variables in the market after the implementation of the unconventional policies. Although this is not a support for causality, it allows us to see some trends and market reaction to the measures¹⁷⁷.

After the VLTRO, the ECB's balance sheet reduced from €3 trillion (January 2013) to approximately €2 trillion (January 2015). The TLTRO substituted part of the previous LTRO maintaining the balance sheet at a certain level before the asset purchase program.¹⁷⁸ Currently the balance sheet is reaching levels as seen at the beginning of 2013 and is expected to increase another €900 billion until March 2017 if the ECB continues its €80 billion monthly purchases (Figure II.4.6).

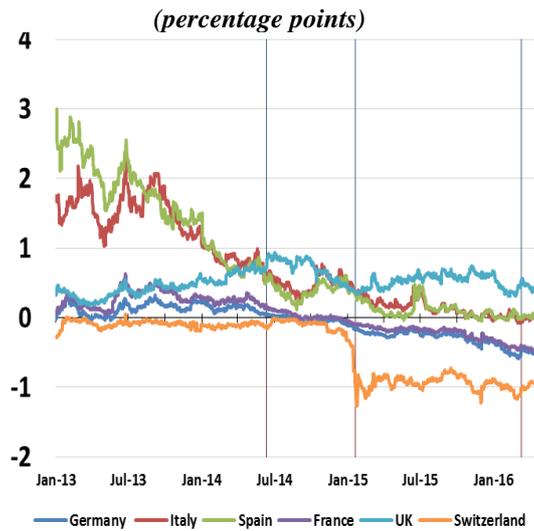
Sovereign yields of the Eurozone were low before negative rates were implemented, potentially reducing the impact of QE.¹⁷⁹ However, it is possible to see an inflection point after the implementation of negative rates and even after the EAPP. This is especially obvious on the 2-year bond yields (Figure II.4.10). The 10-year sovereign bonds also show a reduction in rates. This negative trend is observed before the last wave of programs (Figure II.4.11). Both instruments showed an increase from the second semester of 2015, then a level off and relative stability until the end of the year.

¹⁷⁷ For a summary of research results of QE refer to Part I.

¹⁷⁸ Claeys, Grégory. "[The \(not so\) unconventional monetary policy of the European Central Bank since 2008](#)." Monetary Dialogue discussions Economic and Monetary Affairs Committee. European Parliament. July 8 2014.

¹⁷⁹ Muellbauer, John. "[Combating Eurozone deflation: QE for the people](#)." VOX. December 23 2014.

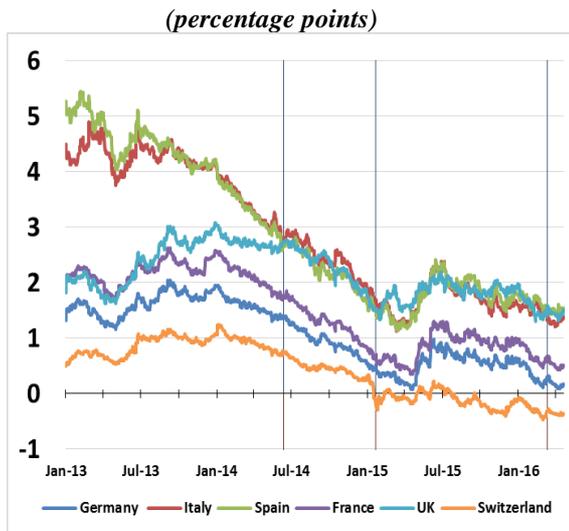
Figure II.4.10: 2- year sovereign bond yield*



*The vertical lines represent the time of the introduction of negative rates in June 2014, the EAPP in January 2015 and the EAPP expansion in March 2016.

Source: Bloomberg. Graph created by Author

Figure II.4.11: 10- year sovereign bond yield*

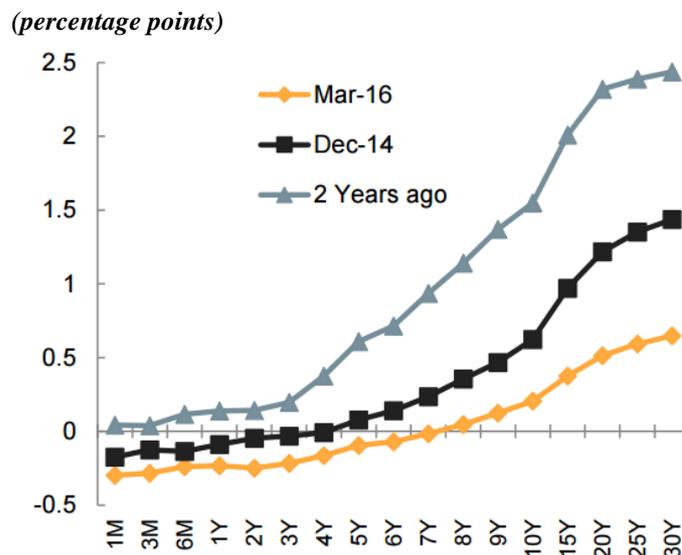


*The vertical lines represent the time of the introduction of negative rates in June 2014, the EAPP in January 2015 and the EAPP expansion in March 2016.

Source: Bloomberg. Graph created by Author.

The German yield curve reveals a reduction in yield since the implementation of EAPP. The yield curve is even flatter than 2014 (see Figure II.4.12). This is a reflection of the portfolio rebalancing channel of the program and the concentration in long term bond purchases.

Figure II.4.12: German bonds yield curve



Source: Bloomberg. Graph created by Author

The stock prices reacted very positively after the introduction of EAPP. However, this initial impact was dissipated by the end of the year (Figure II.4.13).

The exchange rate has depreciated since the introduction of negative rates. However, the effect tended to stabilize from 2015, supporting the short term effects of the policy over market variables (Figure II.4.14).

Figure II.4.13: Major European Stock prices **
(Index June 11 2014 = 100)

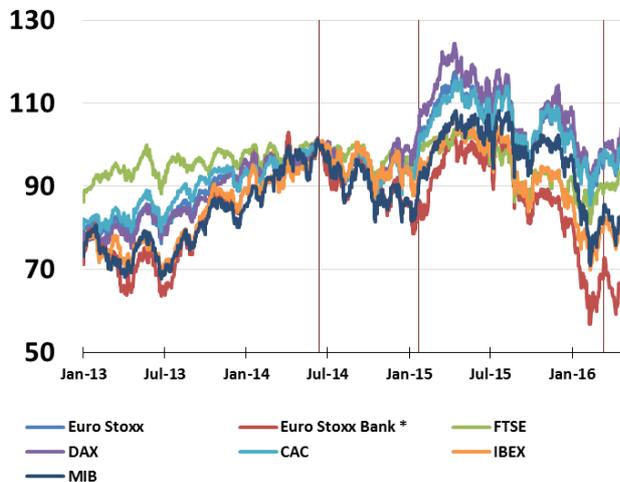


Figure II.4.14: Exchange rate*
(Foreign currency by Euro)



*30 banks of the Euro Stoxx Index.

**The vertical lines represent the time of the introduction of negative rates in June 2014, the EAPP in January 2015 and the EAPP expansion in March 2016.

*The vertical lines represent the time of the introduction of negative rates in June 2014, the EAPP in January 2015 and the EAPP expansion in March 2016.

Source: Bloomberg. Graph created by Author

Source: Bloomberg. Graph created by Author

Inflation expectations maintained a downward trend after the rate reduction. The expectations were at 1.5 percent in January 2015. Since the introduction of EAPP, the inflation rate fluctuates between 1.5 and 2 percent (Figure II.4.7).

If we observe credit to non-MFIs variation, the trend has changed since June 2014 after the negative rates were introduced (Figure II.4.15). The credit channel has been one of the major problems in the Euro area in recent years. However, recent new measures seem to have recovered credit institutions lending rates.

Figure II.4.15: Credit growth to non-MFIs
(annual percentage change)

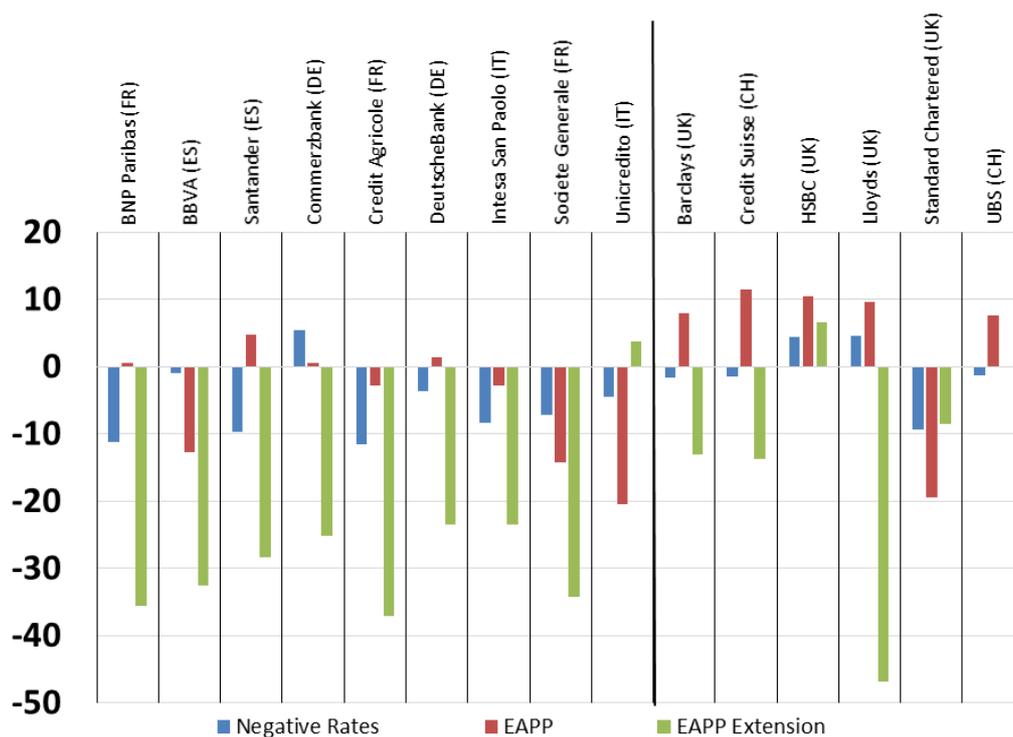


*The vertical lines represent the time of the introduction of negative rates in June 2014 and the EAPP in January 2015.

Source: European Central Bank. Graph created by Author

Determining if the EAPP reduces risk embedded in the financial system is hard to assess particularly in the short-term. However, changes in market risk of key financial institutions in the Euro area suggests otherwise. Figure II.4.16 shows the monthly change of CDS spreads between the month of announcement and the immediate following month. These announcements include those for negative rates and the EAPP extension on March 10th 2016. On average the announcement's effects reduced market risk perception of banks.

Figure II.4.16: Bank CDS change one month after the ECB policy announcement*
(Basis points, sample of banks)



*FR: France, ES: Spain, DE: Germany, IT: Italia, UK: United Kingdom and CH: Switzerland.

Source: Bloomberg. Graph created by Author

There are not many studies from the effects of the Euro area QE, mainly because of its recent implementation. Most of the literature assessing the EAPP of the ECB, deliver some initial market impacts, non-causal effects or correlations among the relevant variables. Moreover, some articles concentrated in analyse the properness and permanence of the program. Mainly given the potential room that the policymakers has to increase the purchases given the legality and capacity of the markets. Those restrictions seems to be crucial for the ECB's EAPP.

Recent Developments

There seems to be a positive response to policies, either since the implementation of negative rates or after the announcement and implementation of EAPP. However, those initial impacts on markets almost disappeared or adjusted to previous levels from 2015, especially as the market expected an extension to the program in December 2015 which did not occur. After the initial negative market reaction, which risked putting results achieved by the EAPP at risk, Draghi intervened by announcing an EAPP extension and the standing facilities of the ECB by the following meeting in March.

On the last meeting of March 10th, 2016, the Governing Council reduced the deposit facility rate even further to -0.4 percent. They decided to extend the TLTRO into four new operations rate and increase purchases to €80billion. Details on the purchasing of assets were not clarified. Unlike previously the announcement included non- financial corporate debt, Corporate Sector Purchase Program (CSPP) (Figure II.4.17).

Figure II.4.17: Announcement ECB meeting March 10th 2016.

