

Åhl, Magnus

**Working Paper**

## How big is the toolbox of a central banker? Managing expectations with policy-rate forecasts. Evidence from Sweden

Sveriges Riksbank Working Paper Series, No. 339

**Provided in Cooperation with:**

Central Bank of Sweden, Stockholm

*Suggested Citation:* Åhl, Magnus (2017) : How big is the toolbox of a central banker? Managing expectations with policy-rate forecasts. Evidence from Sweden, Sveriges Riksbank Working Paper Series, No. 339, Sveriges Riksbank, Stockholm

This Version is available at:

<https://hdl.handle.net/10419/189939>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

SVERIGES RIKSBANK  
WORKING PAPER SERIES

339



# How big is the toolbox of a central banker? Managing expectations with policy-rate forecasts: Evidence from Sweden

*Magnus Åhl*

May 2017

WORKING PAPERS ARE OBTAINABLE FROM

[www.riksbank.se/en/research](http://www.riksbank.se/en/research)

Sveriges Riksbank • SE-103 37 Stockholm

Fax international: +46 8 21 05 31

Telephone international: +46 8 787 00 00

The Working Paper series presents reports on matters in the sphere of activities of the Riksbank that are considered to be of interest to a wider public.

The papers are to be regarded as reports on ongoing studies and the authors will be pleased to receive comments.

The opinions expressed in this article are the sole responsibility of the author(s) and should not be interpreted as reflecting the views of Sveriges Riksbank.

How big is the toolbox of a central banker?

Managing expectations with policy-rate forecasts:  
Evidence from Sweden

Magnus Åhl\*

Sveriges Riksbank Working Paper Series  
No. 339

May 2017

**Abstract**

Some central banks have decided to publish forecasts of their policy rates. Can such forecasts manage market expectations of future policy rates? I use regression analysis on Swedish data to conclude that the answer is yes. The published Riksbank forecasts affect expectations of the future repo rate up to a horizon of approximately a year and a half. However, the response of market expectations to a surprise in the announced repo-rate path is not one-to-one, but is estimated to be less than half of the surprise and decreasing with the forecast horizon.

*JEL classifications:* E52, E58, G14.

*Keywords:* Policy-rate path, monetary-policy expectations.

---

\*IIES Stockholm University and Sveriges Riksbank. Contact: magnus.ahl@riksbank.se.  
I would like to thank Jan Alsterlind, Jens Iversen and Ulf Söderström for detailed comments on an earlier draft as well as valuable discussions. I would also like to thank Paolo Bonomolo, Henrik Eriksson, David Kjellberg, Jesper Lindé, Jonna Olsson, Lars EO Svensson, David Vestin, Karl Walentin and seminar participants at Universitat Autònoma de Barcelona, IIES and the Riksbank for valuable input and discussions, and Lina Fransson for great help with data collection. The opinions expressed in this article are the sole responsibility of the author and should not be interpreted as reflecting the views of Sveriges Riksbank.

## 1 Introduction

Decisions taken at central banks affect the financial conditions for, and hence potentially the lives of, billions of people throughout the world every day. The ultimate goal of any central bank is to create stability for prices; may it be prices of commodities, currencies or something else; and the traditional means in the literature is via either the supply of money or the short-term nominal interest rate — the policy rate. However, people making financial decisions take not only the present, but also the future into account, and hence it is important to manage the expectations about the future for any successful central banker. This paper addresses one tool that might, or might not, be useful for managing such expectations.

Over the past decades, there has been a trend towards more transparency of both the decisions of central bankers and the motivating analysis behind the decisions, e.g. [Dincer and Eichengreen \(2007\)](#). One such step towards transparency is that a few central banks in developed countries have begun to not only announce the level of the policy rate but also the intended future development of the policy rate, a policy-rate path, beginning with the *Reserve Bank of New Zealand* in 1997.<sup>1</sup> Besides providing transparency, one intention of publishing policy-rate paths is to steer the market's expectation of the future policy rate, see for example [Archer \(2005\)](#) and [Ingves \(2007\)](#). That is, if viewed as credible by the market, the policy-rate path itself constitutes a tool for the central bank in the pursuit of price stability. It is only lately that we have enough data to evaluate the potency of this tool. Can central banks use a policy-rate path to affect market expectations at all? If so; how, by how much and how far into the future?

In this paper, I use a case study with data from Sweden in an attempt to answer these and related questions. I conclude that the Swedish central bank has the ability to move market expectations of the future policy rate, as measured by forward rates, by surprising with the policy-rate path. However, the effect is not one-for-one and perhaps not present for the entire forecast horizon. These findings are qualitatively in line with the scarce existing literature on New-Zeeland data; see [Moessner and Nelson \(2008\)](#), [Ferrero and Secchi \(2009\)](#) and [Detmers and Nautz \(2012\)](#); and a number of tests show that they are robust.

In section 2, I discuss the econometric method used and how to match the variables of interest to available data. Section 3 presents the main results and a number of robustness tests are discussed. Finally, section 4 summarizes and concludes.

## 2 Method

This section describes the model used to analyse the question of interest. It also describes the data used in the estimations in detail and some assumptions that have been made, and in some cases relaxed. There is also a discussion of some potential problems with the analysis.

---

<sup>1</sup>The other central banks announcing policy-rate paths are *Norges Bank* (Norway, 2005), *Sveriges Riksbank* (Sweden, 2007) and the *Czech National Bank* (2010).

## 2.1 Econometric approach

In the baseline analysis, a regression approach will be used in attempt to quantify the impact of the Riksbank's announcement of a repo-rate path on the market's expectation of the future repo rate. The regression equation is

$$Impact_{h,t} = \beta_h \cdot Surprise_{h,t} + \gamma_h \cdot X_{h,t} + \varepsilon_{h,t}, \quad (1)$$

where  $Impact_{h,t}$  is the movement in market expectations of the repo rate  $h$  quarters into the future at an announcement of a new repo-rate path at time  $t$ ,  $Surprise_{h,t}$  is the surprise component of the announced repo-rate path,  $X_{h,t}$  is a vector of controls (including a horizon-specific constant) and  $\varepsilon_{h,t}$  is an error term.<sup>2</sup> In section 2.2 I discuss how to measure these variables. The coefficient of main interest is  $\beta_h$ , which measures how much the market expectations are affected by (the surprise element of) the announced repo-rate path. With the correct set of control variables included in  $X_{h,t}$ ,  $\beta_h$  has a causal interpretation.

An alternative specification, following [Detmers and Nautz \(2012\)](#), is

$$Impact_{h,t} = \beta_h^S \cdot Surprise_{h,t} + \beta_h^A \cdot Anticipated_{h,t} + \gamma_h \cdot X_{h,t} + \varepsilon_{h,t}, \quad (2)$$

where  $Anticipated_{h,t}$  is the expected change (by an announcement at  $t$ ) of the repo-rate path (at horizon  $h$  quarters) since the last announcement by the Riksbank. The parameter  $\beta_h^A$  measures the effect of an adjustment of the repo-rate path that is fully expected by the market. Without any measurement errors, in accordance with the effective-markets hypothesis, one would expect this effect to be zero. Hence, one possible interpretation is that any deviation from  $\beta_h^A = 0$  can be viewed as an indication that there are measurement errors present in the variables. It is important to include the variable  $Anticipated_{h,t}$  since it is difficult to measure the anticipated communication by the Riksbank, and this provides an indicator for the quality of the measure that I use. This is also in line with the findings of [Kuttner \(2001\)](#), although there may be other plausible interpretations as well.

It is far from obvious which is the best way to measure the three variables  $Impact_{h,t}$ ,  $Surprise_{h,t}$  and  $Anticipated_{h,t}$ , nor is it obvious what the relevant control variables to include in  $X_{h,t}$  are. Hence, I present a number of different specifications to ensure robustness in section 2.2.

Aside from the baseline analysis, I will motivate the main question I try to answer by investigating whether expectations of the future repo rate tend to change more at days of repo-rate path announcements than other days. This will be done by a simple regression of the kind

$$|Impact_{h,t}| = \alpha_h + \delta_h \cdot D_t^{Announcement} + \eta_h \cdot D_t^{Expiration} + \varepsilon_{h,t}, \quad (3)$$

where  $|Impact_{h,t}|$  is the absolute value of the movement in market expectations of the repo rate  $h$  calendar quarters into the future at day  $t$ ,  $D_t^{Announcement}$  is a dummy variable indicating the days on which a new repo-rate path was announced,  $D_t^{Expiration}$  is a dummy variable indicating expiration dates of the contracts used to measure market expectations, and  $\varepsilon_{h,t}$  is an error term. The nature of  $D_t^{Expiration}$  is technical and will be explained in more detail below.

<sup>2</sup>Note that the coefficients in the equation are indexed by the horizon. There is one equation, and one regression, per horizon. Some control variables might be common for all horizons while others are horizon-specific.

The coefficient of interest is  $\delta_h$ , which measures to what extent market expectations tend to move more, in any direction, on days of repo-rate-path announcements. If  $\delta_h$  is significantly larger than zero, this is evidence that the market's expectation of horizon  $h$  is affected by the announcement.<sup>3</sup> If  $\delta_h = 0$ , this indicates one of two things; either the surprise elements of announced repo-rate paths do not impact market pricing, or the announced repo-rate paths in the sample are well in line with pre-announcement expectations.

## 2.2 Data

Most of the variables introduced in section 2.1 are not observed directly, hence I need to proxy them, which will result in potential measurement errors. This section will present and discuss the data used in the empirical analysis.

The Riksbank publishes a repo-rate forecast, or repo-rate path, six times per year, and has done so since the beginning of 2007. The path consists of quarterly averages for the forecast of the repo rate, and typically has a horizon of 12 quarters. It is announced together with a repo-rate decision and a monetary policy report or update, containing forecasts for a number of macroeconomic variables along with an analysis of the current economic situation.

As a measure of the market's expectations of the future repo rate, I use *Forward Rate Agreements* (FRAs) adjusted for a time-independent risk and term premium.<sup>4</sup> These are futures contracts on an underlying 3-month interbank rate, STIBOR.<sup>5</sup> <sup>6</sup> The usage of such contracts as a measure of market expectations of the future policy rate is in line with the existing literature, see for example [Gürkaynak et al. \(2007\)](#), [Moessner and Nelson \(2008\)](#) and [Ferrero and Secchi \(2009\)](#). This is also how the Riksbank measures expectations of future monetary policy in its own analysis, see [Sveriges Riksbank \(2013\)](#). However, there is need for caution here. It may well be that the FRAs are subject to a time-varying premium and hence do not reflect the expectations directly. There are methods to estimate such time-varying premiums, but different methods tend to give substantially different and uncertain results, so in the main analysis I keep the assumption that the premium is fixed. This assumption is relaxed in section 3.2

The FRA contracts expire two bank days prior to the third Wednesday of the last month in each quarter, i.e. approximately two weeks before the beginning of a new calendar quarter. Hence, if compensated for premia, the FRAs are good measures of the expectations of the average overnight interbank rate in a calendar quarter by the expectations hypothesis.<sup>7</sup> Furthermore, the overnight

<sup>3</sup>The announcement of a repo-rate path is not made in isolation from other announcements. More on this in section 2.2.

<sup>4</sup>It is important to distinguish between expected *communication* and expected *action* by the central bank. The FRAs, compensated for premia, are used as measures of the expected action, but do not provide information on which repo-rate path the market expects the Riksbank to communicate.

<sup>5</sup>The difference between the 3-month STIBOR and the repo rate has been rather constant and on average 0.3 percent over the period of interest. Hence, the FRA quotes are adjusted down by 0.3 percentage points in order to better reflect the expected repo rate.

<sup>6</sup>Also RIBA futures, similar to the FRAs but with the repo rate as the underlying rate, are traded. These are available since 2009, not for as many horizons and are traded in smaller volumes than the FRAs, and are therefore not used in the main analysis. However, using a mix of FRAs and RIBA futures doesn't change the main results much.

<sup>7</sup>To get an even better match with calendar quarters, I assign weights of  $\frac{5}{6}$  and  $\frac{1}{6}$  respectively to two consecutive FRA contracts, following [Detmers and Nautz \(2012\)](#). An alternative

interbank rate is very well correlated with the repo rate.

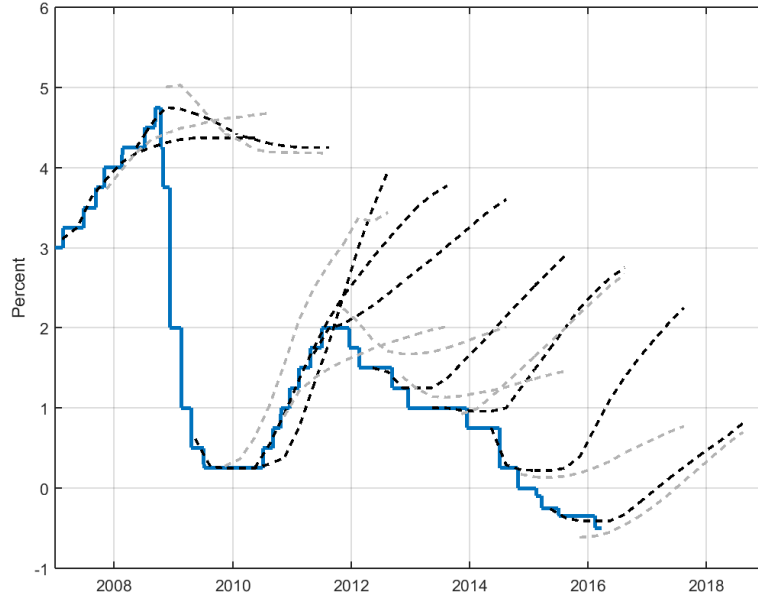


Figure 1: The evolution of the repo rate (thick blue) and selected forecasts by the Riksbank (black) and the market (grey) as quarterly averages at announcement dates. The full set of forecasts is available in figure 4 in appendix A.

