The European Central Bank has engaged in a wide range of non-standard monetary policy measures since 2007. Each new tool was accompanied by an intense public debate on its effectiveness. This study evaluates the average effect of these measures on the macro-economy. The estimates show that unexpected changes in monetary policy that lower euro-area sovereign bond yields lead to a significant rise in real GDP, consumer prices, inflation expectations, and credit volume in the euro area. The effects on the German economy are very similar. All in all, the evaluation shows that non-standard monetary policy shocks are effective and contribute to fulfilling the central bank’s mandate.

Since the onset of the financial crisis in 2007, the European Central Bank (ECB) has engaged in a wide range of non-standard monetary policy measures. These include, for instance, an enlargement of the pool of assets accepted as collateral for refinancing operations and a provision of liquidity to banks at longer maturities than before the crisis. Most recently, the ECB introduced an asset purchase program, which it then extended in December 2015, less than a year after its introduction.

Announcements of each of the new monetary stimulus measures have been accompanied by an intense public and academic debate on associated costs and benefits. On the one hand, supporters of the ECB policy argue that non-standard monetary policy tools are successful in calming financial markets and in improving credit and economic conditions. Critics, on the other hand, doubt the effectiveness of these measures and stress the potential risks, such as a deterioration in financial stability or a widening of the income distribution.

This study assesses how the ECB’s non-standard monetary policy measures can affect the macroeconomy. Since criticism on the effectiveness of these policies has been coming from Germany in particular, we investigate the consequences of the monetary interventions not only for the euro area in general, but also specifically for Germany.

Previous evidence on non-standard monetary policy

The available studies that have analyzed the effects of non-standard monetary policy, particularly quantitative easing (QE) in the US and the UK, show that QE significantly low-
Macroeconometric approach

The macroeconometric approach we employ here follows Gertler and Karadi (2015). We use a vector autoregressive model that includes six variables for the euro area: the two-year yield on government bonds of euro area member countries excluding Germany, a measure of stock market volatility, the volume of credit to non-financial firms, the index of consumer prices, real GDP, and the unemployment rate. The model can be written as

\[ Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + u_t \]

We use this vector autoregressive model to study the impact of a monetary intervention on the entire system of variables considered.

To separate the different driving forces of the variables included in the model, we need to construct a measure that is correlated with unexpected variations in monetary policy. To construct such a measure, we build on Altavilla, Giannone, and Lenza (2014) and extract the surprise variations in government bond yields on the days on which the European Central Bank announced shifts in monetary policy. All in all, we consider 32 policy announcements that occurred between August 2007 and May 2015. (A list with details on each announcement is given in Table 1.)

We then make use of a panel model to extract the common unexpected variation in spreads vis-à-vis Germany of government bond yields of different countries and maturities. In particular, we use bond yields for Italy, Spain, Portugal, and Ireland on maturities two, five, and ten years. The model used is

\[ x_{ijt} = \alpha + \beta x_{ijt-1} + \sum \gamma_a D_a + \sum \delta_n z_{nt} + \eta_{ijt} \]

where the variable \( z_{nt} \) is the surprise component in economic data releases of 139 macroeconomic indicators for the euro area financial markets more generally. The announcements of OMT, for instance, significantly reduced sovereign bond yields in most member countries. Similarly, the SMP lowered yields on sovereign bonds, particularly for those countries that were covered by the program, with large declines in yields on days information on the program was disclosed.\(^5\) LTOs, in turn, seem to have unlocked the bank lending channel and stimulated credit growth.\(^6\)

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Boeckx et al. (2014) and Gambacorta et al. (2014) show that unexpected ECB balance sheet enlargements have a positive impact on economic activity and prices in the euro area. By construction, these estimates exclude ECB policies that are not associated with shifts in the balance sheet. In particular, they do not take into account the effects that function through policy announcements. Communication, however, is typically considered a main policy tool of central banks. In our empirical assessment of the effectiveness of ECB policies, we therefore use the unexpected changes in sovereign bond yields on those days when the ECB communicated its policy to the public, and assess how these movements in government bond yields affect financial markets and the macroeconomy (see Box 1).

Non-standard policies are effective ...

We consider non-standard policy measures that the ECB employed from the beginning of the global finan-
The ECB has announced a number of different non-standard policy measures between 2007 and 2015.

