

Unconventional Monetary Policies in the Euro Area, Japan, and the United Kingdom

Giovanni Dell’Ariccia

International Monetary Fund (IMF)

Pau Rabanal

International Monetary Fund (IMF)

Damiano Sandri

International Monetary Fund (IMF)

ABSTRACT

The paper starts with a discussion of how quantitative easing, forward guidance, and negative interest rate policies work in theory, and some of their potential side effects. It then reviews the implementation of unconventional monetary policy by the European Central Bank, the Bank of England, and the Bank of Japan, including a narrative of how central banks responded to the crisis and the evidence on the effects of unconventional monetary policy actions. The conclusion summarizes the main empirical findings and offers some lessons for the use of unconventional monetary policies in the future.

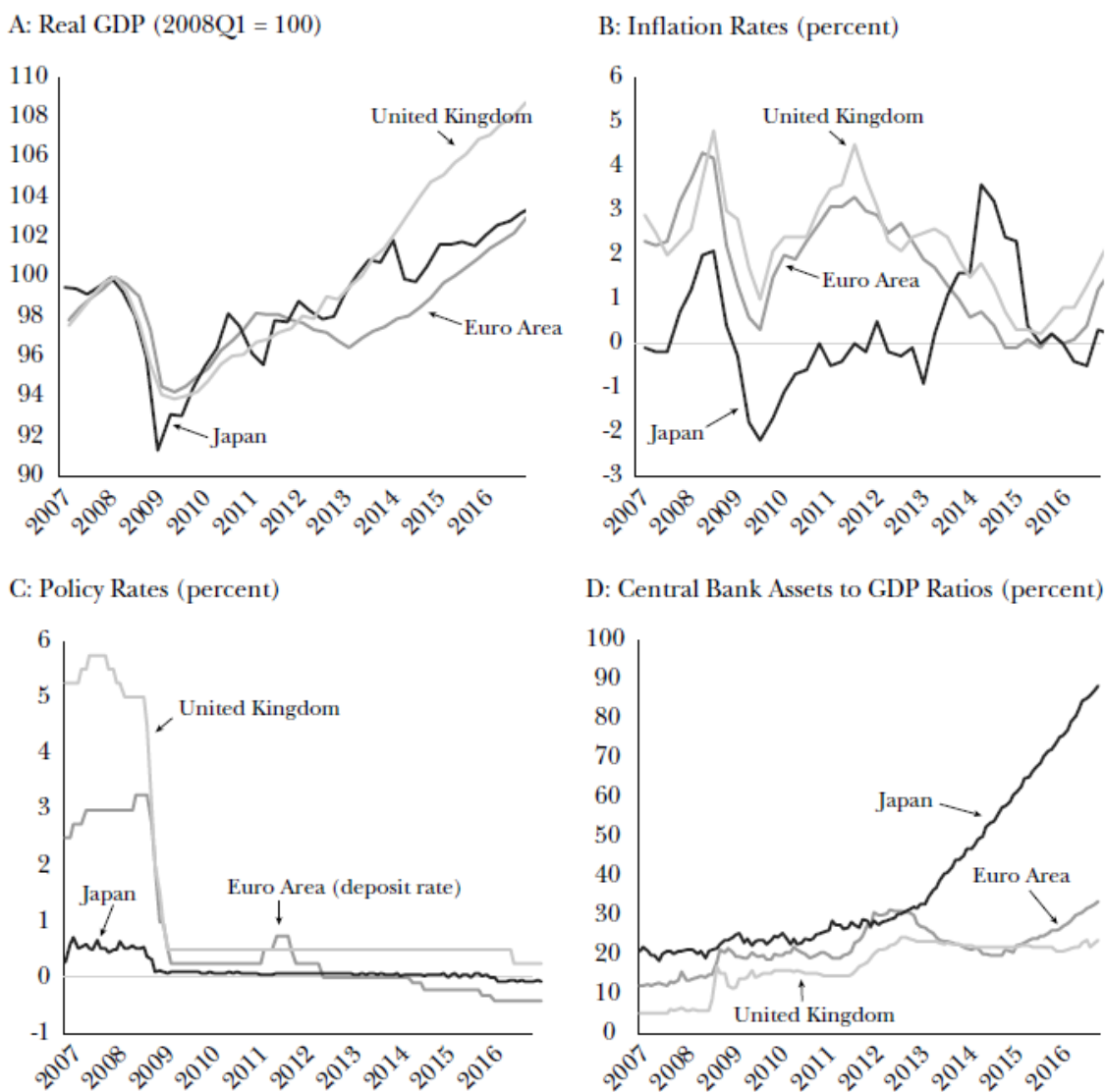
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1. Introduction

The global financial crisis hit hard in the euro area, the United Kingdom, and Japan. Real GDP from peak to trough contracted by about 6 percent in the euro area and the United Kingdom and by 9 percent in Japan. In all three cases, central banks cut interest rates aggressively and then, as policy rates approached zero, deployed a variety of untested and unconventional monetary policies (see Figure 1). In doing so, they hoped to restore the functioning of financial markets, and also to provide further monetary policy accommodation once the policy rate reached the zero lower bound.

Figure 1. Real GDP and central bank assets in the euro area, Japan and the UK



Source: CEIC, Haver Analytics, and authors' calculations.

In all three jurisdictions, the strategy entailed generous liquidity support for banks and other financial intermediaries and large-scale purchases of public (and in some cases private) assets. As a result, central banks' balance sheets expanded to unprecedented levels. Naturally, the specific measures employed by each jurisdiction varied in timing and detail. For example, the European Central Bank first focused on liquidity injections to restore frozen interbank activity and then on the targeted purchase of sovereign bonds to address the erupting sovereign debt crisis in Greece, Ireland, and Portugal in 2010. Only in mid-2014, in the context of anemic growth and below-target inflation, did the European Central Bank adopt its own large-scale asset purchase program. In the United Kingdom, the response to the crisis by the Bank of England was quite similar to that of the US Federal Reserve in timing and style, including mostly via large-scale purchases of government debt. The Bank of Japan entered the crisis with more limited policy room, having experienced the combination of slow growth and near-zero policy interest rates since Japan's financial crisis in the early 1990s. After small initial purchases of government bonds, it became willing after 2012 to purchase a much wider and larger set of public and private securities while also adopting a numerical inflation target.

Overall, unconventional monetary policies have been quite effective in preventing further financial distress, restoring the functioning of financial markets, and providing additional monetary accommodation by compressing long-term interest rates. Furthermore, these policies likely had beneficial effects on macroeconomic variables such as real GDP growth and price stability, although these are more difficult to model and measure.

Looking ahead, to the extent that interest rates remain low over the medium and long run (as seems likely), the zero lower bound in nominal interest rates may be again binding in future recessions. With that in mind, this paper examines the experience with unconventional monetary policies in the euro zone, the United Kingdom, and Japan. The paper starts with a discussion of how quantitative easing, forward guidance, and negative interest rate policies work in theory, and some of their potential side effects. It then reviews the implementation of unconventional monetary policy by the European Central Bank, the Bank of England, and the Bank of Japan, including a narrative of how central banks responded to the crisis and the evidence on the effects of unconventional monetary policy actions. The conclusion summarizes the main empirical findings and offers some lessons for the use of unconventional monetary policies in the future. In a companion paper in this issue, Kuttner reviews the experience of the US Federal Reserve with unconventional monetary policies.

