

The effect of forward guidance and the zero lower bound on interest rate sensitivity to economic news in Sweden*

Richhild Moessner^{a,b,†}, Jakob de Haan^{a,c,d}, David-Jan Jansen^a

^aDe Nederlandsche Bank, PO Box 98, 1000 AB Amsterdam, The Netherlands;

^bCass Business School, London, United Kingdom;

^cUniversity of Groningen, Groningen, The Netherlands;

^dCESifo, Munich, Germany

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Abstract

We study whether the sensitivity of Swedish interest rates to economic news was affected by the Riksbank's forward guidance and the zero lower bound. We find that the sensitivity of interest rate swaps to Swedish macroeconomic news was not significantly affected by forward guidance, suggesting that the conditionality of the forward guidance was understood by market participants and that the guidance was not interpreted as a commitment. We also find that the sensitivity of interest rate swaps to this news was reduced at the effective zero lower bound at short maturities but not at longer maturities.

JEL classification: E52, E58.

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

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[†]Corresponding author. Tel.: 0031 – 65 – 282 9035; fax: 0031 – 20 – 524 2506. E-mail address: r.moessner@dnb.nl (R. Moessner).

1. Introduction

Since 2007 Sveriges Riksbank, the central bank of Sweden, has published its policy rate forecasts as part of the bank's inflation targeting strategy. The Riksbank was among the first central banks to implement this practice. Only the Reserve Bank of New Zealand (since 1997) and Norges Bank, the central bank of Norway, (since 2005) were earlier. Also these central banks are inflation targeters.¹ Communication on the forward path of policy rates is also known as forward guidance (Bernanke and Reinhart, 2004).

The published policy rate forecasts of the Riksbank are conditional on current insights about future economic developments. On 15 February 2007, the Riksbank published quarterly forecasts of the repo rate for the first time. In April 2009, the bank 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

In practice, inflation targeting central banks have emphasised that their policy rate guidance is conditional on economic developments, rather than an unconditional commitment. However, prior to the crisis central bankers frequently noted that market participants may not sufficiently appreciate the conditionality and uncertainty of central banks' policy rate forecasts (cf. Kohn, 2005, and Issing, 2005).

In this paper we investigate the concern that financial markets may not understand the conditionality of the forward guidance provided by the Riksbank. Following Moessner and Nelson (2008), we examine whether market reactions to macroeconomic news change when forward guidance is provided. 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.

We also take the zero lower bound of the policy rate into account. In several countries, including Sweden, the monetary authorities reduced policy rates to levels (close to) zero to

¹The number of inflation-targeting central banks has increased over time as shown by Samaryna and de Haan (2014). However, only few of these central banks publish their forecasts of the policy rate.

²An overview of these repo announcements is available at: <http://www.riksbank.se/en/Monetary-policy/Forecasts-and-interest-rate-decisions/Previous-repo-rate-decisions/>.

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. 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 et al., 2008, Rudebusch and Williams, 2008, and Swanson and Williams, 2014a).

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 2010.³ As to unconventional policy, the Riksbank did not purchase assets. However, it 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 et al., 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, and Andersen, 2012).

Recently, Swanson and Williams (2014a, 2014b) investigated the effectiveness of monetary policy when policy rates are (close to) zero. They estimate the time-varying sensitivity of yields to macroeconomic announcements using daily 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. We also 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. Following Swanson and Williams (2014a, 2014b), 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.⁴

³See <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.

⁴See also Moessner (2014).

The outline of the paper is as follows. Section 2 offers a discussion of forward guidance and the issue of its conditionality, of monetary policy options in times of crisis, and describes the Riksbank's policies during the financial crisis. Section 3 presents the data, section 4 presents the estimation method and discusses the results, while section 5 concludes.

2. Background

2.1 *Forward guidance and conditionality*

Forward guidance has been classified into “Delphic forward guidance” and “Odyssean forward guidance” by Campbell et al. (2012), with Delphic forward guidance defined as merely forecasting macroeconomic performance and likely monetary policy actions, which could affect private sector expectations if the central bank is perceived to have superior forecasting ability or better knowledge about its own monetary policy intentions. By contrast, Odyssean forward guidance is defined as publicly committing the central bank to future monetary policy action. Under this classification, regularly publishing interest rate forecasts under inflation targeting, as done by the Riksbank, falls under Delphic forward guidance. Such Delphic forward guidance is time-consistent, in contrast to Odyssean forward guidance, which involves commitment and is time-inconsistent.

In practice, central banks have emphasised that policy rate guidance is conditional on economic developments, rather than an unconditional commitment. However, prior to the crisis central bankers frequently noted that market participants may not appreciate sufficiently the conditionality and uncertainty of central banks' policy rate forecasts, so that they could impair informational efficiency, with financial markets placing too much weight on central bank forecasts, reducing their own analysis of economic developments (cf. Kohn, 2005, and Issing, 2005).

Moessner and Nelson (2008) investigated this concern that financial markets may not understand the conditionality of the forward guidance for a pre-crisis period of forward guidance by the Federal Reserve. They found that financial market participants understood the conditionality of the forward guidance, and continued to pay close attention to macroeconomic news during the period when the FOMC was providing guidance on future policy rates.

In this paper we investigate whether financial markets understand the conditionality of the forward guidance provided by the Riksbank since 2007. Using the approach of Moessner and Nel-

son (2008), we examine whether market reactions to macroeconomic news change when forward guidance is provided. If market participants would interpret forward guidance as unconditional, i.e. as a commitment to keep interest rates at a particular level, changing economic circumstances would not affect their expectations about future policy rates. Under those conditions, market interest rates will not react to macroeconomic news, i.e. unexpected developments of some macroeconomic variable. A reduction in the sensitivity of interest rate swaps to domestic economic news with the introduction of forward guidance would therefore provide evidence that financial market participants do not understand the conditionality of the guidance and focus on it too much.

Moessner and Nelson (2008) also analysed the effects of the Reserve Bank of New Zealand's published interest rate forecasts. While they find evidence that central bank policy rate forecasts influence market prices in New Zealand, they find no evidence that market participants systematically overweight policy rate guidance or that they do not appreciate the uncertainty and conditionality of it. Detmers and Nautz (2012) studied policy rate forecasts in New Zealand also in the wake of the crisis. Holmsen et al. (2008) conclude for Norway that financial markets seem to understand that the interest rate path published by Norges Bank is conditional on economic developments.

