Norges Bank Watch 2025
An independent evaluation of monetary policy in Norway in 2024

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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 Tore Grobæk Vamraak, Chief economist at Sparebanken Sør, and Leif Anders Thorsrud, Professor at BI Norwegian Business School and Centre for Applied Macroeconomics and Commodity Prices (CAMP).

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 25, 2025
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 in 2024. 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 the new monetary policy strategy document published in May 2024. We also had meetings with Norges Bank on November 19 and the Ministry of Finance on November 25, 2024.

In 2024 the extraordinary price pressure that had been affecting global economies since late 2021 started to vain off. Still, 2024 continued to be a year associated with international turbulence and a high degree of economic uncertainty. The NBW committee acknowledges the challenges of making decisions under such 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 2024.

This report is divided into two main parts. In Section 2 we provide a summary of monetary policy in 2024, focusing on the actual interest rate decisions, their rationale, and market reactions. The main picture is that the central bank's communication was primarily effective, with its decision-making pattern well understood by market participants. However, as also emphasized in Norges Bank Watch (2024), the role played by international spillovers, the exchange rate and inflation nexus, and the degree of policy synchronization continued to be focus points for monetary policy also in 2024. New for this year is an updated monetary policy strategy document, highlighting how Norges Bank is weighting inflation pressure relative to the real-economy when setting the interest rate.

In Section 3 we build on this summary and evaluate the conduct of monetary policy in 2024. To avoid information leakage in our evaluation, i.e., using more information than Norges Bank had when conducting their operations in real-time, we use a simple empirical model to identify potential misjudgments by the bank. The output of this analysis suggests that Norges Bank's inflation beliefs were persistently too high throughout much of 2024, but could have been more accurate. In light of this we discuss how appropriate the interest rate level has been by taking into account risk considerations, the role of international shocks and spillovers, and finally, how the bank balances the trade-off between dampening high inflation pressure without hurting the real economy too much.

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

a) Norges Bank's own risk estimates have for a long time indicated a substantial up-side risk for inflation and, if anything, very little down-side risk for the growth outlook. Thus, although Norges Bank's inflation expectations have been too high, in isolation implying that the interest could have been lower, risk management arguments can

be used to support the chosen policy. In line with this, and as also argued in Norges Bank Watch (2024), we welcome more formal risk and scenario analysis of how alternative assumption might affect the main policy projections.

b) In terms of balancing the inflation and growth trade-offs we have no particular comments related to Norges Bank's new monetary policy strategy document per se. However, we emphasize the importance of tracking not only the intended trade-off implied by the bank's policy, as done in the Monetary Policy Reports in 2024, but also the realized trade-offs. Systematic discrepancies between intended and realized trade-offs could be a sign of systematic policy mistakes. As it turns out we find very little evidence for this type of policy mistakes. What we do find, however, is evidence consistent with Norges Bank putting a historically high weight on the output gap (and employment conditions) when setting the interest rate in 2024. This result is difficult to square with arguments favoring a more dovish policy.

c) In contrast, counterfactual estimates suggest that a slightly higher interest rate level going into the year would have been "optimal" and that the process of lowering the interest rate could have started already in the middle of 2024. Although this argument does not incorporate risk considerations, it is consistent with earlier research documenting that revisions to the interest rate path published by Norges Bank is partly predictable with foreign indicators. Indeed, our updated estimates suggest that Norges Bank has improved in terms of how they incorporate international developments into their analysis, but both interest rate path revisions and inflation forecast revisions are still predictable by international indicators. In other words, it seems that Norges Bank responds to foreign shocks with a delay.

In sum, although counterfactual estimates suggest that a more dovish monetary policy could have been followed in 2024, we find that risk considerations and the bank's strategic view on the inflation-growth trade-off imply that Norges Bank in 2024 applied sound judgment and an appropriate interest rate policy. Still, we would recommend that the bank continues its efforts incorporating more formal risk and scenario evaluations into its monetary policy communication, including the role played by international spillovers.

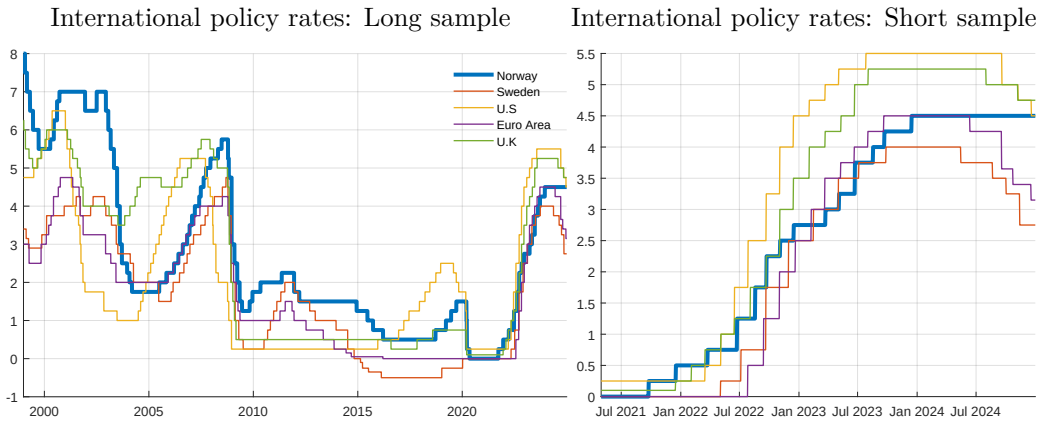

Figure 1. The graph reports the Federal Reserve Target Rate (U.S), Norges Bank Sight Deposit Folio Rate (Norway), ECB Main Refinancing Operations Rate (Euro Area), Bank of England Policy Rate (U.K.) and the Central Bank of Sweden Policy Rate (Sweden).

2 Monetary policy in 2024

Below we first shortly present the general monetary conditions as they were at the onset of 2024. We then describe in greater detail market developments and the conduct of monetary policy during 2024.

2.1 The starting point

Following a period of zero interest rate during the Covid-19 pandemic in 2022 and 2023, the Norwegian policy rate had its steepest and highest increase in 25 years. Two years of restrictions, temporary lock-downs and generous support from the government had resulted in strong demand, stronger than the supply side's capacity. The inflation rose far above the 2% inflation target and the Central Bank needed to increase the policy rate massively.

