Norges Bank

3 | 2024

Norges Bank Papers

Norges Bank's Monetary Policy Handbook

Version 2.0

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1. Introduction

The purpose of this handbook is to document the expert knowledge relevant for Norges Bank's conduct of monetary policy. Its primary focus is to elaborate on the topics and policy challenges described in the Bank's monetary policy strategy statement.[1] We will cite international practice and relevant literature regarding these topics and give an account of the Bank's interpretations and clarifications. We will also describe the analysis system and data basis on which monetary policy decisions are based. The handbook is intended as a living product, which will be updated as the strategy and modelling system evolve.[2]

The starting point of monetary policy is Norges Bank's mission – its mandate – laid down by the Storting (Norwegian parliament) in law and regulation. The monetary policy framework in Norway is flexible inflation targeting. In 2001, the Bank was given a formal inflation target for monetary policy. In March 2018, the mandate was revised in the form of a new Regulation on Monetary Policy, specifying that the operational target of monetary policy is annual consumer price inflation of close to 2% over time. Furthermore, inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment and to counteracting the build-up of financial imbalances.

In monetary policy, a distinction can be made between (overriding) objectives and considerations. This distinction is often related to the objectives the central bank can assume responsibility for and the objectives it cannot assume responsibility for but can *contribute* to. Based on this distinction, "low and stable inflation" can be considered an overriding objective. Even though high and stable output and employment is an overriding objective of overall economic policy, Norges Bank cannot have primary responsibility for high output and employment. The Bank can, however, together with other policy areas, *contribute* to maintaining high and stable output and employment. However, in the practical conduct of monetary policy, the distinction is less important, because the central bank must in any case strike a balance between the different objectives and considerations in the near and medium term. For the sake of simplicity, in what follows we have used the same term – objective – for both overriding objectives and considerations.

In translating the mandate into concrete decisions, a *strategy* is useful. A common definition of the term "strategy" is:

1 See Norges Bank (2024a).

2 Parts of the handbook will be more up-to-date at any given time. Minor updates will be included in the electronic version of this paper, available on Norges Bank's website.

A plan of action designed to achieve a long-term or overall aim.[3]

A monetary policy strategy describes how monetary policy should be conducted in different situations that may occur. For the strategy to be as useful in practice as possible, it should be as operational and specific as possible. The monetary policy strategy serves as a bridge from the monetary policy objectives and considerations as formulated in the mandate (Regulation on Monetary Policy) to the actual conduct of monetary policy, primarily in the form of the policy rate decision and the policy rate forecast published in the *Monetary Policy Report*.

Objectives of monetary policy	Strategy	Implementation
Low and stable inflation with annual consumer price inflation of close to 2% over time High and stable output and employment Counteract the build-up of financial imbalances	How to conduct monetary policy for best possible attainment of policy objectives? How to deal with different types of challenges (shocks, uncertainty)?	How should the policy rate/ rate path be adjusted given the strategy and economic situation? How should the decision be communicated?

Neither the objectives nor the strategy are carved in stone but can be changed over time. However, there are differences in the degree to which they are fixed. The objectives of monetary policy are changed relatively rarely. Frequently changing the objectives could weaken confidence in monetary policy. In Norway, the monetary policy objectives have been changed twice in the past 20 years (see box on page 12). The inflation target was formally introduced in 2001. Before that, the objective was to maintain a stable exchange rate. In the new Regulation on Monetary Policy of 2018, the inflation target was reduced from 2.5 to 2%. At the same time, inflation targeting was to *contribute to high and stable output and employment*. The word "high" was new compared with the earlier regulation, as was the phrase that monetary policy should also *counteract the build-up of financial imbalances.*

The strategy will be somewhat less fixed than the objectives, since the strategy should be developed as new insights are gained from research, analyses and practical experience. But substantial and frequent changes in the strategy will not be appropriate either, whether with regard to the internal decision-making process or external communication.

However, the conduct of monetary policy will, by its nature, depend on the current economic situation and the outlook. Policy rate decisions are normally made at the announced monetary policy meetings of the Monetary Policy and Financial Stability Committee (hereinafter "the Committee"). As a rule, eight such meetings are scheduled each year. In conjunction with four of these meetings, the *Monetary Policy Report* is published, where the policy rate forecast is an important part of the conduct of monetary policy.

3 See Oxford University Press (2022).

The monetary policy strategy can be roughly divided into the following elements: a. specification of objectives, b. trade-off between objectives and c. response pattern.

a. Specification of objectives

For the strategy to be of practical benefit, the objectives of monetary policy must be specified so that policy performance under different policy rate scenarios can be assessed. The different objectives laid down in the mandate vary in their degree of precision. The objective of low and stable inflation is relatively precisely formulated in the mandate as "close to 2 percent over time". It may nevertheless be appropriate to further define the phrases "close to" and "over time". The objective of high and stable output and employment is less precise. How is "high" defined? Central banks with similar objective formulations usually relate it to "the highest level that is consistent with price stability over time". At the same time, it is far from obvious in practice what level this is. The strategy should therefore seek to operationalise "high" so that it is possible to quantify this level. Such a quantification is naturally associated with considerable uncertainty, and the strategy should also provide some guidance on how the central bank should take uncertainty into account in monetary policy. "Counteracting the build-up of financial imbalances" is perhaps even less precise. Financial imbalances are a challenge to define and not least to estimate. Nevertheless, a strategy should seek to operationalise this consideration as far as possible, with a view to striking a balance between the objectives with some degree of consistency.

b. Trade-offs between objectives

The economic situation will normally reflect shocks of varying magnitude that have resulted in deviations from the objectives. Very often there will be a conflict, at least in the near term, between certain objectives. Part of the strategy could be to formulate some principles or criteria for what can be described as an efficient trade-off between objectives. What characterises an efficient trade-off is that performance against one of the objectives cannot be better without performance against at least one of the other objectives being poorer. With appropriate trade-offs, the performance against the various objectives will generally reflect in part the shocks that have occurred, in part the objectives' relative importance (weight) to the decision-makers and in part the strength of the effect of monetary policy on the target variables. In addition to providing criteria for an efficient trade-off, a strategy can also be a tool for ensuring a consistent approach to weighing up the objectives over time, unless the decision-makers deliberately chose to change it.

Central banks' weighting of objectives other than inflation is usually reflected in the time horizon for seeking to bring inflation back to the target after a deviation. A more flexible inflation targeting regime generally implies a longer horizon. The relevant horizon depends on

the shocks that have occurred and whether there are conflicts between the policy required to reach the inflation target and the other monetary policy considerations.

c. Response pattern

The strategy should describe how monetary policy should be formulated depending on the shocks that might occur. Of course, it is not possible to have a detailed action plan in advance for every possible type of shock. But most shocks can be categorised as either demand shocks or supply shocks, and as either transitory shocks or persistent/permanent shocks. A strategy for how to respond to different categories of shocks will be useful for the implementation of monetary policy in practice.

Monetary policy responses to various shocks depend on how the shocks are interpreted and how they are estimated to influence future economic developments. The decision basis, which comprises different kinds of data and the modelling and analysis system, is therefore key to the monetary policy response pattern.

To assess how tight or expansionary monetary policy should be, it is necessary to have an idea of what a neutral monetary policy is, ie when monetary policy contributes to neither an increased nor decreased activity level. A key concept in this connection is the neutral real interest rate[4]. The neutral real interest rate changes over time, and estimates of this rate are uncertain.

The implications of uncertainty are an important part of the strategy that describes the response pattern. Uncertainty surrounds the current economic situation, the outlook and economic relationships, including the effects of monetary policy. Some types of uncertainty are not of material importance for the response pattern, while other types may imply that the policy rate should respond to shocks either more cautiously or more aggressively than otherwise. The monetary policy strategy should provide a measure of guidance on how monetary policy should relate to different types of uncertainty.

Now and then, extraordinary shocks may occur, of which the Covid pandemic, the global financial crisis (GFC) and the effects of Russia's invasion of Ukraine are examples. It is difficult to have a very precise strategy for such shocks since they may be very different in nature and difficult to describe in advance. Nevertheless, the strategy can contain some general guidelines for what may be a relevant response. The interaction between monetary and fiscal policy is also a relevant topic when large extraordinary shocks occur.

Section 2 contains a further specification of objectives (point **a** above) and trade-offs (point **b**), while Section 3 addresses the response pattern (point **c**).

4 The real interest rate is the nominal interest rate minus the inflation rate.

Norges Bank's monetary policy and financial stability committee[1]

The Monetary Policy and Financial Stability Committee is responsible for Norges Bank's role as the executive and advisory monetary policy authority and is responsible for the use of policy instruments to attain the monetary policy objectives. The Committee shall contribute to the promotion of financial stability by providing advice and using the policy instruments at its disposal.

The Committee consists of the governor, the two deputy governors and two external members. The external committee members are appointed by the King in Council for a term of four years. The governor chairs the Committee, and the two deputy governors are the first deputy chair and second deputy chair, respectively. The Committee became operative on 1 January 2020.

The Committee normally holds eight scheduled meetings a year, where policy rate decisions are made. Four of the meetings coincide with the publication of the *Monetary Policy Report*. At the interim monetary policy meetings, where the *Monetary Policy Report* is not published, the Committee also sets the level of the countercyclical capital buffer.

The Committee's meeting schedule is primarily determined by the dates of the eight monetary policy meetings. Prior to the meetings that coincide with the publication of the *Monetary Policy Report,* the Committee meets four times. Prior to the meetings without a report, the Committee meets twice. In 2023, the Committee held 22 meetings.

Bank staff prepare and present relevant analyses and projections that provide the basis for the Committee's discussions and advises the Committee on policy decisions. To ensure that the discussion basis is as far as possible the same for all the Committee members, all have access to the same information and analyses provided by Bank staff.

The Committee is committed to transparent and clear external communication and seeks consensus on its assessments and decisions through in-depth discussion. The "Monetary policy assessment", published in connection with policy rate decisions, and the "Assessment of the countercyclical capital buffer requirement", published in connection with the buffer decisions, reflect the view of the majority. Topics of particular concern to the members in the discussions are highlighted in the assessment. Members that disagree with the assessment of the majority may dissent, and dissenting views are published together with a brief written explanation in the minutes and in the assessment published at the same time as the rate decision. All of the Committee's decisions were unanimous in 2023. To underpin the Committee's form as a collegial committee, the Committee chair, the governor, normally speaks on behalf of the Committee. Other Committee members may issue statements by agreement with the Committee chair.

1 The Committee's rules of procedure contain rules for organising the work of the Monetary Policy and Financial Stability Committee and cover inter alia the Committee's duties, the conduct of meetings and of business and the keeping of minutes (see Rules of procedure for Norges Bank's Monetary Policy and Financial Stability Committee (norges-bank.no)).

2. Objectives and trade-offs

In most countries, the purpose of the central bank is laid down by the political authorities in a central bank act (Table 2.1). The act normally includes a primary objective to maintain monetary value or price stability. The purpose of Norges Bank's activities is laid down by the Storting in the Central Bank Act. A new central bank act was adopted in Norway on 1 January 2020. In many countries, the purpose is more specifically defined in operational objectives, in Norway in the 2018 Regulation on Monetary Policy. In some countries, the objectives are specified in periodically reviewed agreements between the government and the central bank governor (eg Canada and Australia), or in a letter from the government to the central bank (UK and New Zealand). In others, such as the European Central Bank (ECB), the Swedish central bank (Riksbanken)[1] and the US Federal Reserve, the central bank itself defines the operational objective. However, for these central banks too, the operational objective defined by the bank must be within the limits set by the act.

In Norway, Section 1-2 of the Central Bank Act states that the purpose of the central bank's activities is to maintain monetary stability, promote the stability of the financial system and an efficient and secure payment system and contribute to high and stable output and employment.

The Government sets an inflation target for monetary policy through a regulation laid down pursuant to the Central Bank Act.[2] 4 Norway has had an inflation target for monetary policy since 2001. (See box on page 12 for a review of monetary policy from Norway in a historical perspective). The March 2018 Regulation on Monetary Policy reads:

> *Monetary policy shall maintain monetary stability by keeping inflation low and stable.*
>
> *The operational target of monetary policy shall be annual consumer price inflation of close to 2 percent over time.*
>
> *Inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment and to counteracting the build-up of financial imbalances.*

Even though the authorities have set monetary policy objectives, most central banks are free to determine the instruments they use. When we

1 Under Sweden's new central bank act (Sveriges Riksbank Act), which entered into force on 1 January 2023, the Riksbank will, now with approval from Riksdag (the Swedish parliament), specify the inflation target, ie its level and the measure of inflation it shall relate to. As before, the Riksbank shall take the initiative to the specification. The difference is that the Riksdag shall approve this specification before it applies.

2 In Norway, acts are normally supplemented by regulations.

speak of central bank independence, we primarily mean instrument independence and not goal independence.

The difference between instrument independence and goal independence is not as big in practice as in principle. The objectives are often not formulated in specific detail in the monetary policy mandates. In addition, trade-offs must be made between the different objectives. This means that the central bank itself must specify, or operationalise, the objectives and make the trade-offs. The less specific the monetary policy objectives are, or the more objectives the central bank has, the more it can be said that the central bank is goal independent. An inflation target for monetary policy implies a greater degree of goal independence for the central bank than for example an exchange rate target, because inflation targeting largely entails judgement-based trade-offs between various considerations, while the policy rate under a fixed exchange rate regime is primarily given by foreign interest rates and conditions in the FX market.

In addition to the traditional monetary policy objectives – price stability and real economic stability – some central banks in recent years have given more weight to other considerations, such as climate change and income and wealth distribution. Such considerations are ordinarily not directly specified in central bank mandates, but many central bank mandates include elements supporting other government policies. The box on page 46 contains a description of how central banks include climate change considerations in their monetary policy frameworks.

Central bank independence requires democratic accountability. This requirement has also been laid down in the Regulation on Monetary Policy, Section 4 of which states that Norges Bank shall regularly publish the assessments that form the basis of the implementation of monetary policy. How the central bank specifies the objectives and the trade-offs is an important part of such accountability. It is also important to the internal decision-making process and to improve the effectiveness of monetary policy. This section explores how the monetary policy objectives and considerations laid down in the mandate can be specified and how the trade-offs between them can be made in practice.

Table 2.1 Monetary policy objectives in selected countries

Country	Purpose of central bank	Operationalisation	Monetary policy mandate
Australia	"contribute to: - the stability of the currency of Australia; - the maintenance of full employment in Australia; and - the economic prosperity and welfare of the people of Australia." *Reserve Bank of Australia Act (1959)*	The monetary policy objective is defined in collaboration between the government and the central bank and documented in the joint agreement "Statement on the Conduct of Monetary Policy".	The latest agreement of December 2023 states: "They agree that an appropriate goal is consumer price inflation between 2 and 3 per cent". It continues that this formulation provides the flexibility "to set its policy so as best to achieve its broad objectives, including financial stability".
Canada	"...to promote the economic and financial welfare of Canada."[1] *Bank of Canada Act (1934)*	The operational inflation target is defined in collaboration between the government and the central bank in a joint agreement. The inflation target is evaluated, and the agreement renewed every five years.	The latest agreement of December 2021 renewed the inflation target of 2%, measured as the mid-point of the 1–3% inflation control range. The agreement will be renewed at end-2026.
Euro-area	"... to maintain price stability. Without prejudice to the objective of price stability, it shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the TEU[2]."	The European Central Bank (ECB) defines the inflation target. The current strategy was adopted in July 20213. The next assessment of the strategy is expected in 2025.[3]	A symmetric inflation target of 2%. In July 2021 the ECB also presented a climate-related action plan. The ECB will take climate-related factors into account in its monetary policy analyses.
Iceland	"... shall promote price stability, financial stability and sound and secure financial activities." *Act on the Central Bank of Iceland (2019)*	With the approval of the government, the central bank can issue a declaration on a quantitative inflation target.	The target is defined as a 12-month change in the consumer price index of 2.5%.
Japan	"...aimed at price stability, thereby contributing to the sound development of the national economy." *Bank of Japan Act (1997)*	The BoJ specified a price stability target in January 2013.	The inflation target is an annual rise in the CPI of 2%.
New Zealand	"...- the economic objective of achieving and maintaining stability in the general level of prices over the medium term; and the financial objective of protecting and promoting the stability of New Zealand's financial system ...". *Reserve Bank of New Zealand Act (2021)*	The finance minister issues an operational definition of the mandate in the form of a remit for the central bank, normally every five years.	The latest remit came into force on 20 December 2023. The inflation target was reconfirmed: inflation in the interval 1–3% in the medium term. The objective is to maintain future inflation close to a mid-point of 2%.
Norway	"...to maintain monetary stability and to promote the stability of the financial system and an efficient and secure payment system. ... to promote high and stable output and employment." *Sentralbankloven (2019)*	The operationalisation of a stable value of money is laid down in a separate Regulation on Monetary Policy dated March 2018.	"The operational target of monetary policy shall be annual consumer price inflation of close to 2 percent over time. Inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment and to counteracting the build-up of financial imbalances." Regulation on Monetary Policy (2018)
UK	"- to maintain price stability, and - subject to that, support the economic policy of her Majesty's Government, including its objectives for growth and employment." *Bank of England Act (1998)*	The price stability target and the government's economic policy is defined in an annual remit issued by the finance minister.	The latest remit is from November 2024. The inflation target was reconfirmed as 2%. It was also confirmed that: "the government's economic policy is to restore broad-based and resilient growth built on strong and secure foundations. Price and financial stability are essential prerequisites to achieve this objective in all parts of the UK and sectors of the economy, providing the stability required for investment and reform to help businesses to thrive and to help keep the cost of living low for families."
Switzerland	"...shall ensure price stability. In so doing, it shall take due account of economic developments." *Nationalbankgesetz (2003)*	The price stability target is set by the Swiss National Bank (SNB).	The SNB lay down its monetary policy strategy in December 1999. The price stability target is annual CPI inflation of less than 2%.

Country	Purpose of central bank	Operationalisation	Monetary policy mandate
Sweden	"The overriding objective of the Riksbank is to maintain permanently low and stable inflation (the price stability objective). Without neglecting the price stability objective, the Riksbank shall moreover contribute to a balanced development of production and employment (consideration for the real economy). The Riksbank shall also promote a safe and efficient payments system." *Riksbanklagen (2022)*	The Riksbank decides how the formulations in the central bank act should be interpreted.	The Riksbank has defined the inflation target as an annual change in the consumer price index with a fixed interest rate (CPIF) of 2%.
US	"...so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rate." *Federal Reserve Act (1977)*	The Federal Reserve defines its dual mandate. The first time was in 2012.[4] The FOMC stated then that they assessed a long-term target of 2% inflation as consistent with the price stability objective. The Fed launched its first review of the monetary policy framework in 2019. The FOMC plans to conduct a review of the framework roughly every five years.	After the review of the framework, two important changes were made in August 2020. The Fed now regards the inflation target of 2% as an average. Previously, the Fed reacted to deviations in employment from the Bank's estimated maximum level of employment. The Fed will now only react to shortfalls in this level of employment.

1 The Bank of Canada Act contains an introductory section about how the central bank was established, but the act has no objects clause.

2 See Treaty on European Union.

3 See ECB (2021a).

4 *Statement on Longer-Run Goals and Monetary Policy Strategy.* Federal Open Market Committee (FOMC). Update at the FOMC meeting in January each year. From 2019, the "statement" was reaffirmed each year in January with only minor revisions.