There is no clear agreement in previous work on the effectiveness of the Riksbank's forward guidance. 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. Beechey and Österholm (2012) find that the forecast accuracy of survey-based and market-based private sector policy-rate expectations has improved since the Riksbank started publishing its own policy-rate forecasts. 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.

2.2 *Policy options under the ZLB*

The 2007-2009 global financial crisis was not the first time that 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 et al., 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 consumption and investment 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 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, and Swanson and Williams, 2014a).

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 may affect 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, and Swanson and Williams, 2014a). 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.

In practice, central banks have emphasised that their policy rate guidance at the zero lower bound is not a commitment, but that it is conditional on economic developments. For example, the Federal Reserve stated that it “anticipates” that interest rates will remain unchanged through 2014, but it did not give a promise. The Bank of Canada made its forward guidance conditional on the outlook for inflation (Carney, 2012). As expectations about the economic outlook change, partly because of the publication of macroeconomic news, expectations about the central bank’s forward guidance and future policy rates will change, in turn affecting longer-term market interest rates; consequently, longer-term market interest rates continue to respond to macroeconomic news under the zero lower bound.

Second, central banks may use unconventional monetary policies, 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 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 et al., 2011, Lenza et al., 2010, and Pattipeilohy et al., 2013).

As expectations about the economic outlook change, partly due to incoming macroeconomic news, the expected size of a central bank’s quantitative easing programme can change, which can in turn affect longer-term bond yields. Longer-term bond yields can therefore continue to respond to macroeconomic news at the zero lower bound of the policy rate via this channel (Swanson and Williams, 2014b).

Swanson and Williams (2014a) present a model for the effect of the zero lower bound on the sensitivity of market interest rates to macroeconomic news, in the absence of forward guidance and quantitative easing. This model shows that the zero lower bound leads to a reduction in the reaction of market interest rates of all maturities to macroeconomic news. The reduction is greatest at short maturities, but smaller at longer maturities, since longer-term interest rates are an average over expected future short-term interest rates, and at some time in the future short-term interest rates are expected not to be constrained by the zero lower bound anymore. At the zero lower bound market interest rates can continue to respond to macroeconomic news due to quantitative easing and forward guidance, as discussed above.

2.3 Swedish monetary policy during the crisis

During the crisis years, Swedish monetary policy makers 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 Fig. 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). Initially, the Riksbank offered ‘open-ended’ forward guidance, since there was no indication of when or under what conditions policy would be tightened again (Den Haan, 2013). However, on 21 April 2009 the Riksbank introduced time-contingent forward guidance, alongside with 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 2010.⁵

[Figure 1 about here]

Liquidity assistance was a key aspect of the Riksbank’s policy between 2008 and 2011. Fig. 2 shows how this led to an increase in the stock of outstanding loans, while Fig. 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.⁶ 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.⁷ Until the end of October 2010, loans in Swedish kronor were regularly offered, both at fixed and variable interest

⁵The press releases are available at <http://www.riksbank.se/en/Press-and-published/Press-Releases/2009/>. For further discussion, see Woodford (2013).

⁶The 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->.

⁷The press release is available at <http://www.riksbank.se/en/Press-and-published/Press-Releases/2008/Riksbank-lends-SEK-60-billion-over-three-months/>.

rates, and for various maturities. As suggested by Fig. 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.

3. 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. Fig. 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 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 (advance), 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. Among international macroeconomic news, US data tend to be most important for international market interest rates. As a robustness check, we also consider euro area and UK macroeconomic data surprises below.

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]

4. Method and results

First, we investigate whether the sensitivity of interest rate swaps to economic news is affected by the introduction of forward guidance by the Riksbank. Following Moessner and Nelson (2008), 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 period when the Riksbank provided forward guidance, $dum_{FG}(t)$. The regression equation takes the form

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

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 dummy variable $dum_{FG}(t)$ takes the value of one after 15 February 2007 when the Riksbank started publishing forecasts of its policy rate, and is zero otherwise. The coefficient b_j is the estimated response, in basis points, of interest rate swap rates to a one standard-deviation surprise in Swedish economic news outside the guidance period, and $(1 + g_{FG})b_j$ is the response during the guidance period. A significantly negative estimate of g_{FG} would indicate reduced responsiveness during the guidance period, while a significantly positive estimate would indicate increased responsiveness. The regression is estimated using nonlinear least squares, since the regressions are nonlinear in the parameters, and this method allows us to determine significance levels for the changes in reactions to macroeconomic news. We use Newey-West adjusted standard errors to correct for heteroskedasticity and serial correlation.

[Tables 1 and 2 about here]

The results for Equation (1) when all Swedish ($n^d = 8$) and US macroeconomic indicators are included are shown in Table 1. At all maturities the surprises concerning US and Swedish data have the expected sign when they are significant. CPI inflation surprises have the largest coefficient among the Swedish indicators and are significant at the 1% or 5% level at all maturities. The results suggest that the sensitivity of interest rate swaps to Swedish macroeconomic news is not significantly affected at any maturity by the Riksbank's 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% or 10% significance level for maturities of 2 and 10 years by the introduction of forward guidance. For the other maturities, the coefficient of 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 (1) when only surprises concerning Swedish CPI inflation ($n^d = 1$) are included along with news about US macroeconomic indicators are shown in Table 2. The results are very similar to those reported in Table 1.

Next, we consider the effect of the zero lower bound on the interest rate sensitivity to economic news, by interacting 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

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

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 zero otherwise.

[Tables 3 and 4 about here]

The results for Equation (2) are shown in Table 3 when all Swedish and US macroeconomic news indicators are included ($n^d = 8$ and $n^{US} = 11$). At all maturities the surprises concerning US and Swedish data again have the expected sign when they are significant. Surprises regarding CPI inflation again have the largest coefficient among the Swedish indicators, and this coefficient 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 4 shows the corresponding regressions when only Swedish CPI inflation surprises are included ($n^d = 1$) along with surprises concerning US indicators. Similar to the findings as reported in Table 3, 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.

