

Norges Bank Watch 2024

An independent evaluation of monetary policy in
Norway in 2023

Elisabeth Holvik*

Leif Anders Thorsrud[†]

Centre for Monetary Economics
BI Norwegian Business School
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*Sparebank 1. Email: elisabeth.holvik@sparebank1.no

[†]Centre for Applied Macroeconomics and Commodity Prices, BI Norwegian Business School, Nydalsveien 37, 0484 Oslo, Norway. Email: leif.a.thorsrud@bi.no

Foreword

Each year the Centre for Monetary Economics (CME) at the Department of Economics, BI Norwegian Business School, appoints an independent group of experts to evaluate monetary policy in Norway.

This year the Norges Bank Watch (NBW) committee consists of Elisabeth Holvik, Chief economist at SpareBank 1, and Leif Anders Thorsrud, Professor at BI.

The NBW committee is solely responsible for the report and the views therein. The report does not necessarily represent the views of the CME or of its members. The Ministry of Finance uses the NBW reports as input to their annual Financial Markets Report to the Parliament, when assessing the conduct of monetary policy. The Ministry of Finance partly funds the NBW reports.

Oslo, February 23, 2024

Centre for Monetary Economics

Tommy Sveen

1 Introduction and executive summary

The purpose of this report is to evaluate the monetary policy conducted by Norges Bank during 2023. To do so we have focused on the decisions made at the interest rate meetings, the analysis and arguments presented in the official Monetary Policy Reports, and two of the main speeches held by the Central Bank Governor Ida Wolden Bache. We also had meetings with the Ministry of Finance on January 8 and Norges Bank on January 9, 2024.

In 2023 the Norwegian economy was still heavily affected by many of the same factors as in 2022: International turbulence, price pressures, and high uncertainty. The NBW committee acknowledges the challenges of making decisions under great uncertainty and extends its gratitude to Norges Bank for their efforts in difficult years and for sharing their time and experience to illuminate how economic policy in Norway was executed in 2023.

This report is divided into two main parts. In Section 2 we provide a summary of the monetary policy in 2023, focusing on the actual interest rate decisions, their rationale, and market reactions. The main picture is that although the interest rate was increased six times, from 2.75% in the beginning of the year to 4.5%, the central bank's communication was primarily effective, with its decision-making pattern well understood by market participants. However, it also becomes relatively clear that Norges Bank underestimated the resilience of the real economy and the inflation pressure and at the same time overestimated the strength of the exchange rate.

In Section 3 we build on this summary and discuss three issues that deserve extra attention by Norges Bank going forward: The exchange rate, Norges Bank's response to foreign shocks, and uncertainty and risk projections. To facilitate this discussion and support our argumentation we use simple empirical models to challenge the predictions underlying the policy by Norges Bank and their risk assessments.

Although our analysis is simple, and should be interpreted as suggestive rather than conclusive, our results indicate that:

- a) While Norges Bank missed on their exchange rate predictions, we find that an analysis disciplining the economy's long-run developments does much better. Given the exchange rate's important role for inflation dynamics, more formal risk and scenario analysis along the lines discussed in d) below could be valuable. To the extent that risk premium effects are driving the exchange rate fluctuations, more analysis casting light on the underlying drivers of these changes would be welcomed by market analysts.
- b) Earlier research has documented that revisions to the interest rate path published

by Norges Bank is partly predictable with foreign indicators. Our updated estimates suggest that Norges Bank has improved in terms of how they incorporate international developments into their analysis, but interest rate path revisions are still predictable by international indicator(s). In other words, it seems that Norges Bank responds to foreign shocks with a delay. One consequence of this response pattern is a certain pro-cyclicality in the interest rate setting.

- c) Consistent with [a\)](#) and [b\)](#) above, our counterfactual estimates suggest that the interest rate should have been raised faster and earlier in 2023, to then be able to reach the peak at a somewhat earlier point. This response pattern is in qualitative terms consistent with Norges Bank's own alternative simple interest rate rule estimates. It might have been the fear of a possible sharp downturn in the Norwegian economy that held back the monetary Committee, but with the combination of further surprising weakening of the exchange rate and a still very strong labor market into the spring of 2023, a more aggressive interest rate response would have been possible.
- d) Norges Bank should be given credit for having (re)incorporated quantitative measures of uncertainty into their analysis. Going forward we welcome more of this type of analysis alongside more formal risk and scenario analysis of how alternative assumption might affect the main policy projections. In particular, the empirical experiments summarized in [a\)](#) above suggest that a more formal assessment of alternative long-run assumptions, related to, e.g., productivity growth, regulation or persistent changes in Norwegian capital markets, could have affected Norges Bank's exchange rate expectations during and before 2023. In turn, this could have affected the interest rate setting. At a more general level, as we now navigate a period marked by potentially shifting long-term trends, such as the structural transition associated with traditional Dutch disease dynamics, it seems to us as particularly important to assess the robustness of the policy choices to alternative medium- to long-run assumptions.

2 Monetary policy in 2023

Below we first shortly present the general monetary conditions as they were at the onset of 2023. We then describe in greater detail market developments and the conduct of monetary policy during 2023.

2.1 The starting point

Going into 2023 Norges Bank had been among the first central banks to begin normalizing interest rates after they were reduced to zero during the Covid-19 crisis. Indeed, Norges Bank announced a strategy already in September 2021 to gradually increase the interest rate moving forward, setting a different pace compared to other central banks, like the U.S. Federal Reserve, which at the same point in time projected unchanged policy rates for years ahead. Norges Bank deserves credit for its early moves towards normalization post the significant monetary shock of zero interest rates. However, as Figure 1 indicates, by the start of 2023 Norges Bank lagged behind the U.S. and U.K., which had dramatically changed their monetary policies throughout 2022, notably increasing the pace of interest rate hikes during the summer.

On December 14, 2022, the U.S. central bank raised its rate by 0.5 percentage points to 4.5%, revising its end-of-2023 rate forecast from 4.6% to 5.1%, acknowledging a 6% underlying inflation rate and an extremely tight labor market, indicating a challenging cooling of the economy. On December 15, 2022, Norges Bank increased its rate by 0.25 percentage points to 2.75%, predicting a rate of 3.08% by year-end, slightly down from a previous forecast. They highlighted higher-than-expected and persistently high inflation, a tighter labor market with a 1.6% unemployment rate in November, higher growth in other countries than previously anticipated, and significantly adjusted interest rate expectations internationally. Concerns were notably regarding the potential economic downturn due to higher rates and prices, with a belief that global inflation was peaking. The Norwegian krone had significantly weakened throughout 2022, from around 8.7 against the USD in January to a peak of 10.9 in September, then stabilizing around 10 against the USD by the last monetary policy report of December 2022. Despite a negative interest differential, the krone was expected to strengthen by 5% by the end of 2025. In their risk assessment, the monetary Committee underscored the unusually high uncertainty, especially regarding how high inflation influences wage and price formation, with what seemed to use like a symmetric risk of inflation accelerating or decelerating faster than expected.

