

Effectiveness of Unconventional Monetary Policy in the Euro Area: An Assessment Based on a Literature Survey

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Abstract

The ECB has adopted a variety of unconventional monetary policy measures since the Global Financial Crisis. In this paper, we assess the effectiveness of unconventional monetary policy measures based on a review of the empirical literature and on theoretical considerations. Empirical assessments exhibit a high uncertainty since it is very difficult to identify the definite effects of unconventional monetary policy and historical evidence is scarce. Therefore, the estimated effects vary considerably across studies. Overall, the available evidence for the euro area suggests that unconventional measures had significant effects on financial market variables, e.g., they reduced long-term interest rates or stimulated asset prices. Unconventional monetary policy also seems to have stimulated economic activity (GDP and consumer prices) to some extent. The available evidence suggests that unconventional monetary policy had the largest effects at the height of the Global Financial Crisis and the sovereign debt crises on economic activity in the euro area. Afterwards, the effects on economic activity most likely have been rather low. Moreover, the risks associated with unconventional monetary policy measures are expected to increase while the effects on economic activity decrease the longer they are in place.

Analyse und Bewertung der Wirksamkeit unkonventioneller geldpolitischer Maßnahmen im Euroraum: Ein Literaturüberblick

Zusammenfassung

Seit Beginn der Finanzkrise hat die EZB eine Vielzahl unkonventioneller geldpolitischer Maßnahmen ergriffen. In dieser Arbeit untersuchen wir die Wirksamkeit dieser

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Maßnahmen anhand eines empirischen Literaturüberblicks und theoretischer Betrachtungen. Die Ergebnisse empirischer Studien unterliegen aufgrund von Identifikationsproblemen bei der Analyse der Effekte unkonventioneller Geldpolitik und den wenigen verfügbaren historischen Daten hoher Unsicherheit. Dementsprechend variieren die Schätzergebnisse stark zwischen den einzelnen Studien. Insgesamt deuten die vorliegenden Ergebnisse darauf hin, dass die unkonventionellen geldpolitischen Maßnahmen signifikante Auswirkungen auf die Finanzmärkte hatten und z. B. zu einem Sinken der langfristigen Zinssätze und einem Anstieg von Vermögenspreisen geführt haben. Weiterhin gibt es Anzeichen dafür, dass die unkonventionellen geldpolitischen Maßnahmen zu einem gewissen Grad positive Effekte auf die Wirtschaftsaktivität (das BIP und die Konsumentenpreise) haben. Zudem deuten die vorliegenden Ergebnisse darauf hin, dass die Maßnahmen die stärkste Wirksamkeit während der Höhepunkte der globalen Finanzkrise und der europäischen Staatsschuldenkrise erreicht haben. Im Laufe der Zeit hat die Wirksamkeit in Bezug auf die Wirtschaftsaktivität eher abgenommen. Ferner erhöhen sich die Risiken unkonventioneller geldpolitischer Maßnahmen mit zunehmender Dauer.

Keywords: Unconventional monetary policy measures, balance sheet measures, Forward guidance, effectiveness, financial markets, real economy, transmission channels

JEL Classification: E52, E58, E65

I. Introduction¹

In normal times central banks usually conduct their monetary policy by adjusting the short-term interest rate to achieve their targets. With the onset of the Global Financial Crisis central banks, including the European Central Bank (ECB), have faced new challenges that they were unable to address with conventional monetary policy but that have called for so-called unconventional monetary policy. One of these challenges was that the short-term interest rates quickly approached the effective lower bound where further interest rate reductions are complicated, among other things, by the possibility for market participants to hold cash. Furthermore, central banks also faced other challenges that potentially impair transmission channels of monetary policy, such as financial market tensions or – for the ECB – financial market fragmentation across euro area Member States.

There are a number of unconventional monetary policy measures that central banks have adopted. These measures can be differentiated between forward guidance and balance sheet measures. Although there is no general agreement

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on a classification scheme, it seems reasonable to further differentiate balance sheet measures between (i) direct quantitative easing (large-scale purchases of government or private assets with the primary aim of increasing the outstanding monetary base), (ii) direct credit easing (purchases of assets in specific market segments), and (iii) indirect quantitative or credit easing (lending to banks at longer maturities). Quantitative Easing (QE) includes all measures related to direct quantitative easing and direct credit easing. In practice, it is not always possible to neatly sort all unconventional monetary policy measures into the different categories described above. For example, a large-scale asset purchase programme can be interpreted both as direct quantitative easing and as forward guidance (as it can be interpreted as a commitment by the central bank to keep interest rates low for an extended period).

In this paper, we assess the effectiveness of unconventional monetary policy in the euro area by reviewing the relevant theoretical and empirical literature. We start by describing the unconventional monetary policy measures that have been adopted by the ECB since the Global Financial Crisis (Section II.). We then describe potential transmission channels of unconventional monetary policy through which it can stimulate economic activity (Section III.). Next, we give a summary of empirical methods that have been used in the literature to identify the impact of unconventional monetary policy on financial markets and on economic activity, including a discussion about the problems with identifying this impact and the shortcomings of these methods (Section IV.). Based on this summary, we provide an extensive review of the available literature on the impact of unconventional monetary policy measures. Even though we focus on the impact in the euro area, we also take into account the literature that deals with the impact in the United States, the United Kingdom, and Japan because there is considerable uncertainty when estimating the impact of unconventional monetary policy (due to the relatively short experience with this policy) and because some of the relevant measures have been adopted by the ECB only recently (so that empirical evidence on the effectiveness of these measures is scarce) while they were implemented earlier by other central banks. While we aim to summarize the most relevant contributions to this large and growing body of literature, we place a special focus on the literature that deals with the euro area (Section V.). In the next Section, we discuss whether the effectiveness of unconventional monetary policy may decrease over time (Section VI.). In this regard, we also provide a short summary of potential risks and side effects of unconventional monetary policy and whether these risks and side effects may increase over time (Section VII.). Finally, we provide a summary of our results (Section VIII.).

II. Unconventional Monetary Policy of the ECB

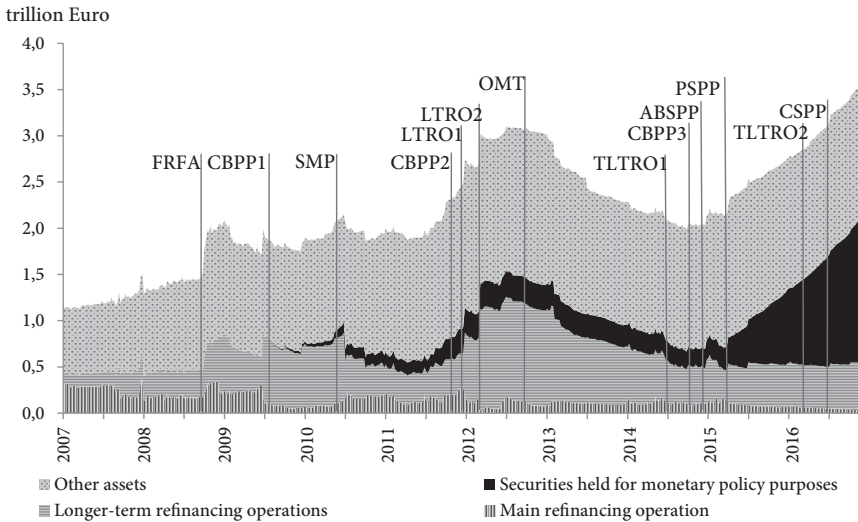
In the wake of the Global Financial Crisis, the ECB adopted a range of unconventional policies including forward guidance and a series of different balance sheet policies. At the beginning of the Global Financial Crisis it adopted mainly indirect quantitative and credit easing measures. Later it also adopted direct credit easing measures, and finally direct quantitative easing measures. In doing so, it deviated somewhat from the unconventional monetary policies adopted by other central banks, such as the Federal Reserve and the Bank of England that put a stronger focus on direct quantitative easing much earlier. This deviation can be explained by the fact that bank lending is a more important source of financing in the euro area than in the United States or the United Kingdom, where financing via capital markets is more dominant. Although the tools utilized differed, in the aftermath of the Global Financial Crisis the aim of all central banks was at the beginning to alleviate financial market stress and later to stimulate economic activity. The ECB later also tried to contain the sovereign debt crisis in several euro area countries.

Beginning in 2008, the ECB adopted, as shown in Figure 1, several indirect quantitative and credit easing measures, including new refinancing operations under tender rules of a fixed rate and full allotment (FRFA). Later, the central bank offered refinancing over longer periods of time (Long-Term Refinancing Operations, LTRO). Furthermore, requirements for accepted collateral became progressively less stringent. Finally, the ECB began to try to expand bank lending by attaching certain provisions to its longer-term refinancing operations (Targeted Longer-Term Refinancing Operations, TLTRO).² These policy measures were designed to provide liquidity and funding to the markets. However, they also contain some of the other aspects of unconventional policy: longer term refinancing operations are, as they allow banks to lock in current low interest rates, a way for the central bank to show its commitment to future low interest rates. In addition, the ECB eased monetary policy further by loosening collateral requirements³ for specific securities with the aim of mitigating risk premia for these securities.⁴

² These TLTROs (from 2014 on) have led to a smaller increase in the central bank's balance sheet than the earlier LTROs (implemented in 2011 and 2012). This could be due to various reasons, including lower liquidity demand outside acute crisis phases or changes in the interest rate environment.

³ Including, but not limited to, the extensive utilization of the so-called Emergency Liquidity Assistance (ELA) instrument.

⁴ A different line of central bank actions concerned foreign exchange markets. For example, starting with the Federal Reserve Bank (Fed) in 2007, the ECB successively entered swap agreements with other major central banks around the world. This had the effect, that if a bank can obtain funding in at least one currency it can meet obligations



Notes: “Securities held for monetary policy purposes” includes asset purchase programmes, “Longer-term refinancing operations” includes standard 3-month operations as well as non-standard LTRO and TLTRO, “Main refinancing operations” are standard operations which can be modified (e.g. by FRFA, lower collateral requirements).