The zero lower bound period occurred during the period of forward guidance by the Riksbank. Next, we therefore control for the effect of the zero lower bound in the previous regression for the effect of forward guidance on the interest rate sensitivity to economic news. We do so by including the dummy variables for the Riksbank's forward guidance and the zero lower bound

in a single regression,

$$\begin{aligned}
y^m(t) - y^m(t-1) = & c + (c_{FG} * dum_{FG}(t) + c_{ZLB} * dum_{ZLB}(t)) + \\
& \sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t)(1 + f_{FG} * dum_{FG}(t) + f_{ZLB} * dum_{ZLB}(t)) + \\
& \sum_{j=1}^{n^d} b_j * sur_j^d(t)(1 + g_{FG} * dum_{FG}(t) + g_{ZLB} * dum_{ZLB}(t)) + \varepsilon_t
\end{aligned} \tag{3}$$

The results for Equation (3) when all Swedish and US macroeconomic indicators are included are shown in Table 5. We can 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, as in Table 1. Moreover, the sensitivity of interest rate swaps to US macroeconomic news is significantly reduced by the Riksbank's forward guidance also at the 5-year maturity, in addition to the 2- and 10-year maturities as was the case in Table 1. We can also see that the sensitivity of interest rate swaps to domestic news continues to be significantly reduced by the zero lower bound at the 1- and 2-year maturities, as in Table 3, albeit at a lower significance level of 5%. 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.

The results for Equation (3) when only Swedish CPI news is included along with news about US macroeconomic indicators are shown in Table 6. The findings for Table 5 carry over, except that the sensitivity of interest rate swaps to domestic news is no longer significantly affected by the zero lower bound at the 1- and 2-year maturities (with p-values of 0.1020 and 0.1333, respectively).

[Tables 5 and 6 about here]

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

$$\begin{aligned}
y^m(t) - y^m(t-1) = & c + c_{UMP} * dum_{UMP}(t) + \sum_{j=1}^{n^{US}} a_j * sur_j^{US}(t) * (1 + f_{UMP} * dum_{UMP}(t)) + \\
& \sum_{j=1}^{n^d} b_j * sur_j^d(t) * (1 + g_{UMP} * dum_{UMP}(t)) + \varepsilon_t
\end{aligned} \tag{4}$$

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 Fig. 2), which led to a large increase in the size of the Riksbank's balance sheet (see Fig. 3).

[Tables 7 and 8 about here]

The results for Equation (4) when all Swedish news indicators are included are shown in Table 7. 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 8.⁸

Finally, we report results of Wald tests for the null hypothesis that the coefficients of 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 1 and 2 and for the combined regressions of Tables 5 and 6. The only exception is for g_{FG} on Swedish CPI inflation surprises for the regression of Tables 2 and 6, where a value of -1 cannot be rejected at conventional significance levels, although the p-values are small (p-values of 0.13). 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 3 to 6. It is also consistent with finding a significantly negative

⁸We do not include $dum_{UMP}(t)$ in the regression together with $dum_{FG}(t)$ and $dum_{ZLB}(t)$ in Equation (3) due to a problem of multicollinearity between $dum_{UMP}(t)$ and $dum_{ZLB}(t)$.

value for g_{ZLB} for Swedish data surprises in the regressions of Tables 3 to 5 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 7 and 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 7 and 8, which partly reflects large standard errors.

[Table 9 about here]

4.1 Robustness tests

Among international macroeconomic news, US data as considered above tend to be most important for international market interest rates. As a robustness check, we also consider euro area and UK macroeconomic data surprises, in addition to US data surprises, in equations (1) to (4). The surprises are again calculated with respect to median Bloomberg survey expectations using real-time data releases, normalised by their standard deviation. The macroeconomic indicators considered for the euro area are 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, based on Brière and Ielpo (2007). The macroeconomic indicators for the United Kingdom are RPIX inflation, average earnings, monthly changes in unemployment, retail sales, PPI inflation, GDP, industrial production, the current account balance, the trade balance in goods, and the public sector net cash requirement, based on Gravelle et al. (2005). The results with all Swedish indicators are shown in Table 10, and those with Swedish CPI only among the Swedish data are shown in Table 11. The main results are very similar to those obtained in the main specification in Tables 1 to 8 above. Forward guidance continues to have no significant effect on the sensitivity of interest rate swaps to domestic economic news, based on Equations (1) and (3), both when all Swedish indicators and when only CPI is included among the Swedish data. And the

sensitivity of interest rate swaps to domestic economic news continues to be reduced at the zero lower bound for the shorter maturities of 1 and 2 years, but not for the longer maturities of 5 and 10 years, based on Equations (2) and (3) when all Swedish indicators are included. There are some differences regarding the responsiveness to international news; based on Equation (3), forward guidance now significantly reduces the sensitivity of interest rate swaps to international economic news at fewer maturities.

[Tables 10 and 11 about here]

As another robustness check, we repeat the regressions reported in Tables 10 and 11 using euro area and UK macroeconomic news in addition to US and Swedish news, but now only include those Swedish and international (US, euro area and UK) macroeconomic indicators which are significant at the 10% level for at least one of the maturities of $m = 1, 2, 5$ or 10 years in the following regression over the whole sample period 1 June 1998 to 31 May 2013,

$$y^m(t) - y^m(t-1) = c + \sum_{j=1}^{n^{US}} a_j^{US} * sur_j^{US}(t) + \sum_{j=1}^{n^{EA}} a_j^{EA} * sur_j^{EA}(t) + \sum_{j=1}^{n^{UK}} a_j^{UK} * sur_j^{UK}(t) + \sum_{j=1}^{n^d} b_j * sur_j^d(t) + \varepsilon_t \quad (5)$$

estimated via OLS using Newey-West adjusted standard errors. The macroeconomic indicators included under this criterion are CPI inflation, the unemployment rate, retail sales, consumer confidence, industrial production, and the trade balance for Sweden; CPI inflation, hourly earnings, industrial production, the ISM manufacturing index, changes in nonfarm payrolls, retail sales, the trade balance, and the unemployment rate for the United States; euro area CPI inflation, the German Ifo business climate index, the German unemployment rate, euro area GDP and German retail sales for the euro area; and average earnings, retail sales and PPI inflation for the United Kingdom.

