Richhild Moessner, Jakob de Haan and David-Jan Jansen

The effect of the zero lower bound, forward guidance and unconventional monetary policy on interest rate sensitivity to economic news in Sweden

DNB WORKING PAPER

De Nederlandsche Bank
Eurosysteem

The effect of the zero lower bound, forward guidance and unconventional monetary policy on interest rate sensitivity to economic news in Sweden

Richhild Moessner, Jakob de Haan and David-Jan Jansen *

The effect of the zero lower bound, forward guidance and unconventional monetary policy on interest rate sensitivity to economic news in Sweden[*]

Richhild Moessner[a,b], Jakob de Haan[a,c,d] and David-Jan Jansen[a]
[a]De Nederlandsche Bank, [b]Cass Business School, [c]University of Groningen, [d]CESifo

January 2014

Abstract

We study whether the sensitivity of Swedish interest rates to economic news was affected by the zero lower bound and the Riksbank's monetary policies. Our results suggest that the sensitivity of interest rate swaps to Swedish macroeconomic news was reduced at the effective zero lower bound at short maturities but not at longer maturities. We also find that the sensitivity of interest rate swaps to this news was not significantly affected at any maturity by forward guidance. Finally, we conclude that the sensitivity of interest rate swaps to news was not significantly affected at any maturity by unconventional monetary policy.

JEL classification: E52, E58.

Key words: Unconventional monetary policy, central bank communication, forward guidance, zero lower bound, interest rate swaps.

I. Introduction

In several countries, including Sweden, the monetary authorities reduced policy rates to levels (close to) zero to counter the economic downturn due to the recent financial crisis. Even when policy rates are at the zero lower bound (ZLB), monetary policy may still be effective through unconventional policies, such as asset purchase programs and liquidity support, and communication on the forward path of policy rates, better known as forward guidance (Bernanke and Reinhart, 2004). As long-term rates are more relevant for economic decisions than the current level of the overnight rate, any action by the central bank that influences interest rate expectations could be a potential tool for monetary policy, even if current short-term rates cannot be reduced any further (Eggertson and Woodford, 2003; Blinder, Ehrmann, Fratzscher, De Haan, and Jansen, 2008; Rudebusch and Williams, 2008; Swanson and Williams, 2012).

In Sweden, the Riksbank's most important policy rate, the repo rate, was at the zero lower bound between 8 July 2009 and 6 July 2010.[1] As to unconventional policy, Sveriges Riksbank (the central bank of Sweden) did not purchase assets. However, the Riksbank provided banks liquidity support by offering loans in Swedish kronor at longer maturities. The first loans were granted in October 2008 and after that loans were offered regularly until the end of October 2010 (Elmér, Guibourg, Kjellberg and Nessén, 2012). In July 2009 the Riksbank decided to offer one-year fixed-interest rate loans to the banks at a low interest rate as part of its unconventional monetary policy measures (Ingves, 2012). The Riksbank's unconventional monetary policy measures also included offering loans to counterparties in US dollars, approving a wider range of securities as collateral, and increasing the number of counterparties (Ingves (2012); Elmér *et al.* (2012); Andersen (2012)).

Already before the crisis, the Riksbank had introduced forward guidance. On 15 February 2007, the Riksbank published quarterly forecasts of the repo rate for the first time. In April 2009, the Riksbank reduced the policy rate to 0.5% and indicated that 'the repo rate is expected to remain at a low level until the beginning of 2011'; in July 2009, the Riksbank reduced the policy rate to 0.25%, and changed its explicit policy rate guidance to that 'the repo rate is expected to remain at this low level until autumn 2010'.[2]

---

[1] See http://www.riksbank.se/en/Interest-and-exchange-rates/Repo-rate-table/. The Executive Board's decision to cut the repo rate to 0.25% was announced on 2 July 2009, and its decision to increase the repo rate to 0.5% was announced on 1 July 2010. These changes in the repo rate became effective on 8 July 2009 and 7 July 2010, respectively.

[2] An overview of these repo announcements is available at: http://www.riksbank.se/en/Monetary-

Recently, Swanson and Williams (2012, 2013) proposed a novel way to investigate the effectiveness of monetary policy when policy rates are (close to) zero. They estimate the time-varying sensitivity of yields to macroeconomic announcements using high-frequency data and compare that sensitivity to a benchmark period in which the ZLB was not a concern. If a particular yield is about as sensitive to news as in the benchmark sample, it is unconstrained. In contrast, if the yield responds very little or not at all to news, it is largely or completely constrained.

Following Swanson and Williams (2012, 2013), we study whether the sensitivity to economic news of short- to long-term interest rates implied by interest rate swaps in Sweden was affected by the effective zero lower bound of the policy rate. We interpret the sensitivity of longer-term interest rates to economic news as a measure of the effectiveness of monetary policy at the zero lower bound. We also investigate whether the sensitivity of interest rate swaps to economic news was affected by the introduction of forward guidance and unconventional monetary policies by the Riksbank. We interpret a reduction in the sensitivity of interest rate swaps to domestic economic news with the introduction of policy rate forecasts as evidence that financial market participants do not understand the conditionality of the guidance and focus on it too much, as in Moessner and Nelson (2008).

The outline of the paper is as follows. Section II offers a discussion of the literature and describes the Riksbank's policies during the financial crisis. Section III presents the data, section IV presents the estimation method and discusses the results, while section V concludes.

II. Background

Policy options in times of crisis

A first set of policy options centre around the zero lower bound. The 2007-2009 global financial crisis was not the first occasion on which policy rates were closing in on the zero lower bound. In the early 2000s, short-term interest rates were close to, or at zero, in a number of countries, including Japan, the United States, and Switzerland (Bernanke, Reinhart and Sack, 2004). Therefore, the options available for monetary policy at the ZLB have been discussed for some time in the literature. The starting point is that long-term interest rates are more relevant for economic decisions than the current level of the policy rate. Therefore, not only the current level of the policy rate, but also the entire path of expected future rates determines the effect

policy/Forecasts-and-interest-rate-decisions/Previous-repo-rate-decisions/.

of monetary policy on the economy. The key insight, then, is that any central bank action that influences interest rate expectations could be a potential tool for monetary policy, even if current short-term rates cannot be reduced any further. The available policy actions include communication and asset purchases (Bernanke *et al.*, 2004; Eggertson and Woodford, 2003; Blinder *et al.*, 2008; Swanson and Williams, 2012).

First, communication by the central bank may affect expectations of the path of expected interest rates. Blinder *et al.* (2008) discuss how signals by the central bank are generally relevant for formation of interest rate expectations. By implication, even when the policy rate can no longer be reduced, there is still a possibility for the monetary policy authority to influence long-term interest rates through this expectations channel (Bernanke and Reinhart, 2004; Swanson and Williams, 2012). Eggertson and Woodford (2003) show that by committing to future monetary accommodation once the zero lower bound ceases the central bank can circumvent the ZLB to be binding.