2. Conceptual framework for unconventional monetary policy

This section introduces three forms of unconventional monetary policy: forward guidance, quantitative easing, and negative interest rate policies. More specifically, it focuses on the mechanisms through which such policies can lower and flatten the yield curve—that is, reduce the interest rate level and shrink the gap between long- and short-term interest rates. This in turn should lower borrowing costs for households and firms, increase credit, boost aggregate demand, and thus ultimately raise inflation and output. As in the case of conventional interest rate cuts, unconventional monetary policies can also support external demand by depreciating the exchange rate. This section concludes with a discussion of these policies' potential negative side effects.

2.1 Forward guidance

Forward guidance aims at providing market participants with information about the intentions of policymakers for the future path of the policy rate. It can come in two forms (Campbell, Evans, Fischer, and Justiniano 2012). In one version, the central bank aims to clarify how monetary policy will evolve in the future depending on its own expectations for economic activity or inflation. In the alternative and potentially more powerful version, the central bank commits to keeping interest rates low even if economic conditions improve in the future and warrant a monetary tightening.

Forward guidance can be made contingent on qualitative or quantitative criteria. As an example of qualitative guidance, the Bank of Japan announced in October 2010 that it would keep rates low until “price stability is in sight.” As an example of quantitative guidance, the Bank of England announced in August 2013 that rates would stay low until the “unemployment rate has fallen to a threshold of 7 percent.” Forward guidance targets can also be time dependent, for example by announcing that rates will stay low until a specific date in the future.

Several factors can hinder the effectiveness of forward guidance and complicate the empirical evaluation of its effects. First, forward guidance may fail to alter expectations. For example, guidance that interest rates will remain low for several years into the future may be ineffective if markets already expect such an interest path or do not find the commitment credible. Second, how the announcement of forward guidance is interpreted by markets can lead to counterintuitive results. For example, forward guidance that interest rates will remain low for longer than expected may signal that the central bank is more seriously concerned about future economic prospects than previously believed, and thus have negative economic effects by denting consumer and business confidence. Alternatively, if market participants believe that forward guidance will be successful in increasing inflation and real GDP growth, long-term rates may increase rather than decrease—although optimism about the future may offset the increase in rates.

2.2. Quantitative easing

Quantitative easing involves the large-scale purchase of securities by the central bank. It is generally implemented through the acquisition of long-term government bonds (an asset in the central bank balance sheet) financed by an increase in the reserve accounts that commercial banks hold at the central bank (a liability for the central bank). The key idea is that, when the policy rate and thus the yield on short-term bonds are at zero, the central bank can still provide monetary stimulus by supporting long-term bond prices and thus lowering long-term yields. This mechanism has been formalized in macroeconomic models: for examples, see Gertler and Karadi (2011) and Chen, Curdia, and Ferrero (2012).

Former Federal Reserve chair Ben Bernanke (2014) once famously said that quantitative easing “works in practice, but it doesn’t work in theory.” His point was that in a theoretical model with no financial market frictions, and in which investors move freely across asset categories, central bank purchases of government bonds should not have any effects on bond yields. Instead, financial markets and arbitrageurs will reposition their portfolios offsetting the effects of central bank purchases. In practice, however, financial markets are segmented, for example because agents have a preference to hold specific securities or because they may find it difficult to short sell the bonds the central bank is buying. In this case, by reducing the net supply of government bonds on the market, central bank purchases raise bond prices and reduce the yield of those bonds. Note that for this to have an effect beyond government bond markets, segmentation cannot be too extreme. Indeed, agents that sell government bonds to the

central bank are expected to rebalance their investment portfolios by purchasing other securities (like corporate bonds, equity, or real estate-backed securities), thus boosting prices for those assets, lowering yields and stimulating consumption and investment.

Quantitative easing can also decrease bond yields through a signaling channel. The purchase of large quantities of government bonds can help to convince markets that the central bank is committed to keeping a loose policy stance. In this regard, quantitative easing operates as a useful complement to forward guidance.

Besides purchasing government securities, quantitative easing can be also implemented through the direct acquisition of privately issued securities. For example, the Bank of Japan has purchased not only government bonds, but also corporate bonds, exchange-traded funds, and real-estate investment funds. The European Central Bank purchased “covered bonds” (that is, collateralized bonds issued by banks or mortgage lenders) in three different phases between 2009 and 2017, and corporate bonds in the primary and secondary markets starting in June 2016. Purchases of private securities can reduce the borrowing costs faced by private agents and stimulate the economy more directly, but they expose the central bank to credit risk and potential losses.

Typically, quantitative easing has been implemented by announcing a specific timeline and amount of purchases. More recently, the Bank of Japan has adopted an alternative “yield curve control” approach, which sets targets for both short- and long-term yields and adjusts purchases to meet those targets. A possible advantage is that if the target is credible, market participants may coalesce around it without requiring purchases by the central bank. But if the target is not credible, the central bank may be forced to purchase bonds in very large quantities or further dent its credibility by revising the target.

2.3 Negative interest rates

The European Central Bank and the Bank of Japan, along with others, have implemented negative interest rates by charging, rather than paying, interest rates on the reserves that commercial banks hold at the central bank. The hope is that individual banks will reduce their excess reserves by increasing lending and purchasing other financial assets. In this way, the policy seeks to reduce lending rates, increase credit supply, and boost prices across financial markets.

The notion that policy interest rates cannot decline below zero derives from the idea that agents would rather hoard cash than deposit money in accounts that charge interest rates (that is, pay negative interest rates). However, using cash involves significant transaction costs and risks (it can be stolen), so that mildly negative rates are unlikely to generate major shifts into holding banknotes.

Several concerns have been raised about negative rates. First, banks appear reluctant to pass negative interest rates on to retail depositors (although there is evidence of pass-through to corporate deposits). Negative rates may thus harm bank profitability and possibly prevent a reduction in lending rates. However, banks seem to have supported profitability by increasing noninterest income through charging other fees.¹ The direct costs of negative reserves on bank reserves are also quantitatively small relative to banks’ balance sheets. Central banks can further reduce these direct costs by charging negative rates only at the margin: for example, required bank reserves are typically exempt from negative interest rates and the Bank of Japan charges negative rates only on a subset of other bank reserves. Second, there are concerns that negative rates can at a certain point lead to a major shift to cash, especially if they are

1. See Cœuré (2016) and Hutchinson and Smets (2017) for the case of the euro area. In Japan, the evidence suggests that the profitability of small regional banks may have been reduced by the negative interest rate policy (IMF 2017b).

perceived to be long lasting. Finally, an important impediment to negative rates may arise from the public perception that they are “unfair.”

Of course, any costs from negative interest rates would need to be weighed against the positive effects that they might have on asset prices and the economic outlook. IMF (2017a) reviews the experiences of several countries with negative interest rates.

2.4 Potential side effects

In principle, unconventional monetary policies can contribute to financial stability if lower interest rates help to stimulate the economy and improve borrowers’ ability to stay current with their loans. However, concerns have been raised about side effects that might endanger financial stability, even when unconventional monetary policy is successful in stimulating the economy. These concerns can be broadly divided into five sets of arguments.