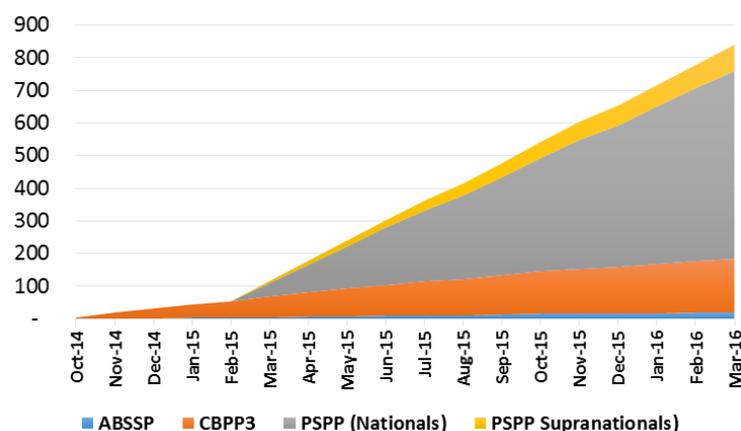
Instrument	Announcement
Interest Rates	The interest rate on the main refinancing operations of the Eurosystem will be decreased by 5 basis points to 0.00%, starting from the operation to be settled on 16 March 2016.
	The interest rate on the marginal lending facility will be decreased by 5 basis points to 0.25%, with effect from 16 March 2016.
	The interest rate on the deposit facility will be decreased by 10 basis points to -0.40%, with effect from 16 March 2016.
EAPP	The monthly purchases under the asset purchase programme will be expanded to €80 billion starting in April.
	Investment grade euro-denominated bonds issued by non-bank corporations established in the euro area will be included in the list of assets that are eligible for regular purchases. This program will be denominated Corporate Sector Purchase Program (CSPP)
TLTRO	A new series of four targeted longer-term refinancing operations (TLTRO II), each with a maturity of four years, will be launched, starting in June 2016. Borrowing conditions in these operations can be as low as the interest rate on the deposit facility.

Source: European Central Bank. "[Press Release: Monetary Policy Decision.](#)" March 10 2016.

Figure II.4.18 shows the total purchases made under EAPP until March 2016, completing a total of €0.832 trillion. The current capacity of program eligible assets is €8.7 trillion.

It will be interesting to see how the ECB progresses with its QE program. A point to consider is whether the ECB's legal and institutional structure will restrict further monetary policy implementation. The current bond purchasing restrictions (25 percent to 33 percent) mean that government bond purchases is limited. This partially explains why the ECB has expanded assets purchases to include corporate bonds as well. It will be interesting to see if the pool of assets continue to expand.

Figure II.4.18 Eurosystem holdings under the EAPP (billion €)



*At amortized cost, in euro million, at month end. Figures may not add up due to rounding. Figures are preliminary and may be subject to revision.

Source: European Central Bank. Graph created by Author

Figure II.4.19: Summary Table of ECB Unconventional Policies (created by Author)

Program	Announcement Date	Targeted End Date	Targeted Total Purchase	Composition of Purchases	Program Details as Announced
CBPP	July 2nd 2009	June 30th 2010	€60 billion.	Euro-denominated covered bonds issued in the euro area	<ul style="list-style-type: none"> ◆ Purchases in both the primary and the secondary markets ◆ Be eligible by the ECB collateral criteria ◆ Limit an issue volume of about €500 million or more and not lower than €100 million ◆ Securities held until maturity
CBPP2	November 3rd 2012	October 31st 2013	€40 billion. (€16.4 billion)		<ul style="list-style-type: none"> ◆ Purchases in both the primary and the secondary markets ◆ Be eligible by the ECB collateral criteria ◆ Limit an issue volume of €300 million or more ◆ Securities held until maturity
SMP	May 10th 2010	Undefined end date (Terminated in Sep. 2012 and <i>de facto</i> finished in Feb. 2012)	Non specified at announcement Discretionary (€218 billion at closed)	Private and Public securities (<i>De facto</i> only sovereign securities)	<ul style="list-style-type: none"> ◆ Purchases in the secondary markets ◆ Discretion about the scope and timing of purchases ◆ Sterilized purchases ◆ Securities held until maturity
OMT	August 2nd 2012	Undefined end date (never implemented)	Non specified at announcement Discretionary (never implemented)	Public securities	<ul style="list-style-type: none"> ◆ Purchases in the secondary markets ◆ Discretion about the scope and timing purchases ◆ Sterilized purchases ◆ Asset purchases maturities between 1-3 years ◆ Securities held until maturity ◆ Conditional to fiscal austerity plan implementation, subject to ESM funding.
CBPP3*	October 20th 2014	October 2016	Non specified at announcement	Euro-denominated covered bonds issued in the euro area	<ul style="list-style-type: none"> ◆ Purchases in both the primary and the secondary markets ◆ Be eligible by the ECB collateral criteria ◆ Securities held until maturity
	January 22nd 2015	Extended to September 2016 as part of the EAPP)	€10 billion monthly jointly with ABSPP		
	March 10th 2016	Extended to March 2017. Ongoing Program	Undefined increase of the buyouts jointly with ABSPP as part of the €80 billion of the EAPP		
ABSPP*	November 21st 2014	November 2016	Non specified at announcement	Euro area eligible asset-backed securities	<ul style="list-style-type: none"> ◆ Be eligible by the ECB collateral criteria ◆ No less than 90% of the obligors of the cash-flow generating the ABS are non-financial corporations or natural persons. ◆ No less than 95% the outstanding principal amount of the cash-flow generating the ABS issue is denominated in euro
	January 22nd 2015	Extended to September 2016 as part of the EAPP)	€10 billion monthly jointly with CBPP3		
	March 10th 2016	Extended to March 2017. Ongoing Program	Undefined increase of the buyouts jointly with CBPP3, as part of the €80 billion of the EAPP		
PSPP*	January 22nd 2015	September 2016	€50 billion monthly	Supranational, €6 billion Sovereign and national agencies debt, €44 billion	<ul style="list-style-type: none"> ◆ Secondary Market Purchases ◆ The Eurosystem will share the risk of the Supranational bonds and €4 billion of the sovereign and national agencies purchases (33% of the purchases are risk-shared) ◆ 25% limit of bond issuance for CAC bonds, 33% limit to bonds issued previous to CAC. ◆ Bonds must have a minimum investment grade rating (BBB- or equivalent) ◆ Unsterilized interventions
	March 10th 2016	Extended to March 2017, with open discretionary extension. Ongoing Program	Undefined increase of the buyouts jointly with CBPP3, ABSPP as part of the €80 billion of the EAPP.	The new share was not yet specified	

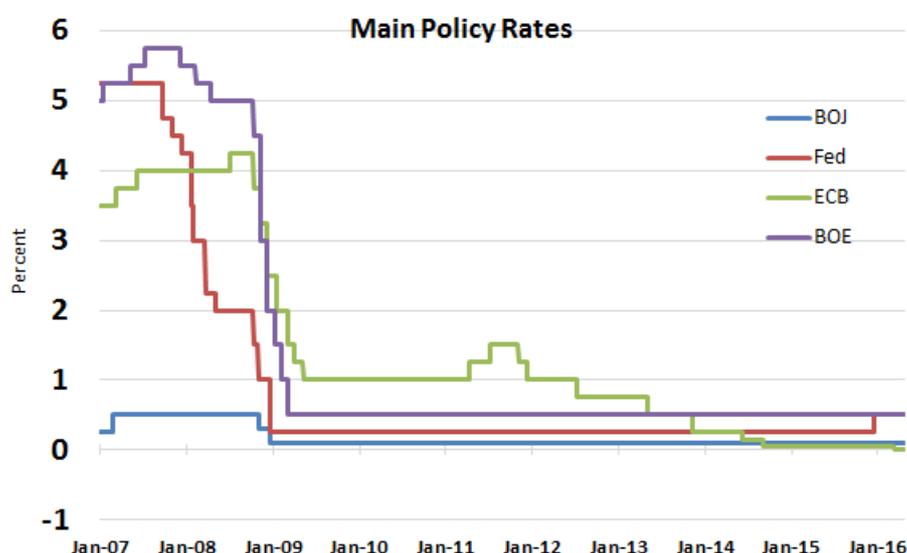
* Since January 2015 compose the EAPP.

Part III: COMPARATIVE ANALYSIS

CHAPTER 1: THE FOUR CENTRAL BANKS

The financial crisis hit on a global scale unseen to the financial world since the worldwide Great Depression of 1930. Each country's different economic and financial structure impacted the tools available to Central Banks to address the crisis. Implementation of QE differed from country to country depending on the interaction between the banking system and monetary authority. Nonetheless, in all cases quantitative easing saw all Central Banks increase their balance sheet and monetary base significantly. Rates took a sharp turn downwards as shown by figure III.1.1 below.

Figure III.1.1: Main Policy Rates across all four central banks



Source: Bloomberg for data. Authors constructed graph.

Despite each Central Bank's actions, the crisis continued and intensified with the collapse of Lehman Brothers in September 2008. As interbank confidence took a further dive, Central Bank authorities' role shifted from its traditional position to that of providing liquidity into the financial system. Initially the role of the Central Bank was to primarily alleviate financial market distress. However, as the crisis unfolded and gained momentum this expanded to include achieving specific inflation targets, containing the European sovereign debt crisis and stimulating stagnating economies.

This chapter will examine the policy responses of the Fed, the Bank of England, the Bank of Japan and the European Central Bank. It begins with a comparison of the timings and methods used by each Central Bank in terms of unconventional monetary policy. The chapter then examines the United Kingdom and United State's financial system and analysis how this might have impacted the type of unconventional monetary policies each Central Bank introduced. Introduction of negative interest rates by the European Central Bank and Bank of Japan as well as the market response to these rates is examined. The chapter concludes by looking into each Central Bank's position to exit as well as the methods available to do so.

I. Timings and unconventional monetary responses:

Prior to 2012 the Federal Reserve and the Bank of England proceeded with unconventional monetary policy by expanding their monetary bases through bond purchases. The European Central Bank and Bank of Japan focused on direct lending to the banks, revealing the bank-centric model of their financial system. By 2016, all four banks had carried out quantitative easing in some form. The intricacies of the QE programs differ to varying degrees across the four Central Banks, reflecting structures of the particular economies and financial systems as well as the motivations for the QE programs.

By the end of 2008 financial markets in the United States were in disarray, output was falling, unemployment was rising and short-term interest rates were close to zero. The Fed was running out of conventional monetary options to ease credit conditions and inject liquidity into the broader financial system.

On November 25th 2008 the Fed was the first Central Bank to announce large-scale asset purchasing measures with the purchase of \$100 billion in *Government-sponsored enterprise debt* and \$500 billion in *Mortgage Backed Securities*. This was the first round of its QE program. So far the BOE and the BOJ had not carried out unconventional policies. However, the ECB faced deteriorating financial conditions, reflected by a sharp rise in October of the 3-month Euribor/overnight indexed swap spread to 198 basis points. The ECB responded with the announcement of fixed-rate tender, full allotment operations (FRFA). The ECB announced that it would lend as much as banks required at a fixed rate given the banks had full collateral. Although these were not large-scale asset purchases, they were unconventional in approach.

In January 2009 the Bank of England announced the Asset Purchase Facility, which initially bought private sector assets funded by Treasury bill issuances and the DMOs cash management operations. Four months later on March 5th the Bank of England announced the first of its QE programs through the purchasing of *medium and long-term gilts*. Prior to this announcement, the main holders of gilts were UK non-bank financial institutions and overseas investors and made up a small part of the UK non-bank financial institutions portfolios. The main component of the first stage of the BOE's QE program was to reduce gilt holdings of the non-bank private sector. As the Fed and the BOE continued to embark on large-scale asset purchase programs, the BOJ and ECB continued instead to lend money to their banking system.

From 2008 to 2012 the Fed continued with two more rounds of quantitative easing, expanding its balance sheet massively. Almost eight years after the crisis plunged the United States' markets into turmoil, the chair of the Federal Reserve Bank of the United States announced that the FOMC had unanimously voted to raise the target rate from 0.25 percent to 0.5 percent. In the United Kingdom, the Bank of England's Asset Purchase Facility announced the last increase to £375 billion in July 2012.