The objective of monetary policy from a historical perspective

How monetary policy has helped to maintain monetary stability has changed over time. Today, Norway has a floating exchange rate, but historically, Norwegian monetary policy has been pegged to one form or another of fixed exchange rate.[1]

After the fixed exchange rate regime broke down in December 1992, Norway continued to operate a more flexible exchange rate targeting regime. Even though there was not an exchange rate corridor for the krone, the orientation of monetary policy up until 1999 was primarily determined by current movements in the krone. When Svein Gjedrem became Governor in 1999, Norges Bank altered its response pattern. Instead of focusing on current movements in the krone, the policy rate would be set so that more long-term preconditions for a stable exchange rate would be met: "*Price and wage inflation which over time is on a par with euro countries is a precondition for a stable exchange rate against the euro. Moreover, monetary policy must not contribute to a downturn which undermines confidence in the krone*".[2] In practice, monetary policy became oriented towards an inflation targeting regime.

An inflation target as the operational target of monetary policy was laid down in a mandate of 29 March 2001. The new regulation did not entail

1 See eg Alstadheim (2016).

2 See Gjedrem (1999).

any material change in the monetary policy response pattern compared with the policy pursued over the two preceding years.[3]

Section 1 of the Regulation on Monetary Policy of 29 March

> *"Monetary policy shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations concerning exchange rate developments. At the same time, monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment.*
>
> *Norges Bank is responsible for the implementation of monetary policy.*
>
> *Norges Bank's implementation of monetary policy shall, in accordance with the first paragraph, be oriented towards low and stable inflation. The operational target of monetary policy shall be annual consumer price inflation of approximately 2.5 per cent over time.*
>
> *In general, the direct effects on consumer prices resulting from changes in interest rates, taxes, excise duties and extraordinary temporary disturbances shall not be taken into account."*

Although an objective of maintaining monetary stability was clearly stated in the Regulation on Monetary Policy of 2001, it had not been mentioned in the Norges Bank Act of 1985. The Regulation provided a more explicit formal and institutional anchor for monetary policy, which contributed to a greater degree of accountability. Norges Bank commented on the draft Regulation and on the consequences for the conduct of monetary policy in a letter to the Ministry of Finance on 27 March 2001. In the letter, the Bank wrote that:

"[t]here has been confidence in the conduct of monetary policy. The communication of Norwegian monetary policy may nevertheless be facilitated with the Government now quantifying an inflation target, in line with international practice."

The inflation target was set at 2.5% in the Regulation, while the implicit inflation target that the Bank previously followed was the level aimed for by euro area countries, ie approximately 2%.[4] Regarding the actual numerical target, in the letter to the Ministry of Finance, the Bank wrote: *"The inflation target of 2.5 per cent is slightly higher than similar objectives for Sweden, Canada and the euro area, but corresponds roughly to targets in the United Kingdom and Australia. The target is also approximately in line with the average inflation rate in Norway in the 1990s."*

The choice of 2.5% must be viewed in the context of the phasing-in of petroleum revenues, which would result in a real appreciation of the krone. The reason for choosing a slightly higher inflation target than the average rate applied by trading partners was for the real appreciation to

3 See Kleivset (2012), page 40: *"For the actual setting of the key policy rate, the formal policy change was less important, 'since a monetary policy response pattern was already in place that was consistent with an inflation targeting regime', as Gjedrem subsequently put it."*

4 The European Central Bank defined "price stability" as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%. This was subsequently clarified to "below, but close to 2 percent".

take place gradually in the form of a widening gap in the price and cost level between Norway and its trading partners, and not in the form of a nominal appreciation of the krone.[5]

In the *Financial Markets Report* presented in spring 2016, the Ministry of Finance announced plans to assess the need to modernise the monetary policy mandate.[6] The Ministry was of the opinion that the wording of the 2001 Regulation reflected the challenges that were relevant at the time.[7] In the intervening period, monetary policy thinking and practice had changed. There was a desire to bring the mandate into alignment with the current conduct of monetary policy.[8] [9]

The new mandate entered into force on 2 March 2018:

> Regulation on Monetary Policy[10]
>
> *"Section 1 Monetary policy shall maintain monetary stability by keeping inflation low and stable.*
>
> *Section 2 Norges Bank is responsible for the implementation of monetary policy.*
>
> *Section 3 The operational target of monetary policy shall be annual consumer price inflation of close to 2 percent over time. Inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment and to counteracting the build-up of financial imbalances."*

The most important changes comprised a downward revision of the inflation target to 2% from the previous 2.5%. The formulation *contributes to high and stable output and employment* replaced the formulation from the regulation from 2001 *contributing to stable developments in output and employment*. The word "high" is new compared with the regulation from 2001.

Also new was the inclusion of the consideration of *counteracting the build-up of financial imbalances*. From time to time, Norges Bank had been giving weight to this in its conduct of monetary policy within the framework of the regulation from 2001.

Stability in the krone's value and stable expectations concerning exchange rate developments was a key element of the regulation from 2001 and helped to build a bridge from the earlier fixed exchange rate regime. However, the Ministry of Finance was of the opinion that there are good arguments to de-emphasise the krone exchange rate and exchange

5 See Torvik (2003) for a discussion of the argument and references to statements.

6 See Meld. St. 29 (2015–2016) (in Norwegian only).

7 See Ministry of Finance for more background on the most important changes (2018).

8 See Meld. St. 8 (2017–2018) (in Norwegian only).

9 See Norges Bank (2017) for a detailed account of the experience with the monetary policy framework in Norway since 2001.

10 On 1 January 2020, the Regulation on Monetary Policy from 2 March 2018 was reissued as a *bestemmelse* instead of a *forskrift* without entailing any change in the formulation. Since English does not formally distinguish between these two types of statutory instrument, this instrument is still translated as "Regulation on Monetary Policy".

rate expectations as objectives *per se*.[11] Experience has shown that the krone can be a useful shock absorber when the economy is affected by shocks. There is no reference to the krone in the new regulation.

The new Central Bank Act, which was passed by the Storting on 17 June 2019 and entered into force on 1 January 2020, confirmed the Regulation on Monetary Policy. The Act superseded the Norges Bank Act of 1985. The new Central Bank Act contains the following provision:

> **Section 1-2. *Purpose of the central banking activities***
> (1) The purpose of the central banking activities is to maintain monetary stability and to promote the stability of the financial system and an efficient and secure payment system.
>
> (2) The central bank shall contribute to high and stable output and employment.

11 See Ministry of Finance (2018).

2.1 "Low and stable inflation"

2.1.1 Literature and international practice

High inflation entails substantial costs for society. When inflation is high, it also tends to fluctuate considerably. High and variable inflation creates uncertainty about the future value of money and makes economic planning more demanding. Uncertainty may also mean that long-term investments will have to give way to investments with a shorter horizon. When prices rise rapidly, price signals are reduced as it becomes more difficult to distinguish between changes in relative prices and the general price level. Prices then lose much of their informational value. High inflation can also lead to undesirable changes in relative prices because some prices change less frequently than others. For example, rapid and unexpected price increases will often lead to changes in real wages because it normally takes time for nominal wages to be adjusted. This particularly affects low-income households.

However, some inflation may be beneficial to the economy. Among other things, this may facilitate wage adjustments by allowing real wages to be reduced without having to cut nominal wages. In addition, some inflation also increases monetary policy space because there is a limit to how low policy rates can be set before there is a loss of transmission to banks' lending rates. Because monetary policy has little influence on the equilibrium real interest rate[3], higher inflation over time will result in a higher nominal interest rate level and thereby a greater distance to the lower bound. Moreover, too low inflation increases the risk of amplifying a downturn through an increase in the real value of debt.

3 The equilibrium real interest rate, or the neutral real interest rate, denotes the interest rate that balances demand with production capacity.

Around the turn of the year 2021/22, inflation rose in most countries, owing to supply-side problems in the form of production and transport bottlenecks and to high energy prices, among other reasons. There was a discussion among economists about whether the increase in inflation was transitory or whether it could persist. But prior to the rise in inflation, inflation had tended for a long time to be *lower* than central bank inflation targets. Many central banks had been concerned about this. The main reason for this concern is the decrease in the equilibrium real interest rate, which has reduced monetary policy space because of the policy rate's lower bound. If inflation is too low, the challenges posed by a low equilibrium interest rate will be amplified.

A number of central banks have considered a variety of strategies to counteract the risk of inflation becoming too low and inflation expectations becoming entrenched at a below-target level. The US Federal Reserve (Fed) is the central bank that has gone furthest in its strategy, revising it in August 2020 and adopting *average* inflation targeting. With average inflation targeting, the central bank will, after inflation has been below target for a period, seek to subsequently bring inflation somewhat above target to "make up for" inflation that has been too low. [4]By overshooting the target in this way, average inflation will be closer to the target, and this strategy may in principle better anchor inflation expectations.[5] The strategy for "overshooting" was, however, asymmetric; the Federal Reserve had no plan to bring inflation down below the target after the sharp rise in 2021.[6]

As for which prices, or what kind of price index, should be stabilised, theories differ somewhat. According to New Keynesian theory, which has had a strong influence on modern monetary policy thinking, monetary policy should stabilise the prices that are most rigid, ie prices that do not often change even though market conditions and costs can vary.[7] In models where the exchange rate passes through fully to prices for imported goods, monetary policy should, according to New Keynesian theory, stabilise prices for domestic goods and services and not the consumer price index (CPI).[8] If prices for imported goods are also rigid (gradual exchange rate pass-through), prices for imported goods should also be stabilised. In general, the prices with the highest degree of rigidity should, according to the theory, be assigned the highest weight in the price index the central bank seeks to stabilise.[9]

On the basis of purely theoretical considerations, the CPI may not be the optimal price index to stabilise. Nevertheless, virtually all the inflation-targeting countries target CPI inflation (Table 2.2). The main reason for

4 In its "Statement on Longer-Run Goals and Monetary Policy Strategy", the Fed writes: "[T]he Committee seeks to achieve inflation that averages 2 percent over time, and therefore judges that, following periods when inflation has been running persistently below 2 percent, appropriate monetary policy will likely aim to achieve inflation moderately above 2 percent for some time." See FED (2020).

5 See Røisland (2017) for a more detailed description of average inflation.

6 See Clarida (2022).

7 For international studies, see: Bils and Klenow (2004), Nakamura and Steinsson (2008). For Norwegian studies, see Erlandsen (2014) and Wulfsberg (2016).

8 See Galì and Monacelli (2005).

9 See Aoki (2001).

this is that the CPI is an index that is well-established and understood by the general public and widely used in contracts. It is also an advantage that this index is produced by an institution outside the central bank (in Norway's case, Statistics Norway (SSB)). Independence can underpin confidence in the inflation target.

Table 2.2 Inflation targeting in selected countries

Country	Dual mandate	Target	Horizon
Australia	No	CPI 2–3%	Medium term
Canada	No	CPI 2%[1]	Medium term
Euro area	No	HCPI[2] 2%	Medium term
Iceland	No	CPI 2.5%	Average
Japan	No	CPI 2%	Medium to long term
New Zealand	Yes	CPI 2%[1]	Medium term
Norway	No	CPI 2%	Will depend on the shocks to which the economy is exposed.[3]
UK	No	CPI 2%	At all times but depends on the shocks to which the economy is exposed.
Switzerland	No	CPI, below 2%	Medium term
Sweden	No	CPIF[4] 2%	Variable, but normally two years
US	Yes	Average PCE[5] 2% over time	Medium term

1 Point target with a tolerance interval of ± 1 percentage point.

2 Harmonised consumer price index.

3 How quickly Norges Bank seeks to reach the target will depend on the shocks to which the economy is exposed and whether there is a conflict between the policy required to reach the inflation target and the other monetary policy considerations.

4 CPI with fixed interest rates (effects of changes in mortgage rates not included).

5 Personal Consumption Expenditure deflator.

An indicator of underlying inflation can also be useful in the monetary policy trade-offs to distinguish signal from noise in inflation. Measures of underlying inflation are therefore used by many central banks as an operational guideline for monetary policy. Central banks usually use indicators that exclude the most volatile goods prices, such as prices for energy and food.

Most central banks monitor several indicators of underlying inflation. The BoC uses three measures.[10] The Reserve Bank of Australia presents developments in underlying inflation using several measures in its monetary policy report.[11] Some central banks have changed the indicators they give weight to without explicitly announcing the change.[12]

2.1.2 Norges Bank's interpretation and assessment

The Regulation on Monetary Policy states that "[t]he operational target of monetary policy shall be annual consumer price inflation of close to 2 percent over time." Thus, the target variable is the CPI and the target

10 See Bank of Canada (2016).

11 See Reserve Bank of Australia (2019).

12 See Fay and Hess (2016).

is 2%.[13] The words "over time" and "close to" are not specifically defined in the Regulation, but reflect two conditions:

(i) Monetary policy cannot control inflation perfectly, and there is a considerable lag between changes in the policy rate and the impact on inflation.

(ii) Different types of shocks will generally occur and different objectives will have to be assessed against each other in the short term. Even if the central bank had been able to control inflation perfectly, it would not have been appropriate to keep inflation at target at all times.

As long as there is confidence that inflation will be low and stable, it is unlikely, in Norges Bank's assessment, that fluctuations in inflation around the target will involve substantial economic costs. At the same time, the Bank will give weight in interest rate setting to avoiding large and persistent deviations from the inflation target, whether above or below the target. The goal is symmetrical; the Bank will, all else being equal, seek to bring inflation back to target just as quickly when inflation is above target as when it is below target.

Most central banks choose an inflation target horizon, for example two years (Table 2.2). However, the optimal horizon will generally depend on the type of shock to the economy and its size and duration. Norges Bank therefore applies a flexible horizon. The specific horizon at any one time will reflect the monetary policy trade-offs (see SSection 2.4). If, for example, inflation has risen above target when unemployment is high, the time horizon for bringing inflation back to target will be longer than when the labour market is better balanced. The Bank's Monetary Policy Report includes the current time horizon for when inflation is projected to return to target.

Norges Bank uses several indicators of underlying inflation (see box on page 19). However, the Bank's main indicator is the CPI-ATE, which is the CPI adjusted for tax changes and excluding energy products.[14] It is the main indicator because energy prices in Norway, and electricity prices in particular, are highly volatile. It is also an advantage that the CPI-ATE is calculated and published by an independent institution, Statistics Norway (SSB). It has become a well-established element in the Bank's monetary policy communication. However, one disadvantage of the CPI-ATE is that this indicator can include transitory price shocks that the Bank chooses to look through in monetary policy and that an indicator of underlying inflation should ideally correct for. The CPI-ATE includes volatile food prices (particularly fruit and vegetables) and volatile air travel prices, which it can often be appropriate to disregard. At the same time, changes in energy price trends can occur that the CPI-ATE does not

13 In the period between the introduction of the inflation target in 2001 to 2018, the target was 2.5%.

14 The main indicator of underlying inflation used between 2008 and 2013 was the CPIXE.

capture, but that the Bank wishes to take into account.[15] No single indicator of underlying inflation is ideal, suggesting that the Bank should look at several indicators and use judgement. For communication purposes, however, it may be appropriate to choose one main indicator.

Whether Norges Bank will react to large changes in individual prices does not depend on whether it can influence the source of the changes. For example, monetary policy cannot influence the prices of imported goods in foreign currency. But by curbing or increasing the level of activity in the economy, it can help prevent changes in prices for some goods from spilling over to other prices and wages. And even though the Bank cannot influence international prices in foreign currency, it can influence the exchange rate. An increase in the policy rate normally leads to an appreciation of the krone and thereby a slower rise in prices for imported goods. However, the monetary policy response to shocks depends on the *underlying* source of the shock because different types of shocks result in various degrees of conflict between the different monetary policy objectives. See further discussion in Section 3 on the monetary policy response to various shocks.

15 An indicator intended to capture this is the CPIXE, which is the CPI adjusted for tax changes and excluding temporary changes in energy prices. This indicator is constructed in the same way as the CPI-ATE but takes account of trends in energy prices instead of excluding energy prices completely, as is the case for the CPI-ATE.

Indicators of underlying inflation[1]

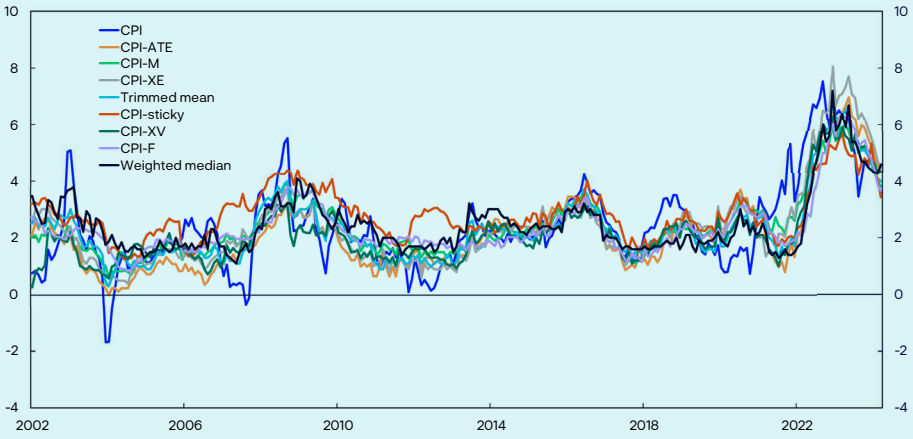
The purpose of indicators of underlying inflation is to strip out transient volatility in inflation and provide a real-time measure of trend consumer price inflation (CPI). Some price components of the CPI tend to vary considerably from period to period. These include energy prices, which can rise sharply in one period and then fall the next. A good indicator of underlying inflation must have certain statistical properties.[2] It should not deviate systematically from the CPI, be less volatile than the CPI and be able to predict future CPI inflation), it must be published at the same time as the CPI, must not be subject to revision and should be easy to understand. In addition, it is an advantage for it to be published by an independent institution.

Norges Bank uses a range of indicators of underlying inflation (Chart 1). The most important for the Bank's analyses is the CPI adjusted for tax changes and excluding energy products (CPI-ATE). CPI-ATE inflation is included in the Bank's main macroeconomic model NEMO, but other indicators are used in the Bank's inflation assessments and may influence the Bank's short-term inflation projections.

1 The box is based on Husabø (2017a).

2 See Husabø (2017a), Jonassen and Nordbø (2007), Roger (1998) and Wynne (1999).

Chart 1 Indicators of underlying inflation
Twelve-month change. Percent. January 2001 – April 2024



Sources: Statistics Norway and Norges Bank

- CPI-ATE: CPI adjusted for tax changes and excluding energy products. Published by Statistics Norway.
- CPI-XE: CPI adjusted for tax changes and excluding temporary changes in energy prices. Based on data from Statistics Norway but produced and published by Norges Bank.[3]
- CPI-XV: CPI adjusted for developments in the eight most volatile price series at group level[4]. Energy prices are excluded in toto. For the remaining seven[5] the average change over the past six or 12 months is included. Based on data from Statistics Norway but produced by Norges Bank.[6]
- Trimmed mean (20%): Various sub-groups are excluded from month to month. The twelve-month change at sub-group level in the CPI is sorted in ascending order. Then the price series corresponding to 10% of the CPI weights at both the top and bottom of the distribution are removed. Produced by Statistics Norway and published by Norges Bank.
- Weighted median: Special case of trimmed mean. The underlying rise in prices in a given month is specified by the price change located at the fiftieth percentile ranked by the sub-groups' CPI weights. Produced by Statistics Norway and published by Norges Bank.
- CPI-M: Constructed by changing the weights in the CPI at group level. Each product group is weighted based on how well it has historically forecast total CPI one month ahead. Better forecasts result in a higher weight. Based on data from Statistics Norway but produced by Norges Bank.[7]

3 See Hov (2009).
4 At group level, the CPI is divided into 39 product and service groups. At subgroup level, the CPI is divided into 93 product and service sub-groups.
5 Air fares, household textiles, fruit, coffee, tea and cocoa, vegetables, fish, newspapers, books and stationery.
6 Not published regularly.
7 See Hov (2005).

