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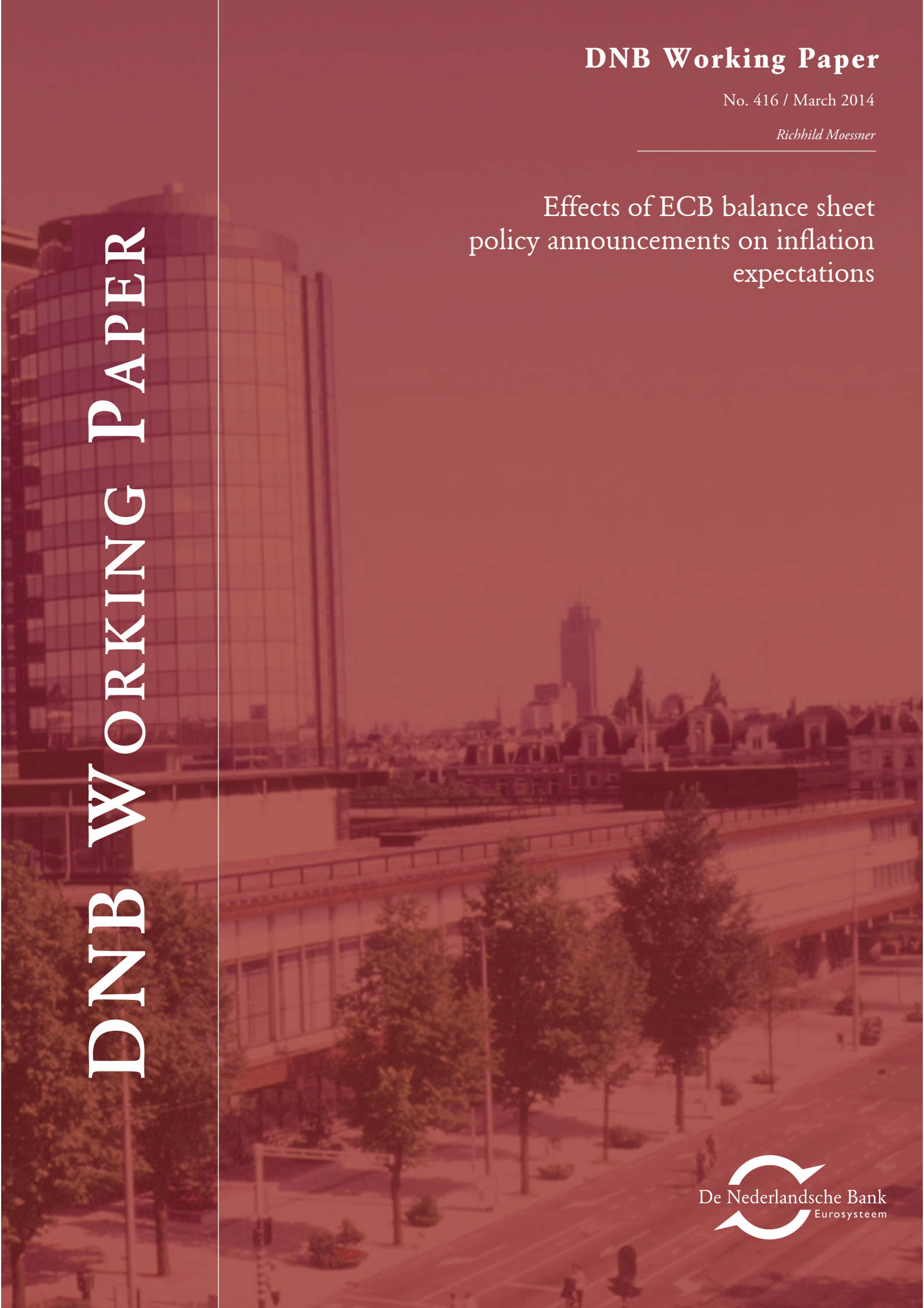

De Nederlandsche Bank
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Richhild Moessner *

* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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De Nederlandsche Bank NV
P.O. Box 98
1000 AB AMSTERDAM
The Netherlands

Effects of ECB balance sheet policy announcements on inflation expectations*

Richhild Moessner[a,b]
[a]De Nederlandsche Bank
[b]Cass Business School

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Abstract

We investigate whether ECB balance sheet policy announcements in the wake of the global financial crisis have affected the ECB's monetary policy credibility as measured by long-term inflation expectations, by looking at their effects on euro area inflation swap rates of maturities up to 10 years. We consider asset purchase programmes and long-term refinancing operations with maturities above 6 months. We find that these announcements only led to a slight increase in long-term inflation expectations. We therefore find no strong evidence to suggest that ECB balance sheet policy announcements have led to much higher long-term inflation expectations, suggesting that the monetary policy credibility of the ECB has not been harmed by these policies.

JEL classification: E52, E58.

Key words: Monetary policy, central bank communication, balance sheet policies, inflation expectations.

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1 Introduction

In the wake of the financial crisis, the ECB has massively expanded its balance sheet to address the crisis. Pattipeilohy et al. (2013) present a survey of the effects of the ECB's unconventional monetary policy during the financial crisis.[1] They highlight a statement of the review of Kozicki et al. (2011) that "studies of the effectiveness of unconventional measures seldom (if at all) attempt to quantify any potential negative externalities." Kozicki et al. (2011) discuss a potential loss of central bank independence and credibility as a risk associated with unconventional monetary policy in the form of large-scale asset purchases.

In this paper we study whether the ECB's balance sheet policy announcements in the wake of the financial crisis have had adverse effects on the ECB's monetary policy credibility, as measured by long-term inflation expectations. We consider asset purchase programmes and long-term refinancing operations (LTROs) with maturities above 6 months. As measures of inflation expectations we use inflation swap rates of maturities up to 10 years.

The effects of central bank balance sheet policy announcements on inflation expectations have previously been studied for the United States and the United Kingdom, but to our knowledge not for the euro area.[2] Krishnamurthy and Vissing-Jorgensen (2011) find that an inflation channel operated in the Federal Reserve's first two Quantitative Easing programmes (QE1 and QE2), with evidence from both inflation swap rates and Treasury Inflation Protected Securities (TIPS) yields showing that expected inflation increased, implying larger reductions in real than in nominal yields. Guidolin and Neely (2010) suggest that inflation expectations appear to react modestly to Large-Scale Asset Purchase (LSAP) announcements. Using a structural VAR to identify the effects of monetary policy shocks for the period November 2008-December 2010, Wright (2011) finds slight evidence that stimulative monetary policy shocks led to a rotation in breakeven rates derived from TIPS and and conventional US Treasuries, with short-term breakeven rates rising and long-term forward breakeven rates falling. Hofmann and Zhu (2013) have studied whether central bank large-scale asset purchase announcements have led to higher inflation expectations in the United States and the United Kingdom. They find that central bank

[1] See also Cecioni et al. (2011).

[2] Galati et al. (2011) examine the impact of the global financial crisis on the formation of inflation expectations. They find that the sensitivity to macroeconomic news of financial market-based long-run inflation expectations appears to have increased, consistent with long-run inflation expectations having become less firmly anchored during the crisis. However, they note that problems in measuring inflation expectations, such as liquidity premia, make it difficult to draw definitive conclusions.

asset purchases had significant effects, but that their quantitative importance was uncertain. They conclude that the reaction of inflation swap rates on the days of programme announcements suggests that central bank asset purchases were probably not the main driver of the shifts in inflation expectations.

Announcements about balance sheet policies are one aspect of central bank communication. An overview of the effects of central bank communication prior to the global financial crisis is provided in Blinder et al. (2008). Woodford (2012) provides an overview of unconventional monetary policy by central banks in the wake of the financial crisis. Effects of the Federal Reserve's large-scale asset purchases are studied for example in D'Amico et al. (2012).

