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ECB asset purchase programs raise inflation expectations in the euro area

By Malte Rieth and Lisa Gehrt

Facing deflationary threats, the ECB has engaged in several forms of asset purchase programs to fulfill its mandate of maintaining price stability. A main objective of these programs is raising inflation expectations, as these are a main determinant of actual inflation. This study empirically evaluates the effectiveness of these ECB policies in raising inflation expectations. The results suggest that the ECB announcements of asset purchase programs significantly increased the expected inflation in the euro area, albeit to a quantitatively modest extent. All in all, inflation expectations were raised by 20 to 30 basis points.

The global financial crisis and the European debt crisis that have been unfolding since 2007 have changed the design and conduct of monetary policy in the euro area. Financial market instability, concerns about the sustainability of sovereign debt, weak economic activity, and a sharp decline in energy prices have posed new challenges to the European Central Bank (ECB). The primary objective of the ECB is maintaining price stability over the medium term, which is quantified as a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) of just under 2%. To this end, the ECB aims to firmly anchor inflation expectations. Stable expectations about future inflation are a prerequisite for stable actual inflation. Anchored expectations indicate public trust in the central banks' commitment to price stability and avoiding inflationary or deflationary spirals. Furthermore, such expectations allow for a proper functioning of the monetary transmission mechanism, which in turn determines the capacity of monetary policy to influence price developments and the ability of the ECB to preserve price stability.

Before the global financial crisis, monetary policy in the euro area consisted mainly of changes in the overnight interest rate in the interbank money market and the associated adjustments to the central bank's money supply through open market operations. By steering the official interest rate, these operations translated into changes in lending and deposit rates, which then affected firms' and private households' access to credit as well as expectations about future monetary policy decisions.

Since the global financial crisis, the ECB has been coping with impairments of the transmission of monetary policy to the real economy. Lowering the main policy rate to zero in the course of the euro area's economic downturn helped ease monetary conditions and constrained future conventional monetary policy. When downward risks to price stability emerged, the ECB implemented a variety of unconventional policy measures to fulfill its mandate. From 2013 onward, actual and expected infla-

tion was on a persistent downward trend, calling into question whether the ECB is able to steer inflation expectations in such a difficult environment. It is therefore of high policy relevance to assess the extent to which the adopted monetary policy measures that have been created since then – which mainly consist of asset purchase programs as well as targeted longer-term refinancing operations (TLTROs) – have been effective in bringing inflation expectations closer to target. In this context, an evaluation of the effects of the announcements of ECB policymakers regarding the introduction of new measures – whether during press conferences or in other relevant speeches – is of particular importance. This is because central bank communication is a major tool in unconventional monetary policy for influencing market expectations.

The empirical results of this study, which is based on regressions of inflation expectations on ECB announcement dummies, suggest that all in all, the announcements of these programs have led to significant increases in euro area inflation expectations. The adopted measures have thereby helped the ECB fulfill its mandate. However, the results reveal an interesting but intuitive dichotomy between the two main types of programs introduced since 2014. Announcements regarding asset purchase programs have significantly raised inflation expectations. Short- to medium-term expectations rose by 20 to 30 basis points overall. Announcements on TLTROs, for their part have not affected expected inflation.

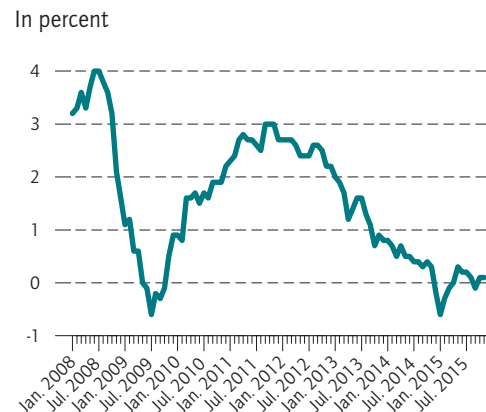
Taken together, these findings indicate that the two policies were effective in achieving their goals. Unlike the purpose of purchase programs, the purpose of TLTROs was a stimulation of private credit creation which in turn was intended to support the pass-through of following policy accommodation to the real economy. As such, TLTROs seem to have cleared the path for the subsequent asset purchase programs.