Second, central banks may use unconventional monetary policies, either in the form of asset purchases and/or liquidity support to banks. Asset purchases by the central bank may influence long-term yields. These purchases can take two forms. On the one hand, the central bank may attempt to change the composition of private sector portfolios. The effects of the former strategy hinges on the degree to which different asset classes are seen as substitutes by investors (Bernanke and Reinhart, 2004). D'Amico and King (2013) provide evidence that the Federal Reserve's purchases of U.S. Treasuries in 2009 have had an effect on yields, suggesting a degree of imperfect substitution. On the other hand, monetary policy authorities could expand the size of the central bank's balance sheet. This strategy of quantitative easing (QE) could be effective if money is an imperfect substitute for other financial assets, or if QE changes expectations of future interest rates (Bernanke and Reinhart, 2004).

The second type of unconventional monetary policy measures is liquidity assistance. On the one hand, providing liquidity is related to the role of central banks as lenders of last resort. However, providing liquidity assistance to banks could also reduce the level of short-term rates or spreads in the interbank money market. This reduction of levels or spreads through injections of additional liquidity may have a positive effect on aggregate demand (Joyce, Tong and Woods, 2011; Lenza, Pill, and Reichlin, 2010; Pattipeilohy, van den End, Tabbae, Frost and De Haan, 2013).

Swedish monetary policy during the crisis

During the crisis years, Swedish monetary policy used a combination of policy tools. The Riksbank reduced interest rates sharply, so that the repo rate was close to the ZLB between July 2009 and July 2010 (see Figure 1). The Riksbank also expanded its forward guidance on the policy rate and conducted unconventional monetary policy through liquidity assistance. Asset purchase programs were not used.

Prior to the financial crisis, a number of central banks – including the Riksbank – were already giving quantitative guidance on the future policy rates underlying their macroeconomic forecasts (Blinder *et al.*, 2008). In 2009 the Riksbank started further enhancing its forward guidance. Initially, this was 'open-ended' forward guidance, since there was no indication of when or under what conditions policy would be tightened again (Den Haan, 2013). The Riksbank introduced time-contingent forward guidance on 21 April 2009, alongside the decision to lower the repo rate to 50 basis points. The accompanying statement indicated that the policy rate was expected to remain low till early 2011. When the repo rate was lowered to 25 basis points in July 2009, the statement indicated that the repo rate was expected to remain low until Autumn 2010.[3]

[Figure 1 about here]

There is no clear agreement in previous work on the effectiveness of the Riksbank's forward guidance. On the positive side, Andersson and Hofmann (2010) find evidence that publishing an interest rate path forecast enhances the central bank's leverage over medium-term interest rates. Their conclusion is based on an analysis of the effectiveness of forward guidance for three countries, including Sweden. Kool and Thornton (2012) investigate the effectiveness of forward guidance for the central banks of four countries, including Sweden. For Sweden, they find evidence that forward guidance improved market participants' ability to forecast short-term rates over short forecast horizons. However, according to Woodford (2012), the Riksbank's time-contingent forward guidance was not so successful, as market participants' expectations were often not in line with projected policy rates. Goodhart and Rochet (2011) are also not convinced. Their empirical evidence suggests that Swedish money market rates at longer horizons do not react to the surprise component in the official policy rate path. This finding would indicate that the projected repo path at longer horizons adjusts to market rates, rather than the other way round.

---

[3] The press releases are available at http://www.riksbank.se/en/Press-and-published/Press-Releases/2009/. For further discussion, see Woodford (2013).

Liquidity assistance was a key aspect of the Riksbank's policy between 2008 and 2011. Figure 2 shows how this led to an increase in the stock of outstanding loans, while Figure 3 illustrates the resulting expansion of the central bank balance sheet. As noted by Goodhart and Rochet (2011), pressure on Swedish banks mainly resulted from large losses on exposures in the Baltic countries and Iceland. On 24 September 2008, the Riksbank established a swap line with the Federal Reserve to address a shortage of funding in U.S. dollars.[4] By the end of October, the Riksbank had lent \$23.9 billion and by the end of 2008 the total amount of loans had risen to \$25 billion (Allen and Moessner, 2010).

[Figures 2 and 3 about here]

By early October 2008, pressure had also substantially increased in Swedish long-term funding markets, leading the Riskbank to establish a SEK 60 billion loan facility.[5] Until the end of October 2010, loans in Swedish kronor were regularly offered, both at fixed and variable interest rates, and for various maturities. As suggested by Figure 2, most of the outstanding loans had matured in 2010. At most, the outstanding amount of loans in Swedish kronor amounted to 9% of GDP (Elmér *et al.*, 2012; Ingves, 2012). As to the effect of the liquidity assistance, Elmer *et al.* (2012) find that short-term rates were reduced by at most 20 basis points, while longer-term rates were reduced by up to two times that amount when the Riksbank projected a low repo rate over a long period of time, while simultaneously announcing a 12-month fixed-rate loan.

III. Data

We use daily data on interest rate swaps with maturities of 1, 2, 5 and 10 years between 1 June 1998 and 31 May 2013 from Bloomberg. Figure 4 shows the development in swap rates over the sample period. Between 1998 and 2005 rates mostly moved in a band between 2 and 6 percent. There was a steady rise in rates between 2006 and 2008, followed by a sharp drop in line with the various cuts in the repo rate. The swap yield curve was relatively steep in 2009 and 2010, but has flattened out in recent years.

The surprises of the real-time macroeconomic data releases are calculated relative to Bloomberg median survey expectations, and are normalized by their standard deviation over the period June

---

[4]The press release is available at http://www.riksbank.se/en/Press-and-published/Press-Releases/2008/Central-Banks-Announce-Swap-Facilities-with-US-Federal-Reserve-.

[5]The press release is available at http://www.riksbank.se/en/Press-and-published/Press-Releases/2008/Riksbank-lends-SEK-60-billion-over-three-months/.

1998 to June 2012. The following macroeconomic indicators for Sweden are included: CPI inflation, PPI inflation, the unemployment rate, retail sales, consumer confidence, GDP, industrial production, and the trade balance. The following US macroeconomic indicators are used: CPI inflation, GDP, hourly earnings, housing starts, industrial production, the ISM manufacturing index, changes in nonfarm payrolls, PPI inflation, retail sales, the trade balance, and the unemployment rate.

The series for Swedish survey data for CPI inflation is available almost every month from the start of the sample period in June 1998, with missing values only in five months prior to 2002, and no missing values from 2002. But the other series for Swedish survey data either start later and/or exhibit some larger gaps of missing values. These gaps occurred when Bloomberg received fewer than three survey responses for a particular indicator in a particular month. Consequently, Bloomberg did not publish summary statistics for that indicator and month, since they would not be meaningful. In the following, we therefore present regression results when only CPI inflation surprises are included as Swedish data, and regression results when all Swedish indicators are included.

[Figure 4 about here]

IV. Method and results

We regress daily changes in interest rate swaps with maturities of $m =$1, 2, 5 and 10 years, $y^m(t) - y^m(t-1)$, in basis points, on the normalized surprise components of US and domestic economic data releases, $sur_j^{US}(t)$ and $sur_j^d(t)$, respectively, and interact the right-hand side variables with a dummy variable for the zero lower bound of the policy rate, $dum_{ZLB}(t)$. The regression equation takes the form

$$y^m(t) - y^m(t-1) = c + c_{ZLB} * dum_{ZLB}(t) + \sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t) * (1 + f_{ZLB} * dum_{ZLB}(t)) +$$

$$\sum_{j=1}^{n^d} b_j * sur_j^d(t) * (1 + g_{ZLB} * dum_{ZLB}(t)) + \varepsilon_t \qquad (1)$$

where the superscript d refers to domestic Swedish data, n^d is the number of domestic macroeconomic indicators, and $n^{US} = 11$ is the number of US macroeconomic indicators included in the regression. The Executive Board's decision to cut the repo rate to 0.25% was announced on 2 July 2009, and its decision to increase the repo rate to 0.5% was announced on 1 July 2010.