From 2012 as the Fed and BOE began moving away from QE programs, the BOJ and ECB went in the opposite direction as it began to introduce asset purchase programs. The extents to which the Fed influenced the BOJ and the ECB's unconventional policies and the BOE's own policies prior are not completely clear. However, it is evident that both institutions introduced policies very much adapted to the condition of their own financial system and economy. At the time, the Fed and the BOE introduced QE programs as a reaction to the impending complete failing of their banking system, and with it their

economy. On the other hand, the ECB and the BOJ have formulated their large-scale asset purchase programs in the face of slow growing economies (not a crashing one) and as such have the liberty of hindsight and (potentially) time to create programs more suitable to their specific market needs.

In 2013 Japan introduced Abenomics, and began printing money to annually buy government bonds. The BOJ announced that it would lengthen the average maturity of Japanese government bonds (7 – 10 years) and that it would also begin to buy ETFs that track the JPX-Nikkei Index 400. Mr. Kuroda, the governor of the Bank of Japan, clarified that these steps were meant to be more of an adjustment as opposed expansion of Japan's easing program. The BOJ's approach is slight different to the ECB and BOE's approach as they have introduced Qualitative and Quantitative Easing.

To put things into context, the BOJ voted to buy approximately \$70 billion of government bonds per month. The US' Federal Reserve, on the other hand, was spending slightly more at \$85 billion per month, keeping in mind that the US economy is almost three times that of Japan's. The BOJ's QE scheme is comparatively vast. Potentially this has something to do with their limited room for monetary manoeuvre (the BOJ are running out of government bonds to buy and they are already in negative interest rates).

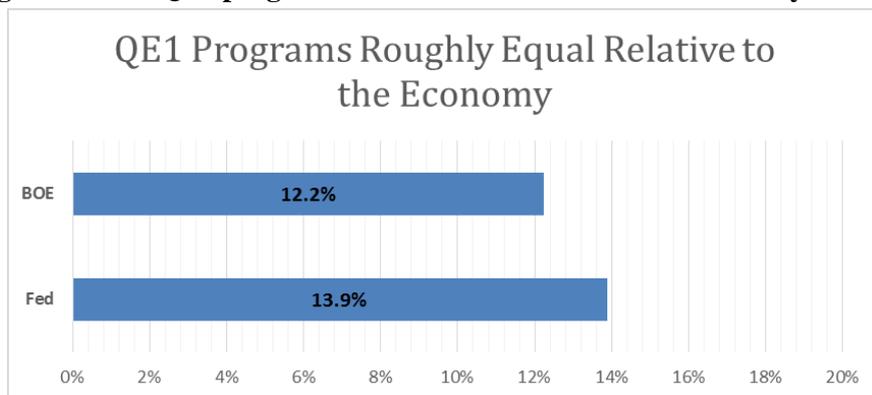
In Europe things have taken a slightly different turn. In January 2015, fearing a deflationary spiral, the ECB announced the Expanded Asset Purchase Program. In March 2015 the Public Sector Purchase Programme revealed how the ECB intended to purchase sovereign bonds and securities both from European institutions and national agencies. The ECB is operating in a very different environment to the other Central Banks. Monetary policy is limited as the Bank is regional, as opposed to just national. The ECB has confirmed they will buy no more than 33 percent of each issuer's debt and no more than 25 percent of each issue. Sceptics are quick to have their voices heard, arguing that the ECB's QE program will not work and unlike the US and UK, long-term interest rates (which QE should add downward pressure to) are already low in Europe.

CHAPTER 2: SCHEMATIC MAPPING OF KEY LSAP PROGRAMS 2008-2015

Implementation (2008 – 2009)

In December 2008, The Federal Reserve became the first central bank to enter into implement LSAPs in the hopes of backstopping the bleeding financial crisis. The Bank of England followed suit less than a month later after initial hesitation. By March of 2009, each of them had expanded their efforts significantly, with the US committing to \$1.725 trillion in purchases through the end of the year. Relative to their respective economies, both the Fed and BOE QE1 programs were roughly equal in proportion (see below).

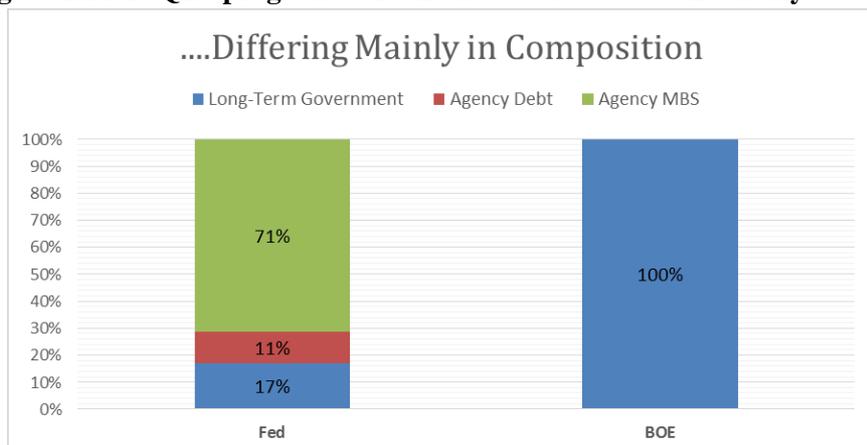
Figure III.2.1: QE1 program of BOE and Fed relative to Economy



Source: Calculations using figures from Table 2. Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013

The composition of the QE purchases, however, differed dramatically, as nearly 80% of purchases were directed towards the ailing US housing market, as illustrated below.

Figure III.2.2: QE1 program of BOE and Fed relative to Economy



Source: Calculations using figures from Table 2. Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013

The Fed and the BOE's readiness to engage in large scale purchases of securities made sense given the depth of their bond markets and the US financial systems' reliance on capital markets more broadly

for sources of finance. The US’ particular focus on purchases of housing market securities was in direct response to the roots of the financial crisis in the US housing market. Purchases of these securities were aimed at providing liquidity to the mortgage market that would in turn alleviate financial market conditions more broadly, given the importance of the housing market in the US.

Financial System Structures: Bank-Centric Eurozone and Japan (2008 – 2009)

Around roughly the same time, Japan and the Eurozone engaged in very different quantitative easing schemes that catered to the idiosyncrasies of their financial systems. In the Eurozone, for instance, banks have traditionally been the main source of financing for the economy. In fact, more than 70% of the external financial of the non-financial corporate sector is provided by banks in the Eurozone, leaving the health of the economy intimately tied to the health of the banking sector. As shown in the graph below, the reliance on banks as opposed to capital markets in the Eurozone is reversed for United States.

Figure III.2.3: Funding of non-financial corporations in the euro area and the United States

(shares in accumulated debt transactions 2002-2012Q1)



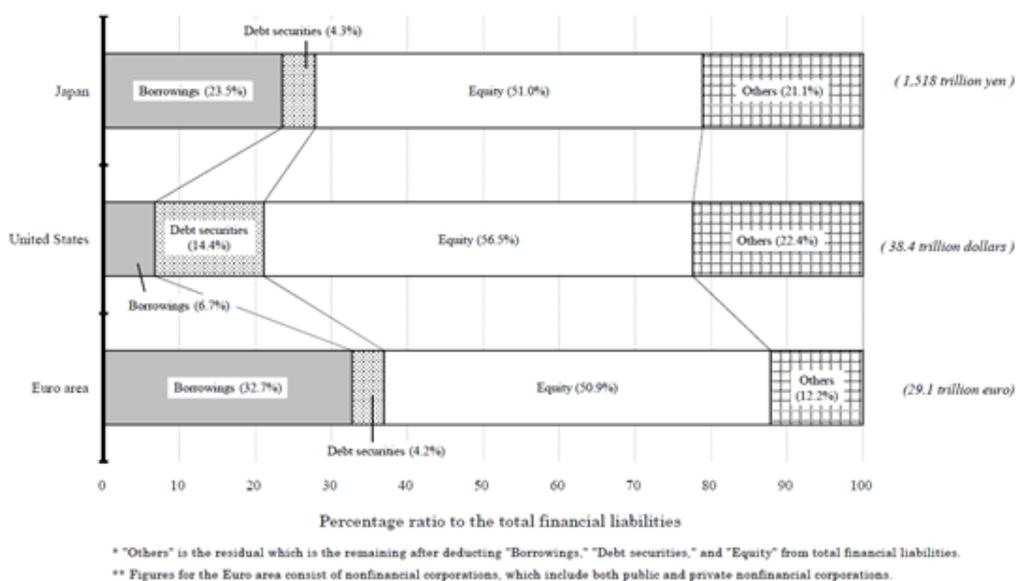
Note: EA stands for the euro area.

Sources: Eurostat, ECB and Federal Reserve System.

Source: Cour-Thimann, Philippine and Winkler, Bernhard, “[The ECB’s Non-Standard Monetary Policy Measures: The Role of Institutional Factors and Financial Structure](#),” European Central Bank, 2013.

A decomposition of the financial liabilities owed by private nonfinancial corporations illustrates the depth of the reliance of the Eurozone and Japan on bank loans when compared to the US reliance on debt markets.

Figure III.2.4: Financial liabilities owed by private nonfinancial corporations



Source: Research and Statistics Department. “[Flow of Funds- Overview of Japan, the United States, and the Euro area.](#)” Bank of Japan, April 2015.

As such, the ECB and BOJ initially engaged in QE programs tailored to their banking systems, but stopped short of LSAPs in the open market. The ECB’s fixed-rate tender, full-allotment (FRFA) operations and the BOJ’s Special-Funds-Supplying Operations (SFSOs) were similar lending operations that provided unlimited amounts (limited only by amount of collateral in the case of BOJ) at fixed rates.

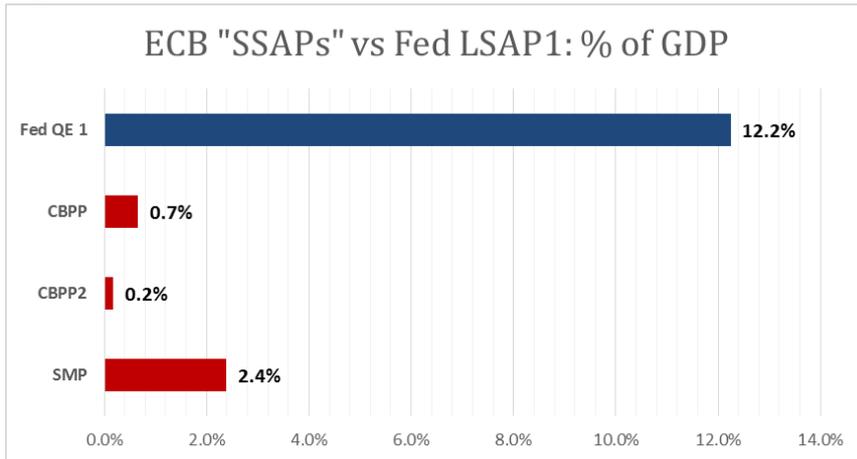
ECB LSAP Hesitation vs. BOJ LSAP Expansion

Though the ECB continued to expand its FRFA and long-term refinancing operations (LTROs), its hesitation to engage in LSAPs persisted through 2012. In May 2009, relatively later than the other leading central banks, the ECB decided to commit to 60 billion euro worth of covered-bonds, a popular source of financing for European banks that ran into distress. The purchase accounted for roughly 2.5% of the covered bond market at the time,¹⁸⁰ but was very small compared to LSAPs conducted by the Federal Reserve (See figure below).¹⁸¹ In October 2011, the second round of Covered Bond Purchases was announced but ended being even smaller than the first. The Securities Markets Program was introduced in May 2010 to purchase sovereign bonds in order to combat the escalating Eurozone debt crisis and bring down yields on Eurozone periphery debt, but remained relatively small by the time it wound down it ended in September 2012.

¹⁸⁰ Fawley, Brett W., and Christopher J. Neely. “[Four Stories of Quantitative Easing.](#)” Federal Reserve Bank of St. Louis. 2013.

¹⁸¹ [Ibid.](#) Calculations using figures from Table 2.