Figure 1 shows the outcome of the repo rate, together with one forecast per year by the Riksbank and corresponding expectations according to the FRAs, for the period of interest.<sup>8</sup> Note that the Riksbank and the market have agreed during some periods and disagreed during other. There are several plausible explanations for the periods of disagreement; the information available to the market might differ from that available to the Riksbank, the premia of the FRAs might change, the view of a steady-state level of interest rate might differ, different models for the economy might be used and the Riksbank's communication might be viewed as non-credible by the market. Probably all of the above are true to some extent, and there might be other explanations too. The reasons for the historical disagreement is both important and interesting per se, but it is not the aim of this paper to explain why it has arisen. For an analysis of consequences of differences between market rates and communicated policy-rate paths, see [De Graeve and Iversen \(2015\)](#).

The most striking period of disagreement is perhaps in 2011, when the Riksbank projected the repo rate to continue increasing at a rapid pace while the market expected the repo rate to increase at a much slower pace or even de-

would be to use the method suggested by [Nelson and Siegel \(1987\)](#) or the extended version in [Svensson \(1994\)](#).

<sup>8</sup>When all forecasts are included the figure becomes difficult to comprehend, see figure 4 in appendix A.



crease. As can be seen in the figure, the market turned out to be less wrong ex-post. This example is discussed in more detail in [Svensson \(2015\)](#).

The FRA quotes are observed for horizons 1 to 12 quarters. More formally, we have the following relationship between the FRAs and the expected future repo rate,

$$FRA_{h,t} = E_t [i_{t+h}^{repo}] + \zeta_{h,t}, \quad (4)$$

where  $FRA_{h,t}$  is the observed futures rate for horizon  $h$  just after the announcement at time  $t$ ,  $E_t [i_{t+h}^{repo}]$  is the market's expectation of the repo rate  $h$  calendar quarters from  $t$  and  $\zeta_{h,t}$  is the premium for horizon  $h$  at time  $t$ .<sup>9</sup> Under the assumption that the premium is not affected by the announcement, i.e.  $\zeta_{h,t} = \zeta_{h,t-\epsilon}$  for all  $h \in \{1, 2, \dots, 12\}$ , it is straightforward to define the data version of the dependent variable as

$$\begin{aligned} Impact_{h,t} &= FRA_{h,t} - FRA_{h,t-\epsilon} \\ &= E_t [i_{t+h}^{repo}] - E_{t-\epsilon} [i_{t+h}^{repo}], \end{aligned} \quad (5)$$

where  $t - \epsilon$  refers to just prior to the announcement. The assumption that the premium is unaffected by the announcement is possibly strong, but difficult to overcome. If this assumption is too strong,  $Impact_{h,t}$  cannot be interpreted as being to the market expectation but rather to the market rates, which are also important for a central bank to manage.

What is meant by “just after” and “just prior to” an announcement? Is the difference one day, hour, minute, second or something else? In this study I use end-of-day quotes, so  $\epsilon$  corresponds to one day. This is common in the literature, see e.g. [Ehrmann and Fratzscher \(2004\)](#) and [Moessner and Nelson \(2008\)](#), and has the advantage that the market has time to fully incorporate the new information announced by the Riksbank in the prices used. A drawback is, however, that the prices will also be influenced by other news and information arriving within the same day. An alternative would be to use intra-day quotes, which is done by [Gürkaynak et al. \(2005\)](#) and advocated by [Winkelmann \(2010\)](#). Choosing this approach instead does not seem to affect the results much.<sup>10</sup> In section 3.2 I also apply a method aimed at controlling for other news arriving within the same days.

I now turn to the variable  $Anticipated_{h,t}$  in equation (2). This variable is the market's expected change in the repo-rate path between two consecutive Riksbank announcements. Another way of putting it is that the repo-rate path that the market expects the Riksbank to announce, just prior to the announcement, is the sum of the last published repo-rate path and the variable  $Anticipated_{h,t}$ . The idea is that the market uses all available information; that which was previously announced by the Riksbank and the new information that has arrived since the last announcement.<sup>11</sup> Some alternative views on this variable are discussed in section 3.2.

<sup>9</sup>[Björk \(2004\)](#) shows that even in a risk neutral setting, the expectations hypothesis need not hold. However, most central banks, including the Riksbank, rely on the expectations hypothesis adjusted for premia in this type of analysis, so I follow their example.

<sup>10</sup>I don't have access to intra-day quotes for the entire period of interest or all horizons, but combining daily data with what intra-day data I have results in only minor changes to the results.

<sup>11</sup>This is similar to what [Archer \(2005\)](#) does. [Winkelmann \(2010\)](#) takes another approach, using jumps in medium- to long-term rates on announcement days to identify anticipated and unanticipated surprises in the announced path.

In the baseline case, I will assume that the market expects the Riksbank to update its view on the repo-rate path in the same way that the market itself updated its view since the last announcement. In this case, I define

$$Anticipated_{h,t} = FRA_{h,t-\epsilon} - FRA_{h,t_p}, \quad (6)$$

where  $FRA_{h,t-\epsilon}$  is the futures rate of horizon  $h$  just prior to the announcement at time  $t$ , as before, and  $FRA_{h,t_p}$  is the futures rate just after the previous announcement by the Riksbank.<sup>12</sup> One implication of this definition is that I assume that the market expects any discrepancy between the market's expectation and the forecast in the Riksbank's last announced path to remain unchanged in the coming announcement, given time-fixed premia.

With this definition of the anticipated change of the repo-rate path, the surprise, or unanticipated change, is defined as the difference between the actual and the anticipated change;

$$Surprise_{h,t} = \left( Path_{h,t}^{RB} - Path_{h,t_p}^{RB} \right) - Anticipated_{h,t}, \quad (7)$$

where  $Path_{h,t}^{RB}$  is the repo-rate path for horizon  $h$ , announced by the Riksbank at time  $t$  and  $Path_{h,t_p}^{RB}$  is the previously announced path.

As noted above, defining  $Anticipated_{h,t}$  and  $Surprise_{h,t}$  by equations (6) and (7) assumes that the market expects the Riksbank to update its views in the same way that the market has updated its views. This need of course not be the case. Alternatively, the anticipated and unanticipated changes in the repo-rate path can be defined as the explained parts and residuals respectively of the following regressions:

$$Path_{h,t}^{RB} = \alpha_h + \mu_h^M \cdot FRA_{h,t-\epsilon} + \mu_h^{M_p} \cdot FRA_{h,t_p} + \mu_h^P \cdot Path_{h,t_p}^{RB} + Surprise_{h,t}. \quad (8)$$

After running these regressions, it is natural to define the anticipated change in the repo-rate path since the last announcement as

$$Anticipated_{h,t} = \alpha_h + \mu_h^M \cdot FRA_{h,t-\epsilon} + \mu_h^{M_p} \cdot FRA_{h,t_p} + (\mu_h^P - 1) \cdot Path_{h,t_p}^{RB}. \quad (9)$$

The explained part of the right-hand side of equation (8) contains the level, and change since last announcement, of the market rates as well as the previously announced path by the Riksbank. This way of defining the anticipated changes and surprises through regression is similar to what Moessner and Nelson (2008) suggest and to what Ferrero and Secchi (2009) do. Note that the simpler definition in equation (6) corresponds to the case  $\alpha_h = 0$ ,  $\mu_h^M = \mu_h^P = 1$  and  $\mu_h^{M_p} = -1$  in equation (9).

Regardless of whether  $Anticipated_{h,t}$  and  $Surprise_{h,t}$  are defined by equations (6) and (7) or equations (8) and (9), there is an obvious risk of correlation between the two. My variable of interest is  $Surprise_{h,t}$ , so if  $Anticipated_{h,t}$  is also correlated with the dependent variable  $Impact_{h,t}$ , it should be included in

<sup>12</sup>The Riksbank publishes a new repo-rate path six times per year, so on average the previous announcement was made two months earlier. However, the intervals between meetings differ over the year.

the right-hand side in the main analysis to avoid omitted-variable bias. I.e., if that is the case, I should use equation (2) rather than (1).

As should be clear from above, the measure of  $Surprise_{h,t}$  is uncertain and may well contain measurement errors. If that is the case, the regression equations (1) and (2) will suffer from regression dilution, also known as attenuation bias, and the estimates of  $\beta_h$  and  $\beta_h^S$  will be biased towards zero. I.e., the true coefficients may in fact be at a greater distance from zero than the results in section 3.1 suggest.

Next I turn to the potential vector of control variables,  $X_{h,t}$  in equations (1) and (2). There might be two reasons to include control variables. The first, and most important, reason would be to prevent omitted-variables bias. It is known, see for example Angrist and Pischke (2008), that leaving out any independent variable that is correlated with the dependent variable and the independent variable of interest will bias the coefficient of interest. The direction of the bias depends on the correlations in question and is in general not known. Hence, I include independent variables that I suspect can have explanatory value for both the  $Surprise_{h,t}$  and  $Impact_{h,t}$  variables. The second reason to include more independent variables is that there might be variables that are not correlated with the surprise, but when interacted with it explains the impact. As mentioned above, including more independent variables comes at a cost of lower power of the results.

Section 3 presents results with different specifications of the control vector. The following variables are included mainly to prevent omitted-variables bias:

**Surprise in decision:** A measure of the surprise in the repo-rate decision.<sup>13</sup>

One can suspect that this very well correlates with surprises along the repo-rate path. Details on how this measure is constructed is found in appendix B.

**Surprise in other horizons:** The average surprise for all horizons *except* the one the regression concerns.<sup>14</sup> If the market pays no attention to the time precision of the repo-rate path, and only reacts to movements in the entire path for all horizons, it will be captured by this term rather than in  $\beta_h$  or  $\beta_h^S$ .

**Dummy, effective lower bound:** The Riksbank has, at some occasions, communicated that lowering the repo rate further might result in technical difficulties due to an effective lower bound. Such a lower bound might affect both the communication by the Riksbank and the interpretation by the market.<sup>15</sup>

**Disagreement:** As can be seen in figure 4, there have been periods when the level of disagreement between the Riksbank's forecasts and the market's

<sup>13</sup>A similar control variable is also used in Ferrero and Secchi (2009), although constructed slightly differently. None of the other covariates listed here seem to be present in the literature addressing this question.

<sup>14</sup>Since two consecutive announcements are often made in two different quarters, the repo-rate path from the previous announcement only covers the 11 first quarters of the new announced path. There are not enough data points where this is not the case to analyse the surprise in the 12 quarter horizon. Hence, this control variable is the average surprise in horizon 1–11 quarters, except the horizon that the regression concerns  $h$ .

<sup>15</sup>The communication whether the interest rate is on the effective lower bound, or close enough to affect the monetary policy, is not always clear. I regard a lower bound to be effective for the period July 2009 – April 2010 and July 2014 – July 2015.

expectations has been both high (with positive and negative sign) and low. It might be that the level of disagreement affects the reasoning by the Riksbank as well as the market's reaction to Riksbank communication. I therefore include a backward-looking one-year moving average of the disagreement (average for all horizons) between the Riksbank's forecast and the market pricing, at the time of the last announcement. This proxy measure of disagreement is demeaned.

As mentioned above, an announcement by the Riksbank contains more than just a repo-rate decision and path. Aside from the list presented above, it would be desirable to also include controls for the market surprise in the remaining parts of the announcement, i.e. forecasts for other macroeconomic variables and analysis of the current economic situation. However, it is very difficult to find such measures.

The following independent variables are included mainly because I am interested in the interaction effect with the surprise:

**Dummy, surprise decreases disagreement:** Along the line of thought that the level of agreement between the Riksbank forecast and market expectations might affect the impact on market expectations, I include a dummy for whether the surprise works to increase or decrease the disagreement. A surprise that decreases the disagreement might be viewed as more credible by the market than a surprise that increases the disagreement further. When included, the dummy variable is demeaned and interacted with the surprise.

**Announcement timing:** The monetary policy meetings of the Riksbank are held at different times within the quarter. Consequently, at some meetings the one quarter ahead forecast refers to a quarter beginning only a few days later, while at other meetings the one quarter ahead forecast refers to a quarter beginning almost three months from the meeting. A reasonable hypothesis is that a repo-rate path announced closer to the beginning of a new quarter will be viewed as more credible and hence a surprise in such a meeting could have a larger impact on market expectations, particularly for short horizons. To capture this, the fraction of the quarter still remaining is included as a control, demeaned and interacted with the surprise.

Using the full set of control variables, equation (2) can be written as

$$\begin{aligned} Impact_{h,t} = & \beta_h^S \cdot Surprise_{h,t} + \beta_h^A \cdot Anticipated_{h,t} + \gamma_{0,h} + \gamma_{1,h} \cdot Surprise_{0,t} \\ & + \gamma_{2,h} \cdot \frac{1}{10} \sum_{j \neq h} Surprise_{j,t} + \gamma_{3,h} \cdot D_t^{ELB} + \gamma_{4,h} \cdot \widetilde{Disagreement}_t + \\ & \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} \cdot Surprise_{h,t} + \gamma_{6,h} \cdot \widetilde{Fraction}_t \cdot Surprise_{h,t} + \varepsilon_{h,t}, \end{aligned} \quad (10)$$

where  $\sim$  denotes deviation from mean (for that specific horizon). Note that under this specification the effect of  $Surprise_{h,t}$  on  $Impact_{h,t}$  is not captured entirely by  $\beta_h^S$ , but rather we have

$$\frac{\partial Impact_{h,t}}{\partial Surprise_{h,t}} = \beta_h^S + \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} + \gamma_{6,h} \cdot \widetilde{Fraction}_t. \quad (11)$$

Table 1: Regression results of equation (3)

$h =$	1	2	3	4	5	6	7	8	9	10	11	12
$\alpha_h$	0.02*** (0.00)	0.02*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.03*** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.03*** (0.00)
$\delta_h$	0.07*** (0.02)	0.05*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.01** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)	0.02*** (0.01)
$\eta_h$	0.18*** (0.03)	0.14*** (0.02)	0.09*** (0.02)	0.10*** (0.02)	0.09*** (0.02)	0.08*** (0.02)	0.07*** (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.04*** (0.01)	0.03*** (0.01)	0.02*** (0.01)
$R^2$	0.25	0.16	0.10	0.10	0.06	0.06	0.02	0.01	0.03	0.01	0.01	0.01
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Obs.	2604	2604	2604	2597	2600	2604	2597	2604	2604	2604	2604	2598

Equation:  $|Impact_{h,t}| = \alpha_h + \delta_h \cdot D_t^{Announcement} + \eta_h \cdot D_t^{Expiration} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

In other words,  $\beta_h^S$  is a good approximation of the effect of  $Surprise_{h,t}$  on  $Impact_{h,t}$  if the remaining two terms in (11) are well approximated by zero, either due to the coefficient being small, the independent variables being small or both. In general, more than just the estimates of  $\beta_h^S$  must be considered. This will be discussed further in section 3.1, where the results are presented.