- CPI F: A measure of the common trend in the rise in prices across price series in the CPI at group level. A factor model is used to filter out price movements caused by sector-specific factors and find the trend that is common to all goods and service groups. Based on data from Statistics Norway but produced by Norges Bank.[8]
- CPI-*sticky prices*: The indicator includes CPI subgroups that in the period between 1999 and 2004 changed prices less than once every 8.5 months. The subgroups account for approximately 25% of the basis for weighting the CPI, and their respective CPI weights are scaled to sum up to 1. Based on data from Statistics Norway but produced and published by Norges Bank.

8 See Husabø (2017b).

2.2 "High and stable output and employment"

2.2.1 Literature and international practice

Setting monetary policy to achieve an inflation target does not mean that monetary policy only focuses on inflation. The mandates of inflation-targeting central banks usually include formulations indicating that real economic stability should also be considered. In the short term, conflicts can arise between stabilising inflation and stabilising the real economy, and central banks must then make a trade-off between the two.

There is a sound theoretical basis for assuming that a large share of business fluctuations involves welfare costs and should be dampened using countercyclical monetary policy.[16] This is because consumers may prefer high and stable consumption, and fluctuations lead to inefficient resource allocation. The usual theoretical models assume that there is a representative household. These models do not capture all of the costs from variations in output and employment, for example that involuntary unemployment will normally involve substantial costs for an individual, and for the household. In models based on a representative household, a downturn will only entail that the household spends a little less time working. In more realistic models, which assume imperfect risk sharing and labour market frictions, for example that time and costs are associated with finding a new job, there are substantial welfare costs associated with variations in employment. Monetary policy should then stabilise employment/unemployment in addition to inflation.[17]

There will normally be no conflict between stabilising output and stabilising employment. Only if there are substantial fluctuations in productivity, can a conflict arise in the short term.

16 See Galí et al (2007). In certain models, fluctuations are efficient and should not be counteracted, but such models are based on strict and to some extent unrealistic assumptions, for example that all prices and wages are flexible.

17 Se Blanchard and Galí (2010).

Both the supply and demand for labour will vary as a result of business cycle fluctuations. During downturns, when labour demand is low and job prospects are poor, labour supply will be lower than its underlying trend. For example, young people may choose to continue their education rather than seek work. Conversely, labour supply will periodically be higher than the underlying trend when labour demand is high and job prospects are favourable.

Over time, employment is limited by the underlying labour supply trend. At the same time, there will always be some unemployment in the economy. This is partly because there will always be some people who are temporarily between jobs, and because employers' needs do not fully match the qualifications and wage expectations of those seeking work. In the literature, this is referred to as natural unemployment or equilibrium unemployment. This unemployment can change over time in response to structural changes in the labour market. The underlying labour supply trend minus equilibrium unemployment can be referred to as potential employment. This may be interpreted as the level of employment sustainable over time. If employment remains above potential, pressures normally arise that accelerate wage growth and bring inflation above target. However, there may be temporary fluctuations in labour supply for cyclical reasons. How much a given deviation in employment from potential employment affects wage growth may therefore vary.

New Keynesian literature often assumes that potential employment is lower than the socially optimal level of employment. The reasons are that firms have market power and limit output to earn higher profits by keeping price margins high, and that wage earners have market power and drive wages above a level consistent with full employment.

There is broad consensus among economists that an expansionary monetary policy can increase output and employment in the short term, but that it cannot raise these levels permanently. Attempting to keep employment permanently above potential employment will only lead to high price and wage inflation.[18] To ensure price stability, the level of ambition for monetary policy should be to stabilise employment close to the highest level consistent with price stability over time.

In standard models, it is usually assumed that economic shocks are symmetric around a trend. In these models, monetary policy can only affect variations in output and employment around these trends. Stabilisation policy only affects the variance of real economic variables – not the average.

Some of the literature assumes instead that economic fluctuations are asymmetric. A pure example of asymmetric fluctuations is the "plucking" model, developed by Milton Friedman.[19] In this model, negative shocks generate cyclical fluctuations, bringing output and employment below

18 See Kydland and Prescott (1977) and Clarida et al (1999).

19 See Friedman (1964, 1993). See also Dupraz et al (2019) for empirical support and the microfoundations of the "plucking" model.

potential. Thus, potential output and employment are ceiling levels and not average levels as in standard models. If the plucking model is correct, traditional ways of estimating potential output and employment will systematically underestimate their potential levels.

Another example of asymmetry is when the occurrence of economic crises (for example financial crises) can result in downturns that are deeper and more protracted than upturns, owing to hysteresis effects in the labour market[20], for example, and because high debt levels can dampen demand for a long period and reduce investment.[21] If economic policy can counteract such sharp downturns, this would raise the average level of output and employment. Much of the research on this topic has focused on the role of monetary policy in counteracting crises. This is discussed later in Section 2.3.

Once a sharp downturn has occurred, monetary policy should in principle attempt to bring employment back to its pre-crisis level. A challenge with this approach is that such a policy could lead to sharply accelerating wage inflation if hysteresis effects are present in the labour market. As long as any hysteresis effects are not permanent, it may be appropriate for policymakers to accept that inflation will be above target for a period until labour market conditions normalise. More jobs could then be created, bringing back some of those who have withdrawn from the labour market.[22] However, the risk of such a policy is that hysteresis effects can prove to be very prolonged or permanent. Monetary policy would then have to be tightened considerably at a later stage to bring inflation back to target.

To the extent that such asymmetries as described above exist, monetary policy can in principle not only reduce the variation in output and employment, but also, coupled with an active stabilisation policy, contribute to higher average output and employment.

Internationally, only central banks with what are referred to as dual mandates explicitly pursue the objective of high employment. The US Federal Reserve (the Fed) has such a dual mandate, where the objectives of high employment and price stability are of equal importance. In the US, the mandate is formulated as "maximum employment[23], stable prices and moderate long-term interest rates". In 2020, the Fed affirmed that it may be necessary to target inflation of somewhat above 2% after a period of below-target inflation. The objective is to achieve inflation that averages 2% over time. At the same time, the Fed clarified that while it previously reacted to "deviations" in employment from the Fed's estimated "employment's maximum level", it would now only react to "shortfalls" in employment from this level. The Fed's strategy attempts to prevent

20 Hysteresis refers to persistent unemployment that rises with every swing in the economic cycle. One explanation for this phenomenon is that in an upturn demand in the labour market is for different or a higher level of skills than the skills that became redundant in the preceding downturn.

21 See Blanchard et al (2015).

22 Such a strategy is proposed by Rudebush and Williams (2016) and Ball (2015), among others.

23 "Maximum employment" is specified as the highest employment level of employment that is sustainable over time, see Williams (2012).

employment falling below a maximum level. The consequence of this is that the Fed will not tighten monetary policy solely in response to what appears to be a tight labour market.

In New Zealand, a new operational monetary policy objective was added to the price stability objective for the RNBZ in 2018. The RBNZ was now to also "contribute to supporting maximum sustainable employment (MSE)" [24]. The RBNZ itself defined MSE as "the highest utilisation of labour resources that can be maintained over time without generating an acceleration in inflation".[25] MSE and price stability were given equal status, thereby formally instituting a dual mandate for the RBNZ.[26]

However, in 2023, a new government was formed that viewed the change to a dual mandate in 2018 as potentially harmful and argued that New Zealand should return to a system whose sole focus was price stability. The Finance Minister stated: "With no hierarchy of objectives, the introduction of a dual mandate heightened the risk of a future policy error – with monetary policy led in multiple directions, even as inflation embedded itself in the economy."[27] The Reserve Bank of New Zealand Act was amended in December 2023[28], and the country returned to a single price stability mandate for monetary policy.

In Sweden, a new central bank act was decided on in 2022, which came into effect on 1 January 2023.[29] Price stability continues to be the over-riding objective, and the Riksbank will consider but will not assign equal weight to real economic developments. The Riksbank will also contribute to ensuring that the financial system is stable and effective and that the general public can make payments.

2.2.2 Norges Bank's interpretation and clarification

Sustaining employment at the highest possible level is an overriding goal of economic policy and decisive for the welfare of society. Contributing to sustaining the level of economic activity so that as many people as possible can find work without having to search for too long is therefore an important consideration for monetary policy as well. Under the mandate for monetary policy, Norges Bank shall contribute to high and stable output and employment.

In the conduct of monetary policy, the word "high" is given an operational interpretation that takes into account what monetary policy can and cannot affect. The level of ambition for monetary policy must be realistic. In line with other central banks with similar objective formulations, Norges Bank has interpreted "high" as the highest level consistent with price stability over time. If a central bank systematically seeks to bring employment above this level by means of an expansionary monetary

24 See Reserve Bank of New Zealand (2018a).
25 See Reserve Bank of New Zealand (2018b).
26 See Williams (2019).
27 See Willis (2023).
28 "Reserve Bank of New Zealand (Economic Objective) Amendment Bill".
29 See Sveriges Riksbank (2023a)

policy, a period of tighter monetary policy and higher unemployment may be necessary at a later stage in order to restore price stability. The highest level of employment consistent with price stability over time is primarily determined by structural conditions such as wage formation, the tax and social security system and population composition. The highest sustainable level cannot be observed directly and will vary over time.

Norges Bank estimates an *output gap*, which is used as an indicator in assessing output and employment relative to the highest level that is consistent with price stability over time. When estimating the output gap, particular weight is given to labour market developments, while short-term fluctuations in labour productivity are normally disregarded. There is therefore normally no conflict between high and stable output and high and stable employment in the Bank's operational interpretation of the mandate.

Cyclical fluctuations are asymmetrical, with downturns often deepening and developing faster than upturns. In addition, the economic costs of cyclical fluctuations are in themselves asymmetrical. High unemployment entails substantial and direct costs both in the form of losses in aggregate income and output and in the form of welfare consequences for individuals who cannot find work. Strong pressures in the labour market may, in turn, entail costs for firms in the form of unfilled vacancies and recruitment costs. But these costs are probably considerably lower than the costs associated with high unemployment.

Possible hysteresis effects can also contribute to asymmetry in the costs of cyclical fluctuations. When downturns are deep and protracted, unemployment can become entrenched at a high level, with many job seekers eventually ending up outside the labour market. Wage and price inflation can then accelerate at a lower level of employment than before the downturn.

In its monetary policy reaction pattern, Norges Bank seeks to take account of the asymmetry of cyclical fluctuations and their costs. By preventing downturns from becoming deep and protracted, monetary policy can contribute to keeping the average level of employment over time as high as possible. If there are signs that hysteresis effects may have occurred following a downturn, it may be appropriate to accept that inflation will temporarily overshoot the target while labour market conditions normalise.

The policy rate affects different groups of households and different industries in different ways. Monetary policy is not a suitable tool for distribution policy or for influencing individual industries because the policy rate affects the economy broadly and cannot be targeted. Nevertheless, the effects of monetary policy on different groups of households and different industries must be taken into account, partly because of the implications for the aggregate impact of the policy rate on the level of activity.

Norges Bank's estimates of the output gap[1]

Norges Bank bases its assessments of the output gap on a broad set of indicators and models that are revised and expanded over time. Particular weight is given to labour market developments. The output gap is defined as the percentage difference between actual and potential mainland output. Potential output means the highest level of output and employment compatible with price stability over time. The methods used to estimate and analyse the output gap in the Bank's analysis system are based on an assumption that cyclical fluctuations do not affect output and that the output gap will normally be close to zero in the estimates within a five-to-10-year horizon. Theories about hysteresis and about whether cyclical fluctuations can affect potential output challenge this assumption and imply that there may be other measures of potential output that take into account hysteresis effects. There are few established methods for estimating this level, but this is an area that the Bank is continuing to explore.

The output gap is not observable, and there is no widely agreed best method for estimating it. No method is without its drawbacks and all methods involve the use of judgement. As the output gap is unobservable, it is also challenging to evaluate the different methods for estimating it.

A good measure of the output gap should nevertheless satisfy certain criteria. The estimate of the output gap should have good real-time properties, ie the historical estimates of the output gap should show little change as a result of new information. Moreover, a common interpretation of potential output is output consistent with stable price and wage inflation. In periods when capacity utilisation is high and employment is growing rapidly relative to the labour force, price and wage pressures tend to increase. A good measure of the output gap should therefore provide information about future developments in inflation and wage growth. A positive output gap implies that the economy is operating above potential and that growth will eventually slow. A good estimate of the output gap should therefore provide an indication of future output growth, as well as some indication of developments in unemployment, since unemployment has historically tracked the output gap with a lag.[2]

Many methods can be used to measure the output gap.[3] The most widely used methods are simple univariate methods (statistical filters). These methods are simple in practice and characteristically only use GDP data. The so-called Hodrick-Prescott (HP) filter is an example of a univariate method.[4] There are also a number of multivariate models which, in addition to GDP data, use data on other variables. Such models have

1 The box is based on Furlanetto et al (2022).

2 Se Armstrong (2015) and Kamber et al (2017).

3 See Hjelm and Jonsson (2010) for an overview.

4 The HP-filter yields potential GDP by minimising the difference between actual and potential GDP, given a limitation on how much potential GDP growth can vary over time (see Hamilton (2017) for an extensive discussion of the HP filter).

much better real-time properties and also have better real-time forecasting properties compared with simple univariate methods such as the HP filter.

To estimate the output gap, Norges Bank uses a set of multivariate models. This is because, on the whole, an average of multivariate models has featured better forecasting properties than the individual models. The models use data on both real and nominal variables. The models are based on two different multivariate methods: unobserved component (UC[5]) models and structural VAR (SVAR) models[6]. In addition, the Bank looks at various labour market indicators when estimating the output gap.

A UC model posits that GDP can be decomposed into an output gap and potential GDP, which are both unobservable. In addition, the model specifies how the unobserved variables evolve over time. The estimation of these equations uses information about variables such as real wage growth, unemployment, business investment, inflation, credit and house prices. At Norges Bank, eight different UC models are estimated. The models differ in terms of estimation frequency, the data used, estimation period and modelling of potential growth. All of the models are estimated using Bayesian methods and are based on published articles on the output gap.[7]

Like the UC models, SVAR models use data from a number of variables to estimate the output gap. The Bank estimates two SVAR models. One (SVAR 1) uses GDP growth for mainland Norway and unemployment (NAV), while the other (SVAR 2) also includes domestic inflation.

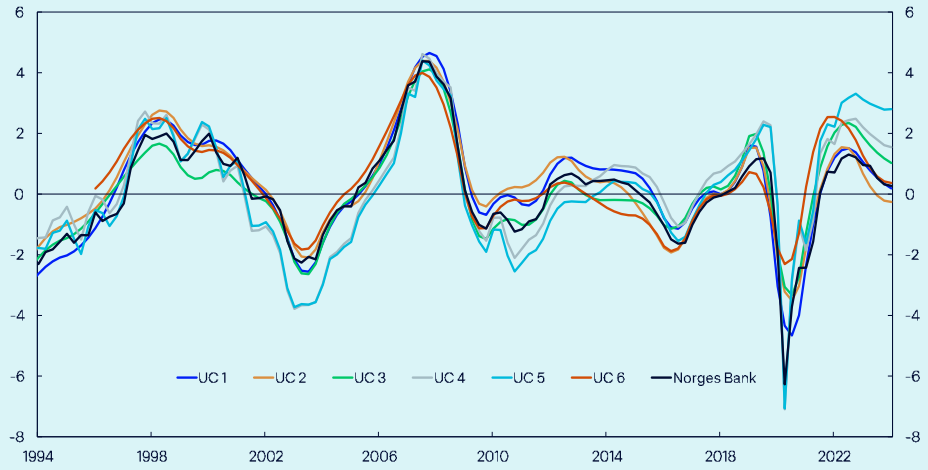
The charts below show estimates from the different models together with Norges Bank's assessments of the output gap as presented in *Monetary Policy Report* 1/24. Charts 1 and 2 show estimates based on the UC models. For Chart 1, information on real wage growth, unemployment, business investment and inflation was used. For Chart 2, information on credit and house price developments was used. Chart 3 shows estimates based on the two SVAR models. Chart 4 shows an average of the models together with the Bank's output gap. Overall, the various models are closely in line with the Bank's estimates of capacity utilisation over time.

5 Unobserved component models.

6 Vector-autoregressive (VAR) models are stochastic models used to capture the linear relationship between time series. A structural VAR model is a VAR model on which restrictions have been imposed based on economic theory.

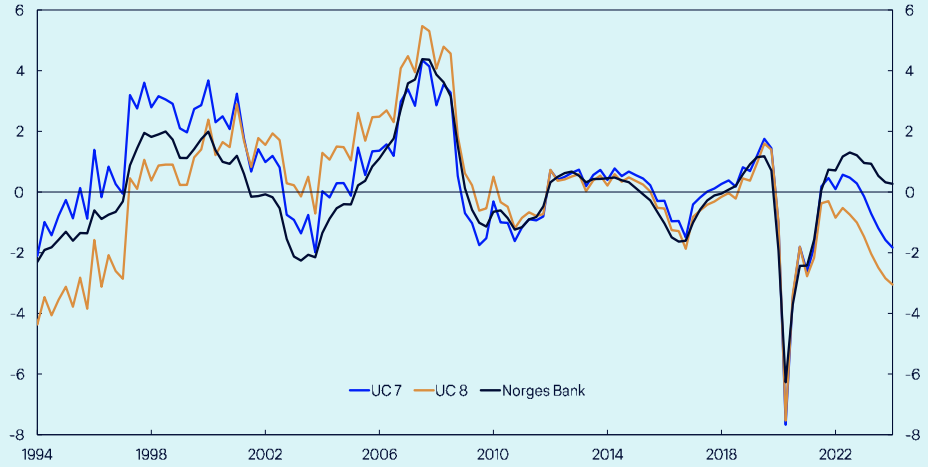
7 See Furlanetto et al (2022) for references.

Chart 1 UC-models 1–6
Percent. 1994 Q1 – 2024 Q1



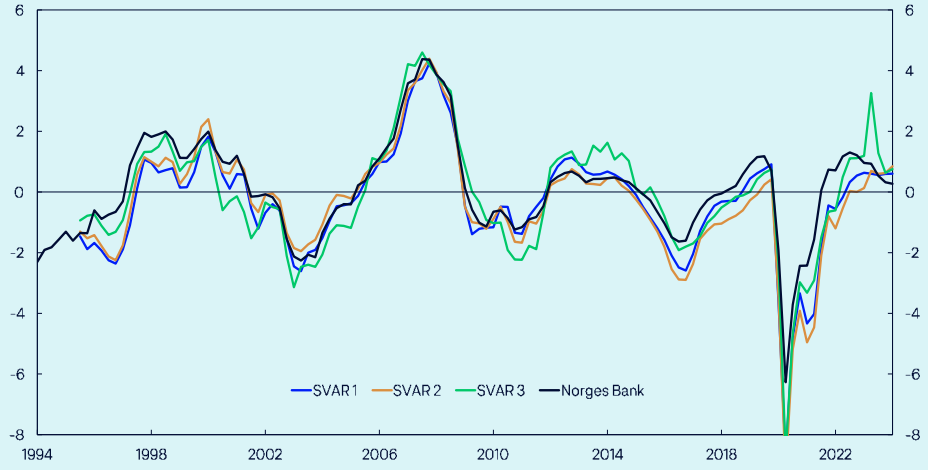
Source: Norges Bank

Chart 2 UC models 7–8
Percent. 1994 Q1 – 2024 Q1



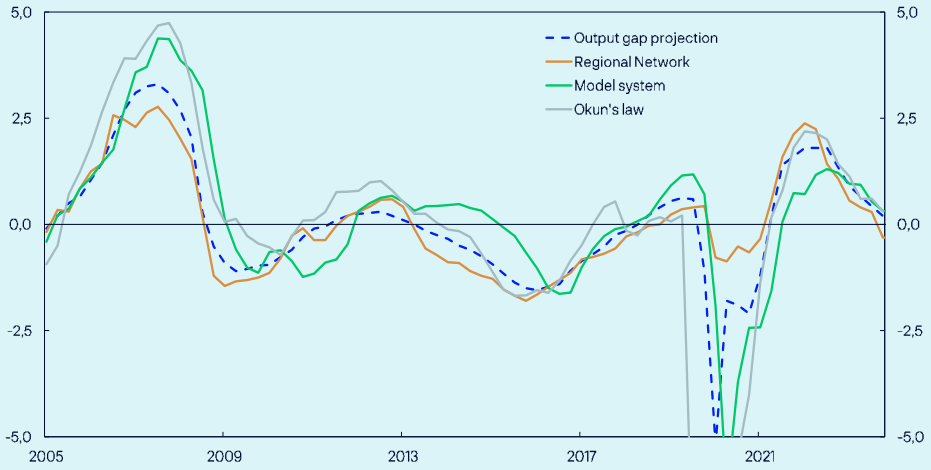
Source: Norges Bank

Chart 3 SVAR models
Percent. 1994 Q1 –2024 Q1



Source: Norges Bank

Chart 4 Model estimate, indicators and output gap projection
Percent. 2005 Q2 – 2024 Q1



Sources: Statistics Norway and Norges Bank

Norges Bank's assessments of the output gap include a number of important indicators, which so far are not included in the above-mentioned models. One reason is that there is little historical data for several of these indicators. An important example of such an indicator is the Bank's Regional Network contacts' assessment of capacity utilisation and labour supply in the Regional Network (Chart 4). The Bank will work to include this information in the Bank's modelling system. Chart 4 also shows what Okun's law indicates regarding the output gap. *Okun's law* is based on an estimated deviation from the trend of registered unemployment as a share of the labour force. As unemployment itself represents economic slack, there is a strong relationship between output and unemployment.