Figure III.2.5: ECB 'SSAPs' vs Fed LSAP1: % GDP

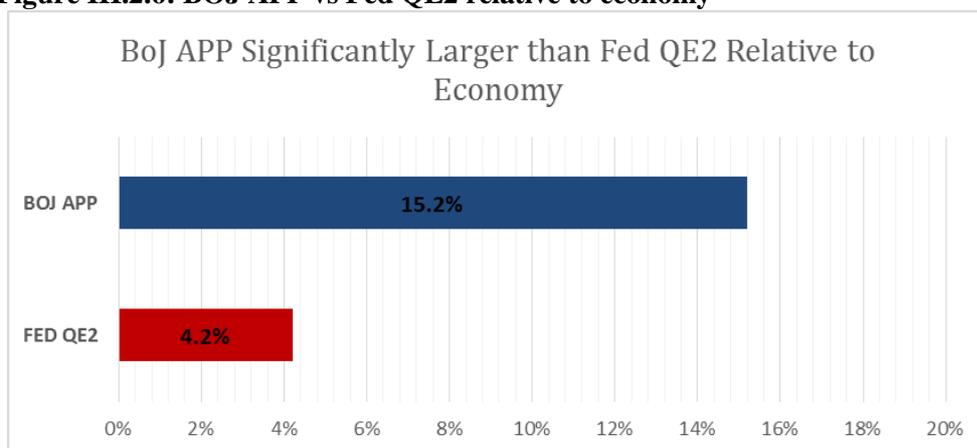


Source: Calculations using figures from Table 2. Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013.

At the other end of the spectrum, the BOJ significantly ramped up its purchases of a variety of assets between December 2008 and March 2009. Purchase announcements committed to Japanese Government Bonds (JGBs), Commercial Paper (CP) and Corporate Bonds, at levels of ¥21.6 trillion (annually), ¥3 trillion and ¥1 trillion, respectively.

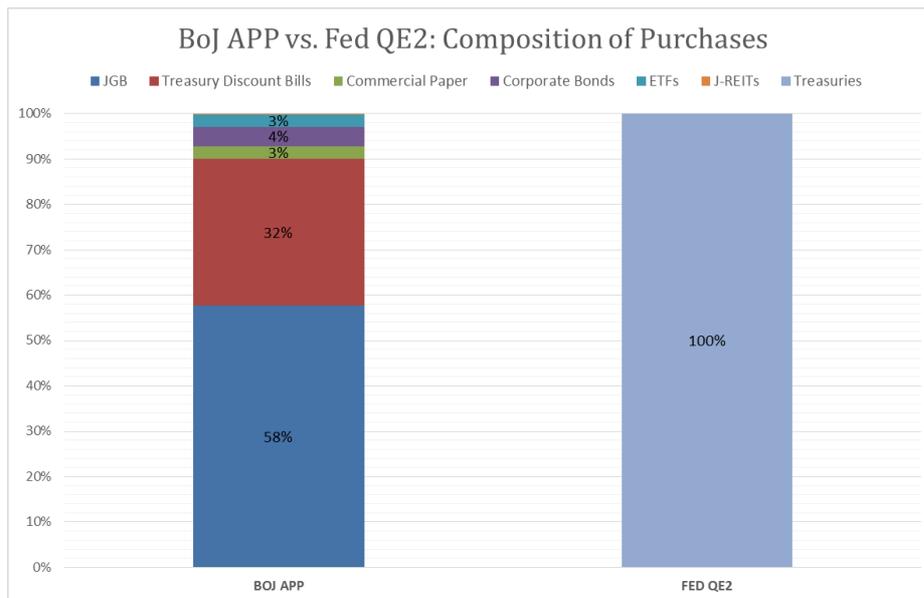
In October 2010, the BOJ announced the new Asset Purchase Program (APP) as part of a monetary easing package, which included ¥5 trillion in new asset purchases across short- and long-term JGBs, commercial paper, corporate bonds, exchange-traded funds (ETFs) and Japanese real-estate investment trusts (J-REITS). The purchases were significantly increased multiple times throughout 2012 until the termination of the program in April 2013. The program was announced just before the Fed's QE2 program in November 2010 and was similar in terms of its goals to combat sluggish growth, but significantly larger and more diverse in terms of its purchases.

Figure III.2.6: BOJ APP vs Fed QE2 relative to economy



Source: Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013.

Figure III.2.7: BOJ APP vs Fed QE2: Composition of purchases



Source: Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013.

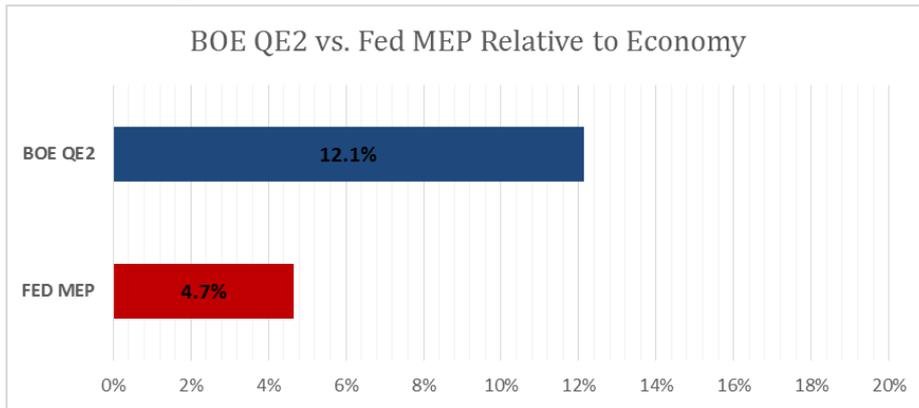
The Eurozone Crisis and Central Bank Responses

As the Eurozone crisis began to threaten the relatively weak and slow recovery in the advanced economies during the summer of 2011, the major central banks were faced with growing fears of a double-dip recession. To combat a slowdown in growth, the Fed entered into “Operation Twist” on September 21, 2011, announcing that it would purchase \$400 extra in long-term Treasuries while simultaneously selling an equal amount of short-term Treasuries. The intention was to lengthen the average maturity of the Fed’s portfolio in order to reduce long-term rates relative to short ones, thereby further easing financial conditions. In an added move of policy accommodation, the Fed also announced that it would reinvest maturing Agency Debt and MBS back into MBS instead of Treasuries in order to provide extra stimulus to the housing market.

Similarly plagued by fears of a double-dip recession and disinflationary trends, the BOE expanded its APF and entered to its own QE2 program on October 6, 2011. Though the cap on purchases was only lifted from £200 billion to £275 billion, the program was eventually extended to an extra £175 billion of long-term gilts on July 5, 2012. Less than two weeks earlier, on June 20, 2012, the Fed announced that it would extend Operation Twist until it exhausted all of its short term Treasuries by year end.

The following graph shows the size of the Fed’s full “Operation Twist” and the BOE’s QE2 relative to their economies. The relative sizes of the programs are a likely indication of the extent to which each economy feared the specter of a double-dip recession.

Figure III.2.8: BOE QE2 vs Fed

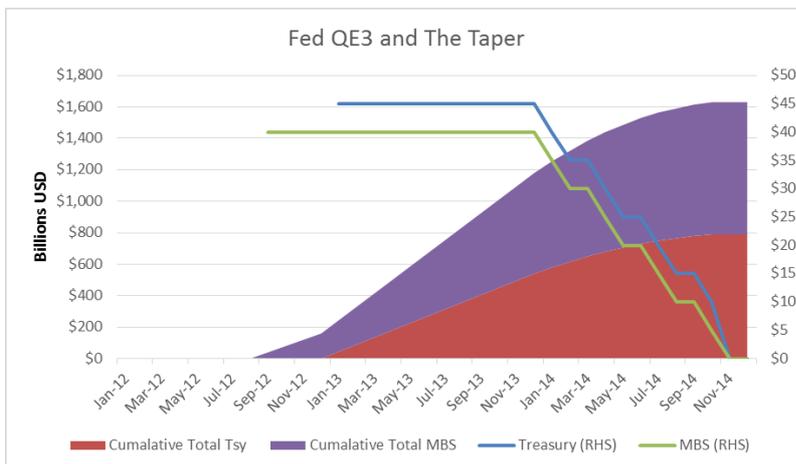


Source: Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013.

2013: The BOJ and Fed Take Center Stage

While Japan experienced an upswing in macroeconomic growth indicators in 2012, the US was faced with a slowdown in labor market recovery and sluggish growth. Before Operation Twist drew to a close, the Fed announced the third LSAP program. QE3, as it is commonly referred to, committed to \$40 billion in monthly purchases of MBS, bringing combined monthly purchases to \$85 billion with the monthly \$45 billion in purchases of long-term Treasuries underneath operation Twist. As short-term securities ran out, Operation Twist drew to a close, but purchases of long-term Treasuries continued into 2013, albeit unsterilized.¹⁸²

Figure III.2.9: Fed QE3 and the Taper



Source: Fawley, Neely, "[Four Stories of Quantitative Easing](#)," Federal Reserve Bank of St. Louis Review, January/February 2013.

In April 2013, BOJ begins on their path of Quantitative and Qualitative Easing, committing to a doubling of the monetary base by 2014 and a rapid increase in the annual rate of purchases of JGBs, ETFs, and J-REITs. The program was accelerated yet again in October 2014.

¹⁸² [Ibid.](#)

For the majority of 2013, the Fed and BOJ remain the major central bank players as the BOE reaches its cap and sovereign yields decline in the Eurozone, prompting less action from the ECB. Nonetheless, disinflationary trends bring the ECB back into the expansionary policy/accommodative policy space.

2014 - 2015: Central Bank Monetary Policy Divergence

In June 2014, Eurozone inflation dips below 1% and expected inflation becomes de-anchored from the historical 2% target for the first time. In an effort to keep expected inflation anchored and combat disinflationary trends, the ECB implements negative rates. Before the year is over, they complement the negative rates with further accommodation in the form of small asset purchase programs, CBPP3 as well as ABSSP. In 2015, the ECB announces its first LSAP program called the Public Sector Purchase Program (PSPP), in an effort to further combat inflation and stimulate growth.

In a similar fashion, the BOJ commits to an aggressive expansion of its QQE programs in 2014 and 2015, targeting a large expansion of the monetary base across a wide range of assets.

Heading in the opposite direction, the Fed begins to moderately taper the pace of its purchases by roughly \$10 billion a month, finally concluding QE3 in October 2014. It commits to maintaining rates low and revisiting them as conditions warrant. Further, it commits to maintaining the size of its balance sheet by reinvesting principal payments on maturing securities. In December 2015, the Federal Reserve becomes the first major central bank to raise its policy rate and begin the path towards normalization.

2016: Uncharted Territory

The ECB aggressively expands its PSPP in March 2016 and continues its use of negative interest rates.

The BOJ pursues its own negative rates for the first time in a persistent effort to guide inflation and expected inflation.

The Fed maintains rates but lowers its optimism for 2016 in terms of the number of rate hikes to be expected.

CHAPTER 3: BOE AND THE FED PROGRAM COMPARISON

Different financial conditions and motives faced by the central banks influenced the approach they took to LSAPs at different stages in the crisis.

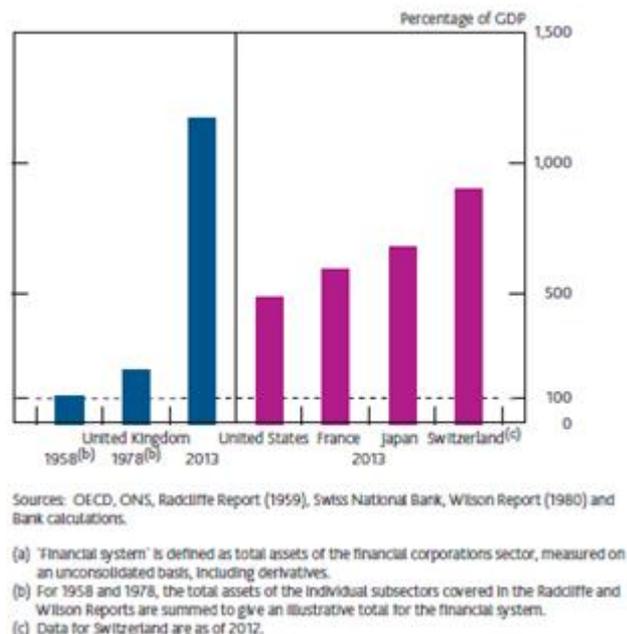
The Fed acted quickly in response to the dysfunctional mortgage market and asset price freefall. Their response was to announcing support for purchases of stressed securities. Although the BOE was initially reluctant to join the Fed and BOJ in easing, it eventually participated in balance sheet expansion in January 2009. As financial markets started to collapse, several of the U.K.'s own banks found themselves exposed to the US mortgage market and liquidity eroded within the U.K. banking sector.