The results are shown in Tables 12 and 13. Based on Equation (1), forward guidance continues to have no significant effect on the sensitivity of interest rate swaps to domestic economic news at the 2-, 5- and 10-year maturities. Based on Equation (1), forward guidance leads to a significant reduction at the 1-year maturity when this subset of Swedish indicators are included, but this coefficient becomes insignificant if Swedish data are restricted to Swedish CPI, i.e. when the other Swedish indicators with larger gaps in survey responses are excluded (see Table 13), or if the zero lower bound is taken into account according to Equation (3) (see Table 12). Based

on Equation (3), forward guidance continues to have no significant effect on the sensitivity of interest rate swaps to domestic economic news. Also, the sensitivity of interest rate swaps to domestic economic news continues to be reduced at the zero lower bound for the shorter maturities of 1 and 2 years, but not for the longer maturities of 5 and 10 years, based on Equations (2) and (3) when all Swedish indicators are included. There are again some differences regarding the significance of the effect of forward guidance on the responsiveness to international news at some maturities.

[Tables 12 and 13 about here]

5. Conclusions

We study whether the sensitivity of Swedish interest rates to economic news was affected by the Riksbank's forward guidance and the zero lower bound. 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 that the sensitivity of interest rate swaps to Swedish macroeconomic news was not significantly affected by 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. Our results also suggest that the Riksbank's forward guidance led market participants to focus somewhat less on US and other international 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.

We also 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 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.

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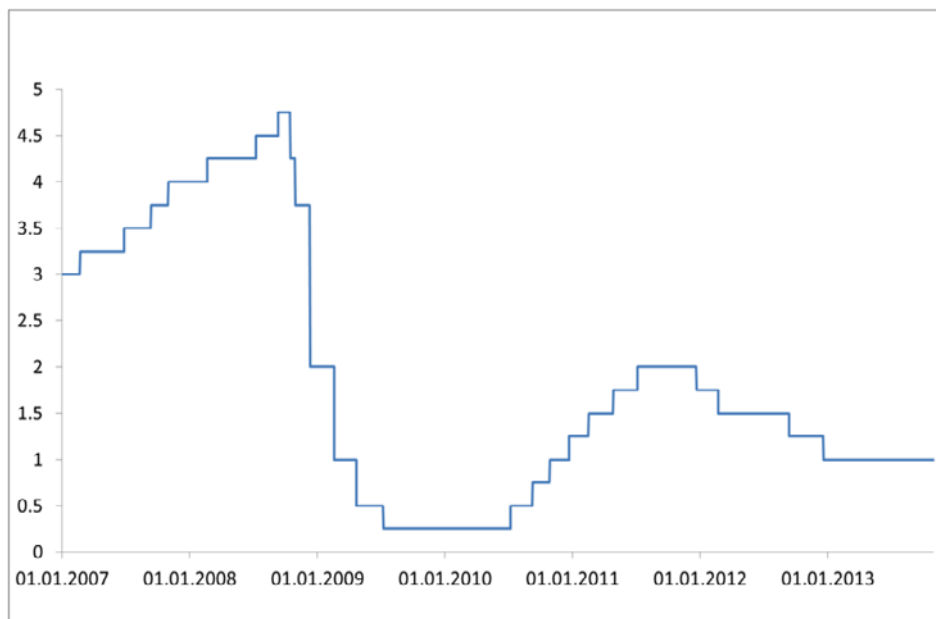
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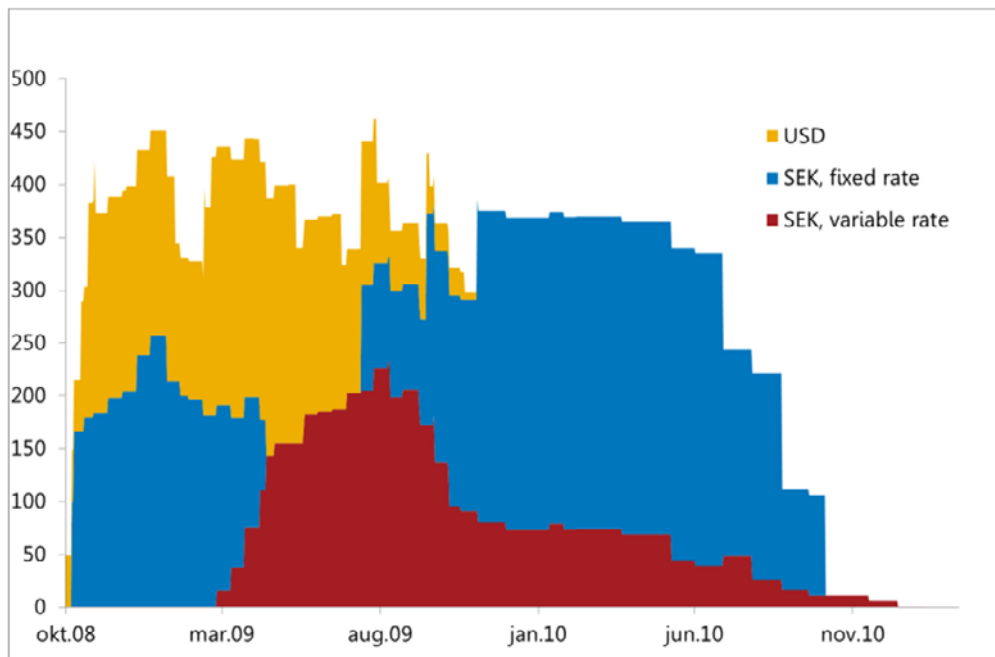
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Figure 1: Riksbank's repo rate (in percent).



Source: Riksbank Monetary Policy Report October 2013.