Norges Bank's estimate of potential output can at all times be read implicitly from output gap estimates together with current output figures. Nevertheless, separate calculations are made for the drivers of potential output, trend productivity and the highest level of employment that can be maintained over time without driving up wage and price inflation (N*). This serves both as a cross-check to output gap estimates and as an important input when estimating future growth in potential output.

When employment is projected to be above N*, output is usually above potential. When projected to be below N*, employment appears to be able to increase without the risk of accelerating wage and price inflation. N* is estimated in a model with 30 demographic groups across age, gender and education.[8] Projections are primarily based on estimates from individual groups together with Statistics Norway's demographic projections. In addition, assessments are made of the effects of other conditions such as the inflow of non-resident workers. Trend productivity projections are based on observed trend productivity. The historical growth rates and productivity projections are shown in Table 1, where a

8 See Ellingsen et al (2024) and Norges Bank (2024b).

falling trend in potential output growth can be observed. The average growth rate in the period between 2010 and 2023 was 1.8%, compared with 3.1% in the 15 preceding years. The projection ahead is even lower, reflecting lower underlying productivity growth.

Table 1 Output and potential output[1]

	Percentage change from previous year					
	1995–2009	2010–2023	2024	2025	2026	2027
Mainland GDP	3.1	1.9	0.5	1.2	1.3	1.6
Potential output	3.1	1.8	1.3	1.6	1.5	1.4
N*	0.8	1.1	0.8	1.0	0.9	0.8
Trend productivity	2.3	0.7	0.5	0.6	0.6	0.6

1 The contributions from N* and trend productivity do not necessarily sum exactly to the annual change in potential output due to rounding.

Capacity utilisation during the Covid pandemic

Assessing the output gap through the pandemic has been more challenging than normal. Usually it is reasonable to assume fairly steady growth in the economy's potential output, which reflects developments in the capital stock, working age population and productivity level in the economy. But the shutdown of the economy in 2020 was a large and unusual shock that affected both the supply and demand sides of the economy.

It was assumed that part of the fall in GDP was ascribable to a temporary decline in potential GDP. Some of the factors of production in some industries were not available owing to lockdown. For example, real capital could not be utilised by firms that had been closed.

On the other hand, there was a historic increase in unemployment. Even though much of the rise in unemployment was due to furloughs, ordinary unemployment also rose. Unemployment also increased in sectors not directly affected by lockdown. Labour market developments therefore indicated that the economic downturn triggered spare capacity in the economy and thus a negative output gap. Put another way, demand in the economy fell more than supply. The fact that the Covid crisis both reduced potential output and led to a negative output gap is well in line with assessments made by other central banks.[9]

9 See eg Bodnár et al (2020)

2.3 “Counteracting the build-up of financial imbalances”

2.3.1 Literature and international practice

Financial crises are rare events, historically occurring every 15 to 20 years.[30] Empirical studies show that financial crises involve higher costs than other recessions and that debt-driven upturns are associated with deeper and more persistent recessions and crises (see also Section 2.2) often referred to as “credit bites back”.[31] The global financial crisis in 2008 showed that instabilities in the financial system can have very adverse macroeconomic consequences.

There is a broadly held view among central bank economists that the regulation and supervision of financial institutions, including macro-prudential policy, should be the first line of defence against shocks to the financial system. Monetary policy can counter the build-up of financial imbalances by “leaning against the wind”. When there is a risk of a build-up of financial imbalances in the economy, the policy rate will be kept higher than would otherwise have been the case. The purpose is to mitigate downside risks to the economy and thus reduce the risk of financial imbalances triggering or amplifying a downturn.[32] [33]

Since financial crises are relatively rare, the empirical basis is uncertain. However, research indicates that monetary policy can contribute to some extent to reducing the likelihood and severity of future crises.[34]

The cost of “leaning against the wind” is a policy rate curbing, for a period, output and inflation more than would normally be implied by the central bank’s response pattern. If the policy rate is systematically kept higher than implied by price stability considerations, this may affect average inflation over time and inflation expectations may fall.

No clear consensus has been reached, among researchers or policy-makers, on whether monetary policy should “lean against the wind”. Some conclude that the benefit of “leaning”, in the form of reduced probability and severity of a crisis, is most likely lower than the costs of such a policy.[35] But there are also studies that show that “leaning” may be favourable in certain situations, particularly when implemented early in a≈period of strong asset price inflation and credit growth.[36] Among the large international institutions, the Bank of International Settlements (BIS) has long argued that central banks should “lean against the wind”[37],

30 See Taylor (2015).

31 See Jordà et al (2013).

32 Financial stability considerations are primarily linked to the risk of sharp economic downturns, but there may also be other reasons for stabilising financial variables. In recent years, economic literature has shown that large movements in asset prices, such as house prices, can result in random distributional effects and create uncertainty about the future scope for consumption.

33 The benefit is particularly high if economic agents underestimate the risk of a crisis and if crisis dynamics are amplified by financial imbalances. See Gerdrup et al (2016).

34 See BIS (2016).

35 See Svensson (2016), Ajello et al (2016) and Pescatori and Lasèen (2016).

36 See Ajello et al (2016) and Guorio et al (2016).

37 See Borio (2014) and Juselius et al (2016). See also Borio (2016) and Filardo and Rungcharoenkitkul (2016).

while the International Monetary Fund (IMF) has been more sceptical.[38] Different results are arrived at owing to alternative assumptions about economic relationships and the estimated effects of the policy rate on output and inflation on the one hand and financial imbalances and crisis severity on the other.

How financial stability considerations are taken into account differs among inflation-targeting central banks, but the main tendency is that monetary policy is rarely used to counter financial imbalances. The conclusion drawn by the Bank of Canada in connection with its regular review of its monetary policy framework is similar to the view reflected in research from the IMF.[39] The Bank of Canada concluded that monetary policy should be adjusted to address financial imbalances only in exceptional circumstances and that the effective use of macroprudential tools "will reduce the incidence of significant tension between monetary policy's objective of low and stable inflation and potential risks to financial stability". In its most recent review of monetary policy in December 2021, the Bank's view was very similar to the view expressed in 2016. The Bank wrote the following: "The Bank will continue to assess financial system vulnerabilities, recognising that a low interest rate environment can be more prone to the development of financial imbalances. A variety of other policy instruments, such as macroprudential tools, are better suited than monetary policy to address these vulnerabilities. But because monetary policy can exacerbate financial vulnerabilities, the Bank will continue to be mindful of the risk that such vulnerabilities can lead to worse economic outcomes down the road."[40]

The US Federal Reserve (the Fed) has expressed scepticism about using the policy rate to counter financial imbalances other than as an option if other alternatives should prove not to function.[41] In August 2020, the FOMC published a new "Statement on Longer-Run Goals and Monetary Policy". In the statement, the consideration of financial stability was noted explicitly: "Moreover, sustainably achieving maximum employment and price stability depends on a stable financial system. Therefore, the Committee's policy decisions reflect its longer-run goals, its medium-term outlook, and its assessments of the balance of risks, including risks to the financial system that could impede the attainment of the Committee's goals".

In its monetary policy strategy, the European Central Bank (ECB) appears open to greater flexibility in responding to the downside risks arising from financial imbalances. The ECB writes that: "The monetary and financial analysis also provides for a more systematic evaluation of the longer-term

38 See IMF (2015). The report concludes that the response pattern of monetary policy should probably not be adjusted to take account of financial stability because the policy rate is too blunt an instrument for financial stability purposes, and because there most often will not in any case be a conflict between the objectives of stable output and inflation and the objective of financial stability. The report also emphasises that it is not always easy in real time to determine the strength of an economic upturn.

39 See Bank of Canada (2016) in connection with the renewal of the inflation target.

40 See Bank of Canada (2021).

41 See Yellen (2014), Brainard (2017) and Quarles (2019).

build-up of financial vulnerabilities and imbalances and their possible implications for the tail risks to output and inflation."[42]

In the period between mid-2010 and over a few subsequent years, Sveriges Riksbank monetary policy "leaned against the wind".[43] The Riksbank was worried about the rapid rise in household debt and house prices over some time. To curb the rise in house prices and debt, the policy rate was set slightly higher than would otherwise have been the case. When inflation did not rise as expected and inflation expectations fell after a period, the Riksbank abandoned "leaning against the wind" to avoid undermining confidence in the inflation target. The policy rate was set at negative levels for a period and alternative instruments were subsequently introduced, such as the purchase of government bonds. See Section 3.5 for a further discussion on alternative instruments.

It has become more common in recent years to quantify risk associated with financial imbalances by using a "Growth-at-Risk" framework.[44] The framework is empirical and can be used to link measures of financial imbalances to forecasts of downside risk in the economy somewhat further ahead. The IMF actively uses this framework when monitoring financial stability.[45] One of the findings in this literature is that expansionary financial conditions (eg high house price inflation and credit growth) may lead to reduced downside risk for the economy in the short term (around one year), but higher downside risk in the medium-term (around three years). In a situation with weak developments in output, employment and inflation, a balance must therefore be struck between the benefits of an expansionary monetary policy stance in the short term and the risk that vulnerabilities build up and make targets more difficult to achieve further out. Conversely, a contractionary monetary policy stance can lead to greater near-term downside risk, but greater future benefit as household and corporate deleveraging can lead to a reduced risk of downturns. If households and non-financial firms are highly vulnerable at the outset, it may require particularly demanding trade-offs.[46]

It is difficult in practice to decide whether central banks "lean against the wind" to some extent as monetary policy should in any case respond to changes in financial variables because these variables have an impact on activity levels. Perhaps the difference between central banks that "lean" (at times) and central banks that do not appear to "lean" is less in practice than indicated by the literature and debate.

2.3.2 Norges Bank's interpretation and clarification

Norway's Regulation on Monetary Policy states that "inflation targeting shall be forward-looking and flexible so that it can contribute to high and stable output and employment and *to countering the build-up of financial*

42 See ECB (2021a).

43 See Ingves (2019).

44 See eg Adrian et al and Aikman et al (2019). For an empirical application of Norwegian data, see Arbatli et al (2020).

45 See IMF (2017).

46 See Liang and Adrian (2019).

imbalances. A build-up of financial imbalances increases the risk of a sharp downturn further out. The consideration of mitigating financial imbalances therefore derives to a great extent from the consideration of high and stable output and employment over time.

Monetary policy cannot take primary responsibility for mitigating the build-up of financial imbalances. The regulation and supervision of financial institutions are the most important tools for cushioning shocks to the financial system.

A persistently low interest rate level can sow the seeds of increased risk-taking and rapid debt accumulation. High debt makes households and firms more vulnerable to income shortfalls, raising the risk of a severe downturn in the future. If there are signs that financial imbalances are building up, the consideration of longer-term stability may warrant maintaining a somewhat higher policy rate than the consideration of maintaining high and stable output and employment in the short term may suggest. The extent of monetary policy tightening depends in part on other regulations and their effect.

Tightening monetary policy to mitigate the build-up of financial imbalances may involve costs in the form of lower demand in the near term. In the monetary policy assessments, Norges Bank weighs the consideration of reducing the risk of a severe downturn in the longer term against maintaining high and stable output and employment in the near term.

In many situations, the degree of conflict between the two considerations will be minimal. In an upturn, for example, property prices and credit will tend to rise sharply. A tighter monetary policy stance will then contribute to both greater stability in the short term and a lower risk of a severe downturn further out. In a situation where the risk of a severe downturn is acute, both the need to stabilise the real economy and maintain financial stability could suggest a rapid reduction of the policy rate as this could counteract a sharp decline in asset prices, which could have triggered or amplified a downturn.

In some situations, there may be a greater conflict between stability in the short and longer term. In a downturn, the policy rate will normally be reduced to curb the downturn. Even though a lower level of activity in the economy also curbs house price inflation and debt growth, a lower interest rate will, in isolation, stimulate the housing market. Such a stimulus will often be desirable and contribute to restraining the decline in economic activity, but in some cases the rise in house prices and debt may be so large that it may conflict with the aim of longer-term stability. There may then be grounds for lowering the policy rate somewhat less or starting to normalise the policy rate a little earlier than implied by the objective of sustaining activity in the short term. In a situation where financial imbalances have already built up, there may also be a conflict between short- and long-term stability. In isolation, a higher policy rate will help reduce debt ratios and thereby mitigate vulnerabilities somewhat

further ahead. However, this consideration must be weighed against the fact that many households and firms may be more vulnerable to interest rate increases and a loss of income in the short term.

Financial imbalances are difficult to measure. Norges Bank uses a range of different indicators based on developments in asset prices and credit to assess whether financial imbalances are building up.[47]

2.4 Trade-offs between monetary policy objectives

Trade-offs between monetary policy objectives are largely based on judgement. Nevertheless, there may be grounds for some guidance for such trade-offs in monetary policy strategy. First, such guidance could improve the internal decision-making process and contribute towards more consistent trade-offs over time. Second, it would lead to a better public understanding of how the central bank makes trade-offs between various objectives and considerations. This may strengthen confidence in monetary policy and improve accountability.

As described above, three objectives are specified in Norges Bank's monetary policy mandate[48]:

1. Consumer price inflation close to 2% over time,
2. High and stable output and employment, and
3. Counteracting the build-up of financial imbalances.

There will often be a short-term conflict between some of these objectives. Striking a balance between the various objectives is an important part of monetary policy.

2.4.1 Literature and international practice

Good trade-offs have two requisite characteristics. First, better performance in achieving one objective should not entail poorer performance in achieving the others. That is, trade-offs must be efficient. Second, the degree to which the various objectives are achieved must reflect (i) the central bank's assessment of the importance of the different objectives, (ii) the effect of monetary policy on the objectives and (iii) the type of shock that has occurred (including the size and duration of the shocks).

An efficient trade-off often implies that the inflation gap (the difference between actual inflation and the 2% inflation target) and the output gap (the difference between actual and potential growth) have different signs. For example, if both gaps are negative, a more expansionary monetary policy may bring inflation closer to target and output closer to its potential level. If there are more than two objectives, for example if the consideration of counteracting the build-up of financial imbalances is also taken into account, there could be situations where it is efficient for the inflation

47 For an overview of the various indicators used to monitor financial stability, see Arbatli and Johansen (2017).
48 As stated in Section 2.1, the term objective is used for both objective and consideration.

gap and the output gap to have the same sign.[49] In many models with forward-looking rational expectations, it would be optimal for gaps to have the same sign for several periods after the occurrence of a shock, also when there are only two objectives.[50]

Monetary policy operates with a lag, with the largest impact of the policy rate on inflation and GDP normally occurring between one and two years after the policy rate has been changed. Therefore, in practice, inflation targeting means inflation forecast targeting. The Swedish economist and former Deputy Governor of the Riksbank Lars Svensson has had considerable influence on the research on inflation targeting and has shown in many of his papers how optimal flexible inflation targeting can be implemented.[51] Svensson's main principle is that the central bank should determine an interest rate path with corresponding inflation and output forecasts so that the expected loss, measured using a loss function with an inflation gap and output gap/unemployment gap, is reduced as much as possible. However, Svensson's approach to optimal flexible inflation targeting has been criticised by many, partly because it does not give sufficient weight to uncertainty and because the model may be misspecified.[52]

In practice, the degree of flexibility in inflation targeting has been linked to the time horizon for achieving the inflation target. The more weight the central bank places on the real economy (a higher lambda; see box on page 38 for a more detailed explanation) and the slower the monetary policy transmission mechanism, the longer the optimal time horizon for achieving the objective.[53] The optimal horizon also depends on the type and duration of shocks. A supply-side shock, which leads to a greater conflict between price stability and stability of the real economy, implies a longer optimal horizon than a demand shock.

Over time, inflation-targeting countries have tended to extend the target horizon. This change does not seem to be a result of a change of opinion regarding how quickly monetary policy has an impact but reflects the authorities' experience and increased understanding of the shocks that can occur. Inflation targeting has become more flexible.[54] The greater flexibility may also reflect the greater importance in the early phase of inflation targeting of building confidence in the inflation target, which could imply a less flexible inflation targeting regime.

Today, most inflation-targeting countries operate with a medium-term time horizon (Table 2.2). A medium-term horizon for achieving the inflation target generally implies that some weight is also given to other targets.

49 See Røisland and Sveen (2018).

50 This is because by promising to set the policy rate so that the inflation gap and the output gap have the same sign in the future, a benefit can be achieved today. For example, if a negative inflation shock occurs, the effect on inflation today would be less if the central bank commits itself to setting a policy rate that leads to high inflation and thus a positive output gap in the future because forward-looking firms take this into account when determining current inflation. See Clarida, Galì and Gertler (1999).

51 See Svensson (2010).

52 See Orphanides (2007).

53 See Smets (2000).

54 See Paulin (2006).

A medium-term time horizon has the advantage of being able to anchor inflation expectations and permit short-term deviations from the target when the economy is exposed to shocks.[55] Extending the horizon does not appear in general to have weakened confidence in central banks.[56] Indeed, this change may have been possible because the credibility of the inflation targeting regime has increased over time.

In the recent period, a number of central banks have signalled their intention also to take climate-related considerations into account in the conduct of monetary policy (see box on page 46. The more considerations monetary policy must take account of, the more difficult the trade-offs will be. There is a vigorous debate among academics and practitioners around the world about whether it desirable and/or possible for central banks to take climate-related considerations into account in the conduct of monetary policy.

2.4.2 Norges Bank's interpretation and clarification

The policy rate path is intended to provide a reasonable trade-off between the various monetary policy objectives. What is a reasonable trade-off is primarily based on judgement, and the monetary policy mandate does not provide clear guidance on how to strike a balance between objectives.

In principle, an assessment of the importance of the various objectives is reflected in their weights in the loss function. Loss functions are discussed in further detail in the box on page 42. In Norges Bank's main model NEMO, the policy rate assumptions and other variables are derived based on the minimisation of a loss function.

As described in Section 2.3, it is difficult to operationalise financial imbalances in terms of a concrete variable or indicator. The box on page 38 provides a further account of the trade-offs and the objective of counteracting the build-up of financial imbalances. This consideration in particular has led the Bank to decide to deviate from a reasonable trade-off between the forecasts for the inflation gap and the output gap. But the consideration of uncertainty as to the effects of the policy rate has probably also played a part. (See SSection 3.4 for further discussion about uncertainty).