### 3 Results

Before turning to the main analysis, I will briefly motivate why it is worth digging into the question of interest. Table 1 reports the regression results of equation (3), where I have used end-of-day FRA quotes for all trading days between February 2005 and July 2015.<sup>16</sup> Note that one regression is run per horizon  $h$ . The coefficient of interest is  $\delta_h$ , which is interpreted as the extra movement of FRA quotes on days when a new repo-rate path is announced, in total 49 days in the sample. We note that  $\delta_h$  is significantly larger than zero for all horizons, indicating that repo-rate expectations tend to move more on announcement days than non-announcement days, still under the assumption that the premium is approximately unaffected by the announcement. Comparing the size of  $\delta_h$  with the size of  $\alpha_h$ , which captures the average movement of the FRA quote on non-announcement trading days, we see that the effect is not only statistically significant but also economically very significant, especially for shorter horizons.

The variable  $D_t^{Expiration}$  in equation (3) is a dummy for the expiration dates, i.e. dates when a FRA contract switches from referring to one calendar quarter to the next. This must of course be taken into consideration. The interpretation of  $\eta_h$  is hence the average difference of the FRA price between two consecutive

<sup>16</sup>The standard errors reported in regression tables throughout the paper are heteroscedasticity-consistent, see e.g. Angrist and Pischke (2008).

Table 2: Regression results of equation (1)

$h =$	1	2	3	4	5	6	7	8	9	10	11
$\beta_h$	0.55*** (0.16)	0.25** (0.11)	0.14** (0.07)	0.10** (0.05)	0.08** (0.04)	0.06* (0.03)	0.06* (0.03)	0.03 (0.03)	0.01 (0.02)	-0.00 (0.02)	-0.01 (0.02)
$\gamma_{0,h}$	0.01 (0.01)	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	0.01 (0.01)
$R^2$	0.53	0.16	0.13	0.13	0.13	0.11	0.09	0.03	0.01	0.00	0.00
$p_F$	0.00	0.01	0.01	0.01	0.01	0.02	0.05	0.24	0.56	0.98	0.68
Obs.	41	46	47	48	48	47	46	46	46	47	40

Equation:  $Impact_{h,t} = \beta_h \cdot Surprise_{h,t} + \gamma_{0,h} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. In this regression, the control vector,  $X_{h,t}$ , consists of a vector of ones only. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

horizon quarters, at the expiration dates. This might capture both premia and expectations of future short rates. There are in total 42 expiration days in the sample.

The overall conclusion from this introductory analysis is that it is worthwhile investigating the movements of the FRA quotes on announcement days closer. That is the main purpose of this paper, and will be presented in the following sections.

### 3.1 Main results

I begin by investigating the very simplest case, and thereafter add complexity in steps. The very simplest case is to run the regressions, one per horizon, in equation (1) without any control variables, i.e.  $X_{h,t}$  is only a vector of ones so that  $\gamma_h$  is an intercept. I also use the simpler definition of  $Surprise_{h,t}$ , i.e. it is defined by equations (6) and (7). The result of these regressions are presented in table 2.

The estimates of  $\beta_h$  suggest that a surprise in the repo-rate path announced by the Riksbank might have a significant effect on market expectations up to a horizon of about 5–7 quarters. However, the suggested effect is quite small for horizons beyond 1 or perhaps 2 quarters.<sup>17</sup> Note in table 2 that the coefficient of determination,  $R^2$ , is low for horizons beyond 1 quarter, suggesting that this model does not perform well in explaining how market expectations are updated on announcement days.

The results of these first simple regressions suggest that the effect we are looking for, the ability of the Riksbank to affect market expectations with the repo-rate path, is present. However, the results should be viewed with great caution. There are reasons to believe that the estimates of  $\beta_h$  are biased, partly

<sup>17</sup>The interpretation of, for instance,  $\hat{\beta}_1 = 0.55$  is that a surprise of 100 basis points in the repo-rate path one quarter ahead should move the market expectations 55 basis points in the same direction for that horizon. Although the estimate for  $\hat{\beta}_7 = 0.06$  is perhaps significantly larger than zero, a movement of market expectations of 6 basis points in response to a 100 basis point surprise must be regarded as very close to nothing.

Table 3: Regression results of equation (2)

$h =$	1	2	3	4	5	6	7	8	9	10	11
$\beta_h^S$	0.47*** (0.09)	0.32*** (0.08)	0.22*** (0.07)	0.18*** (0.05)	0.14*** (0.03)	0.13*** (0.03)	0.13*** (0.03)	0.12*** (0.03)	0.09** (0.03)	0.06* (0.04)	0.05 (0.04)
$\beta_h^A$	0.22*** (0.06)	0.13*** (0.04)	0.11** (0.05)	0.12*** (0.04)	0.11*** (0.03)	0.12*** (0.03)	0.11*** (0.03)	0.11*** (0.03)	0.09*** (0.03)	0.07* (0.04)	0.07 (0.05)
$\gamma_{0,h}$	0.02* (0.01)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.02** (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.02 (0.01)
$R^2$	0.72	0.31	0.28	0.35	0.38	0.43	0.39	0.31	0.21	0.09	0.08
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.22
Obs.	41	46	47	48	48	47	46	46	46	47	40

Equation:  $Impact_{h,t} = \beta_h^S \cdot Surprise_{h,t} + \beta_h^A \cdot Anticipated_{h,t} + \gamma_{0,h} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. In this regression, the control vector,  $X_{h,t}$ , consists of a vector of ones only. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

since we may have a bad measure of the surprise parts of the announced repo-rate paths, partly because there might be other explanatory variables that are correlated with both the impact on expectations and the surprise part of the repo-rate paths. I will now try to remedy these potential problems.

In the next step, I add also the anticipated change in the repo-rate path to the analysis. This should give a hint on the quality of our measure of the surprise part of the announced paths. Table 3 shows the results of the regressions in equation (2), still using equations (6) and (7) to define the anticipated change and the surprise. Note that this leads to a substantial increase in the  $R^2$ , and for most horizons also in the estimates of the coefficient for the surprise,  $\hat{\beta}_h^S$ , compared to the case where the anticipated change is not included. This is a symptom that omitted-variables bias was present but has now been partly overcome. The significant effect of the surprise now stretches up to a 9-to-10-quarter horizon. However, also note that the estimates of the coefficient for the anticipated change,  $\beta_h^A$ , are significantly larger than zero for most horizons. As discussed in section 2.1, this might be an indication that the measure of the variable  $Anticipated_{h,t}$  is bad, and consequently also the measure of  $Surprise_{h,t}$ .

Given the potential problem identified above, the next natural step is to try to improve the measure of  $Anticipated_{h,t}$  from the definition in equation (6). As described in section 2.1, one method, closely related to that suggested in Ferrero and Secchi (2009), is to define  $Anticipated_{h,t}$  by equation (9) after running the regressions of equation (8). Note also that  $Surprise_{h,t}$  is then defined as the unexplained part, or residual, of the same regression. Denoting the regression in (8) by *first stage* and the regression in (2) by *second stage*, the results are presented in table 4.

Let us first consider the first stage. Recall that with  $\alpha_h = 0$ ,  $\mu_h^M = \mu_h^P = 1$  and  $\mu_h^{M_p} = -1$ , equations (6) and (9) are equivalent. It is apparent from table 4 that this is a bad assumptions for all horizons beyond one quarter. Further,

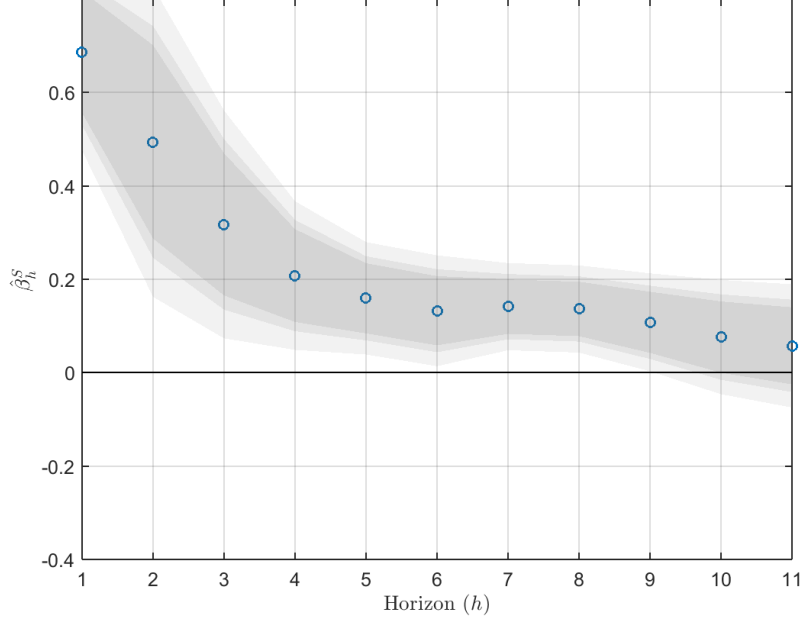


Figure 2: Estimates of  $\beta_h^S$  in equation (2), with 90%, 95% and 99% confidence intervals, for different horizons in quarters.

note that  $R^2$  is high, indicating that the regressions of equation (8) captures the determination of  $Anticipated_{h,t}$  quite well.

The second stage is presented in table 4 and in figure 2, where the estimates of  $\beta_h^S$  are illustrated with confidence intervals for each horizon  $h$ . The estimates of  $\beta_h^A$  are not as significantly different than zero as compared to table 3.<sup>18</sup> This also strengthens the hypothesis that equations (8) and (9) is a good model for the variable  $Anticipated_{h,t}$ . Note also that for some quarters, the estimated impact of the surprise,  $\beta_h^S$ , increases substantially. Also the  $R^2$  increases for some horizons, indicating that the regressions presented in table 4 fits better than those in table 3.

The results presented in table 4 and figure 2 may be viewed as the main results of this study. However, as mentioned above, there are still reasons to suspect bias in  $\beta_h^S$  due to omitted variables and regression dilution. I also run the regressions including all the control variables discussed in detail in section 2.2, i.e. run the regression in equation (10), in an attempt to decrease the omitted-variables bias. The full results are shown in table 5, and the estimates of  $\beta_h^S$  are illustrated in relation to the horizon  $h$  in figure 3. Note that the variables  $Anticipated_{h,t}$  and  $Surprise_{h,t}$  are still defined by the first-stage regressions of equation (8). However, nothing is changed in the first-stage regression from table 4, so table 5 only shows the second stage.

First note that the  $R^2$  values increase for all horizon, and for some quite

<sup>18</sup>In fact, leaving  $Anticipated_{h,t}$  out of the second-stage equation doesn't change the results by much.



Table 4: Regression results of equations (2) and (8)

$h =$	1	2	3	4	5	6	7	8	9	10	11
Second stage											
$\beta_h^S$	0.69*** (0.08)	0.49*** (0.12)	0.32*** (0.09)	0.21*** (0.06)	0.16*** (0.04)	0.13*** (0.04)	0.14*** (0.03)	0.14*** (0.03)	0.11*** (0.04)	0.08 (0.05)	0.06 (0.05)
$\beta_h^A$	0.19*** (0.04)	0.07 (0.04)	0.04 (0.05)	0.05 (0.04)	0.05 (0.03)	0.06* (0.04)	0.06* (0.03)	0.06* (0.03)	0.06 (0.04)	0.06 (0.05)	0.01 (0.05)
$\gamma_{0,h}$	-0.01 (0.01)	0.01 (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.00 (0.01)	0.01 (0.01)	-0.00 (0.01)
$R^2$	0.82	0.41	0.37	0.36	0.37	0.34	0.36	0.33	0.21	0.09	0.04
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.14	0.44
Obs.	36	46	46	48	48	48	46	46	46	46	48
First stage											
$\alpha_h$	-0.00 (0.03)	-0.01 (0.03)	-0.03 (0.04)	-0.07 (0.05)	-0.06 (0.07)	-0.04 (0.08)	0.05 (0.09)	0.09 (0.10)	0.11 (0.13)	0.09 (0.15)	0.08 (0.15)
$\mu_h^M$	1.12 (0.10)	0.92 (0.06)	0.82** (0.07)	0.74*** (0.09)	0.68*** (0.10)	0.59*** (0.11)	0.59*** (0.10)	0.51*** (0.09)	0.45*** (0.08)	0.38*** (0.08)	0.35*** (0.07)
$\mu_h^{M_p}$	-0.90 (0.21)	-0.58*** (0.14)	-0.46*** (0.13)	-0.45*** (0.13)	-0.43*** (0.12)	-0.34*** (0.11)	-0.32*** (0.11)	-0.26*** (0.11)	-0.22*** (0.11)	-0.17*** (0.10)	-0.16*** (0.09)
$\mu_h^P$	0.75 (0.19)	0.66** (0.15)	0.66*** (0.12)	0.74** (0.10)	0.78** (0.08)	0.77*** (0.07)	0.73*** (0.08)	0.74*** (0.08)	0.76** (0.09)	0.78** (0.09)	0.81** (0.08)
$R^2$	0.99	0.99	0.98	0.97	0.96	0.94	0.95	0.95	0.95	0.95	0.95
Obs.	36	46	46	48	48	48	46	46	46	46	48

First stage:  $Path_{h,t}^{RB} = \alpha_h + \mu_h^M \cdot FRA_{h,t-\epsilon} + \mu_h^{M_p} \cdot FRA_{h,t_p} + \mu_h^P \cdot Path_{h,t_p}^{RB} + Surprise_{h,t}$ .