These changes in the repo rate became effective on 8 July 2009 and 7 July 2010, respectively. Since efficient market prices incorporate news at the time of its announcements, we define the dummy variable $dum_{ZLB}(t)$ based on the announcement dates of the repo rate changes. The dummy variable $dum_{ZLB}(t)$ takes on the value of one from 2 July 2009, the day the repo rate cut to 0.25% was announced, to 30 June 2010, the day before the repo rate increase to 0.5% was announced, and and zero otherwise. The regression is estimated using nonlinear least squares and Newey-West adjusted standard errors.

[Tables 1 and 2 about here]

The results for equation (1) are shown in Table 1 when all Swedish and US macroeconomic news indicators are included ($n^d = 8$). At all maturities the surprises concerning US and Swedish data have the expected sign when they are significant. Surprises regarding CPI inflation has the largest coefficient among the Swedish indicators and is significant at the 1% level at all maturities. The results suggest that the sensitivity of interest rate swaps to Swedish macroeconomic news is reduced by around 80% at the zero lower bound for the shorter maturities of 1 and 2 years, at the 1% significance level, but is unaffected at the longer maturities of 5 and 10 years. The sensitivity of interest rate swaps to US macroeconomic news is not significantly affected at any maturity by the zero lower bound.

Table 2 shows the corresponding regressions when only surprises concerning Swedish CPI inflation are included ($n^d = 1$) along with surprises concerning US indicators. Similar to the findings as reported in Table 1, the sensitivity of interest rate swaps to Swedish CPI inflation surprises is reduced by around 80% at the zero lower bound for maturities of 1 and 2 years, but now at the 1% significance level at the 1-year maturity and only at the 5% significance level at the 2-year maturity, and it is unaffected at the longer maturities of 5 and 10 years. The result that the sensitivity of interest rate swaps to US macroeconomic news is not significantly affected at any maturity by the zero lower bound also holds.

These results suggest that monetary policy remained effective at the zero lower bound at longer horizons in Sweden. This could be due to the forward guidance by the Riksbank, which was already in place before the height of the global financial crisis with the collapse of Lehman Brothers, as well as unconventional monetary policy measures mentioned above. In the next steps of the analysis we therefore zoom in on the periods during which these policies were in place.

First, we investigate whether the sensitivity of interest rate swaps to economic news is affected by the introduction of forward guidance by the Riksbank. To do so, we regress daily changes in interest rate swaps on the surprise components of US and domestic economic data releases, and now interact the right-hand side variables with a dummy variable for the period when the Riksbank provided forward guidance, $dum_{FG}(t)$. The regression equation takes the form

$$
\begin{aligned}
y^m(t) - y^m(t-1) \quad = \quad & c + c_{FG} * dum_{FG}(t) + \sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t) * (1 + f_{FG} * dum_{FG}(t)) + \\
& \sum_{j=1}^{n^d} b_j * sur_j^d(t) * (1 + g_{FG} * dum_{FG}(t)) + \varepsilon_t
\end{aligned}
\tag{2}
$$

The dummy variable $dum_{FG}(t)$ takes the value of one after the Riksbank started publishing forecasts of its policy rate, i.e. 15 February 2007, and is zero otherwise.

[Tables 3 and 4 about here]

The results for equation (2) when news on all Swedish macroeconomic indicators is included ($n^d = 8$) are shown in Table 3. The results suggest that the sensitivity of interest rate swaps to Swedish macroeconomic news is not significantly affected at any maturity by the forward guidance. This implies that market participants did not reduce their attention to Swedish macroeconomic news, which suggests that they understood the conditionality of the Riksbank's policy rate forecasts and did not take them as unconditional commitments. The sensitivity of interest rate swaps to US macroeconomic news is reduced by around 35% at the 5% significance level for maturities of 2 and 10 years by the introduction of forward guidance. For the other maturities, the coefficient on the dummy variable is also negative, but it is not significant at the 10% level. This suggests that the Riksbank's forward guidance led market participants to focus somewhat less on US news, which is not necessarily a sign that they did not understand the conditionality of the forward guidance, but might be a desirable reduction of attention paid to international news, possibly due to a better understanding of the Riksbank's reaction function.

The corresponding results for equation (2) when only surprises concerning Swedish CPI inflation are included along with news about US macroeconomic indicators ($n^d = 1$) are shown in Table 4. The results are very similar to those reported in Table 3, although the level of significance of the change in the sensitivity of 2-year interest rate swaps to US macroeconomic news is reduced to 10%.

9

Next, we investigate whether the sensitivity of interest rate swaps to economic news is affected by the Riksbank's unconventional monetary policies. We regress daily changes in interest rate swaps on the surprise components of US and domestic economic data releases, and now interact the right-hand side variables with a dummy variable, $dum_{UMP}(t)$, for the period starting when the Riksbank announced a swap line with the Federal Reserve on 24 September 2008, until 6 October 2010, i.e. the day before the last of its one-year fixed-interest rate loans was repaid. The regression equation takes the form

$$y^m(t) - y^m(t-1) = c + c_{UMP} * dum_{UMP}(t) + \sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t) * (1 + f_{UMP} * dum_{UMP}(t)) +$$

$$\sum_{j=1}^{n^d} b_j * sur_j^d(t) * (1 + g_{UMP} * dum_{UMP}(t)) + \varepsilon_t \tag{3}$$

The dummy variable $dum_{UMP}(t)$ takes on the value of one from 24 September 2008 to 6 October 2010, and zero otherwise. This period includes the Riksbank's liquidity provision in US dollars and at fixed interest rates at the 12-month maturity in Swedish kronor (see Figure 2), which led to a large increase in the size of the Riksbank's balance sheet (see Figure 3).

[Tables 5 and 6 about here]

The results for equation (3) when all Swedish news indicators are included are shown in Table 5. We can see that neither the sensitivity of interest rate swaps to Swedish nor to US news is significantly affected at any maturity by the Riksbank's unconventional monetary policies. The same results hold when only Swedish CPI surprises along with US news indicators are included, as shown in Table 6.

