

Working Paper

No. 128. Januari 2013



Central Bank Forecasts of Policy Interest Rates: An Evaluation of the First Years

By Meredith Beechey
and Pär Österholm

National Institute of Economic Research





Central Bank Forecasts of Policy Interest Rates: An Evaluation of the First Years*

Meredith Beechey[#]

Pär Österholm^{*}

* We are grateful to Jesper Hansson, Göran Hjelm and seminar participants at the National Institute of Economic Research for valuable comments. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Executive Board of Sveriges Riksbank.

[#] Sveriges Riksbank, 103 37 Stockholm, Sweden
e-mail: meredith.beechey@riksbank.se Phone: +46 8 787 0449

^{*} National Institute of Economic Research, Box 3116, 103 62 Stockholm, Sweden
e-mail: par.osterholm@konj.se Phone: +46 8 453 5948

WORKING PAPER NR 128, JANUARY 2013

PUBLISHED BY THE NATIONAL INSTITUTE OF ECONOMIC RESEARCH (NIER)

NIER prepares analyses and forecasts of the Swedish and international economy and conducts related research. **NIER** is a government agency accountable to the Ministry of Finance and is financed largely by Swedish government funds. Like other government agencies, **NIER** has an independent status and is responsible for the assessments that it publishes.

The **Working Paper** series consists of publications of research reports and other detailed analyses. The reports may concern macroeconomic issues related to the forecasts of the institute, research in environmental economics, or problems of economic and statistical methods. Some of these reports are published in their final form in this series, whereas others are previews of articles that are subsequently published in international scholarly journals under the heading of **Reprints**. Reports in both of these series can be ordered free of charge. Most publications can also be downloaded directly from the **NIER** home page.

Abstract

In recent years the central banks of Norway and Sweden have published their endogenous policy interest-rate forecasts. In this paper, we evaluate those forecasts alongside policy-rate expectations inferred from market pricing. We find that for both economies there are only small differences in relative forecasting precision between the central bank and market-implied measures. However, both types of forecast fail tests for unbiasedness and efficiency at longer horizons.

JEL Classification: E52

Keywords: Monetary policy, Market expectations, Norges Bank, Sveriges Riksbank

Summary in Swedish

På senare år har centralbankerna i Norge och Sverige publicerat sina endogena styrränteprognoser. I denna studie utvärderar vi dessa prognoser tillsammans med styrränteförväntningar beräknade utifrån marknadsprissättningen. Vi finner att det är små skillnader i prognosprecision mellan centralbanken och marknadsbaserade mått i såväl Norge som Sverige. Resultaten visar även att såväl centralbankernas prognoser som styrränteförväntningar beräknade utifrån marknadsprissättningen är behäftade med frånvaro av förväntningsriktighet och ineffektivitet på längre horisonter.

Contents

1. Introduction	7
2. Data	8
3. Empirical analysis	9
3.1 Unbiasedness and efficiency	9
3.2 Forecast accuracy	12
4. Conclusions	14
References	16
Appendix	18

1. Introduction

Central bank transparency has increased dramatically over the last two decades as inflation targeting has become a standard framework for monetary policy. The benefits of an open and transparent monetary-policy process are widely agreed upon by policymakers and academics and have led to explicit numerical targets for inflation, publication of minutes from policy-decision meetings and comprehensive monetary policy reports containing forecasts of a large number of variables and detailed descriptions of the analysis behind them.

One of the more recent aspects of the increasing transparency is central banks publishing their own forecasts of the policy interest rate. This is by no means uncontroversial and a lively discussion has arisen about the associated costs and benefits and ultimately the limits to transparency; see, for example, Morris and Shin (2002), Mishkin (2004), Svensson (2006), Blinder *et al.* (2008), Rudebusch (2008), van der Crujisen *et al.* (2010) and Ehrmann *et al.* (2012). Proponents argue that publishing the policy-rate path helps economic agents better understand monetary policy and lends the central bank more influence over longer-term interest rates, thereby improving the central bank's ability to achieve its macroeconomic objectives. Opponents argue that the policy rate path is too uncertain to be worth communicating and point to a risk that the path might be misinterpreted as commitment. While there is no consensus, some academic research suggests that it might be beneficial to publish the path. For example, Rudebusch and Williams (2008) show – using a small theoretical model with private sector imperfect information – that it generally generates better aligned expectations and helps the central bank to achieve its goals.

With the benefits uncertain, few central banks have so far chosen to publish a forecast for the policy rates. There is accordingly yet little data to analyse regarding questions relating to this issue. However, Norges Bank and Sveriges Riksbank took the step early; the former started publishing its own policy rate forecast in October 2005 and the latter followed in February 2007.¹

The purpose of this paper is to evaluate the forecasting properties of policy interest-rate forecasts of the central banks of Norway and Sweden, alongside policy-rate expectations inferred from financial market pricing. We evaluate unbiasedness, efficiency and precision using a standard framework. This analysis provides relevant information on a number of issues. Central banks' forecasts and market expectations diverge at times, creating a tension between outlooks.² The divergence can owe to measurement problems when extracting market expectations from interest rates on finan-

¹ It should be noted that the Reserve Bank of New Zealand was the true pioneer when it comes to endogenous interest-rate forecasts but it provides a forecast of the 90-day bank bill rate, not its own policy rate (the OCR rate).

² For example, Figure A1 in the appendix shows the Riksbank's repo rate forecasts and market expectations in Sweden in October 2010 as presented in the *Monetary Policy Report* October 2010.

cial-market instruments but may also reflect different outlooks about the economy and policy rate. That is, at times the central bank's policy-rate path may not be fully credible. When the forecast paths do diverge, one can ask which will prove to be the better forecast and on which path economic agents would do best to rely. At any given time, the answer to those questions will depend on a range of factors but this paper aims to present some facts from the realised sample so far. Our results show that neither the central banks' forecasts nor market expectations pass simple tests for unbiasedness and efficiency but that there are generally very small differences in forecasting precision between central banks and market expectations.

The rest of this paper is organised as follows. In Section 2, we describe the data used. Section 3 presents the empirical analysis and, finally, Section 4 concludes.