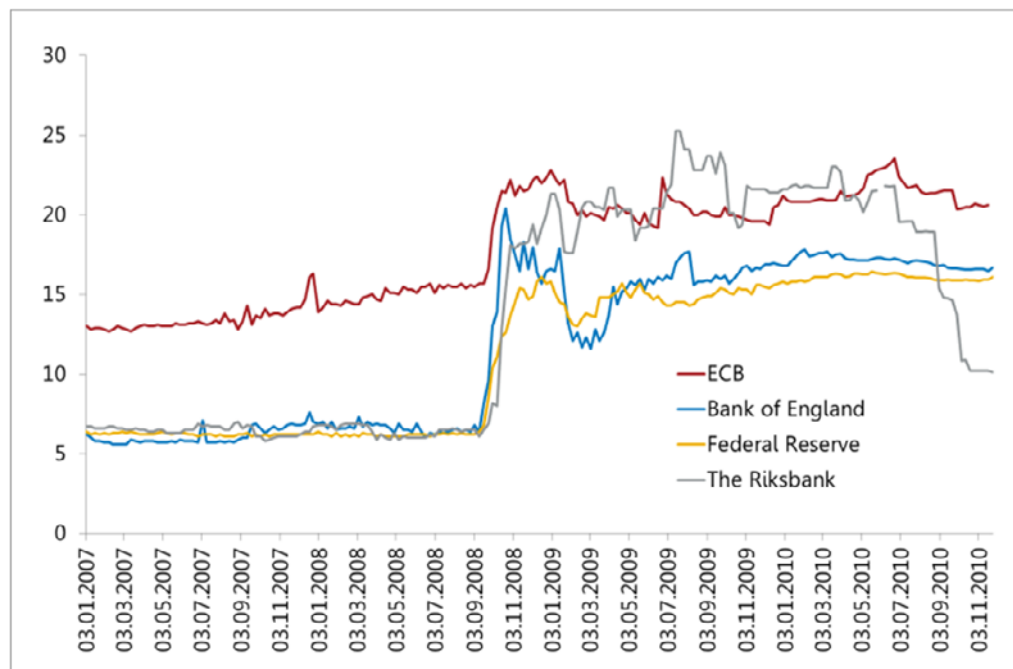
Figure 2: The Riksbank's outstanding loans (SEK billion)



Note: The Riksbank's loans with commercial paper as collateral are not included.

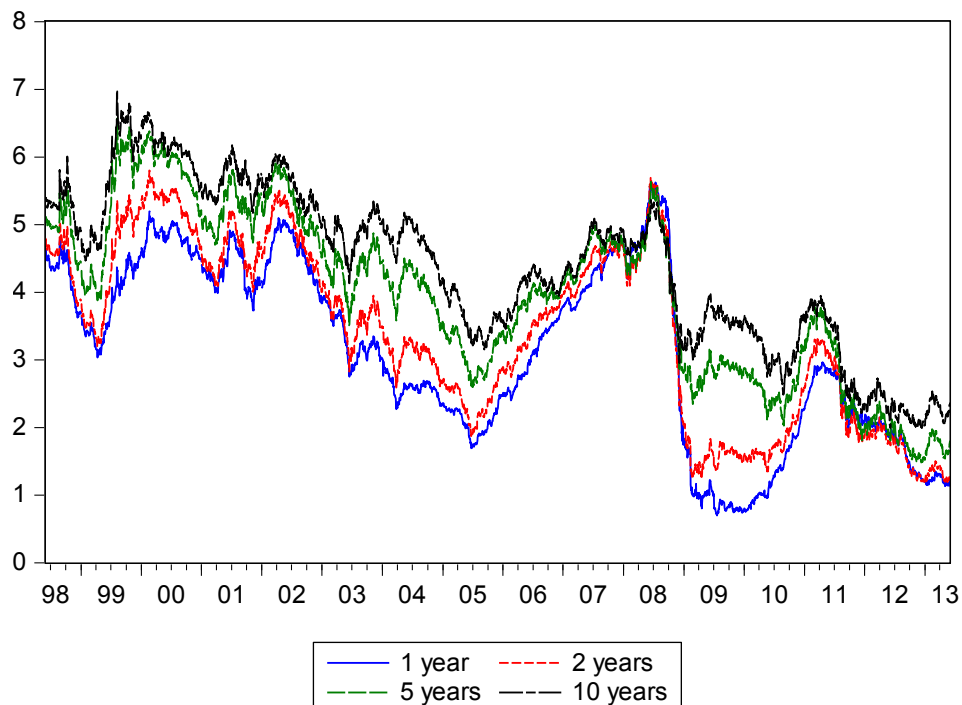
Source: Riksbank Financial Stability Review 2010:2.

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 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}	-0.13	-0.16	-0.15	-0.11
US non-farm payrolls	1.58***	1.89***	2.33***	2.18***
US ISM	1.18***	1.76***	2.08***	2.26***
US unemployment rate	-0.26	-0.46	-0.76	-0.62
US retail sales	0.57*	1.04*	1.29***	1.43***
US industrial production	1.09***	1.26***	1.07***	1.06***
US housing starts	-0.02	-0.27	-0.12	0.07
US CPI	0.25	0.24	0.27	0.56
US PPI	-0.16	-0.20	-0.14	-0.01
US hourly earnings	0.93**	1.32***	1.73***	1.78***
US trade	0.92**	1.26**	1.02**	0.78*
US GDP (advance)	-0.47	-0.19	-0.11	0.38
f_{FG} (on US data surprises)	-0.27	-0.33*	-0.26	-0.38**
SE CPI	2.41***	2.90***	1.85***	1.08**
SE PPI	0.61**	0.47	0.42	0.05
SE unemployment rate	-0.86***	-1.20**	-0.71*	-0.30
SE retail sales	0.60	0.77*	0.36	0.24
SE consumer confidence	0.04	0.63	0.19	0.05
SE GDP	0.45	0.78	0.58	0.22
SE industrial production	0.67*	1.11**	0.62	0.44
SE trade balance	-0.04	0.20	0.73*	0.61
g_{FG} (on SE data surprises)	-0.27	-0.14	0.06	0.34
Adjusted R-squared	0.04	0.05	0.04	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 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	0.002	0.03	0.03	0.01
c_{FG}	-0.15	-0.18	-0.17	-0.12
US non-farm payrolls	1.58***	1.88***	2.33***	2.17***
US ISM	1.18***	1.77***	2.08***	2.26***
US unemployment rate	-0.25	-0.45	-0.75	-0.62
US retail sales	0.56*	1.02*	1.28***	1.42***
US industrial production	1.11***	1.30***	1.11***	1.07***
US housing starts	-0.03	-0.29	-0.12	0.07
US CPI	0.25	0.24	0.27	0.56
US PPI	-0.16	-0.19	-0.13	-0.01
US hourly earnings	0.93**	1.33***	1.73***	1.78***
US trade	0.92**	1.25**	1.01**	0.77*
US GDP (advance)	-0.44	-0.22	-0.12	0.36
f_{FG} (on US data surprises)	-0.26	-0.32*	-0.25	-0.37**
SE CPI	2.56***	3.18***	2.08***	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	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 zero lower bound on reactions of Swedish interest rate swaps to macroeconomic news