The situation in Norway was not at all unique – all the comparable economies were in the same situation coming out of the pandemic, and central banks all over the world increased the policy rates during 2022 and 2023, see Figure 1.

The Norwegian krone went through a substantial weakening in 2022 (12%) and turbulence in 2023 (with further 3% weakening per Dec 31st), compared to the US dollar. The weakened currency contributed substantially to the high inflation level in the Norwegian economy these years.

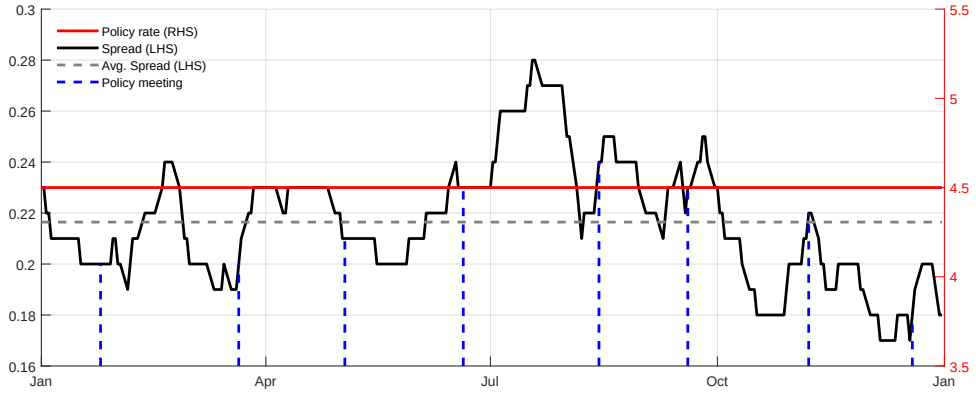

Figure 2. The graph reports the policy rate during 2024 (Norges Bank Sight Deposit Folio Rate), the spread between the 3-month interbank rate (NIBOR) and the policy rate, and monetary policy meeting dates.

2.2 Development and execution

Throughout the eight monetary policy meetings in Norges Bank during 2024, the policy rate was kept unchanged at 4.5 percent. As we can see from Figure 2, the market was not surprised by any of the eight announcements. Expectations moved slightly between the policy meetings, but reverted back for each announcement. Towards the end of 2024, the market came to a stronger belief in an upcoming policy rate cut. The announcement in December supported that, as the Central Bank was very clear that "the Policy rate will most likely be reduced in March 2025".

As Figure 1 shows, most of Norway's trading partners have cut their policy rates substantially during 2024. Norway has been the outlier, keeping the policy rate unchanged throughout 2024. Norges Bank has connected the weak krone towards USD to the policy rate difference between the two countries.[1] During the fall of 2024, as the Federal Reserve reduced their policy rate by 1 percentage point, the krone did not at all strengthen, it rather weakened substantially as shown in Figure 3a.

The Norwegian krone has continued weakening towards USD by almost 12% throughout 2024, totaling 29% since the end of 2021. The Norwegian krone has never ever throughout history been weaker towards the U.S. dollar, except for three days during the start of the Covid-19 pandemic in 2020, when the exchange rate briefly hit the same level as at the end of 2024 (Figure 3b).

In May 2024, Norges Bank announced the updated Monetary policy strategy. The new strategy was a small adjustment from the previous strategy from 2021. The most prominent change was the underlining of that considerable weight shall be given to em-

[1] See, e.g., the Governor's CME speech on monetary policy and the krone exchange rate, at BI Norwegian Business School 9th November 2023 (https://www.norges-bank.no/en/news-events/news-publications/Speeches/2023/09-11-2023-cme/).

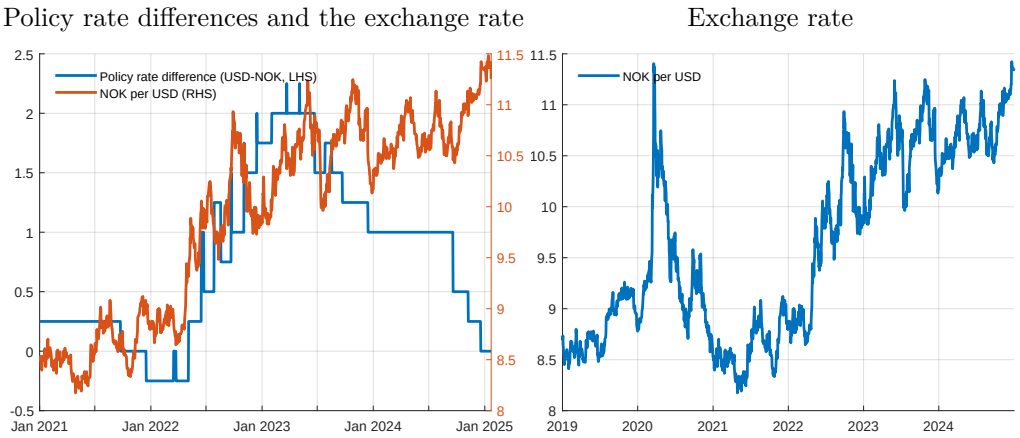

Figure 3. Figure 3a reports the policy rate difference and exchange rate between U.S. dollar and Norwegian krone. Figure 3b reports the exchange rate between U.S. dollar and Norwegian krone for a longer time span.

ployment – also at times when inflation deviates significantly from the target. This can be seen as a direct response to the Labour Organization (LO), which has advocated for lower interest rates to counter what they have seen as too high unemployment (2.1%).[2]

Norges Bank has consistently during 2024 stated that "unemployment will likely edge up" (March 2024) and then "unemployment has edged up from a low level" (September, November, and December 2024). The unemployment has however stayed at a remarkably stable and low level during all of 2024, with variations between 1.9% and 2.1% unemployment rate (Figure 4). Also in absolute numbers, the number of unemployed in the working population has had small variations between 55 400 and 62 900. Both the level and the variation within one single year have historically very seldom been lower than what we observed in 2024.