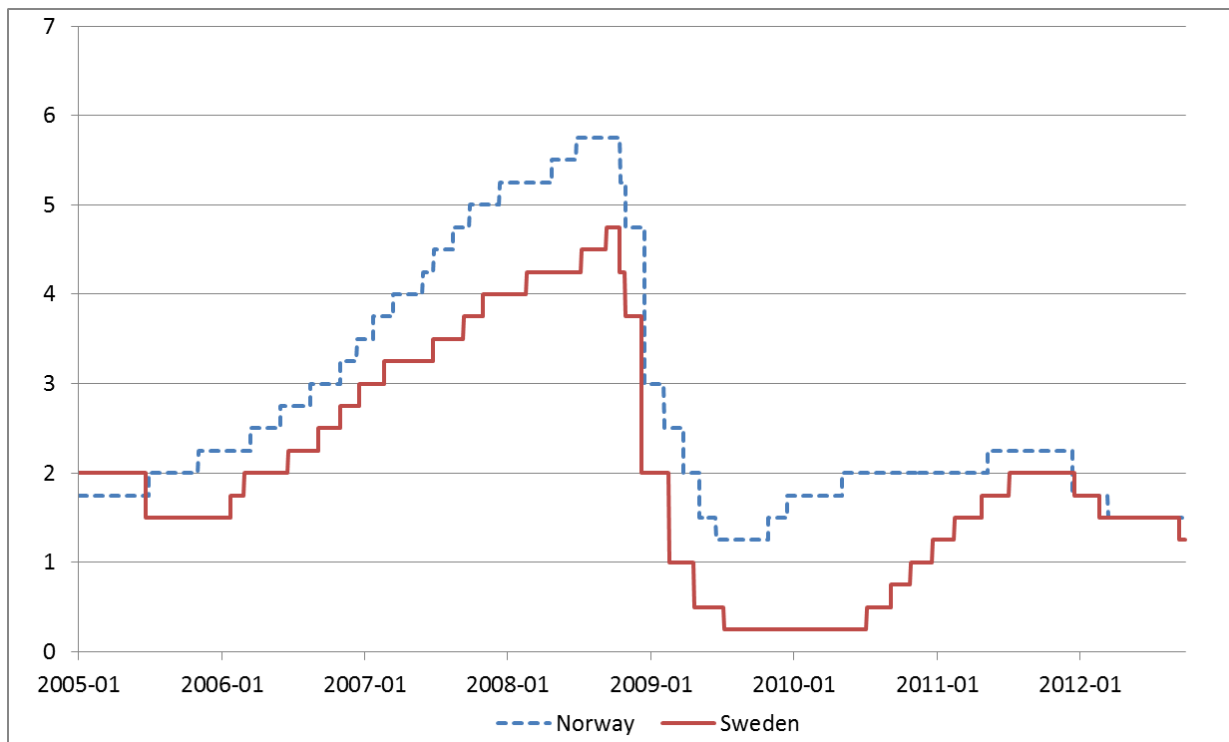
2. Data

Norges Bank's forecasts of the sight deposit rate are those published in the *Inflation Report* or *Monetary Policy Report* from October 2005 to June 2012.³ Similarly, Sveriges Riksbank's forecasts of the repo rate are those published in the *Monetary Policy Report* and *Monetary Policy Update* from February 2007 to July 2012. Data on market expectations inferred from financial market data were provided by Norges Bank and Sveriges Riksbank.

In our empirical analysis, we focus on forecast performance at three different horizons: one quarter, one year and two years. Figures A2 to A4 in the appendix show the forecast errors – defined as $e_{t+h|t} = i_{t+h} - i_{t+h|t}$, where i_{t+h} is the policy rate at time $t+h$ and $i_{t+h|t}$ is the forecast made at time t – at the different horizons in Norway. Figures A5 to A7 in the appendix show the corresponding forecast errors in Sweden.

Figure 1 shows the policy interest rates in Norway and Sweden from January 2005 to September 2012. As can be seen, the sample employed for our evaluation includes the tightening phase which ended in late 2008, the dramatic cuts of late 2008 and early 2009 and the period of very low rates which ensued.

³ Norges Bank changed the name of their main report from *Inflation Report* to *Monetary Policy Report* in 2007.

Figure 1. Policy interest rates in Norway and Sweden.

3. Empirical analysis

Our empirical analysis is divided into two parts. First, we test for unbiasedness and efficiency. Second, we assess the forecast precision of the different forecasts and expectations. The framework employed is standard in the forecast evaluation literature; see, for example, Mehra (2002), Mankiw *et al.* (2003), Baghestani (2008) and Jonsson and Österholm (2011).

3.1 Unbiasedness and efficiency

We first test for unbiasedness, that is, whether the forecast errors have a zero mean. Results are shown in Table 1. For the available samples, all forecasts at all horizons have on average over-predicted the policy-rate outcome in both countries. The extent of the over-prediction is larger in Sweden at one- and two-year horizons and owes in part to the very low interest rates that prevailed during 2009 and 2010. Having quantified the extent of the over-prediction, we ask whether it constitutes a significant bias. This is tested by running the regression

$$i_{t+h} - i_{t+h|t} = \lambda + \omega_t, \quad (1)$$

where i_{t+h} and $i_{t+h|t}$ are defined as above and ω_t is an error term. The null hypothesis $H_0 : \lambda = 0$ is then tested using a standard t -test.⁴ As can be seen from Table 1, the null hypothesis can be rejected at the two-year horizon for both Norges Bank's forecasts (at the ten percent level) and the market expectations (at the five percent level). In Sweden, both the Riksbank's forecasts and market pricing are found to have a significant bias (at conventional levels) at the two longest forecast horizons. Biased forecasts constitute a violation of rational expectations when the forecaster has a symmetric quadratic loss function (which is a common assumption in the literature on forecast evaluations) but not necessarily so if the loss function is asymmetric.⁵ In reality, the forecasters' loss function is not known, clouding an assessment of whether forecasts have been rational over this sample. One should also keep in mind that the sample is short and contains much variation in the policy cycle. For example, forecasts and expectations at the two-year horizon in Sweden from 2007 and the first half of 2008 were generated by agents who were blissfully unaware of the upcoming financial crisis and who overestimated the repo rate substantially.

⁴ Newey-West standard errors are used to address the serial correlation in the residuals.

⁵ See, for example, Elliott *et al.* (2008).

Table 1. RMSEs and results from tests of bias and efficiency.

	Norway			Sweden		
	Mean error	Efficiency	RMSE	Mean error	Efficiency	RMSE
1 quarter						
Central bank	-0.11 (0.09)	-0.10 (0.08)	0.43	-0.14 (0.10)	-0.13 (0.08)	0.43
Market pricing	-0.13 (0.08)	-0.06 (0.05)	0.36	-0.08 (0.11)	-0.14 (0.09)	0.44
Naive	-0.13 (0.23)	-	0.79	-0.14 (0.22)	-	0.76
1 year						
Central bank	-0.65 (0.43)	-0.55 ^b (0.23)	1.46	-0.94 ^c (0.47)	-0.72 ^a (0.19)	1.74
Market pricing	-0.63 (0.39)	-0.44 ^b (0.23)	1.36	-0.85 ^c (0.44)	-0.66 ^a (0.19)	1.62
Naive	-0.27 (0.65)	-	1.81	-0.52 (0.61)	-	1.92
2 years						
Central bank	-1.37 ^c (0.65)	-0.69 ^b (0.31)	2.18	-2.01 ^a (0.63)	-0.78 ^a (0.16)	2.60
Market pricing	-1.41 ^b (0.65)	-0.68 ^c (0.33)	2.21	-1.90 ^a (0.62)	-0.83 ^a (0.13)	2.53
Naive	-0.59 (0.94)	-	2.41	-1.09 (0.89)	-	2.58

Note: "Mean error" gives $\hat{\lambda}$ from equation (1). "Efficiency" gives $\hat{\beta}$ from equation (2). ^a, ^b and ^c indicate significance at the one, five and ten percent level respectively. Newey-West standard errors in parentheses (). Regressions have 22, 19 and 16 observations at the one-quarter, one-year and two-year horizons in Norway. Regressions have 31, 26 and 20 observations at the one-quarter, one-year and two-year horizons in Sweden.

Next, we test for efficient use of macroeconomic data when forming expectations. A straightforward test of efficient use of data tests whether current information about the policy rate is systematically related to the forecast error and is based on the regression

$$i_{t+h} - i_{t+h|t} = \alpha + \beta i_t + v_t, \quad (2)$$

where i_{t+h} and $i_{t+h|t}$ are defined as above and v_t is an error term. As i_t was in the information set at time t , efficient use of data requires that it cannot explain variation in the forecast errors. The null hypothesis $H_0 : \beta = 0$ is tested using a standard t -test (with Newey-West standard errors). Results

are given in Table 1.⁶ At the one-quarter horizon, there are no signs of inefficient use of data in either country. However, looking at the results for the two longest horizons, we see that both the forecasts of the central banks as well as market expectations are judged inefficient (at the five or ten percent level in Norway and at the one percent level in Sweden). While bias is not necessarily a sign of lack of rationality, inefficient use of data is incompatible with strictly rational expectations. However, both central banks and private agents operate with incomplete information about the economy and its dynamics, making fully rational expectations perhaps an excessively demanding benchmark.

3.2 Forecast accuracy

As the last step in our assessment of the policy-rate expectations, we compare the forecasting precision of the central banks' forecasts to the expectations inferred from market pricing. Results are once again given in Table 1.