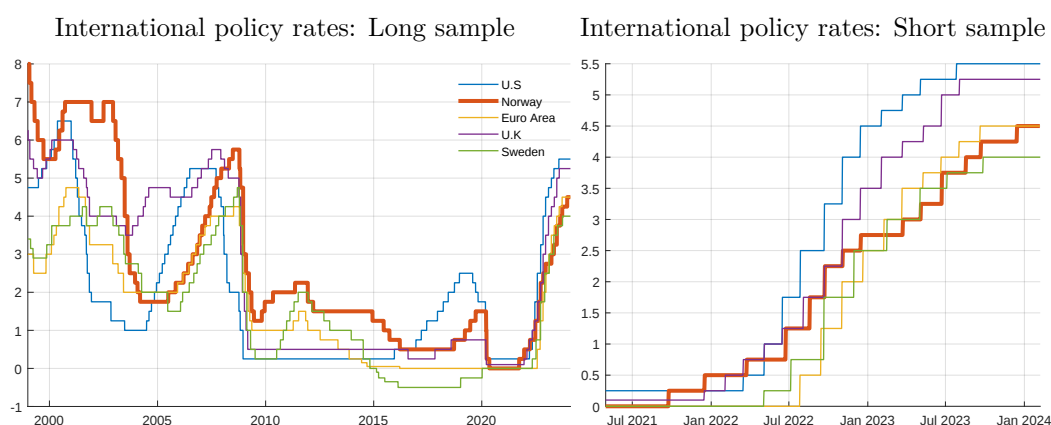


Figure 1. The graph reports the Federal Reserve Target Rate (U.S), Norges Bank Sight Deposit Folio Rate (Norway), ECB Main Refinancing Operations Rate (Euro Area), Bank of England Policy Rate (U.K.) and the Central Bank of Sweden Policy Rate (Sweden).

2.2 Development and execution

Meeting 1: January 19

At the first interest rate meeting in 2023 the rate was kept unchanged at 2.75%. Since the last meeting in December, Norges Bank noted the following developments:

- The labor market appears to be even tighter (than before)
- Energy prices seem to be moderating more than previously assumed

Following a series of interest rate increases, the monetary Committee's analysis suggests that monetary policy had started to tighten the economy. This argues for a more gradual approach to rate setting. At the same time, consumer prices have risen sharply, and inflation is markedly above the target. The Committee pointed out that continued pressure in the economy may contribute to keeping inflation elevated, and these developments could suggest raising the policy rate at the January meeting. The Committee concluded that the interest rate most likely will be increased further in March.

From the January to March meetings, several developments influenced interest rate expectations:

- Banking turmoil in the U.S. and Switzerland led to stock market unrest and declining interest rate expectations. Overall, however, interest rate expectations in other countries had risen to a higher level than assumed in December.
- Stronger global growth.
- Increased geopolitical trade tension after China still had not condemned the Russian invasion of Ukraine. Sanctions and the escalation of sanctions involving technology.
- In the annual speech on February 16, 2023, the Central Bank Governor warned that if currency market participants lack confidence in monetary policy tightening when

inflation rises, the krone could weaken. A weaker krone leads to increased imported inflation and could also result in higher wage growth due to improved profitability in the industry. This might create a self-reinforcing cycle of price and wage growth. Additionally, the Governor noted that several factors suppressing inflation in the decades before the pandemic might be reversing, with reduced trade and measures to make supply chains more robust potentially leading to lower productivity and higher prices.

Meeting 2: March 23

Norges Bank increased the rate by 0.25 percentage points to 3%. The Committee highlighted in their statement that:

- International growth prospects are better than expected.
- Freight prices have decreased to pre-pandemic levels, unemployment has been lower than anticipated, and the downturn in the Norwegian economy appears to be less pronounced than projected in December 2022.
- Energy prices have significantly dropped, and consumer price growth has been lower than expected.
- However, higher wage growth and a weaker krone than previously estimated are expected to drive inflation higher.
- The krone's exchange rate forecast for 2023 was adjusted to nearly 7% weaker than assumed in December, wage growth for 2023 was revised up to 5.1% from the December forecast of 4.7%, oil investments were adjusted up by 2 percentage points to a 6% growth in 2023, and projections of fiscal policy became more stimulative, with an increase from December of 0.7 percentage points to an oil-adjusted deficit of 9.6% of trend GDP.

The Committee adjusted their expectations for a significant downturn in the Norwegian economy to be less severe than anticipated in December. The interest rate path was revised to reach 3.45% by the summer of 2023, an adjustment from the December report which had forecasted a rate of 3.08% for the summer of 2023. In their risk assessment, the Committee highlighted the risk of a weaker krone, stating that if economic pressure persisted, a higher interest rate would be necessary. Conversely, if inflation decreased faster or unemployment was higher than expected, the interest rate could be lower than currently assumed. The likelihood of both scenarios seemed to us to be fairly equal.

Meeting 3: May 4

Norges Bank increased the interest rate by 0.25 percentage points to 3.25%. The Committee noted in their press release that:

- The economic development and inflation had been as expected since the first Mon-

etary Policy Report of the year.

- They highlighted that prospects of higher wage growth and the weakening of the krone exchange rate would contribute to sustaining inflation in the future.

Summarizing the outlook, they mentioned that if the krone remains weaker than assumed, or if the pressure in the economy persists, a higher interest rate than currently envisioned by Norges Bank might be necessary.

Meeting 4: June 22

Norges Bank unexpectedly raised the interest rate by 0.5 percentage points to 3.75%. The Committee cited:

- Significantly higher inflation than forecasted in the previous Monetary Policy Report.
- International interest rates have risen more than anticipated. Higher wage growth and a weaker krone than projected earlier will push up inflation ahead.

They reiterated their previous guidance, stating that if the krone weakens more than expected or if economic pressure persists, a higher interest rate might be necessary. They anticipated another rate increase in August, aiming for a policy rate of 3.98% by the end of the year.

Prior to the interest rate meeting, market rates had increased slightly, and the krone strengthened following unexpectedly high CPI figures released on June 9, with both CPI and core CPI rising to 6.7%. Thus, the market had somewhat adjusted to this news by June 9. However, the market had not fully priced in a 0.5 percentage point rate hike, nor anticipated such a significant upward adjustment of the interest rate path. This led to a 0.1 percentage point increase in short-term money market rates and a strengthening of the krone after the rate decision.

Concerns about losing confidence in the Norwegian krone likely prompted Norges Bank to surprise the market with a 0.5 percentage point rate hike. Despite fears of an economic downturn, unemployment remained at record lows, and wage growth was increasing. Reports from the agricultural sector, heavily reliant on foreign seasonal workers, indicated significant wage increases were necessary to compensate for the weak krone to attract foreign workers. Growth remained strong in other countries, with central banks in the U.S, U.K., and Euro Area raising rates faster than Norges Bank.

Meeting 5: August 17

Norges Bank raised the interest rate by 0.25 percentage points to 4%. The Committee signaled that rates would likely be increased again in September. Their risk assessment mentioned that if the krone weakens more than expected or if economic pressures persist,

a higher rate than indicated in the June Monetary Policy Report might be necessary. Conversely, a sharper slowdown in the Norwegian economy or quicker inflation decline could lead to lower rates than anticipated in June. The risk assessment appeared symmetric, possibly due to a somewhat stronger krone over the summer. The NOK was at this point in time slightly stronger than estimated in the previous monetary policy report.

Meeting 6: September 21

Norges Bank increased the interest rate by 0.25 percentage points to 4.25%. The Committee indicated that “there will likely be one additional policy rate hike, most probably in December” and stressed the need “to maintain a tight stance for some time ahead”. This guidance seemed aimed at countering speculation that the interest rate peak had been reached and that cuts might follow. The decision was based on:

- The still tight labor market.
- Expectations of higher wage growth
- A slight upward adjustment in the policy rate forecast, suggesting a rate around 4.5% through 2024.

In their risk assessment, the Committee highlighted uncertainties about economic development and the tightening effect of current interest rates. They noted that persistent economic pressure or a weaker-than-expected krone could sustain high inflation longer than anticipated, concluding that: “The longer inflation remains elevated, the greater the risk of it becoming entrenched. It may then prove more costly to bring inflation down again at a later stage. On the other hand, the policy rate has been raised significantly over a short period of time, and monetary policy is now having a tightening effect on the economy. The Committee does not want to raise the policy rate more than is necessary to tackle the high level of inflation”. The emphasis on the krone exchange rate and the statement that if the krone turns out to be weaker than projected “we are prepared to raise the policy rate to a further extent than we project at present”, indicated a concern over inflation’s upside risks.

