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

#### DNB Annual Research Conference De Nederlandsche Bank 13 November 2014

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## Motivation (1)

- Most central banks in advanced economies communicate about their future policy rates. However, the underlying rationale for this policy is very different. Whereas some central banks publish the path of future policy rates as part of their inflation targeting (IT) strategy, others communicate about future policy rates as a way to enhance the effectiveness of monetary policy.
- Under IT central bank's projection of the policy interest rate path is "the only appropriate and logically consistent choice" (Mishkin, 2004, p. 9) and "provides the private sector with the best aggregate information for making individual decisions" (Svensson, 2006, p. 185).



## Motivation (2)

- In practice, inflation targeting central banks (RBNZ, Norges Bank, Riksbank) 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).
- Moessner and Nelson (2008) examined this concern for precrisis forward guidance by FOMC, and found that market participants understood conditionality of the guidance.



## Motivation (3)

- **First research question**: do financial markets understand the conditionality of the forward guidance provided by the Riksbank?
- Following Moessner and Nelson (2008), we examine whether market reactions to macroeconomic news changed when the Riksbank introduced forward guidance in 2007.
- 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.



#### Motivation (4)

- If market participants interpret forward guidance as unconditional, changing economic circumstances would not affect their expectations about future policy rates; -> market interest rates will not react to macroeconomic news.
- We also take the zero lower bound (ZLB) of the policy rate into account.
- Even when policy rates are at the ZLB, monetary policy may still be effective through forward guidance about policy rates and unconventional policies, such as asset purchase programs and liquidity support.



## Motivation (5)

- Swanson and Williams (2014a) present a model for the effect of the ZLB on the sensitivity of market interest rates to macroeconomic news, in the absence of forward guidance and quantitative easing.
- 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.



## Motivation (6)

- **Second research question**: was Riksbank's policy still effective at ZLB?
- 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.
- 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.



#### Main findings (preview)

- We find that the sensitivity of interest rate swaps to Swedish macroeconomic news was not significantly affected by forward guidance. This suggests that market participants understood the conditionality of the Riksbank's policy rate forecasts, and did not take them as unconditional commitments.
- We find some evidence that the sensitivity of interest rate swaps to Swedish macroeconomic news was reduced at the zero lower bound for shorter maturities, but was unaffected at longer maturities. This suggests that monetary policy remained effective at the zero lower bound at longer horizons in Sweden.



#### Riksbank's monetary policy

- Forward guidance:
  - Since 2007: forecast of repo rate
  - Time-contingent forward guidance in April 2009
- Zero lower bound: July 2009 July 2010 (next slide)
- Extended liquidity support: loans to banks (SEK, USD), 2008-10, resulting in large expansion of Riksbank's balance sheet (slide thereafter)



#### Riksbank policies: repo rate



#### Riksbank policies: balance sheet (% GDP)



#### Measuring interest rate sensitivity to news

- We measure how interest rate swaps react to macroeconomic news (surprises in CPI, GDP, etc).
- We ompare forward guidance versus non-forward guidance period and ZLB versus non-ZLB period.
- We use the approach of Moessner & Nelson (2008), Swanson & Williams (2014a, 2014b).



#### Data on interest rate swaps (in percent)



#### Method (1)

- Regress daily changes in interest rate swaps with maturities of m=1, 2, 5 and 10 years, y<sup>m</sup>(t)-y<sup>m</sup>(t-1), in basis points, on the surprises of US and domestic economic data releases, sur<sup>US</sup><sub>j</sub>(t) and sur<sup>d</sup><sub>j</sub>(t)
- Interact the right-hand side variables with a dummy variable for forward guidance,  $d_{FG}(t)$

$$y^{m}(t) - y^{m}(t-1) = c + c_{FG} * dum_{FG}(t) + \sum_{j=1}^{n^{US}} a_{j} * sur_{j}^{US}(t) * (1 + f_{FG} * dum_{FG}(t)) + \sum_{j=1}^{n^{d}} b_{j} * sur_{j}^{d}(t) * (1 + g_{FG} * dum_{FG}(t)) + \varepsilon_{t}$$

• n<sup>*d*</sup> is the number of domestic macroeconomic indicators, and n<sup>*US*</sup>=11 is the number of US macroeconomic indicators.