First, when long-term securities purchases and forward guidance flatten the yield curve by compressing term premia, they put pressure on bank profitability (Borio, Gambacorta, and Hofmann, 2015; Borio and Gambacorta, 2017). After all, banks issue short-term liabilities such as deposits and commercial paper and invest in longer-term assets such as mortgages, asset-backed securities, and commercial loans. The profitability of this business model of credit and maturity transformation is proportional to the size of term premia.

Second, the compression in safe yields from monetary easing induces financial intermediaries to move toward riskier assets. For example, this situation can arise if institutional players such as life insurers and pension funds become unable to match promised yield on their long-term liabilities with safe assets (Rajan 2005). Taking additional risk is to some extent an intended effect of monetary easing (Chodorow-Reich 2014), but it can also become excessive from an aggregate welfare point of view.

Third, a low interest rate environment may reduce incentives for banks to recognize and write off nonperforming loans (Caballero, Hoshi, and Kashyap 2008).

Fourth, by increasing asset prices and reducing volatility, central bank purchases may lead to the build-up of asset-price deviations from their fundamentals and trigger a later sharp asset-price correction. This may also create liquidity risks in the nonbank financial sector, as investors may become too complacent (ECB 2017).

Fifth, critics of unconventional policies have also warned that when central banks stray from their traditional way of conducting monetary policy, they might jeopardize their hard-fought independence. The more a central bank becomes involved in multiple (and less measurable) objectives and policy instruments, critics say, the more monetary authorities become exposed to political interference (Taylor 2016). On the other hand, central banks may also come under heavy political pressure if their reluctance to adopt unconventional monetary measures leads to a more severe financial and economic crisis.

3. The euro area

The European Central Bank’s response to the crisis and unconventional monetary policy implementation can be divided in three phases. First, between September 2008 and the end of 2009, the European Central Bank focused on supporting the banking sector, using instruments which can be categorized as part of a central bank’s function as “lender of last resort.” Second, during the sovereign-debt crisis of several euro-area countries between early-2010 and late-2012, the European Central Bank purchased government bonds to restore market functioning and the transmission mechanism of monetary policy.

Third, starting in mid-2013, the European Central Bank implemented a more aggressive combination of forward guidance, large-scale asset purchases, negative interest rates, and targeted credit supply policies.

3.1 Economic developments and monetary policy responses in the euro area

After reaching a pre-crisis peak in the first quarter of 2008, real GDP in the euro area contracted by 6 percent in real terms within the year. Consumer price inflation fell well below the 2 percent target, prompting the European Central Bank to lower its benchmark rate (the main refinancing rate) from 4.25 percent to 1 percent over the course of 2008. As the space for conventional monetary policy dwindled, the reaction of the European Central Bank to the global financial crisis can be divided into three main phases.

The initial strategy of the European Central Bank focused on addressing the increased credit and counterparty risk that had led to a sharp decline in interbank trading, thus impairing the monetary transmission mechanism in the euro area. Early in the financial crisis, then-president of the European Central Bank Jean-Claude Trichet (2009) pointed out the large differences in the composition of funding sources for nonfinancial corporations between the euro area, where bank financing accounted for roughly 70 percent of firms' total external financing, and the United States, where firms relied to a much larger extent on market-based sources (like issuing bonds) that made up about 80 percent of total external financing (Cour-Thimann and Winkler 2013).

Specifically, the policy response included expanding its main liquidity operations, and introducing several rounds of Longer-Term Refinancing Operations during 2008 and 2009. This de facto replaced the drop in interbank market activity with increased intermediation through the central bank (González-Parámo 2011).² Other policies included foreign-currency operations (swap lines with the Federal Reserve in US dollars), a broadening of the collateral framework allowing banks to use a broader range of assets in refinancing operations with the European Central Bank, and the launch of the Covered Bond Purchase Program. This last program was relatively small in size and was justified to “improve market liquidity” and “ease funding conditions for banks and enterprises.” Broadly speaking, these policies can be understood as “lender of last resort” actions, in which a central bank makes credit available to financial intermediaries during financial stress.

But the euro-zone financial woes were soon compounded by a potential fiscal and sovereign-debt crisis in several member countries. In one notable event on November 5, 2009, the newly elected Greek Prime Minister Papandreou acknowledged that the Greek fiscal deficit would be 12.7 percent of GDP rather than the 3.7 percent reported by the outgoing government. The confidence shock associated with this announcement raised concerns about the high level of public debt in Italy and Portugal and the indebtedness of the private sector in Ireland and Spain. During the first half of 2010, government borrowing rates increased to unsustainable levels in Greece (see Figure 2B), which required financial assistance through an EU–IMF program.

Before the eruption of the sovereign debt crisis, the European Central Bank had hesitated to use large-scale asset purchases of government bonds in the euro area. Its legal authority was unclear since Article 123 of the Treaty on the Functioning of the European Union prohibits monetary financing of governments. But on May 10, 2010, one week after the IMF and the European Union had announced the

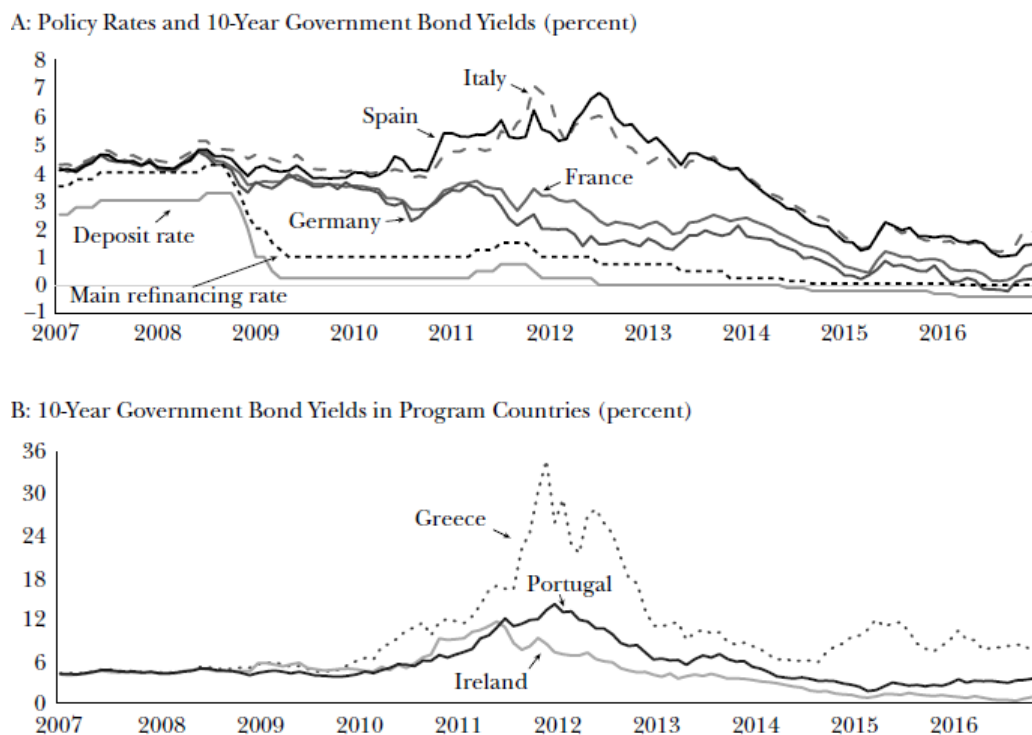
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2. The LTROs (Longer-Term Refinancing Operations) differed from the standard MROs (Main Refinancing Operations) because they were conducted at fixed rates and with full allotment, thereby making them unlimited, and their maturities were longer (3, 6, and 12 months, instead of the one-week MROs). The LTRO balance at the European Central Bank increased from €1.5 trillion to €2.8 trillion, a 90 percent increase, between early 2008 and early 2010.

first bailout package for Greece, the European Central Bank launched the Security Markets Program. The program involved purchasing government debt issued by Greece, Ireland, and Portugal and was implemented “to address the malfunctioning of securities markets and restore an appropriate monetary policy transmission mechanism” (ECB 2010). Because the program involved government bonds purchases in the secondary market, it was viewed as not breaching Article 123.