Next, we include the dummy variables for the zero lower bound, the Riksbank's forward guidance and the Riksbank's unconventional monetary policy in a single regression,

$$y^m(t) - y^m(t-1) = c + (c_{ZLB} * dum_{ZLB}(t) + c_{FG} * dum_{FG}(t) + c_{UMP} * dum_{UMP}(t)) +$$

$$\sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t)(1 + f_{ZLB} * dum_{ZLB}(t) + f_{FG} * dum_{FG}(t) + f_{UMP} * dum_{UMP}(t)) +$$

$$\sum_{j=1}^{n^d} b_j * sur_j^d(t)(1 + g_{ZLB} * dum_{ZLB}(t) + g_{FG} * dum_{FG}(t) + g_{UMP} * dum_{UMP}(t)) + \varepsilon_t$$

$$\tag{4}$$

The results for equation (4) when all Swedish macroeconomic indicators are included are shown in Table 7. Compared to the results reported in Table 1, the sensitivity of interest rate swaps

to domestic news continues to be significantly reduced by the zero lower bound at the 2-year maturity, but at a lower significance level of 5%, and with a larger reduction of around 100%, while it is no longer affected at the 1-year maturity. It also continues to be unaffected at the longer maturities of 5 and 10 years. The sensitivity of interest rate swaps to US news continues to be unaffected by the zero lower bound. We can also see that the sensitivity of interest rate swaps to domestic macroeconomic news continues not to be significantly affected at any maturity by the Riksbank's forward guidance. But now the sensitivity of interest rate swaps to US macroeconomic news is reduced by the Riksbank's forward guidance at the 5% or 1% significance level for all of the maturities of 1, 2, 5 and 10 years, and not just at two of the maturities as was the case in Table 3, and by a larger amount of around 45% to 50%. Moreover, the sensitivity of interest rate swaps to Swedish and US news continues not to be significantly affected at any maturity by the Riksbank's unconventional monetary policies. The results for equation (4) when only Swedish CPI news is included along with news about US macroeconomic indicators are shown in Table 8. The results just described for Table 7 carry over, except that the sensitivity of interest rate swaps to domestic news is no longer affected by the zero lower bound at the 2-year maturity.

[Tables 7 and 8 about here]

Finally, we report results of Wald tests for the null hypothesis that the coefficients on the dummy variables interacted with macroeconomic data surprises are equal to -1, for each of the regressions performed above (see Table 9). A coefficient of -1 would imply that the reactions to macroeconomic news have been completely attenuated. The most striking result is that we can reject at the 10% level in almost all cases that the coefficient of the dummy variable for forward guidance is equal to -1, both when interacted with Swedish and US data surprises, and both for the individual regressions of Tables 3 and 4 and for the combined regressions of Tables 7 and 8. The only exception is for g_{FG} on Swedish CPI inflation surprises for the regression of Tables 4 and 8, where a value of -1 cannot be rejected at conventional significance levels, although the p-values are small (p-values of 0.13 and 0.11, respectively). For the coefficient of the dummy variable for the zero lower bound, we can reject a value of -1 at the 10% level in all cases for US data surprises, but in none of the cases for Swedish data surprises. This is consistent with finding no significantly negative coefficient for the dummy variable for the zero lower bound interacted with US data surprises in Tables 1, 2, 7 and 8. It is also consistent with finding a

11

significantly negative value for g_{ZLB} for Swedish data surprises in the regressions of Tables 1 and 2 for the 1- and 2-year maturities, and partly reflects large standard errors for the 5- and 10-year maturities, for which g_{ZLB} is not significantly negative. For the coefficient of the dummy variable for unconventional monetary policies, we can reject a value of -1 at the 10% level in all cases for US data surprises, which is consistent with finding no significantly negative coefficient for the dummy variable for unconventional monetary policies interacted with US data surprises in Tables 5 to 8. But we cannot reject a value of -1 at the 10% level in some cases when the dummy variable for unconventional monetary policy is interacted with Swedish data surprises, even though none of the coefficients is significant in Tables 5 to 8, which partly reflects large standard errors.

[Table 9 about here]

V. Conclusions

We study whether the sensitivity to economic news of short- to long-term interest rates implied by interest rate swaps in Sweden was affected by the zero lower bound of the policy rate. We interpret the sensitivity of longer-term yields to economic news as a measure of the effectiveness of monetary policy. We also investigate whether the sensitivity of interest rate swaps to economic news was affected by the introduction of forward guidance and unconventional monetary policies by the Riksbank. We interpret a reduction in the sensitivity of interest rate swaps to domestic economic news with the introduction of forward guidance as evidence that financial market participants do not understand the conditionality of the guidance.

We find some evidence that the sensitivity of interest rate swaps to Swedish macroeconomic news was reduced at the zero lower bound for the shorter maturities of 1 and 2 years, but was unaffected at the longer maturities of 5 and 10 years. This suggests that monetary policy remained effective at the zero lower bound at longer horizons in Sweden. This could be due to forward guidance by the Riksbank, which was already in place before the height of the global financial crisis, as well as unconventional monetary policy measures. We also find that the sensitivity of interest rate swaps to Swedish macroeconomic news was not significantly affected at any maturity by the forward guidance. This implies that market participants did not reduce their attention to Swedish macroeconomic news, which suggests that they understood the conditionality of the Riksbank's policy rate forecasts, and did not take them as uncondi-

tional commitments. Our results also suggest that the Riksbank's forward guidance led market participants to focus somewhat less on US news, which is not necessarily a sign that they did not understand the conditionality of the forward guidance. In fact, it might be a desirable reduction of the attention paid to international news, possibly due to a better understanding of the Riksbank's reaction function. Moreover, we find that the sensitivity of interest rate swaps to Swedish and US macroeconomic news was not significantly affected at any maturity by the Riksbank's unconventional monetary policies.

References

[1] Allen, W. and Moessner, R. (2010). Central Bank Co-operation and International Liquidity in the Financial Crisis of 2008-9, BIS Working Paper no. 310, Basle.

[2] Andersen, R. (2012). Quantitative Easing the Swedish Way, Federal Reserve Bank of San Francisco Economic Synopses no. 33, 1-2.

[3] Andersson, M. and Hofmann, B. (2010). Gauging the Effectiveness of Quantitative Forward Guidance: Evidence from Three Inflation Targeters, in Cobham, D., Eitrheim, O., Gerlach, S. and Qvigstad, J. (eds.), *Inflation Targeting Twenty Years On: Past Lessons and Future Prospects.* New York, Cambridge University Press, 368–397.

[4] Bank of England (2013). Monetary Policy Trade-offs and Forward guidance. Available at http://www.bankofengland.co.uk/publications/Documents/inflationreport/2013/ ir13augforwardguidance.pdf.

[5] Bernanke, B. S. and Reinhart, V.R. (2004). Conducting Monetary Policy at Very Low Short-Term Interest Rates, *American Economic Review 94*, 85–90.

[6] Bernanke, B. S., Reinhart, V.R. and Sack, B.P. (2004). Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment, *Brooking Papers on Economic Activity 2*, 1–100.

[7] Blinder, A. S., Ehrmann, M., Fratzscher, M., De Haan, J. and Jansen, D. (2008). Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence, *Journal of Economic Literature 46*, 910–45.

[8] Borio, C. and Disyatat, P. (2010). Unconventional Monetary Policies: An Appraisal, *The Manchester School 78*, 53–89.

[9] D'Amico, S. and King, T.B. (2012). Flow and Stock Effects of Large-scale Treasury Purchases: Evidence on the Importance of Local Supply. *Journal of Financial Economics 108*, 425–448.

[10] Den Haan, W. (2013). Introduction. In: Den Haan, W. (ed), *Forward Guidance: Perspectives from Central Bankers, Scholars and Market Participants*, CEPR, London, 1–21.

[11] Eggertsson, G. B. and Woodford, M. (2003). The Zero Bound on Interest Rates and Optimal Monetary Policy. *Brookings Papers on Economic Activity 1*, 193–233.

[12] Elmér, H., Guibourg, G., Kjellberg, D. and Nessén, M. (2012). The Riksbank's Monetary Policy Measures During the Financial Crisis. Evaluation and Lessons Learnt, Sveriges Riksbank Economic Review 3, 8-31. Available at: www.riksbank.se/Documents/Rapporter/POV/2012/rap_pov_121017_eng.pdf.