	1 year	2 years	5 years	10 years
<i>c</i>	-0.08	-0.06	-0.04	-0.03
<i>c_{ZLB}</i>	0.14	0.06	-0.18	-0.30
US non-farm payrolls	1.50***	1.68***	2.18***	1.96***
US ISM	0.98***	1.53***	1.82***	1.96***
US unemployment rate	-0.27	-0.43	-0.77*	-0.72*
US retail sales	0.38	0.81**	1.07***	1.08**
US industrial production	0.83**	1.00**	0.86**	0.72**
US housing starts	-0.01	-0.19	-0.03	0.16
US CPI	0.16	0.19	0.23	0.47
US PPI	-0.08	-0.15	-0.14	-0.09
US hourly earnings	0.71**	1.12***	1.53***	1.59***
US trade	0.77**	1.03**	0.83**	0.56*
US GDP (advance)	-0.35	-0.19	-0.16	0.03
<i>f_{ZLB}</i> (on US data surprises)	0.68	0.12	0.18	-0.04
SE CPI	2.29***	2.89***	1.95***	1.26***
SE PPI	0.51	0.47	0.43	-0.02
SE unemployment rate	-0.89***	-1.30***	-0.78*	-0.46
SE retail sales	0.64**	0.83**	0.42	0.33
SE consumer confidence	0.02	0.60*	0.21	0.10
SE GDP	0.53	0.63	0.42	-0.05
SE industrial production	0.61*	1.02**	0.65	0.46
SE trade balance	-0.14	0.14	0.75*	0.85**
<i>g_{ZLB}</i> (on SE data surprises)	-0.81***	-0.78***	-0.33	-0.75
Adjusted R-squared	0.04	0.05	0.03	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 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	-0.04	-0.03
c_{ZLB}	0.13	0.06	-0.19	-0.30
US non-farm payrolls	1.50***	1.68***	2.18***	1.96***
US ISM	0.98***	1.54***	1.82***	1.96***
US unemployment rate	-0.26	-0.42	-0.76*	-0.71*
US retail sales	0.38	0.80*	1.06***	1.08**
US industrial production	0.87***	1.06**	0.90***	0.73**
US housing starts	-0.03	-0.21	-0.04	0.15
US CPI	0.17	0.19	0.23	0.47
US PPI	-0.07	-0.13	-0.14	-0.08
US hourly earnings	0.71**	1.13***	1.53***	1.60***
US trade	0.79**	1.05**	0.84**	0.57*
US GDP (advance)	-0.33	-0.20	-0.16	0.02
f_{ZLB} (on US data surprises)	0.65	0.11	0.17	-0.04
SE CPI	2.37***	3.00***	2.04***	1.30***
g_{ZLB} (on SE CPI surprises)	-0.81***	-0.78**	-0.65	-0.61
Adjusted R-squared	0.03	0.04	0.03	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 the Riksbank's forward guidance and the zero lower bound 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}	-0.18	-0.18	-0.14	-0.07
c_{ZLB}	0.25	0.17	-0.10	-0.26
US non-farm payrolls	1.64***	1.93***	2.34***	2.20***
US ISM	1.16***	1.75***	2.10***	2.26***
US unemployment rate	-0.31	-0.43	-0.75	-0.61
US retail sales	0.49*	0.96*	1.22***	1.40***
US industrial production	1.04***	1.24***	1.11***	1.06***
US housing starts	-0.02	-0.27	-0.13	0.06
US CPI	0.21	0.25	0.29	0.58
US PPI	-0.16	-0.19	-0.06	0.03
US hourly earnings	0.88**	1.30***	1.70***	1.75***
US trade	0.89**	1.30***	1.07**	0.81**
US GDP (advance)	-0.36	-0.17	-0.05	0.39
f_{FG} (on US data surprises)	-0.34	-0.38*	-0.33*	-0.42**
f_{ZLB} (on US data surprises)	0.72	0.32	0.37	0.22
SE CPI	2.38***	2.87***	1.86***	1.04**
SE PPI	0.57*	0.47	0.40	-0.02
SE unemployment rate	-0.90***	-1.31***	-0.76*	-0.46
SE retail sales	0.67*	0.82**	0.39	0.23
SE consumer confidence	0.00	0.59	0.20	0.09
SE GDP	0.50	0.68	0.49	0.16
SE industrial production	0.63	1.00**	0.60	0.35
SE trade balance	-0.11	0.15	0.68	0.60
g_{FG} (on SE data surprises)	-0.13	0.00	0.14	0.59
g_{ZLB} (on SE data surprises)	-0.70**	-0.78**	-0.41	-1.31
Adjusted R-squared	0.04	0.05	0.04	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 the Riksbank's forward guidance and the 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	0.00	0.03	0.03	0.01
c_{FG}	-0.19	-0.21	-0.15	-0.08
c_{ZLB}	0.25	0.19	-0.10	-0.25
US non-farm payrolls	1.63***	1.92***	2.34***	2.20***
US ISM	1.16***	1.75***	2.10***	2.26***
US unemployment rate	-0.30	-0.43	-0.75	-0.61
US retail sales	0.49	0.95*	1.21***	1.40***
US industrial production	1.07***	1.29***	1.14***	1.08***
US housing starts	-0.04	-0.28	-0.13	0.06
US CPI	0.21	0.25	0.29	0.58
US PPI	-0.15	-0.17	-0.07	0.04
US hourly earnings	0.88**	1.30***	1.70***	1.75***
US trade	0.89**	1.29***	1.06**	0.80**
US GDP (advance)	-0.33	-0.19	-0.06	0.36
f_{FG} (on US data surprises)	-0.33	-0.36*	-0.32*	-0.41**
f_{ZLB} (on US data surprises)	0.71	0.31	0.36	0.21
SE CPI	2.56***	3.18***	2.07***	1.22**
g_{FG} (on SE CPI surprises)	-0.28	-0.21	-0.07	0.20
g_{ZLB} (on SE CPI surprises)	-0.55	-0.58	-0.57	-0.76
Adjusted R-squared	0.04	0.04	0.03	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 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	0.02	0.01	0.00
C_{UMP}	-0.70**	-0.59**	-0.46**	-0.36
US non-farm payrolls	1.49***	1.70***	2.16***	2.00***
US ISM	0.90***	1.58***	1.71***	1.99***
US unemployment rate	-0.26	-0.42	-0.75*	-0.68*
US retail sales	0.31	0.87**	0.89**	1.19**
US industrial production	0.73**	1.04**	0.75**	0.75**
US housing starts	-0.07	-0.22	-0.04	0.13
US CPI	0.21	0.15	0.25	0.42
US PPI	0.00	-0.15	-0.10	-0.13
US hourly earnings	0.75**	1.15***	1.56***	1.59***
US trade	0.77*	1.04**	0.84**	0.59*
US GDP (advance)	-0.51	-0.22	-0.19	0.05
f_{UMP} (on US data surprises)	0.40	-0.07	0.29	-0.15
SE CPI	2.36***	2.82***	1.87***	1.06***
SE PPI	0.63**	0.45	0.41	0.03
SE unemployment rate	-0.88***	-1.21**	-0.69*	-0.20
SE retail sales	0.61*	0.72*	0.37	0.30
SE consumer confidence	0.14	0.67*	0.22	0.02
SE GDP	0.64	0.78	0.56	0.25
SE industrial production	0.50	0.99**	0.67	0.63
SE trade balance	0.07	0.19	0.74*	0.59*
g_{UMP} (on SE data surprises)	-0.49	-0.13	0.12	0.67
Adjusted R-squared	0.04	0.05	0.04	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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 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	0.00
c_{UMP}	-0.70**	-0.58**	-0.46**	-0.37
US non-farm payrolls	1.49***	1.70***	2.17***	2.01***
US ISM	0.91***	1.59***	1.72***	2.00***
US unemployment rate	-0.25	-0.41	-0.75*	-0.67*
US retail sales	0.30	0.87*	0.91**	1.21***
US industrial production	0.76**	1.09***	0.79**	0.77**
US housing starts	-0.08	-0.24	-0.05	0.13
US CPI	0.21	0.15	0.25	0.42
US PPI	0.01	-0.12	-0.09	-0.12
US hourly earnings	0.76**	1.16***	1.57***	1.59***
US trade	0.78*	1.03**	0.82**	0.56*
US GDP (advance)	-0.49	-0.24	-0.19	0.05
f_{UMP} (on US data surprises)	0.40	-0.06	0.28	-0.16
SE CPI	2.43***	2.98***	2.03***	1.26***
g_{UMP} (on SE CPI surprises)	-0.45	-0.28	-0.21	-0.07
Adjusted R-squared	0.04	0.04	0.03	0.03
No. of obs.	3851	3872	3872	3872