Later, the European Central Bank announced that it would also purchase Italian and Spanish government bonds. In total, the European Central Bank purchased €218 billion of Greek, Irish, Italian, Portuguese, and Spanish bonds as of end-2012 and held them until maturity. As shown in Figure 2, the launch of the Securities Market Program did not calm sovereign-debt markets in the euro area. Ireland, which had suffered a banking crisis in 2009–2010 amidst a collapsing housing bubble, requested an IMF–EU program, which was signed in December 16, 2010. Portugal also received a bailout package on May 20, 2011. Peripheral countries in the euro-zone entered a double-dip recession, and the real GDP in the euro area declined again during 2011–2012. Borrowing spreads for Italy and Spain kept creeping higher, unlike those in France and Germany (Figure 2). These countries were trapped in destructive self-fulfilling dynamics, where concerns about fiscal sustainability (because of large deficits and low growth prospects) increased the likelihood of sovereign debt default, which in turn increased borrowing costs, making it all more likely that countries would end up defaulting and perhaps having to leave the euro altogether. This “redenomination risk” (Cœuré 2013) increased borrowing costs further.

Figure 2. Government borrowing costs and policy rates in the euro area



Source: Haver Analytics and the European Central Bank.

In this context, the European Central Bank strengthened its commitment to quantitative easing in two ways. Perhaps most critically, in a conference on July 26, 2012, in London, the European Central Bank

President, Mario Draghi, made a statement that became famous: “Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough.” The European Central Bank soon followed up by announcing the Outright Monetary Transactions (OMT) program, which would include purchases of government bonds in secondary markets for member countries that requested its activation and accepted monitoring. The program was announced “to address severe distortions in government bond markets which originate from, in particular, unfounded fears on the part of investors of the reversibility of the euro.” Together, the announcement of the OMT program and Draghi’s “whatever it takes” speech reversed the sovereign-debt market self-destructing spiral. And this was accomplished without ever making purchases under the program, since to date, not a single member country has made a formal request.³

By 2013, the euro-zone economy had emerged from recession and the sharpest risk of a sovereign debt crisis had been averted, but growth remained anemic and inflation was stuck below its target. At this point, the European Central Bank employed more “standard” unconventional monetary policy tools to improve credit conditions and provide monetary stimulus. First, on July 4, 2013, the European Central Bank used forward guidance for the first time, with President Draghi stating: “The Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time.” Second, the European Central Bank announced the introduction of a negative interest rate of -0.1 for its deposit facility on June 5, 2014. Subsequently, the European Central Bank announced further cuts to this rate up to -0.4 percent in March 2016. In parallel, the European Central Bank announced a new round of credit easing measures. The Targeted Longer-Term Refinancing Operations gave banks who lent to households and firms more favorable financing conditions from the European Central Bank, in order to reinforce the pass-through from negative interest rates to retail lending rates and increase credit supply in vulnerable countries (Hutchinson and Smets 2017).

Most important, the European Central Bank announced the introduction of its own large-scale asset purchase programs on September 4, 2014. President Draghi said that these programs “will have a sizeable impact on our balance sheet” and that their launching would “support our forward guidance on the key ECB interest rates.” Under the umbrella of the asset purchase program, the ECB purchased asset-backed securities, covered bonds, corporate sector bonds, and government bonds. Total holdings of securities in the program as of May 2018 was about €2.4 trillion (or about 23 percent of euro area GDP).

3.2 Effects of unconventional monetary policy in the euro area

Empirical researchers have used a variety of econometric tools to measure the effects of the European Central Bank policy measures. A central problem is identification: how to distinguish the effect of these policies from other macroeconomic news releases and policy initiatives taking place at the same time in the euro area. For instance, the Security Markets Program was announced on May 10, 2010, while the IMF board approved the first Greek program on May 9, 2010. These years have a constant overlap of changes in European Central Bank policy, national policy, IMF policy, all against an evolving backdrop of economic and market events.

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3. The Outright Monetary Transactions program had some meaningful differences from the earlier Securities Market Program that enhanced its effectiveness. Under the Outright Monetary Transactions, the European Central Bank explicitly gave up seniority, which was instead retained under the Securities Market Program. Furthermore, differently from the Securities Market Program, the Outright Monetary Transactions included conditionality.

One way to meet the identification challenge is to use high-frequency data and focus on a narrow window around policy changes. This “event study” methodology studies the reaction of financial variables such as government and corporate yields, and stock prices, which are available at high frequency (within minutes or hours) around a policy announcement. Table 1 summarizes the findings of a few studies in the euro area. In general, the literature finds significant effects on government bond yields from unconventional monetary policy actions undertaken by the European Central Bank. The largest effect is found by Krishnamurthy, Nagel, and Vissing-Jorgensen (2018), who estimate that the Security Markets Program and the announcement of the Outright Monetary Transactions reduced two-year government bond yields by 200 basis points in Italy and Spain, 500 basis points in Portugal and Ireland, and 1,000 basis points in Greece. The decline can be attributed to a decline in default risk (which explains 37 percent of the total reduction), reduced redenomination risk (13 percent of the total reduction), and reduced market segmentation by increasing liquidity in distressed markets (50 percent of the total reduction). In contrast, estimates of the impact of the Long-Term Refinancing Operations are much smaller. These operations were intended to restore inter- bank liquidity, but in practice banks used the funds to purchase government debt, thereby reducing sovereign yields (Ongena, Popov, and van Horen 2016).