The outline of the paper is as follows. Section 2 presents the data and section 3 presents the method and results. Finally, section 4 concludes.

2 Data

As measures of inflation expectations, we consider inflation rates implied by euro area inflation swap contracts based on the index of CPI ex-tobacco, since these are more liquid than the inflation swap contracts based on the CPI. We use daily data for maturities of 1, 2, 5 and 10 years, as well as the 5-year forward inflation swap rate 5 years ahead, a rate commonly used as a measure of monetary policy credibility. We study the sample period from 1 January 2008 to 31 December 2012.

[Figure 1 about here]

We control for the effect of macroeconomic news on inflation expectations by including surprises in 16 euro area macroeconomic indicators and in 11 US macroeconomic indicators in the regressions. We include US macroeconomic indicators since they have been shown to affect financial markets internationally, including in Canada (Gravelle and Moessner (2002)), in the United Kingdom (Gravelle et al. (2005)), and in the euro area (Goldberg and Leonard (2003)). We include 16 macroeconomic indicators for the euro area (including for member countries of the euro area) based on Brière and Ielpo (2007), who identified them on account of their importance in affecting the euro area yield curve (see Table 3 of Brière and Ielpo (2007)). They are euro area CPI inflation (flash estimate), euro area CPI inflation, the German Ifo business climate index, the German ZEW expectations survey, the European Commission euro area consumer confidence indicator, French business confidence manufacturing industry sentiment index (INSEE), the euro

area unemployment rate, the German unemployment rate, euro area GDP, euro area retail sales, German retail sales, German industrial production, German manufacturing orders, euro area M3 annual growth rate, German CPI inflation, and German PPI inflation. We use the following US macroeconomic indicators based on Moessner and Nelson (2008), US CPI inflation, GDP, hourly earnings, housing starts, industrial production, the ISM manufacturing index, nonfarm payrolls, PPI inflation, retail sales, the trade balance, and the unemployment rate. The surprises of the real-time macroeconomic data releases are calculated relative to Bloomberg median survey expectations and are normalized by their standard deviation. We also control for the effect of surprises in the ECB's main refinancing rate. The surprises of the refinancing rate are also calculated relative to Bloomberg median survey expectations and normalized by their standard deviation.

In the wake of the financial crisis, the ECB has massively expanded its balance sheet (Figure 1). For an overview of unconventional monetary policy measures by the ECB see Cour-Thimann and Winkler (2013), Pattipeilohy et al. (2013), Szczerbowicz (2012) and Falagiarda and Reitz (2013). In this paper we consider the effects of official ECB balance sheet policy announcements in the form of asset purchase programmes (covered bond purchase programmes 1 and 2, the securities market programme and the outright monetary transactions programme) and long-term refinancing operations with maturities above 6 months, which are shown in Table 1. We select these balance sheet policies since they might be expected to be particularly relevant for the formation of long-term inflation expectations. Falagiarda and Reitz (2013) study the impact of a wider range of announcements about the ECB's balance sheet policies made from January 2008 to December 2012 on the sovereign risk of Italy, also including announcements made in speeches, rather than restricting them to official ECB announcements as we do in Table 1, and announcemens made about fixed rate full allotment tender operation, collateral eligibility, foreign exchange swap lines, long-term refinancing operations at all maturities, in addition to asset purchase programmes in the form of covered bond purchase programmes 1 and 2, the securities market programme and the outright monetary transactions programme. For robustness, we also consider the impact of this wider selection of ECB balance sheet policy announcements as identified in Table 2 of Falagiarda and Reitz (2013).