A review of ECB measures during the crisis

The ECB has stressed on several occasions that all non-standard policies aim to ensure price stability and firmly anchor inflation expectations. Yet the explicit objectives of the different policy measures have changed over time depending on the current dominant challenges. When broad fears about the financial health of euro area banks ensued following the global financial crisis, the ECB introduced supplementary longer-term refinancing operations (LTROs), which were aimed at stabilizing financial conditions and mitigating funding risks. Additionally, the ECB launched covered bond purchase programs with the intention to improve liquidity in private debt security markets and encourage credit institutions to expand lending.

Figure 1

Evolution of euro area HICP inflation



Source: Datastream.

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Inflation embarked on a pronounced downward drift since 2012.

Throughout the sovereign debt crisis, the ECB had to cope with malfunctioning government bond markets, which hampered the effectiveness of monetary policy. Against this background, the ECB announced the Securities Markets Program (SMP). This program's aim was to repair the monetary policy transmission mechanism. Later it was replaced by the Outright Monetary Transactions (OMTs), which were equipped with a conditionality requirement to incentivize fiscal prudence and structural reforms.¹

When downward risks to inflation materialized during 2013 and 2014, the ECB explicitly targeted monetary policy at raising inflation expectations. As can be seen from Figures 1 and 2, euro area headline inflation went on a pronounced downward trend, followed by market-based measures of expected inflation. In view of mounting deviations from the inflation target of just under 2%, the ECB lowered the policy rate to 0.05% in autumn 2014 in multiple steps. Furthermore, in June of the same year, the ECB announced a series of TLTROs, which differed from standard LTROs in that they conditioned borrowing by the counterparty on lending to the euro area non-financial private sector. Their intention was to improve the transmission of monetary stimulus by encouraging lending to the real economy.²

¹ Praet, P. (2013). The crisis response in the euro area. <http://www.ecb.europa.eu/press/key/date/2013/html/sp130417.en.html> (accessed 2 June 2016).

² ECB (2014): Introductory statement to the press conference (with Q&A). <https://www.ecb.europa.eu/press/pressconf/2014/html/is140703.en.html> (accessed 2 June 2016).

Based on an overall subdued outlook for inflation and credit dynamics, the ECB announced the asset-backed securities purchase program (ABSPP) and the third covered bond purchase program (CBPP3) in September 2014. Both unconventional measures were initiated with the objective of pushing inflation rates closer to 2% by easing the monetary policy stance and facilitating credit provision to the real economy.³

Given continuing declines in actual and expected inflation, the ECB announced the expanded asset purchase program (EAPP) in January 2015, which was aimed at addressing the risks of a prolonged period of low inflation or even deflation. Specifically, the large-scale asset purchase program is supposed to further ease monetary and financial conditions, and stimulate economic activity, thereby bringing inflation back up. The EAPP encompasses the ABSPP and CBPP3, but adds the purchases of secondary market sovereign bonds. Monthly purchases amounted to €60 billion and were to continue at least until September 2016. Later, the ECB announced an extension of the program's size and duration. Up until at least March 2017, the ECB will purchase €80 billion in assets per month. In 2016, the ECB also reinforced its accommodative monetary policy stance by further lowering policy rates, adding the purchases of corporate sector bonds to the EAPP, and launching TLTROs with new features to stimulate credit creation.