Table 1. Unconventional monetary policy effects in the Euro area

<i>Study</i>	<i>Notes</i>	<i>Government bond yields</i>	<i>Real GDP</i>	<i>Prices</i>	<i>Other</i>
Darracq-Paries and De Santis (2015)	3-year LTRO effects using a VAR model		+0.8%	+0.3%	+3% credit, -0.2% lending spreads
Cahn, Matheron, and Sahuc (2014)	Effects of an LTRO of 2 percent of GDP. DSGE model with financial frictions.		+1%		
De Pooter, Martin, and Pruitt (2015)	Effect of the SMP on peripheral bonds liquidity premia	-32 to -40bps on impact, -13 to -17 bps are lasting			
Ghysels, Idier, Manganelli, and Vergote (2016)	Effects of SMP with VAR model with high-frequency data.	-320 bps (Italy 2y), -180 bps (Spain 2y), -230 bps (Italy and Spain 10y). Similar results for Ireland and Portugal, not significant for Greece.			
Eser and Schwab (2016)	Cumulative SMP effects of purchases looking at high-frequency data	-10 bps (5y), -170bps (Portugal .5y), -190bps (Spain 5y), -210bps (Italy 5y), -330bps (Greece 5y)			
Ferrando, Popov, and Udell (2015)	OMT effects of SME access to credit in euro area distressed countries				Probability of being credit constrained was reduced by 6.4%
Altavilla, Giannone, and Lenz (2014)	Effects of OMT announcements using event studies and VAR models	-199 bps (Italy 2y) -234 bps (Spain 2y), no effects in Germany and France	+1.5% (Italy), +2 % (Spain)	+1.2% (Italy), +0.74% (Spain)	+3.6% (credit, Italy), +2.3% (credit, Spain)

Fratszcher, Lo Duca, and Straub (2016)	Effects of LTRO, SMP, and OMT announcements using high-frequency data	-25bps to -121bps (Italy and Spain 10y)			+4.1 to +8.7% (equity prices)
Krishnamurthy, Nagel, and Vissing-Jorgensen (2018)	Effects of OMT, SMP, and LTROs	-200 bps (Italy and Spain 2Y), -500bp (Portugal and Ireland 2y), -1,000bps (Greece 2y).			+4% to +13% (stock prices)
Kojien, Koulischer, Nguyen, and Yogo (2016)	Effects of APP on portfolio holdings by institutional investors	Average -13bps. Range -2 to -60 bps (higher in distressed countries)			
Andrade, Breckenfelder, De Fiore, Karadi, and Tristani (2016)	Effects of APP using time series and DSGE models	-45 bps	+1.1%	+0.4% (actual), +0.45% (expectations)	
Mouabbi and Sahuc (2016)	Effects of APP and TLTRO using a DSGE model with an estimated shadow rate		+0.56% (average of 2014–2016)	+0.25% (average of 2014–2016)	-400 bps (shadow rate)
Cova, Pagano, and Pisani (2015)	Effects of APP in a DSGE model		+1.4%	+0.8%	
Hutchinson and Smets (2017)	Effects of NIRP, TLTRO, and APP	-155 bps (Average euro area 10y bond)	+1.7% (accum. 2016–2019)	+0.5% (accum. 2016–2019)	-70 bps (lending rate), 13 percent euro depreciation

Notes: LTRO is Longer-Term Refinancing Operations; SMP is Security Markets Program; OMT is Outright Monetary Transactions; APP is Asset Purchase Program; TLTRO is Targeted Longer-Term Refinancing Operations; NIRP is Negative Interest Rate Policy. VAR means “vector autoregression”; DSGE means “dynamic stochastic general equilibrium.” SME stands for “small and medium-sized enterprises”; “bps” are basis points.

The effects on government yields in the euro area were generally highly persistent, as documented in the paper by Ghysels, Idier, Manganelli, and Vergote (2016) using a vector autoregressive model with daily data. Eser and Schwab (2016) conclude that the Security Markets Program improved liquidity conditions and reduced default-risk premia, but that the signaling of future low interest rates did not play a role. De Pooter, Martin, and Pruitt (2015) find that the liquidity premium declined between 32 and 40 basis points and helped reduce government yields. This channel is important since the European Central Bank justified its intervention due to a lack of liquidity and depth in certain securities markets.

Other studies confirm the effects of actions of the European Central Bank on peripheral Europe government bonds, although perhaps with smaller estimated effects (Fratzcher, Lo Duca, and Straub 2016). Other studies have focused on the credit effects of the European Central Bank’s programs. Ferrando, Popov, and Udell (2015) study the effect of the Outright Monetary Transactions announcement on small and medium enterprises’ access to credit. They find that the probability of being credit-constrained in peripheral euro countries declined by 6.4 percent due to the announcement. Arce, Gimeno,

and Mayordomo (2017) find that the Corporate Sector Purchase Program and Targeted Longer-Term Refinancing Operations increased bond issuance by large corporations, as well as bank credit to smaller corporations in Spain, thus providing support to the credit reallocation hypothesis.

The unconventional monetary policies of the European Central Bank clearly affected financial variables. But what about the ultimate objective of affecting macro-economic aggregates? This connection is obviously harder to establish because macroeconomic variables are slower-moving and do not lend themselves to event studies. The methodology employed uses a macroeconomic model, typically either a time series vector autoregressive or dynamic stochastic general equilibrium model at monthly or quarterly frequency. With this approach, the effects of unconventional policies on government yields are fed through the model to obtain implications for prices, real activity, and other macroeconomic variables.

As one example, Altavilla, Giannone, and Lenz (2014) find that the announcement of the Outright Monetary Transactions program lowered 2-year Italian bond yields by 199 basis points and Spanish bonds yields by 234 basis points. In a second stage, using a multicountry vector autoregression model, the authors find that the announcement raised Italian GDP by 1.5 percent and consumer price index by 1.2 percent, while it raised Spanish GDP by 2 percent and consumer price index by 0.74 percent over a 3-year horizon. Credit also increased in both countries. The same study finds that France and Germany's yields did not fall due to the Outright Monetary Transactions announcement, but these countries still benefitted from higher growth in the periphery through trade linkages. Other studies summarized in Table 1 also suggest that the effects of the Longer-Term Refinancing Operations (LTRO) and asset purchase program (APP) were positive and stimulated the euro area economy (especially, Mouhabbi and Sahuc 2015). But as Burriel and Galesi (2016) show, there can be substantial heterogeneity in the effects of unconventional monetary policies on euro area member countries.

The effects of the negative interest rate policies (NIRPs) are harder to quantify because the European Central Bank and other macroeconomic policymakers undertook other measures during the same period. However, evidence on the behavior of government yields and lending rates (see Figure 2) suggests that negative interest rates operate very much like interest rate cuts when these are in positive territory. Using a simple event analysis of the data after the four policy announcements that placed the deposit facility rate in negative territory (the initial announcement was done on June 5, 2014, with subsequent cuts of 0.1 percent in three different meetings), we found that deposit rate cuts were typically followed by downward shifts in the yield curves, especially for Germany on the first announcement date, and for Italy and Spain in the subsequent rate changes.

The combined effect of all the measures implemented since the summer of 2013 reduced benchmark lending rates for households and corporations in the euro area from 3 percent in the summer of 2013 to 1.7 percent in the fall of 2017. In addition, the euro depreciated by about 30 percent vis-à-vis the US dollar during the same period. Hutchinson and Smets (2017) find the combined effect of all these measures provided a boost to real GDP of 1.7 percent (on a cumulative basis between 2016–2019) and to inflation of 0.5 percent (over the same period).

4. The United Kingdom

Since the beginning of the global financial crisis, unconventional monetary stimulus in the United Kingdom has passed through three main phases. First, large-scale quantitative easing programs between 2009 and 2012 sought to halt the recession and support the economic rebound. Second, forward guidance announcements in 2013 and 2014 clarified the intention of the Bank of England not to raise policy rates.

Third, an additional round of quantitative easing occurred when the United Kingdom voted to leave the European Union in 2016.