Second stage:  $Impact_{h,t} = \beta_h^S \cdot Surprise_{h,t} + \beta_h^A \cdot Anticipated_{h,t} + \gamma_{0,h} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. In the first-stage regression, significance levels refer to significant difference from the reference levels  $(0, 1, -1, 1)$  for  $(\alpha_h, \mu_h^M, \mu_h^{M_p}, \mu_h^P)$  respectively. In the second-stage regression, the control vector,  $X_{h,t}$ , consists of a vector of ones only. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

much, compared to the case where the control variables are not included (4). This suggests that the controls included are helpful in explaining the impact on market expectations, as measured by the FRA contracts. In other words, the model where the controls are included is probably closer to the true model explaining the impact on the FRA quotes than the one without controls. This indicates that I might have overcome some omitted-variables bias.

Now turn to the estimates of  $\beta_h^S$ . We see that these decrease for short horizons as well as long horizons when the controls are included. However, they increase for some medium-term horizons. The most likely explanation to why

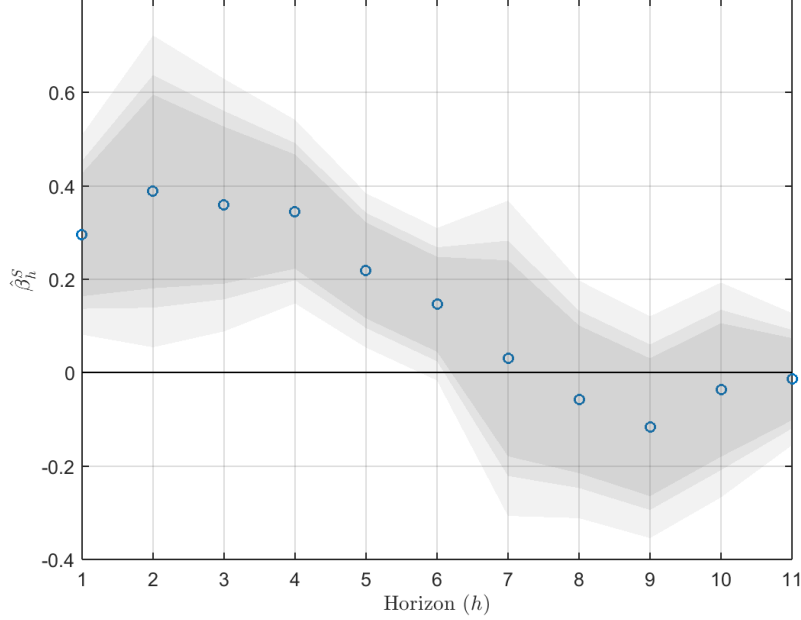


Figure 3: Estimates of  $\beta_h^S$  in equation (10), with 90%, 95% and 99% confidence intervals, for different horizons in quarters.

the estimates decrease for short horizons is that these are affected by the control for the surprise in the repo-rate decision. The estimates of these coefficients,  $\gamma_{1,h}$ , are significantly larger than zero for horizons of 1 and 2 quarters. Judging from the size of the estimates, it seems that a surprise in the repo-rate decision is more effective than a surprise to the repo-rate path at managing the market expectations of very short horizons.

There are some more notable results in table 5. The standard errors of  $\hat{\beta}_h^S$  increase compared to the case where the control variables are not included. This is probably the effect of small samples being used to estimate more parameters. As in the case without control variables, the estimates of  $\beta_h^A$  are well approximated by zero for most horizons, and the main results remain if  $Anticipated_{h,t}$  is left out of the equation.

The estimates of  $\gamma_{2,h}$ , capturing the impact on forward rates for horizon  $h$  from path surprises in all horizons except  $h$ , are significantly different than zero for some horizons. This suggests that there may be reactions to the entire curve rather than the specific quarterly timing of the repo-rate path. Some of the  $\hat{\beta}_h^S$  might be overestimated in the sense that there is a counter impact in the other direction, while other might be underestimated. However, for most horizons the estimates of  $\gamma_{2,h}$  are well approximated by zero, so the main picture remains intact.

The two terms containing the coefficients  $\gamma_{3,h}$  and  $\gamma_{4,h}$  are included, as was mentioned above, in attempt to prevent omitted-variables bias. Although the estimates of these might be interesting for other reasons, they are not important

Table 5: Regression results of equation (10)

$h =$	1	2	3	4	5	6	7	8	9	10	11
	Second stage										
$\beta_h^S$	0.30*** (0.08)	0.39*** (0.12)	0.36*** (0.10)	0.34*** (0.07)	0.22*** (0.06)	0.15** (0.06)	0.03 (0.12)	-0.06 (0.09)	-0.12 (0.09)	-0.04 (0.08)	-0.01 (0.05)
$\beta_h^A$	0.08*** (0.03)	-0.00 (0.05)	0.02 (0.05)	0.01 (0.04)	0.00 (0.03)	0.00 (0.04)	0.03 (0.03)	0.06* (0.04)	0.05 (0.04)	0.04 (0.06)	0.06 (0.06)
$\gamma_{0,h}$	-0.00 (0.01)	0.02* (0.01)	0.02* (0.01)	0.02** (0.01)	0.02* (0.01)	0.01 (0.01)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	0.02 (0.01)	0.01 (0.01)
$\gamma_{1,h}$	0.64*** (0.12)	0.50*** (0.18)	0.23 (0.19)	0.22* (0.13)	0.19* (0.10)	0.17 (0.11)	0.03 (0.14)	-0.01 (0.15)	-0.04 (0.12)	-0.01 (0.14)	0.02 (0.11)
$\gamma_{2,h}$	0.01 (0.05)	-0.03 (0.09)	-0.07 (0.09)	-0.20** (0.09)	-0.13 (0.10)	-0.07 (0.12)	0.12 (0.19)	0.24* (0.14)	0.27** (0.11)	0.07 (0.11)	0.11* (0.05)
$\gamma_{3,h}$	-0.01 (0.02)	-0.06*** (0.02)	-0.07*** (0.01)	-0.09*** (0.02)	-0.06*** (0.01)	-0.04*** (0.02)	-0.04** (0.02)	-0.02 (0.02)	-0.02 (0.02)	0.00 (0.03)	-0.02 (0.02)
$\gamma_{4,h}$	-0.01 (0.03)	0.02 (0.05)	0.06 (0.05)	0.05 (0.04)	0.04 (0.04)	0.02 (0.04)	0.01 (0.05)	-0.02 (0.05)	-0.02 (0.04)	-0.03 (0.05)	-0.04 (0.05)
$\gamma_{5,h}$	0.02 (0.09)	0.03 (0.14)	0.17 (0.13)	0.25*** (0.09)	0.18*** (0.06)	0.19*** (0.07)	0.22*** (0.08)	0.10 (0.08)	0.18** (0.09)	0.28 (0.18)	-0.07 (0.12)
$\gamma_{6,h}$	-0.70*** (0.18)	-1.13** (0.44)	-0.74*** (0.25)	-0.46*** (0.13)	-0.33*** (0.10)	-0.28** (0.11)	-0.18 (0.14)	-0.10 (0.14)	0.02 (0.14)	0.10 (0.20)	-0.03 (0.20)
$R^2$	0.92	0.68	0.60	0.68	0.68	0.63	0.50	0.41	0.38	0.20	0.17
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.33	0.47
Obs.	36	46	46	48	48	48	46	46	46	46	48

Equation:  $Imp_{h,t} = \beta_h^S \cdot Surp_{h,t} + \beta_h^A \cdot Antic_{h,t} + \gamma_{0,h} + \gamma_{1,h} \cdot Surp_{0,t} + \gamma_{2,h} \cdot \frac{1}{10} \sum_{j \neq h} Surp_{j,t} + \gamma_{3,h} \cdot D_t^{ELB} + \gamma_{4,h} \cdot \widetilde{Disagr}_t + \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} \cdot Surp_{h,t} + \gamma_{6,h} \cdot \widetilde{Frac}_t \cdot Surp_{h,t} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. For the first-stage results, see table 4. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

for our question of interest, and are hence not discussed further here.

The coefficient  $\gamma_{5,h}$  captures the extra effect a surprise has if it is in the direction that closes the existing disagreement, or discrepancy, between the Riksbank's forecast and the market expectations. The estimates are significantly larger than zero for some horizons, suggesting that at least for some horizons the impact of a surprise might be larger if the surprise is such that the Riksbank's new forecast is more in line with the market expectations. Intuitively it makes sense that a movement closer to the market expectations is viewed as more

credible by the market, which is in line with positive coefficients. Although not significant for all horizons,  $\hat{\gamma}_{5,h}$  in general have the correct sign. The lack of significance might arise from measurement errors and a small sample, as discussed above.

The estimates of  $\gamma_{6,h}$  are significantly smaller than zero for some, mainly short, horizons. This also makes sense intuitively, since the interpretation is that a forecast that is released early within the current quarter is viewed as less credible for each horizon. It is simply the case that there is more time left until the beginning of the calendar quarter that the horizon refers to. It also makes sense that the effect is larger for shorter horizons, since the relative difference caused by the release date within the quarter is larger the shorter the horizon is.

The main question of interest is what impact a surprise in an announced repo-rate path has on market expectations of the future repo rate, i.e. the partial derivative  $\frac{\partial \text{Impact}_{h,t}}{\partial \text{Surprise}_{h,t}}$ . We recall equation (11), and by using the results from table 5 we can conclude the following;  $\hat{\beta}_h^S$  is probably a good approximation of the effect we are interested in if we complement it with information on whether the surprise closes or opens the disagreement and where in the quarter the announcement is placed, slightly dependent on which horizons we are mainly interested in.

Regardless of whether one finds the specification with a large set of control variables, presented in table 5, or the more scarce specification presented in table 4 more reliable, the overall impression of matching equation (2) to data is that it seems like the Riksbank has the ability to affect market expectations with the repo-rate path. The effect is however small or zero beyond one-and-a-half years, and even for shorter horizons the effect is not one-to-one. Less than half of a surprise is reflected in the expectations, and the effect is decreasing with the horizon. These results may be viewed as lower bounds, since there is reason to suspect biased estimates of  $\beta_h^S$  towards zero due to regression dilution because of measurement errors.

Managing the expectations up to about half a year might be more effectively done by surprising with the repo-rate decision. One should also bare in mind that the surprise in the repo-rate decision is highly positively correlated with the surprise in the very short horizon of the repo-rate path, so in practice, a combination of path and decision surprise is often the case.

Even with the more extensive set of controls, there is still reason to worry about omitted-variables bias. Especially, I would like to include controls for the surprise in other information released by the Riksbank simultaneously as the announcement of the repo-rate path and decision. As mentioned above, this includes forecasts for other macroeconomic variables and analysis of the current economic situation. However, this is unobserved and difficult to proxy, and hence I have no other choice than to leave it omitted. This might bias the estimates of interest, and it is difficult to guess the sign and size of such a potential bias.

### 3.2 Robustness

This section will discuss the robustness of the results presented in section 3.1. I introduce a control for the within-day movement caused by other macroeconomic news than the announcement. I will also look at other measures of the

surprise of an announcement than those defined in equations (7) and (8). I show that the results hold when a proxy for a time-and-horizon-specific premium is introduced. I also compare the measures of anticipated announcements presented in section 2.2 to a survey performed before each announcement. The control variables are relaxed one at the time to investigate the importance of each, and finally I try to analyse how robust the results are over time, which is difficult with such a small sample.

In order to overcome the problems arising from potential impact of other macroeconomic news arriving within announcement days, I impose a proxy for the impact of news other than the announcement by the Riksbank. The proxy I use is the daily movement of the Norwegian FRA rates. Economic and financial conditions are very similar in the neighbouring countries Norway and Sweden, and hence there is reason to believe that the Norwegian FRA market should react similar as the Swedish FRA market to news, at least that is not Swedish-specific or Norway-specific in its nature. Both Norway and Sweden are small open economies, and hence influenced largely by international news. The short-term rates, both in the interbank markets and the treasury bill markets, are highly correlated. During the period of interest, there have been no coinciding days of policy-rate announcements in the two countries. Hence, including the  $Impact_{h,t}$ , as defined in equation (5), for Norway as a control variable in  $X_{h,t}$  in equations (1) and (2) might capture the non-announcement effect, if there is one.<sup>19</sup> This is possible since the Norwegian and Swedish FRAs are constructed the exact same way, with the same settlement dates. Table 6 in appendix C shows the regression results of including the term  $+\gamma_{7,h} \cdot Impact_{h,t}^{NO}$  in equation (10). In Norway, FRAs are only available for a horizon of 8 quarters, hence the quarters 9–11 have been excluded. As before, the first stage regression is not altered and is hence excluded. The effect on the results is very limited, indicating either that the daily FRA rates are good enough at isolating the effect of an announcement or that the impact on Norwegian FRAs is not good enough at capturing the effect of other news. It is also worth noting that the coefficient for the impact on Norwegian FRAs is non-significant for most horizons.