The Fed concentrated more on mortgage backed securities (MBS) in its initial purchase program, while the BOE concentrated on the gilt purchases alone. Their different reasons were primarily related to their financial systems. The Fed wanted to bring confidence and ease of liquidity into the mortgage sector, a key market for the monetary transmission mechanism in the US. On the other hand, the BOE went after banking confidence and market liquidity in the UK's bank-centered economy.

Motives

The United Kingdom's economy relies heavily on the financial sector. Figure III.3.1 below and shows the UK's financial system as percentage of GDP.

Figure III.3.1: UK's size of financial system



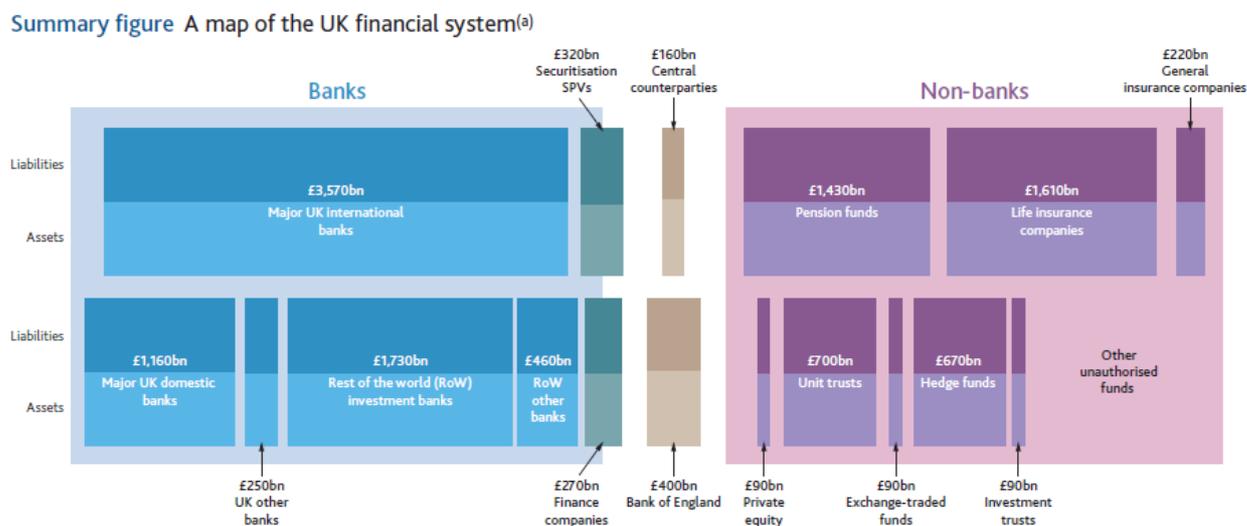
Source: Burrows, Oliver, and Katie Low. "[Mapping the UK financial system.](#)" Q2 2015.

For the BOE, saving the banking system was the main issue. A banking melt down was likely after the mortgage market collapse in the US. As banks' assets depleted, the crisis deepened due to asset

liability mismatch. Liquidity started to evaporate. As growth slowed down as well, the BOE gave further stimulus to the economy to stop slowdown and generate investment and spending to spur growth. The below figure breaks down the UK financial system.

FED aim in this crisis was to save the mortgage and credit market under pressure initially. However, like in UK, with deteriorating outlook for economic growth and fall in expected inflation Fed expanded the program from MBS to government bonds as well. The choice to enter a credit easing program rather than a pure QE regime was due to the US financial system’s idiosyncratic structure. Unlike other advanced economies’ financial systems, the US financial system was heavily relies heavily on non-bank financial institutions and capital markets as a source of finance.

Figure III.3.2: The U.K financial system*



* Sectors are sized in proportion to their total financial assets excluding derivatives and cross-border exposures of foreign-owned bank branches.

Source: Burrows, Oliver., and Katie Low. “[Mapping the UK financial system.](#)” Q2 2015.

Program Options

The BOE acted to save local and foreign banks under its jurisdiction. It did this by buying gilts in different episodes over the four years after the crisis began. The purpose was to support liquidity in banking by creating additional reserves i.e. unsterilized. It also included other assets, though relatively small in quantity, to focus individual markets such as corporate bonds and commercial paper.

In its first episode (Q1) from 2009-2010, the BOE increased its balance sheet by £200bn of gilts purchases. The second episode (Q2), the BOE further increased the program by £175bn to £375bn in gilts purchases. Since then the BOE has maintained the expanded balance sheet by reinvesting the maturing proceeds.

The Fed’s asset purchases differed in that they were treasuries, MBS and agency debt. In total, the Fed bought approximately \$1690bn of Treasuries (excluding operation twist), \$200bn of Agencies and \$2090bn of MBS over the course of all 3 QEs.

Results

The study published in May 2012 by Jens Christensen and Glenn Rudebusch, both of Federal Reserve Bank of San Francisco, highlighted some key findings and analysis of QE1 data alone. Going through a similar economic environment, the FED and BOE purchased roughly comparable amounts of respective bonds relative to the size of their economies and to outstanding government debt. As stated in individual chapters, both programs resulted in a significant decrease in yields confirmed by different studies.

As expressed in the BOE chapter earlier, the purchases of gilts had a significant impact on the UK economy. It did this by lowering yields by approximately 104bps after its initial Q1 program. However, results vary slightly for Christensen/Rudebusch research as indicated in the below table.

Figure III.3.3: Impact of changes in Treasuries on announcement dates

	US	UK	US	UK
	5 Year	5 Year	10 Year	10 Year
QE1	-97bps	-44bps	-89bps	-43bps

Source: Federal Reserve Bank of San Francisco. Data from Figure III.3.4. Table created by Author.

These effects are only for QE1 and only on announcement dates and does not include longer time horizon which brought yields further down in both US and UK. Also, figure below shows US announcement effect on UK yields before UK QE announcements reflecting a significant impact as well. Vice versa effect of UK announcements on U.S yields is very complicated to breakdown.

Figure III.3.4: Changes in U.S. Treasury yields (& OIS Rates) on LSAP (QE1) announcement dates

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Nov. 25, 2008	-5	-9	-14	-22	-21
II Dec. 1, 2008	-3	-6	-12	-21	-22
III Dec. 16, 2008	-7	-8	-11	-16	-17
IV Jan. 28, 2009	-5	-1	5	10	12
V Mar. 18, 2009	-13	-17	-26	-47	-52
VI Aug. 12, 2009	1	0	-1	1	6
VII Sep. 23, 2009	-1	-2	-4	-4	-2
VIII Nov. 4, 2009	-1	-1	-1	3	7
Total net change	-34	-45	-65	-97	-89

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Nov. 25, 2008	-5	-7	-14	-25	-28
II Dec. 1, 2008	-5	-5	-13	-21	-19
III Dec. 16, 2008	-17	-17	-15	-29	-32
IV Jan. 28, 2009	0	4	6	11	14
V Mar. 18, 2009	-3	-5	-12	-27	-38
VI Aug. 12, 2009	-2	-2	-1	-2	1
VII Sep. 23, 2009	-2	-3	-5	-6	-5
VIII Nov. 4, 2009	-1	-2	-3	1	5
Total net change	-35	-37	-58	-97	-102

Changes in U.S. Treasury Yields on LSAP Announcement Dates. Changes are measured in basis points.

Changes in U.S. OIS Rates on LSAP Announcement Dates. Changes are measured in basis points.

Source: Federal Reserve Bank of San Francisco. "[The Response of Interest Rates to U.S. and U.K. Quantitative Easing.](#)" May 2012.

Figure III.3.5: Changes in U.K. Gilt yields (& OIS Rates) on QE1 announcements dates

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Feb. 11, 2009	-16	-24	-30	-25	-20
II Mar. 5, 2009	0	0	-2	-18	-32
III May 7, 2009	1	0	1	5	6
IV Aug. 6, 2009	1	2	-3	-11	-7
V Nov. 5, 2009	0	0	1	4	7
VI Feb. 4, 2010	0	-1	-2	-2	-1
VII Oct. 6, 2011	1	3	4	3	4
Total net change	-13	-20	-31	-44	-43

Changes in U.K. Gilt Yields on QE Announcement Dates.
All changes are measured in basis points.

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Feb. 11, 2009	-22	-22	-32	-23	-16
II Mar. 5, 2009	11	13	8	-5	-17
III May 7, 2009	0	1	7	14	15
IV Aug. 6, 2009	-2	-8	-8	-2	2
V Nov. 5, 2009	1	0	-5	2	4
VI Feb. 4, 2010	-1	-4	-10	-5	-4
VII Oct. 6, 2011	1	3	8	8	8
Total net change	-12	-18	-32	-12	-8

Changes in U.K. OIS Rates on QE Announcement Dates.
All changes are measured in basis points.

Source: Federal Reserve Bank of San Francisco. "[The Response of Interest Rates to U.S. and U.K. Quantitative Easing.](#)" May 2012.

Positive spillover to U.K: They also find that there was a significant impact on U.K yields on U.S LSAP announcement and how global interdependency of financial markets transfer impact from one region to another or one asset class to another.

Figure III.3.6: Changes in U.K. Gilt yields on U.S. LSAP (QE1) announcements dates prior to start of U.K. QE1

Event	Maturity				
	6-month	1-year	2-year	5-year	10-year
I Nov. 25, 2008	-8	4	14	-1	-16
II Dec. 1, 2008	-26	-35	-42	-33	-23
III Dec. 16, 2008	-15	-20	-24	-24	-24
IV Jan. 28, 2009	1	0	-3	-4	2
Total net change	-49	-51	-56	-62	-61

Changes in U.K. Gilt Yields on U.S. LSAP Announcement Dates Prior to U.K. QE Program.
All changes are measured in basis points.

Source: Federal Reserve Bank of San Francisco. "[The Response of Interest Rates to U.S. and U.K. Quantitative Easing.](#)" May 2012.

Comparison

After looking at several approaches to assessing the financial market impact of QE with literature, research and analysis, we conclude that QE, in both countries, had a significant and economically important impact on the bond market as seen above in comparison of US to UK.

Another aspect to consider between U.S. to U.K. is the issue of negative cash flows, if they were to arise for the respective central bank. While Fed does not have anything to protect itself if it starts to have losses piling up on its QE holdings of negative cash flows arising due to liabilities it has to meet on these assets. On the other hand, HMT has provided complete indemnification to Bank of England on certain negative cash flows as explained in Bank of England chapter.

Indemnification

The APF was fully indemnified by HM Treasury (HMT) meaning that any financial losses as a result of the asset purchases were borne by HMT, and any gains were owed to HMT as well. It is interesting that HMT indemnified BOE holdings under APF; however, they did not provide indemnification on FLS program. Fed does not hold that privilege from the US Treasury.

Central Bank's balance sheet and monetary base

Below graphs gives us a clear picture of the pre-crisis levels comparison to end of 2014 for all four major central banks. Main point to take away from below chart is the size of the monetary base expansion as percentage of GDP, and outright purchases as percentage of total assets held by the bank. Both U.S and U.K massively expanded in both categories as they accumulated assets to expand balance sheet.