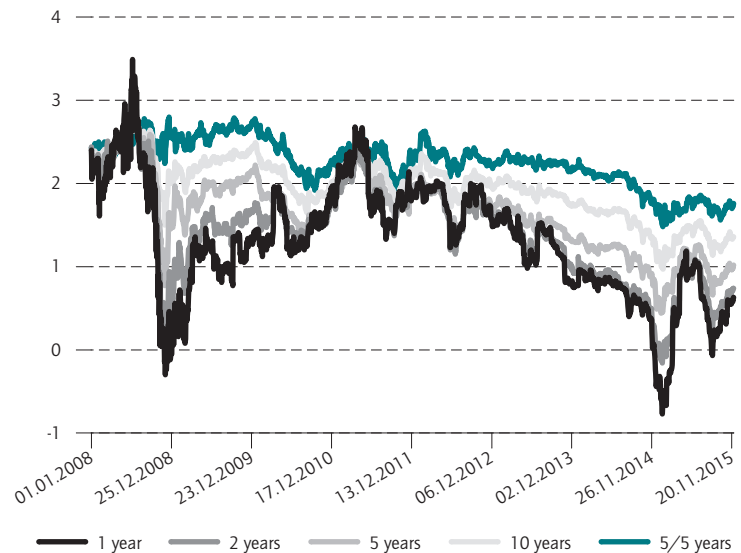
Previous research inconclusive

Most of the literature on unconventional monetary policy by the ECB focuses on measures up to 2013 and primarily on their impact on interest rates, asset prices and equity markets. By contrast, only a few studies have analyzed the effects on inflation expectations of the programs implemented after 2013.⁴ Moreover, the limited existing empirical evidence is inconclusive.

Briciu and Lisi (2015) analyze the impact of unconventional monetary policy announcements on various economic and financial variables up to January 2015.⁵ Drawing on an event study design, they find that central bank announcements on the EAPP have contributed to higher long-term inflation expectations, while those on ABSPP, CBPP3, and TLTROs have had a negative effect. However, they only examine unconventional monetary policy announcements and do not control for interest rate decisions or macroeconomic announcements. Yet these

Figure 2

Evolution of euro area inflation-indexed swap rates In percent



Source: Datastream.

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Inflation expectations over different horizons declined considerably since 2012.

potentially occur at the same time as unconventional monetary policy announcements and are likely to affect the formation of inflation expectations. They should therefore be taken into account in an empirical analysis.

A study by Van den End and Pattipeilohy (2015) finds no significant effect on inflation expectations in the euro area by policies that were implemented before December 2014.⁶ The paper focuses on the impact of actual changes in the size or composition of the ECB's balance sheet and thereby neglects any possible effects caused by policy announcements. It thus potentially underestimates the total effect of ECB monetary policy on inflation expectations.

New evidence: ECB asset purchase programs do raise euro area inflation expectations

This study evaluates the effectiveness of the unconventional monetary policy measures introduced by the ECB in raising euro area inflation expectations. Specifically, it quantifies the announcement effects of the different

³ ECB (2014): ECB announces operational details of asset-backed securities and covered bond purchase programmes. https://www.ecb.europa.eu/press/pr/date/2014/html/pr141002_1.en.html (accessed 10 January 2016).

⁴ Vgl. Rieth et. al.(2016) EB 7 and Bernoth et. al. (2014) WB 37

⁵ See Briciu, L., Lisi, G. (2015): An event-study analysis of ECB balance sheet policies since October 2008. European Economy, Economic Brief 001.

⁶ See van den End, J. W., Pattipeilohy, C. (2015): Central bank balance sheet policies and inflation expectations. DNB Working Paper No. 473.

Box

Empirical Approach

This study analyzes the impact of unconventional monetary policy announcements on inflation expectations by estimating the following regression model:

$$\Delta inf_t^E = \alpha + \beta UMPA_t + \delta_1 S_MRO_t + \delta_2 S_Z_t + \sum_{i=1}^{11} \gamma_i D_i + \varepsilon_t$$

The dependent variable is the daily change in basis points in inflation expectations as measured by euro area inflation-indexed swap rates for maturities of one, two, five, or ten years or as the five year/five year forward rate. The independent variables of interest are captured by the dummy vector of announcements on unconventional monetary policy, $UMPA_t$,

with $UMPA_t = [EAPP_t, ABSPP \& CPBB3_t, TLTRO_t]$.