In August 2024, the Liberal party announced the idea of establishing a "krone commission" to find out why the krone had weakened so much, and to assess alternative monetary policies including pegging towards the euro. The party leader of the Conservative party supported the idea briefly afterwards. At the press conference after the monetary policy meeting the same month, the Governor elaborated on the negative effects of establishing such a commission, underlining that if such a commission were to be established, it would be crucial that its mandate would be clear and well-defined. She added that it would not be beneficial if uncertainty arose about the objectives of the monetary policy. That put the discussion to an immediate rest.

[2] https://www.lo.no/hva-vi-mener/okonomi-og-samfunn/nyheter-om-samfunn-og-okonomi/derfor-mener-lo-norges-banks-rentepolitikk-er-feil/

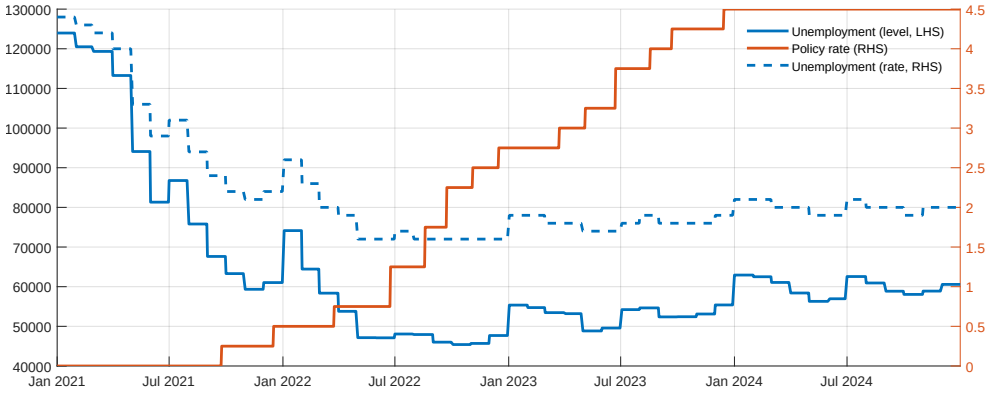

Figure 4. Unemployment (registered, males and females, from NAV) and the policy rate (Norges Bank Sight Deposit Folio Rate).

2.3 Summary and overall impression

During 2024, Norges Bank held 8 monetary policy meetings, and kept the policy rate unchanged at 4.5%. Through its communication, the central bank has avoided surprising the market.

Although most other central bank, including the U.S. Federal Reserve, have reduced their policy rates, the Norwegian krone has continued weakening to a record-low level towards the U.S. dollar, totaling 29% since the end of 2021.

Norges Bank has updated their Monetary policy strategy, underlining that considerable weight shall be given to employment. This is consistent with the low and stable unemployment rate we observed in 2024.

3 Comments and considerations

In Norges Bank Watch (2024), which evaluated the conduct of monetary policy in 2023, a simple empirical model was used for reassessing the economy's recent history without our current knowledge (at the time), and thereby evaluate the adequacy of Norges Bank's real-time beliefs and suggest potential learning points. As it is very easy to be wise after the event, we continue this practice in this year's report, and use the same model for consistency and because the role played by international spillovers, inflation and the exchange rate continued to be among the focus points also in 2024.

The benchmark model used is a Vector Autoregression (VAR)

$$\boldsymbol{y}_t = \boldsymbol{c} + \boldsymbol{\beta}_1 \boldsymbol{y}_{t-1} + \ldots + \boldsymbol{\beta}_p \boldsymbol{y}_{t-p} + \boldsymbol{\varepsilon}_t \quad \boldsymbol{\varepsilon}_t \sim i.i.d.N(0, \boldsymbol{\Sigma}_{\boldsymbol{\varepsilon}}), \tag{1}$$

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

To speak to recent events, as discussed in Section 2, we include in the $\boldsymbol{y}_t$ 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^*).[3] Using these variables also allows us to enforce restrictions consistent with economic theory on the system, related to, e.g., the long-run behavior of the exchange rate which turned out to be of particular importance in Norges Bank Watch (2024). In the interest of preserving space, we refer to Appendix A for more information about how we enforce the economic restriction on (1), the exact model specification, and estimation.

Our primary interest are the predictions for the domestic variables produced by the system. These are reported for four key variables in Figure 5 together with real-time predictions produced by Norges Bank. Three main patterns emerge: First, both the GDP growth and interest rate predictions produced by Norges Bank are relatively well aligned with actual outcomes. The model-based predictions are also relatively accurate for these variables - although somewhat on the up-side. Second, whereas Norges Bank Watch (2024) documented how Norges Bank's exchange rate view was too optimistic relative to the model and outcomes in 2023, we now observe that both the model and Norges Bank predictions are reasonably well aligned with actual events. Third, at the end of 2022 the model-based predictions and Norges Bank's beliefs about future inflation developments were very accurate. One year later, however, Norges Bank's assumptions about the future price pressure was too high. As we discuss more in Section 3.2, this bias largely continued also in later monetary policy reports.

Using the discrepancy between outcomes, model-based predictions and Norges Bank's beliefs as a metric for evaluating to what extent Norges Bank could have applied better judgment during 2024, their inflation beliefs, which were too high, stand out. In turn, this might have resulted in a higher interest rate (path) throughout 2024 than it otherwise would have if Norges Bank's inflation beliefs had been more in line with actual outcomes.

Below we analyze the source and potential rational for Norges Bank's inflation view and its potential consequences for the interest rate setting. Although many different dimensions could have been addressed, we focus on three we find particularly relevant; risk considerations, the international dimension of economic shocks, and the updated monetary policy strategy.