We discuss the effectiveness of the policies by means of estimated impulse response functions to a non-standard monetary policy innovation. The idea of these impulse functions is to feed the estimated model with a hypothetical monetary policy shock and to see how this shock propagates through the economy, holding constant the other driving forces of the variables. We scale the hypothetical shock such that it lowers the two-year yield on euro-area government bonds (excluding Germany) by 0.25 percentage points.9

... in the euro area

We first study whether non-standard policies are effective in the euro area as a whole, and then consider the case of Germany. Figure 1 reports the results for the euro area benchmark specification. The solid green line shows the point estimate, while the black lines and shaded areas depict the 90 percent confidence bands, which are used to evaluate whether the point estimate is statistically significantly different from zero. The top left panel shows that the two-year rate drops on impact, before slightly overshooting and then returning to the level where it would have been without the surprise expansion. This leads to a significant and prolonged reduction in uncertainty on financial markets, as measured by the VStoxx.10 The volume of credit to non-financial corporations gradually increases and reaches a peak after three years. This overall change in financial conditions is associated with a gradual increase in prices as well as in the real GDP, with output peaking after 18 months, slightly earlier than prices. The responses of output and inflation are mirrored in the unemployment rate, which reaches its minimum after approximately two years, before returning to trend. All in all, the simulation shows that on average, the different non-standard measures of the ECB can lead to a significant stimulation of the macroeconomy.

While our results generally confirm previous estimates of the effectiveness of non-standard monetary policy, there are several interesting differences. Specifically, the above-

9 The two-year yield is computed as a GDP-weighted average of bond yields for the following countries: Austria, Belgium, Finland, France, Ireland, Italy, Netherlands, Portugal, and Spain. Germany is excluded, as German bonds played a particular role as a safe haven asset during the euro crisis. They are analyzed separately in the section on Germany.

10 The VStoxx is an index based on Euro Stoxx 50 realtime options prices and is designed to capture market expectations of near-term up to long-term financial market volatility. In the literature, the VStoxx and similar measures are often used as a measure for financial market risk aversion and uncertainty. See, for instance, Bekaert, G., Hoerova, M., Lo Duca, M. (2013): Risk, Uncertainty and Monetary Policy, Journal of Monetary Economics, 60(7), 771-798.
ECB POLICIES EFFECTIVE

Figure 1

Macroeconomic effects of ECB policy in the euro area
In percent / percentage points deviations from trend

<table>
<thead>
<tr>
<th>2-year sovereign bond yield</th>
<th>VStoxx Index of Stock Market Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>2</td>
</tr>
<tr>
<td>0.2</td>
<td>1</td>
</tr>
<tr>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>0.0</td>
<td>-1</td>
</tr>
<tr>
<td>-0.1</td>
<td>-2</td>
</tr>
<tr>
<td>-0.2</td>
<td>-3</td>
</tr>
<tr>
<td>-0.3</td>
<td>-4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credit to non-financial corporations</th>
<th>Harmonized Index of Consumer Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>0.20</td>
</tr>
<tr>
<td>2</td>
<td>0.15</td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
</tr>
<tr>
<td>0</td>
<td>0.05</td>
</tr>
<tr>
<td>-1</td>
<td>-0.05</td>
</tr>
<tr>
<td>-2</td>
<td>-0.10</td>
</tr>
<tr>
<td>-3</td>
<td>-0.15</td>
</tr>
<tr>
<td>-4</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Real GDP</th>
<th>Unemployment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>0.05</td>
</tr>
<tr>
<td>0.6</td>
<td>-0.05</td>
</tr>
<tr>
<td>0.4</td>
<td>-0.10</td>
</tr>
<tr>
<td>0.2</td>
<td>-0.15</td>
</tr>
<tr>
<td>0.0</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

1 Green solid lines are point estimates, black lines and shaded areas are 90 % confidence bands.
Source: calculations of DIW Berlin.

An unexpected monetary expansion decreases government yields, stock market volatility and the unemployment rate, and increases credit, prices and real GDP.

mentioned studies that measure the stance of monetary policy using central bank balance sheets rather than government bond yields typically find that output and prices respond more quickly, peak earlier (after about six months), and reach their maximum simultaneously. Instead, we find a more sluggish response of both variables, peaking only after roughly two years, and with output leading prices. Interestingly, the output and price dynamics implied by our estimates are more similar to the behavior of these variables following a “standard” (conventional) monetary policy shock that works through changes in the policy rate.11

As the primary mandate of the ECB is to stabilize inflation, and since inflation expectations play a crucial role for actual inflation, we next evaluate the effects of non-standard monetary policy innovations on core consumer prices and several measures of inflation expectations. We add each variable to the benchmark six-variable VAR model, one at a time, and combine the responses of the marginal variables into one graph. The figure shows that, as headline and core prices increase, the difference between the share of analysts who expect a rising inflation rate and the share who anticipate a falling inflation rate widens significantly, by about five percentage points five months after the monetary policy shock.