Figure III.3.7: Central banks' balance sheets: size and composition

	Dates	Total Assets (% GDP)	Monetary Base (% GDP)	Outright Purchases (% GDP)	Outright Purchases (% total assets)
ECB	Latest	17.6	11.9	2.2	12.1
	Peak (June 2012)	26.2	18.0		
	2007	9.9	8.8		
FED	Latest	24.5	23.4	24.4	99.5
	2007	5.8	5.5		
Japan	Latest	59.1	54.7	53.1	89.9
	2007	16.3	17.1		
UK	Latest	22.6	20.8	20.9	92.4
	2007	5.4	4.4		

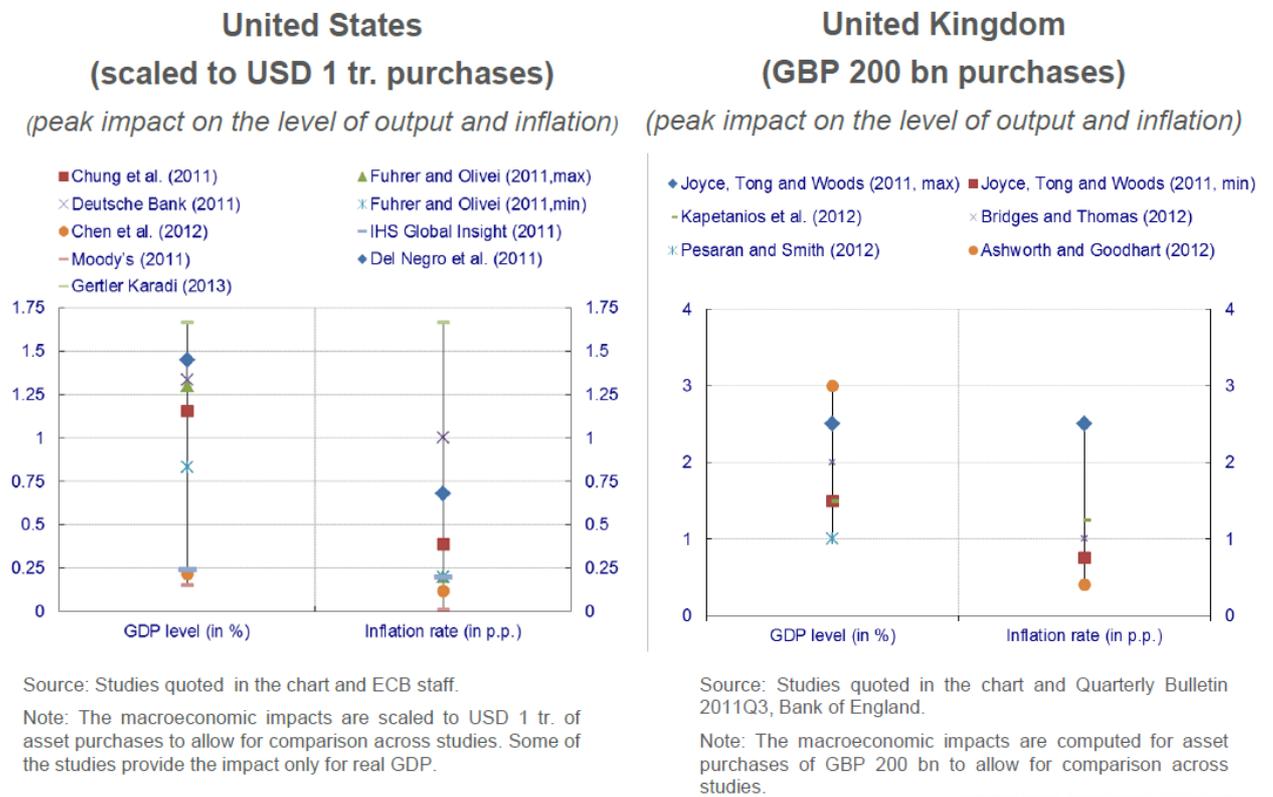
Note: 2014 GDP based on *OECD November 2014 Economic Outlook forecast*. Figure for Federal Reserve *monetary base* refers to October 2014.

Source: ECB, "[Monetary Policy Forum "Panel discussion on Central Banking with Large Balance Sheets."](#) 2015

Transmission Channels and Impact of LSAPs on bond yields

Below chart reveals literature and studies done by respective researchers and their findings on effects of QE on yields plus GDP and inflation.

Figure III.3.8: Impact of LSAPs

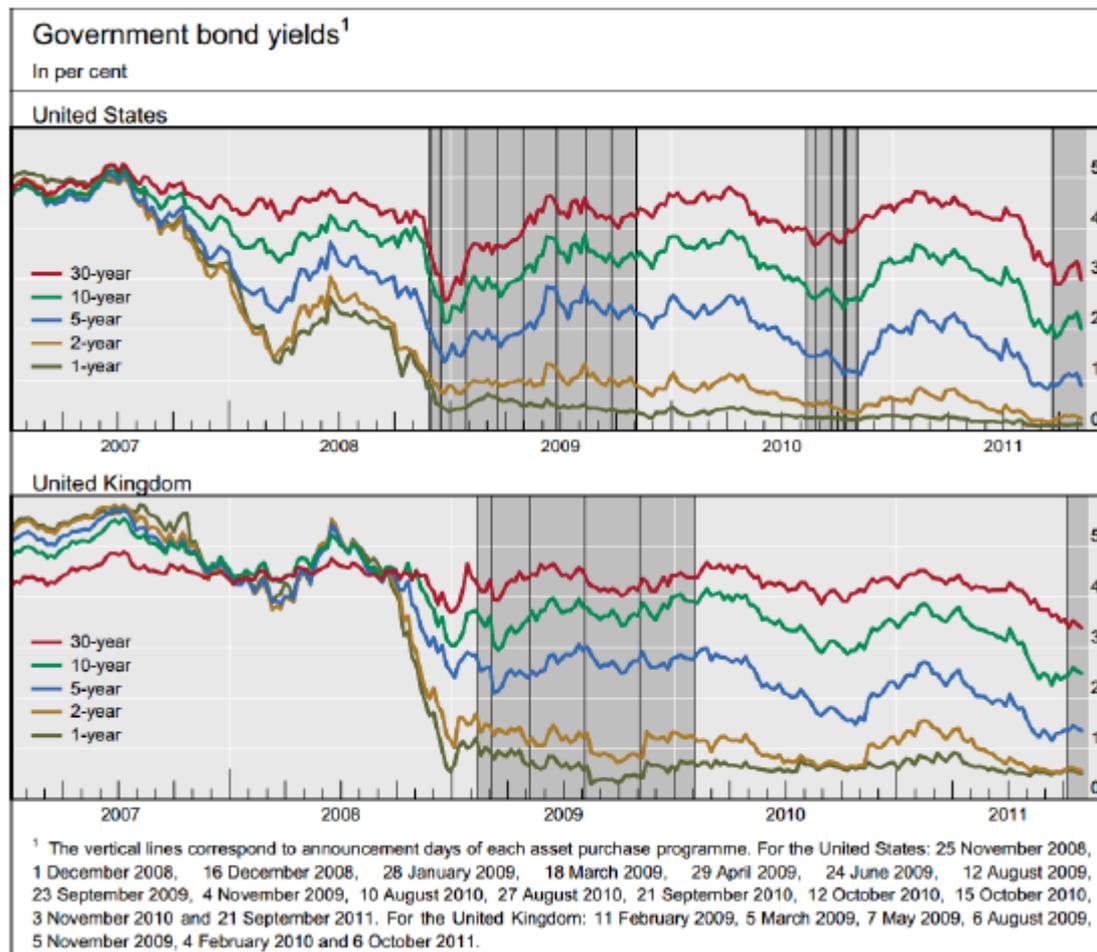


Source: ECB. [“Monetary Policy Forum “Panel discussion on Central Banking with Large Balance Sheets.”](#) 2015

Effects on yields of other asset segment

Though yields were lower across the whole yield curve for Fed, the movement has been relatively lower in BOE's impact.

Figure III.3.9: Impact of on UK and US Government bond yields

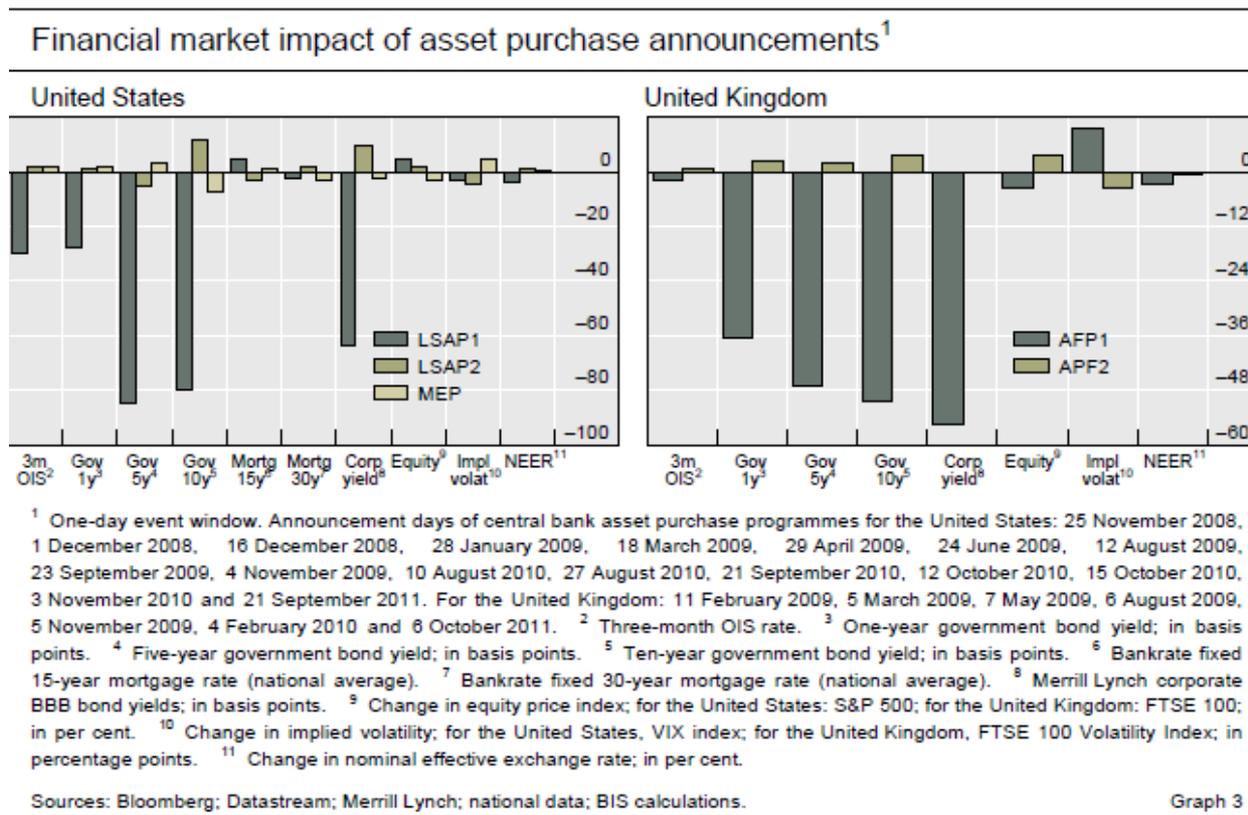


Source: Meaning, Jack., and Feng Zhu. "[The Impact of recent central bank asset purchase programs.](#)" December 2011.

Financial market impact of asset purchase announcements:

Below graphs display the cumulative effects with a one day time window. What we see is that the announcements had a strong and immediate reaction/impact on government bond yields. 5 year and 10 year were affected the most indicating to both the Fed and the BOE that they need to target longer dated maturities for better impact on lowering yields. Secondly, both first episodes of the FED LSAP1 and the BOE's APF1/QE1 had a far stronger impact than the second instalment. Market already expected and priced the second episodes resulting lower movements.

Figure III.3.10: Financial market impact of asset purchase announcements



Source: Meaning, Jack., and Feng Zhu. “[The Impact of recent central bank asset purchase programs.](#)” December 2011.

CHAPTER 4: THE ECB, BOJ & THE FED PROGRAM COMPARISON

The Eurozone and Japan are the only two major economies that are actively implementing LSAPs with negative interest rates. Though the European and Japanese experiences in recent years share some similarities with regard to deflationary pressures, the programs have differed significantly in their design and implementation. As Chairwoman Janet Yellen recently stated that “we wouldn’t take those off the table” with regard to negative interest rates, the BOJ’s and ECB’s most recent ventures into negative rate territory offer a learning opportunity of the costs and benefits associated with the unconventional monetary policy.

Macroeconomic Context and Motives

Both the ECB and BOJ decided to implement a Negative Interest Rate Policy (NIRP) in response to challenging macroeconomic environments. After 25 years of stagnation and adverse demographic trends, Japan found itself aggressively expanding its unconventional monetary policy operations to combat the deflationary syndrome. Though a subdued inflation outlook has plagued the Euro area for a relatively shorter amount of time, the ECB’s recent expansion of its QE program coupled with negative deposit rates mirrors the BOJ’s attempt to fight deflation and stimulate economy activity.

Program Options

Although the two central banks imposed negative rates on their financial systems, the BOJ and ECB sequenced and structured their NIRPs in different manners.

Somewhat ironically, institutional constraints meant that the ECB was able to pursue the more politically palatable NIRP as early as mid-2014 in order to “underpin the firm anchoring of medium to long-term inflation expectations.”¹⁸³ The NIRP was part of a larger program of unconventional measures, including the PSPP, and was introduced in June 2014 when it cut the deposit rate to -10 basis points.¹⁸⁴ By March 2016, it had cut the deposit thrice more to finish at -40 basis points. On the other hand, the BOJ’s introduction of the NIRP in January 2016 came after an aggressive expansion of its QQE program and continued disappointment with its inflation target.