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

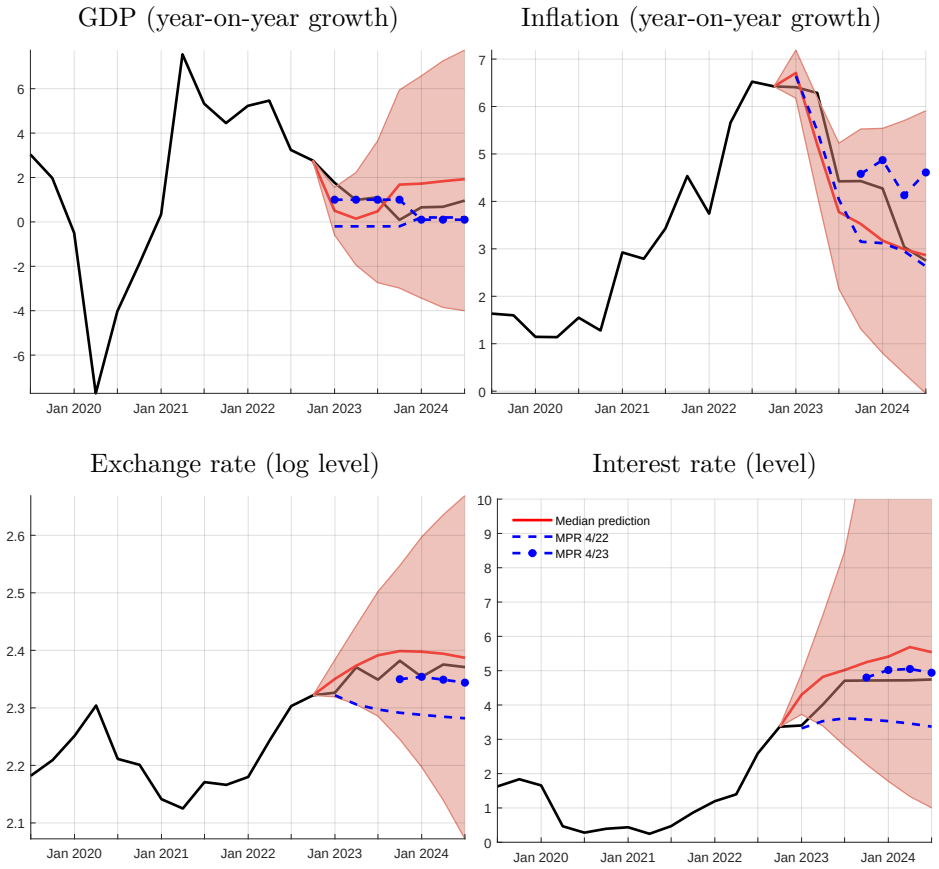

Figure 5. The graphs report the predicted and actual outcomes for four of the domestic variables in the model described by (1). The model is estimated using data up to 2022:Q4. The outcome variables enter the model in (log) levels but are transformed as described in each graph. Red solid lines are median 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 2022:Q4 and 2023:Q4, respectively. Note the following: The GDP predictions are transformed from nominal to real growth using the inflation predictions. For Norges Bank we have illustrated the yearly predictions for 2023 and 2024 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.

3.1 Risk considerations and counterfactual modeling

It has for a long time been well acknowledged that the conduct of monetary policy involves crucial elements of risk management, see, e.g., Evans et al. (2016) and the references therein. To be able to systematically manage risk, it helps to have a formal view about uncertainty. 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 and growth projections. The usage of these uncertainty measures has continued in the mon-

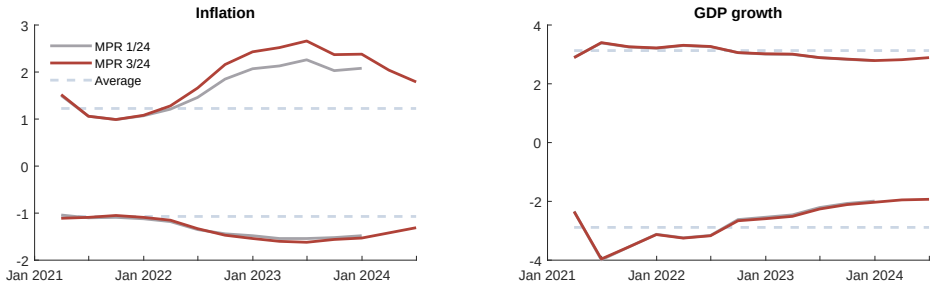

Figure 6. The graphs are sourced from Norges Bank and illustrate the risk associated with consumer price inflation and GDP growth eight quarters ahead. Risk is measured as the spread between percentiles and the median obtained from quantile regressions. The broken horizontal lines illustrate the average spread across the sample 2010-2019 for the 5th and 95th lower and upper percentile, respectively. The colored lines report the estimates of these quantities in Monetary Policy Report 1 (2024) and Monetary Policy Report 3 (2024). See Bowe et al. (2023) for more details.

etary policy reports in 2024. As in Norges Bank Watch (2024) 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 and also for guiding alternative policy scenarios.

A risk management view could also be used to rationalize keeping interest rate higher than the too pessimistic inflation beliefs discussed in the previous section would imply. To illustrate this, Figure 6 reports the inflation and growth tail risk estimates published in Monetary Policy Report 1 (2024) and Monetary Policy Report 3 (2024). As clearly seen in these graphs, the risks associated with future growth were hardly revised throughout the year and were not very far from normal levels. If anything, we observe a smaller downside risk. In contrast, the medium-term inflation outlook was clearly skewed towards higher values and also revised up during the year.

To address the consequences of Norges Bank's wrong inflation beliefs from a somewhat different perspective, we can use the model from (1) to produce a counterfactual interest rate path addressing the question; If we would have had the right beliefs regarding growth and inflation (and the exchange rate), what would the appropriate interest rate have been? The answer is obtained by simulating the model forward under the assumption that all variables in the model, except the domestic interest rate, are known up until the end of the sample. Figure 7 reports the result. As seen in the figure, the dynamic correlations implied by the data suggest that we are at an appropriate interest rate level. However, we also observe that the model-implied interest rate peaked already in 2023, and have started to fall in 2024. The alternative interest rate paths produced using simple rules, published by Norges Bank in every Monetary Policy Report in 2024, suggest a qualitatively similar picture.