I now turn to the measure of the variable  $Anticipated_{h,t}$ , and hence indirectly the variable  $Surprise_{h,t}$ . So far, these have been defined in two ways, either by equations (6) and (7) or by the regression equation (8) (together with (9)). I will investigate two more cases, suggested in Moessner and Nelson (2008); the path that the market expects the Riksbank to announce is given by the market pricing of the FRAs just prior to the announcement, and the path that the market expects the Riksbank to announce is the same as the one that was announced previously by the Riksbank. More formally,

$$Anticipated_{h,t} = FRA_{h,t-\epsilon} - Path_{h,t_p}^{RB} \quad \text{and} \quad (12)$$

$$Anticipated_{h,t} = 0 \quad (13)$$

<sup>19</sup>An endogeneity problem might also arise, if the announcement by the Riksbank also has an impact on the market expectations of future Norwegian policy rates. We would have what Angrist and Pischke (2008) refer to as a “bad control”. This is not unrealistic, since monetary policy is typically highly correlated in Norway and Sweden. However, including a dummy variable for the announcement days of Norges bank, the central bank of Norway, in the regression equation (3) gives estimates that are not significantly larger than zero for any horizons except the 12-quarter horizon. This suggests that at least the Swedish market is not affected much by the communication of Norges bank, so one might expect the reverse to be true as well.

respectively. In the first case, the market's expectation of communication and action by the Riksbank coincides. The market disregards the history of, often systematic, discrepancy between the Riksbank forecast and the market expectations, and expects the Riksbank to fully change its forecast to be in line with the market's expectations. This is what Svensson (2015) refers to as *full predictability*. The second case assumes that the anticipated change in the Riksbank's communication is zero. Kuttner (2001) and Gürkaynak et al. (2005) argue that this is not likely the case. Both these assumptions might seem extreme and unrealistic, but have the advantage of being simple in construction, and are hence worthwhile investigating. Note that when equation (12) or (13) are used, there is no need for a first-stage regression.

A summary of the results of the first case, expected communication coincides with market expectations, i.e. the anticipated change in the communicated path is given by equation (12), are given in table 7 in appendix C. Note that the  $R^2$  is similar compared to the main results in table 5, and also the estimates of  $\beta_h^S$  are quite similar. However, also the estimates of  $\beta_h^A$  are in general significantly larger than zero, suggesting that this specification probably is not as good as the one used in the main analysis.

The results of the other alternative case, when the communicated path is expected not to change since the previous announcement, i.e. the anticipated change in the communicated path is zero, are summarised in table 8. Note that this is a regression of equation (1) rather than equation (2), since the anticipated change is defined to be zero in this case. The estimates of  $\beta_h$  are very different from the main results. This entire case is difficult to interpret and does not add much to the conclusion. However, it serves to emphasize the importance of finding a good measure of the anticipated and unanticipated parts of the Riksbank communication.

One obvious drawback of using FRAs as a measure of expectations of the future repo rate is that it might contain different kinds of premia, which was briefly discussed in section 2.2. In the main analysis, I compensate for a *time-and-horizon-fixed* aggregate premium. An assumption that the premium does not change over time and is the same for all horizons might be too strong. Without commenting further on the type or nature of these possible premia, I follow Ferrero and Secchi (2009) in an attempt to allow the aggregate premium to vary over time and horizons. The idea is that, although market rates like the FRAs might contain premia, survey expectations should not. Hence I construct the varying horizon-specific premium as the difference between FRA rates and the expected future repo rate according to a survey.<sup>20</sup> The survey is not conducted on the same dates as the announcements by the Riksbank, so I use linear interpolation in the time dimension to get a timely estimate. Also, the survey only concerns horizons of 1, 4 and 8 quarters. Linear interpolation is used also in the horizon dimension to get estimates for intermediate horizons. I extrapolate beyond 8 quarters by simply using the value of the 8-quarter horizon. Figure 5 in appendix C shows how these measures of the premium have evolved during the period of interest.

Table 9 presents the results when the varying premium is used. In line with Ferrero and Secchi (2009), the estimates of  $\beta_h^S$  are slightly higher for most short

<sup>20</sup>A monthly survey performed by TNS Sifo Prospera ([prospera.se](http://prospera.se)) is used, where about 50 money market participants, mainly Swedish but also international, are asked to quantify their beliefs on different macroeconomic developments, including the repo rate, for different horizons. Up until the third quarter of 2009 the survey was conducted only quarterly.

horizons. The  $R^2$  is also increased for some short horizons. Overall, the picture of the transmission mechanism of the repo-rate path remains when the time-varying premium is used. One perhaps notable thing is that the estimates of  $\gamma_{1,h}$ , the impact of a surprise in the repo-rate decision, is significantly larger than zero only for the 1-quarter horizon, suggesting that the repo-rate decision might be an even worse instrument for affecting expectations beyond the immediate future.

It is important to beware that using a time-varying premium, defined the way I have, does not resolve the problem that the announcement might have an effect on the premium itself, see equations (4) and (5). This weakness remains, but as has been mentioned above, it might not be important to distinguish between affecting expectations or the premium – in both cases the forward rates move, which might be the aim.

Now to the question of whether my measure of the anticipated (by the market) repo-rate path is good. As mentioned above, the market's expectation of which repo-rate path will be announced by the Riksbank, just prior to the announcement, is unobserved. I have however defined and used two different proxies, one defined by equations (6) and (7) and the other defined by regression of equation (8) and then using equation (9), plus two robustness checks presented above. One way of verifying the quality of these proxies is to compare them with surveys of the Riksbank's expected communication, although this is concerned with other potential problems. One such survey exists, where the Swedish commercial bank SEB asks the largest Swedish bond-market investors approximately one week prior to a new Riksbank announcement about their quantitative beliefs regarding not only the *actions* by the Riksbank but also regarding the *communication*, specifically the announcement of a repo-rate path. The survey doesn't cover the entire path, but typically asks about three specific horizons, and is hence not suitable as a substitute for the proxies used in this study. However, it is interesting to compare these specific observations to the proxies I use.

Figure 6 plots expectations of the announced path according to the survey and according to the proxy in equation (8), where each colour represents a horizon. Running simple regressions where the proxy is explained by the survey and a constant suggest that we cannot reject the hypothesis that the coefficient is one for the survey measure and the constant is zero.<sup>21</sup> The results hold also when the proxy is defined by equations (6) and (7). From this I conclude that the survey gives reason to believe that the proxies for path surprises used in this study are valid.

A very interesting question, that has been left untouched so far, is whether the results are robust over time. Detmers and Nautz (2012) use similar methods and find that the ability of the Reserve Bank of New Zealand to affect market expectations with the policy-rate path has declined since the outbreak of the financial crisis in 2008. Unfortunately, this sample is too small to make any advanced exercises on the subject, like distinguishing between the periods before and after the outbreak of financial crisis. However, the results are robust to leaving out periods of one year at the time.

<sup>21</sup>This corresponds to all observations being on the 45-degree line in figure 6.

## 4 Conclusions

Market expectations of future monetary policy, as measured by futures rates, tend to move more than normal on days when the Riksbank announces a new repo-rate path, raising the question of what ability the Riksbank has to manage such expectations with the repo-rate path. I have used regression analysis to investigate whether unanticipated changes in the repo-rate path impact the market expectations of the future repo rate on different horizons. There are no perfect measures of neither the anticipation of an announced repo-rate path nor the expected future repo rate, so proxies for these are constructed. The proxy for expected future action, i.e. the future repo rate, is standard in the literature, and my results suggest that the proxy used for anticipated communicated path is valid.

The results of the regressions indicate that the Riksbank has the ability to use the repo-rate path to affect market expectations up to between one and three years. The effect is less than one-to-one and decreasing with the horizon.

For very short horizons, one and two quarters, a surprise in the repo-rate decision might be more effective at managing expectations. A combination of surprises in the decision and path, which is typically the case, seems to be an effective way to manage expectations.

The impact of a path surprise might be even larger if the surprise is in such a direction that it closes the gap between the Riksbank's announced forecast and the market expectations. If the surprise should be such that the gap is widened further, the impact might be smaller. Also the timing within the calendar quarter of the announcement might affect the size of the impact, especially for short horizons.

There is a risk that the estimated effects are biased towards zero due to measurement errors in the proxy for surprise in the repo-rate path. Another potential source of biased estimates is that I have no means of controlling for the impact of surprises in other information released by the Riksbank in the same announcement as the repo-rate path and decision. Such information include forecasts of other macroeconomic variables and an analysis of the current economic situation. It is difficult to guess the size and sign of such a potential bias.



## References

- Angrist, J. D. and Pischke, J.-S. (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton university press.
- Archer, D. (2005). Central bank communication and the publication of interest rate projections. In *Sveriges Riksbank conference, "Inflation Targeting: Implementation, Communication, and Effectiveness"*, Stockholm, June.
- Björk, T. (2004). *Arbitrage Theory in Continuous Time*. Oxford university press, 2 edition.
- De Graeve, F. and Iversen, J. (2015). Central bank policy paths and market forward rates: A simple model. Working Paper 303, Sveriges Riksbank.
- Detmers, G.-A. and Nautz, D. (2012). The Information Content of Central Bank Interest Rate Projections: Evidence from New Zealand. *Economic Record*, 88(282):323–329.
- Dincer, N. N. and Eichengreen, B. (2007). Central Bank Transparency: Where, Why, and with What Effects? Working Paper 13003, National Bureau of Economic Research.
- Ehrmann, M. and Fratzscher, M. (2004). Taking Stock: Monetary Policy Transmission to Equity Markets. *Journal of Money, Credit and Banking*, 36(4):719–737.
- Ferrero, G. and Secchi, A. (2009). The announcement of monetary policy intentions. *Bank of Italy Temi di Discussione (Working Paper) No*, 720.
- Gürkaynak, R. S., Sack, B., and Swanson, E. T. (2005). Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking*, 1(1):55–93.
- Gürkaynak, R. S., Sack, B. P., and Swanson, E. T. (2007). Market-Based Measures of Monetary Policy Expectations. *Journal of Business & Economic Statistics*, 25(2):201–212.
- Ingves, S. (2007). Communication – what demands are made of an independent central bank? Speech at the Swedish Economics Association, Stockholm.
- Krueger, J. T. and Kuttner, K. N. (1996). The Fed Funds Futures Rate as a Predictor of Federal Reserve Policy. *Journal of Futures Markets*, 16(8):865–879.
- Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. *Journal of Monetary Economics*, 47(3):523–544.
- Moessner, R. and Nelson, W. R. (2008). Central Bank Policy Rate Guidance and Financial Market Functioning. *International Journal of Central Banking*, 4(4):193–226.
- Nelson, C. R. and Siegel, A. F. (1987). Parsimonious modeling of yield curves. *Journal of business*, pages 473–489.

- Svensson, L. E. (1994). Estimating and Interpreting Forward Interest Rates: Sweden 1992-1994. Working Paper 4871, National Bureau of Economic Research.
- Svensson, L. E. (2015). Forward Guidance. *International Journal of Central Banking (forthcoming)*, 11.
- Sveriges Riksbank (2013). Perspectives on monetary policy expectations and forward rates. *Monetary Policy Report February 2013 (Box article)*, pages 48–52.
- Winkelmann, L. (2010). The Norges Bank’s key rate projections and the news element of monetary policy: A wavelet based jump detection approach. SFB 649 discussion paper 2010-062, Berlin.

## A Repo-rate paths and market pricing

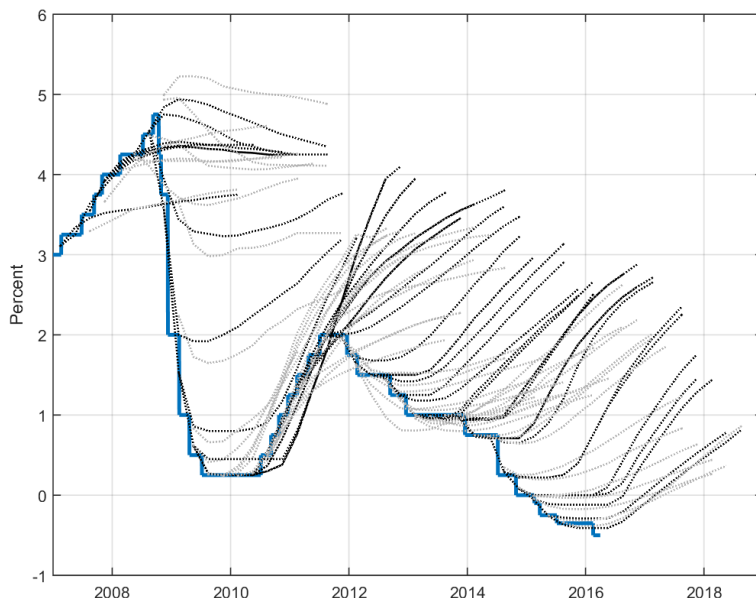


Figure 4: The evolution of the repo rate (thick blue) and forecasts by the Riksbank (black) and the market (grey) as quarterly averages at announcement dates.

## B Surprise in the repo-rate decision

One of the control variables that are included in the main analysis is the surprise component of a repo-rate decision. This is the difference between the change that is anticipated by the market just prior to a Riksbank announcement and the actual change of the repo rate at that announcement. Note that the surprise can be non-zero even if the change of the repo rate is zero, if the anticipated change is non-zero. The anticipated change is unobserved, and hence so is the surprise. However, market pricing data provides a good proxy for the anticipated change, and the method used to create this proxy is described in this appendix.

The method described here is the same as the Riksbank uses and has been using for many years. However, the details have never been published and are hence given here. The method is loosely built on [Krueger and Kuttner \(1996\)](#).