Turning to Norway, forecast errors generally are small at the one-quarter horizon. The root mean square errors (RMSEs) for Norges Bank and market expectations are 0.43 and 0.36 respectively. Reflecting the difficulties of forecasting, absolute forecast errors are on average larger the longer the forecast horizon. At the one-year horizon, Norges Bank's RMSE is 1.46 and market expectations' 1.36; at the two-year horizon, the corresponding numbers are 2.18 and 2.21. As can be seen from Figures A2, A3 and A4, both market-inferred expectations and Norges Bank over-predicted the future policy rate substantially before the dramatic cut of December 2008. This is particularly evident for one- and two-year ahead forecasts in which the forecast miss affects forecast errors for several subsequent periods.⁷ The market-inferred expectations exhibit slightly higher forecast precision than Norges Bank's forecasts at the two shorter horizons but the difference is small at all horizons. Naïve forecasts exhibit the largest RMSEs at all horizons.

To test if there are any significant differences in forecasting performance between Norges Bank and the alternatives we conduct a modified Diebold-Mariano test under the assumption of a quadratic loss function.⁸ This is based on the regression

$$\left(e_{t+h|t}^{CB}\right)^2 - \left(e_{t+h|t}^{alt}\right)^2 = \delta + \chi_t, \quad (3)$$

⁶ We do not test for efficient use of data when it comes to the naïve forecast. It is after all a simple benchmark and should of course be treated as such.

⁷ Recall that by definition the forecast error of an h -step ahead forecast is serially correlated. Even an efficient forecast for horizon h has an MA($h-1$) structure.

⁸ We use the modified test of Harvey *et al.* (1997) rather than the original one suggested by Diebold and Mariano (1995) since our samples are fairly small.

where $e_{t+h|t}^{CB}$ are the forecast errors of the central bank and $e_{t+h|t}^{alt}$ are the forecast errors of the alternative method we are comparing it to, that is, either market pricing or the naïve forecast; χ_t is an error term. The null hypothesis is that the forecast accuracy of the central bank is equal to that of the alternative and is tested by comparing a transformation of the t -statistic on $\hat{\delta}$ to the relevant critical value from the t -distribution. Results are shown in Table 2. The null hypothesis cannot be rejected in a single case and we hence conclude that there is no support for a difference in forecast accuracy.

Table 2. Results from modified Diebold-Mariano test.

	Norway	Sweden
1 quarter		
Market pricing	0.90	-1.58
Naive	-1.39	-1.44
1 year		
Market pricing	1.29	1.72 ^c
Naive	-1.03	-0.83
2 years		
Market pricing	-0.13	0.64
Naive	-0.33	0.08

Note: Entries in the table are the test statistic from the modified Diebold and Mariano test of Harvey *et al.* (1997). ^a, ^b and ^c indicate significance at the one, five and ten percent level respectively. Regressions have 22, 19 and 16 observations at the one-quarter, one-year and two-year horizons in Norway. Regressions have 31, 26 and 20 observations at the one-quarter, one-year and two-year horizons in Sweden.

The results for Sweden show that the Riksbank has the lowest RMSE at the one-quarter horizon, albeit only marginally less than that of market-inferred expectations. At the one- and two-year horizons, the Riksbank's forecasting performance is slightly poorer than that of market-inferred expectations; at the one-year horizon, the modified Diebold-Mariano test suggests that this difference is statistically significant at the ten percent level. At the two-year horizon, the Riksbank also performs worse than a naïve forecast but the differences between the different measures at this horizon are quantitatively small and in no case statistically significant.

Overall, there is little support for a qualitative difference between central banks' forecasts and market-implied expectations of the policy rate. The forecasts follow similar patterns over time and it is evident from Figures A2 to A7 that neither the central banks nor markets foresaw the abrupt cut in policy rates in the immediate wake of the financial crisis.

Both Norges Bank and the Riksbank do reasonably well relative to a naïve forecast. Norges Bank outperforms it at all horizons, as does the Riksbank at the three-month and one-year horizons. That is, central banks add information above and beyond a naïve forecast at reasonably long horizons, calling into question Goodhart and Lim's (2011) suggestion that central banks should adopt a more mechanical approach – such as a no-change or implied forward market rate assumption – at horizons beyond two quarters.⁹

Goodhart and Lim's (2011) recommendation can also be questioned on other grounds. Both a constant policy interest rate over the forecast horizon and implied forward market rates have been used and later abandoned by several central banks (including Norges Bank and Sveriges Riksbank); drawbacks included difficulties in generating and interpreting the forecasts and indeterminacy in forecasting scenarios.¹⁰ There is also intuitive theoretical appeal in the idea that communicating the outlook aids private agents' decision making about consumption and investment – thereby improving the implementation of monetary policy. Publishing endogenous interest-rate forecasts is also in line with the conclusions of Faust and Leeper (2005) and Faust and Wright (2008) that unconditional forecasts of the policy interest rate (and goal variables) provide a more effective means of communication than conditional forecasts.

4. Conclusions

The results in this paper reveal only modest differences in forecast precision between central banks' policy-rate projections and market-implied rate expectations. From a policy point of view, this is interesting for a number of reasons. First, it is probably comforting for proponents of endogenous interest-rate path publications that the central bank's forecast precision is roughly on par with the market's and generally superior to a naïve forecast. From that benchmark, concerns that publication of central-bank projections may prompt a deterioration in other agents' forecasts seems unwarranted.¹¹ Second, the relatively even forecast performance – combined with the fact that the central banks do fairly well compared to a naïve forecast – does not lend support for Goodhart and Lim's (2011) recommendation that central banks should abandon their own forecasts in favour of market-implied expectations or no-change forecasts. Third, when divergences do arise between the central bank and the market-implied forecasts, the results in this paper do not give strong priors about how the divergence will be resolved. After all, market-implied expectations have, over these samples, been as fair a guide to future developments as central-bank forecasts.

⁹ Specifically, Goodhart and Lim (2011) evaluate short-term interest rate forecasts in New Zealand and the United Kingdom where the former are the forecasts of the Reserve Bank of New Zealand and the latter have been derived from money market yield curves. They conclude (p. 135) that the forecasts "... have been excellent for the immediate forthcoming quarter, reasonable for the next quarter, and useless thereafter".

¹⁰ See, for example, Ólafsson (2007) for a discussion.

¹¹ Dale *et al.* (2011) suggest that a central bank which publishes forecasts of poor quality risks causing the private sector's forecast precision to deteriorate.

However, both central-bank projections and expectations inferred from market pricing fail tests for bias and inefficiency at longer forecast horizons. This may reflect difficulties in forecasting during a turbulent period or more fundamentally, incomplete knowledge of the structure and dynamics of the economy. The results nevertheless indicate that forecasts do not live up to the demanding standards of fully rational expectations.