The structure of the individual NIRPs has led some to speculate that the BOJ’s unique, three-tiered approach may be weaker than the ECB’s blanket approach to negative rates. Whereas the ECB is charging a flat deposit rate of -40 basis points on all deposits held in excess reserves, the BOJ will only charge -.1% on new bank reserves generated as a result of the BOJ’s asset purchase program. At the same time, existing bank reserves will continue to be paid interest at 0.1% while required reserves receive 0%.¹⁸⁵ Since Japanese banks are relatively more incentivized to hold excess reserves than European financial institutions, there is likely to be less impact on bank profits or bank depositors in Japan in the short term.

¹⁸³ Bech, Morten, and Aytok Malkhozov. “[How Have Central Banks Implemented Negative Policy Rates?](#)” Bank for International Settlements. March 2016.

¹⁸⁴ [Ibid.](#)

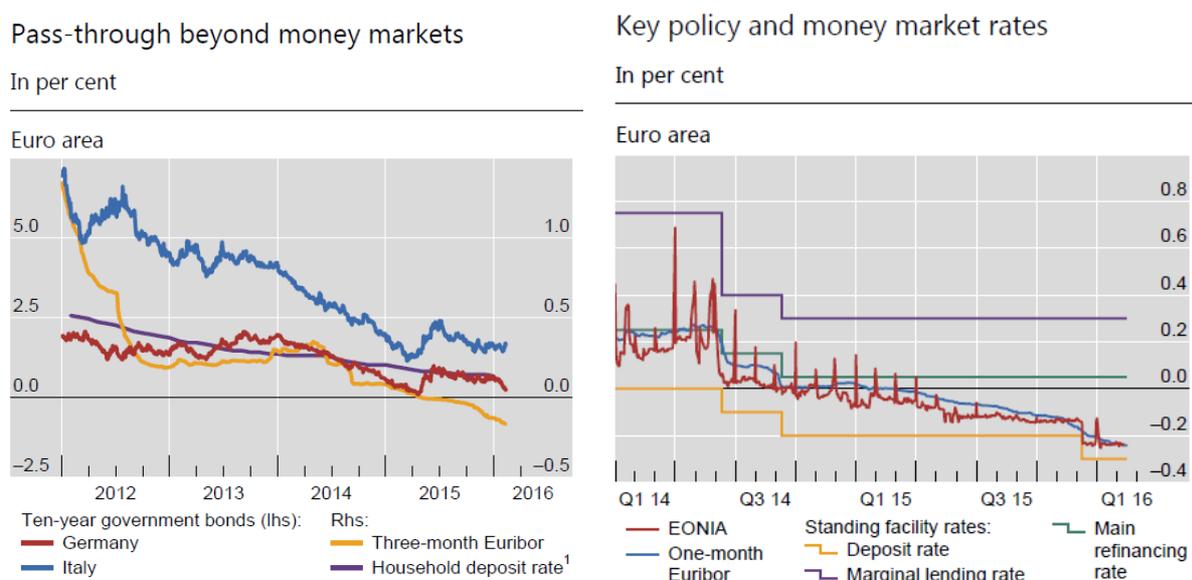
¹⁸⁵ Harding, Robin, Sam Fleming, and Claire Jones. “[Japan Joins Negative Rates Club.](#)” Financial Times, 29 Jan. 2016.

Results

The immediate market reactions to the negative interest rate policy went in opposite directions. For Japan, global markets saw the announcement as a big surprise and had immediate effects on stock price and exchange rate, with the Nikkei index surging and the yen falling nearly 2% against the USD.¹⁸⁶ Unfortunately, the currency appreciated less than two weeks later to its strongest level since 2014 as worries over China led investors to the safe-haven of the Japanese Yen.¹⁸⁷ For the ECB, the policy was also a surprise, but had lasting effects in terms of currency depreciation.

The long-term effects of the central banks' NIRPs will likely differ as well. Though the Japanese experiment with negative rates is relatively new, overall financial market performance remains disappointing. On the other hand, there is now empirical evidence that negative rates have passed through to short-term money market rates with very little impact on trading volume in the Eurozone (See Figure III.4.1 Left). Though negative rates in the Eurozone also coincided with a reduction in longer-maturity and higher-risk yields, it is difficult to decompose the effects of negative rates from the simultaneous LSAP programs being conducted by the ECB (See Figure III.4.1 Right).

Figure III.4.1: Negative Rate Pass-Through to Money Markets (March 2016)



Source: Bech, Morten, and Aytek Malkhozov. [How Have Central Banks Implemented Negative Policy Rates?](#) Bank for International Settlements, Mar. 2016. pp 38-40.

¹⁸⁶ Bradsher, Keith. "Bank of Japan, in a Surprise, Adopts Negative Interest Rate." The New York Times, 29 Jan. 2016.

¹⁸⁷ Ismail, Netty Idayu, and Anooja Debnath. "Yen Advance Is So Strong It's Triggering Intervention Warnings." Bloomberg.com. Bloomberg, 9 Feb. 2016.

Negative Rates and the Federal Reserve

Given the particular importance of MMFs in US financial markets, the effect of negative rates on Eurozone MMFs provide important insight into their potential use in the US.

In an August 2010 memo, the Fed discussed the question of precisely how negative interest rates could become in the US. The staff expressed concern that significantly low or negative rates “would likely result in dramatically reduced trading volumes in funding markets” as well as “further reductions in the profitability of MMFs, with an increased likelihood that some MMFs...would leave the market.”¹⁸⁸ Though the experience in the Eurozone may be too young to draw conclusions from, the lack of decline in trading volumes or squeeze on MMFs is a positive sign.

Former Fed Chairman Bernanke has also recently expressed the view that “events since the staff memo was written have reduced, but not eliminated these concerns,”¹⁸⁹ noting that MMFs will have to display *floating* net asset values by year end. This will reduce the potential for investor withdrawals over concerns of MMFs “breaking the buck” and returning less than the full amount invested. Additionally, the banking sector and larger economy, he argues that most European economies using negative rates are significantly more negative than the levels analysed in the memo, yet currency hoarding has not materialized.

It is unlikely that the Fed will apply negatives rate in the short term given the recent path to normalization. Nonetheless, given the relatively smooth (albeit nascent) experiences in the EU and Japan, it may serve as another tool in the monetary policy toolkit to be kept in mind for future macroeconomic challenges.

¹⁸⁸ Burke, Chris, Spence Hilton, Ruth Judson, Kurt Lewis, and David Skeie. "[Reducing the IOER Rate: An Analysis of Options.](#)" Federal Reserve System, 5 Aug. 2010.

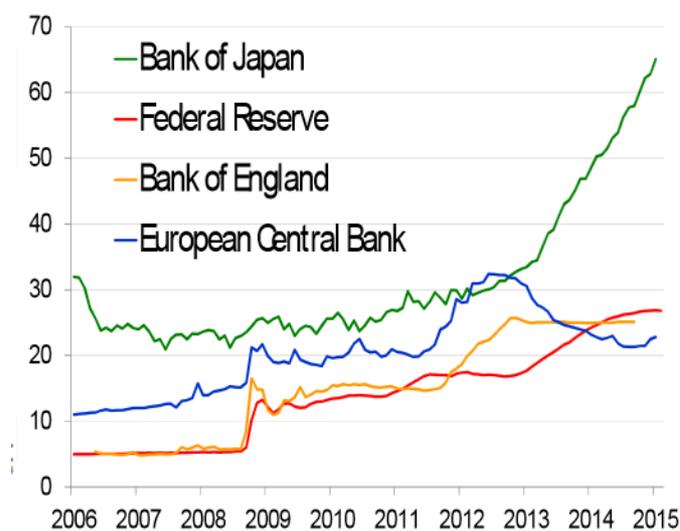
¹⁸⁹ Bernanke, Ben S. "[What Tools Does the Fed Have Left? Part 1: Negative Interest Rates.](#)" Brookings.edu. The Brookings Institution, 18 Mar. 2016.

CHAPTER 5: EXIT STRATEGIES

Exit Strategies Comparison

With unprecedented expansions in the central bank balance sheets after successive rounds of LSAPs (See Figure III.5.1), a significant challenge ahead lies on the path to normalization. While the Fed and the BOE are on a trajectory to wind up their QE programs, the BOJ and ECB are further expanding their balance sheets with new, unique and complex programs. All four of the central banks have left the path towards normalization open to speculation, highlighting the complexity behind the process.

Figure III.5.1: Balance as percentage of GDP



Source: Claeys, Gregory. [“Financial Stability Risk and Ultra Loose Monetary Policy.”](#) March 2015.

At the time of writing, the Fed and the BOE are the only banks who are on paths that are consistent with unwinding of the balance sheet. The Fed has signalled its intention to normalize both the size and composition of its balance sheet while the BOE has stopped growing the balance sheet but has committed to maintaining its size as a policy tool. Although U.S and U.K economy’s macro indicators have started to normalize with weak but stable growth, unwinding smoothly will likely pose challenges.

Below are the preliminary plans and condensed summaries of the Fed’s and BOE’s approaches to balance sheet normalization:

Figure III.5.2: Summary of exit strategies

US Normalization Principles & Plans¹⁹⁰	U.K. Exit Strategies
Gradual and predictable No active sales of MBS* Return to Treasury holdings only More details available on U.S. chapter	Preceding with caution Considering all the outcomes Retaining flexibility More details available on U.K. chapter

*Though the Fed does not plan to actively sell MBS at the time of writing, they have signalled that it may become necessary in the future.

Source: Table created by Author

The principles that each of the central banks have put forth leave room for speculation and an array of unwinding scenarios discussed at the end of the section. Though the language of each normalization strategy differs, the frameworks are similar in the sense that they leave room for the monetary authority to maneuver.

To date, the BOJ and ECB have not made any official announcement on an exit strategy for their expanded QE programs and balance sheets. Given the complexity of assets and macroeconomic objectives of these central banks, there is no preset course or one-size-fits-all approach to unwinding their respective assets. However, there are themes that have emerged within relevant literature that suggest that transparency and a sound understanding of the financial and fiscal risks involved is key to a smooth unwinding.¹⁹¹ A growing body of research adheres to these themes and provides unwinding scenarios of different sorts for the central banks of this report.

Case Study: BOJ Passive Unwind vs. Fed Active Unwind

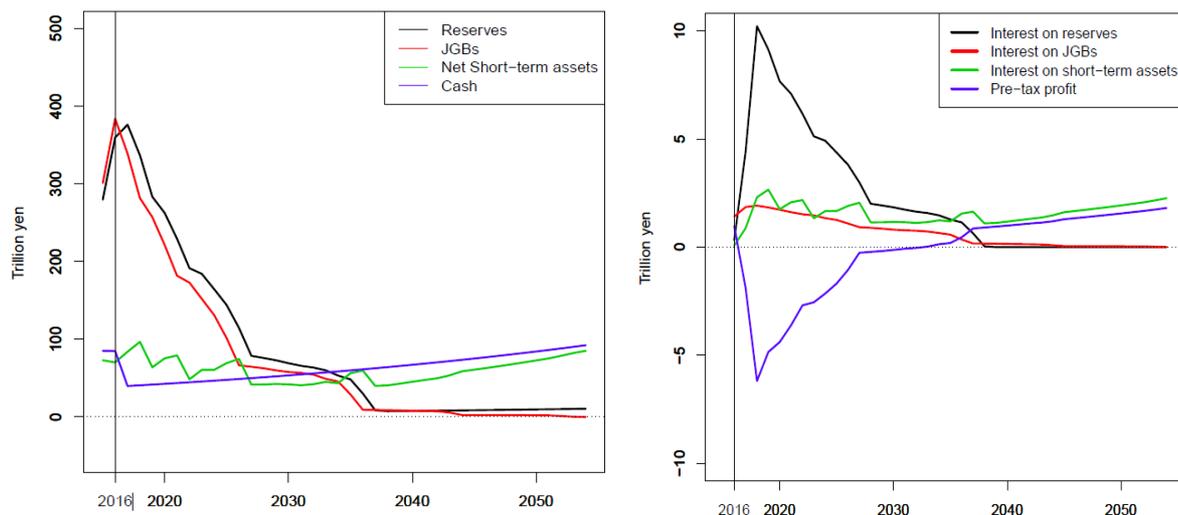
As detailed earlier in this report, the balance sheet of a central bank can be unwound by allowing assets to mature and expire. Alternatively, it can conduct active sales in an effort to speed up or smooth out the unwinding process. A comparative approach to the active and passive unwinding of the Fed and BOJ balance sheets reveals the costs and benefits associated with each as well as potential paths forward.