[Figure 2 about here]

[Table 1 about here]

3 Method and results

We regress changes in m-year inflation swap rates (in basis points), $\Delta y^m(t)$, for maturities of m =1, 2, 5 and 10 years, as well as for 5-year forward inflation swap rates 5 years ahead, m =5y/5y, on a dummy variable for the announcements of ECB balance sheet policies, $d_{BS}(t)$, and on the surprise components of 16 euro area and 11 US macroeconomic data releases, $surprise_j(t)$, $j = 1, ..., 27$, to control for the effects of economic data on inflation expectations, as well as on surprises in the ECB's main refinancing rate, $refi_{sur}(t)$. For each indicator j, the variable $surprise_j(t)$ takes on the value of the normalised surprises on the dates of the release of the macroeconomic indicator j, and zero on other days. The regression equation follows the approach of Hofmann and Zhu (2013) and takes the form

$$\Delta y^m(t) = c + a * d_{BS}(t) + \sum_{j=1}^{27} (b_j * surprise_j(t)) + g * refi_{sur}(t) + \varepsilon_t \quad (1)$$

where $\Delta y^m(t) = y^m(t) - y^m(t-1)$ for a 1-day window, $d_{BS}(t)$ takes the value of 1 on days when the ECB announced balance sheet policies, as listed in Table 1, and zero otherwise. We use Newey-West adjusted standard errors. Such regressions are commonly used in studying the effects of central bank communication on financial asset prices (see Knütter et al. (2011)). Using daily changes, ie a 1-day window, for the event study regressions, has the advantage that the window is so narrow that little other news that could affect market prices is contained within it. On the other hand, a shorter window has the disadvantage that it may capture reactions that may be reversed later, or that it does not capture the full reaction. For robustness, we therefore also present results for a 5-day window, using $\Delta y^m(t) = y^m(t+4) - y^m(t-1)$ in equation (1). Using such a longer window can show if the reactions are more persistent, and therefore more economically meaningful, rather than being immediately reversed, and may capture a fuller reaction to the news. Daily and weekly windows are commonly used in event study regressions.

The results for estimating equation (1) are shown in Table 2. We can see that for the 1-day window the dummy variable for all of the ECB's balance sheet policy announcements combined related to asset purchase programmes and LTROs with maturities above 6 months did not have a significant effect on inflation expectations at any of the maturities. This suggests that the ECB's monetary policy credibility, as measured by the anchoring of long-term inflation expectations, has not been adversely affected by these balance sheet policies. For the 5-day window, the dummy variable did not have a significant effect on inflation expectations at the 1- and 2-year

maturities; it led to a slight increase of around 3 basis points on average per announcement at the 5- and 10-year maturities, at the 10% and 5% significance levels, respectively, but was insignificant for 5-year forward inflation swap rates 5 years ahead. This also suggests that the ECB's monetary policy has retained its credibility.

[Table 2 about here]

Next, in order to better capture the surprise components of asset purchase announcements, we create a separate dummy variable for asset purchase announcements if they were the first for a particular programme, $d^f_{AP}(t)$, which takes the value of 1 on the dates 7 May 2009, 10 May 2010, 6 October 2011 and 2 August 2012, and zero otherwise. The remaining balance sheet policy announcements listed in Table 1 are included in the dummy variable $d^{oth}_{BS}(t)$, with $d_{BS}(t) = d^f_{AP}(t) + d^{oth}_{BS}(t)$. The regression equation then takes the form

$$\Delta y^m(t) = c + a_1 * d^f_{AP}(t) + a_2 * d^{oth}_{BS}(t) + \sum_{j=1}^{27} (b_j * surprise_j(t)) + g * refi_{sur}(t) + \varepsilon_t \qquad (2)$$