[13] Goodhart, C. and Rochet, J-C. (2011). Evaluation of the Riksbank's Monetary Policy and Work with Financial Stability 2005-2010. Available at

http://www.riksbank.se/Upload/Dokument_riksbank/Kat_publicerat/Rapporter/2011/

Goodhart%20Rochet%20engelska.pdf.

[14] Ingves, S. (2012). Presentation at ECB colloquium: "Monetary policy in unconventional times", Frankfurt, 16 May. Available at http://www.ecb.europa.eu/events/pdf/conferences/colloq_papad/Ingves_Colloquiumpaper.pdf ?37a665cf198cea9ae21366b48e1bb8ab.

[15] Joyce, M., Tong, M. and Woods, R. (2011). The United Kingdom's Quantitative Easing Policy: Design, Operation and Impact, *Bank of England Quarterly Bulletin* 2011:3.

[16] Kool, C. and Thornton, D. (2012). How Effective is Central Bank Forward Guidance? Federal Reserve Bank of St. Louis Working Paper no. 2012-063A, St. Louis.

[17] Lenza, M., Pill, H. and Reichlin, L. (2010). Monetary Policy in Exceptional Times. *Economic Policy.* April, 295-339.

[18] Moessner, R. and Nelson, W. (2008). Central Bank Policy Rate Guidance and Financial Market Functioning. *International Journal of Central Banking 4*, 193-226.

[19] Pattipeilohy, C., van den End, J.W., Tabbae, M., Frost, J. and De Haan, J (2013). Unconventional Monetary Policy of the ECB during the Financial Crisis: An Assessment and New Evidence. DNB Working Paper no. 381, Amsterdam.

[20] Raskin, M. (2013). The Effects of the Federal Reserve's Date-Based Forward Guidance, Federal Reserve Board Finance and Economics Discussion Series no. 2013-37, Washington.

[21] Riksbank (2010), Financial Stability Review 2010:2.

[22] Rudebusch, G. D. and Williams, J.C. (2008). Revealing the Secrets of the Temple: The Value of Publishing Central Bank Interest Rate Projections. In: Campbell, J.Y. (ed.), *Asset Prices and Monetary Policy*, Chicago, University of Chicago Press, pp. 247-284.

[23] Svensson, Lars E.O. (2011). Practical Monetary Policy: Examples from Sweden and the United States. *Brookings Papers on Economic Activity*, Fall, 289–332.

[24] Swanson, E. and Williams, J. (2012). Measuring the Effect of the Zero Lower Bound on Medium- and Longer-Term Interest Rates. Federal Reserve Bank of San Francisco Working Paper no. 2012-02, San Francisco.

[25] Swanson, E. and Williams, J. (2013). Measuring the Effect of the Zero Lower Bound on Yields and Exchange Rates in the U.K. and Germany, *Journal of International Economics*, forthcoming.

[26] Woodford, M. (2012). Methods of Policy Accommodation at the Interest-Rate Lower Bound. Paper presented at Jackson Hole Symposium on "The Changing Policy Landscape", August 31-September 1.

[27] Woodford, M. (2013). Forward Guidance by Inflation-Targeting Central Banks, *Sveriges Riksbank Economic Review* 2013-3, 81–120.

Figure 1: Riksbank's repo rate (in percent).
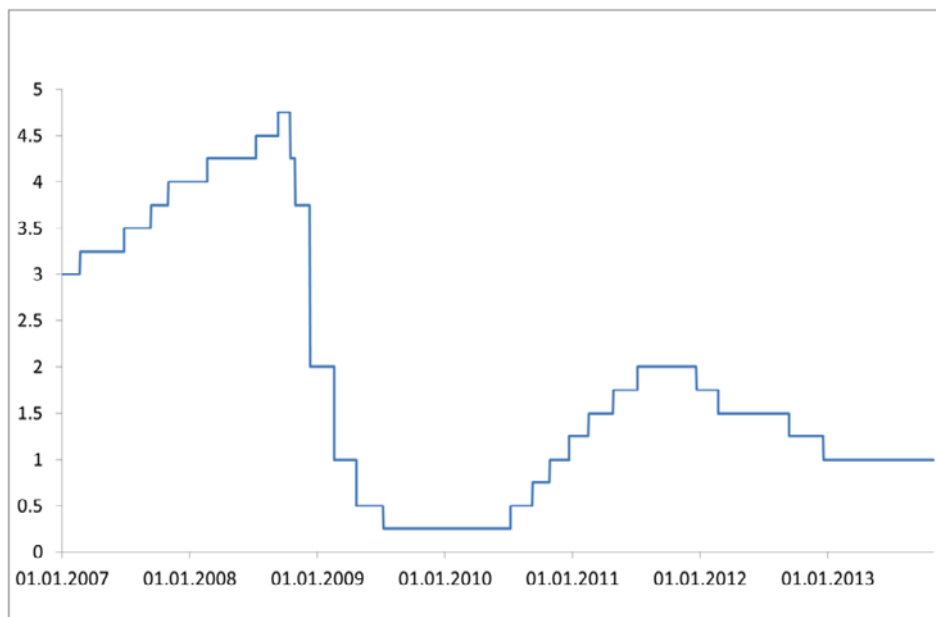
Source: Riksbank Monetary Policy Report October 2013.
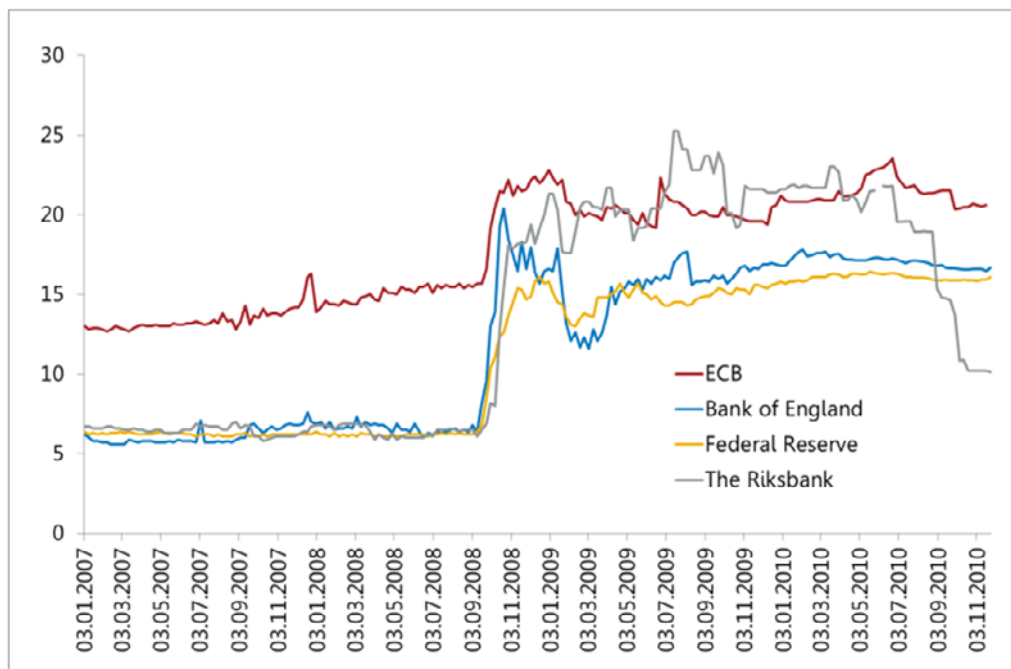