Sources: ECB Eurosystem balance sheet, ECB, own calculations.

Figure 1: Eurosystem Balance Sheet Assets

Since 2009 the ECB started to adopt direct credit easing measures that included interventions in specific markets, namely covered bonds (Covered Bond Purchase Programme, CBPP), debt of distressed sovereigns (Securities Markets Programme, SMP), and asset-backed securities (Asset-Backed Securities Purchase Programme, ABSPP). These direct credit easing measures only moderately contributed to an increase in the ECB’s balance sheet because the volume of these measure is usually relatively small. Since 2015, the ECB also adopted direct quantitative easing measures by implementing the Expanded Asset Purchase Programme (EAPP), which includes the purchase of government bonds in proportion to the respective countries’ share in ECB capital (Public Sector Purchase Programme, PSPP). Since 2016, selected corporate bonds (Corporate Sector Purchase Programme, CSPP) have also been included in the EAPP.⁵ With the adoption of the EAPP, the balance sheet of the ECB started to increase again

in the other ones as well (reducing currency mismatch risks). This helps keeping banks liquid even if interbank foreign exchange markets freeze up in a crisis due to mistrust arising from asymmetric information about individual solvency.

⁵ The EAPP also includes the CBPP and the ABSPP.

after it had decreased as the volume of the refinancing operations receded in 2013 and 2014.

While many of the measures described above can also be interpreted as a form of implicit forward guidance as they provide information about the future path of the ECB's monetary policy, the ECB has also adopted explicit forward guidance. In 2013 it started to communicate to the public its expectations about future monetary policy, including the notion that fixed rate full allotment refinancing would continue and interest rates would be kept low for an extended period. The most important forward guidance provided by the ECB was President Mario Draghi's 2012 "whatever it takes"-speech and the announcement of the Outright Monetary Transactions (OMT) programme.⁶ Although never utilized it signalled a commitment by the ECB to preserve countries' membership in the single currency area by, if necessary, intervening in their sovereign debt markets. OMT was therefore a mixture of forward guidance (explaining how the central bank reaction would look like if some future conditions were to arise) and an intervention in specific markets (influencing the risk premia of certain instruments by, inter alia, reducing the risk of redenomination).

III. Transmission Channels and Theoretical Considerations

In this Section, we describe potential transmission channels of unconventional monetary policy through which it could stimulate economic activity. We differentiate between balance sheet measures and forward guidance.

1. Balance Sheet Measures

QE measures can involve a variety of policy measures such as changes in the size, composition, and duration of the central bank's balance sheet, respectively portfolio, or adjusting collateral requirements.⁷ Specific foreign exchange market interventions that increase the central bank's balance sheet like foreign currency swap lines between central banks can also be categorized as QE measures.

⁶ The OMT programme reduced uncertainty for market participants by providing information about the central banks intentions conditional on future developments. Therefore, we discuss OMT as forward guidance in this Section. When we provide a review of the empirical literature (Section V.), we follow the literature and discuss it as a balance sheet measure when it is analysed together with balance sheet measures and as forward guidance when it is analysed individually.

⁷ In fact, following our definition Quantitative Easing will always increase the size of the balance sheet. However, central banks have also engaged in "Qualitative Easing" that only changes the composition and duration of the central bank's balance sheet without expanding it. The so-called "Operation Twist" conducted by the Federal Reserve is an example of Qualitative Easing.

Like standard QE measures such interventions increase liquidity in the banking system, though in this case in foreign currency denominated assets.

The aim of all these measures is an increase in aggregate demand and inflation. The transmission works through various channels, most of which aim at a further flattening of the yield curve by directly targeting medium to long-term rates. While different transmission channels can be clearly distinguished in theory, one should bear in mind that it is difficult to disentangle the different channels empirically.

a) Portfolio Balance Channel

By means of asset purchases, a central bank can reduce the supply of a specific asset (class) on the financial market and simultaneously increase the amount of circulating money, which will lead to higher prices and lower yields on the purchased assets. Because of the lower yields investors are incentivized to rebalance their portfolios by searching for alternative assets with higher returns. Accordingly, an increased demand for substitutive assets also leads to rising prices and falling interest rates in other market segments and in particular to a decrease of risk premia. Correspondingly, QE leads not only to lower interest rates in the specific market segment included in an asset purchase program of the central bank, but to generally lower interest rates.⁸ In general, aggregate demand should increase as financing conditions improve via lower interest rates. In addition, falling interest rates make investments in domestic assets less attractive relative to foreign assets. Hence, QE triggers net capital outflows (or reduces net capital inflows) as investors move to foreign assets that yield higher returns. This leads to currency depreciation, increasing exports and lowering imports. Further, the increase in asset prices contributes directly through wealth effects and indirectly via an increase in the value of collateralizable assets to higher aggregate demand.

b) Bank Lending Channel

The injection of liquidity results in a rise of credit supplied by banks, reducing liquidity and term premia and, accordingly, lowering lending rates charged by banks. The fall in bank lending rates boosts credit demand and supply. The subsequent improvement in the balance sheet position of investors and banks eases

⁸ However, empirically it has been shown, that in addition to a general flattening of the yield curve, the effects on the real economy depend on the type of assets purchased. For example, the US QE1 program involved large scale purchases of mortgage backed securities which stimulated the real estate sector much more than other sectors of the US economy (*Di Maggio/Kermani/Palmer* 2016).

leverage constraints and allows banks to extend more credit at lower costs to the private sector. This is called the bank lending channel. Further, expansionary monetary policy increases the value of outstanding bank loans through an appreciation of collateral and the expected associated repayment flows.

Better financing conditions improve growth prospects, increase profitability and mitigate default probabilities in the non-financial sector. These positive feedback effects further improve the condition of the balance sheets of investors and banks, and increase their willingness to extend new credit in a self-reinforcing positive spiral.

c) Fiscal Channel

Furthermore, especially if the central bank's securities purchases include government bonds – as was the case with the ECB's sovereign bond purchases – then these purchases may ease government budget constraints. Therefore, this improves the scope for implementing fiscal policy measures without raising public debt, stimulating investment and aggregate demand. Further, the close linkage between sovereign debt refinancing and a country's default risk lowers sovereign bonds yields, sovereign credit default swap rates (CDS) as well as the respective spreads. In particular, sovereign bond purchases in the European periphery may have induced lower sovereign bond yields and CDS rates in the respective countries and, in addition, could have led to spill-over effects to other Member States.

d) Expectations and Confidence

Assuming the effectiveness of the introduced unconventional monetary policy measures and the intactness of the previously discussed transmission channels, the economic activity and outlook should improve as a result of the expansionary unconventional monetary policy. Accordingly, the introduced measures should significantly stimulate GDP and induce price increases and thereby lead to higher inflation. Given that market participants adjust their expectations right away and anticipate these medium-run economic effects, one would expect inflation expectations to increase immediately, which would lead to an instantaneous reduction in the real interest rate. Further, this could also have confidence effects by improving the economic outlook; reducing uncertainty and lowering financial market volatility, particularly in times of financial distress. Strengthened business confidence may encourage investment spending directly and may also contribute to a reduction of risk premia. This confidence channel can affect portfolio decisions and asset prices.

2. Forward Guidance

In general, forward guidance is defined as the central bank communicating information about its future monetary policy actions to financial market participants and the public at large. Depending on how credible this information is people will adjust their expectations and behaviour accordingly.

In practice, the concept of forward guidance encompasses a considerable range of policies. They can be categorized along several dimensions, including their aims and how those are to be achieved.

First, one can broadly distinguish between “Delphic” and “Odyssean” forward guidance (*Campbell et al. 2012*):

- Delphic forward guidance provides the central banks assessment of the economic outlook. This form of forward guidance would only have an effect if the central bank is perceived to have better knowledge about the economy or superior forecasting ability vis-à-vis the market. *Praet (2014)* states that he does not believe this to be true. If he is correct and his belief is widely shared, then market actors’ economic outlook would not depend on the central banks’ forecast. This would, for example, give the ECB the ability to signal its aim to keep monetary policy loose for an extended period without having to fear that this would be interpreted as a negative signal for the economic outlook by financial markets, which could have contractive side effects for the economy.
- Odyssean forward guidance provides information about the metaphorical mast to which the central bank wants to tie itself. In other words, the central bank gives a signal about policy actions it will take in the future (possibly amended by some conditions that would need to be fulfilled for certain actions to be triggered). The effectiveness of this type of forward guidance crucially depends on the credibility of the central bank to follow through on its announcements. After the financial crisis, central banks increasingly attempted to use Odyssean forward guidance to provide expansionary stimuli.

Second, forward guidance can have several aims:

- Forward guidance can be used to provide further stimulus to the economy when short-term interest rates have reached the effective lower bound. The rationale is that long-term interest rates today are tightly connected to the expected path of short-term interest rates such that the central bank can reduce long-term rates by committing to a lower path of the (short-term) policy rate; this channel is frequently called the “signalling channel” in the literature. Since investment and the purchase of durable goods depend on the long-term financing conditions, a credible policy of this type would provide additional stimulus to the economy (*Praet 2013, Filardo/Hofmann 2014*).

- Furthermore, forward guidance can help the central bank to clarify its reaction function, i.e., the way it reacts to changes in the economic outlook. If successful this would, *ceteris paribus*, lead to a reduction in the volatility of market expectations and possibly also to lower risk premia. This would improve financing costs and provide economic stimulus at the margin (*Filardo/Hofmann 2014*). It would also reduce adjustment costs from unexpected changes in monetary policy.
- Even when central banks are not operating at the effective lower bound, forward guidance may sometimes prove useful if it can help repair the transmission channels of monetary policy. For example, if banks are reluctant to lend despite very low short-term rates, assurances regarding the provision of liquidity for an extended period of time may help unclog the credit channel. A special case is the fear of redenomination in a currency union: an explicit commitment to preserve the membership of all participants could reduce risk spreads, counteracting asymmetrical challenges to the transmission of monetary policy (*Praet 2014*).