where we again control for the surprises of 11 US and 16 euro area macroeconomic indicators, as well as for surprises in the ECB's main refinancing rate, and where $\Delta y^m(t) = y^m(t) - y^m(t-1)$ and $\Delta y^m(t) = y^m(t+4) - y^m(t-1)$ for the 1-day ond 5-day windows, respectively. The results are shown in Table 3. We can see that for the 1-day window the dummy variable for first asset purchase announcements leads to an increase in inflation swap rates of 6 basis points on average per annoucement at the 1-year maturity which is significant at the 5% level, of 5 basis points on average per announcement at the 5-year and 10-year maturities (significant at the 5% and 1% significance levels, respectively), and of 4 basis points for the 5-year inflation swap rate 5 years ahead, which is significant at the 1% level. The dummy variable for balance sheet policy announcements which were not first announcements of asset purchase programmes is not significant at any maturity. This evidence therefore suggests that asset purchase announcements which were first of their kind had a slight effect in increasing long-term inflation expectations, while the remaining balance sheet policy announcements had no significant effect on long-term inflation expectations. These results suggest that the monetary policy credibility of the ECB, as measured by the anchoring of long-term inflation expectations, has not been harmed by these balance sheet policies. For the 5-day window, the coefficient on the dummy variable for first asset purchase announcements become somewhat larger and more significant for the 1- to 5-year

maturities, but remains little changed at the 10-year maturity and becomes slightly smaller and less significant for the 5-year inflation swap rate 5 years ahead. The coefficient on the dummy variable for balance sheet policy announcements which were not first announcements of asset purchase programmes becomes significantly negative at the 1- and 2-year maturities for the 5-day window. These results also suggest that the monetary policy credibility of the ECB has not been harmed by these balance sheet policies. The significant increase in inflation expectations at the 1-year maturity due to first asset purchase announcements suggests that these announcements contributed to bringing short-term inflation expectations back to more normal levels and the ECB's definition of price stability of 2%, after they had become very low and even turned negative in the wake of the failure of Lehman Brothers in late 2008 and the intensification of the global financial crisis (see Figure 1).

[Table 3 about here]

Next, for robustness we perform the regression of equation (1) when replacing the dummy variable $d_{BS}(t)$ for the balance sheet policy announcements listed in Table 1 with a dummy variable $d_{UMP}(t)$ which equals 1 on the wider range of unconventional monetary policy announcement dates identified in Table 2 of Falagiarda and Reitz (2013), as discussed in section 2, and zero otherwise. The results are shown in Table 4. We can see that for the 1-day window the dummy variable for the wider range of balance sheet policy announcements led to a slight increase of around 4 basis points at the 1-year maturity, and of around 1 basis point at the 5- and 10-year maturities, on average per announcement, but it had no significant effect on the 5-year inflation swap rate 5 years ahead. For the 5-day window, the dummy variable is no longer significant at any maturity. These results also suggests that the ECB's monetary policy credibility has not been adversely affected by these announcements. The significant increase in inflation expectations at the 1-year maturity due to the announcements suggests that the announcements contributed to bringing short-term inflation expectations back to more normal levels from their low and deflationary levels in late 2008.

[Table 4 about here]

4 Conclusions

We investigated whether ECB balance sheet policy announcements in the wake of the global financial crisis have affected the ECB's monetary policy credibility as measured by long-term

inflation expectations, by looking at their effects on euro area inflation swap rates of maturities up to 10 years. We considered asset purchase programmes and long-term refinancing operations with maturities above 6 months. We find that these announcements only led to a slight increase in long-term inflation expectations. We therefore find no strong evidence to suggest that ECB balance sheet policy announcements have led to much higher long-term inflation expectations, suggesting that the monetary policy credibility of the ECB has not been harmed by these policies.