References

- Baghestani, H. (2008), "Federal Reserve versus Private Information: Who Is the Best Unemployment Rate Predictor?", *Journal of Policy Modeling* 30, 101-110.
- Blinder, A., Ehrmann, M., Fratzscher, M., de Haan, J. and Jansen, D.-J. (2008), "Central Bank Communication and Monetary Policy: A Survey of the Evidence", *Journal of Economic Literature* 46, 910-945.
- Dale, S., Orphanides, A. and Österholm, P. (2011), "Imperfect Central Bank Communication: Information versus Distraction", *International Journal of Central Banking* 7, 3-39.
- Diebold F. X. and Mariano R. S. (1995), "Comparing Predictive Accuracy", *Journal of Business and Economic Statistics* 13, 253-263.
- Ehrmann, M., Eijffinger, S. C. W. and Fratzscher, M. (2012), "The Role of Central Bank Forecasts for Guiding Private Sector Forecasts", *Scandinavian Journal of Economics* 114, 1018-1052.
- Elliott, G., Komunjer, I. and Timmermann, A. (2008), "Biases in Macroeconomic Forecasts: Irrationality or Asymmetric Loss?", *Journal of the European Economic Association* 6, 122-157.
- Faust, J. and Leeper, E. M. (2005), "Forecasts and Inflation Reports: An Evaluation", Paper presented at Sveriges Riksbank's conference *Inflation targeting: implementation, communication and effectiveness*, June 2005.
- Faust, J. and Wright, J. H. (2008), "Efficient Forecast Tests for Conditional Policy Forecasts", *Journal of Econometrics* 146, 293-303.
- Goodhart, C. A. E. and Lim, W. B. (2011), "Interest Rate Forecasts: A Pathology", *International Journal of Central Banking* 7, 135-171.
- Harvey, D., Leybourne, S. and Newbold, P. (1997), "Testing the Equality of Prediction Mean Squared Errors", *International Journal of Forecasting* 13, 281-291.
- Jonsson, T. and Österholm, P. (2011), "The Forecasting Properties of Survey-Based Wage-Growth Expectations", *Economics Letters* 113, 276-281.
- Mankiw, N. G., Reis, R., Wolfers, J. (2003), "Disagreements about Inflation Expectations", *NBER Macroeconomics Annual* 18, 209-248.
- Mehra, Y. P. (2002), "Survey Measures of Expected Inflation: Revisiting the Issues of Predictive Content and Rationality", *Federal Reserve Bank of Richmond Quarterly Review* 88, 17-36.
- Mishkin, F. S. (2004), "Can Central Bank Transparency Go Too Far?", In: Kent, C. and Guttman, S. (eds), *The Future of Inflation Targeting*, Reserve Bank of Australia, Sydney.
- Morris, S. and Shin, H. S. (2002), "Social Value of Public Information", *American Economic Review* 92, 1521-1534.
- Ólafsson, T. T. (2007), "Publications of Its Own Policy Rate Path Boosts the Effectiveness of Central Bank Monetary Policy", *Central Bank of Iceland Monetary Bulletin* 2007/1, 71-86.

Rudebusch, G. D. (2008), “Publishing Central Bank Interest Rate Forecasts”, *Federal Reserve Bank of San Francisco Economic Letter* 2008-02.

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

Svensson, L. E. O. (2006), “Social Value of Public Information: Morris and Shin (2002) Is Actually Pro-Transparency, Not Con”, *American Economic Review* 96, 448-452.

Sveriges Riksbank (2010), *Monetary Policy Report* October 2010.

van der Cruijsen, C. A. B., Eijffinger, S. C. W. and Hoogduin, L. H. (2010), “Optimal Central Bank Transparency”, *Journal of International Money and Finance* 29, 1482-1507.

Appendix

Figure A1. Repo rate and forecasts/expectations in Sweden.

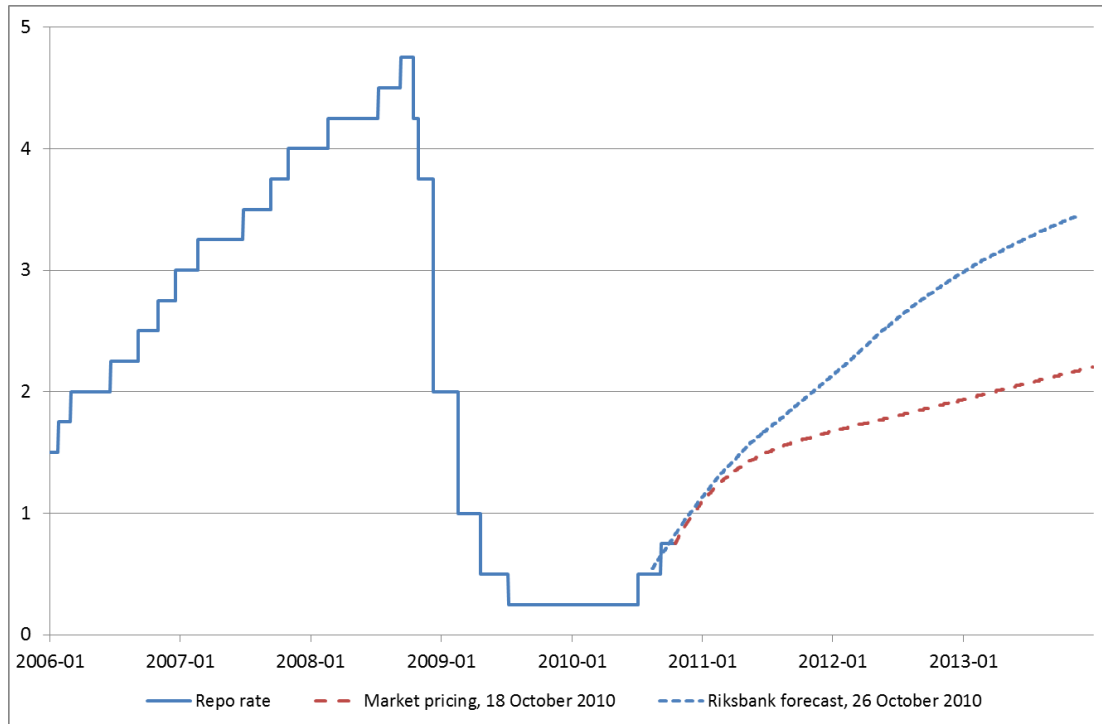
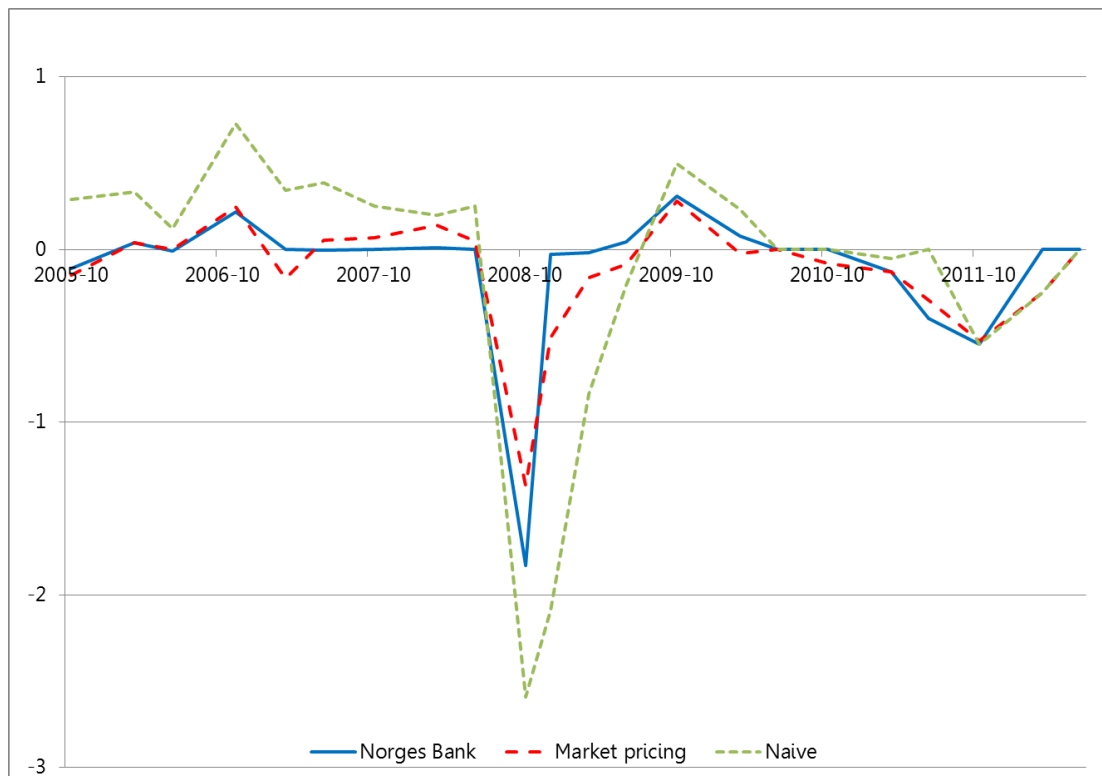
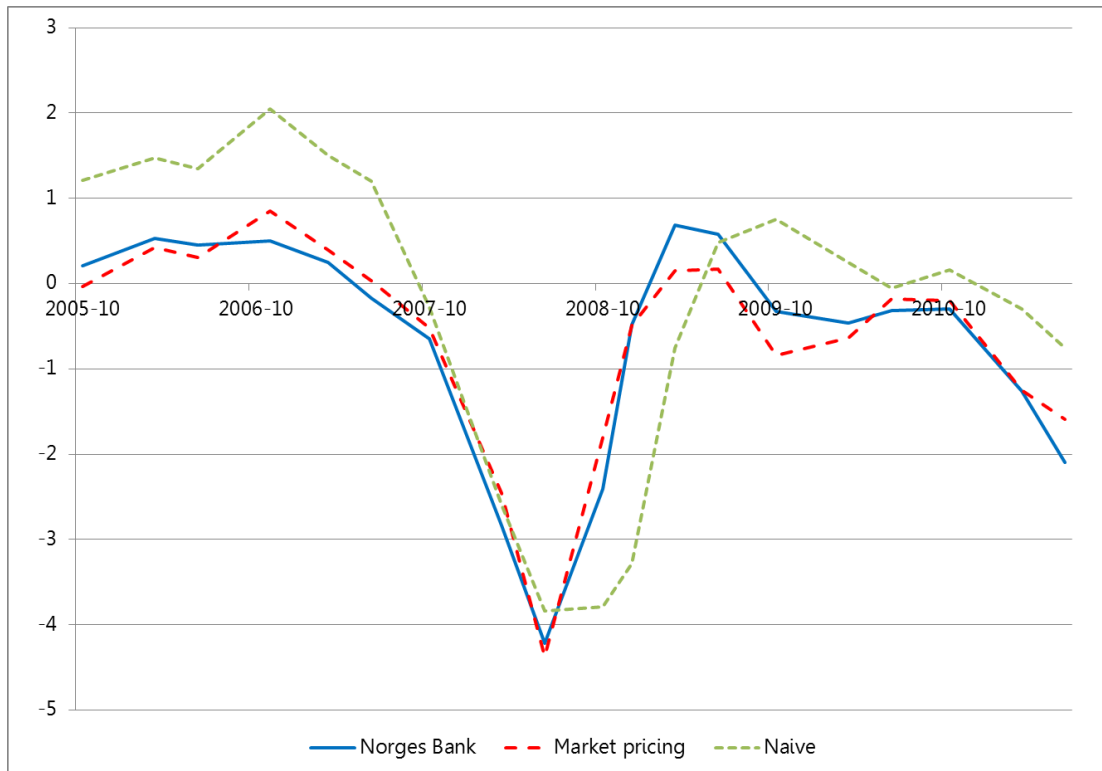