I use interest rate swaps to determine the surprise component of a repo-rate decision. The swaps I use are 30-day STINA-swaps, with the STIBOR T/N as the underlying variable part.<sup>22</sup> The way the STINA-swap works is that it breaks even if the (geometrical) average STIBOR T/N from  $t+2$  to  $t+32$  equals

<sup>22</sup>STIBOR T/N is a Swedish inter-bank interest rate used for overnight loans stretching from the next day to the day after that.

the swap rate. This makes the STINA-swap rate the expected average of the STIBOR T/N rate over the duration. I disregard any swap premia, which I have reasons to believe are very close to zero in this case.

In turn, the STIBOR T/N rate is typically very close to the repo-rate plus a fixed premium of 10 basis points.<sup>23</sup> In cases where the premium deviates from the normal 10 basis points, I make an implicit assumption that it will not be affected by the repo-rate announcement.

When a new repo rate is announced, it is not implemented until the next Wednesday after the day before the announcement. When using the STINA swaps to measure the expected repo-rate change, I will consider two periods; the period from the announcement to the implementation of the (potentially) new repo-rate ( $I$ ) and the period from the implementation to the settlement day of the STINA-swap ( $II$ ). I exploit that the repo rate is known during period  $I$ , and once the decision is announced it is also known in period  $II$ .<sup>24</sup> I consider the change in the STINA-swap rate from just prior to an announcement at time  $t$  ( $i_{t-\epsilon}^{\text{STINA}}$ ) to just after the announcement ( $i_t^{\text{STINA}}$ ), and let  $\tau_I$  and  $\tau_{II}$  denote the number of days of period  $I$  and  $II$  respectively.<sup>25</sup> We have

$$1 + i_t^{\text{STINA}} \cdot \frac{30}{360} = \left(1 + E_t \left[ i_I^{\text{T/N}} \right] \cdot \frac{1}{360} \right)^{\tau_I} \left(1 + E_t \left[ i_{II}^{\text{T/N}} \right] \cdot \frac{1}{360} \right)^{\tau_{II}},$$

where  $i_I^{\text{T/N}}$  and  $i_{II}^{\text{T/N}}$  are the STIBOR T/N rates in periods  $I$  and  $II$  respectively, by the assumption that the STINA-swap interest rate is the expected average of the STIBOR T/N over the duration. Taking natural logarithms and using the known approximation that  $\ln(1+x) \approx x$  when  $x$  is small, we get

$$\begin{aligned} i_t^{\text{STINA}} \cdot \frac{30}{360} &\approx E_t \left[ i_I^{\text{T/N}} \right] \cdot \frac{\tau_I}{360} + E_t \left[ i_{II}^{\text{T/N}} \right] \cdot \frac{\tau_{II}}{360} && \Longleftrightarrow \\ i_t^{\text{STINA}} &\approx \frac{\tau_I E_t \left[ i_I^{\text{T/N}} \right] + \tau_{II} E_t \left[ i_{II}^{\text{T/N}} \right]}{30}. \end{aligned}$$

Equivalently, we have

$$i_{t-\epsilon}^{\text{STINA}} \approx \frac{\tau_I E_{t-\epsilon} \left[ i_I^{\text{T/N}} \right] + \tau_{II} E_{t-\epsilon} \left[ i_{II}^{\text{T/N}} \right]}{30}.$$

This gives us, for the change in the STINA-swap rate,

$$\begin{aligned} i_t^{\text{STINA}} - i_{t-\epsilon}^{\text{STINA}} &\approx \frac{\tau_I E_t \left[ i_I^{\text{T/N}} \right] + \tau_{II} E_t \left[ i_{II}^{\text{T/N}} \right] - \left( \tau_I E_{t-\epsilon} \left[ i_I^{\text{T/N}} \right] + \tau_{II} E_{t-\epsilon} \left[ i_{II}^{\text{T/N}} \right] \right)}{30} \\ &= \frac{\tau_I \left( E_t \left[ i_I^{\text{T/N}} \right] - E_{t-\epsilon} \left[ i_I^{\text{T/N}} \right] \right) + \tau_{II} \left( E_t \left[ i_{II}^{\text{T/N}} \right] - E_{t-\epsilon} \left[ i_{II}^{\text{T/N}} \right] \right)}{30}. \end{aligned}$$

<sup>23</sup>This is a consequence of the facilities offered to banks by the Riksbank.

<sup>24</sup>I am using 30-day swaps and regular repo-rate announcements of the Riksbank are more than one month apart. However, two times during the period of interest the repo-rate has been changed between regular announcement days. If the market expects this to happen, the results may be invalid. Since repo-rate changes between meetings seem to be very rare and difficult to predict, I assume that market expectations rely on this not being the case.

<sup>25</sup>Since the announcements by the Riksbank take place on different weekdays,  $\tau_I$  and  $\tau_{II}$  vary, but we always have  $\tau_I + \tau_{II} = 30$ .

Since the repo rate is known in period  $I$  we have  $E_t [i_I^{T/N}] = E_{t-\epsilon} [i_I^{T/N}]$ , and since it is not expected to change within period  $II$  we have

$$\begin{aligned} E_t [i_{II}^{T/N}] - E_{t-\epsilon} [i_{II}^{T/N}] &= E_t [i_{II}^{\text{repo}} + \eta] - E_{t-\epsilon} [i_{II}^{\text{repo}} + \eta] \\ &= E_t [i_{II}^{\text{repo}}] - E_{t-\epsilon} [i_{II}^{\text{repo}}] \\ &= \text{Surprise}_{0,t}, \end{aligned}$$

i.e. the unanticipated change in the repo rate at time  $t$ , where  $\eta$  is the premium of the STINA T/N rate. This is where the assumption that the premium is unaffected by the announcement is crucial. Solving finally gives the surprise as a measure of the observed change in the STINA-swap rate,

$$\begin{aligned} i_t^{\text{STINA}} - i_{t-\epsilon}^{\text{STINA}} &= \frac{0 + \tau_{II} \text{Surprise}_{0,t}}{30} && \Longleftrightarrow \\ \text{Surprise}_{0,t} &= \frac{\tau_{II}}{30} (i_t^{\text{STINA}} - i_{t-\epsilon}^{\text{STINA}}). \end{aligned}$$

In practice, the Riksbank uses the change in the STINA-swap rate from the day prior to a repo-rate announcement to the end of the announcement day, for technical reasons. The formula then has to be adjusted with another term, since the two STINA swaps compared have different settlement days. The derivation is straightforward and this is also the measure that is used in this study.

## C Results of robustness checks; tables and figures

Table 6: Regression results of equation (10) including movement of corresponding Norwegian futures rate as control variable

$h =$	1	2	3	4	5	6	7	8
	Second stage							
$\beta_h^S$	0.17** (0.07)	0.43*** (0.13)	0.36*** (0.10)	0.34*** (0.08)	0.21*** (0.06)	0.12 (0.07)	0.03 (0.12)	-0.02 (0.09)
$\beta_h^A$	0.06** (0.03)	-0.00 (0.05)	0.02 (0.05)	0.01 (0.04)	0.00 (0.03)	-0.00 (0.04)	0.03 (0.03)	0.05 (0.03)
$\gamma_{7,h}$	0.49** (0.20)	-0.21 (0.32)	-0.02 (0.38)	0.13 (0.23)	0.29** (0.13)	0.17 (0.13)	0.17 (0.14)	0.37*** (0.11)
$R^2$	0.93	0.69	0.60	0.69	0.70	0.64	0.52	0.50
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Obs.	36	45	46	48	48	48	46	46

Equation:  $Imp_{h,t} = \beta_h^S \cdot Surp_{h,t} + \beta_h^A \cdot Antic_{h,t} + \gamma_{0,h} + \gamma_{1,h} \cdot Surp_{0,t} + \gamma_{2,h} \cdot \frac{1}{10} \sum_{j \neq h} Surp_{j,t} + \gamma_{3,h} \cdot D_t^{ELB} + \gamma_{4,h} \cdot \widetilde{Disagr}_t + \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} \cdot Surp_{h,t} + \gamma_{6,h} \cdot \widetilde{Frac}_t \cdot Surp_{h,t} + \gamma_{7,h} \cdot Imp_{h,t}^{NO} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. The regressions also include the coefficients  $\gamma_{n,h}$ ,  $n \in \{0, 1, \dots, 6\}$ . The estimates of these have been left out.

\*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

Table 7: Regression results of equation (10) when the anticipated change of the path is given by (12)

$h =$	1	2	3	4	5	6	7	8	9	10	11
$\beta_h^S$	0.15** (0.06)	0.24*** (0.08)	0.44*** (0.09)	0.29*** (0.05)	0.20*** (0.05)	0.10** (0.05)	0.05 (0.06)	-0.06 (0.07)	-0.03 (0.08)	0.07 (0.07)	0.07 (0.07)
$\beta_h^A$	0.05* (0.03)	0.01 (0.06)	0.10** (0.04)	0.10*** (0.03)	0.08** (0.03)	0.10*** (0.03)	0.12*** (0.03)	0.11*** (0.02)	0.08*** (0.03)	0.06 (0.04)	0.06 (0.05)
$R^2$	0.93	0.71	0.69	0.68	0.63	0.57	0.49	0.46	0.36	0.20	0.20
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.34	0.48
Obs.	42	47	47	48	48	48	47	47	47	47	40

Equation:  $Imp_{h,t} = \beta_h^S \cdot Surp_{h,t} + \beta_h^A \cdot Antic_{h,t} + \gamma_{0,h} + \gamma_{1,h} \cdot Surp_{0,t} + \gamma_{2,h} \cdot \frac{1}{10} \sum_{j \neq h} Surp_{j,t} + \gamma_{3,h} \cdot D_t^{ELB} + \gamma_{4,h} \cdot \widetilde{Disagr}_t + \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} \cdot Surp_{h,t} + \gamma_{6,h} \cdot \widetilde{Frac}_t \cdot Surp_{h,t} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. The regressions also include the coefficients  $\gamma_{n,h}$ ,  $n \in \{0, 1, \dots, 6\}$ . The estimates of these have been left out. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

Table 8: Regression results of equation (10) when the anticipated change of the path is zero

$h =$	1	2	3	4	5	6	7	8	9	10	11
$\beta_h$	0.11*** (0.03)	-0.03 (0.08)	-0.03 (0.08)	0.17** (0.07)	0.26*** (0.06)	0.26*** (0.08)	0.18** (0.08)	0.13* (0.07)	-0.00 (0.07)	0.00 (0.07)	0.01 (0.06)
$R^2$	0.94	0.52	0.43	0.49	0.58	0.56	0.43	0.34	0.26	0.13	0.13
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09	0.59	0.56
Obs.	42	47	47	48	48	48	47	47	47	47	48

Equation:  $Imp_{h,t} = \beta_h \cdot Surp_{h,t} + \gamma_{0,h} + \gamma_{1,h} \cdot Surp_{0,t} + \gamma_{2,h} \cdot \frac{1}{10} \sum_{j \neq h} Surp_{j,t} + \gamma_{3,h} \cdot D_t^{ELB} + \gamma_{4,h} \cdot \widetilde{Disagr}_t + \gamma_{5,h} \cdot \widetilde{D}_{h,t}^{Closing} \cdot Surp_{h,t} + \gamma_{6,h} \cdot \widetilde{Frac}_t \cdot Surp_{h,t} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX and the Riksbank.

Note:  $h$  refers to the horizon in quarters. The regressions also include the coefficients  $\gamma_{n,h}$ ,  $n \in \{0, 1, \dots, 6\}$ . The estimates of these have been left out. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

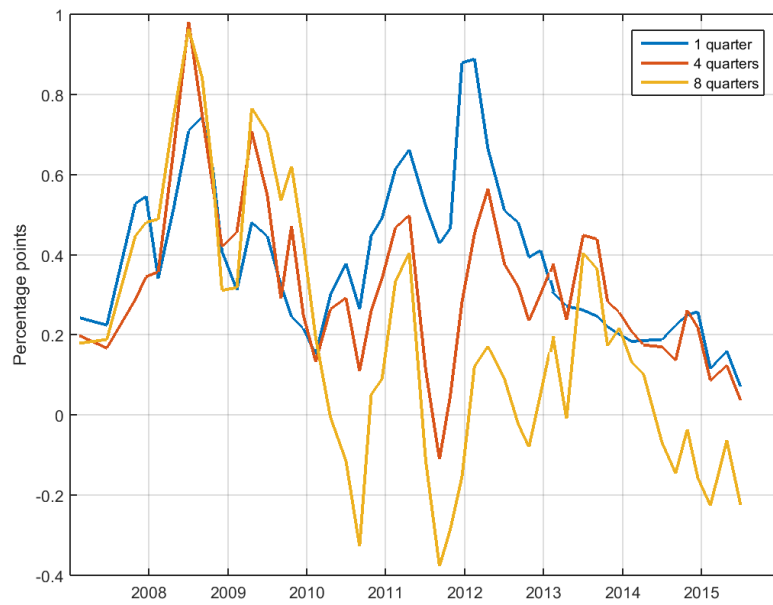


Figure 5: Time-varying premia constructed as the difference between market pricing and a survey.