As described above, it has been common practice among inflation-targeting central banks to let the trade-off between the inflation target and other targets and considerations be represented in the choice of *horizon* for achieving the inflation target. In the first few years after the introduction of inflation targeting in Norway, Norges Bank had a two-year horizon. This was then common practice for inflation-targeting central banks. The horizon gradually became more flexible, and perhaps the Bank's horizon was more flexible than the horizon of other inflation-targeting central banks. This has been expressed by inflation projections

55 See Hammond (2012).
56 See Paulin (2006).

that have often not returned to target within the projection horizon in the Bank's monetary policy reports, which is about three years.

The Bank does not currently specify any particular horizon. The time horizon for bringing inflation back to target will depend on the extent to which inflation stabilisation comes at the expense of high and stable output and employment. If, for example, inflation has risen above target when unemployment is high, the time horizon for bringing inflation back to target will normally be longer than when the labour market is better balanced. The Bank's Monetary Policy Report includes the current time horizon for when inflation is projected to return to target.

When assessing the time horizon for achieving the inflation target, Norges Bank will take into account the effect of the deviation from the target on confidence in the inflation target. Confidence cannot be measured precisely, but can be assessed using various indicators, such as the market's expectations of future inflation and movements in financial markets.

When economic agents expect inflation to return to target after a deviation, disturbances affecting the economy will have less impact on inflation. The duration of a higher level of inflation will be shorter if firms and the social partners expect inflation to come down and take this into account when setting prices and wages. In addition, the exchange rate will normally appreciate when inflation rises unexpectedly because FX market participants expect the policy rate to be set higher in order to stabilise inflation. Similarly, the exchange rate will normally depreciate in the event of an unexpected decline in inflation. With confidence that the central bank will stabilise inflation, the exchange rate will therefore contribute to stabilising inflation when unexpected changes in inflation occur.

Modelling objectives and trade-offs: Loss functions

It is common in the literature to present monetary policy objectives with the aid of a "loss function". The policy rate paths generated by NEMO are based on this kind of loss function. The term "optimal policy" is often used for the monetary policy derived by minimising a loss function in a given model.

The loss function is intended to reflect decision-makers' preferences in the trade-off between objectives. Like all models, a loss function is simplification of reality, where assumptions are made inter alia about the function's form. A possible "translation" of the Regulation on Monetary Policy to a loss function is as follows:

(1) $L_t = (\pi_t - \pi^*)^2 + \lambda(y_t - y_t^*)^2$

where π_t is inflation in period t, π^* is the inflation target, y^t is output and y_t^* is the highest level of output compatible with price stability. y can also be an employment target. λ is the weight decisions-makers place on stability in output/employment relative to the weight on stable inflation. L_t measures the loss in each period, but monetary policy is to be forward-looking and minimise an expected discounted loss:

$$E_t \sum_{k=0}^{\infty} \beta^k L_{t+k}$$

where β is the discounting factor. In this loss function, deviations from the targets are squared. This is a common assumption, for which there are several reasons. First, such an assumption is often necessary to solve for an optimal policy in the model. Second, quadratic loss functions treat deviations from the targets symmetrically. For example, below-target inflation is just as "costly" as corresponding above-target inflation. Third, quadratic loss functions entail that narrow deviations from the target mean little, eg that inflation is 2.1 and not 2.0%, while wider deviations have considerable bearing. Given the uncertainty about the "optimal" inflation rate for an economy and challenges in measuring inflation precisely, such a modelling of the costs of deviations from the target may seem reasonable. The same considerations apply to deviations from the level of output/employment compatible with price stability.

It is not necessarily the case that the central bank's attitude to deviations from the targets is always symmetrical. For example, Norges Bank considers deviations in employment from the highest level compatible with price stability as asymmetrical; there are appreciable costs associated with negative deviations from y_t^* while there are considerably lower costs associated with positive deviations (see Section 2.2.2). To take account of this, one can either specify an asymmetrical loss function, which makes estimation of the optimal policy more complicated, or one can make judgement-based deviations from the optimal policy with the aid of "monetary policy shocks", so that the policy rate path better represents policymakers' true preferences.

The Regulation on Monetary Policy also states that monetary policy shall contribute to counteracting the build-up of financial imbalances. It is not obvious how this consideration can be modelled in the loss function. It may be argued that the consideration of financial stability is not a separate objective but is derived from the consideration of high and stable output and employment over time. Financial imbalances can increase the risk of sharp economic downturns, ie a sharp decline in y_t further ahead. If the relationship between financial imbalances and the risk of sharp downturns is well represented in the model, minimising the loss function in (1) will result in a policy that provides an optimal monetary policy response to financial imbalances. In that case, there is no need for an extra expression in the loss function to represent financial imbalances.

However, in practice it may be appropriate to capture the consideration of counteracting financial imbalances with a separate expression in the loss function. There are two reasons for this: First, modelling the relationship between the stability of the real economy and financial imbalances poses a considerable challenge. Second, modelling such relationships fairly realistically will make the model cumbersome. This suggests a simple model, where the risk of sharp downturns is not modelled explicitly, but which is limited to the relationship between the interest rate and financial variables such as debt growth, house prices and other financial variables associated with increased risk of future downturns. The consideration of financial stability can then be modelled by adding an expression for financial imbalances to the loss function as follows:

$$(2)\ L_t = (\pi_t - \pi^*)^2 + \lambda(y_t - y_t^*)^2 + \gamma(f_t - f_t^*)^2$$

here, f_t is a relevant financial variable, or aggregate of several financial variables, and f_t^* is its equilibrium value. Both the output gap/employment gap $(y_t - y_t^*)$ and the financial gap $(f_t - f_t^*)$ are unobservable variables that must be estimated.

Like the output gap/employment gap, there are reasons for the financial gap to be included asymmetrically and not squared in the loss function. Financial stability concerns are generally greater if house price inflation and debt growth are higher than a normal level than if they are lower.

A risk associated with asymmetric targets is that they can lead to monetary policy biases. For example, a tendency to set a higher policy rate than otherwise if the financial gap is positive but not a correspondingly lower rate if the gap is negative could in isolation lead to average inflation that is too low. There may, however, be other asymmetries that can result in biases that are opposite in sign, such as the above-mentioned asymmetry in the output gap. The net effect of various biases on average inflation is in principle very difficult to estimate.

The loss function in the Bank's main model, NEMO, used as the basis for deriving the policy rate path, is:

$$(3)\ L_t = (\pi_t - \pi^*)^2 + \lambda(y_t - y_t^*)^2 + \gamma(i_t - i_t^*)^2 + \delta(i_t - i_{t-1})^2$$

where i_t is the nominal interest rate and i_t^* is the normal interest rate level, defined as the neutral real interest rate + the inflation target.

Currently, the Bank does not operate with an aggregate indicator, f_t, for financial imbalances, but uses various indicators and judgement-based assessments when performing assessments of financial imbalances. Instead, the Bank uses an expression for the deviation in the interest rate from the normal rate, $(i_t - i_t^*)$, to address some of this consideration. Intuitively, there is a greater risk of financial instability when the interest rate deviates substantially from its normal level.[1] In addition, the weight of the output gap is higher than otherwise, because there is a correlation

1 See Evjen and Kloster (2012).

between high aggregate demand and high house price inflation and credit growth.

In the Bank's operational loss function, an expression is also included for changes in the interest rate, $(i_t - i_{t-1})$. This expression is called "interest rate smoothing" and is commonly included in loss functions of this kind, even though interest rate smoothing is not an objective in itself. The primary motivation for interest rate smoothing is to obtain more realistic policy rate paths in line with decision-makers' preferences. Optimal policy without this expression tends to result in bigger changes in the interest rate than what is observed in practice. Central banks normally take a slightly gradual approach to interest rate setting, for reasons that are not necessarily captured by the model. Interest rate smoothing can also be motivated by its ability to have a favourable effect on agents' expectations.[2]

However, given the characteristics of this kind of model, the weights in the loss function will not necessarily reflect decision-makers' assessments of the importance of the various targets. The specification of the loss function must be viewed in the context of how the entire model is specified, where the primary consideration is to model the Bank's historical response pattern. A change in the specification or quantification of the model will generally result in a somewhat different response pattern. Changes in the model must therefore often "counteract" changes in the loss function for the response pattern emerging from the model to be consistent with the Bank's historical response pattern.

Judgement should be used in all use of models for policy purposes. The policy rate paths derived from NEMO and the loss function above will always be assessed and adjusted on the basis of judgement and other information. Because both the model and the loss function are simplifications, the weights in the loss function are not necessarily constant over time but may depend on factors not captured by the modelling system. In some cases, it may be correct to give weight to considerations other than those included in the loss function. Nevertheless, optimal policy will be a useful starting point for policy discussions and an aid for checking whether the response pattern is consistent over time.

2 Goodfriend (1991) shows that interest rate smoothing better enables the central bank to influence long-term interest rates. Woodford (2003) shows that interest rate smoothing provides a "gain from commitment" by making monetary policy history-dependent, which contributes to more stable inflation.

Monetary policy trade-offs illustrated by the forecasts of inflation and the output gap

In monetary policy theory, monetary policy trade-offs are usually represented by a loss function:

(1) $L = (\pi - \pi^*)^2 + \lambda y^2$,

where L is the loss, π is inflation, π* is the inflation target and y is the output gap[1]. Lambda () indicates how much weight the central bank places on output stability in relation to inflation stability.

The central bank's trade-offs, represented by the loss function, cannot be observed directly. Only the actual policy choices can be observed. If the loss function (1) is used as a basis, the actual policy choices will be represented by the first-order condition for minimising the loss. In simple models, it will look like this:[2]

(2) $\pi - \pi^* + \alpha y = 0$,

where $\alpha = \lambda/\gamma$, where γ is the slope of the Phillips curve (ie how much inflation increases when the output gap widens). In models with more realistic dynamics, the first-order condition becomes more complicated. Equation (2) can then be interpreted as a simple target criterion, which is an approximation of optimal trade-offs given the model.[3]

The target criterion (2) states that the central bank shall set the interest rate so that a weighted sum of the inflation gap ($\pi - \pi^*$) and the output gap is zero. It implies that the two gaps should have opposite signs.[4] For example, if both the inflation gap and the output gap are negative, the central bank will achieve better goal attainment with a lower interest rate, since this will bring both inflation closer to target and higher output and employment. When the two gaps have opposite signs, there will be a conflict between the two objectives; it is not possible to bring inflation closer to target without adversely affecting output and employment.

The weight on output and employment in relation to inflation is expressed in alpha (α). However, it is not obvious what a correct value for alpha is. If we start from the optimal value of alpha in simple models ($\alpha = \lambda/\gamma$), it depends on what is a reasonable value of lambda and the estimated slope of the Phillips curve. The Federal Reserve (Fed) has interpreted a dual mandate to mean that lambda is 1 in a loss function with an inflation and unemployment gap[5].[6] Lars Svensson, often referred to as "the father

1 For the sake of simplicity, (the logarithm of) the potential output is normalised to y* to 0 (ie Y*=1 and non-log form) (cf definition of the output gap in the box on page 38).

2 See eg Røisland and Sveen (2018).

3 The difference between a simple target criterion and the first-order criterion in more complicated models is related to the difference between a simple interest rate rule, such as the Taylor rule, and a more complicated optimal interest rate reaction function. Even if they are not optimal, simple rules and criteria can be more robust to the model being misspecified than optimal rules and criteria. See Giannoni and Woodford (2017) for an analysis of optimal target criteria.

4 This is sometimes referred to as the "Qvigstad rule" after Qvigstad (2006).

5 The unemployment gap is the deviation of unemployment from the lowest level consistent with price stability over time.

6 See Federal Reserve Bank of Chicago (2020). See also Debortoli et al (2019).

of inflation targeting" because of his influence on inflation targeting, also argues that inflation and unemployment should have approximately equal weight in the loss function under flexible inflation targeting, also when the mandate is hierarchical in the sense that low and stable inflation takes precedence in the trade-offs.[7] [8]

In the monetary policy literature, it is more common to use the output gap than the unemployment gap as an indicator of the real economy, but they represent the same consideration. When comparing loss functions with the output gap and the unemployment gap respectively, one must take into account the relationship between the two, often referred to as "Okun's Law", in order to obtain a lambda that represents the same weight on the real economy. In the United States, Okun's Law is approximately $u = -0.5y$, which implies that a weight on the unemployment gap of 1, as argued by the Fed and Svensson, implies the same emphasis as $\lambda = 0.25$ in equation (1).[9] Statistics Norway has estimated Okun's Law for Norway to be $u = -0.31y$, which is also in line with our estimates.[10] Given this estimate, an equal weight on unemployment and inflation in the loss function implies that lambda in equation (1) is $\lambda \approx 0.1$.[11]

In order to obtain an estimate of γ, ie how much inflation increases when the output gap increases, we have based our analysis on the relationship in our macroeconomic model NEMO. A temporary decline in the interest rate leads to an increase in inflation that is just over half of the increase in the output gap, which implies a value of γ just above 0.5.[12] This means that an 'equality' between inflation and unemployment, based on the Fed's and Svensson's interpretation, implies $\alpha \approx 0.2$ in the target criterion (2).

However, when applied in a purely operational context, interpreting 'equality' between inflation and unemployment is not obvious. While the Fed and Svensson interpreted that as assigning equal weight to inflation and unemployment in the loss function, it can also be interpreted as giving equal weight to inflation and the output gap. The latter interpretations would have implied in the target criterion (2) for Norway, ie ten times the weight it would have had if unemployment had the same weight as inflation in the loss function.

The target criterion (2) is based on current inflation and output, as most commonly formulated in simple theory models. In reality, monetary policy influences inflation and output with a lag. Given that lag, it is impossible in practice for monetary policy to satisfy a target criterion based on inflation and output in the current period because shocks occur that change inflation and the level of activity, and that monetary policy does not have time to counteract in the very short term. It is therefore more appropriate

7 See Svensson (2014).

8 See Section 2.2.1 for a discussion of the difference between an equal (dual) mandate and a hierarchical mandate.

9 To see it, one can start from the Fed's loss function $L = (\pi - \pi^*)^2 + u^2$ and replace u by $u = -0.5y$, which gives $L = (\pi - \pi^*)^2 + 0{,}25y^2$..

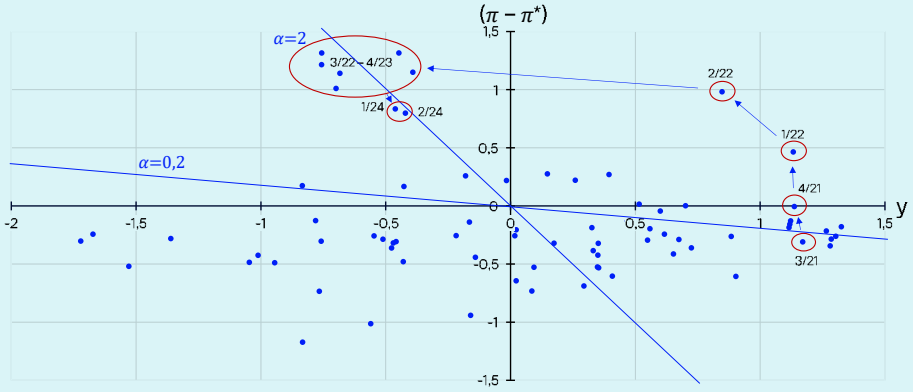
10 See Statistics Norway (2022), pp 16–17.

11 By replacing u in Fed's loss function with $-0.31y$, we obtain the following loss function which is equivalent to the Fed's «dual» loss function: $L = (\pi - \pi^*)^2 + 0{,}961y^2$..

12 See Kravik and Mimir (2019).

to focus on the *forecasts* of inflation and the output gap one to three years ahead. Over this horizon, the central bank is able to satisfy a target criterion such as (2).

Chart 1 Projections of inflation and output gap in previous monetary policy reports
Average 1–3 years ahead



Source: Norges Bank

Chart 1 shows combinations of inflation gap and output gap forecasts in various *Monetary Policy Reports* since Norges Bank began publishing interest rate forecasts in 2005.[13] The attainment of policy objectives is better the closer the points are to the centre, but the points will deviate from the intersection when shocks arise that result in short-term conflict between the two objectives.

The blue lines in the chart represent two versions of the target criterion – one () that represents the optimal criterion when equal weight is given to inflation and unemployment in the loss function, as argued by Yellen and Svennson, and one () that represents the optimal criterion if inflation and the output gap are weighted equally in the loss function.

As the chart shows, neither of the two target criteria provides a good description of the various forecasts. It can therefore be concluded that the assessments are more complex than can be summarised in a simple target criterion. Nor is it the case that the Committee only considers the forecasts of inflation and the output gap when assessing the interest rate path. For example, the Committee may place weight on risk factors that are relevant to the conduct of monetary policy, but which cannot easily be incorporated into the actual forecasts. This may at times generate substantial deviations from a simple linear relationship between the inflation and output gap forecasts, as implied by simple theoretical models.

It is also worth noting that in many of the *Monetary Policy Reports*, the inflation gap and output gap forecasts have the same sign. It is, seem-

13 Forecasts based on technical assumptions, such as market interest rate expectations, published before 2005, do not necessarily reflect the central bank's assessments, since market expectations may deviate from the policy rate path envisaged by the central bank.

ingly, a violation of one of the conditions for optimal policy. In particular, the cases where both gaps are negative, ie the points are located in the southwestern quadrant of the chart, have occurred frequently.

One important reason why Norges Bank has in many cases set up an interest rate path that results in inflation below target while the output gap is negative in its forecasts is the consideration of counteracting the build-up of financial imbalances. Even though a lower interest rate would have brought inflation further up to target and resulted in a less negative output gap, a very low interest rate may contribute to increased borrowing, higher property prices and thereby possible financial imbalances. This may in turn increase the risk of severe downturns further ahead. The consideration of mitigating the build-up of financial imbalances was a stated consideration in many *Monetary Policy Reports*, particularly in the years following the financial crisis, and particularly in the period 2016–2017. 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.[14]

Uncertainty surrounding the effects of monetary policy is also relevant to the trade-offs. An important result, shown by William Brainard in 1967, is that monetary policy should respond more cautiously to shocks when there is uncertainty about the effects of the interest rate.[15] When, due to this uncertainty, the central bank changes the interest rate less than would otherwise have been the case when disturbances occur, it may in some situations be the correct trade-off that both inflation and output gap forecasts have the same sign. If, for example, an inflation shock brings inflation above target while the output gap is positive, uncertainty about the effect of the interest rate may in theory imply that it may not be optimal to increase the interest rate to the extent that one of the gaps turns negative.

While in most cases both gaps are negative in chart 1, there are also some cases where both are positive. This was most pronounced in the first two *Monetary Policy Reports* of 2022, where forecasts in isolation indicate that goal attainment could have been better with a higher interest rate path. During this period, the Committee gave weight to the fact that the objective of stabilising inflation around the target somewhat further out implied a higher policy rate, but that uncertainty surrounding economic developments and households' response to a higher interest rate level suggested that the policy rate should be raised gradually.

Since autumn 2022 and through the period covered in Chart 1, the inflation gap has been positive over the forecast horizon, while the output gap has been negative on average. The forecasts therefore satisfy the requirement of different signs in the target criterion (2). The trade-offs in this period are more in line with a target criterion based on equal weighting of inflation and output than on equal weighting of inflation and unemployment in the loss function.

14 See Røisland and Sveen (2018).
15 See Brainard (1967).

Climate change, the macroeconomy and monetary policy

Climate change and measures to reduce greenhouse gas emissions will increasingly affect the global economy. The number and intensity of extreme weather events such as heat waves, droughts and floods is on the rise. At the same time, in order to reach the Paris Agreement targets to limit global warming to 1.5 degrees, the speed of the transition to a low-carbon economy must accelerate significantly.