In sum, these considerations suggest that the interest rate level is appropriate despite

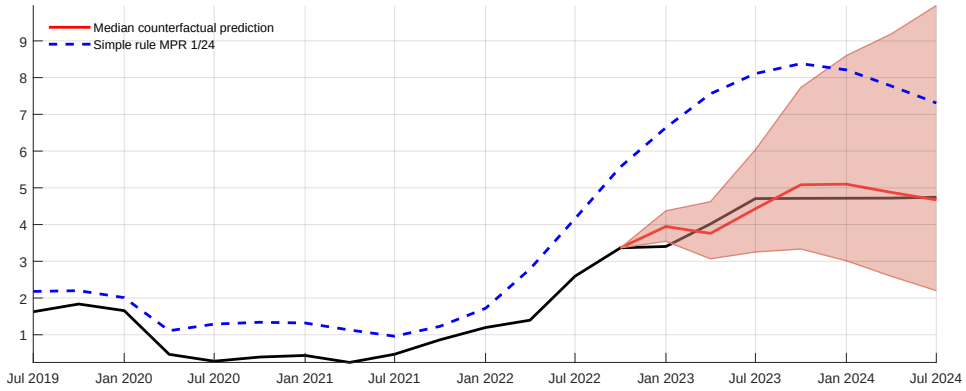

Figure 7. Counterfactual interest rate. The black solid line reports the actual data and outcomes. The red solid line is the median prediction obtained by simulating the model described in (1) forward, starting from 2022:Q4, under the assumption that the domestic interest rate is unknown but that all other variables entering the model are known up until the end of the sample. The shaded area illustrates 68% posterior probability bands. The blue broken line is the "simple rule" estimate published in Monetary Policy Report 1 (2024).

Norge Bank's wrong inflation beliefs. At the same time, we observe from Figure 6 that the level of upside inflation risk is coming down towards the end of the sample and that the counterfactual interest rate path dynamics suggest a downward trend as well. In the next section we investigate how international factors might play a role for these dynamics and the inflation mistakes made by the central bank.

3.2 International shocks and domestic responses

Building on research by Bjørnland et al. (2020), henceforth BTZ, Norges Bank Watch (2024) questioned whether Norges Bank responds timely to changes in international business cycles and foreign shocks. The change in international interest rates, international inflation dynamics, and the inflation prediction mistakes by Norges Bank throughout 2024 motivates asking the same question in this year's report.

In particular, we update part of the analysis in BTZ using data until 2024, and investigate to what extent revisions in the interest rate and inflation 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 and U.S. inflation. These are among the significant global indicators in BTZ, but also particularly relevant for Norway in general and for understanding the latest inflation developments (and interest rate responses) in particular.

Let $f_{2|I_{t-1}}$ be the two-step ahead forecast of the policy rate or inflation 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.[4] 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

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

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

With forecast revisions defined by (2), the simple regression model we use is

$$r_{ij,t} = \alpha_{ij} + \gamma_{ij} r_{ij,t-1} + \beta_{ij} x_{t-1} + \varepsilon_{ij,t}, \tag{3}$$

where x_{t-1} is either the year-on-year change in the monthly nominal oil price or the U.S. price index. To only include information which was available to the central bank when constructing $f_{j|I_{t-1}}$, x_{t-1} is mapped to the quarterly structure of $r_{ij,t}$ using the monthly cut-off dates published within the monetary policy reports.

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

The upper graphs in Figure 8 report the t-statistic associated with β_{ij} when (3) is recursively estimated with an expanding estimation window and using either the interest rate path or inflation forecast revisions as dependent variables. The graphs document that revisions in the interest rate path are still partly predicable using international indicators (the price of oil). However, the pattern towards the end of the sample has not become better or worse compared to Norges Bank Watch (2024). In terms of the inflation forecast revisions we observe a somewhat similar qualitative picture, documenting how the U.S. inflation rate is a significant predictor for Norges Bank's inflation forecast revisions.

Episodes such as the Great Financial Crisis (GFC) and recent global inflation surge are clearly important for the dynamics discussed above. As the forecast revisions accumulate into the actual forecast errors, this is also evident from the lower graph in Figure 8, where we see that there is a high correlation between U.S. inflation and subsequent inflation forecast errors in the aftermath of the GFC and Covid-19.

Predictable forecast errors and revisions are a clear violation of conventional economic theory. 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,

[4]Here, 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.

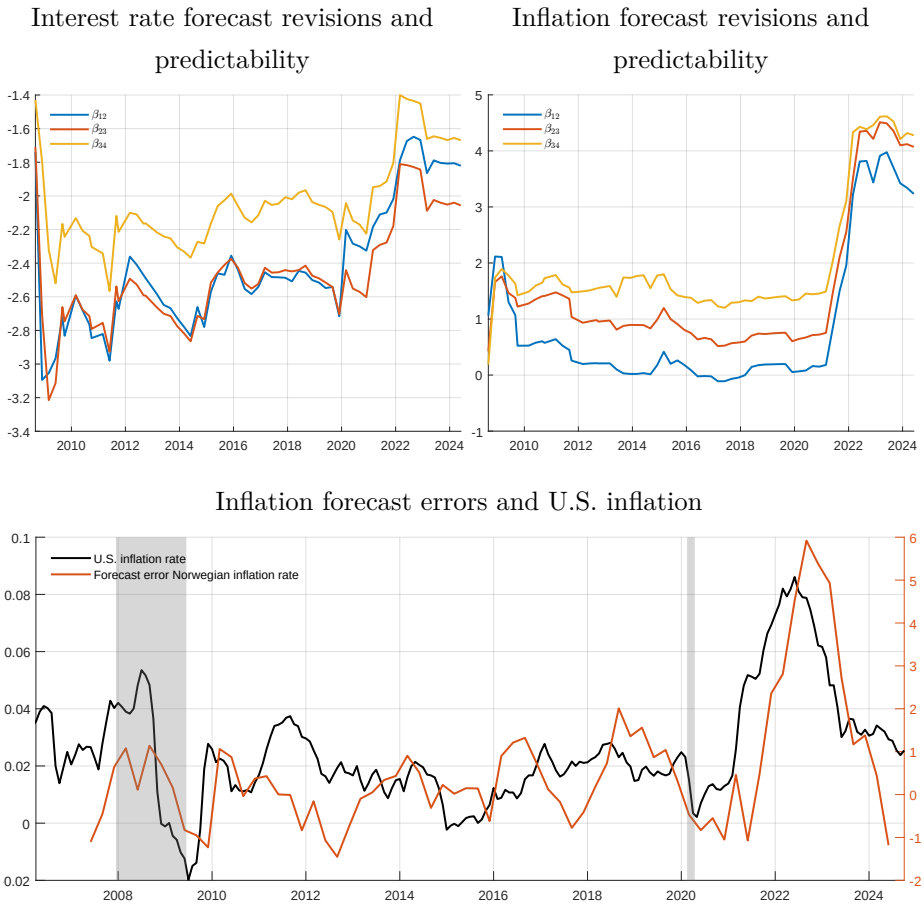

Figure 8. The upper left graph reports the recursively estimated t-statistic for $\hat{\beta}$ in (3) when the equation is estimated using the three different interest rate path revisions ($r_{ij,t}$) as dependent variables and the oil price at the forecast origin as a predictor. The upper right graph reports the same type of statistic from a regression using inflation forecast revisions as dependent variables and U.S. inflation at the forecast origin as a predictor. The lower graph report the inflation forecast error at the four quarters ahead horizon alongside the U.S. inflation rate.

the results presented in Figure 8 suggest that more work would be beneficial. The challenge is that the role of international developments seems to be very time-dependent and only really relevant when big common (global) shocks happen. In relation to this, looking into systematic ways of deciding when to change into "international mode", i.e., putting larger weight on international developments, seems like a valuable effort.