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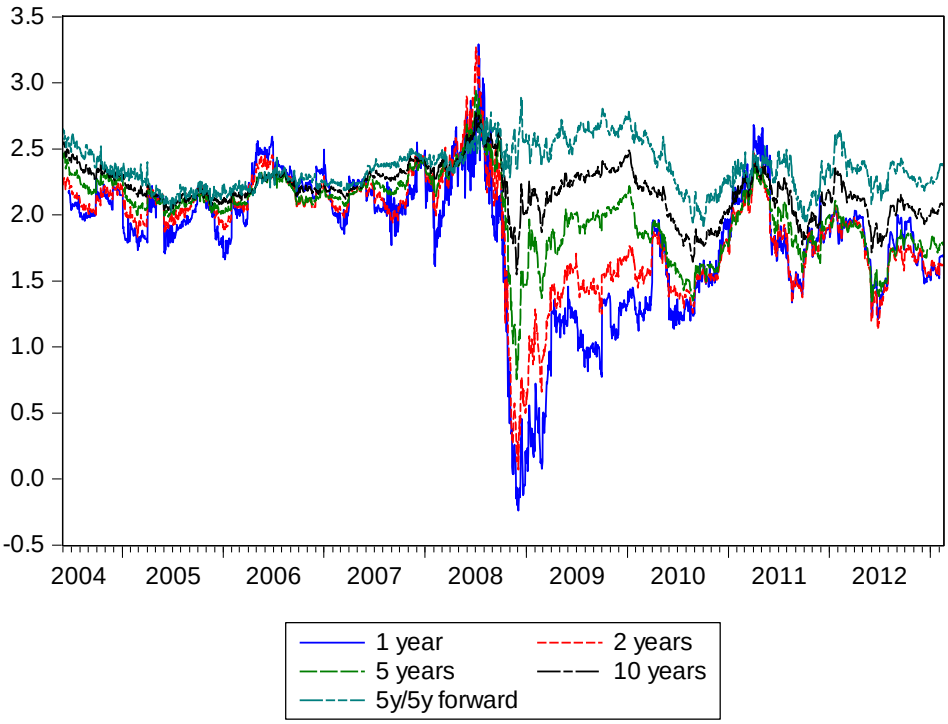
Figure 1: Euro area inflation swap rates (CPI ex-tobacco), in percent



Source: Bloomberg.

Figure 2: Central bank balance sheet size; total assets in national currencies (June 2007=100)

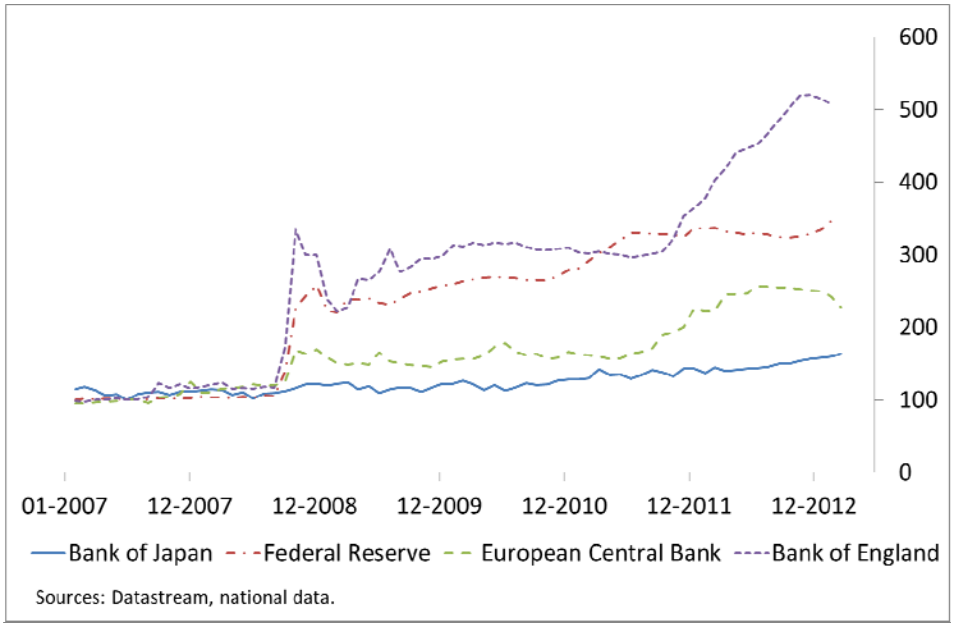


Table 1: ECB balance sheet policy announcements[a]

Date	ECB balance sheet policy announcements
7 May 2009	Covered bond purchase programme 1 and 1-year LTROs
4 June 2009	Covered bond purchase programme 1
2 July 2009	Covered bond purchase programme 1
10 May 2010[b]	Securities market programme[c]
8 August 2011[d]	Securities market programme
6 October 2011	Covered bond purchase programme 2 and 1-year LTROs
3 November 2011	Covered bond purchase programme 2
8 December 2011	3-year LTROs
2 August 2012	Possibility of Outright monetary transactions programme
6 September 2012	Technical features of Outright monetary transactions programme