Meeting 7: November 2

Norges Bank kept the interest rate unchanged, stating that monetary policy is now tightening the economy, and the full effects of past rate hikes are yet to be seen. The Committee’s assessment is that the rate is close to what is necessary to curb inflation, allowing time to assess further rate adjustments.

To guide the market, the Committee wrote: “Based on the Committee’s current assessment of the outlook, the policy rate will likely be raised in December. The Committee will have received more information about the inflation outlook ahead of its monetary policy meeting in December. If the Committee becomes more assured that underlying

inflation is on the decline, the policy rate may be kept on hold.”

In Norges Bank’s yearly CME speech, on November 9th, Central Bank Governor Ida Wolden Bache gave a speech titled “Monetary policy and the krone exchange rate” ([Bache, 2023](#)). In the speech Bache highlighted the balance between following global interest rates and adjusting for Norway’s economic outlook with a flexible inflation target and high employment objective. Although a flexible inflation targeting regime allows Norway to depart from international interest rate levels, to, e.g., support domestic growth and employment, large and sustained differences might threaten the confidence in the bank’s willingness to stabilize inflation and thus potentially lead to additional price and wage growth, the Governor said.

In addition to the interest rate differential between Norway and its main trading partners, the Governor highlighted three factors as potential explanations for the weak exchange rate; Relatively weak productivity growth in Norway since the mid 2000s; Saving shifting from the domestic to the international market; Increased risk premium. Of these, the two former are commonly regarded as more long-run and structural explanations outside the control of Norges Bank, while the risk premium and interest rate differential are more short-run effects that the central bank (potentially) can affect.

The speech was by some market observers taken as a warning that Norges Bank would put more weight on the exchange rate going forward. However, the financial markets did not factor in that the bank would increase the policy rate in December. Indeed, following falling interest rate expectations in the U.S., interest rate expectations also fell in Norway in the weeks prior to the December meeting.

Meeting 8: December 14

Norges Bank unexpectedly raised the interest rate by 0.25 percentage points to 4.5%, and forecast that the policy rate will lie around 4.5 percent until autumn 2024 before gradually moving down. The Committee’s assessment was that:

- “The krone has depreciated further. This will keep inflation elevated ahead despite an easing of international price impulses. Employment is high, and unemployment remains low...The Committee is concerned with balancing the risk of tightening too much against the risk of tightening too little. The economy is now cooling down, and the full effects of the past rate hikes have yet to be seen. On the other hand, inflation is high, and the krone depreciation makes it more challenging to bring down inflation. An increase in the policy rate now will reduce the risk of inflation remaining high for a long period of time.”

Norges Bank’s December rate hike was based on a risk assessment that the krone depreciation could keep inflation high for an extended period. Their inflation forecast indicated

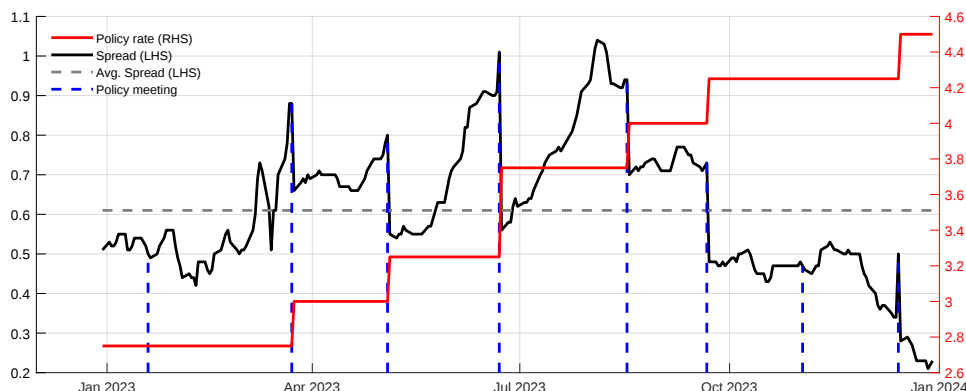


Figure 2. The graph reports the policy rate (Norges Bank Sight Deposit Folio Rate), the spread between the 3-month interbank rate (NIBOR) and the policy rate, and monetary policy meeting dates.

that even with the December report’s interest rate path, the inflation target would not be met within the forecast period. It is our understanding that the Committee feared that failing to raise rates would have risked significantly higher inflation throughout the period, potentially undermining confidence in the kroner and causing further depreciation. The consideration for the exchange rate led to the statement that if cost inflation remains high or the krone weakens more than expected, inflation could stay high longer, and the Committee is prepared to raise the policy rate again.

2.3 Summary and overall impression

During 2023 Norges Bank held 8 interest rate meetings, raising rates at 6 of them. Most rate changes were largely anticipated by the market, except for those in June and December, which caused significant market movements on the meeting days. As indicated in Figure 2, the market impact was greatest in December, with a 0.16 percentage point increase in the 3-month interbank rate. Overall, the central bank’s communication was primarily effective, with its decision-making pattern well understood by market participants. Statements from the Central Bank Governor at press conferences and articles contributed to a better understanding of the monetary policy decisions made.

One general observation from the narrative outlined above is that Norges Bank underestimated the resilience of the real economy and also the overall inflation pressure in 2023. A central variable in this context, as also reflected in Norges Bank’s communication, is the exchange rate. Despite increasing the policy rate by almost two percentage points during the year, Norges Bank was continuously surprised by how weak it remained. Another observation obtained from Norges Bank’s communication in 2023, and our meeting with the monetary Committee, is their acknowledgment of the risks and uncertainties associated with the economic situation and the policy choices.

2023 was not only an eventful year for monetary policy but also for technological



Figure 3. The graph reports the most relevant terms, according to ChatGPT, in terms of summarizing Norges Bank’s press releases following the 8 monetary policy meetings in 2023.

progress. To ensure the reader, and ourselves, that the summary above is not solely a subjective impression of events, we supplied ChatGPT with the press releases associated with each interest rate meeting in 2023 and asked it to extract the main issues and produce a short summary. Appendix B reports the answer we got and shows that there is a large degree of consistency between our and the machine generated summary. Figure 3 illustrates this and shows that the most relevant terms identified by ChatGPT are associated with the high inflation rate, economic activity, the weak krone and international conditions.

3 Comments and considerations

Below we comment in greater detail on the general impressions summarized in Section 2.3. Key to the discussion are domestic and international prices and interest rates, aggregate economic activity, and the krone exchange rate. In Section 3.1 we develop a simple empirical model fitted for this purpose. We then use the model for reassessing the economy’s recent history without our current knowledge, and thereby evaluate the adequacy of Norges Bank’s real-time beliefs and suggest potential learning points. As we discuss in Section 3.2, the modeling assumptions related to the exchange rate seem crucial. A relevant question in this context is whether Norges Bank has responded efficiently to new information stemming from abroad. We explore this in greater detail in Section 3.3. Finally, in Section 3.4 we discuss these issues in light of the risks and uncertainties highlighted in Norges Bank’s communication.

3.1 A benchmark view with priors for the long-run

The benchmark model we use is a reduced-form Vector Autoregression (VAR). The model can be written as

$$\mathbf{y}_t = \mathbf{c} + \beta_1 \mathbf{y}_{t-1} + \dots + \beta_p \mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t \quad \boldsymbol{\varepsilon}_t \sim i.i.d.N(0, \boldsymbol{\Sigma}_\varepsilon), \quad (1)$$

where $\mathbf{y}_t$ is a $(n \times 1)$ vector of endogenous variables which depend on a constant ($\mathbf{c}$), their own p lagged values via the autoregressive parameters β , and a vector of stochastic error terms $\boldsymbol{\varepsilon}_t$ with zero mean and covariance matrix $\boldsymbol{\Sigma}_\varepsilon$.