Figure 2: The Riksbank's outstanding loans (SEK billion)
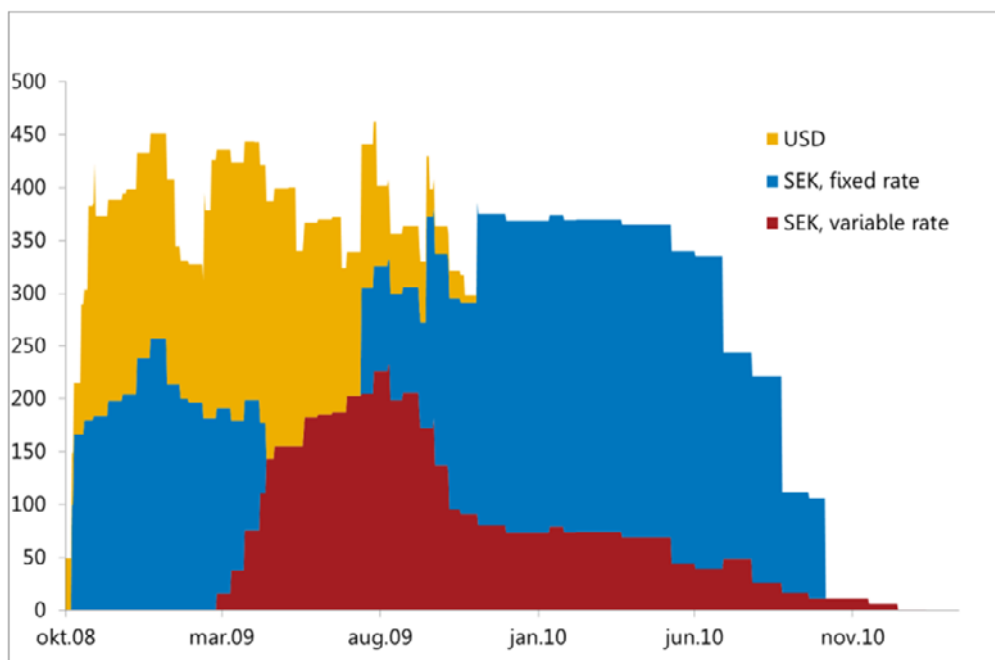
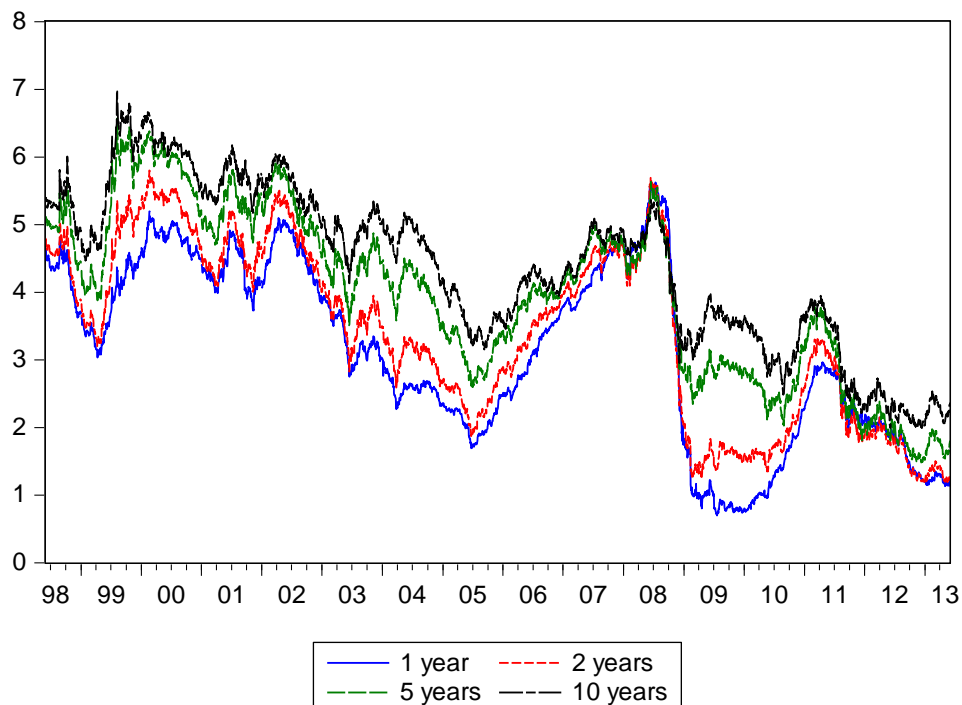Note: The Riksbank's loans with commercial paper as collateral are not included.
Source: Riksbank Financial Stability Review 2010:2.

Figure 3: Central bank balance sheets (percentage of GDP)

Source: ECB, Bank of England, Federal Reserve, Riksbank Financial Stability Review 2010:2.

Figure 4: Swedish interest rate swaps (in percent).

Source: Bloomberg.

Table 1: Effect of zero lower bound on reactions of Swedish interest rate swaps to macroeconomic news

	1 year	2 years	5 years	10 years
c	-0.08	-0.06	-0.04	-0.03
c_{ZLB}	0.13	0.05	-0.19	-0.32
US non-farm payrolls	1.51***	1.68***	2.18***	1.96***
US ISM	0.99***	1.53***	1.81***	1.95***
US unemployment rate	-0.26	-0.43	-0.77*	-0.72*
US retail sales	0.40	0.81**	1.06***	1.06**
US industrial production	0.84**	1.00**	0.86**	0.71**
US housing starts	-0.01	-0.19	-0.03	0.16
US CPI	0.17	0.19	0.23	0.47
US PPI	-0.09	-0.14	-0.13	-0.07
US hourly earnings	0.72**	1.12***	1.52***	1.57***
US trade	0.79**	1.03**	0.83**	0.56*
US GDP	-0.54	-0.49	-0.71	-0.81
f_{ZLB} (on US data surprises)	0.56	0.11	0.21	0.06
SE CPI	2.29***	2.89***	1.94***	1.26***
SE PPI	0.52	0.48	0.47	0.02
SE unemployment rate	-0.89***	-1.30***	-0.76*	-0.45
SE retail sales	0.65**	0.83**	0.42	0.34
SE consumer confidence	0.03	0.60*	0.22	0.09
SE GDP	0.53	0.64	0.46	-0.03
SE industrial production	0.61*	1.02**	0.66	0.47
SE trade balance	-0.13	0.14	0.77*	0.85**
g_{ZLB} (on SE data surprises)	-0.77***	-0.76***	-0.23	-0.64
Adjusted R-squared	0.03	0.04	0.03	0.02

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 2: Effect of zero lower bound on reactions of Swedish interest rate swaps to macroeconomic news, for US data and Swedish CPI