***, **, 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_{FG} (on US data surprises)	0.0015	0.0004	0.0001	0.0002
g_{FG} (on SE surprises)	0.0005	0.0001	0.0075	0.0657
Regression of Table 2				
f_{FG} (on US data surprises)	0.0013	0.0003	0.0000	0.0001
g_{FG} (on SE CPI surprises)	0.0085	0.0038	0.0373	0.1251
Regression of Table 3				
f_{ZLB} (on US data surprises)	0.0416	0.0308	0.0016	0.0136
g_{ZLB} (on SE surprises)	0.3674	0.3977	0.1481	0.6293
Regression of Table 4				
f_{ZLB} (on US data surprises)	0.0416	0.0299	0.0016	0.0134
g_{ZLB} (on SE CPI surprises)	0.4427	0.4960	0.5009	0.5824
Regression of Table 5				
f_{FG} (on US data surprises)	0.0040	0.0014	0.0004	0.0010
f_{ZLB} (on US data surprises)	0.0140	0.0035	0.0001	0.0004
g_{FG} (on SE surprises)	0.0002	0.0000	0.0084	0.0604
g_{ZLB} (on SE surprises)	0.3077	0.5100	0.2910	0.7527
Regression of Table 6				
f_{FG} (on US data surprises)	0.0035	0.0012	0.0003	0.0008
f_{ZLB} (on US data surprises)	0.0146	0.0039	0.0001	0.0004
g_{FG} (on SE CPI surprises)	0.0054	0.0022	0.0363	0.1291
g_{ZLB} (on SE CPI surprises)	0.1796	0.2722	0.4899	0.8093
Regression of Table 7				
f_{UMP} (on US data surprises)	0.0117	0.0098	0.0003	0.0067
g_{UMP} (on SE surprises)	0.1534	0.0152	0.0455	0.0985
Regression of Table 8				
f_{UMP} (on US data surprises)	0.0110	0.0102	0.0004	0.0079
g_{UMP} (on SE CPI surprises)	0.2246	0.0922	0.2227	0.3568

Table 10: Coefficients on dummy variables interacted with Swedish and international macro news, all Swedish, US, euro area and UK indicators