4.1 Economic developments and monetary policy responses in the United Kingdom

The UK economy was severely affected by the global financial crisis, especially because of the reliance of its large financial sector on wholesale funding. GDP started to contract in the second quarter of 2008 and fell by about 6 percent in real terms within a year. The Bank of England responded by sharply cutting interest rates from 5.75 to 0.5 percent by March 2009. Despite this large rate cut and the inflationary pressures arising from the sterling depreciation, the Bank of England feared that inflation would still fall below the 2 percent target. To provide additional monetary stimulus, the Bank of England launched the first round of quantitative easing (QE1) announcing the purchase of £75 billion of government bonds financed with the expansion of central bank reserves. Purchases were later increased to £200 billion (about 13 percent of 2009 GDP) and completed in January 2010.

GDP started to recover in the third quarter of 2009, but at a subdued pace. In 2011, the intensification of the euro-area sovereign debt crisis threatened the UK economic outlook. Despite inflation rising toward 5 percent because of an increase in the value-added-tax and rising energy prices, in October 2011 the Bank of England announced a new round of quantitative easing (QE2). This was followed by a third round of asset purchases (QE3) in July 2012 that brought the total size of quantitative easing to £375 billion, about 25 percent of GDP and 35 percent of the outstanding stock of British government bonds.⁴

Despite economic growth remaining weak, the persistence of inflation above target raised concerns that the Bank of England could soon raise interest rates. In August 2013, the Bank of England decided to clarify the expected path of monetary policy by introducing forward guidance with explicit quantitative targets. It announced that it would not raise policy rates or reduce the stock of bonds purchased under quantitative easing at least until unemployment declined below 7 percent (from the ongoing 8 percent level). This guidance would cease to hold if medium-term inflation was expected to increase by 0.5 percent above target; if inflation expectations became de-anchored; or if the stance of monetary policy posed significant threats to financial stability.

Economic growth finally gained strength in late 2013. As the unemployment rate fell toward the 7 percent threshold faster than expected, in February 2014 the Bank of England provided additional forward guidance. It argued that considerable spare capacity remained in the economy, so that it expected to keep rates low for longer and eventually raise them only gradually.

Even though the UK economy was growing at a steady pace, the Bank of England deployed a new round of monetary stimulus in August 2016 following the “Brexit” vote to leave the European Union. To sustain economic growth, the Bank of England launched a fourth round of asset purchases (QE4) including £60 billion of government bonds and £10 billion of corporate bonds. The purchase of corporate bonds was expected to provide more stimulus than government bonds because corporate bonds have higher yields, and so investors selling them could be more likely to invest in other risky securities. Furthermore, the Bank of England cut the policy rate from 0.5 to 0.25 percent and launched the Term

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4. The Bank of England also launched several programs to support the banking sector, including the Special Liquidity Scheme in April 2008 allowing banks to swap high-quality mortgage-backed securities with UK Treasury bills; the Extended Collateral Term Repo in June 2012 to provide banks with liquidity in case of exceptional market-wide stress; and the Fund for Lending Scheme in July 2012 to incentivize banks to increase domestic lending. For a review of the effects of liquidity facilities during the global financial crisis in advanced economies, see Gagnon and Hinterschweiger (2013).

Funding Scheme to provide banks with funding close to the policy rate and encourage the pass-through of the policy rate cut to lower lending rates.

4.2 Effects of unconventional monetary policy in the United Kingdom

Several papers, summarized in Table 2, have sought to measure the impact of quantitative easing on UK government bond yields using event studies. This approach analyzes the responses of bond yields right after Bank of England announcements of new asset purchases. Results show that the £200 billion purchases under QE1 had a sizable impact on yields, lowering them between 50 and 100 basis points.

Table 2. Unconventional monetary policy effects in the United Kingdom

<i>Study</i>	<i>Notes</i>	<i>Government bond yields</i>	<i>GDP</i>	<i>Inflation</i>
Joyce, Lasaosa, Stevens, and Tong (2011); Joyce and Tong (2012)	Event study of £200b QE1. Portfolio rebalancing channel is predominant.	-100 bps		
Christensen and Rudebusch (2012)	Event study of £275b QE1/ QE2. Portfolio rebalancing is predominant.	-47 bps		
Bridges and Thomas (2012)	Money demand/supply model to analyze impact of £200b QE1.	-150 bps	+2%	+1%
Kapetanios, Mumtaz, Stevens, and Theodoridis (2012)	VAR responses to 100 bps reduction in government bond yields		+1.5%	+1.25%
Baumeister and Benati (2013)	VAR responses to 50 bps reduction in government bond yields		+3%	+2%
Churm, Joyce, Kapetanios, and Theodoridis (2015)	Event study of £175b QE2/ QE3 and VAR estimates of macro impact	-45 bps	+0.5/0.8%	+0.6%
Weale and Wieladek (2016)	VAR responses to QE of 1% of GDP, estimated over QE1/ QE2/ QE3	negligible	+0.25%	+0.32%

Note: QE1, QE2, and QE3 are three consecutive rounds of quantitative easing. VAR is “vector autoregression.”

The effects on bond yields seem to have weakened over the subsequent quantitative easing announcements (Joyce, McLaren, and Young 2012). This does not necessarily imply that quantitative easing is subject to decreasing returns, so that it becomes less effective in larger volumes. Instead, yields may not have moved as much in response to later announcements because market participants started to anticipate new rounds of quantitative easing depending on the inflation and growth outlook. For example, McLaren, Banerjee, and Latto (2014) analyze unexpected announcements by the Bank of England about changes in the maturity distribution of bond purchases and find that asset purchases within a certain maturity segment were associated with similar reductions in yields under both QE1 and QE2.

The literature has also tried to shed light on the channels through which quantitative easing in the UK affected government bond yields. Event studies (Joyce, Lasaosa, Stevens, and Tong 2011; Christensen and Rudebusch, 2012) suggest a minor role for the signaling channel since the expectation of long-term rates did not decline much in response to quantitative easing announcements. Therefore, the reduction in bond yields seem mostly due to a compression in term premia. In contrast, the vector autoregression

analysis of Weale and Wieladek (2016) found that quantitative easing had a negligible effect on yields, while it stimulated the economy by reducing uncertainty.

The effects of quantitative easing on financial markets went beyond the effect on government bond yields. Joyce et al. (2011) find evidence that pension funds and insurance companies responded to the reduction in government bond yields by increasing their holdings of corporate bonds, leading to a reduction in corporate yields. Furthermore, quantitative easing seems to have led to a moderate depreciation of the British pound. The effects on equity prices have been instead more difficult to identify (Joyce et al. 2011). Quantitative easing also had minimal effects on bank lending because UK banks were poorly capitalized and trying to deleverage (Butt, Churm, McMahon, Morotz, and Schanz 2014; Joyce and Spaltro 2014).

Regarding the implications of quantitative easing for growth and inflation, various studies find sizable positive effects. Most of the papers listed in Table 2 rely on vector autoregression estimates that trace out the economy responses to an increase in asset purchases by the central bank or to a given reduction in government bond yields. Estimates vary considerably across studies, with QE1 increasing real GDP between 1.5 and 3 percent and raising inflation between 1.5 and 4 percent.

Finally, evidence about the effect of forward guidance in the United Kingdom is very limited. Filardo and Hoffman (2014) show that the forward guidance announcements in 2013 and 2014 did not lead to a reduction in expected future rates or in government bond yields. However, forward guidance seems to have reduced the volatility of expected future interest rates and has likely contributed to keeping expected interest rates low, despite sustained GDP growth in 2014.