To cast light on recent developments, we include in the $\mathbf{y}_t$ vector Gross Domestic Product (GDP), Consumption (C), Wage costs (W), the Norwegian Kroner to U.S. Dollar Spot Exchange Rate (E), the Consumer Price Index (CPI), the 3-month Interbank Rate (R), the U.S. Consumer Price Index (CPI^*) and 3-month Interbank Rate (R^*).¹

The inclusion of the foreign variables allows us to capture international price and monetary policy impulses, but also enforce restrictions consistent with economic theory on the system. In particular, the inclusion of domestic and international interest rates allows the model to capture interest rate differentials and the uncovered interest rate parity (UIP) channel which has been central in Norges Bank's communication about the exchange rate. And, by including domestic and international price indexes we can enforce long-run restrictions consistent with the purchasing power parity (PPP) condition on the system. Likewise, the inclusion of wages and consumption together with GDP allows us to put restrictions on the long-run behavior of the labor share, which is central to the Norwegian wage settlement system, and the consumption-to-GDP ratio.

However, rather than dogmatically imposing the long-run restrictions alluded to above, we adopt the prior for the long-run approach developed by [Giannone et al. \(2019\)](#). They show that this Bayesian-based approach strikes a good balance between imposing long-run restrictions supported by economic theory, but that might be wrong, and the evidence provided by the data. We refer to [Giannone et al. \(2019\)](#) for a detailed description of the estimation procedure and full prior specification. For those somewhat more technically oriented we describe shortly in [Appendix A](#) the connection between this prior-based modeling strategy and the cointegration literature and so-called Vector Error Correction Models (VECM). Here we note that we via the prior assume that there are at least two trends in the system, one real and one nominal, that PPP holds in the long-run, and that there is a stationary relationship between C and GDP and W and GDP . Of course, when confronted with data, these prior views might, or might not, hold.

¹For simplicity, and given its important role in the global economy, we use U.S. data here. Because of the long-run priors adopted below, and chain linkages in the National Account Statistics, we use nominal values for GDP , C , and W in the model.

The model in (1) is estimated on a sample starting in the late 1990s and ending in 2021. We then use the model to make quarterly out-of-sample predictions for 2022 and 2023, where the 2-year predictive horizon allows the long-run equilibrium relationships to potentially play out. We allow for $p = 4$ lags and also estimate a version of (1) using the popular Minnesota prior (Litterman, 1986), i.e., imposing a dynamic shrinkage prior on the autoregressive parameters but no priors for the long-run.

Our primary interest are the predictions for the domestic variables produced by the system(s). These are reported in Figure 4 together with real-time predictions produced by Norges Bank (when a comparison is possible). Although the model is estimated in level form, for visual clarity and informativeness we transform the predictions as stated in the graph headings. Three main patterns emerge: First, as Norges Bank, the model predicts fairly precisely the growth in GDP (and C). However, wage growth has been somewhat stronger in the data than predicted by the model.² Second, the model misses completely the burst in inflation happening in 2022 and the high inflation levels in 2023, and so did Norges Bank. A result of this is that both Norges Bank and the model significantly underestimated the rise in interest rates during this period. Third, the model captures surprisingly well the strong depreciation of the exchange rate. In contrast, Norges Bank had a rather persistent belief about an exchange rate appreciation.

If we are willing to take the empirical model seriously, what can we learn from this? First, it seems fruitless to criticize Norges Bank for not being able to predict the surge in inflation. It was an unpredictable shock. Second, the fact that the realized interest rate was much higher than predicted by both the model and Norges Bank, but output and consumption growth turned out more or less as predicted, suggest a stronger than expected resilience of the real economy. Going forward, work and analysis casting light on the reasons for this should be valuable.³ Third, Norges Bank misses completely the exchange rate developments. The model predictions show that it would have been possible to do better. Given the focus on the exchange rate for inflation developments in 2023, we elaborate more on this below.

²The degree of precision is perhaps not at the level Norges Bank, nor the reader, would prefer, but potentially what one would have to expect in applied macroeconomics.

³Monetary Policy Report 4 (2023, pp. 49–52) contains a summary of a forthcoming Staff Memo, titled “The interest rate sensitivity of consumption and investment”, speaking to this issue. However, the analysis does not take into account that the sensitivity might be subject to changes across time, which might be an interesting extension.