Figure A2. Forecast errors at the one-quarter horizon in Norway.



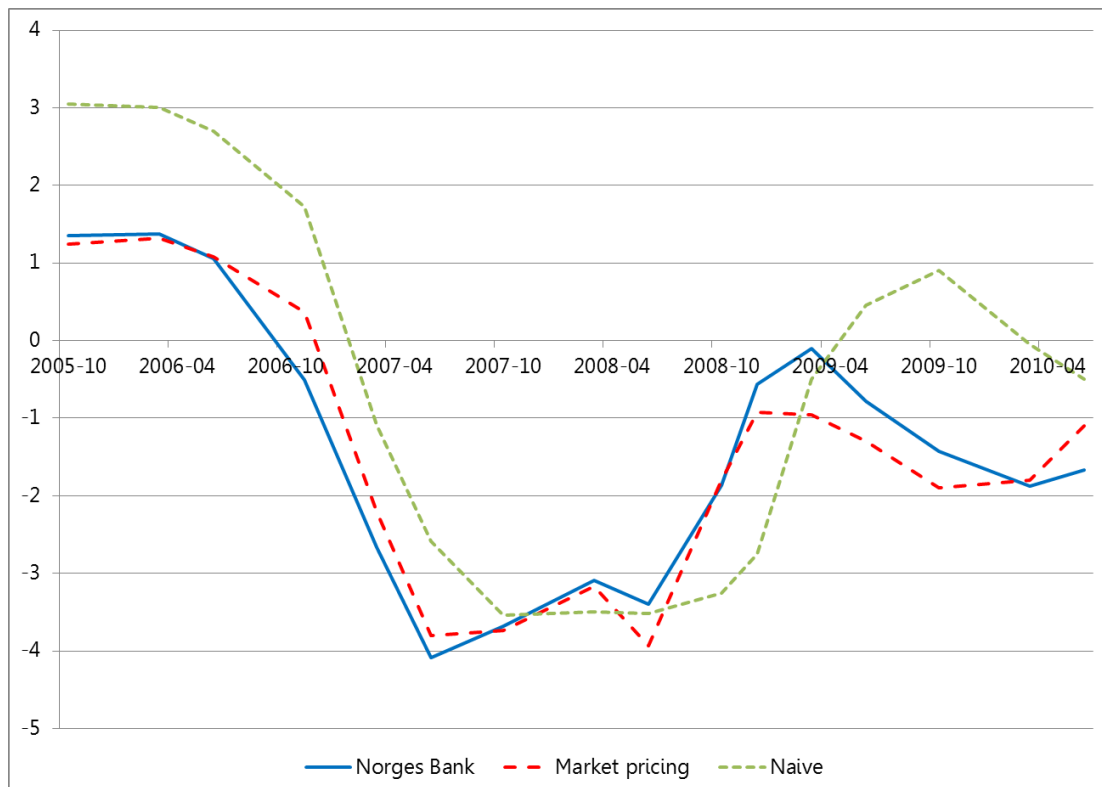
Note: Date refers to when forecast was made.

Figure A3. Forecast errors at the one-year horizon in Norway.



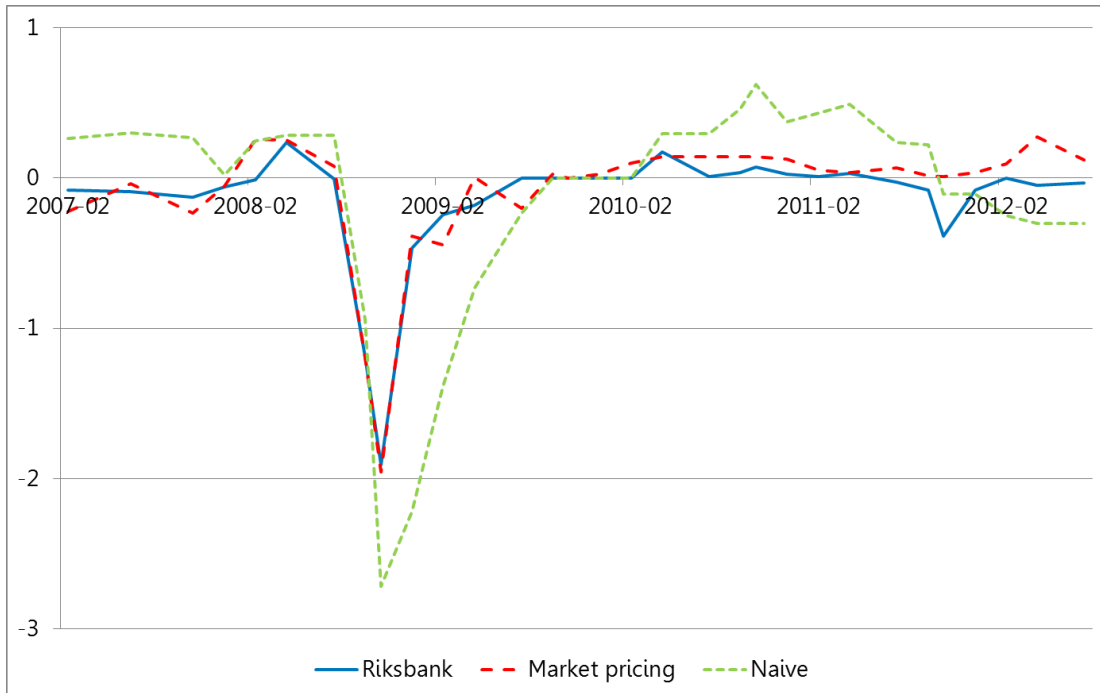
Note: Date refers to when forecast was made.