5. Japan

In Japan, the initial monetary response to the global financial crisis was relatively weak, involving forward guidance announcements between 2010 and 2012 supported by limited asset purchases. The Bank of Japan delivered much stronger monetary stimulus after the election of Prime Minister Shinzo Abe in 2012, by adopting a 2 percent inflation target and launching very large quantitative easing programs in 2013 and 2014. In 2016, the Bank of Japan entered a third phase of monetary stimulus by introducing the “yield curve control” framework and charging negative interest rates on central bank reserves.

5.1 Economic developments and monetary policy responses in Japan

At the onset of the global financial crisis in 2008, Japan had already gone through a long period of low growth and inflation dating back to the early 1990s. The crisis made things much worse. Japan’s GDP started to contract in the second quarter of 2008, falling in a year by about 8.5 percent. The Bank of Japan responded by marginally lowering the policy interest rate from 50 to 10 basis points and providing liquidity to the banking sector. Economic growth resumed at a moderate pace in the second half of 2009, but the recovery stalled in late 2010.

On October 5, 2010, the Bank of Japan entered a first phase of unconventional monetary stimulus based on forward guidance and modest asset purchases. It started by clarifying its intention not to raise rates until “price stability is in sight” if no major financial risk materialized. Furthermore, the Bank of Japan announced the purchase of ¥5 trillion assets (later increased to ¥20 trillion, equal to about 4 percent of GDP) under a newly established asset purchase program. However, the economic recovery remained feeble because of the headwinds from weak global demand and the appreciation of the yen. With inflation stubbornly anchored around zero, in February 2012, the Bank of Japan re-iterated its

intention not to raise rates and to use asset purchases (further increased by ¥10 trillion) until inflation is expected to reach the “1 percent goal” in so far as this does not raise “significant risk” especially regarding financial imbalances.

The strength of monetary stimulus increased significantly after the 2012 election of Prime Minister Abe who called for fiscal stimulus, structural reforms, and much greater monetary accommodation. The Bank of Japan responded by introducing an explicit inflation target of 2 percent and announcing that it would use asset purchases and keep rates low to “achieve this target at the earliest possible time.” In February 2013, it launched the first round of “quantitative and qualitative monetary easing” (QQE1). The program involved the open-ended purchases of ¥50 trillion Japanese government bonds and ¥1 trillion exchange-traded funds per year. After a sizable but temporary increase in inflation, deflationary pressures reemerged in late 2014, leading the Bank of Japan to increase asset purchases (QQE2) up to ¥80 trillion Japanese government bonds and ¥3 trillion in exchange-traded funds per year. QQE1 and QQE2 also involved the purchase of Japan real estate investment trusts in the amount of ¥30 and ¥90 billion, respectively.

Despite the large size of asset purchases, Japanese consumer prices remained broadly flat in 2015 partly due to a decline in oil prices and weak external demand because of the economic slowdown in China. Thus, the Bank of Japan provided additional monetary stimulus in 2016 through several major announcements. In January 2016, it announced the introduction of a negative interest rate of -0.1 percent on a portion of the reserve deposits that financial institutions held at the central bank. In September 2016, the Bank of Japan launched the “yield curve control” framework under which the Bank aims to control both short and long-term interest rates. Specifically, it announced that it would keep short-term rates on central bank reserves at -0.1 percent and continue to purchase Japanese government bonds to keep the 10-year yield around the current zero percent. Furthermore, the Bank of Japan introduced an “inflation-overshooting commitment” to keep expanding the monetary base until inflation exceeds the 2 percent target on an ongoing basis.

5.2 Effects of unconventional monetary policy in Japan

To understand the challenges faced by monetary policy in Japan during the global financial crisis, it is helpful to review Japan’s prior economic history. In the early 1990s, Japan faced a collapse in real estate and stock prices. This led to strong deflationary pressures that the Bank of Japan tried to offset by pioneering unconventional monetary policy tools. After bringing policy rates to zero in 1999, in 2001 the Bank of Japan embarked on a ¥35 trillion quantitative easing program (described in McCauley and Ueda 2009). Faced with an improved economic outlook, in 2006 the Bank of Japan exited quantitative easing and increased policy interest rates. Nonetheless, inflation remained around zero raising concerns that the Bank of Japan had not provided enough monetary stimulus and was not committed to reinflating the economy (Ito and Mishkin 2006; Bernanke 2000).

The Bank of Japan’s announcement in 2010 to start a new asset purchase program and keep rates at zero led to a mild reduction in government bond yields, by about 10 basis points at the 10-year maturity, as shown in Table 3. However, mild deflation persisted, inflation expectations remained largely unchanged, and the yen exchange rate did not depreciate. The muted response of inflation was at least in part a reflection of the limited credibility in fighting deflation that the Bank of Japan had acquired during the previous decades. This perception was probably strengthened by the fact that asset purchases were scaled up in small amounts of about ¥5 trillion each during several subsequent announcements (Shirai 2017).

Table 3. Unconventional monetary policy effects in Japan

<i>Study</i>	<i>Notes</i>	<i>Government bond yields</i>	<i>GDP</i>	<i>Inflation</i>
Lam (2011); Ueda (2012)	Event study of BoJ announcement on Oct 5, 2010.	-10 bps		
De Michelis and Iacoviello (2016)	VAR analysis of 2% inflation target announcement in Jan 2013			+0.8%
Arai (2017)	Event study of announcements around QQE1	-14 bps		
Hausman and Wieland (2014)	Announcement effects and VAR analysis of QQE1	-11 bps	up to +1%	
Kan, Kishaba, and Tsuruga (2016)	QQE1 effects using BoJ's large-scale macroeconomic model		+0.6/4.2%	+0.3/1.5%
Michaelis and Watzka (2017)	VAR analysis of QQE, response to 1% increase in bank reserves		Not significant	+0.2%

Note: QQE is “quantitative and qualitative easing.” QQE1 is the first round of QQE. VAR is “vector autoregression.” BoJ is Bank of Japan.

Forward guidance to keeping rates low until inflation resumed was also largely ineffective because of the entrenched deflationary pressures. If an economy is expected to experience deflation for a prolonged period, promises to keep policy rates low until a distant point in the future when inflation will eventually increase are largely ineffective to stimulate present output and inflation (Katagiri 2016).

The election of Prime Minister Abe reinvigorated the efforts of the Bank of Japan to provide monetary stimulus. The decision in January 2013 to adopt the 2 percent inflation target had significant effects on inflation (De Michelis and Iacoviello 2016), strengthened by the announcement of the QQE1 program. Despite market participants already anticipating new monetary easing measures, the announcement of such a large-scale program led to a further reduction in long-term yields, by about 11–14 basis points (Arai 2017; Hausman and Wieland 2014).

Regarding the ultimate effects of QQE1 on output and inflation, identification is particularly challenging because the government enacted a concomitant fiscal stimulus as part of the so-called “Abenomics” program. However, analyses using vector autoregressions tend to find positive, albeit moderate, effects on both inflation and output (Hausman and Wieland 2014; Kan, Kishaba, and Tsuruga 2016; Michaelis and Watzka 2017). QQE1 was also associated with an increase in stock prices and decline in corporate bond yields (Arai 2017). The impact on the exchange rate was marginal, probably because the yen had already depreciated sharply a few months earlier when Abe called for extraordinary monetary easing during his electoral campaign. Despite the extraordinary size of asset purchases, QQE1 and QQE2 failed to deliver a sustained increase in inflation. Long-term inflation expectations increase to only about 1 percent (De Michelis and Iacoviello 2016). Furthermore, inflation declined again to zero in 2015, thus defying the Bank of Japan intention to meet the 2 percent target by then (as announced at the launch of QQE1). This has renewed concerns about the inflation target not being credible, given the entrenched deflationary mindset.