Third, the communication about future monetary policy can take different forms:

- Central bank statements can be conditional or unconditional. Conditional forward guidance would inform the audience that the central bank intends to conduct its future monetary policy depending on developments in variables such as inflation, unemployment, or exchange rates, whereas the size and duration of unconditionally signalled policy is supposed to be unaffected by incoming data.
- Furthermore, policy makers can choose the degree of precision of their announcements. A (credible) commitment to future policy actions becomes the more effective in reducing risk premia and providing stimulus for the economy the more information the central bank provides about their future plans and on the relevant information for their monetary policy decisions. The effectiveness regarding the reduction of risk and the provision of stimulus of a (credible) commitment to future policy actions increases when the central bank provides more information about its future policies and the economic variables it plans to consider for upcoming decisions.

Forward guidance does not have to come in the form of explicit statements by the central bank. Often it is provided indirectly through other monetary policy actions. For example, when a central bank conducts an unconventional asset purchasing programme, market participants may believe that the central bank's balance sheet will stay elongated for an extended period of time. Reasons for this include that if inflation and interest rates pick up again in the future, bonds bought by the central bank in times of lower rates might, unless held to maturity, only be saleable with a considerable nominal loss, something central bankers

would be loath to do. Furthermore, a sudden reversal of central bank purchases could lead to considerable turbulences at least in the markets for the affected securities and underlying assets (possibly affecting the solvency of some issuers if they depend on continuous access to refinancing at favourable conditions) which policy makers would be expected to try to avoid.

IV. Empirical Identification of the Effects of Unconventional Monetary Policy

In the empirical literature, there are two canonical approaches for evaluating the effects of unconventional monetary policies: event studies and vector autoregressive models (VAR models). Recently, hybrid approaches have also been applied. Event studies typically consider announcement effects, i. e. the effect of the announcement of unconventional monetary policy measures. Since event studies usually rely on high frequency data (daily, intra-daily), this restricts the analysis to the effects on variables with the same frequency, primarily financial market variables, such as interest rates, the yield curve, or asset prices. In contrast, VAR models are also used to estimate effects on lower frequency variables, such as output and inflation, which are usually in the main interest of central banks. However, compared to event studies it is more challenging to identify causal relationships in VAR models. In addition, mixtures of both approaches have been used, namely VAR models that focus on the announcement effects of QE programmes (e. g., *Weale/Wieladek 2016*) and studies that in a first step identify the effects of announcements on financial market variables using an event-study approach and, in a second step, take these identified effects to estimate the impacts on output and inflation using either a theoretical or an empirical model (e. g., *Gertler/Karadi 2015*). The latter approach may suffer from the fact that in the second step typically models are used that assume that the relationship between financial variables and economic activity is constant over time while in reality this relationship may vary, in particular in extraordinary times, in which unconventional monetary policy measures are usually adopted.

1. Event Studies

Event studies analyse whether the announcement of news about unconventional monetary policy measures changes financial market expectations, leading to changes in financial market variables. To identify the impact of announcements of unconventional monetary policy measures, the effects on interest rates or other financial market variables are measured within a small time window around the announcement. The time window is chosen to be sufficiently large to capture the complete effect of an announcement but also sufficiently small to

avoid other new information to have an impact (*Gagnon et al. 2010*). Moreover, control variables that account for such new information can be included in the model. The dependent variables in event studies are usually the changes of interest rates or asset returns on the day of the announcement. Using such a short time window is appropriate when markets are efficient insofar as that all financial market variables immediately adjust when the announcement of an unconventional monetary policy measure takes place.⁹ Further, it assumes that the announcement is the sole driver of changes of financial market variables in this time window. Moreover, this method assumes that the changes of financial market variables at the time of the announcement did not trigger or affect the announcement. Given these assumptions, event-studies are able to identify a causal effect of an announcement of an unconventional monetary policy measure on financial market variables (*Gertler/Karadi 2013*).

The event study approach is a very useful tool to evaluate the effects of the announcement of unconventional monetary policy measures on financial market variables, because the identification of the causal relationship is relatively straightforward. Moreover, it is possible to differentiate between different forms of unconventional monetary policy measures or even between each individual measure. However, this approach has also important limitations. One of the most important limitations is that this approach does neither consider the impact of a measure that has been partly or completely expected by financial markets nor the impact of the implementation of a measure.¹⁰ Therefore, event studies capture only the surprise component (the unexpected part) of a measure and it is mostly insufficient to simply relate this surprise component to the overall volume of a policy measure. As a consequence, the effectiveness of a measure (relative to its volume) can hardly be assessed and the effectiveness of different measures (relative to their volumes) cannot be compared. Another limitation is that with this approach the direct effects on output and inflation, which are usually the main concern of central banks, cannot be determined because the causal identification of the impact of unconventional monetary policy only works at a high frequency at which output and inflation data are not available. Another caveat is that conclusions about the length and the persistence of the effects can be drawn only under very strong assumptions, such as the efficient market hypothesis. Finally, the effects of different announcements made on the same day are very hard to disentangle and the overall number of observations available for estimation is limited, increasing the estimation uncertainty.

⁹ However, *Fratzscher et al. (2016)* argue that for a number of reasons this is not necessarily the case.

¹⁰ Recently, event study approaches have been augmented with the aim to take also the impact of the implementation of measures into account (see e.g. *Fratzscher et al. 2016*).

2. VAR Models

VAR models estimate systematic dynamic correlations between the relevant macroeconomic variables and policy instruments. To estimate the effects of unconventional monetary policy, typically the volume of the balance sheet of a central bank is included as the policy instrument. By imposing restrictions on the relationships between the variables in the VAR model, unconventional monetary policy shocks (or balance sheet shocks) can be identified. These shocks are used to assess the causal relationship between unconventional monetary policy measures and the relevant macroeconomic variables. The restrictions usually stem from economic theory and can include restrictions on the dynamic relationship between the variables. For example, it is usually assumed that a balance sheet shock (or more generally a monetary policy shock) does not have a contemporaneous impact on output and inflation because it takes time for monetary policy to work through the economy before finally impacting these variables.

VAR models are the most popular method to study the effects of conventional monetary policy (see, e.g., *Bernanke/Blinder* 1992, *Bernanke/Mihov* 1995, *Christiano* et al. 1999 or *Peersman/Smets* 2001) and there is a consensus in the literature on the effects of monetary policy on output and inflation. An advantage of using VAR models for estimating the impact of unconventional monetary policy is that they could directly tie in with the existing literature on conventional monetary policy. Furthermore, the effects on output and inflation can be directly estimated. Moreover, it is possible to estimate the effectiveness of unconventional monetary policy measures relative to its volume because the estimated impact is related to the volume of a measure (e.g., the change in the balance sheet). A disadvantage of VAR models is that the identification of causal relationships of unconventional monetary policy is challenging because due to the limited time period during which such policy has been used by central banks only short samples are available for estimation. Therefore, it is also difficult to compare the effectiveness of different unconventional monetary measures. Moreover, while the VAR estimation includes an identification of monetary policy shocks, i.e. it yields estimates of the surprise effect of monetary policy (i.e., when and to which extent monetary policy measures were not anticipated by market participants), the reliability of the effects of unconventional monetary policy estimated in VARs depends on the correct estimation of the timing and the size of such surprise effects. Generally, it is difficult to distinguish monetary policy shocks from other shocks (like demand shocks) and the identifying assumptions are disputable. Further, the frequency of data used in VARs is usually monthly or quarterly, so that it is difficult to correctly identify the timing and the size of anticipation effects of financial markets that take place on a daily or even intra-daily frequency.

V. Effectiveness of Unconventional Monetary Policy Measures – A Review of the Literature

The empirical literature on the effectiveness of unconventional monetary policy focuses either on the effectiveness of balance sheet measures (Section IV.1) or on forward guidance (Section IV.2). The literature on the effectiveness of balance sheet measures can be further differentiated into the literature that estimates the effects on financial markets and on economic activity, with the former usually being based on event studies and the latter on VAR models. The literature that compares the effectiveness of different balance sheet measures is relatively scarce and usually evaluates the effects of these measures on financial market variables.

1. Balance Sheet Measures

a) Effects on Financial Markets

In the literature, there is a broad consensus that expansive balance sheet measures lead to a drop in long-term yields and a boost in asset prices. Many of these studies focus on the impact of QE programmes on financial markets in the US. The meta study by *Williams* (2014) based on papers that analyse US data shows that overall the size of the effects of monetary policy on long-term yields is very uncertain. Summarizing results from 14 papers, a QE programme comprising \$1 trillion in asset purchases is found to lower 10-year treasury yields by between 30 and 300 basis points. However, the average effect is a reduction of only about 40 basis points because the study finding a 300 basis point reduction is a severe outlier. Comparing a reduction of long-term yields by 40 basis points via QE programmes to conventional monetary policy, similar effects could be reached by lowering the short-term policy rate by about 1.5 to 1.75 percentage points (*Chung et al.* 2012, *Gürkaynak et al.* 2005). Studies for Japan (*Ugai* 2007) and for the United Kingdom (*Joyce et al.* 2012) also find that balance sheet measures lead to a decline in long-term yields.¹¹

For the euro area, there are several studies that qualitatively support the results for the US, Japan, and the UK. For the euro area, the studies also put a focus on differences in the impact between different Member States of the euro area and on government bond spreads across countries. *Fratzscher et al.* (2016) evaluate the impact of the ECB's unconventional monetary policy measures on financial markets by using an event study approach with daily data from 2007 to 2012 and controlling for a large number of news shocks to distinguish financial

¹¹ For a more detailed description on the earlier results on the effectiveness of Quantitative Easing, see *Gern et al.* (2015).

market movements caused by ECB policy from other causes. Their results show that the announcement of ECB policy measures had a significant impact on financial market variables. Equity prices increased in all countries of the euro area following the announcement of the OMT and SMP programmes. Reductions in bond yields were concentrated in the “periphery” countries, while yields in the “core” countries even slightly increased so that bond spreads between the “periphery” and the “core” euro area countries decreased.¹² The OMT related announcements in July and September 2012, for example, led to a cumulated 74 basis points decline in 10-year government bond yields in Italy and Spain and the SMP-related announcements in May 2010 and August 2011 to a 121 basis points reduction. Using confidential actual intervention data on ECB policy actions until mid-2014, *Gibson et al. (2016)* show that also the implementation of unconventional monetary policy measures of the ECB led to a decrease in sovereign spreads and alleviated financial stress. However, they find that the quantitative effects of these measures were modest, though statistically significant. For example, sovereign bonds purchases under the SMP programme have an average effect on sovereign bond spreads of Greece, Ireland, Italy, Portugal and Spain vs. Germany of between 3 to 22 basis points, calculated for a given month and scaled to a volume of €1 billion.