## Method (2)

- Dummy variable  $d_{FG}(t)$  takes the value of one after the Riksbank started publishing forecasts of its policy rate.
- Coefficient  $b_j$  is the estimated response 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.
- The regression is estimated using nonlinear least squares and Newey-West adjusted standard errors; sample period 1 June 1998 to 31 May 2013.



# Method (3)

- Surprises of the real-time macroeconomic data releases are calculated relative to Bloomberg median survey expectations, and are normalized by their standard deviation.
- US: 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.
- Sweden: CPI inflation, PPI inflation, the unemployment rate, retail sales, consumer confidence, GDP, industrial production, and the trade balance.



## Method (4)

- Swedish survey data for CPI inflation is available almost every month, 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.
- Therefore regressions with only CPI inflation surprises are included as Swedish data, and regressions with all Swedish indicators included.



#### Results for effect of forward guidance (1)

- At all maturities the surprises concerning US and Swedish data have the expected sign when they are significant.
- Surprises regarding CPI inflation have the largest coefficient among the Swedish indicators and are significant at the 1% or 5% level at all maturities.
- Sensitivity of interest rate swaps to Swedish macroeconomic news not significantly affected at any maturity by forward guidance.
- This suggests that markets understood the conditionality of the Riksbank's policy rate forecasts and did not take them as unconditional commitments.



#### Results for effect of forward guidance (2)

- 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, coefficient of the dummy variable is also negative, but not significant at the 10% level.
- This suggests that the Riksbank's forward guidance led market participants to focus somewhat less on US news. This might be due to a better understanding of the Riksbank's reaction function.
- Only including Swedish CPI inflation (plus US data): results very similar.



	1 year	2 years	5 years	10 years
c	-0.01	0.01	0.02	0.00
C <sub>FG</sub>	-0.13	-0.16	-0.15	-0.11
US non-farm payrolls	1.58***	1.89***	2.33***	2.18***
USISM	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⊨6 (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 <sub>FG</sub> (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
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#### Table 1: Effect of forward guidance, US and Swedish data

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

#### Effect of zero lower bound

• Interact the right-hand side variables with a dummy variable for the zero lower bound of the policy rate,  $d_{ZLB}(t)$ 

$$y^{m}(t) - y^{m}(t-1) = c + c_{ZLB} * dum_{ZLB}(t) + \sum_{j=1}^{n^{US}} a_{j} * sur_{j}^{US}(t) * (1 + f_{ZLB} * dum_{ZLB}(t)) + \sum_{j=1}^{n^{d}} b_{j} * sur_{j}^{d}(t) * (1 + g_{ZLB} * dum_{ZLB}(t)) + \varepsilon_{t}$$

The dummy variable d<sub>ZLB</sub>(t) equals 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.



#### Results for effect of ZLB

- 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.
- -> Monetary policy remained effective at the zero lower bound at longer horizons in Sweden; could be due to forward guidance, as well as unconventional monetary policy measures.



	1 year	2 years	5 years	10 years
с	-0.08	-0.06	-0.04	-0.03
CZLB	0.14	0.06	-0.18	-0.30
US non-farm payrolls	1.50***	1.68***	2.18***	1.96***
USISM	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
f <sub>ZLB</sub> (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**
g <sub>ZLB</sub> (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

#### Table 3: Effect of zero lower bound, US and Swedish data

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

# Results for effect of forward guidance and ZLB combined

- The ZLB 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, by including the dummy variables for the Riksbank's forward guidance and the zero lower bound in a single regression.
- We find that results of individual regressions are robust to this combined specification.