Regarding the impact of negative interest rates, Japan’s announcement in 2016 led to a downward shift in the yield curve that pushed 10-year yields below zero (IMF 2017a). Negative rates led also to a reduction in deposit and lending rates. Nonetheless, the impact on GDP and inflation has been hard to identify. Furthermore, negative rates appear to have put further strain on the profitability of several of Japan’s regional banks.

6. Lessons of unconventional monetary policy: What worked and what did not

The experience with unconventional monetary policy in the euro area, Japan, and the United Kingdom provides abundant evidence that unconventional monetary policy contributed to easing monetary policy conditions after the policy rate hit the zero lower bound. Most studies find significant cumulative effects of quantitative easing and forward guidance on the yields of long-term government bonds. Negative interest rates have also been effective in lowering bond yields. These effects are clearly visible on the short-end of the yield curve, which dipped below zero in the euro area and Japan after the implementation of negative policy rates. Furthermore, unconventional monetary policy has contributed to reducing corporate yields, raising stock prices, and depreciating the exchange rate. The experience with unconventional monetary policy of other countries not covered in this paper (such as Denmark, Sweden, and Switzerland) is qualitatively in line with this evidence (IMF 2017a; De Graeve and Lindé 2015).

Evidence on how unconventional monetary policy affected output and inflation is more limited. While the effects on financial variables can be assessed using high-frequency indicators, the impact on macro variables can only be observed over longer lags and is thus confounded by possible concomitant shocks. Constructing a counterfactual scenario to tease out the effects of unconventional monetary policy is particularly difficult because these measures were often adopted in periods of exceptional financial distress—which are hard to model. That said, existing studies suggest positive impacts of unconventional monetary policies on both GDP and inflation.

The analysis also suggests that unconventional monetary policy tends to be more effective under three specific conditions.

First, the effects appear stronger in periods of heightened financial distress, which is consistent with economic theory that quantitative easing should have stronger price effects under segmented-market conditions. For example, in the United Kingdom the first round of quantitative easing at the peak of the crisis in 2009 seems to have had stronger effects on bond yields than subsequent rounds. Furthermore, unconventional monetary policy measures in the euro area have been particularly effective when they contributed to the reestablishment of market liquidity and elimination of redenomination risks. For instance, the reduction in spreads in peripheral European countries was very large after the “whatever it takes” statement and the announcement of the Outright Monetary Transactions program.⁵

Second, unconventional monetary policy is less effective when deflationary pressures are entrenched, so that the economy is expected to remain at the zero lower bound for a long period of time. The experience of Japan is emblematic. When the yield curve is already quite flat and close to zero even at long maturities, quantitative easing can have only a limited impact on further reducing yields. Forward

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5. In addition, the size of the quantitative easing surprise was essentially larger in the euro area during heightened financial stress, and the effects were probably commensurate with the size of the surprise. The difference may be due as much to the extent of the surprise as to the overall size of quantitative easing (including both its surprise and expected components). Indeed, Altavilla, Carboni, and Motto (2015) suggest that low financial distress can actually reinforce some monetary policy transmission channels (specifically, the duration and credit channel).

guidance also tends to lose effectiveness. The promise to keep rates low in a distant future when the economy exits the zero lower bound has limited effects on current spending and investment decisions. Negative interest rates can provide some additional stimulus, but they are bounded below by concerns over their effects on bank profitability and on the threshold at which economic agents switch to cash.

Third, unconventional monetary policy requires that the central bank is credible in its attempt to provide sustained monetary accommodation. For example, the unconventional monetary policy measures adopted by the Bank of Japan between 2010 and 2012 probably had a muted impact on inflation because the central bank's commitment to deliver sustained inflation was undermined by decades of mild deflation. Stronger effects were associated with the unconventional monetary policy measures adopted in 2013 when Prime Minister Abe provided political backing for the Bank of Japan to provide aggressive monetary stimulus. Similarly, the Long-Term Refinancing Operations undertaken by the European Central Bank in the early years of the crisis had limited impact on lending rates and aggregate demand, partly because markets were skeptical about the determination and legal powers of the European Central Bank. The open-ended commitment under Outright Monetary Transactions was much more effective in reducing sovereign yields and laying the foundations for the economic recovery.

So far, there is little evidence that the undesired side effects of unconventional monetary policy have materialized. Inflation has been below target in Japan and the euro area for quite some time. In the United Kingdom, inflation was above target in several years, but this was mostly due to one-off shocks (such as value-added tax increases) and the effect of the exchange rate depreciation. Bank profitability has been under pressure but this seems more a byproduct of stagnant economic conditions than of unconventional policies. If anything, banks seem to have benefitted from the stimulative effects of unconventional monetary policy and the associated reflation of asset prices and improvement in asset quality. There was concern over banks and nonfinancial institutions taking on too much risk because of a "search for yield" strategy when interest rates are low for too long, but this does not appear to have materialized.

However, the activism of central banks during the crisis has increased political scrutiny (for examples, see Davies 2016). This happened in part because the expansion of central bank balance sheets has increased the potential for capital losses that may in turn have significant fiscal implications. Furthermore, unconventional monetary policy, with its effects on asset prices and bank balance sheets, is often perceived to have greater distributional effects than traditional interest rate policy. Finally, greater political scrutiny can also arise simply because unconventional monetary policy at this scale is new and not fully understood. While politicians should retain their prerogative to amend central banks' goals and instruments as our understanding of monetary policy and economic circumstances evolve, central banks should retain operational independence.

Looking ahead, unconventional monetary policy measures should remain part of the monetary toolkit because they can provide crucial relief if a future severe recession pushes economies against the zero lower bound. However, unconventional monetary policy is far from a panacea—in particular, it faces limits once the yield curve is close to zero even at long maturities. Therefore, it is crucial to design policy responses that can complement unconventional monetary policy, such as fiscal stimulus. It would also be useful to think about how to reduce the likelihood that the zero lower bound may become binding in the first place. Possible measures include increasing the inflation target to leave more room for conventional cuts in nominal interest rates, or promoting structural reforms to boost growth.

The experience with unconventional monetary policies also leaves several questions unanswered. Two in particular deserve further research. First, there is the question of the relationship between the amount of securities purchased by the central bank and the effectiveness of quantitative easing. In that context,

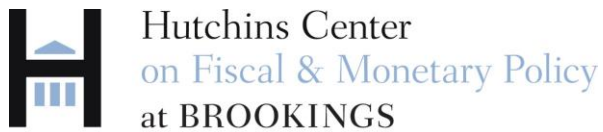
how does the total amount announced and the periodic flow of purchases interact in affecting market yields. The second question is whether central bank purchases should be limited to certain classes of assets, and what are the risks of widening those limits. Put differently, when is it that quantitative easing ceases to be a monetary measure and enters the realm of fiscal policy?

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