In terms of the conduct of monetary policy in 2024, the response patterns documented above suggest that Norges Bank will have to revise down their interest rate path in the near future. BTZ document that these types of predictable revisions lead to a positive co-movement between the interest rate and both the macro economy and financial markets. We find it questionable whether creating this type of pro-cyclicality was Norges Bank

initial intention.[5] However, the adequacy of the interest rate setting should also be judged based on an overall assessment of the inflation and growth trade-offs faced by the bank. We turn to this next.

3.3 The strategy and intention-realization alignment

In May 2024 Norges Bank published an update of its monetary policy strategy document. The strategy describes the Committee's interpretation of its monetary policy mandate and sets out how the Committee will orient monetary policy in response to different shocks that could hit the economy.

The strategy was first adopted in 2021, and Norges Bank wrote in their press release that "The updated strategy is consistent with the Committee's conduct of monetary policy over recent years and does not entail a change in the conduct of monetary policy". Still, Governor Ida Wolden Bache emphasized that "The updated strategy articulates that the Committee interprets its mandate to mean that considerable weight shall be given to employment – also at times when inflation deviates significantly from the target".

Perhaps as an attempt to manage expectations, but definitely speaking directly to the conduct of monetary policy and the strategic considerations, Norges Bank already in Monetary Policy Report 1 (2024, pp. 55–59) published a separate box titled "Monetary policy trade-offs illustrated by the forecasts of inflation and the output gap". The analysis casts light on the trade-offs faced by the bank and how it is weighting inflation pressure relative to the real-economy. Following its initial use the same type of analysis has been published in every Monetary Policy report in 2024.

As a tool for communicating Norges Bank's intentions and strategic considerations we appreciate this type of analysis, and we do not have any comments towards the general strategy per se. However, having good intentions (forecasts) alone does not necessarily ensure a good result. Below we redo the analysis performed by Norges Bank, but extend it along two dimensions. First, we explicitly model how the strategic considerations have changed across time. Second, we compare the ex-post inflation and output gap predictions (intentions) to the ex-ante realizations. The first analysis extends Norges Bank's own analysis on the subject matter and lays the ground for the second analysis where we more formally "test" to what extent Norges Bank's strategic intentions on average are well

[5]This 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. A counter-argument would of course be that periods of large international shocks are also associated with large, and potentially skewed, uncertainty. In this case, as discussed in Section 3.1, higher-order moment considerations might rightfully receive a higher weight than the first-order moments (expectations) the results above are based upon.

aligned with subsequent realizations. Systematic discrepancies between intentions and realizations could be a sign of systematic policy mistakes.

The starting point for our analysis is the same as in Monetary Policy Report 1 (2024, pp. 55–59) and the text-book description provided by, e.g., Røisland and Sveen (2018). That is, in simple business cycle models the trade-off faced by the central bank in terms of setting the interest rate can be expressed using a loss function such as

$$L = (\pi - \pi^*)^2 + \lambda y^2, \tag{4}$$

where π is inflation, π^* the inflation target, and y the output gap. Accordingly, λ indicates how much weight the central bank places on output stability in relation to inflation stability. Now, the central bank is assumed to set an interest that minimizes L given the functioning of the economy - as described by their model. In simple models, the optimal policy is

$$\pi - \pi^* + \alpha y = 0 \tag{5}$$

where $\alpha = \lambda/\gamma$, and γ is the slope of the Phillips curve, i.e., how much inflation increases when the output gap widens.[6]

From (5) it follows that an optimal policy implies that the two gaps should have opposite signs. Now, this easy to evaluate optimality condition comes with some caveats. First, in more complex models it might not hold. For example, when financial imbalances are represented in the loss function, in addition to the inflation and output gap, the inflation gap and output gap do not necessarily have the opposite sign for optimal trade-offs. This motivates tracking α across time to evaluate the adequacy of potential departures from the simple text-book optimality condition. Second, monetary policy affects the economy with a lag and is operated as a combination of both formal modeling and human judgment. Accordingly, α in (5) is not observed and has to be inferred from data. To do so we follow the literature and Norges Bank and use the inflation and output gap predictions published by the central bank, which is a reasonable strategy when the interest rate level itself is a function of these predictions.[7]

The upper left graph in Figure 9 shows a scatter plot of the inflation and output gap projections published by Norges Bank since 2006 and up until today. As also argued by Norges Bank in their Monetary Policy reports in 2024, we do not observe a clear pattern,

[6]The updated monetary policy strategy emphasizes that considerable weight should be put on employment (as opposed to the output gap used in (4)). Okun's law does, however, establish a close link between employment (u) and the output gap, where $u = 0.31y$ is consistent with the view of both Norges Bank and Statistics Norway. E.g., if Norges Bank puts equal weight on the inflation gap and employment in (4), $\lambda \approx 0.1$.

[7]We use the average of the predictions from one to eight quarters ahead. The results reported below are robust to using the average of only the first year.