The responsibility – and the most effective tools – to reduce greenhouse gas emissions lie with the political authorities. The policy rate, on the other hand, is not a targeted instrument for contributing to the transition. However, because climate change and climate transition affect economic developments, they affect monetary policy trade-offs.

Climate-related conditions affect the economy through both transitory shocks and more long-term structural changes. The economy can also be affected through the following mechanisms:[1]

- More frequent and more extreme weather events, such as drought and flooding, destroy crops, factories, value chains and infrastructure. This may result in a negative supply shock, with temporary increases in prices[2], resulting in supply chain disruptions within both the production and distribution of goods. At the same time, demand may be affected.[3] Norway is less exposed to extreme weather events than many other countries, but the Norwegian economy will also be affected, particularly through global effects on prices for energy and other commodities.
- Stricter climate policy, such as higher prices for greenhouse gas emissions (carbon prices) and regulations, may put upward pressure on prices in the near term while the effects in the longer term are uncertain.[4]
- Adapting to more extreme weather events requires higher investment in for example landslide and flood mitigation measures, while the transition to a low-carbon economy requires higher investment in renewable energy and other low-emission technology. Such investment may, in turn affect prices and activity levels as well as productivity and the structure of the economy.
- Uncertainty about future climate-related change (climate risk) also affects the economy today.[5] For example, uncertainty related to future climate policy or green technology may reduce business investment.[6]

1 See NGFS (2020a), Batten et al (2020) and Andersson et al (2020) for more details on how climate-related effects can impact the macroeconomy.

2 See Erlandsen et al (2023), Parker (2018), Faccia et al (2021) and Ciccarelli et al (2023).

3 See NGFS (2024a).

4 See NGFS (2024b).

5 Climate risk can affect among other things share prices, bank lending and exchange rates, see for example Bolton and Kacperczyk (2021) and Kapfhammer et al (2020).

6 See NGFS (2024b) and Berestycki et al (2022).

Climate change may also have an impact on monetary policy trade-offs. Extreme weather events, for example, may pull inflation and output in different directions and may – if the impact persists – make monetary policy trade-offs more demanding.[7] (cf. discussion in Section 3.4). Furthermore, climate transition may affect different groups, sectors or regions in different ways, which could in turn alter how policy rates affect the economy. Climate-related factors may also affect the neutral real interest rate (see Section 3.3.2 for a definition of the neutral real interest rate), for example through effects on growth potential in economies or owing to heightened uncertainty.[8] This may in turn have an impact on the monetary policy stance.

Climate-related work in international monetary policy

Internationally, many central banks are working to integrate climate change considerations into the analytical framework for monetary policy. For example, in recent years, in this field, the European Central Bank (ECB), has strengthened its analytical capacity within macroeconomic modelling, research and statistics[9], while the Bank of Canada is seeking to develop new models and methods sources to better understand climate-related effects on the Canadian economy.[10] The central banks in the UK, Japan, New Zealand, Sweden and Denmark are other central banks that have signalled that they are paying greater attention to how climate-related changes affect their countries' economies.[11]

Some central banks have a monetary policy mandate that requires them, as long as this does not comprise the primary goal of price stability, to support the government's broader policies that may include the transition to a low-carbon economy.[12] For example, the central banks of Sweden, the UK and the euro area have such mandates.[13] These three central banks have also, to some extent, taken climate considerations into account in their corporate bond purchase programmes ("green QE") (See Section 3.5 on alternative instruments).[14]

Climate-related work and monetary policy at Norges Bank

In Norway, climate considerations are not part of the monetary policy mandate. However, because climate change and the climate transition affect economic developments, Norges Bank works to enhance its understanding of how climate change and the climate transition affect the Norwegian economy.[15]

7 See Matsen (2019) and Kabundi et al (2022).

8 See Bylund and Jonsson (2020), Dietrich et al (2021) and Mongelli et al (2022).

9 See Drudi et al (2021) and ECB (2024b).

10 See Bank of Canada (2022).

11 See Bank of England (2024b), Bank of Japan (2021), Reserve Bank of New Zealand (2023), Sveriges Riksbank (2023) and Nationalbanken (2024).

12 According to an NGFS survey, about half have a mandate containing a formulation that monetary policy shall support the government's economic policies (see NGFS (2020b)). See also Dikau and Volz (2021).

13 See Sveriges Riksbank (2023b), the UK Government (2023), the ECB (2024a) and Sjøblom (2021).

14 See Sveriges Riksbank (2023b), Bank of England (2021) and ECB (2021b).

15 Climate change and the climate transition also have an impact on other parts of Norges Bank's activities, see Norges Bank (2023a), NBIM (2023) and Erlandsen et al (2022).

The climate transition is essentially an energy transition. Norges Bank therefore closely monitors developments in energy markets and is working to better integrate these markets into its analytical framework. The Bank conducts an annual survey of the effects of climate-related changes on enterprises in the Bank's Regional Network. The results from these surveys show that climate-related factors, and in particular factors related to the climate transition are affecting many enterprises, for example by resulting in increased investment.[16]

Norges Bank also cooperates with others – both within monetary policy and other areas – to increase knowledge about how climate-related changes affect the economy, particularly by participating in the Network of Central banks and Supervisors for Greening the Financial System (NGFS)[17]. Through the NGFS, Norges Bank contributes, among other things, to analyses of how climate-related factors affect the macro-economy in the near and medium term.

16 See Brekke et al (2023) and Norges Bank (2021a).

17 See www.ngfs.net/en for more information.

3. Response pattern

The monetary policy response pattern describes how the central bank applies its monetary policy instruments depending on the nature of the shocks that occur and the objectives and trade-offs between them. The response pattern also depends on how monetary policy influences the various objectives and economic forecasts. In addition, the response pattern depends on assessments of uncertainty about economic developments and the functioning of the economy, including the effect of monetary policy.

An important component of a description of the response pattern is the monetary policy instruments available and their effect on key economic variables. In this section, we will address this topic first. The response pattern also builds on a decision basis, and we will describe data and information sources, and the system of models included in the decision basis for monetary policy.

Since the response pattern describes the monetary policy response to various shocks, it is important to have a "zero point", ie how monetary policy should be oriented in the absence of shocks when the economy is in equilibrium. This is called neutral monetary policy. Estimating when monetary policy is neutral is not a trivial exercise, and what constitutes neutral monetary policy can change over time. We therefore begin with neutral monetary policy and indicators of monetary tightness before turning to how monetary policy, and the policy rate in particular, will deviate from this neutral level in the event of different shocks.

In conclusion, we look at tools other than the policy rate that central banks may have at their disposal and the types of shocks that can best be dealt with by an interaction between monetary policy and fiscal policy.

3.1 Monetary policy instruments

3.1.1 The policy rate and forward guidance

The most important monetary policy instrument is the sight deposit rate, often referred to as the policy rate. Forward guidance on policy rate developments can also be seen as an important instrument.

The policy rate is set by the Monetary Policy and Financial Stability Committee at the Bank's monetary policy meetings.[1] Norges Bank normally holds eight monetary policy meetings per year. In connection with four of these meetings, the Monetary Policy Report (MPR) is published and a press conference is held at which the policy rate decision and the MPR are presented. The MPR contains an assessment of the outlook for the Norwegian economy and the Bank's policy rate forecast

1 The policy rate and the implementation of monetary policy are described further in Norges Bank (2021b).

(policy rate path). The analyses in the MPR form the basis for the Committee's assessments and decisions regarding the policy rate. The policy rate decision is finalised on the day before the decision and the MPR are published. The Committee's assessment of the economic outlook and monetary policy is presented in the "Monetary policy assessment" in the MPR. The "Monetary policy assessment" will normally also include a forecast for the policy rate and projections for consumer price inflation and the output gap given developments in the policy rate.

Policy rate

The pass-through of the policy rate to short-term market rates is the first step in monetary policy transmission. Norges Bank ensures this pass-through by setting the terms for banks' loans from and deposits in the central bank and by managing the quantity of central bank reserves in the banking system. Central bank reserves are banks' overnight deposits in the central bank. Banks need central bank reserves to settle interbank transactions.[2]

In Norway, banks are remunerated at the policy rate on a certain quantity of central bank reserves overnight, a predetermined quota. Deposits in excess of the quota are remunerated at the reserve rate, which is 1 percentage point lower. Along with the D-loan rate, the interest rate on banks' short-term loans from Norges Bank, the reserve rate forms a corridor around the policy rate of ±1 percentage point.

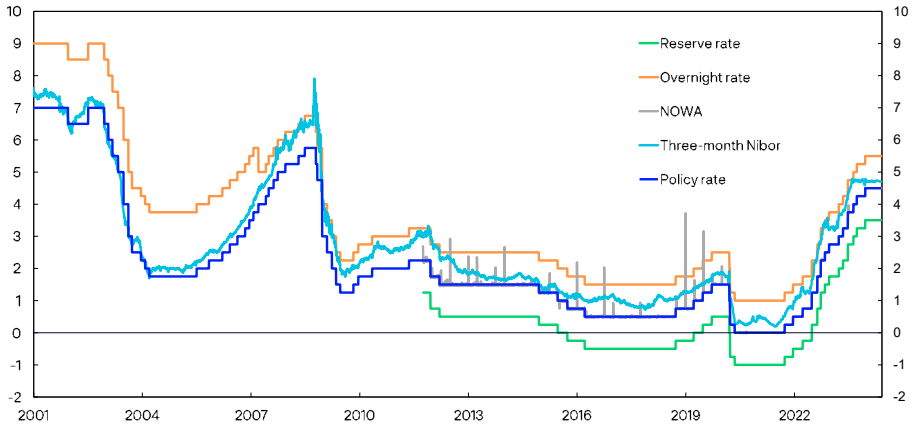
Banks' total quotas amount to around NOK 45 billion. Norges Bank aims to maintain central bank reserves within a range of between NOK 30 billion and NOK 40 billion. The Bank does this by using market operations to offer banks loans from or deposits in the central bank, so that banks' overnight deposits are kept within the target range. In Norway, the government maintains an account in Norges Bank. Substantial and frequent transactions between the government's and banks' accounts in Norges Bank may result in considerable changes in the quantity of central bank reserves, before Norges Bank's market operations, referred to as structural liquidity. Norges Bank prepares and publishes projections of structural liquidity. If there are prospects that the quantity of central bank reserves in banks' deposit accounts in Norges Bank will exceed the upper threshold of the target range, central bank reserves are withdrawn by offering banks F-deposits. If there are prospects that central bank reserves will fall below the lower threshold of the target ranges, banks are offered the opportunity to borrow central bank reserves in the form of F-loans. The maturity of F-loans and F-deposits is adjusted to the structural liquidity forecast, and the rate is normally close to the policy rate.

2 Central bank reserves serve as means of interbank settlement: When a bank deposit is transferred from Bank A to Bank B, reserves are transferred from Bank A's account in the central bank to Bank B's in the central bank. A bank is willing to accept customer deposits from other banks (liabilities) because at the same time an equal amount of central bank reserves (a claim on the central bank) is transferred to its reserve account. This enables banks' customers to use their deposits as a means of payment to customers of other banks.

The quota system can be viewed as a cross between a “corridor” system and a “floor” system, which are the most common systems in other countries. Under a quota system, errors in the forecast of total deposits in the banking system have less of an impact on market interest rates compared with a corridor system, and banks have more incentive to redistribute central bank reserves among themselves overnight at an interest rate close to the policy rate. A bank with deposits in excess of its quota has an incentive to lend the excess to other banks with room on their quota. It will prefer to do this to avoid having to keep the reserves on deposit in Norges Bank at the lower reserve rate. Banks that borrow reserves can deposit them in their account with Norges Bank and receive the policy rate. See box on page 53 for a discussion of Norges Bank’s principles for liquidity management.

Redistributed central bank reserves are unsecured overnight interbank loans. The interest rate on these loans is called Nowa (Norwegian Overnight Weighted Average) and is normally close to the policy rate (Chart 3.1). Money market rates with longer tenors, such as three-month Nibor (Norwegian Interbank Offered Rate), will normally deviate more from the policy rate because they are also affected by policy rate expectations and include a risk premium. Nevertheless, over time, Nibor will track developments in the policy rate.

Chart 3.1 Norges Bank’s interest rates and money market rates
Percent. February 2001 – May 2024



Sources: Bloomberg and Norges Bank

Forward guidance

The policy rate influences the interest rates banks, households and businesses face from day to day. When economic agents make decisions, however, expectations about future developments in the policy rate play a role. An important part of monetary policy is therefore to manage expectations about developments in monetary policy. There are a number of ways to engage in such expectations management.

Norges Bank has published policy rate forecasts, the policy rate path, since 2005. The Bank’s policy rate path expresses the interest rate that

in the Bank's opinion provides the best possible trade-off between monetary policy objectives. The rate path shows the Bank's expected developments in the policy rate, given its current assessment of the state of the economy, outlook, balance of risks and functioning of the economy. The policy rate forecast is shrouded in considerable uncertainty. If the economic outlook, balance of risks or the Bank's assessment of the functioning of the economy change, the policy rate may also turn out differently from the one indicated by the rate path.

With the aid of the policy rate paths and related communication, Norges Bank provides forward guidance regarding future policy rate developments and information about the central bank's response pattern. When these signals are perceived as credible, the effect of future changes in the policy rate may occur earlier.

Norges Bank attaches weight to transparency in its monetary policy communication. The aim is for the decision basis and trade-offs on which a monetary policy decision is based to be reflected in the MPR. The MPR provides more information about trade-offs, assessments and the outlook than most similar reports by other central banks, where trade-offs and monetary policy assessments are more commonly reflected in the minutes of decision-making meetings.

Central bank communication is constantly evolving. During the GFC, a number of central banks ended up in a situation where their ability to conduct conventional monetary policy was limited by the lower bound for the policy rate. Unconventional measures (see SSection 3.5) were employed, such as asset purchases (quantitative easing) and what has been called "forward guidance". At the time, the term forward guidance was used for explicit statements by the central bank on future policy rate developments. While the aim of monetary policy in normal times had been to enhance the effectiveness of monetary policy instruments, the purpose of forward guidance was for central bank communication itself to become a monetary policy instrument. Since the GFC, forward guidance has evolved into a broader and more normal concept.[3] Today, the policy rate path and Norges Bank's statements on future policy rate developments are referred to as the central bank's forward guidance.

Two types of forward guidance are often distinguished in the literature. In one variant, the central bank issues a statement on future policy rate developments, given its economic assessment. This type of forward guidance can be viewed as pure forecast, and not a promise. Norges Bank's policy rate path is an example of this type of forward guidance. In the other variant, there is more of a commitment by the central bank to a specific monetary policy within a certain horizon or dependent on certain economic conditions. This type of forward guidance is therefore more akin to a promise than a forecast; the central bank seeks to influence

3 *"Departing from the zero lower bound will deprive forward guidance of its special necessity as the only remaining monetary policy instrument. In the end, the term 'forward guidance' might remain, but the meaning will be reduced to the state of normal communication to guide expectations with the aim of making monetary policy more effective."* See Issing (2019), page 38.

expectations by “tying itself to the mast”. That is why the former type is often referred to as “Delphic forward guidance”, while the latter type is called “Odyssean forward guidance”. In practice, communication about future monetary policy will often have elements of both types of forward guidance.

Odyssean forward guidance may be particularly useful in a crisis situation or when the policy rate is close to its lower bound. An example is when the US Federal Reserve announced in 2012 that its policy rate would be held close to zero as long as unemployment was above 6.5%, provided that inflation did not rise significantly in the meantime.

Norges Bank’s principles for liquidity policy and the role of the central bank[1]

One of the aims of liquidity policy is to keep the shortest money market rates close to the policy rate. The central bank achieves this by setting the terms for banks’ loans and deposits in the central bank and by controlling the quantity of central bank reserves in the banking system (referred to as the liquidity management system). In addition to ensuring the implementation of monetary policy, the aim of liquidity policy is to promote an efficient payment system and financial stability. Liquidity policy also plays an important role in times of financial stress in that the central bank can inject liquidity into the banking system or provide loans to individual banks on special terms.

There are different types of liquidity management systems, all of which regulate the supply and cost of central bank reserves. The most common are variations of what are known as corridor and floor systems. In a corridor system, banking system reserves are low (at zero or marginally above zero) and the policy rate is normally midway between the Bank’s deposit and lending rates for banks, referred to as the standing facilities. Such a system gives banks an incentive to borrow from and deposit reserves with each other overnight. Otherwise, banks with a positive balance on their account with the central bank have to deposit these reserves at the deposit rate (which is lower than the policy rate), while banks with a negative balance have to borrow reserves from the central bank at the lending rate (which is higher than the policy rate). The purpose of the interest rate corridor is to give banks an incentive to avoid using the central bank’s standing facilities, but instead redistribute the reserves among themselves in the interbank market at a rate close to the policy rate. In a floor system, on the other hand, the central bank ensures there is an ample supply of reserves in the banking system. As a result, the overnight interbank rate is pushed down towards the central bank deposit rate, which will then be the policy rate. Compared with a corridor

1 Based on Norges Bank (2021b)

system, it is cheap for banks to keep reserves at the central bank under a floor system because all reserves are remunerated at the policy rate.

Norges Bank uses a quota system in its liquidity management. In a quota system, a certain quantity of banks' reserves is remunerated at the policy rate, ie a quota. Deposits in excess of the quota are remunerated at a lower interest rate, the reserve rate. This means that banks have an incentive to keep deposits below the quota. If the deposits are likely to exceed the quota, banks then have an incentive to lend reserves in the interbank market, in the same way as in a corridor system.

In a quota system, as in a corridor system, keeping large reserves at the central bank is costly for banks as deposits in excess of the quota are remunerated at a rate below the policy rate. In a quota system, central bank reserves are primarily intended in normal times to serve as a means of settlement between banks rather than a store of value. This is in line with Norges Bank's principles for liquidity policy, where the objectives are: (1) ensure that there is a high degree of pass-through from the Bank's policy rate to money market rates, (2) promote an efficient payment system, (3) offer liquidity insurance and act as lender of last resort, and (4) provide a framework for liquidity and credit risk to be borne as far as possible by private agents in the financial system. The first three objectives can also be achieved in a system with an ample supply of reserves (such as a floor system). However, if it is important for risk to be borne by private agents (4), it must cost more to keep central bank reserves as a liquid asset of durable value.

The objective that risk should be borne by private agents reflects the low level of risk tolerance the central bank should have. If banks can borrow substantial reserves from the central bank at a low price, the central bank's role in transforming securities pledged as collateral for loans into highly liquid assets (central bank reserves) entails the transfer of considerable risk from the banking system to the central bank. The central bank's risk will be low if the securities' credit risk is low and haircuts are applied to their collateral value. In practice, however, it is difficult for the central bank to fully eliminate this risk. The more reserves the central bank must offer banks in the form of loans, the higher the central bank's potential exposure to credit risk will be.

The principle of sharing risk between private agents and the central bank also reflects the regulatory liquidity and capital requirements imposed on banks by the authorities. The authorities' requirements are largely intended to ensure that banks must adjust their balance sheets so that they are resilient to substantial risk without needing liquidity support from the central bank or other public authorities. As little risk as possible should be transferred to the central bank in particular or to the government in general. *The central bank's liquidity policy should support this principle, ie contribute to ensuring that risk is borne by the private banking system.*

In line with this view, central bank reserves should primarily be a means of settlement for banks and thereby a liquidity management instrument that ensures the efficiency of the payment system and the efficient transmission of monetary policy. In times of financial market stress, when central bank measures can involve offering substantial central bank reserves that are then used as a store of value, the reserves offered should be priced separately and not be a consequence of the ordinary conduct of liquidity policy.