Briciu/Lisi (2015) expand the sample of *Fratzscher et al. (2016)* until 2015 to include the announcement of the EAPP. They broadly confirm the findings by *Fratzscher et al. (2016)*. The size of the impact, however, differs considerably across the different programmes. In tendency, following policy announcements bond yields decreased in periphery countries and increased in core countries. For example, policy announcements led to decreases of up to 66 basis points of 10-year government bond yields in Italy and Spain. While yields for Italy and Spain decreased following most announcements, there were, however, also increases of up to 40 basis points following specific policy measures. For Germany, yields increased by up to 34 basis points following most announcements, but there were also some decreases of up to 17 basis points. *Andrade et al. (2016)* focus on the effects of the ECB’s EAPP, but do not consider earlier unconventional policy measures of the ECB. Overall, like *Briciu/Lisi (2015)*, they find significant persistent announcement effects of the EAPP on sovereign yields and an increase in share prices of banks with a high portfolio share of sovereign bonds. While the announcement effects are significant, they find almost no additional implementation effects. The authors use a general equilibrium model and compare the effects of the EAPP to conventional monetary policy measures. They conclude that the EAPP has an effect similar to a 100 basis point interest rate cut.

¹² The “periphery” countries considered in their sample are Italy and Spain and the “core” countries are Austria, Finland, Germany, and the Netherlands.

Falagiarda/Reitz (2015) focus specifically on the effects on sovereign bond spreads within the euro area by analysing more than fifty announcements of the ECB (press conferences, press releases and speeches) between January 2008 and September 2012. They find that the ECB's announcements reduced long-term bond yield spreads relative to Germany in all GIIPS countries, except of Greece.¹³ *Szczerbowicz* (2015) measures the impact of the ECB's unconventional monetary policies on bank and government borrowing costs. The borrowing conditions for banks are measured by money-market spreads (short-term funding) and covered bond spreads (longer-term funding). Government borrowing costs are approximated by sovereign bond spreads. She uses an event study approach and daily data from 2007 until 2012. She classifies seven categories of unconventional monetary policy news according to ECB press releases and shows that SMP, OMT, and covered bond purchase programmes were most effective in lowering borrowing costs for banks and governments when there was high sovereign risk, while exceptional liquidity measures (in particular long-term refinancing operations) reduced money market tensions. Further, she finds spillover effects to other asset classes.

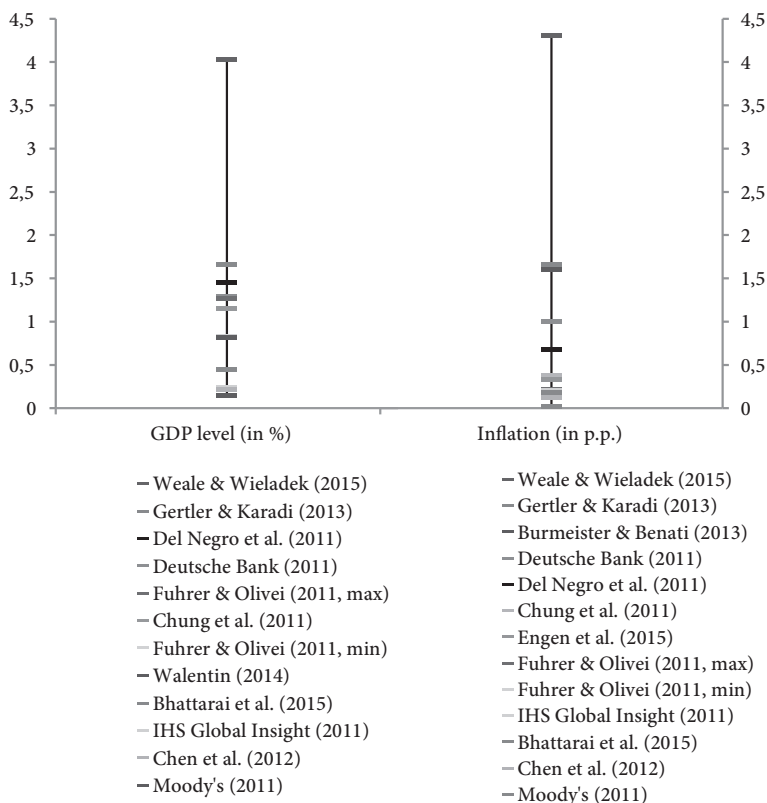
Summing up the findings of the various studies, unconventional monetary policy had significant effects on a broad range of financial market variables. In the euro area these effects were on average stronger for "periphery" countries leading to a decline in intra euro area government bond spreads. However, the size of the estimated effects considerably depends on the different programmes analysed.

b) Effects on Economic Activity

There is a broad consensus in the literature that QE programmes have not only positive effects on financial market variables, but also on output and inflation. However, the size of the estimated effects varies considerably across studies. Looking at studies focusing on the US, for example, the peak effects of QE programmes scaled to \$1 trillion on GDP range between 0.2 and 4 percent. Similarly, the effects on inflation range from values close to 0 to about 4.3 percentage points. However, the study by *Weale/Wiedelak* (2016) that finds the largest effect can be considered as an outlier. If this study is excluded, the average peak effect is an increase of GDP by 0.9 percent and of inflation of 0.5 percentage points (Figure 2).

For the euro area, there are fewer studies, which we will discuss in more detail. Overall, results for the euro area show that qualitatively unconventional monetary policy leads to similar effects as conventional monetary policy: a tem-

¹³ The GIIPS countries are Greece, Ireland, Italy, Portugal, and Spain.



Notes: The macroeconomic impacts are scaled to USD 1 tr. of asset purchases to allow for comparison across studies. Some of the studies provide the impact only for real GDP. Order of references below the Figure is equal to the order of horizontal lines in the Figure.

Source: Studies quoted in the chart and *Constancio (2015)*; own calculations.

Figure 2: Effects of Balance Sheet Measures on GDP and Consumer Price Inflation in the US (in Percent)

porary (hump-shaped) response of output and a lagged but permanent increase in prices. Quantitatively, studies for the euro area find a very large range of possible effects on output and inflation ranging from effects close to zero to large effects, similar to the literature based on US data.

Boeckx et al. (2016b) study the macroeconomic effects of ECB balance sheet measures for the euro area as a whole and also for individual Member States from 2007 to 2014 using VAR models. Their results show that an expansionary balance sheet shock leads to an increase in credit growth, stabilizes financial markets, and has a positive impact on output and inflation. The dynamic effects

are very similar to the findings in the literature on the effects of conventional monetary policy. Furthermore, they find a currency depreciation, a decrease in money market spreads as well as lower intra-euro area sovereign bond spreads versus the benchmark country Germany. Overall, their results suggest that balance sheet policies of the ECB are also effective to counter risks to financial stability. Via a counterfactual analysis, they show that euro area output and inflation would have been more than 1 percentage point lower in 2012 without the three-year LTRO programmes.

Bernoth et al. (2016) analyse the effects of Quantitative Easing in two steps. First, using an event study approach they estimate that the announcement of the EAPP decreased sovereign bond yields in the euro area (except Germany) by 10 basis points. They then simulate the effect of such a surprise 10 basis point decrease in sovereign bond yields on real GDP, consumer prices and inflation expectations using a VAR estimated on data from mid-2007 to mid-2015. They find an increase in economic activity of up to 0.2 percent and an increase in inflation of about 0.1 percentage points. They point out that these findings are not necessarily a good guidance for the effects of unconventional monetary policy in the future because sovereign bond yields in the euro area are currently lower than they were in the analysed sample period. Therefore, there is less scope for stimulating macroeconomic effects from unconventional monetary policy measures, as the leeway for lowering bond yields further is potentially smaller.

Using a different method, a stylized theory-based macroeconomic model, *An-drade et al. (2016)*, find much larger effects. Their results show that the purchases announced on 22 January 2015 increased output by up to 1.1 percent and inflation by up to 40 basis points. Compared to the results in other studies, this illustrates that results of the effects of unconventional monetary policy on output and inflation are very uncertain and dependent on the framework. According to their findings, the EAPP programme is estimated to be roughly comparable to a decrease in standard policy interest rates by 1 percentage point.

Boeckx et al. (2016a) use the local projections method to analyse whether the unconventional monetary policies of the ECB have been effective in stimulating bank lending to the private sector for the period from July 2007 to December 2014. More precisely, they estimate dynamic effects of such policies on the volume of bank lending to households and firms, as well as the corresponding lending rates. Their dataset consists of 131 individual euro area banks and their bank lending rates and the respective volume of lending, credit support policy shocks, as well as of control variables capturing the main macroeconomic, financial and monetary fluctuations. Their results show that these policies stimulated lending by banks to the private sector and find support for the “bank lending view” of monetary transmission. In particular, they conclude that the policies were most effective for small banks (size effect), banks with less liquid

balance sheets (liquidity effect), banks that depend more on wholesale funding (retail effect) and low-capitalized banks (capital effect).

Overall, there is evidence that balance sheet measures are effective in stimulating output and inflation. However, the size of these effects varies considerably across studies. Different studies are hardly comparable as they use different models and simulation scenarios. The purely empirically based papers imply rather moderate effects on output and inflation, while model simulations in some cases yield quite large effects.

c) Do the Effects Between Different Balance Sheet Measures Vary a Great Deal?