Table 9: Regression results of equation (10) with a time-and-horizon-varying premium illustrated in figure

5

$h =$	1	2	3	4	5	6	7	8	9	10	11
Second stage											
$\beta_h^S$	0.32*** (0.06)	0.36*** (0.08)	0.41*** (0.08)	0.41*** (0.08)	0.25*** (0.05)	0.18*** (0.05)	-0.05 (0.12)	-0.10 (0.11)	-0.15 (0.11)	-0.03 (0.07)	-0.03 (0.05)
$\beta_h^A$	0.07* (0.03)	0.04 (0.03)	0.04 (0.04)	0.06 (0.04)	0.05 (0.04)	0.02 (0.04)	0.05 (0.03)	0.06** (0.03)	0.07** (0.03)	0.08 (0.05)	0.07 (0.05)
$\gamma_{1,h}$	0.51*** (0.10)	0.26 (0.16)	0.07 (0.17)	0.18 (0.13)	0.16 (0.11)	0.14 (0.13)	-0.07 (0.16)	-0.09 (0.16)	-0.07 (0.13)	0.04 (0.18)	0.01 (0.12)
$R^2$	0.94	0.80	0.70	0.71	0.68	0.65	0.50	0.44	0.39	0.14	0.17
$p_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.67	0.46
Obs.	36	46	46	48	48	48	46	46	46	46	48
First stage											
$\alpha_h$	-0.03 (0.04)	-0.05* (0.03)	-0.08** (0.03)	-0.13*** (0.05)	-0.14** (0.06)	-0.14** (0.07)	-0.08 (0.08)	-0.03 (0.09)	0.00 (0.12)	0.01 (0.15)	-0.02 (0.15)
$\mu_h^M$	1.26* (0.14)	0.97 (0.09)	0.91 (0.08)	0.90 (0.09)	0.86 (0.10)	0.80* (0.11)	0.76** (0.10)	0.67*** (0.08)	0.60*** (0.08)	0.51*** (0.07)	0.47*** (0.08)
$\mu_h^{M_p}$	-0.64 (0.26)	-0.44*** (0.13)	-0.49*** (0.12)	-0.53*** (0.15)	-0.51*** (0.13)	-0.43*** (0.12)	-0.36*** (0.12)	-0.25*** (0.11)	-0.22*** (0.12)	-0.17*** (0.12)	-0.20*** (0.10)
$\mu_h^P$	0.39*** (0.21)	0.53*** (0.14)	0.64*** (0.10)	0.70** (0.11)	0.72*** (0.10)	0.71*** (0.08)	0.66*** (0.09)	0.63*** (0.10)	0.65*** (0.12)	0.70** (0.12)	0.78** (0.09)
$R^2$	0.99	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.96	0.96
Obs.	36	46	46	48	48	48	46	46	46	46	48

First stage:  $Path_{h,t}^{RB} = \alpha_h + \mu_h^M \cdot FRA_{h,t-\epsilon} + \mu_h^{M_p} \cdot FRA_{h,t_p} + \mu_h^P \cdot Path_{h,t_p}^{RB} + Surprise_{h,t}$ .

Second stage:  $Impact_{h,t} = \beta_h^S \cdot Surprise_{h,t} + \beta_h^A \cdot Anticipated_{h,t} + \gamma_{0,h} + \varepsilon_{h,t}$ .

Data sources: Bloomberg, Nasdaq OMX, the Riksbank and TNS Sifo Prospera.

Note:  $h$  refers to the horizon in quarters. In the first-stage regression, significance levels refer to significant difference from the reference levels  $(0, 1, -1, 1)$  for  $(\alpha_h, \mu_h^M, \mu_h^{M_p}, \mu_h^P)$  respectively. The regressions also include the coefficients  $\gamma_{n,h}$ ,  $n \in \{0, 2, 3, \dots, 6\}$ . The estimates of these have been left out. \*\*\*, \*\* and \* refer to significance at the 1%, 5% and 10% levels respectively.

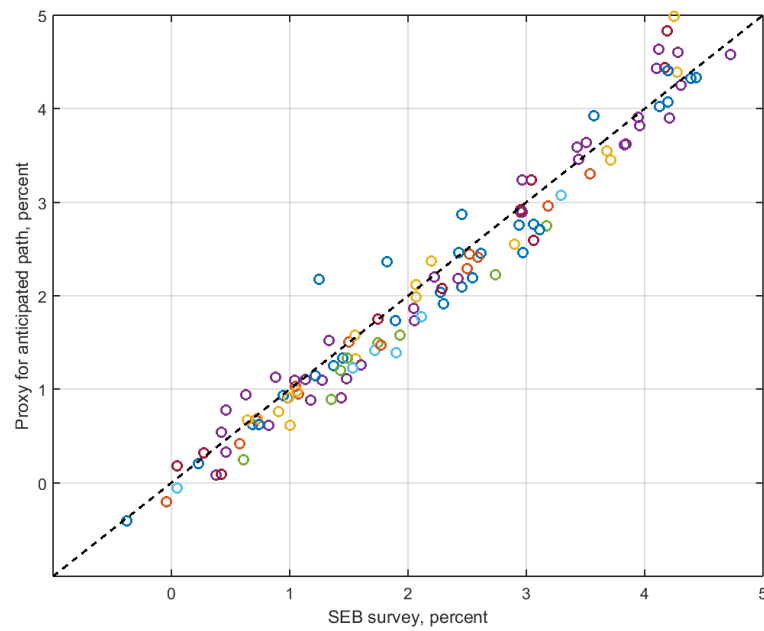


Figure 6: Comparison of a survey measure of expected communicated repo-rate path and the proxy used in the quantitative exercises. Each colour represents a horizon.

# Earlier Working Papers:

For a complete list of Working Papers published by Sveriges Riksbank, see [www.riksbank.se](http://www.riksbank.se)

Estimation of an Adaptive Stock Market Model with Heterogeneous Agents <i>by Henrik Amilon</i>	2005:177
Some Further Evidence on Interest-Rate Smoothing: The Role of Measurement Errors in the Output Gap <i>by Mikael Apel and Per Jansson</i>	2005:178
Bayesian Estimation of an Open Economy DSGE Model with Incomplete Pass-Through <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Mattias Villani</i>	2005:179
Are Constant Interest Rate Forecasts Modest Interventions? Evidence from an Estimated Open Economy DSGE Model of the Euro Area <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Mattias Villani</i>	2005:180
Inference in Vector Autoregressive Models with an Informative Prior on the Steady State <i>by Mattias Villani</i>	2005:181
Bank Mergers, Competition and Liquidity <i>by Elena Carletti, Philipp Hartmann and Giancarlo Spagnolo</i>	2005:182
Testing Near-Rationality using Detailed Survey Data <i>by Michael F. Bryan and Stefan Palmqvist</i>	2005:183
Exploring Interactions between Real Activity and the Financial Stance <i>by Tor Jacobson, Jesper Lindé and Kasper Roszbach</i>	2005:184
Two-Sided Network Effects, Bank Interchange Fees, and the Allocation of Fixed Costs <i>by Mats A. Bergman</i>	2005:185
Trade Deficits in the Baltic States: How Long Will the Party Last? <i>by Rudolfs Bems and Kristian Jönsson</i>	2005:186
Real Exchange Rate and Consumption Fluctuations following Trade Liberalization <i>by Kristian Jönsson</i>	2005:187
Modern Forecasting Models in Action: Improving Macroeconomic Analyses at Central Banks <i>by Malin Adolfson, Michael K. Andersson, Jesper Lindé, Mattias Villani and Anders Vredin</i>	2005:188
Bayesian Inference of General Linear Restrictions on the Cointegration Space <i>by Mattias Villani</i>	2005:189
Forecasting Performance of an Open Economy Dynamic Stochastic General Equilibrium Model <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Mattias Villani</i>	2005:190
Forecast Combination and Model Averaging using Predictive Measures <i>by Jana Eklund and Sune Karlsson</i>	2005:191
Swedish Intervention and the Krona Float, 1993-2002 <i>by Owen F. Humpage and Javiera Ragnartz</i>	2006:192
A Simultaneous Model of the Swedish Krona, the US Dollar and the Euro <i>by Hans Lindblad and Peter Sellin</i>	2006:193
Testing Theories of Job Creation: Does Supply Create Its Own Demand? <i>by Mikael Carlsson, Stefan Eriksson and Nils Gottfries</i>	2006:194
Down or Out: Assessing The Welfare Costs of Household Investment Mistakes <i>by Laurent E. Calvet, John Y. Campbell and Paolo Sodini</i>	2006:195
Efficient Bayesian Inference for Multiple Change-Point and Mixture Innovation Models <i>by Paolo Giordani and Robert Kohn</i>	2006:196
Derivation and Estimation of a New Keynesian Phillips Curve in a Small Open Economy <i>by Karolina Holmberg</i>	2006:197
Technology Shocks and the Labour-Input Response: Evidence from Firm-Level Data <i>by Mikael Carlsson and Jon Smedsaas</i>	2006:198
Monetary Policy and Staggered Wage Bargaining when Prices are Sticky <i>by Mikael Carlsson and Andreas Westermark</i>	2006:199
The Swedish External Position and the Krona <i>by Philip R. Lane</i>	2006:200

Price Setting Transactions and the Role of Denominating Currency in FX Markets <i>by Richard Friberg and Fredrik Wilander</i>	2007:201
The geography of asset holdings: Evidence from Sweden <i>by Nicolas Coeurdacier and Philippe Martin</i>	2007:202
Evaluating An Estimated New Keynesian Small Open Economy Model <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Mattias Villani</i>	2007:203
The Use of Cash and the Size of the Shadow Economy in Sweden <i>by Gabriela Guibourg and Björn Segendorf</i>	2007:204
Bank supervision Russian style: Evidence of conflicts between micro- and macro-prudential concerns <i>by Sophie Claeys and Koen Schoors</i>	2007:205
Optimal Monetary Policy under Downward Nominal Wage Rigidity <i>by Mikael Carlsson and Andreas Westermark</i>	2007:206
Financial Structure, Managerial Compensation and Monitoring <i>by Vittoria Cerasi and Sonja Daltung</i>	2007:207
Financial Frictions, Investment and Tobin's $q$ <i>by Guido Lorenzoni and Karl Walentin</i>	2007:208
Sticky Information vs Sticky Prices: A Horse Race in a DSGE Framework <i>by Mathias Trabandt</i>	2007:209
Acquisition versus greenfield: The impact of the mode of foreign bank entry on information and bank lending rates <i>by Sophie Claeys and Christa Hainz</i>	2007:210
Nonparametric Regression Density Estimation Using Smoothly Varying Normal Mixtures <i>by Mattias Villani, Robert Kohn and Paolo Giordani</i>	2007:211
The Costs of Paying – Private and Social Costs of Cash and Card <i>by Mats Bergman, Gabriella Guibourg and Björn Segendorf</i>	2007:212
Using a New Open Economy Macroeconomics model to make real nominal exchange rate forecasts <i>by Peter Sellin</i>	2007:213
Introducing Financial Frictions and Unemployment into a Small Open Economy Model <i>by Lawrence J. Christiano, Mathias Trabandt and Karl Walentin</i>	2007:214
Earnings Inequality and the Equity Premium <i>by Karl Walentin</i>	2007:215
Bayesian forecast combination for VAR models <i>by Michael K. Andersson and Sune Karlsson</i>	2007:216
Do Central Banks React to House Prices? <i>by Daria Finocchiaro and Virginia Queijo von Heideken</i>	2007:217
The Riksbank's Forecasting Performance <i>by Michael K. Andersson, Gustav Karlsson and Josef Svensson</i>	2007:218
Macroeconomic Impact on Expected Default Frequency <i>by Per Åsberg and Hovick Shahnazarian</i>	2008:219
Monetary Policy Regimes and the Volatility of Long-Term Interest Rates <i>by Virginia Queijo von Heideken</i>	2008:220
Governing the Governors: A Clinical Study of Central Banks <i>by Lars Frisell, Kasper Roszbach and Giancarlo Spagnolo</i>	2008:221
The Monetary Policy Decision-Making Process and the Term Structure of Interest Rates <i>by Hans Dillén</i>	2008:222
How Important are Financial Frictions in the U S and the Euro Area <i>by Virginia Queijo von Heideken</i>	2008:223
Block Kalman filtering for large-scale DSGE models <i>by Ingvar Strid and Karl Walentin</i>	2008:224
Optimal Monetary Policy in an Operational Medium-Sized DSGE Model <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Lars E. O. Svensson</i>	2008:225
Firm Default and Aggregate Fluctuations <i>by Tor Jacobson, Rikard Kindell, Jesper Lindé and Kasper Roszbach</i>	2008:226
Re-Evaluating Swedish Membership in EMU: Evidence from an Estimated Model <i>by Ulf Söderström</i>	2008:227

The Effect of Cash Flow on Investment: An Empirical Test of the Balance Sheet Channel <i>by Ola Melander</i>	2009:228
Expectation Driven Business Cycles with Limited Enforcement <i>by Karl Walentin</i>	2009:229
Effects of Organizational Change on Firm Productivity <i>by Christina Håkanson</i>	2009:230
Evaluating Microfoundations for Aggregate Price Rigidities: Evidence from Matched Firm-Level Data on Product Prices and Unit Labor Cost <i>by Mikael Carlsson and Oskar Nordström Skans</i>	2009:231
Monetary Policy Trade-Offs in an Estimated Open-Economy DSGE Model <i>by Malin Adolfson, Stefan Laséen, Jesper Lindé and Lars E. O. Svensson</i>	2009:232
Flexible Modeling of Conditional Distributions Using Smooth Mixtures of Asymmetric Student T Densities <i>by Feng Li, Mattias Villani and Robert Kohn</i>	2009:233
Forecasting Macroeconomic Time Series with Locally Adaptive Signal Extraction <i>by Paolo Giordani and Mattias Villani</i>	2009:234
Evaluating Monetary Policy <i>by Lars E. O. Svensson</i>	2009:235
Risk Premiums and Macroeconomic Dynamics in a Heterogeneous Agent Model <i>by Ferre De Graeve, Maarten Dossche, Marina Emiris, Henri Sneessens and Raf Wouters</i>	2010:236
Picking the Brains of MPC Members <i>by Mikael Apel, Carl Andreas Claussen and Petra Lennartsdotter</i>	2010:237
Involuntary Unemployment and the Business Cycle <i>by Lawrence J. Christiano, Mathias Trabandt and Karl Walentin</i>	2010:238
Housing collateral and the monetary transmission mechanism <i>by Karl Walentin and Peter Sellin</i>	2010:239
The Discursive Dilemma in Monetary Policy <i>by Carl Andreas Claussen and Øistein Røisland</i>	2010:240
Monetary Regime Change and Business Cycles <i>by Vasco Cúrdia and Daria Finocchiaro</i>	2010:241
Bayesian Inference in Structural Second-Price common Value Auctions <i>by Bertil Wegmann and Mattias Villani</i>	2010:242
Equilibrium asset prices and the wealth distribution with inattentive consumers <i>by Daria Finocchiaro</i>	2010:243
Identifying VARs through Heterogeneity: An Application to Bank Runs <i>by Ferre De Graeve and Alexei Karas</i>	2010:244
Modeling Conditional Densities Using Finite Smooth Mixtures <i>by Feng Li, Mattias Villani and Robert Kohn</i>	2010:245
The Output Gap, the Labor Wedge, and the Dynamic Behavior of Hours <i>by Luca Sala, Ulf Söderström and Antonella Trigari</i>	2010:246
Density-Conditional Forecasts in Dynamic Multivariate Models <i>by Michael K. Andersson, Stefan Palmqvist and Daniel F. Waggoner</i>	2010:247
Anticipated Alternative Policy-Rate Paths in Policy Simulations <i>by Stefan Laséen and Lars E. O. Svensson</i>	2010:248
MOSES: Model of Swedish Economic Studies <i>by Gunnar Bårdsen, Ard den Reijer, Patrik Jonasson and Ragnar Nymoen</i>	2011:249
The Effects of Endogenous Firm Exit on Business Cycle Dynamics and Optimal Fiscal Policy <i>by Lauri Vilmi</i>	2011:250
Parameter Identification in a Estimated New Keynesian Open Economy Model <i>by Malin Adolfson and Jesper Lindé</i>	2011:251
Up for count? Central bank words and financial stress <i>by Marianna Blix Grimaldi</i>	2011:252
Wage Adjustment and Productivity Shocks <i>by Mikael Carlsson, Julián Messina and Oskar Nordström Skans</i>	2011:253