Figure A4. Forecast errors at the two-year horizon in Norway.



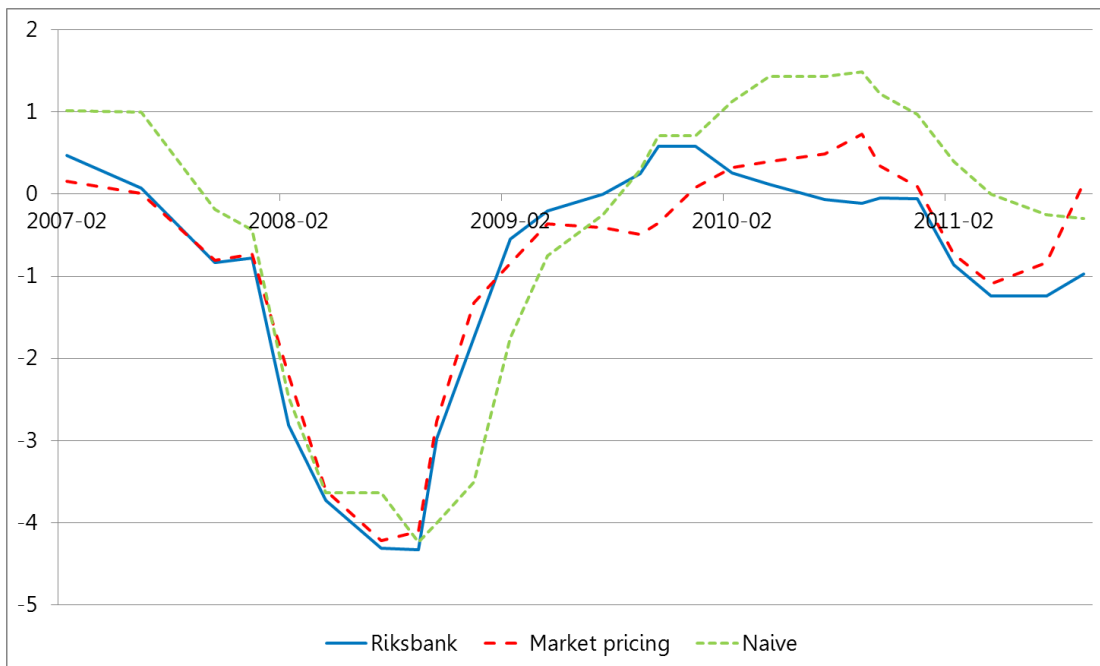
Note: Date refers to when forecast was made.

Figure A5. Forecast errors at the one-quarter horizon in Sweden.



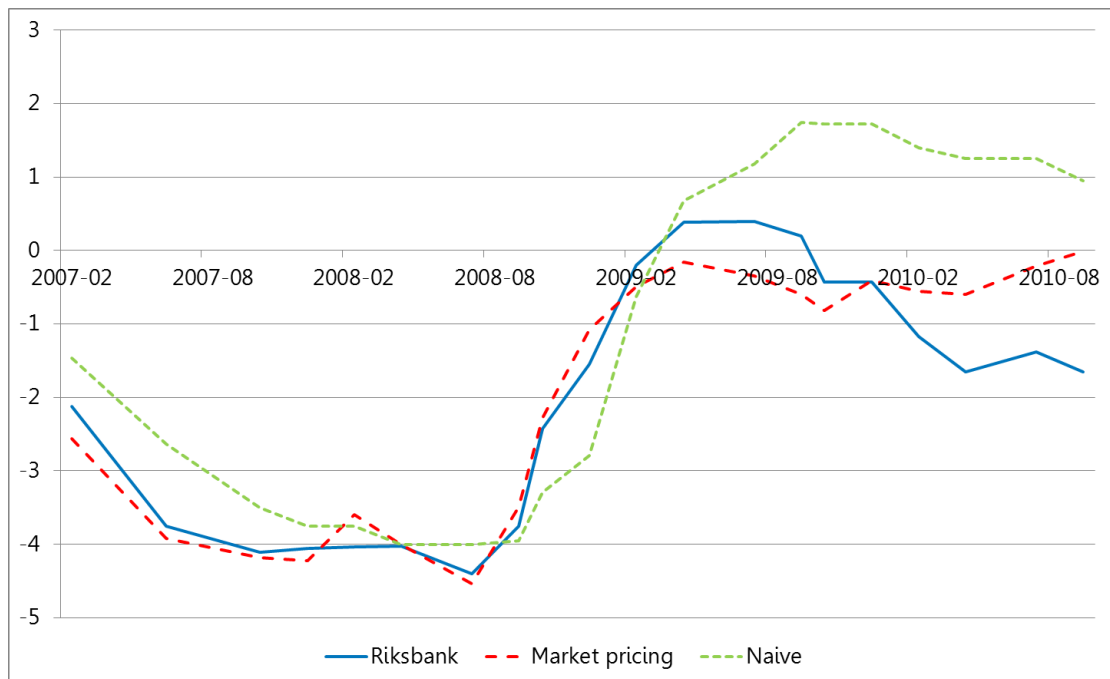
Note: Date refers to when forecast was made.

Figure A6. Forecast errors at the one-year horizon in Sweden.



Note: Date refers to when forecast was made.

Figure A7. Forecast errors at the two-year horizon in Sweden.



Note: Date refers to when forecast was made.

Titles in the Working Paper Series

No	Author	Title	Year
1	Warne, Anders and Anders Vredin	Current Account and Business Cycles: Stylized Facts for Sweden	1989
2	Östblom, Göran	Change in Technical Structure of the Swedish Economy	1989
3	Söderling, Paul	Mamtax. A Dynamic CGE Model for Tax Reform Simulations	1989
4	Kanis, Alfred and Aleksander Markowski	The Supply Side of the Econometric Model of the NIER	1990
5	Berg, Lennart	The Financial Sector in the SNEPQ Model	1991
6	Ågren, Anders and Bo Jonsson	Consumer Attitudes, Buying Intentions and Consumption Expenditures. An Analysis of the Swedish Household Survey Data	1991
7	Berg, Lennart and Reinhold Bergström	A Quarterly Consumption Function for Sweden 1979-1989	1991
8	Öller, Lars-Erik	Good Business Cycle Forecasts - A Must for Stabilization Policies	1992
9	Jonsson, Bo and Anders Ågren	Forecasting Car Expenditures Using Household Survey Data	1992
10	Löfgren, Karl-Gustaf, Bo Ranneby and Sara Sjöstedt	Forecasting the Business Cycle Not Using Minimum Autocorrelation Factors	1992
11	Gerlach, Stefan	Current Quarter Forecasts of Swedish GNP Using Monthly Variables	1992
12	Bergström, Reinhold	The Relationship Between Manufacturing Production and Different Business Survey Series in Sweden	1992
13	Edlund, Per-Olov and Sune Karlsson	Forecasting the Swedish Unemployment Rate: VAR vs. Transfer Function Modelling	1992
14	Rahiala, Markku and Timo Teräsvirta	Business Survey Data in Forecasting the Output of Swedish and Finnish Metal and Engineering Industries: A Kalman Filter Approach	1992
15	Christofferson, Anders, Roland Roberts and Ulla Eriksson	The Relationship Between Manufacturing and Various BTS Series in Sweden Illuminated by Frequency and Complex Demodulate Methods	1992
16	Jonsson, Bo	Sample Based Proportions as Values on an Independent Variable in a Regression Model	1992
17	Öller, Lars-Erik	Eliciting Turning Point Warnings from Business Surveys	1992
18	Forster, Margaret M	Volatility, Trading Mechanisms and International Cross-Listing	1992
19	Jonsson, Bo	Prediction with a Linear Regression Model and Errors in a Regressor	1992