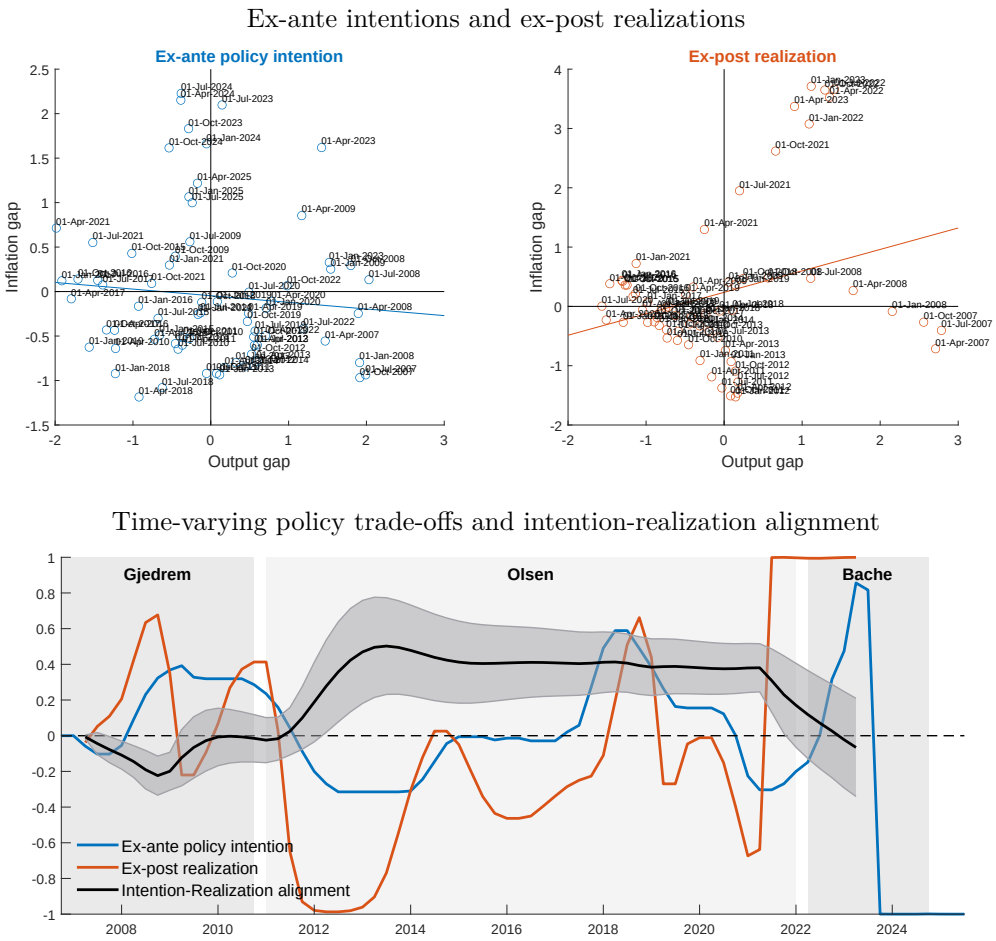

Figure 9. The upper graphs report a scatter plot of the average one to eight quarters ahead inflation- (π_t) and output-gap (y_t) predictions and outcomes as reported by Norges Bank. The lower graph reports the estimated time-varying slope parameter in the equation $\pi_{i,t} - \pi_t^* = \beta_{i,t} y_{i,t} + \epsilon_{i,t}$, where $i \in \{intention, realization\}$, ϵ_t is an error term, and we have omitted the constant for notation simplicity. To improve the readability of the graph, we have scaled the estimated slope parameters with the Hyperbolic tangent function, i.e., $tanh(\hat{\beta}_{i,t})$. The black solid line and gray shaded area reports the point estimate and 90% confidence intervals resulting from projecting (the unscaled difference) $\hat{\beta}_{intention,t} - \hat{\beta}_{realization,t}$ onto a constant using an expanding estimation window.

although the slope parameter is weakly negative (implying that $\alpha > 0$). To learn more about how this slope might have changed across time, we estimate a simple time-varying parameter model

$$\pi_t - \pi^* = \beta_t y_t + \epsilon_t, \tag{6}$$

where ϵ_t is an error term and the parameter of interest, β_t, is plotted as the blue line in the lower graph in Figure 9.[8] As clearly seen from this graph, the policy trade-off has been far from constant and negative across the sample. E.g., following the financial crisis around

[8] In (6) a constant term is omitted for notation simplicity. To estimate the time-varying parameter model we have followed, e.g., Korobilis et al. (2022), and used a simple re-parameterization trick in combination with a standard elastic net estimator. See Appendix B for a more detailed explanation.

2008 our estimates are consistent with an interpretation where Norges Bank put more weight on financial stability and thereby allowed for a positive slope parameter in (6). In contrast, towards the end of the sample our results suggest that the slope parameter has become highly negative. This is consistent with Norges Bank putting a very high weight on the output gap (and employment conditions) when setting the interest rate.[9]

Importantly, however, the optimal policy ex-ante might not be optimal ex-post. Clearly, unexpected shocks happening after the forecast origin will create a discrepancy between the predicted and realized values. But, on average, the policy trade-off embedded in the predictions should also be present in the realized values. If not, the interest rate set at the forecast origin would be systematically unaligned with the subsequent macroeconomic dynamics, at least from the perspective of the central bank's initial intentions. Or, in other words, the trade-off between inflation and the real economy implied by the interest rate policy and the central bank's judgment is not well aligned with the trade-off in reality, and a different interest rate policy would have had to be followed to achieve the intended trade-off.

Speaking to this line of reasoning, the upper right graph in Figure 9 reports the realized values for the predictions in the graph to the upper left. On average we observe a positive relationship between the output and inflation gap realizations, but also that this slope estimate is driven by a few observations. The red line in the lower graph in Figure 9 reports the time-varying parameter from (6) when the equation is estimated using the realized inflation and output gap values (and not the predicted values). Clearly, there is a large degree of co-movement between the ex-post (realizations) and ex-ante (intentions) slope parameters (trade-off), but not a perfect correlation.