Given the huge difficulties in empirically assessing the effectiveness of unconventional monetary policy in general, it is even more challenging to compare the effectiveness of different unconventional monetary policy measures. Such a comparison is complicated by the fact that many of these different measures have been announced and implemented in overlapping time periods. If the measures worked through different transmission channels of monetary policy and could be captured via different indicator variables, an identification of the effects of different effects may be feasible in VAR models. However, many of these measures work through several and coinciding transmission channels (Table 1). For example, the LTRO programme is supposed to work via at least three different transmission channels (the portfolio balance, the interest, and the bank lending channel) on output and inflation while the asset purchasing programmes with a focus on government bonds mainly work via the fiscal and portfolio balance channel. Even worse, all programmes also work indirectly via other transmission channels on economic activity. For example, all programmes may have had an impact on the exchange rate even though it was not the main purpose of these programmes to do so. Moreover, many programmes, such as the OMT programme, have reduced financial fragmentation, financial stress, or uncertainty and thereby had effects on the functioning of the transmission channels and on economic activity. Even if identification were theoretically feasible, it would be difficult to implement it empirically due to the short time periods in which these unconventional monetary policy measures have been adopted.

Therefore, comparisons of different unconventional monetary policy measures have so far only been conducted by means of event studies. However, as described above, event studies can only estimate the announcement effect of a measure and are therefore inappropriate to provide a comprehensive comparison of the effectiveness of different measures.

Table

**Transmission Channels of Unconventional Monetary Policy Measures
and Indicator Variables**

<i>Transmission channel</i>	<i>Implemented policy</i>	<i>Measurement indicator</i>
<i>Financial markets</i>		
<i>Portfolio balance channel</i>	LTROs, EAPP (e.g., CBPP, PSPP)	Asset and stock market prices, interest rates and spreads, bank and sovereign CDS, money market spreads
<i>Interest rate channel</i>	FRFA, LTROs	Volatility indices (e.g. CISS), money in circulation, money market spreads
<i>Exchange rate</i>	funding in foreign currency, swap agreements	Exchange rate movements
<i>Direct pass-through:</i>		
<i>Bank lending channel</i>	FRFA, LTROs	BLS indicators, credit and loan volumes
<i>Interlinkages to sovereign debt:</i>		
<i>Fiscal channel</i>	SMP, OMT, PSPP, FRFA	Sovereign spread and yield, sovereign and bank CDS

Note: Transmission channels that are within the main purpose of each of unconventional monetary policy measures. According to Boeckx et al. (2016b); Ciccarelli et al. (2013); Draghi (2014) and own considerations.

Regarding the announcements effects on government bond yields, the available studies come to different results. *Briciu/Lisi* (2015) find that the OMT and SMP programmes had the largest effects on government bond yields in Spain and Italy, with the effects of OMT being somewhat larger. Both programmes led, however, to a slight increase in government bond yields in Germany. *Fratzcher* et al. (2016) also find that the announcement of the SMP and the OMT programme had significant effects on yields in Italy and Spain, with the effect of the SMP being somewhat larger. Regarding interest rate spreads between German government bonds and government bonds of other euro area countries, *Szczerbowicz* (2015) finds that the SMP and the OMT programme had the largest impact in Italy and Spain as well as in the euro area as a whole compared to other programmes, such as the LTRO programme. In contrast, *Falagiarda/Reitz* (2015) find large effects of the LTRO programme on spreads in Italy and Spain. According to them, the SMP programme also had large effects while the impact of the OMT announcement was smaller but still signifi-

cant. Overall, there is no consensus in the literature as to which of the different unconventional monetary policy measures has had the largest impact. Reasons could be different estimation samples, categorizations of announcements, and empirical models.

One reason why the results in the literature may vary considerably – in addition to the large problems with identification of the impact of different measures and the reasons mentioned above – is that the specific circumstances when a measure is adopted probably play a crucial role for its effectiveness. For example, direct credit easing measures that target specific market segments are usually much smaller in volume than direct quantitative easing measures. However, it is reasonable to assume that they are more effective than direct quantitative easing measures when restoring the functioning of a market segment. Direct quantitative easing measures are in turn probably most effective in improving broad-based financial market conditions whereas indirect credit or quantitative easing measures, such as the LTROs, might be most effective in addressing liquidity problems in the banking sector.

2. Forward Guidance

Estimating the effectiveness of forward guidance is difficult because it is complicated to disentangle the forward guidance component from the direct effects of simultaneously announced policy measures and because central bank communications can take many different forms. The effectiveness of forward guidance depends on this communication to be credible and correctly understood by financial market participants. However, it is difficult to measure whether forward guidance is indeed perceived to be credible and correctly understood.

Theoretically, forward guidance can have a significant impact on the economy. For example, *Coenen/Warne* (2013) using the ECB's New Area Wide Model find that at the lower bound for nominal interest rates forward guidance can reduce the downside risks to inflation.¹⁴ However, real world advantages of forward guidance are probably lower than those predicted by standard models (for an example, see *Eggertson/Woodford* 2003) since those models are very sensitive to changes in their assumptions. *McKay et al.* (2016) point out that the large theoretical effects of forward guidance crucially depend on the complete markets assumption in these models and are considerably reduced if this assumption is relaxed.

The empirical evidence for the impact of forward guidance is mixed. *Filardo/Hofmann* (2014) argue that strong conclusions cannot be drawn regarding the announcement effects of interest rate forward guidance on future rates. Al-

¹⁴ And indeed, if overdone, can increase the upside risks.

though there seem to be some moderate effects, these effects vary considerably over time and with regard to the specific circumstances when forward guidance is adopted. Furthermore, the data are likely contaminated by concurrent announcements regarding other policy measures and the fact that expectation formation is not solely dependent on official announcements.¹⁵ They also find some evidence that while forward guidance helps to reduce interest rate volatility this effect fades out relatively quickly. This would be consistent with the time inconsistency problem of a central bank being unable to credibly commit today to holding the future interest rate low for longer than justified by actual output and inflation dynamics in the future. *Campbell et al. (2012)* are even unable to identify effects of forward guidance on inflation and unemployment forecasts that exhibit the expected sign in US data. They interpret this as evidence that the Fed was perceived to have superior information about the economic outlook than the private sector (Delphic forward guidance) and that therefore forward guidance of the Fed to keep interest rates low for a longer than expected period was interpreted by financial markets as an indication for a worsened economic outlook.

Regarding the announcement of the OMT programme the studies discussed in Section IV.1 found in general that OMT has led to a significant decline in long-term yields and an increase in asset prices, even though there is considerable uncertainty concerning the size of the effects. *Krishnamurthy et al. (2014)* find that the decrease in bond yields for Italy and Spain was due to decreased default and segmentation risks whereas reduced redenomination risks may also have been a factor in Spain and Portugal. They also find considerable stock price increases across all countries. The rise in perceived commonality in default risk as the reason for lower peripheral bonds is affirmed by *Saka et al. (2015)*. Furthermore, *Acharya et al. (2015a)* find that the announcement of OMT induced US money market funds to provide more unsecured lending to European banks.

Altavilla et al. (2014) use a multi-country VAR model to analyse the effect of the OMT programme. In a first step they look at the effects of OMT announcements on the sovereign bond markets in France, Germany, Italy, and Spain and find strong effects in the peripheral countries (in line with the results of *Falagarda/Reitz 2015*). In a second step, they used these results to calibrate a scenario in an estimated multi-country VAR. This scenario analysis shows that the reduction in bond yields due to the OMT announcement is associated with a significant increase in real activity between 0.3 percent for Germany and 2 percent for Spain. In addition, consumer prices increase significantly between 0.3

¹⁵ Market participants may often anticipate the next actions of policy makers before they are announced. In such cases, adjustments in interest rates would take place before forward guidance becomes part of the official record.

percent in Germany and 2 percent in Italy. These effects appear to be very large in comparison to other studies. However, while most studies look at the effects of one-time surprise shocks, *Altavilla et al. (2014)* simulate a specific scenario in which bond yields of Italy and Spain are assumed to decrease over a 3-year horizon by about 2 percentage points.

However, this improvement of the financial conditions in the euro area did not necessarily have a strong impact on real activity. *Acharya et al. (2015b)* use firm level micro data to retrace the effects of OMT. They find that the significant reduction in peripheral government debt yields produced windfall valuation gains especially for banks in peripheral countries (because government bonds of these countries exhibited the strongest price increases and these banks had the largest exposure to their home sovereigns). This strengthened their equity positions and ability to obtain funding, both from private sources as well as from the Eurosystem. As a result, the loan supply to private borrowers increased. However, firms used these new loans to build up cash reserves, leaving employment and investment unaffected. By looking at firms' credit servicing ability and splitting them into good and bad borrowers, *Acharya et al. (2015b)* find that the beneficiaries of the newly provided funding were the bad borrowers. Before OMT, all firms were financially constrained, which afterwards ceased to be true for low-quality borrowers but remained for the high-quality type.

All in all, forward guidance seems to have limited effects on financial markets and on economic activity. Overall, the effects seem to be smaller than those of balance sheet measures even though one should keep in mind that these measures cannot be neatly distinguished. The experience with the OMT announcement suggests that credible promises of future central bank actions can have considerable effects on financial markets. However, OMT was announced in a very specific situation and focussed at the then very high risk premia on certain securities. Less turbulent times may provide smaller opportunities for forward guidance as an effective policy instrument.

VI. Does the Effectiveness of Unconventional Measures Decrease Over Time?

Empirical studies on the effectiveness of unconventional monetary policy measures usually estimate the average impact of these measures for a specific time period. These time periods usually start with the beginning of the Global Financial Crisis when unconventional monetary policy measures were systematically applied for the first time (with Japan being an exception). However, these studies do not assess whether the effectiveness may have changed over time, i. e. whether the effectiveness has decreased. Such an assessment is complicated by

the fact that the experiences, on which empirical studies draw on, are very limited.