The specified model allows the impact to vary across monetary policy programs. Variables covered in $UMPA_t$ take the value of one on days with ECB announcements on the respective monetary policy measure, and zero on all other days. Announcements related to the $ABSPP$ and the $CBPP3$ completely overlap and are consequently captured in one dummy variable. The variable S_MRO_t controls for surprises with respect to conventional interest rate decisions. It equals the surprise value on days with changes in the main refinancing operations rate, and zero otherwise. S_Z_t controls for surprise effects related to macroeconomic data releases in the euro area and the US. The surprises are computed as the normalized difference between actual releases and median expectations according to Bloomberg survey data. Inter alia, they include news on unemployment, gross domestic product, inflation, and consumer confidence (see Table 4 for an exhaustive list). Quarterly dummy variables D_i control for time-fixed effects, such as changes in swap-rate volatility. The analysis is based on data from January 2013 to November 2015.

A particular challenge associated with event studies on central bank communication is how to avoid announcements that had been anticipated, and hence revealed no new information to market participants. This problem is addressed by investigating the reaction of German and Italian government bond yields in response to ECB announcements. If substantial movements fail to materialize, announcements do not appear sufficiently unexpected and are therefore excluded from the regression analysis. The threshold values are defined as the median daily changes in German and Italian yields on announcement days because the underlying securities are among the most liquid government bonds in the euro area. Accordingly omitted announcements are denoted by asterisks in Table 5.

In addition to the analysis of immediate, daily changes in inflation swap rates, an alternative model also accounts for delayed market reactions. The choice of the time window is nontrivial. If it is too narrow, it may not capture the full impact of announcements, especially if it takes time for market participants to un-

Table 1

Macroeconomic data releases

Euro Area

CPI inflation
CPI inflation (flash estimate)
European Commission consumer confidence indicator
GDP
M3 annual growth rate
retail sales
unemployment rate

Germany

CPI inflation
Ifo business climate index
industrial production
manufacturing orders
PPI inflation
retail sales
unemployment rate
ZEW expectations survey

United States

CPI inflation
GDP
hourly earnings
housing starts
industrial production
nonfarm payrolls
PPI inflation
retail sales
ISM manufacturing index
trade balance
unemployment rate

France

business confidence manufacturing industry sentiment index

Source: Bloomberg.

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derstand the announcement or if markets are impaired. An excessively large window may account for delayed effects but is likely to contain distortions produced by other, irrelevant news.¹ In addition to the analysis of daily changes, an alternative model used for robustness analysis compares the change in inflation swap rates from the closing level on the day prior to the announcement to that on the day following the announcement (Table 2). While this approach increases the amount of noise, a wider time horizon allows for the incorporation of delayed reactions.

¹ Rogers, J. H., Scotti, C., Wright, J. H. (2014): Evaluating Asset-Market Effects of Unconventional Monetary Policy: A Cross-Country Comparison. *Economic Policy* 29.80 (2014): 749–799.

measures on inflation-indexed swap rates. The analysis is based on data from January 2013 onward, when inflation started on a marked downward trajectory. The details of the regression framework are set out in the accompanying box. In brief, the econometric analysis is based on an “event study” or dummy-variable approach that regresses daily changes in inflation-indexed swap rates on dummies indicating days of important ECB announcements of non-standard monetary policy measures as well as several control variables.

Altogether, the findings suggest that the announcements of the asset purchase programs have significantly and economically meaningfully increased inflation expectations. Quantitatively, the effects are rather moderate, however, compared to the effects of similar programs implemented by the monetary authorities in the US and UK. In contrast to the announcements of the asset purchase programs, announcements of TLTROs have not led to increases in expected inflation.