In September 2015, the BOJ’s balance sheet held roughly 250 trillion yen in JGBs, nearly 50% of Japan’s nominal GDP. Using this size as a benchmark, Fujiki and Tomura (2015) apply a set of assumptions to the BOJ’s balance sheet in order to compare the fiscal outcomes between a passive and active approach with regard to unwinding. Assuming an annual inflation rate of 0%, an inflation target of 2%, a two-year phase in of short-term rates to the long-run level and a growth rate 0.3% above inflation, the authors project the fiscal costs, net assets and net worth over the medium- to long-term (See Figure III.5.3).

¹⁹⁰ Federal Reserve Bank. "Press Release." FRB: Federal Reserve Issues FOMC Statement on [Policy Normalization Principles and Plans](#). Sept. 2014.

¹⁹¹ Blinder, Alan S., Thomas J. Jordan, Donald L. Kohn, and Frederic S. Mishkin. "[Exit Strategy: Geneva Reports on the World Economy](#)." Centre for Economic Policy Research. September 2013.

Figure III.5.3: BOJ's Balance Sheet



Source: Fujiki, Hiroshi and Tomura, Hajime, “[Fiscal Cost to Exit Quantitative Easing: The Case of Japan](#)” Tokyo Center for Economic Research (TCER) Paper No. E-99. September 2015.

The figure on the left shows the balance sheet items for the BOJ if it were to take a passive approach to unwinding the balance sheet and simply hold the JGBs to maturity. It would take roughly 20 years for the excess reserves due to QE to disappear. The figure on the right illustrates that a passive approach to unwinding would record roughly 15 years of accounting losses and zero payments of profit to the government. The significant losses are the result of the natural maturity transformation that takes place on the BOJ’s balance sheet. Since it purchased low-interest bonds during its QE program, its interest expense eventually outpaces interest revenue as it raises the rate paid on reserves during normalization.¹⁹²

The BOJ scenario is not meant to conclude that a passive unwinding of the balance sheet is correct or incorrect path for the BOJ to embark upon. Rather, it is meant to reaffirm the importance of a firm understanding of the fiscal and financial risks associated with any unwinding scenario of an expanded balance sheet. A transparent and well-informed approach can better mitigate and prepare for any potential losses associated with the normalization process.

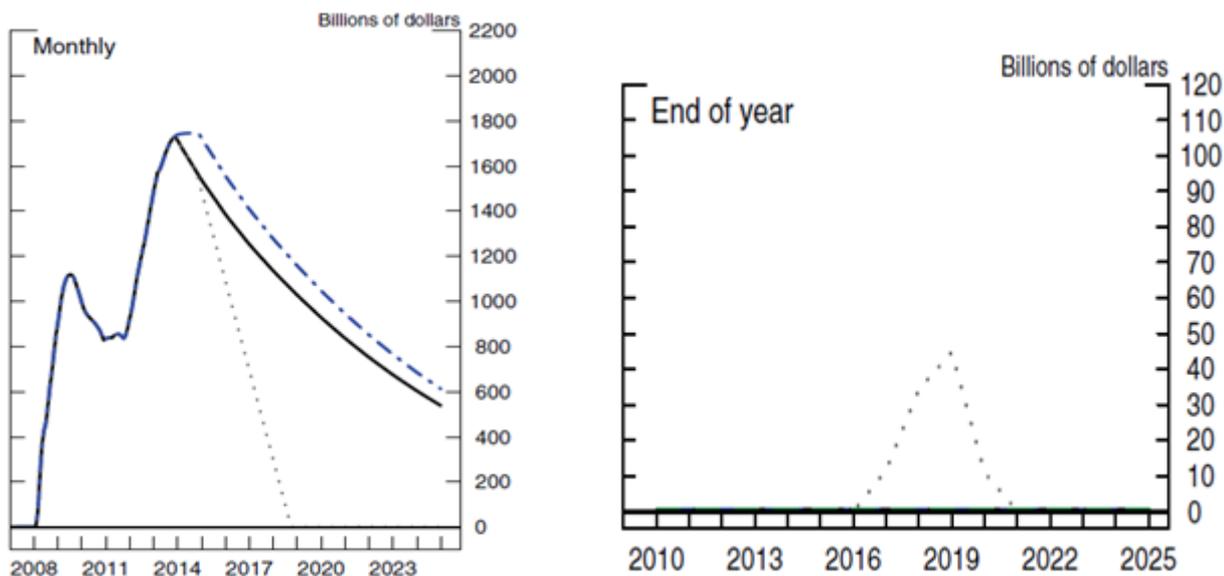
Although the Fed has explicitly stated that it “does not anticipate selling agency mortgage-backed securities as part of the normalization process,” it has left the potential open for “limited sales” in the long-run.¹⁹³ In the same vein, FOMC members have expressed a desire to return the balance sheet to its traditional holdings of Treasuries while removing itself from MBS and the housing market more broadly. Since the potential remains for an active unwinding of the balance sheet through the sale of agency MBS, it is worthwhile to conduct a similar analysis of this particular path to normalization.

¹⁹² Fujiki, Hiroshi and Tomura, Hajime, “[Fiscal Cost to Exit Quantitative Easing: The Case of Japan](#)” Tokyo Center for Economic Research (TCER) Paper No. E-99. September 2015.

¹⁹³ Federal Reserve Bank. “[Press Release: FOMC Statement on Policy Normalization Principles and Plans](#).” Federal Reserve Bank, September 2014.

Though somewhat outdated, Carpenter (2013) applies a similar set of assumptions to the Fed’s balance sheet in which the Bank takes an active role in selling MBS holdings over four years, beginning six months after liftoff (See figure III.5.4)

Figure III.5.4: SOMA Agency MBS Holdings **Figure III.5.5: Deferred Asset**



Source: Carpenter, Seth., Jane Ibrig, Elizabeth Klee, Daniel Quinn, Alexander Boote. [“The Federal Reserve’s Balance Sheet and Earnings: A primer and projections.”](#) The Federal Reserve Board. January 2013.

As shown in the figures above, an active sale of MBS that rapidly reduces the balance sheet in around 4 years bears capital losses for the Federal Reserve. Similar to the passive unwinding scenario of the BOJ, the losses arise as a result of the relatively low-coupon MBS. The difference here is that they are sold in an environment of rising interest rates, yielding capital losses on the sales. Because of the losses, there will be a short period of time in which the Fed will have to record a deferred asset and remit zero balances to the Treasury.¹⁹⁴

Though the assumptions made within this study are no longer accurate for the Fed’s current balance sheet given the expansion of QE3, the active unwinding scenario is revealing about the potential challenges involved with the Fed actively seeking to remove itself from the housing market.

The Path Forward

As shown in the comparison of unwinding scenarios between the BOJ and the Fed above, it is not necessarily the case that active management is better than passive management with regard to the central bank balance sheet. Rather, different macroeconomic objectives and diverse balance sheets will likely result in a path that is the best fit for the particular bank and economic context of the time.

The path that monetary authorities decide to take will ultimately depend on their macroeconomic context as well as peculiarities in specific asset markets. The following options can be considered:

¹⁹⁴ Carpenter, Seth., Jane Ibrig, Elizabeth Klee, Daniel Quinn, Alexander Boote. [“The Federal Reserve’s Balance Sheet and Earnings: A primer and projections.”](#) The Federal Reserve Board. January 2013.

Selling Securities outright – active approach

Banks can actively sell assets it purchased during different QEs. This will be most effective in settings of high inflation and future unanchored expectations indicating rise for higher inflation than the central bank's target, or growth overheating than central bank's forecasts. For both Fed and BOE, this approach seems unrealistic. Selling securities will not only raise yields, but will also put downward pressure on asset prices i.e. both banks are targeting low yields while supporting price stability so exercising this option has the least of probabilities.

Maturing assets not re-invested – Passive (Gradual) approach

Banks can also take the approach not to re-invest maturing assets back into the CB's expanded balance sheets. This process will allow a gradual wind down as assets come due. Bank of England and Fed, both have indicated indirectly to follow this path as long as there is an output gap and threat of deflations remains.

Reinvesting maturing assets into duration for gradual equally paced long term wind down – Passive (Snail pace) approach

This approach allows CB banks to keep reinvesting maturing assets into new assets, however, with a plan to invest in assets, which when come due, smooth the assets maturity gaps in the long run. This will gradually wind down the balance sheet on a longer horizon in a consistent and orderly manner. Also, it does not put pressure in any sector of the duration.

Keeping expanded balance sheet as a “new normal”.

Central banks may accept the new role of having expanded balance sheet forever. Not the best of choices as many central bankers have openly stated that this is not their priority nor role, however, if circumstances of weak global economy consistently exists and inflation constantly undershoots banks target, both Fed and BOE will look for alternatives and this may become a new norm.

CHAPTER 6: IMPACT & EFFECTIVENESS

During the financial crisis, monetary authorities implemented policies not well understood from a theoretical or the empirical point of view. The theoretical underpinnings of these new monetary measures and their effectiveness were studied, producing an incredible amount of literature.

The following table summarizes by country the program effects on financial markets, specifically the 10-year yield. Quantitative easing and forward guidance seem to be associated with substantial decreases in long-term yields and stable financial markets.

Country	Program	Security	Low (effectiveness in bps)	High	Study		
U.S	LSAP1		22	100	Gagnon et al (2011)		
					20	Krishnamurthy and Vissing-Jorgensen (2012)	
					37	56	Bauer and Rudebusch (2011)
					29	53	Christensen and Rudebusch (2012)
						32	Hamilton and Wu (2011)
			0		Thornton (2012)		
		MBS		42	147	Krishnamurthy and Vissing-Jorgensen (2012)	
					32	Hamilton and Wu (2011)	
		LSAP2		8	10	Krishnamurthy and Vissing-Jorgensen (2012)	
				0		Thornton (2014)	
			0		Kool and Thornton (2012)		
			0		Thornton (2012)		
UK	LSAPs		35	60	Meier (2009)		
			80	90	Joyce et al (2011)		
			50	100	Breedon, Chadha, and Waters (2012)		
Japan	2001-2006		0	50	Ugai (2007)		
	ABS		0		Ueda (2012)		
	CME	JGB		10	Lam (2011) and Ueda (2012)		
		Equity		3	Lam (2011) and Ueda (2012)		
Euro	10% increase of monetary base \approx				Peersman (2011)		
	25bps policy rate cut						
	100% CB balance sheet increase \approx				Gambacorta et al. (2012)		
	300bps policy rate cut						

1/ Cumulative effect on the 10 year Treasury yield

Source: Goldman Sachs Global Investment Research (2016), IMF (2013), and authors' compilation.

Goldman Sachs Global Investment Research. (2016). "Printing Presses before Helicopters."

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CONCLUSION

Central Bank responses to the 2007-2009 financial crisis are still being felt today, with the Fed and BOE moving away from their quantitative easing programs and the BOJ and ECB continuing to actively pursue an unconventional monetary policy. Central Banks played a significant role during the crisis, acting as lender-of-last resort and providing liquidity to financially distressed institutions and sovereign states. The Central Bank of Eurozone, Japan, United Kingdom and United States all faced a different financial, political and economic environment. Europe's recovery is still lagging behind with extremely low inflation and Japan faces stagnant growth and deflationary pressures. Japan has been especially creative with its monetary policy, carrying out both extensive QQE programs and going into negative rate territory.

Further, as its balance sheet swells the BOJ may very much run out of government bonds option to buy. BOJ has massively expanded yet the results are ordinarily with inflation still lower the Bank's target. Over in Europe the ECB has faced criticism that the ECB's QE program will not work, even as ECB adopts open-ended purchases in bonds. Instead, the debate of economic stimulus through fiscal policy should begin to be considered more strongly, and the concept of helicopter money.

This paper focussed on quantitative easing programs across the Bank of England, Bank of Japan, The Federal Reserve and the European Central Bank. The paper began with a conceptual analysis of QE programs. It then provided a deep dive into each central bank and their respective unconventional monetary policies. The paper concluded by comparing and contrasting the effects and impact of large scale asset purchases of each program.

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