1. Theoretical Considerations

There are several reasons why the effectiveness of monetary policy could vary over time. While some of these reasons are related to the question as to why the effectiveness of monetary policy may change over time in general, some of these reasons are related to effectiveness of monetary policy during financial crises and are therefore more relevant for the period since the Global Financial Crisis.¹⁶

There are several reasons why monetary policy could be more effective during the acute phase of financial crises but less effective in their aftermath. One reason is that in the acute phase of a financial crisis uncertainty, financial stress, and credit constraints are particularly high. To the extent that monetary policy is able to alleviate uncertainty, financial stress, and credit constraints it could have an additional stimulating effect on economic activity compared to normal times when, for example, a further reduction of uncertainty – having returned already to normal levels – is less likely to have an additional effect on economic activity.¹⁷ Indeed, there is evidence that monetary policy is able to alleviate uncertainty, financial stress, and credit constraints (*Basu/Bundick 2012; Bekaert et al. 2013; Bernanke/Gertler 1995*). Monetary policy could be less effective in the aftermath of financial crises because these crises are usually preceded by the build-up of large financial imbalances, such as large increases in private credit and a boom on the housing market (*Jorda et al. 2015*). When these imbalances are corrected in the aftermath of financial crises, which usually takes a prolonged period of time, important transmission channels (such as the credit or interest rate channel) of monetary policy may be hampered (*Borio 2014*).

Furthermore, monetary policy could have diametrical effects on the soundness of the financial sector, which in turn is crucial for how monetary policy is transmitted into the real economy. When monetary policy, e.g. large-scale government bond purchase programmes, leads to a decline in interest rates, the corresponding increase in asset prices (e.g., the increase in the price of govern-

¹⁶ One reason why the effectiveness of monetary policy could vary over the business cycle is that the effectiveness is related to capacity utilization, i.e. that monetary policy is more effective during recessions, when capacity utilization is low. While earlier empirical studies were supportive of this hypothesis (*Lo/Piger 2005; Peersman/Smets 2002*), more recent studies challenge the earlier findings (*Caggiano et al. 2014; Tenreiro/Thwaites 2016*).

¹⁷ In this regard, it is relevant that the relationship between financial stress or uncertainty and economic activity might be non-linear, i.e. financial stress or uncertainty only harm economic activity after they have passed a specific threshold. For example, *van Roye (2014)* finds threshold effects for the impact of financial stress on euro area GDP.

ment bonds) will lead to windfall profits in the banking sector and strengthen the financial soundness. For example, after the announcement of the OMT programme, banks in the GIIPS countries received large windfall profits because the prices for government bonds of these countries increased (Acharya et al. 2015b). However, when interest rates stay at very low levels for prolonged periods of time, this will lower profit opportunities related to maturity transformation in the banking sector (Borio et al. 2015). In turn, the financial health of the banking sector could worsen in the medium run. For the euro area, the latter could be particularly problematic because the financial health of the banking sector in several countries is still suffering from a large amount of non-performing loans and because interest rates have already been very low for a period of about ten years and are expected to remain low for a prolonged time.

2. Empirical Evidence

While there are theoretical arguments supporting that the effectiveness of unconventional monetary policy has decreased over time, empirical evidence is scarce. However, there is increasing evidence that monetary policy is more effective during the acute phase of a financial crisis while it is less effective (compared to normal times) in the aftermath of financial crises. For example, Ciccarelli et al. (2013) find that monetary policy in the euro area became more effective in the period from 2007 to 2011 and Dahlhaus (2016) shows that US monetary policy is more effective when financial stress is high, which is usually the case during the acute phase of financial crises. Bech et al. (2014) find that monetary policy has no significant effects on economic activity in the aftermath of financial crises. In a comprehensive analysis, Jannsen et al. (2015) find that monetary policy is more effective in the acute phase of a financial crisis while it has no significant effects on output and inflation in the aftermath of financial crises. While not all studies explicitly take unconventional monetary policy into account, Jannsen et al. (2015) use shadow interest rates as monetary policy instruments, which implicitly account for unconventional monetary policy measures (Wu/Xia 2014). In addition, Borio/Zabai (2016) conclude based on a review of the empirical literature and on theoretical arguments that the effectiveness of unconventional monetary policy measures deteriorates over time. One reason why the effectiveness of unconventional monetary policy measures may decrease over time could be that it has negative side effects that are increasing the longer unconventional monetary policy measures are in place. We discuss some of these potential negative side effects in more detail in the next Section.

VII. Risks Associated with Unconventional Measures

Monetary policy can have several side effects that are associated with economic costs or risks (White 2012). For an assessment of whether the stance of monetary policy is appropriate, these side effects should be considered in addition to the effectiveness of monetary policy to stabilize inflation and output. Many of these risks and side effects are not directly related to unconventional monetary policy but rather to prolonged periods of very expansionary monetary policy. In this regard, an important aspect of unconventional monetary policy is that it is usually related to longer periods of very expansionary monetary policy than conventional monetary policy because it becomes more difficult to tighten monetary policy (e.g., because it is practically not feasible for central banks to sell a large amount of assets in a relatively short period of time or because central banks do not want to deviate from their forward guidance to remain credible).¹⁸ Given that it seems theoretically plausible that the risks and side effects of expansionary monetary policy increase the longer it is in place, unconventional monetary policy is associated with higher risks than conventional monetary policy.

Side effects typically discussed include that expansionary monetary policy enhances risk-taking in the financial sector and thereby triggers financial imbalances that undermine financial stability (Drehmann et al. 2012; Rajan 2005, Maddaloni/Peydro 2011). In this regard, there is also empirical evidence that these risks increase the longer expansionary monetary policy is in place (Kahn 2010, Maddaloni/Peydro 2011, 2012). Moreover, expansionary monetary policy (which was also implemented with the argument that it was “to buy” time for national governments to implement structural reforms) may provide disincentives for structural reforms, e.g., because it lowers government bond yields. It also puts the independence of the ECB under threat because the more public and private debtors become accustomed to very low interest rates the more likely it becomes that an increase of interest rates would lead to a recurrence of the sovereign debt crises in the euro area or to large credit defaults that further weaken the financial health of the banking sector. Currently, it seems unlikely that the ECB is able to conduct its monetary policy independently of the fiscal position of the euro area Member States and of the financial health of the financial system in the near future, indicating that it has already lost some of its independence in deciding about

¹⁸ Central banks that have accumulated a large volume of assets in their balance sheet by QE programmes could tighten monetary policy also by increasing interest rates and do not have to sell large amounts of their assets. However, this could weaken the balance sheet of central banks and in turn weaken their credibility so that this form of tightening is also associated with risks (Boysen-Hogrefe et al. 2015; Boysen-Hogrefe et al. 2016).

the stance of its monetary policy.¹⁹ In this regard, the exit from the very expansionary monetary policy likewise becomes more difficult.²⁰

Another potential side effect that is becoming more and more relevant and that may counteract the effectiveness of monetary policy in stimulating output and inflation is that expansionary monetary policy potentially contributes to the misallocation of resources. *Cette et al.* (2016) empirically show that there is a significant relationship between the real interest rate and productivity: the lower the real interest rate, the lower is productivity. They also show that the strong decline in real interest rates associated with the introduction of the euro contributed significantly to the low growth rates of productivity in Spain and Italy in the period before the Global Financial Crisis. The rationale for the impact of real interest rates on productivity is that in a low interest rate environment it becomes more likely that less productive firms attract more than proportional funding. *Gopinath et al.* (2015) show based on firm level data that this mechanism contributed significantly to the productivity slowdown in Spain before the Global Financial Crisis. Very low interest rates can even lead to the so-called “Zombification” of firms and banks, namely a situation when firms, which are de-facto bankrupt, get further funding because financially weak banks want to avoid writing down loans to these firms. This phenomenon has also been analysed for Japan (*Caballero et al.* 2008; *Hoshi/Kashyap* 2004). With regard to the euro area, *Acharya et al.* (2015b) show based on firm-level data that the windfall profits for banks in the peripheral countries due to the OMT announcement have led to an increase of loans to firms with below than average credit servicing ability. Given that these firms usually were already debtors of these banks and that they had to pay lower interest rates for their new loans than firms in the core countries of the euro area with very high credit ratings, the OMT announcement probably contributed to the “Zombification” of firms in the euro area. *Acharya et al.* (2015b) also show that these firms did not use the additional funding for investment or job creation so that even in the short-run no stimulating effects for the economy have taken place. To the extent that such a behaviour of banks is not specific for the OMT programme but also present for other unconventional monetary policy measures or more generally for periods of very expansionary monetary policy this issue is becoming more and more

¹⁹ The EAPP could also have an impact on how the ECB conducts its monetary policy. The ECB may try to avoid increases in the interest rates in the future even if this would be appropriate in terms its inflation target because this would lower the value of the assets in its balance sheet (or in extreme cases lead to the default of assets, such as government bonds) and could weaken the financial position of the ECB. A weaker financial position could be a threat to the independence of a central bank (*Boysen-Hogrefe et al.* 2015; *Boysen-Hogrefe et al.* 2016).

²⁰ For a more detailed description of these risks and side effects, see *White* (2012); *Gern et al.* (2015), or *Boysen-Hogrefe et al.* (2016).

relevant in the euro area and may counteract the expected stimulating effects of unconventional monetary policy on output and inflation.