Finally, to assess the degree to which intentions are well aligned with realizations, we project $\hat{\beta}_{intention,t} - \hat{\beta}_{realization,t}$ onto a constant using an expanding estimation window and report in Figure 9 the point estimates together with 90% confidence bands. In short samples the average differences between intentions and realizations might be different than zero simply due to unexpected shocks and randomness. However, as we obtain more and more evidence this effect should be averaged out. As such, it is interesting to observe that following many years of a positive average discrepancy, the policy intentions seem to

[9]Since $\alpha = \lambda/\gamma$, and γ is assumed to be constant, λ increases when $\beta = -\alpha$ becomes more negative. Note, however, that there is disagreement in the literature regarding the stability of Phillips curve slope parameter (γ), although the constant assumption is supported by studies such as Bergholt et al. (2024). Moreover, there can be many reasons for observing changes in the slope. Thus, our narrative should be interpreted with care.

have become better aligned with the realized trade-off towards the end of the sample.[10]

In sum, our estimates are consistent with an interpretation where Norges Bank during 2024 put a high weight on the real economy and employment conditions. Our results also suggest that the intended trade-off embedded in the interest rate setting has become reasonably well aligned with the realized trade-off during the last five years. Whether this positive result is mainly driven by extreme events associated with the post-Covid-19 period, or better policy, is up for debate. In relation to our discussion in earlier sections about the bank's inflation projection mistakes and the implications for the interest rate setting, the results presented here are difficult to square with arguments favoring a more dovish policy.

[10] The argument that the average difference between intended and realized slopes should be zero is sensitive to the relative effectiveness of the demand and exchange rate channel of monetary policy and the importance of demand versus supply shocks. However, we have also estimated the average slope difference while controlling for historical demand and supply shocks, finding that this gives result very similar to those reported in Figure 9.

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Appendices

Appendix A Priors for the long-run

The model in (1) allows us to formulate long-run restrictions, consistent with economic theory, on the system. In Norges Bank Watch (2024) central mechanisms were interest rate differentials, the uncovered interest rate parity (UIP) channel, and long-run restrictions consistent with the purchasing power parity (PPP) condition. A-priori it seems reasonable that the same mechanisms should be particularly important also this year. Likewise, we also 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 here shortly describe the connection between this prior-based modeling strategy and the cointegration literature and so-called Vector Error Correction Models (VECM). For this purpose, it is useful to re-write the model in (1) from level to difference form

$$\Delta \boldsymbol{y}_t = \boldsymbol{c} + \boldsymbol{\Pi}\boldsymbol{y}_{t-1} + \boldsymbol{\Gamma}_1 \Delta \boldsymbol{y}_{t-1} \ldots + \boldsymbol{\Gamma}_{p-1}\boldsymbol{y}_{t-p+1} + \boldsymbol{\varepsilon}_t \tag{7}$$

where $\boldsymbol{\Pi} = (\boldsymbol{\beta}_1, \ldots, \boldsymbol{\beta}_p) - I_n$ and $\boldsymbol{\Gamma}_j = -(\boldsymbol{\beta}_{j+1} + \ldots + \boldsymbol{\beta}_p)$ with $j = 1, \ldots, p-1$. Readers familiar with the cointegration literature will now recognize (7) as a so-called Vector Error Correction Model (VECM), where the parameter matrix $\boldsymbol{\Pi}$ plays a crucial role in terms of determining the long-run behavior of the system.

Now, define $\boldsymbol{\Lambda} = \boldsymbol{\Pi}\boldsymbol{H}^{-1}$ and $\tilde{\boldsymbol{y}}_{t-1} = \boldsymbol{H}\boldsymbol{y}_{t-1}$ and write (7) as

$$\Delta \boldsymbol{y}_t = \boldsymbol{c} + \boldsymbol{\Lambda}\tilde{\boldsymbol{y}}_{t-1} + \boldsymbol{\Gamma}_1 \Delta \boldsymbol{y}_{t-1} \ldots + \boldsymbol{\Gamma}_{p-1}\boldsymbol{y}_{t-p+1} + \boldsymbol{\varepsilon}_t \tag{8}$$

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

the description in Section 3 and above, we define:

$$\tilde{\boldsymbol{y}}_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} CPI_t^* \\ GDP_t \\ C_t \\ W_t \\ E_t \\ CPI_t \\ R_t \\ R_t^* \end{bmatrix} \begin{matrix} \textbf{International price} \\ \textbf{Real trend} \\ \textbf{Consumption/GDP ratio} \\ \textbf{Labor share} \\ \textbf{PPP} \\ \textbf{Domestic prices} \\ \textbf{Nominal trend} \\ \textbf{International interest rate} \end{matrix} \tag{9}$$

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.

The model in (1) is estimated on a sample starting in the late 1990s and ending in 2022. We then use the model to make quarterly out-of-sample predictions for 2023 and 2024, 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.

Appendix B Time-varying parameter estimation

Estimating time-varying parameter models can be numerically challenging and often involve filtering algorithms that can be computationally demanding. Korobilis et al. (2022) propose alternative approaches, based on hierarchical shrinkage priors or standard regression regularization techniques.

Let y_t be a scalar time series observation for $t = 1, \ldots, T$, $\boldsymbol{X}_t$ a p-dimensional vector of covariates (that can include an intercept, own lags of y and exogenous predictors), and β_t a vector of time-varying (or drifting) regression coefficients, such that

$$\begin{aligned} y_t &= \beta_t \boldsymbol{X}_t + e_t, \\ \beta_t &= \beta_{t-1} + u_t, \end{aligned} \tag{10}$$

where e_t and u_t are independent error terms and we have enforced the common random walk assumption for the parameter dynamics. Then, instead of estimating (10) using filtering techniques, we can simply reformulate the problem into a static regression for

the parameters $\Delta\beta_t = \beta_t - \beta_{t-1}$. This takes the form

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_{T-1} \\ y_T \end{bmatrix} = \begin{bmatrix} \boldsymbol{X}_1 & 0 & \dots & 0 \\ \boldsymbol{X}_2 & \boldsymbol{X}_2 & \ddots & 0 \\ \vdots & \ddots & \ddots & \vdots \\ \boldsymbol{X}_{T-1} & \dots & \boldsymbol{X}_{T-1} & 0 \\ \boldsymbol{X}_T & \dots & \boldsymbol{X}_T & \boldsymbol{X}_T \end{bmatrix} \begin{bmatrix} \beta_1 \\ \Delta\beta_2 \\ \vdots \\ \Delta\beta_{T-1} \\ \Delta\beta_T \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_{T-1} \\ e_T \end{bmatrix}, \tag{11}$$

where we implicitly assume that $\beta_0 = 0$, such that $\Delta\beta_1 = \beta_1$.

The time-varying parameter formulated in the static form in (11) can be estimated using many different estimators, both classical and bayesian (as discussed in Korobilis et al. (2022)). Here we apply the standard elastic net estimator and choose the regularization parameter using 5-fold cross-validation.