The second measure of inflation expectations is taken from the European Commission consumer survey. It gives a qualitative assessment of respondents’ expectations about the development of consumer prices over the following twelve months. While inflation expectations increase on impact and for about one year according to this measure, the increase is not statistically significant.

The swap rate increases significantly, indicating an increase in inflation expectations.

Figure 2
Effects of ECB policy on euro area inflation expectations
In percent / percentage points deviations from trend

- Index of Core Consumer Prices
- Inflation Expectations ZEW survey
- Inflation Expectations EC survey
- Inflation Expectations 2-year swap rates

1 Green solid lines are point estimates, black lines and shaded areas are 90% confidence bands.
Source: calculations of DIW Berlin.

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An unexpected monetary expansion increases inflation expectations.

12 We add each variable to the benchmark six-variable VAR model, one at a time, and combine the responses of the marginal variables into one graph.
As a final step in the evaluation of the effectiveness of non-standard monetary policy, we investigate the impact on several alternative measures of economic activity. Figure 3 reports impulse responses of retail sales, industrial production, car registrations, and new orders. Except for the first measure, all activity indicators increase significantly, either on impact or some months after the monetary surprise. The strongest response is found for new orders and industrial production, even exceeding the peak response of GDP.

As a word of caution, however, the results should not be necessarily interpreted as supporting the recent extension of the asset purchasing program. Sovereign bond yields in the euro area are currently on a lower level than they have been during most of the analyzed sample period. Thus there is potentially less room for beneficial macroeconomic effects from non-standard monetary policy measures through lowering bond yields further.

... and in Germany

We now investigate the effects of the ECB non-standard monetary policy measures on Germany’s macroeconomy. The results are shown in Figure 4. Contrary to the average two-year yield in the euro area, German sovereign bond yields increase in response to the monetary expansion. The two-year yield rises by 0.1 percentage points and for roughly six months. The reaction of the

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Figure 3

Effects of ECB policy on euro area real activity
In percent / percentage points deviations from trend

1 Green solid lines are point estimates, black lines and shaded areas are 90 % confidence bands.
Source: calculations of DIW Berlin.

An unexpected monetary expansion increases real activity.

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13 As the measures of economic activity are a proxy for real GDP, we do not add them as a seventh variable to the baseline model, but instead replace GDP.

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14 As before, we compute the impulse responses of the variables for Germany by adding them as a seventh variable to the euro area baseline model.
ECB POLICIES EFFECTIVE

ECB reduced financial market uncertainty, the demand for safe-haven assets declined.

Remarkably, despite the increase in sovereign bond yields, the responses of the other variables show that the German economy does profit from the monetary stimulus. Real GDP increases significantly on impact and five-year yield is about half as large and less significant. This positive (rather than negative) reaction of German Bund yields to the surprise expansion can be explained by a flight-to-safety phenomenon. Particularly during the height of the euro-area debt crisis, German government bonds were seen as a safe haven for financial investors. As the non-standard monetary policy innovations of the ECB reduced financial market uncertainty, the demand for safe-haven assets declined.

In Germany, an unexpected monetary expansion decreases the unemployment rate and increases government yields, prices and real GDP.

\[\text{Source: calculations of DIW Berlin.}\]
for roughly two years, and a similar response can be observed for the price level. The increase in real output is accompanied by a decrease in the unemployment rate, which falls by up to 0.2 percentage points. The last panel shows that stock prices in Germany also increase after the policy innovation, indicating that financial markets do not perceive the non-standard expansion as harmful for the growth prospects of German companies.

Conclusion

This study estimates the effects of non-standard ECB policy on the macroeconomy in the euro area and in Germany. For the euro area, it shows that unexpected monetary expansions, associated with a decline in sovereign bond yields, lead to a rise in real GDP and prices. Importantly, inflation expectations also increase. Moreover, financial market uncertainty decreases and the volume of credit to non-financial corporations rises. These results suggest that the ECB’s non-standard monetary policy measures have supported the real economy and prices in the euro area over the past few years.

The reaction of the macroeconomy in Germany is qualitatively similar to that of the euro area. Even though sovereign yields tend to increase in response to the expansionary surprises, prices and output rise, and the unemployment rate falls. Overall, the results indicate that the German economy profited from the monetary interventions, possibly due to its close financial and economic ties with the rest of the euro area.

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