	1 year	2 years	5 years	10 years
Forward guidance				
C_{FG}	-0.14	-0.15	-0.15	-0.11
f_{FG} (on international data surprises)	-0.26	-0.30**	-0.23	-0.30**
g_{FG} (on SE data surprises)	-0.32	-0.18	0.01	0.29
Zero lower bound				
C_{ZLB}	0.14	0.06	-0.18	-0.31
f_{ZLB} (on international data surprises)	0.001	-0.20	-0.45	-0.38
g_{ZLB} (on SE data surprises)	-0.86***	-0.80***	-0.32	-0.77
Forward guidance and zero lower bound				
C_{FG}	-0.18	-0.17	-0.13	-0.07
C_{ZLB}	0.25	0.16	-0.11	-0.28
f_{FG} (on international data surprises)	-0.28	-0.31**	-0.16	-0.27*
f_{ZLB} (on international data surprises)	0.14	0.06	-0.29	-0.14
g_{FG} (on SE data surprises)	-0.17	-0.05	0.07	0.49
g_{ZLB} (on SE data surprises)	-0.71**	-0.76**	-0.36	-1.24
Unconventional monetary policy				
C_{UMP}	-0.73**	-0.58**	-0.47**	-0.39
f_{UMP} (on international data surprises)	0.46	-0.29	-0.03	0.14
g_{UMP} (on SE data surprises)	-0.56	-0.13	0.12	0.76

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

Table 11: Coefficients on dummy variables interacted with Swedish CPI and international macro news, all US, euro area and UK indicators

	1 year	2 years	5 years	10 years
Forward guidance				
C_{FG}	-0.16	-0.18	-0.16	-0.12
f_{FG} (on international data surprises)	-0.23	-0.27*	-0.21	-0.29**
g_{FG} (on SE CPI surprises)	-0.38	-0.31	-0.18	0.08
Zero lower bound				
C_{ZLB}	0.14	0.06	-0.18	-0.32
f_{ZLB} (on international data surprises)	-0.02	-0.21	-0.44	-0.38
g_{ZLB} (on SE CPI surprises)	-0.82***	-0.79**	-0.69	-0.65
Forward guidance and zero lower bound				
C_{FG}	-0.20	-0.20	-0.14	-0.07
C_{ZLB}	0.26	0.18	-0.10	-0.28
f_{FG} (on international data surprises)	-0.25	-0.27*	-0.14	-0.25
f_{ZLB} (on international data surprises)	0.09	0.01	-0.29	-0.16
g_{FG} (on SE CPI surprises)	-0.28	-0.20	-0.07	0.24
g_{ZLB} (on SE CPI surprises)	-0.56	-0.61	-0.63	-0.86
Unconventional monetary policy				
C_{UMP}	-0.73**	-0.58	-0.47	-0.40
f_{UMP} (on international data surprises)	0.44	-0.28	-0.04	0.14
g_{UMP} (on SE CPI surprises)	-0.48	-0.30	-0.26	-0.03

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

Table 12: Coefficients on dummy variables interacted with Swedish and international macro news, reduced number of Swedish, US, euro area and UK indicators^a

	1 year	2 years	5 years	10 years
Forward guidance				
C_{FG}	-0.14	-0.15	-0.15	-0.11
f_{FG} (on international data surprises)	-0.20	-0.24	-0.25*	-0.38***
g_{FG} (on SE data surprises)	-0.36*	-0.23	-0.09	0.22
Zero lower bound				
C_{ZLB}	0.12	0.06	-0.19	-0.30
f_{ZLB} (on international data surprises)	0.34	0.04	-0.01	-0.16
g_{ZLB} (on SE data surprises)	-0.86***	-0.85***	-0.43	-0.72
Forward guidance and zero lower bound				
C_{FG}	-0.17	-0.18	-0.14	-0.07
C_{ZLB}	0.23	0.17	-0.11	-0.26
f_{FG} (on international data surprises)	-0.25	-0.27*	-0.28*	-0.39***
f_{ZLB} (on international data surprises)	0.42	0.20	0.18	0.09
g_{FG} (on SE data surprises)	-0.23	-0.09	0.01	0.47
g_{ZLB} (on SE data surprises)	-0.63**	-0.76**	-0.44	-1.26
Unconventional monetary policy				
C_{UMP}	-0.71**	-0.57**	-0.45*	-0.36
f_{UMP} (on international data surprises)	0.26	-0.20	-0.03	-0.07
g_{UMP} (on SE data surprises)	-0.53	-0.17	0.02	0.63

^a Only those Swedish, US, euro area and UK indicators are included which are significant at 10% level for at least one of the maturities of 1, 2, 5 or 10 years in equation (5). ***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013. Only the coefficients on dummy variables are shown.

Table 13: Coefficients on dummy variables interacted with Swedish CPI and international macro news, reduced number of US, euro area and UK indicators^a

	1 year	2 years	5 years	10 years
Forward guidance				
C_{FG}	-0.15	-0.17	-0.16	-0.12
f_{FG} (on international data surprises)	-0.19	-0.22	-0.24	-0.37***
g_{FG} (on SE CPI surprises)	-0.37	-0.31	-0.17	0.08
Zero lower bound				
C_{ZLB}	0.13	0.07	-0.19	-0.30
f_{ZLB} (on international data surprises)	0.32	0.04	-0.01	-0.16
g_{ZLB} (on SE CPI surprises)	-0.80***	-0.77**	-0.63	-0.59
Forward guidance and zero lower bound				
C_{FG}	-0.19	-0.21	-0.15	-0.08
C_{ZLB}	0.24	0.19	-0.10	-0.25
f_{FG} (on international data surprises)	-0.23	-0.25	-0.27*	-0.38**
f_{ZLB} (on international data surprises)	0.40	0.18	0.17	0.07
g_{FG} (on SE CPI surprises)	-0.27	-0.21	-0.07	0.23
g_{ZLB} (on SE CPI surprises)	-0.54	-0.57	-0.56	-0.78
Unconventional monetary policy				
C_{UMP}	-0.71**	-0.57**	-0.45*	-0.37
f_{UMP} (on international data surprises)	0.26	-0.20	-0.04	-0.09
g_{UMP} (on SE CPI surprises)	-0.46	-0.29	-0.24	-0.04

^a Only those US, euro area and UK indicators are included which are significant at 10% level for at least one of the maturities of 1, 2, 5 or 10 years in equation (5). ***, **, and * represent significance at the 1%, 5% and 10% level, respectively. Newey-West adjusted standard errors. Sample period: 6/01/1998-5/31/2013. Only the coefficients on dummy variables are shown.