20	Gorton, Gary and Richard Rosen	Corporate Control, Portfolio Choice, and the Decline of Banking	1993
21	Gustafsson, Claes-Håkan and Åke Holmén	The Index of Industrial Production – A Formal Description of the Process Behind it	1993
22	Karlsson, Tohmas	A General Equilibrium Analysis of the Swedish Tax Reforms 1989-1991	1993
23	Jonsson, Bo	Forecasting Car Expenditures Using Household Survey Data- A Comparison of Different Predictors	1993
24	Gennotte, Gerard and Hayne Leland	Low Margins, Derivative Securitates and Volatility	1993
25	Boot, Arnoud W.A. and Stuart I. Greenbaum	Discretion in the Regulation of U.S. Banking	1993
26	Spiegel, Matthew and Deane J. Seppi	Does Round-the-Clock Trading Result in Pareto Improvements?	1993
27	Seppi, Deane J.	How Important are Block Trades in the Price Discovery Process?	1993
28	Glosten, Lawrence R.	Equilibrium in an Electronic Open Limit Order Book	1993
29	Boot, Arnoud W.A., Stuart I Greenbaum and Anjan V. Thakor	Reputation and Discretion in Financial Contracting	1993
30a	Bergström, Reinhold	The Full Tricotomous Scale Compared with Net Balances in Qualitative Business Survey Data – Experiences from the Swedish Business Tendency Surveys	1993
30b	Bergström, Reinhold	Quantitative Production Series Compared with Qualitative Business Survey Series for Five Sectors of the Swedish Manufacturing Industry	1993
31	Lin, Chien-Fu Jeff and Timo Teräsvirta	Testing the Constancy of Regression Parameters Against Continous Change	1993
32	Markowski, Aleksander and Parameswar Nandakumar	A Long-Run Equilibrium Model for Sweden. The Theory Behind the Long-Run Solution to the Econometric Model KOSMOS	1993
33	Markowski, Aleksander and Tony Persson	Capital Rental Cost and the Adjustment for the Effects of the Investment Fund System in the Econometric Model Kosmos	1993
34	Kanis, Alfred and Bharat Barot	On Determinants of Private Consumption in Sweden	1993
35	Kääntä, Pekka and Christer Tallbom	Using Business Survey Data for Forecasting Swedish Quantitative Business Cycle Variable. A Kalman Filter Approach	1993
36	Ohlsson, Henry and Anders Vredin	Political Cycles and Cyclical Policies. A New Test Approach Using Fiscal Forecasts	1993

37	Markowski, Aleksander and Lars Ernsäter	The Supply Side in the Econometric Model KOSMOS	1994
38	Gustafsson, Claes-Håkan	On the Consistency of Data on Production, Deliveries, and Inventories in the Swedish Manufacturing Industry	1994
39	Rahiala, Markku and Tapani Kovalainen	Modelling Wages Subject to Both Contracted Increments and Drift by Means of a Simultaneous-Equations Model with Non-Standard Error Structure	1994
40	Öller, Lars-Erik and Christer Tallbom	Hybrid Indicators for the Swedish Economy Based on Noisy Statistical Data and the Business Tendency Survey	1994
41	Östblom, Göran	A Converging Triangularization Algorithm and the Intertemporal Similarity of Production Structures	1994
42a	Markowski, Aleksander	Labour Supply, Hours Worked and Unemployment in the Econometric Model KOSMOS	1994
42b	Markowski, Aleksander	Wage Rate Determination in the Econometric Model KOSMOS	1994
43	Ahlroth, Sofia, Anders Björklund and Anders Forslund	The Output of the Swedish Education Sector	1994
44a	Markowski, Aleksander	Private Consumption Expenditure in the Econometric Model KOSMOS	1994
44b	Markowski, Aleksander	The Input-Output Core: Determination of Inventory Investment and Other Business Output in the Econometric Model KOSMOS	1994
45	Bergström, Reinhold	The Accuracy of the Swedish National Budget Forecasts 1955-92	1995
46	Sjöö, Boo	Dynamic Adjustment and Long-Run Economic Stability	1995
47a	Markowski, Aleksander	Determination of the Effective Exchange Rate in the Econometric Model KOSMOS	1995
47b	Markowski, Aleksander	Interest Rate Determination in the Econometric Model KOSMOS	1995
48	Barot, Bharat	Estimating the Effects of Wealth, Interest Rates and Unemployment on Private Consumption in Sweden	1995
49	Lundvik, Petter	Generational Accounting in a Small Open Economy	1996
50	Eriksson, Kimmo, Johan Karlander and Lars-Erik Öller	Hierarchical Assignments: Stability and Fairness	1996
51	Url, Thomas	Internationalists, Regionalists, or Eurocentrists	1996
52	Ruist, Erik	Temporal Aggregation of an Econometric Equation	1996
53	Markowski, Aleksander	The Financial Block in the Econometric Model KOSMOS	1996

54	Östblom, Göran	Emissions to the Air and the Allocation of GDP: Medium Term Projections for Sweden. In Conflict with the Goals of SO ₂ , SO ₂ and NOX Emissions for Year 2000	1996
55	Koskinen, Lasse, Aleksander Markowski, Parameswar Nandakumar and Lars-Erik Öller	Three Seminar Papers on Output Gap	1997
56	Oke, Timothy and Lars-Erik Öller	Testing for Short Memory in a VARMA Process	1997
57	Johansson, Anders and Karl-Markus Modén	Investment Plan Revisions and Share Price Volatility	1997
58	Lyhagen, Johan	The Effect of Precautionary Saving on Consumption in Sweden	1998
59	Koskinen, Lasse and Lars-Erik Öller	A Hidden Markov Model as a Dynamic Bayesian Classifier, with an Application to Forecasting Business-Cycle Turning Points	1998
60	Kragh, Börje and Aleksander Markowski	Kofi – a Macromodel of the Swedish Financial Markets	1998
61	Gajda, Jan B. and Aleksander Markowski	Model Evaluation Using Stochastic Simulations: The Case of the Econometric Model KOSMOS	1998
62	Johansson, Kerstin	Exports in the Econometric Model KOSMOS	1998
63	Johansson, Kerstin	Permanent Shocks and Spillovers: A Sectoral Approach Using a Structural VAR	1998
64	Öller, Lars-Erik and Bharat Barot	Comparing the Accuracy of European GDP Forecasts	1999
65	Huhtala, Anni and Eva Samakovlis	Does International Harmonization of Environmental Policy Instruments Make Economic Sense? The Case of Paper Recycling in Europe	1999
66	Nilsson, Charlotte	A Unilateral Versus a Multilateral Carbon Dioxide Tax - A Numerical Analysis With The European Model GEM-E3	1999
67	Braconier, Henrik and Steinar Holden	The Public Budget Balance – Fiscal Indicators and Cyclical Sensitivity in the Nordic Countries	1999
68	Nilsson, Kristian	Alternative Measures of the Swedish Real Exchange Rate	1999
69	Östblom, Göran	An Environmental Medium Term Economic Model – EMEC	1999
70	Johnsson, Helena and Peter Kaplan	An Econometric Study of Private Consumption Expenditure in Sweden	1999
71	Arai, Mahmood and Fredrik Heyman	Permanent and Temporary Labour: Job and Worker Flows in Sweden 1989-1998	2000