Table 1 reports the regression results of the model specified in the box. Announcements on the ABSPP/ CBPP₃ and the EAPP mostly yield highly statistically significant

Table 2

ECB announcements on unconventional monetary policy, April 2014 to September 2015

Policy	Date	Announcement
CBPP3/ABSPP*	03.04.14	Indication of further monetary policy measures based on an overall subdued outlook for inflation
ABSPP/TLTRO	05.06.14	Intensification of preparatory work for purchases of asset-backed securities. First announcement on TLTROs
TLTRO*	03.07.14	Announcement on detailed modalities
TLTRO*	29.07.14	Announcement on further details
CBPP3/ABSPP	04.09.14	Decision on ABSPP and CBPP3
TLTRO	18.09.14	Announcement on amount allotted in TLTROs
CBPP3/ABSPP*	02.10.14	Key operational details of ABSPP and CBPP3
CBPP3/ABSPP*	06.11.14	Statement on the intention to buy covered bonds and asset-backed securities in order to expand the balance sheet towards the dimension in early 2012
EAPP	21.11.14	Statement by Mario Draghi indicating further policy measures if the current policy programs are not effective enough to raise inflation and expectations
EAPP	22.01.15	Announcement on the EAPP
EAPP	05.03.15	Announcement of the starting date for purchases of public sector securities
EAPP	03.09.15	ECB signals expansion of the EAPP beyond 2016
EAPP*	23.09.15	Adjustments in the purchase process

Source: ECB.

Table 1

Immediate impact of ECB announcements on expected inflation

Immediate Reactions (daily changes)

	1Y	2Y	5Y	10Y	5Y/5Y
Regression Coefficients					
TLTRO	-2.451	-0.982	-0.859	-0.981	-1.101
ABSPP & CBPP3	3.722	3.103***	2.425***	2.987***	3.553**
EAPP	5.329***	4.792***	4.606***	3.309**	1.19
N	759	759	759	759	759
Cumulative Effect (point estimate times number of announcements)					
ABSPP & CBPP3	-	6	5	6	7
EAPP	21	19	18	13	-
Joint Effect of asset purchase programs	21	25	23	19	7

Level of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: Own calculations.

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ECB announcements significantly lift expected inflation.

Table 2

Delayed impact of ECB announcements on expected inflation

Delayed Reactions (two-day changes)

	1Y	2Y	5Y	10Y	5Y/5Y
Regression Coefficients					
TLTRO	-5.283**	-3.598**	-3.202**	-2.518*	-1.803
ABSPP & CBPP3	6.947***	6.456***	5.064***	4.771***	4.439***
EAPP	4.730***	4.396***	4.070***	2.114*	0.301
N	758	758	758	758	758
Cumulative Effect (point estimate times number of announcements)					
TLTRO	-11	-7	-6	-5	-
ABSPP & CBPP3	14	13	10	10	9
EAPP	19	18	16	8	-
Joint Effect of asset purchase programs	33	30	26	18	9

Level of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: Own calculations.

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The announcement effects are stronger when considering two-day windows.

and positive coefficients. Those on TLTROs are insignificant. Specifically, announcements on the ABSPP and the CBPP3 led to increases in inflation expectations at maturities of two, five, and ten years as well as on the five year/ five year forward rate. The point estimates vary between 2 and 4 basis points. The only exception is the one-year swap rate, for which the coefficient turns out insignificant. As documented in the bottom panel of Table 1, the

cumulative effect of all announcements on the ABSPP and CBPP3 on expected inflation amounts to an increase of between 5 and 7 basis points, depending on the maturity considered.⁷

The effects of announcements regarding the EAPP are stronger. Intuitively, they tend to be more pronounced on shorter maturities. The regression results suggest that on average, an announcement led to an increase of expected inflation by between 3 and 5 basis points. The only exception is the estimated impact on the five year/ five year forward rate, which does not respond significantly. The cumulative effect of the EAPP announcements ranges from between 13 and 21 basis points. These effects are substantially larger than the cumulative effects of ABSPP and CBPP3 announcements.

In contrast to these policy measures, TLTRO announcements did not significantly affect expected inflation. None of the point estimates is statistically significant. A reason for the lack of impact of this program on inflation expectations may be its different objective. The TLTROs had the specific purpose of stimulating private sector credit creation, and thereby favor the pass-through of further policy accommodation to the real economy. In this regard, the TLTRO announcements are aimed at unlocking the monetary transmission channel, tilling the field for a proper functioning of the subsequent asset purchase programs.