VIII. Summary

The ECB has adopted a series of unconventional monetary policy measures since the Global Financial Crisis. These measures include forward guidance and balance sheet measures. Currently, balance sheet measures are the most important monetary policy tool of the ECB. With regard to the effectiveness there is a broad consensus in the literature that unconventional monetary policy of the ECB and other central banks have significantly improved financial market conditions: long-term yields declined and asset prices increased even though there is considerable uncertainty associated with respect to the size of these effects. However, this does not imply that unconventional monetary policy was effective in stimulating output and inflation because the typical relationship between financial markets and output and inflation may be different in extraordinary times when unconventional monetary policy is usually adopted. Given the available evidence in the literature unconventional monetary policy of the ECB was very effective in stabilizing economic activity in the acute phase of the Global Financial Crisis and the Sovereign Debt Crisis but probably only had small temporary effects outside of these phases. There are theoretical arguments as to why the effectiveness of very expansionary monetary policy in general and of unconventional monetary policy more specifically is decreasing over time. This question has not been fully addressed in the empirical literature because the limited historical experiences make it difficult to account for time varying effects. The available empirical evidence and theoretical considerations favour the view that the effectiveness of very expansionary monetary policy and of unconventional monetary policy is decreasing over time. In general, monetary policy seems to be more effective in the acute phase of a financial crisis and less effective in its aftermath. One reason why the effects of very expansionary monetary policy may decline over time is that very low real interest rates contribute to the misallocation of resources and thereby dampen productivity. Moreover, the longer very expansionary monetary policy is in place, the more it weighs on the profitability of banks and thereby weakens the financial health of the banking sector. Given that monetary policy has now already been very expansionary for about 10 years and given that there are also several other risks associated with it, such as excessive risk-taking in the financial sector, boom-and-bust cycles, delay of structural reforms, and risks for central bank independence, it seems questionable whether a further easing of monetary policy would be effective in stimulating economic activity. With regard to the comparison of the effectiveness of different unconventional monetary policy measures the literature is inconclusive. One reason for this is that the effectiveness of these measures depends on the

specific circumstances when they are implemented. Overall, the results point to a higher potential of balance sheet measures compared to forward guidance. The announcement of the OMT programme, if interpreted as forward guidance, is an exception as it had a large impact on government bond yields and risk premia. However, this programme cannot be repeatedly used to stimulate economic activity and inflation.

References

- Acharya, V. V./Eisert, T./Eufinger, C./Hirsch, C.* (2015b): Whatever it takes: The Real Effects of Unconventional Monetary Policy. IMF 16th Jacques Polak Annual Research Conference, November 2015. Available at: <https://www.imf.org/external/np/res//2015/arc/pdf/pdf>.
- Acharya, V. V./Pierret, D./Steffen, S.* (2015a): Do Central Bank Interventions Limit the Market Discipline from Short-Term Debt? Working Paper. Available at: <https://www.frbatlanta.org/-/media/Documents/news/conferences/2015/1119-the-role-of-liquidity-in-the-financial-system/acharya-pierret-steffen-do-central-bank-interventions-limit-market-discipline-preliminary.pdf?la=en>.
- Adrian, T./Shin, H. S.* (2010): Financial intermediaries and monetary economics. FRB of New York Staff Report 398. Available at: https://www.newyorkfed.org/medialibrary/media/research/staff/_sr398.pdf.
- Altavilla, C./Giannone, D./Lenza, M.* (2014): The financial and macroeconomic effects of OMT announcements. CEPR Discussion Paper No. DP10025. Available at: <http://www.csef.it/WP/wp352.pdf>.
- Andrade, P., et al.* (2016): The ECB's asset purchase programme: an early assessment. ECB Working Paper No. 1956. Available at: <https://www.ecb.europa.eu/pub///ecb-wp1956.en.pdf>.
- Basu, S./Bundick, B.* (2012): Uncertainty shocks in a model of effective demand. NBER Working Paper 18420. Available at: <http://www.nber.org/papers/w18420.pdf>.
- Bech, M. L./Gambacorta, L./Kharroubi, E.* (2014): Monetary policy in a downturn: Are Financial crises special? *International Finance* 17(1), pp. 99–119.
- Bekaert, G./Hoerova, M./Lo Duca, M.* (2013): Risk, uncertainty and monetary policy, *Journal of Monetary Policy* 60(7), pp. 771–788.
- Bernanke, B. S./Blinder, A. S.* (1992): The federal funds rate and the channels of monetary transmission. *The American Economic Review* 82(4), pp. 901–921.
- Bernanke, B. S./Gertler, M.* (1995): Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives* 9(4), pp. 27–48.
- Bernanke, B. S./Mihov, I.* (1995): Measuring monetary policy, No. 10. Reihe Ökonomie/ Economics Series, Institut für Höhere Studien (IHS). Available at: <http://www.ihs.ac.at/publications/eco/es-10.pdf>.
- Bernoth, K./Hachula, M./Pfiffer, M./Rieth, M.* (2016): Effectiveness of the ECB programme of asset purchases: Where do we stand? DIW Berlin: Politikberatung kom-

- pakt, No. 113. Available at: https://www.diw.de/documents/publikationen/73/diw_01.c.537782.de/diwkompakt_2016-113.pdf
- Bhattarai, S./Neely, C. J.* (2016): A Survey of the Empirical Literature on US Unconventional Monetary Policy. ISO 690. FRB St. Louis Working Paper No. 2016-21. Available at: <https://research.stlouisfed.org/wp/2016/2016-021.pdf>.
- Boeckx, J./de Sola Perea, M./Peersman, G.* (2016a): The transmission mechanism of credit support policies in the Euro Area, No. 302. ISO 690. Available at: <https://.nbb.be/doc/oc/repec/reswpp/wp302en.pdf>.
- Boeckx, J./Dossche, M./Peersman, G.* (2016b): Effectiveness and transmission of the ECB's balance sheet policies. *International Journal of Central Banking*, forthcoming.
- Borio, C.* (2014): The financial cycle and macroeconomics: what have we learnt? *Journal of Banking and Finance* 45 (August), pp. 182–98.
- Borio, C./Gambarcorta, L./Hofmann, B.* (2015): The influence of monetary policy on bank profitability, BIS Working Papers 514. Available at: <http://www.bis.org//.pdf>.
- Borio, C./Zabai, A.* (2016): Unconventional monetary policies: a re-appraisal, BIS Working Papers 570. Available at: <http://www.bis.org/publ/work570.pdf>.
- Borio, C./Zhu, H.* (2008): Capital regulation. Risk-Taking and Monetary Policy: A Missing Link in the Transmission Mechanism. BIS Working Papers 268. Available at: <http://www.bis.org/publ/work268.htm>.
- Boysen-Hogrefe, J./Fiedler, S./Jannsen, N./Kooths, S./Reicher, C./Reitz, S.* (2016): Sovereign bond purchases and risk sharing arrangements: Implications for euro area monetary policy. Briefing Paper prepared for the European Parliament, Policy Department A: Economic and Scientific Policy, Monetary Dialogue June 2015. Available at: https://polcms.secure.europarl.europa.eu/cmsdata/upload/110f4183-1698-4a56-ace4-caa3f524e795/KIEL_2015-06-02-IfW-Sovereign%20Bond%20Purchases_FINAL.pdf.
- Boysen-Hogrefe, J./Fiedler, S./Jannsen, N./Kooths, S./Reitz, S.* (2016): Limits in terms of eligible collateral and policy risks of an extension of the ECB's quantitative easing programme. Briefing Paper prepared for the European Parliament, Policy Department A: Economic and Scientific Policy, Monetary Dialogue February 2016. Available at: https://polcms.secure.europarl.europa.eu/cmsdata/upload/04df92cd-b266-476b-b4e7-f0b93efc810e/KIEL_FINAL.pdf.
- Brand, C./Buncic, D./Turunen, J.* (2010): The Impact of ECB Monetary Policy Decisions and Communication on the Yield Curve. *Journal of the European Economic Association* 8(6), pp. 1266–1298.
- Briciu, L./Lisi, G.* (2015): An event-study analysis of ecb balance sheet policies since October 2008, ECONOMIC BRIEF – Economic and Financial Affairs 001. Available at: http://ec.europa.eu/economy_finance/publications/eeeb/pdf/eb001_en.pdf.
- Caballero, R. J./Hoshi, T./Kashyap, A. K.* (2008): Zombie Lending and Depressed Restructuring in Japan. *American Economic Review* 98(5), pp. 1943–1977.
- Caggiano, G./Castelnuovo, E./Groshenny, N.* (2014): Uncertainty shocks and unemployment dynamics in U.S. recessions. *Journal of Monetary Economics* 67, pp. 78–92.
- Campbell, J. R./Evans, C. L./Fisher, J. D. M./Justiniano, A./Calomiris, C. W./Woodford, M.* (2012): Macroeconomic Effects of Federal Reserve Forward Guidance. *Brookings Pa-*