[a] Asset purchase programmes and long-term refinancing operations (LTROs) with maturities above 6 months. [b] Announced on 9 May, a Sunday, so that incorporated into market prices on 10 May. [c] Announced together with 6-month LTROs and ECB-Federal Reserve swap line. [d] Announced on 7 August, a Sunday, so that incorporated into market prices on 8 August.

Table 2: Reactions of euro area inflation swap rates to ECB balance sheet policy announcements

Dependent variable: Daily changes in euro area inflation swap rates (CPI ex-tobacco) in basis points					
Variable	1 year	2 years	5 years	10 years	5y/5y forward
1-day window					
c	-0.129	-0.055	-0.095	-0.060	-0.024
d_{BS}	2.568	0.072	2.177	1.704	1.229
R^2	0.033	0.061	0.046	0.039	0.027
No. of observations	1305	1305	1305	1305	1305
5-day window					
c	-0.369	-0.363	-0.289	-0.208	-0.128
d_{BS}	-0.640	1.590	3.022*	2.587**	2.149
R^2	0.029	0.033	0.036	0.051	0.053
No. of observations	1305	1305	1305	1305	1305

***, ** and * represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Coefficients on surprises in 11 US and 16 euro area macroeconomic variables and ECB refinancing rate not shown. Sample period: 1/01/2008-12/31/2012.

Table 3: Reactions of euro area inflation swap rates to ECB balance sheet policy announcements, separately for first asset purchase announcements

Dependent variable: Daily changes in euro area inflation swap rates (CPI ex-tobacco) in basis points					
Variable	1 year	2 years	5 years	10 years	5y/5y forward
1-day window					
c	-0.132	-0.057	-0.097	-0.062	-0.026
d^{f}_{AP}	5.930**	3.474	5.049**	4.711***	4.369***
d^{oth}_{BS}	0.280	-2.243	0.222	-0.342	-0.909
R^2	0.034	0.062	0.049	0.044	0.030
No. of observations	1305	1305	1305	1305	1305
5-day window					
c	-0.375	-0.369	-0.292	-0.210	-0.128
d^{f}_{AP}	7.428***	10.927***	7.299***	4.938***	2.561*
d^{oth}_{BS}	-6.130**	-4.765**	0.111	0.987	1.869
R^2	0.030	0.036	0.037	0.052	0.053
No. of observations	1305	1305	1305	1305	1305

***, ** and * represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Coefficients on surprises in 11 US and 16 euro area macroeconomic variables and ECB refinancing rate not shown. Sample period: 1/01/2008-12/31/2012.

Table 4: Reactions of euro area inflation swap rates to wider range of ECB unconventional monetary policy announcements[a]

Dependent variable: Daily changes in euro area inflation swap rates (CPI ex-tobacco) in basis points					
Variable	1 year	2 years	5 years	10 years	5y/5y forward
1-day window					
c	-0.253	-0.103	-0.130	-0.089	-0.047
d_{UMP}	3.619**	1.248	1.300**	1.048**	0.795
R^2	0.037	0.062	0.048	0.041	0.028
No. of observations	1305	1305	1305	1305	1305
5-day window					
c	-0.343	-0.333	-0.313	-0.234	-0.156
d_{UMP}	-0.781	-0.479	1.166	1.137	1.108
R^2	0.029	0.032	0.035	0.051	0.053
No. of observations	1305	1305	1305	1305	1305

***, ** and * represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Coefficients on surprises in 11 US and 16 euro area macroeconomic variables and ECB refinancing rate not shown. Sample period: 1/01/2008-12/31/2012.

[a] Wider range of ECB unconventional monetary policy announcements as identified in Table 2 of Falagiarda and Reitz (2013).

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