	1 year	2 years	5 years	10 years
c	-0.07	-0.06	-0.03	-0.03
c_{ZLB}	0.13	0.06	-0.19	-0.32
US non-farm payrolls	1.51***	1.68***	2.18***	1.96***
US ISM	0.99***	1.54***	1.82***	1.95***
US unemployment rate	-0.26	-0.42	-0.76*	-0.71*
US retail sales	0.39	0.80*	1.06***	1.06**
US industrial production	0.88***	1.06**	0.90***	0.72**
US housing starts	-0.03	-0.21	-0.04	0.15
US CPI	0.17	0.19	0.23	0.47
US PPI	-0.08	-0.13	-0.14	-0.06
US hourly earnings	0.72**	1.13***	1.53***	1.58***
US trade	0.80**	1.05**	0.84**	0.57*
US GDP	-0.49	-0.44	-0.60	-0.80
f_{ZLB} (on US data surprises)	0.55	0.10	0.19	0.05
SE CPI	2.37***	3.00***	2.04***	1.30***
g_{ZLB} (on SE CPI surprises)	-0.81***	-0.78**	-0.65	-0.60
Adjusted R-squared	0.03	0.04	0.03	0.02

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 3: Effect of Riksbank's forward guidance on reactions of Swedish interest rate swaps to macroeconomic news

	1 year	2 years	5 years	10 years
c	-0.01	0.01	0.02	0.00
c_{FG}	-0.14	-0.16	-0.16	-0.12***
US non-farm payrolls	1.60***	1.91***	2.34***	2.16***
US ISM	1.21***	1.78***	2.10***	2.24
US unemployment rate	-0.26	-0.46	-0.75	-0.64***
US retail sales	0.60*	1.06*	1.30***	1.40***
US industrial production	1.15***	1.28***	1.10***	1.02
US housing starts	-0.02	-0.28	-0.13	0.08
US CPI	0.26	0.24	0.27	0.55
US PPI	-0.19	-0.21	-0.14	-0.02***
US hourly earnings	0.98**	1.34***	1.74***	1.77*
US trade	0.94**	1.28**	1.04**	0.77
US GDP	-1.03*	-0.87	-0.94	-0.95**
f_{FG} (on US data surprises)	-0.34	-0.37**	-0.29	-0.34**
SE CPI	2.41***	2.90***	1.85***	1.07
SE PPI	0.67**	0.52*	0.47*	0.10
SE unemployment rate	-0.86***	-1.20**	-0.71*	-0.30
SE retail sales	0.62*	0.78*	0.37	0.25
SE consumer confidence	0.06	0.64	0.20	0.04
SE GDP	0.45	0.78	0.59	0.22
SE industrial production	0.67*	1.11**	0.62	0.44
SE trade balance	-0.02	0.21	0.74*	0.62
g_{FG} (on SE data surprises)	-0.28	-0.14	0.07	0.35
Adjusted R-squared	0.03	0.04	0.03	0.02

   ***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 4: Effect of Riksbank's forward guidance on reactions of Swedish interest rate swaps to macroeconomic news, for US data and Swedish CPI

	1 year	2 years	5 years	10 years
c	0.00	0.03	0.03	0.01
c_{FG}	-0.15	-0.18	-0.17	-0.12
US non-farm payrolls	1.60***	1.90***	2.34***	2.16***
US ISM	1.21***	1.78***	2.10***	2.24***
US unemployment rate	-0.26	-0.45	-0.75	-0.63
US retail sales	0.58*	1.04*	1.30***	1.40***
US industrial production	1.16***	1.32***	1.13***	1.04***
US housing starts	-0.03	-0.29	-0.13	0.08
US CPI	0.26	0.25	0.27	0.56
US PPI	-0.19	-0.20	-0.13	-0.01
US hourly earnings	0.98**	1.34***	1.74***	1.77***
US trade	0.95**	1.27**	1.03**	0.76*
US GDP	-0.90	-0.73	-0.81	-0.89
f_{FG} (on US data surprises)	-0.33	-0.35*	-0.28	-0.34**
SE CPI	2.56***	3.18***	2.07***	1.22**
g_{FG} (on SE CPI surprises)	-0.38	-0.32	-0.18	0.06
Adjusted R-squared	0.03	0.04	0.03	0.02

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 5: Effect of Riksbank's unconventional monetary policy on reactions of Swedish interest rate swaps to macroeconomic news

	1 year	2 years	5 years	10 years
c	0.03	0.03	0.01	0.00
c_{UMP}	-0.70**	-0.59**	-0.46**	-0.37
US non-farm payrolls	1.51***	1.71***	2.17***	1.99***
US ISM	1.02***	1.61***	1.73***	1.98***
US unemployment rate	-0.23	-0.41	-0.75*	-0.69*
US retail sales	0.45	0.93**	0.93**	1.14**
US industrial production	0.88**	1.08***	0.77**	0.74**
US housing starts	-0.04	-0.22	-0.04	0.13
US CPI	0.18	0.11	0.24	0.43
US PPI	-0.07	-0.17	-0.12	-0.12
US hourly earnings	0.79**	1.15***	1.57***	1.59***
US trade	0.79*	1.04**	0.85**	0.60*
US GDP	-0.76	-0.69	-0.67	-0.89
f_{UMP} (on US data surprises)	0.04	-0.17	0.23	-0.10
SE CPI	2.35***	2.82***	1.86***	1.05***
SE PPI	0.66**	0.48*	0.46*	0.08
SE unemployment rate	-0.89***	-1.22**	-0.68*	-0.19
SE retail sales	0.62*	0.73**	0.38	0.31
SE consumer confidence	0.16	0.68*	0.22	0.02
SE GDP	0.63	0.78	0.57	0.26
SE industrial production	0.50	0.99**	0.68	0.64
SE trade balance	0.09	0.20	0.76*	0.60*
g_{UMP} (on SE data surprises)	-0.50	-0.14	0.15	0.71
Adjusted R-squared	0.04	0.04	0.03	0.02

*** , ** , and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 6: Effect of Riksbank's unconventional monetary policy on reactions of Swedish interest rate swaps to macroeconomic news, for US data and Swedish CPI

	1 year	2 years	5 years	10 years
c	0.03	0.03	0.02	0.01
c_{UMP}	-0.70**	-0.58**	-0.46**	-0.38
US non-farm payrolls	1.51***	1.71***	2.18***	2.00***
US ISM	1.02***	1.62***	1.75***	1.99***
US unemployment rate	-0.23	-0.40	-0.75*	-0.68*
US retail sales	0.42	0.92*	0.95**	1.18**
US industrial production	0.90**	1.13***	0.82**	0.76**
US housing starts	-0.06	-0.24	-0.05	0.14
US CPI	0.18	0.12	0.24	0.43
US PPI	-0.06	-0.15	-0.10	-0.11
US hourly earnings	0.79**	1.16***	1.57***	1.59***
US trade	0.80**	1.04**	0.82**	0.57*
US GDP	-0.65	-0.57	-0.53	-0.82
f_{UMP} (on US data surprises)	0.07	-0.15	0.22	-0.13
SE CPI	2.43***	2.98***	2.03***	1.26***
g_{UMP} (on SE CPI surprises)	-0.48	-0.29	-0.22	-0.07
Adjusted R-squared	0.03	0.04	0.03	0.02

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 7: Effect of zero lower bound and the Riksbank's forward guidance and unconventional monetary policy on reactions of Swedish interest rate swaps to macroeconomic news