- pers on Economic Activity (Spring), pp. 1–80. Available at: <http://jstor.org/stable/23287215>.
- Cette, G./Fernald, J./Mojon, B.* (2016): The Pre-Great Recession Slowdown in Productivity. *European Economic Review* 88, pp. 3–20.
- Christiano, L. J./Eichenbaum, M./Evans, C. L.* (1999): Monetary policy shocks: What have we learned and to what end? In J. B. Taylor and M. Woodford (Eds.), *Handbook of Macroeconomics* (1 ed.), Volume 1, Chapter 2, pp. 65–148. Elsevier.
- Chung, H./Laforte, J.-P./Reichsneider, D./Williams, J. C.* (2012): Have We Underestimated the Probability of Hitting the Zero Lower Bound? *Journal of Money, Credit and Banking* 44(2), pp. 47–82.
- Ciccarelli, M./Maddaloni, A./Peydro, J.-L.* (2013): Heterogeneous transmission mechanism: monetary policy and financial fragility in the eurozone. *Economic Policy* 28(75), pp. 459–512.
- Coenen, G./Warne, A.* (2014): Risks to Price Stability, the Zero Lower Bound, and Forward Guidance: A Real-Time Assessment, *International Journal of Central Banking*, June, pp. 7–54.
- Constancio, V.* (2015): Assessing the new phase of unconventional monetary policy at the ECB, Panel remarks at the Annual Congress of the European Economic Association, University of Mannheim, 25 August 2015.
- Dahlhaus, T.* (2016): Conventional Monetary Policy Transmission during Financial Crises: An Empirical Analysis. *Journal of Applied Econometrics*, forthcoming.
- Drehmann, M./Borio, C./Tsatsonis, K.* (2012): Characterising the financial cycle: don't lose sight of the medium term! BIS Working Paper 380. Available at: <http://www.bis.org/publ/work380.pdf>.
- ECB Research Bulletin (2015): The financial and macroeconomic effects of OMT announcements. No 22, Summer 2015. Available at: <https://ecb.europa.eu/pub/pdf/other/researchbulletin22.en.pdf?299bd869cf893d0f8dacc99e46c56bf8>.
- Eggertson, G./Woodford, M.* (2003): The Zero Bound on Interest Rates and Optimal Monetary Policy. Available at: <http://www.columbia.edu/~mw2230/BPEA.pdf>.
- Falagiarda, M./Reitz, S.* (2015): Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed euro area countries. *Journal of International Money and Finance* 53, pp. 276–295.
- Fiedler, S./Hanisch, I./Jannsen, N./Wolters, M.* (2016): Transmission channels of unconventional monetary policy in the euro area: Where do we stand? Briefing Paper prepared for the European Parliament, Policy Department A: Economic and Scientific Policy, Monetary Dialogue November 2016. Available at <https://polcms.secure.europarl.europa.eu/cmsdata/upload/b573dae7-6092-45f5-b89a-85d219d07720/KIEL.pdf>.
- Filardo, A./Hofmann, B.* (2014): Forward guidance at the zero lower bound. In: BIS Quarterly Review. International banking and financial market developments, March 2014. Available at: http://www.bis.org/publ/qtrpdf/r_qt1403f.pdf.
- Fratzsch, M./Duca, M. L./Straub, R.* (2016): ECB Unconventional Monetary Policy: Market Impact and International Spillovers. *IMF Economic Review*, 64(1), pp. 36–74.

- Gagnon, J./Raskin, M./Remache, J./Sack, B. (2010): Large-Scale Asset Purchases by the Federal Reserve: Did They Work? Federal Reserve Bank of New York Staff Reports No 447. Available at: http://www.ny.frb.org/research/staff_reports/pdf.
- Garriga, C./Kydland, F. E./Sustek, R. (2016): Nominal Rigidities in Debt and Product Markets. NBER Working Paper 22613. Available at: <http://www.nber.org/papers/w22613>.
- Gern, K.-J./Jannsen, N./Kooths, S./Wolters, M. (2015): Quantitative Easing: What are the key policy messages relevant for the euro area? Briefing Paper prepared for the European Parliament, Policy Department A: Economic and Scientific Policy, Monetary Dialogue March 2015. Available at: https://polcms.secure.europarl.europa.eu/upload/b7278e81-bb5a-4aef-86ab-a0d208c96b7c/IfW_KIEL_QE_FINAL.pdf.
- Gertler, M./Karadi, P. (2013): QE 1 vs. 2 vs. 3 ...: A Framework for Analysing Large-Scale Asset Purchases as a Monetary Policy Tool. *International Journal of Central Banking* 9(1), pp. 5–53.
- (2015): Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics* 7(1), pp. 44–76.
- Gibson, H. D./Hall, S. G./Tavlas, G. S. (2016): The effectiveness of the ECB's asset purchase programs of 2009 to 2012. *Journal of Macroeconomics* 47, pp. 45–57.
- Gopinath, G./Kalemi-Ozcan, S./Karabarbounis, L./Villegas-Sanchez, C. (2015): Capital Allocation and Productivity in Southern Europe. NBER Working Paper 2015. Available at: <http://www.nber.org/papers/w21453>.
- Gürkaynak, R. S./Sack, B./Swanson, E. T. (2005): Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking* 1, pp. 55–93.
- Hoshi, T./Kashyap, A. K. (2004): Japan's Financial Crisis and Economic Stagnation. *Journal of Economic Perspectives* 18(1), pp. 3–26.
- Jannsen, N./Potjagailo, G./Wolters, M. (2015): Monetary Policy during Financial Crises: Is the Transmission Mechanism Impaired? Kiel Working Papers, 2005, Kiel Institute for the World Economy, Kiel. Available at: <https://www.ifw-members.ifw-kiel.de/publications/monetary-policy-during-financial-crises-is-the-transmission-mechanism-impaired/monetary-policy-during-financial-crises-is-the-transmission-mechanism-impaired>.
- Jorda, O./Schularick, M./Taylor, A. M. (2015): Leveraged Bubbles. *Journal of Monetary Economics* 76, pp. S1–S20.
- Joyce, M./Miles, D./Scott, A./Vayanos, D. (2012): Quantitative Easing and Unconventional Monetary Policy – An Introduction. *The Economic Journal* 122 (564), pp. F271–288.
- Kahn, G. A. (2010): Taylor Rule Deviations and Financial Imbalances. *Economic Review* (2), pp. 63–99.
- Krishnamurthy, A./Nagel, S./Vissing-Jorgensen, A. (2014): ECB policies involving government bond purchases: Impact and channels, Working Paper. Available at: <https://people.stanford.edu/akris/sites/default/files/ecbbonds.pdf>.
- Lenza, M./Pill, H./Reichlin, L. (2010): Monetary policy in exceptional times. *Economic Policy* 25 (62), pp. 295–339.

- Lo, M. C./Piger, J.* (2005): Is the response of output to monetary policy asymmetric? Evidence from a regime-switching coefficients model. *Journal of Money, Credit and Banking* 37 (5), pp. 865–886.
- Maddaloni, A./Peydro, J.-L.* (2011): Bank Risk-Taking, Securitization, Supervision, and Low Interest Rates: Evidence from the Euro-Area and the US Lending Standards. *Review of Financial Studies* 24 (6), pp. 2121–2165.
- (2012): The Low Monetary Rates Paradox, Banking Stability and Credit: Evidence from the Euro Area. Available at: http://www.ecb.int/events/pdf/conferences/rolecred/Maddaloni_Peydro_Jan2012_ijcb_all.pdf?87d990d1aef06eabc0253e919a46b8c1.
- McKay, A./Nakamura, E./Steinsson, J.* (2016): The Power of Forward Guidance Revisited. *American Economic Review* 106(10), pp. 3133–3158.
- Peersman, G.* (2011): Macroeconomic effects of unconventional monetary policy in the euro area. ECB Working Paper 1397. Available at: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1397.pdf?99ef78cb1aa613f60d8716d0db59b585>.
- Peersman, G./Smets, F.* (2001): The monetary transmission mechanism in the euro area: more evidence from VAR analysis. ECB Working Paper No. 91. Available at: <http://zentral-bank.eu/pub/pdf/scpwps/ecbwp091.pdf>.
- (2002): Are the effects of monetary policy in the euro area greater in recessions than in booms? In L. Mahadeva and P. Sinclair (Eds.), *Monetary Transmission in Diverse Economies*, Chapter 2, pp. 28{48. Cambridge University Press Cambridge, UK.
- Pesaran, M. H./Smith, R. P.* (2012): Counterfactual Analysis in Macroeconometrics: An Empirical Investigation into the Effects of Quantitative Easing, IZA Discussion Papers 6618, Institute for the Study of Labor (IZA): Available at: <https://papers.ssrn.com/sol3.cfm?dp6618.pdf?abstractid=2085205&mirid=1>.
- Praet, P.* (2013): Forward guidance and the ECB. Column published on VoxEU.org, 6 August 2013. Available at: <http://voxeu.org/article/forward-guidance-and-ecb>.
- (2014): Current issues and challenges for central bank communication. Speech at the conference “The ECB and Its Watchers XV”, Frankfurt am Main, 12 March 2014. Available at: <http://www.ecb.europa.eu/press/key/date/2014/html/sp140312.en.html>.
- Rajan, R. G.* (2005): Has Financial Development Made the World Riskier? NBER Working Paper 11728, National Bureau of Economic Research, Cambridge, MA. Available at: http://www.nber.org/papers/w11728.pdf?new_window=1.
- Rieth, M./Piffer, M./Hachula, M.* (2016): ECB policies effective in the euro area and Germany. *DIW Economic Bulletin* 6(7), pp. 83–91.
- Saka, O./Fuertes, A.-M./Kalotychou, E.* (2015): ECB policy and Eurozone fragility: Was De Grauwe right? *Journal of International Money and Finance* 54, pp. 168–185.
- Szczerbowicz, U., et al.* (2012): The ECB unconventional monetary policies: Have they lowered market borrowing costs for banks and governments? CEPII Working Paper 2012-36. Available at: http://www.cepii.fr/PDF_PUB/wp/2012/wp2012-36.pdf.
- (2015): The ECB unconventional monetary policies: have they lowered market borrowing costs for banks and governments? *International Journal of Central Banking* 11 (4), pp. 91–127.

- Tenreyro, S./Thwaites, G.* (2016): Pushing on a string: US monetary policy is less powerful in recessions. *American Economic Journal: Macroeconomics* 8(4), pp. 43–74.
- Ugai, H.* (2007): Effects of the Quantitative Easing Policy: A Survey of Empirical Analyses. *Monetary and Economic Studies* 25 (1), pp. 1–48.
- van Roye, B.* (2014): Financial stress and economic activity in Germany. *Empirica* 41(1), pp. 101–126.
- Weale, M./Wieladek, T.* (2016): What are the macroeconomic effects of asset purchases? *Journal of Monetary Economics* 79, pp. 81–93.
- White, W. R.* (2012): Ultra Easy Monetary Policy and the Law of Unintended Consequences, Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute, Working Paper No. 126. Available at: <http://dallasfed.org/assets/documents//wpapers/2012/0126.pdf>.
- Williams, J. C.* (2014): Monetary Policy at the Zero Lower Bounds: Putting Theory into Practice. Hutchins Center on Fiscal & Monetary Policy at Brookings, January 16. Available at: <http://www.brookings.edu/research/papers/2014/01/16-monetary-policy-zero-lower-bound-williams>.
- Wu, J. C./Xia, F. D.* (2014): Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound. *Journal of Money, Credit and Banking* 48(2-3), pp. 253–291.