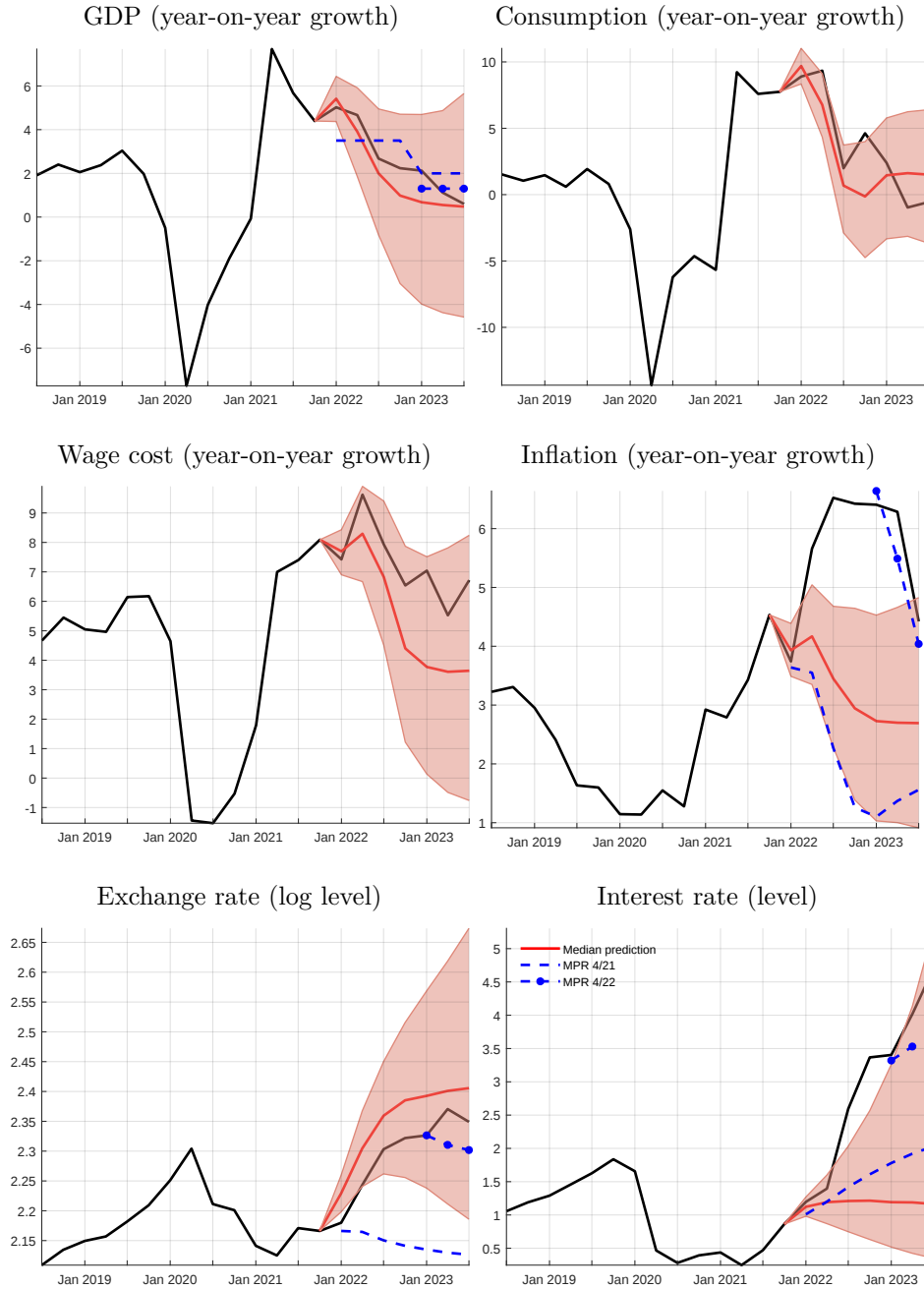


Figure 4. The graphs report the predicted and actual outcomes for the domestic variables in the model described by (1). The model is estimated using data up to 2021:Q4. The outcome variables enter the model in (log) levels but are transformed as described in each graph. Red solid lines are median model predictions. The shaded areas are 68% posterior probability bands. The black solid line reports the actual data and outcomes. The broken blue lines are the predictions from the Monetary Policy Reports published in 2021:Q4 and 2022:Q4, respectively. Note the following: The GDP and C predictions are transformed from nominal to real growth using the inflation predictions. For Norges Bank we have illustrated the yearly predictions for 2022 and 2023 as a whole; In the graph reporting the interest rate predictions we have added a 0.5 mark-up to Norges Bank’s policy rate predictions; Norges Bank provides predictions for the I44 exchange rate. In the graph we have normalized these predictions so that they reflect the (log) level of the exchange rate used here at the forecast origin.

3.2 Exchange rate redux

The exchange rate has been given special focus in at least one of the monetary policy reports in 2023, see [Monetary Policy Report 1 \(2023, pp. 24–26\)](#), and in Norges Bank’s yearly CME speech Governor Ida Wolden Bache gave a very informative overview of recent relevant research and Norges Bank’s exchange rate view ([Bache, 2023](#)). According to Norges Bank, but also standard macroeconomic theory, the exchange rate tends to appreciate if the interest rate differential increases, due to UIP, and will also tend to appreciate if the price level at home is lower than abroad, due to more long-run equilibrium adjustments and PPP.

To the extent that the UIP condition is empirically important, the relatively accurate model-based exchange rate trajectory in Figure 4 must be accompanied by a predicted weakening of the interest rate differential. As seen in the left graph in Figure 5, this happened in the data, but not in the model. In other words, seen through the lens of the model it is difficult to explain the strong exchange rate depreciation with UIP.

From Norges Bank’s perspective the departure from UIP is very often explained by changing risk premiums. Although we acknowledge that predicting these types of fluctuations is demanding, market analysts have for some time welcomed more analysis and communication of the underlying drivers of these changes (see, e.g., [Holvik \(2022\)](#)). Central questions have been about different types of political risks and changes in the Norwegian capital market due to changes in both regulations and investors willingness to take risks in the domestic market. As an example, in the aftermath of the events in March 2020, Norges Bank published an analysis pointing out that the (exchange rate) market had become more vulnerable because Norwegian institutional investors increasingly placed their savings abroad and the effects of currency hedge rebalancing motives.⁴ A related question is to what extent Norges Bank’s interest rate policy has an independent and additional effect on the risk premium (see, e.g., [Bjørnland \(2009\)](#) and the references therein). Again, definite answers and predictions would be unrealistic to obtain, but more frequent and up-to-date empirical estimates would have been perceived positively by market analysts.

Alternatively, more long-run developments might play a larger role for the exchange rate dynamics than what the typical risk premium explanation would suggest. Indeed, when we estimate the model in (1) without imposing any long-run priors, the predicted

⁴The petroleum tax payments in October 2022 created another example affecting money market rates. As concluded in [Huse et al. \(2023\)](#): “Regulatory requirements and internal guidelines relating to liquidity and capital adequacy limited the amount banks could borrow from Norges Bank and constituted an important factor behind the rise in money market rates.” A working group, led by the Ministry of Finance, is now examining how a liquidity squeeze of this type potentially could be avoided going forward. We are looking forward to their report.

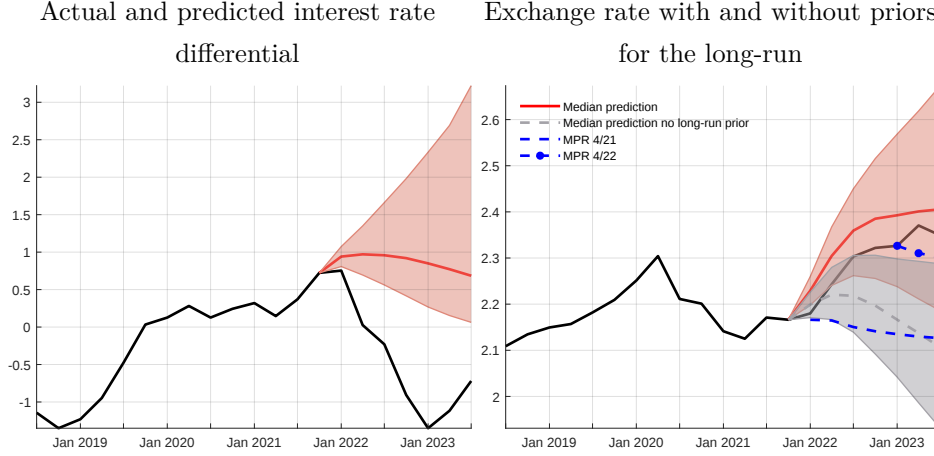


Figure 5. The left graph reports $r_t - r_t^*$ as in the data and in the predictions from the model in 1. The right graph reports the model-based exchange rate predictions (same as in Figure 4) and similar predictions constructed from a model estimated without imposing the long-run priors. The shaded areas are 68% posterior probability bands. The black solid line reports the actual data and outcomes.

exchange rate becomes much more aligned with Norges Bank's view.⁵ This is illustrated in the right graph in Figure 5, and suggest that more medium- to long-run dynamics, including PPP, play an important role for understanding the exchange rate during this period.⁶ The recent focus on the Norwegian wage settlement system is also relevant in this context. I.e., when faced with large international shocks a weak exchange rate might be beneficial in the short-run, but a persistently weak exchange rate might fuel a wage and price spiral with potentially adverse long-run effects on the real economy. Thus, the expected medium- to long-run dynamics put relatively clear restrictions on the nexus between monetary policy and the exchange rate.

While we refrain from drawing too strong conclusions from this simple and somewhat preliminary analysis, we would argue that Norges Bank could have done more to better understand (and communicate) the exchange rate dynamics prior to and during 2023. The exchange rate channel is particularly strong in Norway as a small open economy with coordinated wage setting and a large Government Pension Fund which increases in

⁵For this model the predictions for the other variables in the system are not reported, but they are not materially different from those reported in Figure 4. The observant reader might be surprised that the benchmark model predicts a strong exchange rate depreciation, in line with the actual outcomes, but underestimate the level of domestic inflation. However, the model also heavily underestimates the inflation level abroad. Thus, the inflation difference observed in the data is relatively consistent with what the model predicts.

⁶In relation to this, the earlier work by Akram (2006) is interesting. He finds that the Norwegian exchange rate appears remarkably consistent with the PPP theory and that the convergence towards PPP is relatively rapid; the half-life of a deviation from parity is just about 1.5 years. However, the study is based on data from the mid 2000s and earlier, which might not be representative anymore.

value when the currency depreciates. The risk of how a weak exchange rate influences the wage and inflation dynamics in the Norwegian economy is well described by Øistein Røisland, Director in Norges Bank, in two theoretical articles in *Samfunnøkonomen* (Røisland, 2023b,a), and also alluded to in Bache (2023). Against this background we would have welcomed more quantitative analysis on how different short- and long-run assumptions about the exchange rate developments would have affected the interest rate path, growth, and inflation.