Stylized (Arte) Facts on Sectoral Inflation <i>by Ferre De Graeve and Karl Walentin</i>	2011:254
Hedging Labor Income Risk <i>by Sebastien Betermier, Thomas Jansson, Christine A. Parlour and Johan Walden</i>	2011:255
Taking the Twists into Account: Predicting Firm Bankruptcy Risk with Splines of Financial Ratios <i>by Paolo Giordani, Tor Jacobson, Erik von Schedvin and Mattias Villani</i>	2011:256
Collateralization, Bank Loan Rates and Monitoring: Evidence from a Natural Experiment <i>by Geraldo Cerqueiro, Steven Ongena and Kasper Roszbach</i>	2012:257
On the Non-Exclusivity of Loan Contracts: An Empirical Investigation <i>by Hans Degryse, Vasso Ioannidou and Erik von Schedvin</i>	2012:258
Labor-Market Frictions and Optimal Inflation <i>by Mikael Carlsson and Andreas Westermark</i>	2012:259
Output Gaps and Robust Monetary Policy Rules <i>by Roberto M. Billi</i>	2012:260
The Information Content of Central Bank Minutes <i>by Mikael Apel and Marianna Blix Grimaldi</i>	2012:261
The Cost of Consumer Payments in Sweden <i>by Björn Segendorf and Thomas Jansson</i>	2012:262
Trade Credit and the Propagation of Corporate Failure: An Empirical Analysis <i>by Tor Jacobson and Erik von Schedvin</i>	2012:263
Structural and Cyclical Forces in the Labor Market During the Great Recession: Cross-Country Evidence <i>by Luca Sala, Ulf Söderström and Antonella Trigari</i>	2012:264
Pension Wealth and Household Savings in Europe: Evidence from SHARELIFE <i>by Rob Alessie, Viola Angelini and Peter van Santen</i>	2013:265
Long-Term Relationship Bargaining <i>by Andreas Westermark</i>	2013:266
Using Financial Markets To Estimate the Macro Effects of Monetary Policy: An Impact-Identified FAVAR* <i>by Stefan Pitschner</i>	2013:267
DYNAMIC MIXTURE-OF-EXPERTS MODELS FOR LONGITUDINAL AND DISCRETE-TIME SURVIVAL DATA <i>by Matias Quiroz and Mattias Villani</i>	2013:268
Conditional euro area sovereign default risk <i>by André Lucas, Bernd Schwaab and Xin Zhang</i>	2013:269
Nominal GDP Targeting and the Zero Lower Bound: Should We Abandon Inflation Targeting?*	2013:270
<i>by Roberto M. Billi</i>	
Un-truncating VARs* <i>by Ferre De Graeve and Andreas Westermark</i>	2013:271
Housing Choices and Labor Income Risk <i>by Thomas Jansson</i>	2013:272
Identifying Fiscal Inflation* <i>by Ferre De Graeve and Virginia Queijo von Heideken</i>	2013:273
On the Redistributive Effects of Inflation: an International Perspective* <i>by Paola Boel</i>	2013:274
Business Cycle Implications of Mortgage Spreads* <i>by Karl Walentin</i>	2013:275
Approximate dynamic programming with post-decision states as a solution method for dynamic economic models <i>by Isaiah Hull</i>	2013:276
A detrimental feedback loop: deleveraging and adverse selection <i>by Christoph Bertsch</i>	2013:277
Distortionary Fiscal Policy and Monetary Policy Goals <i>by Klaus Adam and Roberto M. Billi</i>	2013:278
Predicting the Spread of Financial Innovations: An Epidemiological Approach <i>by Isaiah Hull</i>	2013:279
Firm-Level Evidence of Shifts in the Supply of Credit <i>by Karolina Holmberg</i>	2013:280

Lines of Credit and Investment: Firm-Level Evidence of Real Effects of the Financial Crisis <i>by Karolina Holmberg</i>	2013:281
A wake-up call: information contagion and strategic uncertainty <i>by Toni Ahnert and Christoph Bertsch</i>	2013:282
Debt Dynamics and Monetary Policy: A Note <i>by Stefan Laséen and Ingvar Strid</i>	2013:283
Optimal taxation with home production <i>by Conny Olovsson</i>	2014:284
Incompatible European Partners? Cultural Predispositions and Household Financial Behavior <i>by Michael Haliassos, Thomas Jansson and Yigitcan Karabulut</i>	2014:285
How Subprime Borrowers and Mortgage Brokers Shared the Piecial Behavior <i>by Antje Berndt, Burton Hollifield and Patrik Sandås</i>	2014:286
The Macro-Financial Implications of House Price-Indexed Mortgage Contracts <i>by Isaiah Hull</i>	2014:287
Does Trading Anonymously Enhance Liquidity? <i>by Patrick J. Dennis and Patrik Sandås</i>	2014:288
Systematic bailout guarantees and tacit coordination <i>by Christoph Bertsch, Claudio Calcagno and Mark Le Quement</i>	2014:289
Selection Effects in Producer-Price Setting <i>by Mikael Carlsson</i>	2014:290
Dynamic Demand Adjustment and Exchange Rate Volatility <i>by Vesna Corbo</i>	2014:291
Forward Guidance and Long Term Interest Rates: Inspecting the Mechanism <i>by Ferre De Graeve, Pelin Ilbas &amp; Raf Wouters</i>	2014:292
Firm-Level Shocks and Labor Adjustments <i>by Mikael Carlsson, Julián Messina and Oskar Nordström Skans</i>	2014:293
A wake-up call theory of contagion <i>by Toni Ahnert and Christoph Bertsch</i>	2015:294
Risks in macroeconomic fundamentals and excess bond returns predictability <i>by Rafael B. De Rezende</i>	2015:295
The Importance of Reallocation for Productivity Growth: Evidence from European and US Banking <i>by Jaap W.B. Bos and Peter C. van Santen</i>	2015:296
SPEEDING UP MCMC BY EFFICIENT DATA SUBSAMPLING <i>by Matias Quiroz, Mattias Villani and Robert Kohn</i>	2015:297
Amortization Requirements and Household Indebtedness: An Application to Swedish-Style Mortgages <i>by Isaiah Hull</i>	2015:298
Fuel for Economic Growth? <i>by Johan Gars and Conny Olovsson</i>	2015:299
Searching for Information <i>by Jungsuk Han and Francesco Sangiorgi</i>	2015:300
What Broke First? Characterizing Sources of Structural Change Prior to the Great Recession <i>by Isaiah Hull</i>	2015:301
Price Level Targeting and Risk Management <i>by Roberto Billi</i>	2015:302
Central bank policy paths and market forward rates: A simple model <i>by Ferre De Graeve and Jens Iversen</i>	2015:303
Jump-Starting the Euro Area Recovery: Would a Rise in Core Fiscal Spending Help the Periphery? <i>by Olivier Blanchard, Christopher J. Erceg and Jesper Lindé</i>	2015:304
Bringing Financial Stability into Monetary Policy* <i>by Eric M. Leeper and James M. Nason</i>	2015:305
SCALABLE MCMC FOR LARGE DATA PROBLEMS USING DATA SUBSAMPLING AND THE DIFFERENCE ESTIMATOR <i>by MATIAS QUIROZ, MATTIAS VILLANI AND ROBERT KOHN</i>	2015:306

SPEEDING UP MCMC BY DELAYED ACCEPTANCE AND DATA SUBSAMPLING <i>by MATIAS QUIROZ</i>	2015:307
Modeling financial sector joint tail risk in the euro area <i>by André Lucas, Bernd Schwaab and Xin Zhang</i>	2015:308
Score Driven Exponentially Weighted Moving Averages and Value-at-Risk Forecasting <i>by André Lucas and Xin Zhang</i>	2015:309
On the Theoretical Efficacy of Quantitative Easing at the Zero Lower Bound <i>by Paola Boel and Christopher J. Waller</i>	2015:310
Optimal Inflation with Corporate Taxation and Financial Constraints <i>by Daria Finocchiaro, Giovanni Lombardo, Caterina Mendicino and Philippe Weil</i>	2015:311
Fire Sale Bank Recapitalizations <i>by Christoph Bertsch and Mike Mariathasan</i>	2015:312
Since you're so rich, you must be really smart: Talent and the Finance Wage Premium <i>by Michael Böhm, Daniel Metzger and Per Strömberg</i>	2015:313
Debt, equity and the equity price puzzle <i>by Daria Finocchiaro and Caterina Mendicino</i>	2015:314
Trade Credit: Contract-Level Evidence Contradicts Current Theories <i>by Tore Ellingsen, Tor Jacobson and Erik von Schedvin</i>	2016:315
Double Liability in a Branch Banking System: Historical Evidence from Canada <i>by Anna Grodecka and Antonis Kotidis</i>	2016:316
Subprime Borrowers, Securitization and the Transmission of Business Cycles <i>by Anna Grodecka</i>	2016:317
Real-Time Forecasting for Monetary Policy Analysis: The Case of Sveriges Riksbank <i>by Jens Iversen, Stefan Laséen, Henrik Lundvall and Ulf Söderström</i>	2016:318
Fed Liftoff and Subprime Loan Interest Rates: Evidence from the Peer-to-Peer Lending <i>by Christoph Bertsch, Isaiah Hull and Xin Zhang</i>	2016:319
Curbing Shocks to Corporate Liquidity: The Role of Trade Credit <i>by Niklas Amberg, Tor Jacobson, Erik von Schedvin and Robert Townsend</i>	2016:320
Firms' Strategic Choice of Loan Delinquencies <i>by Paola Morales-Acevedo</i>	2016:321
Fiscal Consolidation Under Imperfect Credibility <i>by Matthieu Lemoine and Jesper Lindé</i>	2016:322
Challenges for Central Banks' Macro Models <i>by Jesper Lindé, Frank Smets and Rafael Wouters</i>	2016:323
The interest rate effects of government bond purchases away from the lower bound <i>by Rafael B. De Rezende</i>	2016:324
COVENANT-LIGHT CONTRACTS AND CREDITOR COORDINATION <i>by Bo Becker and Victoria Ivashina</i>	2016:325
Endogenous Separations, Wage Rigidities and Employment Volatility <i>by Mikael Carlsson and Andreas Westermark</i>	2016:326
Renovatio Monetæ: Gesell Taxes in Practice <i>by Roger Svensson and Andreas Westermark</i>	2016:327
Adjusting for Information Content when Comparing Forecast Performance <i>by Michael K. Andersson, Ted Aranki and André Reslow</i>	2016:328
Economic Scarcity and Consumers' Credit Choice <i>by Marieke Bos, Chloé Le Coq and Peter van Santen</i>	2016:329
Uncertain pension income and household saving <i>by Peter van Santen</i>	2016:330
Money, Credit and Banking and the Cost of Financial Activity <i>by Paola Boel and Gabriele Camera</i>	2016:331
Oil prices in a real-business-cycle model with precautionary demand for oil <i>by Conny Olovsson</i>	2016:332
Financial Literacy Externalities <i>by Michael Haliasso, Thomas Jansson and Yigitcan Karabulut</i>	2016:333



The timing of uncertainty shocks in a small open economy <i>by Hanna Armelius, Isaiah Hull and Hanna Stenbacka Köhler</i>	2016:334
Quantitative easing and the price-liquidity trade-off <i>by Marien Ferdinandusse, Maximilian Freier and Annukka Ristiniemi</i>	2017:335
What Broker Charges Reveal about Mortgage Credit Risk <i>by Antje Berndt, Burton Hollifield and Patrik Sandås</i>	2017:336
Asymmetric Macro-Financial Spillovers <i>by Kristina Bluwstein</i>	2017:337
Latency Arbitrage When Markets Become Faster <i>by Burton Hollifield, Patrik Sandås and Andrew Todd</i>	2017:338



Sveriges Riksbank  
Visiting address: Brunkebergs torg 11  
Mail address: se-103 37 Stockholm

Website: [www.riksbank.se](http://www.riksbank.se)  
Telephone: +46 8 787 00 00, Fax: +46 8 21 05 31  
E-mail: [registratorn@riksbank.se](mailto:registratorn@riksbank.se)