# Results for effect of forward guidance and ZLB combined

- Sensitivity of interest rate swaps to domestic macroeconomic news continues not to be significantly affected at any maturity by the Riksbank's FG.
- Sensitivity of interest rate swaps to domestic news continues to be significantly reduced by the ZLB at the 1- and 2-year maturities. It also continues to be unaffected at the longer maturities of 5 and 10 years.
- Sensitivity of interest rate swaps to US macroeconomic news is significantly reduced by forward guidance also at the 5-year maturity.
- Sensitivity of interest rate swaps to US news continues to be unaffected by the zero lower bound.

EUROSYSTEEM

#### Table 5.

	1 year	2 years	5 years	10 years
c	-0.01	0.01	0.02	0.00
CFG	-0.18	-0.18	-0.14	-0.07
CZLB	0.25	0.17	-0.10	-0.26
US non-farm payrolls	1.64***	1.93***	2.34***	2.20***
USISM	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 <sub>FG</sub> (on US data surprises)	-0.34	-0.38*	-0.33*	-0.42**
f <sub>ZLB</sub> (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
gzLB (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

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

EUROSYS

#### Test whether reaction completely attenuated

- Results of Wald tests for the null hypothesis that the coefficients on the dummy variables interacted with macroeconomic data surprises are equal to -1.
- 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.
- The only exception is for  $g_{FG}$  on Swedish CPI inflation surprises for the regression for the 10-year maturity 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).



#### Test whether reaction completely attenuated

- 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 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.

# Table 9: Wald tests whether coefficients on the dummy variables equal to -1 (p-values)

	1 year	2 years	5 years	10 years
Regression of Table 1				
fFG (on US data surprises)	0.0015	0.0004	0.0001	0.0002
g <sub>FG</sub> (on SE surprises)	0.0005	0.0001	0.0075	0.0657
Regression of Table 2				
f <sub>FG</sub> (on US data surprises)	0.0013	0.0003	0.0000	0.0001
g <sub>FG</sub> (on SE CPI surprises)	0.0085	0.0038	0.0373	0.1251
Regression of Table 3				
f <sub>ZLB</sub> (on US data surprises)	0.0416	0.0308	0.0016	0.0136
g <sub>ZLB</sub> (on SE surprises)	0.3674	0.3977	0.1481	0.6293
Regression of Table 4				
f <sub>ZLB</sub> (on US data surprises)	0.0416	0.0299	0.0016	0.0134
g <sub>ZLB</sub> (on SE CPI surprises)	0.4427	0.4960	0.5009	0.5824

# Table 9: Wald tests whether coefficients on the dummy variables equal to -1 (p-values), continued

Regression of Table 5				
f <sub>FG</sub> (on US data surprises)	0.0040	0.0014	0.0004	0.0010
f <sub>ZLB</sub> (on US data surprises)	0.0140	0.0035	0.0001	0.0004
g <sub>FG</sub> (on SE surprises)	0.0002	0.0000	0.0084	0.0604
g <sub>ZLB</sub> (on SE surprises)	0.3077	0.5 <mark>1</mark> 00	0.2910	0.7527
Degraceion of Table C				
Regression of Table 6				
f <sub>FG</sub> (on US data surprises)	0.0035	0.0012	0.0003	0.0008
<i>f<sub>FG</sub></i> (on US data surprises) <i>f<sub>ZLB</sub></i> (on US data surprises)	0.0035 0.0146	0.0012 0.0039	0.0003 0.0001	0.0008 0.0004
f <sub>FG</sub> (on US data surprises) f <sub>ZLB</sub> (on US data surprises) g <sub>FG</sub> (on SE CPI surprises)	0.0035 0.0146 0.0054	0.0012 0.0039 0.0022	0.0003 0.0001 0.0363	0.0008 0.0004 0.1291

## Conclusions (1)

- 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.
- 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.



## Conclusions (2)

- 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.
- Our results also suggest that the Riksbank's forward guidance led market participants to focus somewhat less on US news. This might be a desirable reduction of the attention paid to international news, possibly due to a better understanding of the Riksbank's reaction function.