In particular, simple alternative scenarios could have helped making policy more robust. For example, in *Monetary Policy Report 1* (2023, pp. 24–26) Norges Bank describes how they somewhat subjectively have revised down the equilibrium real exchange rate, but does not report or discuss how their main policy projections might differ for alternative assumptions regarding this highly uncertain concept. As highlighted by the Central Bank Governor herself in Bache (2023), key developments to understand in this context are productivity growth and the shifts in saving patterns from domestic to international markets. We return to this point when discussing uncertainty and risk in Section 3.4.

3.3 International shocks and domestic responses

One interpretation of the narrative outlined in Section 2 and the analysis in Sections 3.1 and 3.2 is that Norges Bank in 2023 put too little weight on the risks associated with a weak exchange rate and potentially too much weight on avoiding adverse growth outcomes. Consistent with such an interpretation we see from Figure 1 that while Norges Bank for many years had a higher interest rate than many of our trading partners, they allowed it to become lower during 2023. This motivates questioning whether Norges Bank responds timely to changes in international business cycles and foreign shocks?

A large number of so-called reduced-form studies have documented how global developments play a large role in explaining business cycles and inflation dynamics in small and open economies (Kose et al. (2003), Ciccarelli and Mojon (2010), Mumtaz et al. (2011)). At the same time it is well known in the academic literature that standard Dynamic Stochastic General Equilibrium models (DSGE), which Norges Bank’s policy model (NEMO) is an example of, struggle to match this evidence.⁷

The work by Bjørnland et al. (2020), henceforth BTZ, is motivated by this fact, and hypothesize that the discrepancy matters for how monetary policy is conducted, and ultimately for how central banks make revisions to their interest rate paths, i.e., their announced policy intentions. Indeed, BTZ document that revisions, and forecast errors,

⁷See Justiniano and Preston (2010) and the references therein for the DSGE related literature. Recent advances in the theoretical business cycle literature have tried to bridge the gap between the empirical findings and theory, with Bergholt and Sveen (2014) being one example among others.

in the interest rate paths published by Norges Bank (and the Riksbank and the Reserve Bank of New Zealand) can be predicted by timely and forward-looking international indicators. Domestic variables, on the other hand, are less informative in this respect.

Now, the data used in BTZ ends in 2017. Below we update part of the analysis using data until 2023. In particular, we investigate to what extent revisions in the interest rate paths published by Norges Bank can be predicted with data capturing global developments known at the forecast origin. However, whereas BTZ consider a large set of international indicators and factors, we only consider the price of oil. This is one of the significant global indicators in BTZ, but also a particularly relevant variable for Norway in general and for understanding the latest international inflation developments (and interest rate responses) in particular.

Let $f_{2|I_{t-1}}$ be the two-step ahead forecast of the policy rate given information at time $t - 1$, and let $f_{1|I_t}$ be the one-step ahead (counterpart) forecast made one quarter later and given information up to time t .⁸ The forecast revisions between these two series (the one-step ahead and the two-step ahead forecast series) can then be found as: $r_{12,t} \equiv f_{1|I_t} - f_{2|I_{t-1}}$, or more generally:

$$r_{ij,t} \equiv f_{i|I_t} - f_{j|I_{t-1}} \text{ where } i = j - 1 \text{ and } j \in \{2, 3, 4\} \quad (2)$$

i.e., we consider revisions between two and one, three and two, and four and three quarter ahead predictions.

With interest rate path revisions defined by (2), the simple regression model we consider can be written as:

$$r_{ij,t} = \alpha_{ij} + \gamma_{ij}r_{ij,t-1} + \beta_{ij}\Delta_{12}oil_{t-1} + \varepsilon_{ij,t} \quad (3)$$

where $\Delta_{12}oil_{t-1}$ is the year-on-year change in the monthly nominal oil price. It is mapped to the quarterly structure of $r_{ij,t}$ using the monthly cut-off dates published within the monetary policy reports. I.e., we only include information which was available to the central bank when constructing $f_{j|I_{t-1}}$.

The parameter of interest in (3) is β_{ij} . A significant estimate suggests that the central bank values this information, because their interest rate path revisions are dependent upon it, but also that they do not fully incorporate the information it contains when making their initial policy decisions.

The left graph in Figure 6 reports the t-statistic associated with β_{ij} when (3) is recursively estimated with an expanding estimation window. The right graph reports the

⁸Here, for simplicity, we assume that forecasts are produced at regular intervals four times per year. In practice the frequency of publications varies. See the Appendix in BTZ for a detailed description of how the data is compiled.

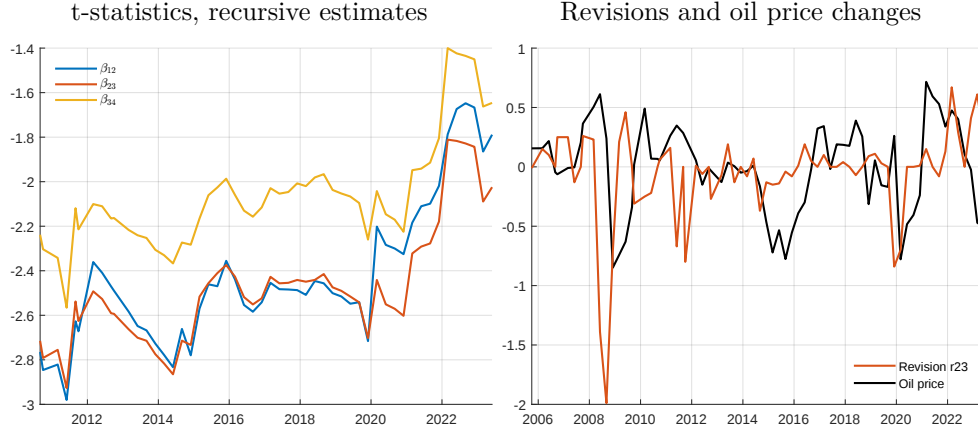


Figure 6. The left graph reports the t-statistic for $\hat{\beta}$ in (3) when the equation is estimated using the three different revisions ($r_{ij,t}$) as dependent variables and when recursively increasing the estimation sample with one more observation at each iteration. The first estimation sample contains data for the period 2005:Q4 to 2010:Q4. The last estimation sample contains data up to 2023:Q4. The right graph reports the year-on-year change in the price of oil and the $r_{23,t}$ revision time series. The oil price series reflects its value at the forecast origin at each time point. E.g., when the oil price change was strongly positive in the summer and early autumn of 2008, the subsequent monetary policy path revisions in early 2009 were large.

$\Delta_{12}oil$ variable together with the r_{23} revision. The figure provides potentially both good and bad news. The potentially bad news is that for most part the results are in line with those reported in BTZ, where $\hat{\beta}$ is significant irrespective of which revision pair we look at. The potentially good news is that there is an upward trend in the t-statistics suggesting that the oil price variable plays a less significant role in (3) today than it did, e.g., 5 years ago. Still, the drop in significance is clearly associated with the period following the Covid-19 pandemic, and towards the very end of the sample we observe signs of a reversal. The overall conclusion is therefore very much aligned with that in BTZ.