72	Öller, Lars-Erik and Bharat Barot	The Accuracy of European Growth and Inflation Forecasts	2000
73	Ahlroth, Sofia	Correcting Net Domestic Product for Sulphur Dioxide and Nitrogen Oxide Emissions: Implementation of a Theoretical Model in Practice	2000
74	Andersson, Michael K. And Mikael P. Gredenhoff	Improving Fractional Integration Tests with Bootstrap Distribution	2000
75	Nilsson, Charlotte and Anni Huhtala	Is CO ₂ Trading Always Beneficial? A CGE-Model Analysis on Secondary Environmental Benefits	2000
76	Skånberg, Kristian	Constructing a Partially Environmentally Adjusted Net Domestic Product for Sweden 1993 and 1997	2001
77	Huhtala, Anni, Annie Toppinen and Mattias Boman,	An Environmental Accountant's Dilemma: Are Stumpage Prices Reliable Indicators of Resource Scarcity?	2001
78	Nilsson, Kristian	Do Fundamentals Explain the Behavior of the Real Effective Exchange Rate?	2002
79	Bharat, Barot	Growth and Business Cycles for the Swedish Economy	2002
80	Bharat, Barot	House Prices and Housing Investment in Sweden and the United Kingdom. Econometric Analysis for the Period 1970-1998	2002
81	Hjelm, Göran	Simultaneous Determination of NAIRU, Output Gaps and Structural Budget Balances: Swedish Evidence	2003
82	Huhtala, Anni and Eva Samalkovis	Green Accounting, Air Pollution and Health	2003
83	Lindström, Tomas	The Role of High-Tech Capital Formation for Swedish Productivity Growth	2003
84	Hansson, Jesper, Per Jansson and Märten Löf	Business survey data: do they help in forecasting the macro economy?	2003
85	Boman, Mattias, Anni Huhtala, Charlotte Nilsson, Sofia Ahlroth, Göran Bostedt, Leif Mattson and Peichen Gong	Applying the Contingent Valuation Method in Resource Accounting: A Bold Proposal	
86	Gren, Ing-Marie	Monetary Green Accounting and Ecosystem Services	2003
87	Samakovlis, Eva, Anni Huhtala, Tom Bellander and Magnus Svartengren	Air Quality and Morbidity: Concentration-response Relationships for Sweden	2004
88	Alsterlind, Jan, Alek Markowski and Kristian Nilsson	Modelling the Foreign Sector in a Macroeconometric Model of Sweden	2004
89	Lindén, Johan	The Labor Market in KIMOD	2004

90	Henrik Braconier, Tomas Forsfält	A New Method for Constructing a Cyclically Adjusted Budget Balance: the Case of Sweden	2004
91	Hansen, Sten and Tomas Lindström	Is Rising Returns to Scale a Figment of Poor Data?	2004
92	Hjelm, Göran	When Are Fiscal Contractions Successful? Lessons for Countries Within and Outside the EMU	2004
93	Östblom, Göran and Samakovlis, Eva	Costs of Climate Policy when Pollution Affects Health and Labour Productivity. A General Equilibrium Analysis Applied to Sweden	2004
94	Forslund Johanna, Eva Samakovlis and Maria Vredin Johansson	Matters Risk? The Allocation of Government Subsidies for Remediation of Contaminated Sites under the Local Investment Programme	2006
95	Erlandsson Mattias and Alek Markowski	The Effective Exchange Rate Index KIX - Theory and Practice	2006
96	Östblom Göran and Charlotte Berg	The EMEC model: Version 2.0	2006
97	Hammar, Henrik, Tommy Lundgren and Magnus Sjöström	The significance of transport costs in the Swedish forest industry	2006
98	Barot, Bharat	Empirical Studies in Consumption, House Prices and the Accuracy of European Growth and Inflation Forecasts	2006
99	Hjelm, Göran	Kan arbetsmarknadens parter minska jämviktsarbetslösheten? Teori och modellsimuleringar	2006
100	Bergvall, Anders, Tomas Forsfält, Göran Hjelm, Jonny Nilsson and Juhana Vartiainen	KIMOD 1.0 Documentation of NIER's Dynamic Macroeconomic General Equilibrium Model of the Swedish Economy	2007
101	Östblom, Göran	Nitrogen and Sulphur Outcomes of a Carbon Emissions Target Excluding Traded Allowances - An Input-Output Analysis of the Swedish Case	2007
102	Hammar, Henrik and Åsa Löfgren	Explaining adoption of end of pipe solutions and clean technologies – Determinants of firms' investments for reducing emissions to air in four sectors in Sweden	2007
103	Östblom, Göran and Henrik Hammar	Outcomes of a Swedish Kilometre Tax. An Analysis of Economic Effects and Effects on NOx Emissions	2007
104	Forsfält, Tomas, Johnny Nilsson and Juhana Vartianinen	Modellansatser i Konjunkturinstitutets medelfristprognoser	208
105	Samakovlis, Eva	How are Green National Accounts Produced in Practice?	2008

107	Forslund, Johanna, Per Johansson, Eva Samakovlis and Maria Vredin Johansson	Can we by time? Evaluation. Evaluation of the government's directed grant to remediation in Sweden	2009
108	Forslund, Johanna Eva Samakovlis, Maria Vredin Johansson and Lars Barregård	Does Remediation Save Lives? On the Cost of Cleaning Up Arsenic-Contaminated Sites in Sweden	2009
109	Sjöström, Magnus and Göran Östblom	Future Waste Scenarios for Sweden on the Basis of a CGE-model	2009
110	Österholm, Pär	The Effect on the Swedish Real Economy of the Financial Crisis	2009
111	Forsfält, Tomas	KIMOD 2.0 Documentation of changes in the model from January 2007 to January 2009	2009
112	Österholm, Pär	Improving Unemployment Rate Forecasts Using Survey Data	2009
113	Österholm, Pär	Unemployment and Labour-Force Participation in Sweden	2009
114	Jonsson, Thomas and Pär Österholm	The Properties of Survey-Based Inflation Expectations in Sweden	2009
115	Hjelm, Göran and Kristian Jönsson	In Search of a Method for Measuring the Output Gap of the Swedish Economy	2010
116	Vartiainen, Juhana	Interpreting Wage Bargaining Norms	2010
117	Mossfeldt, Marcus and Pär Österholm	The Persistent Labour-Market Effects of the Financial Crisis	2010
118	Östblom, Göran, Maria Ljunggren Söderman and Magnus Sjöström	Analysing future solid waste generation – Soft linking a model of waste management with a CGE-model for Sweden	2010
119	Broberg, Thomas, Per-Olov Marklund , Eva Samakovlisa and Henrik Hammar	Does environmental leadership pay off for Swed-ish industry? - Analyzing the effects of environ-mental investments on efficiency	2010
120	Gustavsson, Magnus and Pär Österholm	Labor-Force Participation Rates and the Informational Value of Unemployment Rates: Evidence from Disaggregated US Data	2010
121	Jonsson, Thomas and Pär österholm	The Forecasting Properties of Survey-Based Wage- Growth Expectations	2010
122	Antipin, Jan-Erik, Jimmy Boumediene and Pär Österholm	On the Usefulness of Constant Gain Least Squares when Forecasting the Unemployment Rate	2011
123	Broberg, Thomas, Tomas Forsfält and Göran Östblom	The Excess Cost of Supplementary Constraints in Climate Policy: The Case of Sweden's Energy Intensity Target	2011

124	Patrik Baard, Henrik Carlsen, Karin Edvardsson Björnberg and Maria Vredin Johansson	Scenarios and Sustainability. A Swedish Case Study of Adaptation Tools for Local Decision-Makers	2011
125	Hansson, Sven Ove, Karin Edvardsson Björnberg and Maria Vredin Johansson	Making Climate Policy Efficient Implementing a Model for Environmental Policy Efficiency	2011
126	Antipin, Jan-Erik, Farid Jimmy Boumediene and Pär Österholm	Forecasting Inflation Using Constant Gain Least Squares	2012
127	Meredith Beechey, Pär Österholm	Policy Interest Rate Expectations in Sweden: A Forecast Evaluation	2012
128	Meredith Beechey, Pär Österholm	Central Bank Forecasts of Policy Interest Rates: An Evaluation of the First Years	2013

Konjunkturinstitutet, Kungsgatan 12-14, Box 3116, 103 62 Stockholm
Tel: 08-453 59 00, Fax: 08-453 59 80, E-post: ki@konj.se, Webb: konj.se

ISSN 1100-7818