3.1.2 Transmission mechanism

When the central bank changes its policy rate, both nominal and real interest rates facing households and firms will be affected. In an open economy, nominal and real exchange rates will also be affected. Monetary policy can affect the economy through several channels. The transmission mechanism is a blanket term that covers these channels, and it is common to distinguish three primary channels: the *demand channel*, the *exchange rate channel* and the *expectations channel*.

1. The *demand channel* describes how a change in the policy rate affects total domestic demand and hence inflation. A change in total demand will affect inflation through changes in both price setting and wage growth. A reduction in total demand will reduce demand for labour, thereby pulling down wage inflation. At the same time, inflation will be pulled down when firms reduce the rise in prices for the goods they sell. The effect of the policy rate on total demand can be divided into four elements:

    a. *Substitution channel: A change in the real interest rate will affect total demand in the economy by influencing consumption and investment. An increase in the real interest rate makes saving more attractive, and this may also occur as a result of higher debt repayment. This reduces household demand for consumption goods. Firms will thus experience lower demand for the goods they sell while also facing higher financing costs. This reduces investment demand.*

    b. *Wealth channel to consumption: A change in the interest rate affects the value of net household wealth and hence household demand for goods and services. A change in the interest rate affects financial asset prices, but also the value of housing wealth. For Norwegian households, the effect of changes in house prices will have the strongest wealth effect. Since different assets are used as loan collateral, changes in asset prices may also affect access to credit. A fall in house prices as a result of an interest rate increase will for example make it more difficult for households to borrow against home equity. This may also contribute to lower consumption demand.*

2. *Cash flow channel*[4] *to total consumption*: A change in interest rates affects households' current disposable income and hence consumption, through the effect on net interest income. Higher interest rates reduce the disposable income of households that have more debt than bank deposits but increases the disposable income of households with high net bank deposits and low debt. The debt-to-income ratio of the Norwegian household sector is high, and higher interest rates will therefore reduce consumption through the effect on disposable income.*Exchange rate channel to inflation* describes how movements in the krone exchange rate resulting from a policy rate change affect inflation and demand. A policy rate hike can result in a stronger krone, reducing the price of imported consumer goods and intermediate goods, with an attendant fall in consumer price inflation. A stronger krone exchange rate also increases the price of domestic exports and reduces the price of imported goods, dampening net exports and hence aggregate demand. This will reduce labour demand and hence dampen wage growth. In addition, lower earnings for export-oriented industries may also dampen wage growth.[5]

3. The *expectations channel* describes how expectations of a future interest rate affect total demand and inflation. The policy rate is an overnight interest rate, which in itself is not of particular importance for demand and inflation. It is the money market rates and banks' deposit and lending rates that matter, and these rates are largely determined by economic agents' expectations of future levels of the policy rate. The central bank influences agents' expectations through forward guidance. This guidance can be in the form of statements, eg that the policy rate will most likely be raised in the course of the next six months, or in the form of policy rate forecasts, which Norges Bank and some other central banks publish.

See box on page 57 for more about the functioning of the transmission mechanism in the Norwegian economy.

It is widely assumed that monetary policy only has a transitory effect on the economy, ie it is neutral in the long run. In the short (and medium) run, monetary policy may affect real economic variables such as output and employment. But further out, the effect of monetary policy will fade, with variables returning to their equilibrium levels. Monetary policy is capable of influencing nominal variables in both the short and long run.

To the extent that economic fluctuations are asymmetric, eg owing to labour market hysteresis, monetary policy can, in principle, contribute not only to reducing variability in output and employment but also to raising the averages of these two variables. See Section 2.2 for a further discussion of this effect.

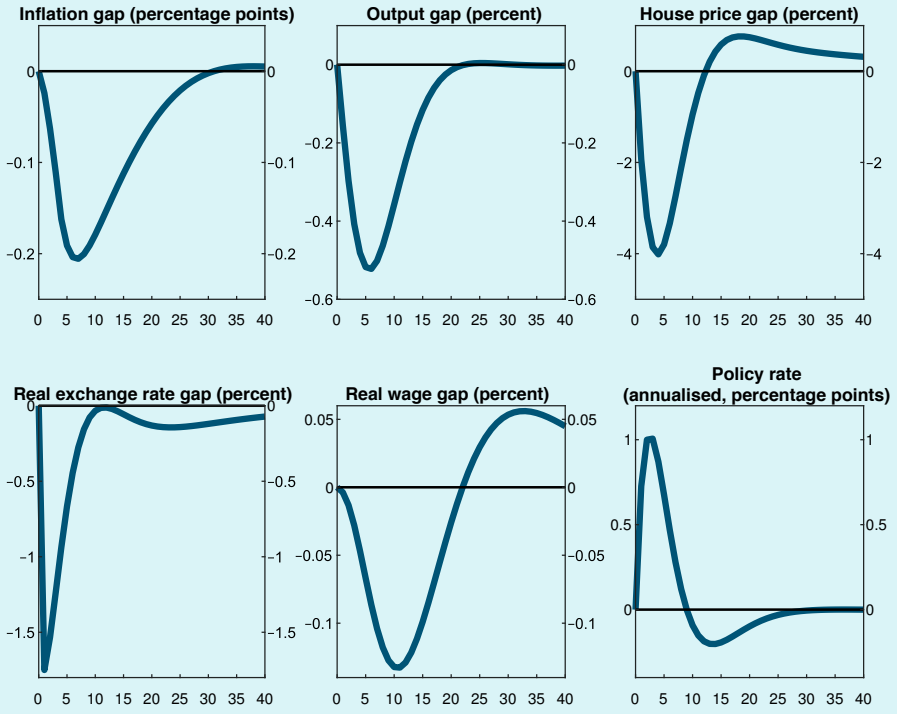
4 See Gerdrup and Torstensen (2018) for a static analysis of the cash flow channel.

5 See Røisland (2023a).

How the policy rate influences the Norwegian economy?

Looking at the impulse response functions of a monetary policy shock in NEMO gives us a picture of how the transmission mechanism functions in the Norwegian economy. Chart 1 presents the impulse response functions for a sample of macro variables: inflation, output, exchange rate, policy rate, house prices and wage growth.[1] We look at a shock that is normalised so that the policy rate rises at most by 1 percentage point on an annualised basis.

Chart 1 Impulse response functions of a monetary policy shock in NEMO



In the model, a change in the policy rate affects the economy through the demand channel, exchange rate channel and expectations channel. A policy rate hike results in a reduction in domestic demand and a stronger real exchange rate. The rise in short-term interest rates affects the real economy through the banking sector. A rise in lending rates to households and businesses depresses household consumption and business investment, leading in turn to a fall in total demand and thus in total output. A fall in house prices amplifies the decline in consumption and investment and limits households' additional borrowing since borrowing depends on home values. In addition, a stronger exchange rate reduces exports and leads to a shift from domestically produced goods to imports. It takes a little over a year before the effect on output is at its most pronounced, at which time output is around 0.5% lower than it would have been absent the policy rate hike.

1 See Kravik and Mimir (2019) for impulse response functions for more variables.

As a consequence of the fall in total demand, non-financial businesses will reduce their demand for labour, which will lead to a decline in wages and number of hours worked. This reduces the prices of domestically produced goods. In addition, a stronger exchange rate pushes down import prices. It takes a little over two years before the effect on inflation is at its most pronounced, at which time inflation is 0.2%age point lower than it would have been absent the policy rate hike.

In Chart 1, we see that the effect of a policy rate hike on total demand does not completely fade until after four years, while the effect on inflation persists for six years. It is important to note that the impulse responses only show the isolated effects of the monetary policy shock. In reality, the economy will be hit by new shocks in the meantime, and the central bank's ability to control inflation and output will thus be far from perfect.

3.2 Decision basis

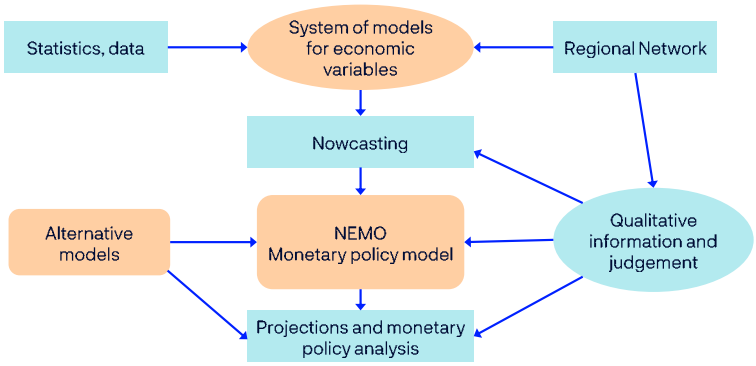
Norges Bank's decision basis for monetary policy is founded on analyses and forecasts of the Norwegian and global economy. These analyses and forecasts are updated four times a year and are published in the Bank's monetary policy report (MPR). They are based on assessments of the current situation, projections for exogenous variables, ie variables that are not, or are to a limited extent, affected by the Bank's policy rate setting (for example public demand), a quantification of relationships in the economy in both the near and long term and our perception of these relationships.

In order to project future economic developments, a thorough analysis of the current economic situation is needed. The analyses of the current situation are based on updated statistics, other information about cyclical developments and various empirical forecasting models. Together with assumptions regarding exogenous driving forces the analyses form the basis of our monetary policy analysis and forecasts (Chart 3.2).

In its forecasting, the Bank seeks to build a bridge between the assessment of the current situation and our assumptions regarding the long-term relationships in the economy. The Bank's core macroeconomic model NEMO is an important tool. In addition, the forecasts are determined by the Monetary Policy and Financial Stability Committee's trade-offs between monetary policy objectives. Monetary policy trade-offs are discussed further in Section 2.4.

Together with the monetary policy analysis, this results in a decision on the appropriate monetary policy stance and the Bank's forecast of the policy rate path ahead, in order to best attain the Bank's monetary policy objectives. When the fundamental premises change, the forecast of the policy rate (the policy rate path) and other economic variables will also change.

Chart 3.2 System for monetary policy analysis and forecasting



3.2.1 Data and information sources

In order to make sound monetary policy trade-offs and accurate forecasts, Norges Bank depends on reliable data and information on economic developments in Norway and abroad. The Bank therefore obtains a broad set of data from different statistics providers.

Norges Bank analyses economic developments among Norway's trading partners. In addition to data from global financial markets and developments in interest rates and interest rate expectations, the Bank monitors in particular data on output, employment and prices. The Bank also closely monitors energy and commodity markets, using for example reports from international organisations such as the International Energy Agency (IEA) and the US Energy Information Administration (EIA).

Norges Bank has constructed two indicators, IPK and IPI, that capture international price impulses to Norwegian prices for consumer, capital and intermediate goods, respectively. The IPK is based on imported consumer goods and on producer price developments in exporting countries.[6] The IPI is also based on producer price developments among different trading partners, with particular focus on imported capital and intermediate goods.[7]

Statistics Norway is an important source of data for Norway. The consumer price index (CPI) is one of the most important variables in the monetary policy analysis. Norges Bank closely monitors consumer prices adjusted for tax changes and excluding energy products (CPI-ATE) and other underlying inflation indicators produced by Statistics Norway. The Bank also estimates a number of underlying inflation indicators (see box on page 19). The broad range of inflation indicators help provide a more detailed picture of underlying inflationary pressures.

Main economic aggregates in the national accounts are key to understanding cyclical developments in the Norwegian economy. Total gross

6 See Fastbø (2018) and Røstøen (2004)

7 See Brubakk et al (2024).

domestic product (GDP) is an important main aggregate, but because the business cycles have little influence on petroleum production, particular weight is given to mainland GDP, where oil and gas extraction, pipeline transport and international shipping are excluded. Both the production and demand side of the economy are analysed to understand the driving forces behind economic developments. Demand components, such as household consumption, business investment, housing investment, petroleum investment, public demand, exports and imports are analysed in detail to gauge the current situation in the economy and project future economic developments. Household income accounts provide important additional information on household consumption and saving behaviour.

Statistics Norway is also an important source of insight into the labour market. The national accounts provide information on employment developments in Norway, while the Labour Force Survey (LFS) estimates the size of the labour force, employment and unemployment. The Norwegian Labour and Welfare Administration (NAV) is also a key provider of labour market data and publishes monthly data on registered unemployment, in addition to data on eg unemployment benefit applications, furloughs, redundancies and job vacancies.

Statistics Norway's register statistics on the number of jobs and wages provide further information on employment developments and are a key source of information on current wage developments through the year. Reports from the Technical Calculation Committee for Wage Settlements (TBU) on the basis for wage settlements provide important information on for example wage carryover in sectors affected by wage agreements and the social partners' inflation expectations.

Public documents such as the National Budget and the Report to the Storting on Long-Term Perspectives for the Norwegian Economy provide insight into the fiscal policy stance and are useful in assessing the outlook for public demand. Projections for increases in tax revenues and transfers in public documents are included in the basis for Norges Bank's projections for household disposable income and consumption.

Norges Bank's Regional Network collects information from a broad sample of businesses across Norway (see box on page 65 for further details). The Regional Network provides the Bank with both quantitative and qualitative information, which is useful when interpreting statistics and improves the Bank's understanding of economic developments. The information from Regional Network contacts also functions as a cross-check of early statistics that are uncertain and are often subsequently substantially revised. The Expectations Survey, conducted by Ipsos on behalf of Norges Bank, provides information on expectations of price and wage inflation, for example.

In the event of very sudden and sharp shocks to the economy, alternative data sources may be particularly useful. In recent years, Norges Bank has used a number of new data sources to, among other things, monitor

developments in real time. During the pandemic, card transaction data were particularly useful in the assessment of consumption and saving behaviour. Mobility and search data from the technology company Google also provided timely and frequent information on household behaviour through the pandemic. When freight rates surged during the pandemic, the Bank used different data sources that could provide information on international freight rate developments. A number of the new data sources used in recent years are now included as explanatory variables in the Bank's short-term models, which has helped to improve the models' forecasting properties.

The use of new data changes continually as new technology increasingly enables the use of new and faster data sources. New technology also makes it possible to process ever larger amounts of data at a lower cost. In the Bank's work to achieve a deeper understanding of important economic mechanisms over time, the Bank has increasingly used disaggregated individual and firm-level data, including microdata from the tax authorities, various registers and the *a-ordning*, a coordinated service used by employers to report income and other employee information to NAV. These data sources provide more detailed information than aggregated macrodata and improve, for example, the Bank's understanding of different groups' movements in and out of the labour market and how monetary policy affects different household groups. Data on all firms in Norway help to ascertain and understand the risk of bankruptcy and possible spillovers.

The information base used when preparing projections for developments in Norway and abroad also contains analyses from the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), other central banks and investment banks.

The analyses in the *Monetary Policy Report* (*MPR*) are normally based on information up to and including the Friday before publication of the *MPR* and the interest rate decision. The monetary policy decision is based on information up until the decision is made.

3.2.2 Models and use of models

Norges Bank utilises a spectrum of models in order to answer different questions. For short-term forecasts of the economy, the Bank primarily uses empirical models with the best possible forecasting properties. Medium- and long-term projections are based more on models constructed using economic theory and that are calibrated and estimated to capture the different transmission channels from monetary policy to economic variables. Among these models, NEMO is the Bank's main model.

Empirical forecasting models and conditional forecasts

The Bank uses a broad set of empirical models to produce short-term forecasts, such as different wage models (see box on page 66) and models to forecast short-term developments in private consumption.[8]

8 See Norges Bank (2023b).

The Bank has also developed empirical models to cross-check the forecasts from the Bank's main model, the Norwegian Economy Model (NEMO). The empirical models for inflation and GDP are combined in the model framework SMART (System for Model Analysis in Real-Time).[9] In SMART, forecasts from the different models are weighted together based on their historical forecasting properties. The SMART system thus ensures that weight is given to information that has previously been important for predicting economic developments. SMART is estimated based on real-time data, ie data actually available when the forecasts were made. Using real-time data takes into account the measurement errors and substantial lags of many published data series. A number of the data series are revised multiple times following initial publication. Work is under way to further develop SMART to include more key macro-economic variables. The system is well suited for testing new empirical models and using them in forecasting work.

Bayesian VAR models, which include many of the same variables as NEMO, are used to cross-check projections from NEMO. During a fore-casting process, iterations are made between the cross-check models and NEMO. Alternative models are also used to elucidate relationships in the Norwegian economy, including how the policy rate affects different parts of the economy.[10]

Some key variables are forecast outside NEMO and are included as conditional forecasts. For these variables, much of the information needed to forecast developments is not part of NEMO, such as foreign inflation and output, petroleum investment and money market premiums.

In order to forecast foreign inflation and output, a combination of inter-nally and externally produced models are used, both short-term and potential growth models. The Bank is part of the IMF Global Projection Model Network (GPMN) and uses the GPM model as a consistency check for forecasts two to three years ahead. The GPM is also used to make scenario analyses, along with the Global Integrated Monetary and Fiscal Model (GIMF), also developed by the IMF. Forecasts of petroleum prices and future interest rates among trading partners are based on market expectations.

The krone exchange rate is normally projected to change relatively little over the forecast horizon from its recent level. However, consideration is given to the fact that policy rate decisions have an impact on the exchange rate when they surprise the market. If the policy rate is raised more than anticipated by the market, the krone will normally appreciate. Norges Bank's exchange rate forecasts assume such an effect. More-over, the Bank's experience is that short-term movements in the krone exchange rate can be traced back to movements in the risk premium (see box on page 70). Analyses of the foreign exchange market and insight from market participants can provide us with an indication of how much

9 SMART is described in more detail in Bowe et al (2023).

10 See Norges Bank (2023c).

the risk premium has changed and whether the changes can be expected to be long-lasting. In some cases, observed foreign exchange market turmoil suggests that the risk premium will be unusually high for a period. In that case the exchange rate can be assumed to appreciate ahead.

NEMO – Norges Bank's macroeconomic main model

Norges Bank's macroeconomic main model NEMO is used as the basis for monetary policy analyses but also to provide forecasts of economic variables in the medium and long term.[11] Moreover, the model is a useful tool in the work to understand the underlying forces driving economic fluctuations. The model has been in continuous development since it was first used in 2006.

NEMO is a dynamic, stochastic, general equilibrium (DSGE) model for a small open economy and shares features with macroeconomic models at other central banks. NEMO models the behaviour of households, firms, private banks and the central bank. The model also includes a fiscal rule. The task of monetary policy in the model is to help to stabilise the economy and bring inflation back to target when the economy has been exposed to shocks. The model contains a Norwegian and a foreign sector, where the Norwegian oil services industry is a separate production sector. The foreign sector is assumed to affect the Norwegian economy, but the converse is not the case. This is a common assumption in small open economy models.

In models such as NEMO, developments in endogenous variables (those determined in the model) will depend on exogenous variables (those determined outside the model). The endogenous variables will fluctuate around a long-run equilibrium level that is determined by structural conditions in the Norwegian economy. Since the equilibrium level cannot be observed, statistical methods and judgement are used to estimate equilibrium levels on the basis of historical data. NEMO interprets the history and the projections and finds the combination of shocks that explains with the greatest degree of probability the fluctuations around the estimated equilibrium levels. These shocks will typically operate through numerous channels and affect the economy for a lengthy period.

On the basis of its interpretation of economic driving forces and shocks, the model generates a policy rate forecast based on minimising a loss function (see box on page 42). The model generates a policy rate path that brings inflation back to target and closes the output gap. In order to obtain the best possible projection, NEMO is conditioned on short-term projections and forecasts for exogenous variables.[12]

The policy rate forecast generated by the model serves as input into the monetary policy discussion. What constitutes a reasonable trade-off

11 The model is described further in Kravik and Mimir (2019).

12 The forecasts are cross-checked against the forecasts of a range of other models at sectoral level. Smaller theoretically based DSGE models complement NEMO in conceptual matters, and Norges Bank is working on developing models that are based on microdata and incorporate irrational behaviour.

in monetary policy is judgement-based (Section 2.4). There is no mechanical link between the model's policy rate path and Norges Bank's policy rate forecasts. Even so, such models can provide the monetary policy analysis with a fundamental structure and discipline the monetary policy discussion.