Predictable forecast errors and revisions are a clear violation of conventional economic theory. Still, we use the wording “potentially” in the paragraph above because the predictability of forecast revisions using foreign variables could be a result of, e.g., (rational) strategical considerations (Walsh (2007) and Van der Cruysen et al. (2010)), an explicit desire for forecast smoothing (Mirkov and Natvik (2016)), or noisy economic signals, like in theories considering information rigidities (Sims (2003), Mankiw and Reis (2002), Coibion and Gorodnichenko (2015)). However, we find it puzzling that these explanations apply to international developments, and not also domestic ones. I.e., as shown in BTZ, the predictability holds foremost for international data and not domestic variables. Moreover, as documented in BTZ, following a monetary policy surprise associated with the predictable part of the forecast errors, output, inflation, and asset prices all increase. Thus, the predictable component of the monetary innovation leads to a positive co-movement

between the interest rate and both the macro economy and financial markets.⁹ In the context of the upward revisions in the interest rate during 2023, and to the extent that these revisions were predictable in 2023, we find it questionable that Norges Bank aimed for this type of response pattern.

As such, although we know that Norges Bank has taken actions over the last decade to better incorporate the effect of international developments into their modeling strategies, it is tempting to ask whether the policy response by Norges Bank the last years has been timely or whether it has been somewhat lagging and thereby creating some type of pro-cyclicality? A good answer to this question requires more analysis, and a normative recommendation on how the central bank should have responded requires a more structural analysis. However, if we simulate forward the model used in Section 3.1 under the assumption that all variables in the model, except the domestic interest rate, are known up until the end of the sample, we obtain the counterfactual interest rate reported in Figure 7. As seen in the figure, the dynamic correlations implied by the data suggest that the push for higher interest rates should have started and potentially peaked earlier. E.g., in early 2023 the difference between the counterfactual interest rate and the actual interest rate is roughly one percentage point.¹⁰ Interestingly, the alternative interest rate paths produced using simple rules, published by Norges Bank in every Monetary Policy Report in 2023, suggest a qualitatively similar picture. In Figure 7 this is illustrated using the simple rule estimates published by Norges Bank in [Monetary Policy Report 1 \(2023\)](#).

3.4 Uncertainty and risk

Macroeconomic analysis is difficult and riddled by a large degree of uncertainty. At the most general level there are uncertainties about the fundamental laws of economics and at the more specific level there is uncertainty about the effectiveness of monetary policy. On top of this we are very often uncertain about the current state of the economy because we lack (high frequency) data or the available data is subject to substantial subsequent revisions.

Norges Bank recognizes the substantial uncertainty in its analysis and projections. Up until the Covid-19 pandemic Norges Bank also included quantitative descriptions of the uncertainty related to growth, inflation, and interest rate projections in their Monetary

⁹This type of response pattern has been coined the information component of monetary policy, see, e.g., [Jarocinski and Karadi \(2020\)](#), and stands in stark contrast to conventional monetary policy shocks.

¹⁰Considering the significant uncertainty inherent in this analysis, one should not overemphasize these differences. Moreover, this analysis does not speak directly to the issue discussed above. The reason for this is that the interest rate discrepancies reported in Figure 7 are due to departures from historical correlation patterns whereas a (normative) analysis of more timely policy response patterns would require a theoretical model because such response patterns are not observed in the data.

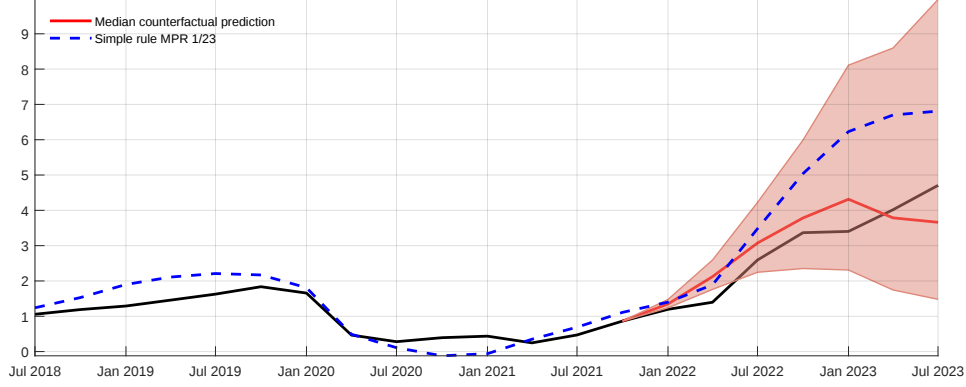


Figure 7. Counterfactual interest rate. The black solid line reports the actual data and outcomes. The red solid line is the median prediction, and is obtained by simulating the model described in (1) forward, starting from 2021:Q4, under the assumption that the domestic interest rate is unknown but that all other variables entering the model are known up until the end of the sample. The shaded area is 68% posterior probability bands. The blue broken line is the simple rule estimate published in [Monetary Policy Report 1 \(2023\)](#).

Policy Reports. For understandable reasons, this became difficult during the pandemic, when extreme observations likely led to modeling challenges. We know there are discussions within Norges Bank to bring these considerations back into the monetary policy communication, and strongly support these efforts.

In relation to this, recent time series research provides compelling evidence that variables like output and inflation have conditional distributions characterized by fat tails and skewness, with correlation patterns that fluctuate throughout the business cycle ([Delle Monache et al., 2021](#); [Lopez-Salido and Loria, 2022](#); [Carriero et al., 2023](#); [Fernández-Villaverde and Guerrón-Quintana, 2020](#)). Figure 8 provides an example in the case of inflation forecasting. Here we have followed work by [Delle Monache et al. \(2021\)](#) and [Labonne \(2022\)](#) and fitted a parametric Skew- t distribution with time-varying location, scale, and shape parameters. This type of model is often used in the recent forecasting literature, and can be written as

$$\pi_t = \mu_t + v_t, \quad v_t \sim Skt(0, \sigma_t, \alpha_t, \nu), \quad (4)$$

where π_t is inflation and the t subscripts associated with μ_t , σ_t , and α_t illustrate that the location of the distribution, as well as its variance and skewness, can change over time. For the particular example used here, we have further allowed the oil price variable used in Section 3.3 to affect these time-varying moments.¹¹

As seen in Figure 8, when entering 2023 the conditional distribution of inflation is far from normally distributed, and there is substantially more probability mass below

¹¹For a more detailed description, and technical details, we refer to [Delle Monache et al. \(2021\)](#) and [Labonne \(2022\)](#) and the references therein. We thank Paul Labonne for producing the results reported in Figure 8.

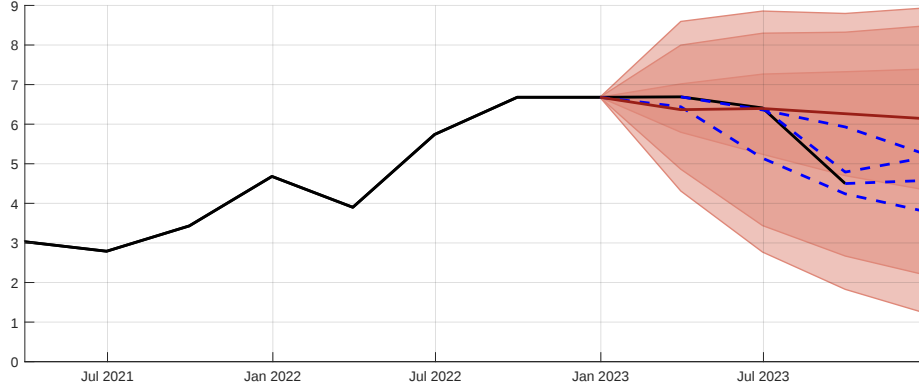


Figure 8. Quarterly inflation predictions and uncertainty. The Skew-t model described in (4) is estimated using data up to the end of 2022. The shaded areas illustrate the 99%, 95%, and 68% confidence intervals together with the median prediction. The black solid line reports actual (headline) inflation developments (ending here in 2023:Q3). The broken blue lines report the official Norges Bank inflation forecasts for 2023, sampled from each of the four monetary reports this year.

the median prediction than above it. Thus, the inflation predictions from this particular model are skewed towards lower values. Alternative model specifications might of course change this picture. The important point here is that the degree of skewness might change considerably over the business cycle, and models and graphs like this provides the forecast user with a much more meaningful description of risks than more normal predictive densities would (Adrian et al., 2019).