As a sensitivity check, the next step in the analysis allows for delayed market reactions (see Table 2). This is done by considering the two-day change in inflation swap rates following ECB announcements. In this case, the effects of ABSPP- and CBPP3-related announcements are considerably stronger than suggested by the benchmark results based on the daily change. Inflation expectations now rise at all maturities and the size of the point estimates nearly doubles. The cumulative effects aggregate to between 9 and 14 basis points, depending on the maturity. Similarly, the overall impact of the announcements on asset purchase programs increases strongly when considering two-day changes in inflation swap rates. For the two-year horizon, the cumulative effect suggests an increase of 30 basis points.

On the other hand, when allowing for delayed effects, there is some evidence that TLTRO announcements induce a decline in inflation expectations. This finding indicates that the announcements came short of market expectations. Indeed, markets were disappointed in response to the news release of September, 18 2014 on

⁷ Cumulative effects of policy programs are calculated as the mathematical product of point estimates and the number of announcements per program.

Table 3

Impact of Fed and BoE announcements on expected inflation

Daily changes¹

	1Y	5Y	10Y	5Y/5Y
USA				
LSAP1	15.31	36.47***	20.50***	4.23
LSAP2	11.05	-0.06	8.46***	17.08***
Mep	-6.50	5.74***	7.45***	9.17***
LSAP3	6.89	9.80***	2.56	-4.76
UK				
APF1	-25.02***	-10.00***	7.52***	25.26***
APF2	16.21***	3.19***	4.35***	5.52***

¹ Regression Coefficients.Level of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Source: Hofmann, B., Zhu, F. (2013): Central bank asset purchases and inflation expectations. BIS Quarterly Review March 2013.

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Relative to the US and UK, the effects of the ECB measures are more moderate.

the amount allotted within this liquidity scheme. The take-up of loans of the first tranche by European banks fell far short of analysts' expectations.

While the study shows that the announcements of asset purchase programs significantly increased euro area inflation expectations, it is nontrivial to compare the estimated coefficients with existing estimates of the effects of similar monetary measures introduced in the US and the UK. Hofmann and Zhu (2013) assess the impact of central bank asset purchase announcements on inflation swap rates.⁸ Table 3 reports their results for comparison. While the estimated coefficients mostly exceed the point estimates in this study in absolute size, the results for the US and UK are also more mixed in terms of the

⁸ See Hofmann, B., Zhu, F. (2013): Central bank asset purchases and inflation expectations. BIS Quarterly Review March 2013.

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sign of the coefficients. While most announcements led to pronounced increases in inflation swap rates, short- and medium-run expectations in the UK strongly decline in response to announcements.

While the overall effectiveness of the programs is difficult to compare across countries, it seems that the market reactions were stronger in the US and the UK. This gap is likely to reflect the different timing of the purchase programs: in the US and UK, quantitative easing was announced much earlier than in the euro area, namely the apex of the financial crisis and during its immediate aftermath. Government bond yields were much higher back then and hence much more affected. This in turn seems to have translated into stronger responses of inflation expectations. Moreover, market participants were still unfamiliar with these unconventional policies and were therefore so surprised by the announcements of central banks that they would buy debt securities on a massive scale. In contrast, the ECB announcements on the EAPP might have been more anticipated due to persistently downward-trending inflation and inflation expectations.

Conclusion

This study analyzes whether the ECB's unconventional monetary policy measures adopted since 2013 were effective in raising inflation expectations in the euro area. The empirical findings suggest that the announcements of asset purchase programs led to significant increases in inflation expectations over various horizons. In contrast, news on targeted longer-term refinancing operations (TLTROs) were not effective in terms of raising inflation expectations.

In sum, the results suggest that the ECB retains control over inflation expectations. This control is a key prerequisite for achieving the primary mandate of price stability. The findings also suggest, however, that compared to the US and UK experiences, the impact of the ECB's measures on inflation expectations was of moderate size. Altogether, the study suggests that more can and needs to be done to bring euro area inflation back to target.

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