	1 year	2 years	5 years	10 years
c	-0.01	0.02	0.02	0.00
c_{ZLB}	1.45***	1.08**	0.43	0.05
c_{FG}	0.11	0.04	-0.01	0.00
c_{UMP}	-1.50***	-1.14**	-0.67*	-0.40
US non-farm payrolls	1.67***	1.95***	2.40***	2.18***
US ISM	1.18***	1.73***	2.02***	2.24***
US unemployment rate	-0.29	-0.42	-0.65	-0.62
US retail sales	0.49	0.89*	0.94**	1.25**
US industrial production	1.06***	1.21***	0.94***	1.02***
US housing starts	-0.05	-0.30	-0.18	0.05
US CPI	0.23	0.31	0.39	0.61
US PPI	-0.21	-0.23	-0.01	0.06
US hourly earnings	0.98**	1.38***	1.88***	1.77***
US trade	0.96**	1.41***	1.25***	0.88**
US GDP	-0.77	-0.71	-0.74	-0.95
f_{ZLB} (on US data surprises)	0.53	0.22	0.03	0.23
f_{FG} (on US data surprises)	-0.46**	-0.48**	-0.53***	-0.44**
f_{UMP} (on US data surprises)	0.12	0.19	0.60	0.14
SE CPI	2.36***	2.87***	1.84***	1.01**
SE PPI	0.67**	0.50	0.43	-0.02
SE unemployment rate	-0.90***	-1.25***	-0.66*	-0.33
SE retail sales	0.70**	0.94**	0.46	0.34
SE consumer confidence	0.12	0.60	0.17	0.04
SE GDP	0.66	0.65	0.54	0.24
SE industrial production	0.50	1.10***	0.73	0.57
SE trade balance	0.02	0.12	0.71	0.61
g_{ZLB} (on SE data surprises)	-0.42	-1.03**	-0.65	-1.75
g_{FG} (on SE data surprises)	-0.05	-0.14	-0.01	0.11
g_{UMP} (on SE data surprises)	-0.28	0.42	0.51	1.28
Adjusted R-squared	0.04	0.04	0.03	0.02

 ***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 8: Effect of zero lower bound and the Riksbank's forward guidance and unconventional monetary policy on reactions of Swedish interest rate swaps to macroeconomic news, for US data and Swedish CPI

	1 year	2 years	5 years	10 years
c	0.01	0.03	0.03	0.01
c_{ZLB}	1.44***	1.10**	0.43	0.06
c_{FG}	0.09	0.00	-0.03	0.00
c_{UMP}	-1.48***	-1.13**	-0.66	-0.41
US non-farm payrolls	1.67***	1.94***	2.40***	2.18***
US ISM	1.15***	1.72***	2.02***	2.24***
US unemployment rate	-0.28	-0.43	-0.66	-0.62
US retail sales	0.45	0.87	0.95**	1.27**
US industrial production	1.06***	1.25***	0.98***	1.04***
US housing starts	-0.07	-0.32	-0.18	0.05
US CPI	0.23	0.33	0.39	0.61*
US PPI	-0.20	-0.22	-0.01	0.07
US hourly earnings	0.98**	1.39***	1.88***	1.77***
US trade	0.99**	1.40***	1.21***	0.84**
US GDP	-0.65	-0.61	-0.62	-0.92
f_{ZLB} (on US data surprises)	0.49	0.19	0.01	0.22
f_{FG} (on US data surprises)	-0.46**	-0.47**	-0.51***	-0.44**
f_{UMP} (on US data surprises)	0.18	0.22	0.59	0.13
SE CPI	2.56***	3.17***	2.07***	1.22**
g_{ZLB} (on SE CPI surprises)	-0.51	-0.80	-0.76	-0.93
g_{FG} (on SE CPI surprises)	-0.26	-0.32	-0.12	0.12
g_{UMP} (on SE CPI surprises)	-0.06	0.33	0.26	0.26
Adjusted R-squared	0.04	0.04	0.03	0.02

***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013.

Table 9: p-values for Wald tests of whether coefficient on dummy variable interacted with macroeconomic data surprises is equal to –1

	1 year	2 years	5 years	10 years
Regression of Table 1				
f_{ZLB} (on US data surprises)	0.0475	0.0278	0.0009	0.0055
g_{ZLB} (on SE surprises)	0.2919	0.3537	0.1071	0.4814
Regression of Table 2				
f_{ZLB} (on US data surprises)	0.0472	0.0281	0.0011	0.0058
g_{ZLB} (on SE CPI surprises)	0.4461	0.4965	0.5004	0.5783
Regression of Table 3				
f_{FG} (on US data surprises)	0.0018	0.0005	0.0000	0.0001
g_{FG} (on SE surprises)	0.0004	0.0001	0.0069	0.0641
Regression of Table 4				
f_{FG} (on US data surprises)	0.0017	0.0004	0.0000	0.0001
g_{FG} (on SE CPI surprises)	0.0084	0.0038	0.0373	0.1251
Regression of Table 5				
f_{UMP} (on US data surprises)	0.0269	0.0162	0.0004	0.0035
g_{UMP} (on SE surprises)	0.1463	0.0137	0.0397	0.0924
Regression of Table 6				
f_{UMP} (on US data surprises)	0.0244	0.0165	0.0005	0.0050
g_{UMP} (on SE CPI surprises)	0.2340	0.0915	0.2241	0.3568
Regression of Table 7				
f_{ZLB} (on US data surprises)	0.0474	0.0261	0.0323	0.0070
f_{FG} (on US data surprises)	0.0131	0.0085	0.0093	0.0017
f_{UMP} (on US data surprises)	0.0329	0.0056	0.0002	0.0024
g_{ZLB} (on SE surprises)	0.2532	0.9594	0.7141	0.6457
g_{FG} (on SE surprises)	0.0000	0.0001	0.0086	0.0823
g_{UMP} (on SE surprises)	0.1348	0.0010	0.0766	0.1233
Regression of Table 8				
f_{ZLB} (on US data surprises)	0.0601	0.0346	0.0387	0.0084
f_{FG} (on US data surprises)	0.0115	0.0065	0.0063	0.0012
f_{UMP} (on US data surprises)	0.0293	0.0061	0.0002	0.0033
g_{ZLB} (on SE CPI surprises)	0.4026	0.7382	0.8248	0.9655
g_{FG} (on SE CPI surprises)	0.0028	0.0012	0.0219	0.1094
g_{UMP} (on SE CPI surprises)	0.0951	0.0075	0.1893	0.4278

Previous DNB Working Papers in 2014

No. 406   **Raymond Chaudron and Jakob de Haan**, Identifying and dating systemic banking crises using incidence and size of bank failures

No. 407   **Ayako Saiki and Sunghyun Henry Kim**, Business cycle synchronization and vertical trade integration: A case study of the Eurozone and East Asia

No. 408   **Emmanuel de Veirman and Andrew Levin**, Cyclical changes in firm volatility

No. 409   **Carlos Arango, Yassine Bouhdaoui, David Bounie, Martina Eschelbach and Lola Hernández**, Cash management and payment choices: A simulation model with international comparisons

No. 410   **Dennis Veltrop and Jakob de Haan**, I just cannot get you out of my head: Regulatory capture of financial sector supervisors

No. 411   **Agnieszka Markiewicz and Andreas Pick**, Adaptive learning and survey data

No. 412   **Michael Ehrmann and David-Jan Jansen**, It hurts (stock prices) when your team is about to lose a soccer match