Indeed, Norges Bank has already taken some of the steps alluded to above into account. Building on [Bowe et al. \(2023\)](#), both [Monetary Policy Report 3 \(2023, pp. 41–42\)](#) and [Monetary Policy Report 4 \(2023, pp. 40–42\)](#) contain a valuable discussion and quantification of the time-varying risk and uncertainty surrounding the inflation, house-price inflation, and growth projections. We credit these efforts, and advice that they are used and developed even further to highlight and discuss the potential up- and down-side risks associated with the main policy predictions.¹²

We would also advise Norges Bank to more actively use these types of non-Gaussian predictive distributions for alternative policy evaluations. The discussion in [Section 3.2](#) provides an example where the main policy projections are made conditional on an assumption regarding the equilibrium real exchange rate. However, an important question is how these policy projections would differ if one assumed a very different value for this highly uncertain parameter? Evaluating alternative scenarios and assumptions in the

¹²Our understanding is that the density predictions produced in [Bowe et al. \(2023\)](#) are centered so that the point forecast predictions are similar to those from Norges Bank’s SMART system. To the extent that the bank has preferences for reporting only one set of point forecast trajectories, a similar type of centering could be done between the non-Gaussian density predictions and the projections produced by main policy model NEMO. Alternatively, different types of tilting and soft conditioning algorithms can relatively easily be applied (see, e.g., [Waggoner and Zha \(1999\)](#) and [Robertson et al. \(2005\)](#)).

context of uncertainty and risk projections would help address this question and also cast light on the bank’s underlying preferences. E.g., if there is significant up-side risks to future inflation, and a relatively small change in the long-run real exchange rate equilibrium assumption leads to significantly higher inflation in the bank’s models, a choice not to increase the interest rate could be rationalized if there are also significant down-side risks to future growth.¹³

To some extent this comment mirrors previous suggestions from NBW reports advocating for the publication of board meeting minutes to illuminate how diverse perspectives influence policy decisions. Thus far, Norges Bank has refrained from releasing the minutes. One could argue that disclosing internal debates could hinder decision-making efficiency and clarity in communication. Nonetheless, a more nuanced approach that examines the impact of varying assumptions on policy scenarios within a framework of uncertainty and risk could offer insights into differing viewpoints without encountering the aforementioned drawbacks.

At a more general level, we advocate for allocating more space in the Monetary Policy Reports to exploring alternative assumptions and risk modeling. Given that access to data is broadly similar for all, Norges Bank’s unique insights into its economic understanding and model choices represent a significant informational advantage that could be communicated better. This is particularly crucial now, as we navigate a period marked by shifting long-term trends, associated with, e.g., demographics, climate change, the energy transition, or globalization patterns. In the Norwegian context, the structural transition associated with traditional Dutch disease dynamics and productivity trends is perhaps especially relevant (see, e.g., [Bjørnland et al. \(2019\)](#)). In such an environment it seems to us as particularly important to assess the robustness of the policy choices to alternative medium- to long-run assumptions. Not because we necessarily believe that monetary policy is non-neutral in the long-run, but because recent research has highlighted that monetary policy affects how, and how fast, the economy approaches a potentially new long-run equilibrium (see, e.g., [Bergholt et al. \(2023\)](#) and the references therein).

¹³Indeed, the historical uncertainty estimates presented in [Monetary Policy Report 4 \(2023, pp. 40–42\)](#) suggest that there has been some degree of up-side risk to inflation throughout 2022 and 2023. However, the same estimates for GDP growth have been fairly balanced, questioning the existence of any specific down-side risks to future growth.

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Appendices

Appendix A Priors for the long run

To describe our prior view in more technical terms, it is useful to re-write the model in (1) from level to difference form

$$\Delta \mathbf{y}_t = \mathbf{c} + \mathbf{\Pi} \mathbf{y}_{t-1} + \mathbf{\Gamma}_1 \Delta \mathbf{y}_{t-1} \dots + \mathbf{\Gamma}_{p-1} \mathbf{y}_{t-p+1} + \boldsymbol{\varepsilon}_t \quad (5)$$

where $\mathbf{\Pi} = (\boldsymbol{\beta}_1, \dots, \boldsymbol{\beta}_p) - I_n$ and $\mathbf{\Gamma}_j = -(\boldsymbol{\beta}_{j+1} + \dots + \boldsymbol{\beta}_p)$ with $j = 1, \dots, p-1$. Readers familiar with the cointegration literature will now recognize (5) as a so-called Vector Error Correction Model (VECM), where the parameter matrix $\mathbf{\Pi}$ plays a crucial role in terms of determining the long-run behavior of the system.

Now, define $\mathbf{\Lambda} = \mathbf{\Pi} \mathbf{H}^{-1}$ and $\tilde{\mathbf{y}}_{t-1} = \mathbf{H} \mathbf{y}_{t-1}$ and write (5) as

$$\Delta \mathbf{y}_t = \mathbf{c} + \mathbf{\Lambda} \tilde{\mathbf{y}}_{t-1} + \mathbf{\Gamma}_1 \Delta \mathbf{y}_{t-1} \dots + \mathbf{\Gamma}_{p-1} \mathbf{y}_{t-p+1} + \boldsymbol{\varepsilon}_t \quad (6)$$

Accordingly, in this transformed model, the problem of setting up a prior on $\mathbf{\Pi}$ corresponds to choosing a prior for $\mathbf{\Lambda}$, conditional on the selection of a specific matrix $\mathbf{H}$.

We refer to [Giannone et al. \(2019\)](#) for a detailed description of the estimation procedure and full prior specification, but describe here our choice of the important $\mathbf{H}$ parameter matrix. In particular, in line with the description in Section 3.1, we define:

$$\tilde{\mathbf{y}}_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} CPI_t^* \\ GDP_t \\ C_t \\ W_t \\ E_t \\ CPI_t \\ R_t \\ R_t^* \end{bmatrix} \begin{matrix} \text{International price} \\ \text{Real trend} \\ \text{Consumption/GDP ratio} \\ \text{Labor share} \\ \text{PPP} \\ \text{Domestic prices} \\ \text{Nominal trend} \\ \text{International interest rate} \end{matrix} \quad (7)$$

I.e., via the prior we assume that there are at least two trends in the system, one real and one nominal, that PPP holds in the long-run, and that there is a stationary relationship between consumption and GDP and wages and GDP. Of course, when confronted with data, these prior views might, or might not, hold.

Appendix B ChatGPT summary of press releases

We supplied ChatGPT with the press releases associated with each interest rate meeting in 2023 and asked it “... please summarize, in one short paragraph, the main focus points

across all documents, and, in addition, the main issues identified by Norges Bank?” The answer we got was: “The press releases from Norges Bank throughout 2023 detail a series of policy rate adjustments in response to inflation rates significantly above their target. The main focus points include the central bank’s efforts to manage inflation through rate hikes, with the policy rate ultimately raised to 4.5 percent by year-end. The documents highlight a tight labor market and high economic activity as persistent issues, alongside concerns about high wage growth, a depreciating krone, and the impact of international economic conditions. Norges Bank identifies persistently high inflation as a substantial societal cost, emphasizing a cautious balance between tightening monetary policy to control inflation and monitoring economic slowdown risks. The bank indicates readiness to adjust the policy rate further based on economic developments, inflation trends, and the krone’s performance.”