Norges Bank has launched a project to establish an improved macro model. This entails a review of many NEMO characteristics to ensure that it is optimised for forecasting and monetary policy analyses in an economy undergoing constant change. Efforts are being made to review the effects of the policy rate and important shocks to the Norwegian economy, not least from abroad, and to ensure more realistic expectations formation. Furthermore, the Bank aims to introduce more macroeconomic trends in the model, consider limited heterogeneity among households and assess whether the supply side of the economy should be given a more prominent role. The project will also assess wage and price setting and whether the model can be quantified on larger datasets. In addition to developing an improved macro model, the Bank also aims to clarify the division of labour with other macro models that can be used to analyse more current risks or mechanisms so that the macro model does not become too large and complicated. The Bank will also investigate how its analysis and modelling system can best take into account the effects of physical climate change and climate transition on the Norwegian economy, both globally and in Norway. The project is scheduled for completion in 2026 and, among other things, follows up advice from an expert committee that has assessed the macro models at the Bank.[13] The Bank intends to learn from a similar project from the Bank of Canada.[14] In the future, cooperation with other central banks, such as the Bank of England, will also be useful when they begin to follow up recommendations from the Bernanke report.[15]

Judgement

Judgement, qualitative information and expertise are used at all stages of the decision-making process, for assessing the economic situation, for producing projections and for assessing monetary policy. New relevant information and new assessments rarely point in the same direction. The forecasting process is therefore largely iterative.

3.2.3 Evaluation and quality assurance

Norges Bank attaches importance to transparency in its monetary policy communication. The Bank reports on the conduct of monetary policy in its *Annual Report*. The trade-offs on which policy rate setting are based are published regularly, including in the MPR.

Norges Bank Watch (NBW) is an independent expert group that has evaluated the conduct of monetary policy each year since 2000.[16] The composition of the NBW group varies from year to year. The members are

13 See Canova et al (2019).
14 See Coletti (2023)
15 See Bank of England (2024b).
16 See the reports from Norges Bank Watch, CME.no.

appointed by the Centre for Monetary Economics (CME) at BI Norwegian Business School.

The purpose of NBW is to contribute to the debate on Norwegian monetary policy and provide input to the public on both how Norges Bank has defined its role and how its policy is implemented and communicated to the outside world.[17]

NBW reports serve inter alia as input to the Ministry of Finance's evaluation of Norges Bank's conduct of monetary policy.[18] The Ministry's assessment is presented to the Storting (Norwegian parliament) in the annual *Financial Markets Report*, and the governor appears in a public hearing before the Standing Committee on Finance and Economic Affairs in connection with the debate on the report.

17 See Chapter 6.2.10 of NOU (Official Norwegian Report) 2017:13.
18 Since 2001, the Ministry of Finance has contributed towards the financing of the reports from NBW.

Regional Network

In 2002, Norges Bank established a regional network of around 1800 enterprises and organisations throughout Norway. Four times a year, management-level contacts in around 450 of these are interviewed about economic developments and the outlook ahead.

The contact sample reflects the production side of the economy both by sector and geographically. Norges Bank's Regional Network is divided into seven regions: North, Central, North-West, South-West, South, Inland and East. The Bank has primary responsibility for the network as a whole, while regional research institutions conduct most of the interviews. The Bank meets with some of the enterprises in Region East.

The purpose of the network is to obtain early signals of developments in the Norwegian economy. Regular interviews with contacts give the Bank timely and useful information about contacts' assessments of the current situation and the outlook for their own business or institution.[1] The responses are summarised in reports and data series for key economic variables at the national, regional and sector level.

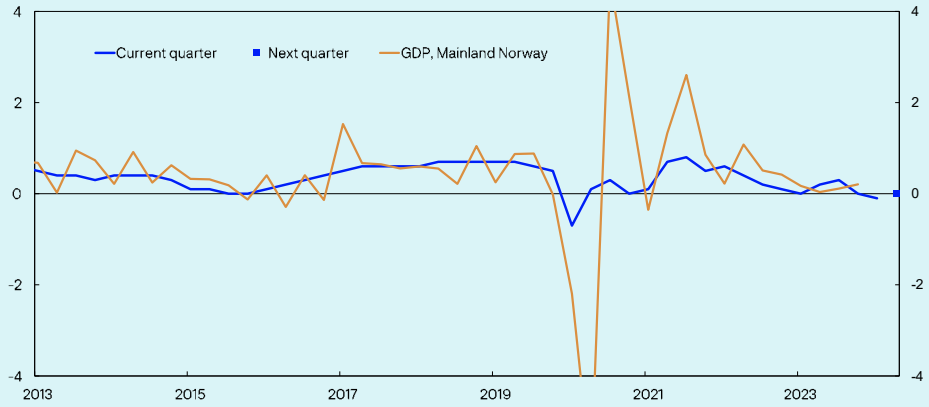
Direct contact with executives enables the Bank to obtain nuanced and comprehensive information that is not covered by statistics or captured in a questionnaire. For that reason, both qualitative and quantitative information from network contacts is actively used in the Bank's analyses and forecasting and thus form part of the basis for monetary policy decisions.

1 The Regional Network's *samtaleguide* (pdf) [interview guide] (in Norwegian only) contains a list of the main topics discussed.

Information from the network has proved to provide a reliable indication of Norwegian economic developments over time (Chart 1).[2] Regional Network data for actual and expected growth in output and employment provide reliable estimates of output and employment growth in the national accounts one to two quarters ahead.

The results from the Regional Network are judgement-based assessments based on interviews of network contacts. Reports from the Regional Network do not represent the views of the Bank or individual enterprises on economic developments.

Chart 1. GDP for mainland Norway[1] and the Regional Network's indicator for output growth in current and next quarter
Quarterly growth. Percent. 2013 Q1 – 2024 Q1



1 Seasonally adjusted
Sources: Statistics Norway and Norges Bank

2 See Brander et al (2017).

Models for forecasting wage growth

When making wage growth projections, Norges Bank seeks to use all available information and apply models that give the lowest possible forecast error over time. The Bank uses its core model NEMO, other empirical models that contain key wage formation variables and information such as survey-based wage expectations and the outcome of wage settlements for different sectors of the economy.

The core model NEMO is based on a simplified representation of Norwegian wage formation where the workers' share of value added in the economy – the labour share – is stable in the long term. Important factors such as price expectations, the output gap, the oil price, GDP for mainland Norway and past wage trends affect the model-based wage projections, but current figures for the labour share are not explicitly included. By using alternative empirical models, the Bank can still take

into account changes in the labour share when making projections. These models are well-suited to capturing the importance of profitability and the labour share in manufacturing for wage growth.

The alternative models, as described below, are used both in making short-term wage growth projections and to cross-check projections from NEMO further out in the projection period. The short-term wage growth projection is also based on expected wage growth derived from Norges Bank's Expectations Survey and the Regional Network Survey, as well as the negotiated wage norm when available.

The alternative empirical models contain key variables for wage negotiations, such as TBU's[1] inflation forecasts and employers' ability to pay wages. The models contain much of the same information set but have different structures. The relationships highlighted by the models reflect key features of the Norwegian wage formation model.

The Norwegian system of wage negotiations is set up in such a way that the tradeable sector's ability to pay wages provides a norm for total wage growth.[2] The labour share in manufacturing is expected to be stable over time. In principle, the profitability of the non-tradable sector has no bearing on wage growth in this model. The labour cost share in the non-tradable sector remains stable over time as firms adjust their prices. In practice, it seems that profitability within one's own sector is also important for wage growth in non-tradable industries.[3] The Bank's wage models therefore take account of both profitability in manufacturing and more aggregated profitability figures.

To measure the labour share Norges Bank uses labour costs as a share of factor income.[4] The Bank considers the labour share in manufacturing and in mainland Norway, respectively, as a measure of the ability to pay wages. Over the past few years, the labour share in manufacturing has declined markedly and been lower than the 20-year average. Overall, the labour share in firms in mainland Norway has also been somewhat below the historical average, but the gap is smaller than in manufacturing.[5] Some measure of the labour share enters all empirical models discussed below.

One of the wage growth models used is an error correction model (ECM) containing the labour share for mainland Norway (ω) as an error correction term.[6] This means that the labour share will tend to move towards its historical average after a period of deviations. All else equal, a period of low labour share will lead to higher wage growth in the following years. Adjustment is gradual, and deviations from equilibrium will not be fully

1 TBU is the abbreviation for the Norwegian Technical Calculation Committee for Wage Settlements.
2 See Aukrust (1977).
3 See Brubakk and Hagelund (2022).
4 Factor income is the sum of wage costs and operating profit.
5 The public sector and housing services are excluded in the calculation of the labour share for mainland Norway. Furthermore, both the labour share in manufacturing and mainland Norway are adjusted for self-employed persons.r
6 The model is documented in Brubakk et al (2018a).

eliminated in the short term. The model also accounts for inflation expectations (πe) measured by TBU's inflation forecast where available, real price gains, measured by the GDP deflator for mainland Norway relative to the CPI (τ), productivity growth (z) and an unemployment gap ($\hat{u}$).

$$\Delta w_t = c + \beta_1 \pi_t^e + \beta_2 \Delta \tau_t + \beta_3 \Delta z_t + \beta_4 \Delta \hat{u}_t + \beta_5 \hat{u}_{t-1} + \beta_6 \omega_{t-1}$$

Norges Bank bases the ECM on variables for mainland Norway. The explanatory power, measured by R2, is good and close to 0.9. The explanatory power of the model deteriorates if the Bank only uses variables for the manufacturing sector.[7]

In addition to the ECM, Norges Bank uses two VAR models estimated using Bayesian methods (BVAR).[8] The models use many of the same variables that enter into the ECM, see equation below:[9]

$$\boldsymbol{Y}_t^i = \boldsymbol{A}_0 + \boldsymbol{A}_1 \boldsymbol{Y}_{t-1}^i + \boldsymbol{A}_2 \boldsymbol{Y}_{t-2}^i + \boldsymbol{e}_t$$

$$\boldsymbol{Y}_t^{MN} = \begin{pmatrix} w_t \\ Z_t^{MN} \\ \pi_t^e \\ \hat{y}_t \\ \omega_t^{MN} \end{pmatrix}, \quad \boldsymbol{Y}_t^{mfg} = \begin{pmatrix} w_t \\ Z_t^{mfg} \\ \pi_t^e \\ \hat{y}_t \\ \omega_t^{mfg} \end{pmatrix}$$

A key advantage of using a BVAR model is that the model forecasts all variables that enter the system of equations. This makes it easier to construct alternative versions of the model and to evaluate their forecasting properties. Norges Bank uses two versions of the BVAR model: One based on data for mainland Norway, and one based on data for the manufacturing sector. Both models forecast total annual wage growth, but the manufacturing version uses explanatory variables that are more relevant to the manufacturing sector. In periods where profitability has evolved differently across manufacturing and all businesses, having two versions can be especially useful.

In a BVAR model it is more challenging to interpret the linkages between the explanatory variables than in an ECM as BVARs are less structural. However, it is possible to conduct some simple exercises to isolate the effect of changing one of the explanatory variables. Chart 1 shows the change in projected wage growth using the BVAR model for mainland Norway, when conditioning on a lower labour share in 2024. The exercise indicates that a 1 percentage point lower labour share raises wage growth by just below 0.2 percentage point the following year. This is slightly lower than the corresponding effect in the ECM model, which lies between 0.2 and 0.3 percentage point. All else equal, the BVAR model for

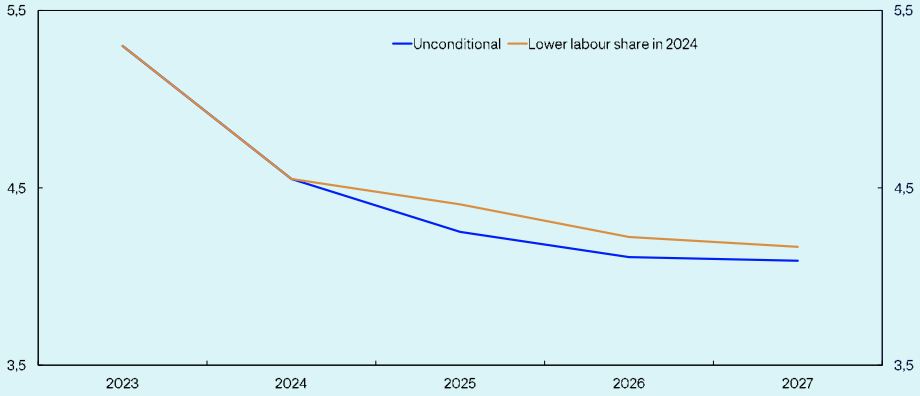
7 In addition, figures for manufacturing are more prone to revision. From 2011 to 2021 the labour share in manufacturing was on average revised by 1.1 percentage points for mainland Norway and 3.9 percentage points for manufacturing firms.

8 The models are estimated from 1980 to 2023. The models are documented in a forthcoming publication on norges.bank.no.

9 The models contain annual wage growth (W), value of productivity ($Z^i = z^i \times py^i$), expected inflation (π^e), output gap ($\hat{y}$) and a measure of the labour share (ω^i).

mainland Norway indicates that the effect peaks the year after the decline in the labour share, but the effect is also long-lasting.

Chart 1. Isolated effect of a 1 percentage point lower labour share in 2024
Annual wage growth. Percent



Source: Norges Bank

In addition to the empirical models, wage growth expectations in Norges Bank's Expectations Survey and Regional Network also provide valuable information. A comparison of the forecasting properties across the different surveys and models suggests that the wage expectations of the social partners have historically provided the most accurate wage growth projections (Table 1). The values in the table indicate normal deviation between projected and actual wage growth. Historically, the near-term forecasting accuracy of the empirical models has been lower than the wage expectations of the social partners. However, it should be noted that this evaluation is based on the BVAR's own forecasts. These forecasts are not necessarily in line with the rest of the macroeconomic scenario from the Bank. In the forecasting process, the Bank will normally condition on its forecasts where possible. This will probably improve the accuracy of the forecasts compared with Table 1.

Table 1 Forecast properties measured by RMSE. Forecast given in Q1. Evaluated 2005–2023[1]

Model/indicator	RMSE		
	Current year	Next year	In two years
Expectations survey– Social partners	0.5	0.9	-
Expectations survey – business leaders	0.8	1.2	-
Regional Network	0.6	-	-
BVAR – Mainland Norway	0.7	1.1	1.1
BVAR – Manufacturing	0.8	1.2	1.2

1 The ECM model is not included in the evaluation as it must be conditioned on exogenous variables in order to provide wage forecasts. Evaluation therefore requires recursive estimates for all explanatory variables that the model does not itself produce. This is not available for the entire period from 2005 to 2023.

What influences the krone exchange rate?

Norges Bank does not have a policy target for the krone. The exchange rate is still something that the Bank is concerned with because of its importance for inflation and activity in the Norwegian economy. Nor is the exchange rate independent of the Bank's conduct of monetary policy. Through the effect of the exchange rate on the wider economy, the exchange rate channel can amplify the effect of the policy rate (see Section 3.1.2 The transmission mechanism).[1]

Monetary policy is not alone in influencing the exchange rate, movements in the krone exchange rate are determined by a wide range of factors – both domestic and international. It is therefore challenging to explain all exchange rate movements, as is also supported by a large body of research.

In a discussion of factors that drive the exchange rate, it is useful to start with what is called uncovered interest parity, expanded below to include a risk premium, (σ_t). s_t is the nominal exchange rate (logarithm), while $E_t s_{t+1}$ is the expected exchange rate in the subsequent period. ($i_t - i_t^*$) is the interest rate differential against other countries.

(1) $$s_t = -(i_t - i_t^*) + E_t s_{t+1} + \sigma_t$$

This equation states that an investor must earn the same expected risk-adjusted return on investments in two different countries when measured in a common currency. If the interest rate differential is positive, the return on a risk-free investment will be higher in Norway than abroad. To make investing in both markets attractive, the krone exchange rate must then be expected to depreciate. If the interest rate differential increases unexpectedly, the krone, according to this equation, will appreciate immediately, but depreciate afterwards.

Even though the equation is too simple to explain movements in the krone exchange rate, experience has shown that some of the mechanisms may apply. Normally, the krone will appreciate when the interest rate differential against other countries increases unexpectedly, and, correspondingly, the krone will depreciate when the interest rate differential decreases. In spring 2022, the interest rate differential against Norway's main trading partners fell, and by more than the market had expected. The decline in the interest rate differential coincided with the krone depreciation.

The third term in the equation can be interpreted as payment for the additional risk of investing in NOK. There are several reasons why such a risk premium exists in FX markets.[2] A substantial portion of trading in Norwegian kroner is between market participants such as banks and hedge funds. These participants have different – and limited – informa-

1 See Røisland and Sveen (2018)

2 See Bacchetta and van Wincoop (2010), Gabaix and Maggiori (2015) and Evans and Rime (2019)

tion, and their willingness and ability to bear currency risk may be limited. Many transactions may be disconnected from macroeconomic conditions. The risk premium captures how different FX market participants interpret information, the framework conditions they face and how they operate.

Major currencies such as the euro and the US dollar dominate trading in global FX markets. In total, trades against the krone account for approximately 1 percent of international FX trades. Minor currencies tend to be more exposed than major currencies to changes in market participants' risk assessments and to changes in supply and demand from market participants requiring currency conversion.

Risk premium volatility may explain a significant share of exchange rate movements, and the greatest impacts often coincide with international market turmoil. In recent years, the pandemic, war and high inflation have led to heightened geopolitical and economic uncertainty, and market volatility has increased. This has probably led to a flight by investors to "safe haven" currencies and away from less liquid and more volatile currencies.

An important insight from this framework, shown in equation (1), is that the exchange rate depends not only on the interest rate differential and risk premium today, but also on market expectations regarding these variables in the future. If something happens that causes market expectations to change, the exchange rate will change today.

This is also consistent with what can be observed. The krone will often appreciate if the central bank sets a higher policy rate than expected by the market or if market policy rate expectations rise.

However, small changes in the krone exchange rate normally follow Norges Bank's monetary policy meetings. This is probably because the monetary policy response pattern is well known and because the FX market is forward-looking. Consistent with this, we see that the krone exchange rate often reacts when key macro data for the Norwegian economy are released that differ from expectations. For example, the krone exchange rate often appreciates when inflation exceeds market expectations.

Another important insight is that not only is policy rate setting in Norway important for the exchange rate, so are the actions of central banks in other countries.

With free capital movements and an inflation target identical to Norway's trading partners' targets, Norway cannot have a policy rate that over time deviates substantially from foreign policy rates. However, with a floating exchange rate, Norges Bank is not bound to have the same policy rate level as Norway's trading partners. The Bank can set the policy rate based on the outlook for the Norwegian economy and has room for

flexible inflation targeting, where monetary policy can also contribute to keeping employment high.

This assumes that there is confidence that inflation will be stabilised around the target. The central bank must react when there are prospects that inflation will rise above target, even when the source of inflation is external. If monetary policy does not react, the krone may depreciate substantially, leading in turn to higher imported inflation, which could spill over into domestic price and wage inflation. If the policy rate is not raised when inflation increases, the exchange rate may fuel a wage-price spiral.

The nominal exchange rate is the rate that at any given time leads to FX market equilibrium. The exchange rate is, however, also important for equilibrium in the real economy, and in this context, the real exchange rate is the most relevant, Q_t.

$$(2) \quad Q_t = S_t \frac{P_t^*}{P_t}$$

The real exchange rate indicates the price of foreign goods relative to Norwegian goods in a common currency. If the real exchange rate depreciates – which in equation (2) implies a higher value – it will be, on average, more expensive to purchase goods and services abroad than at home.[3]

The real exchange rate can be regarded as a price that results in current account equilibrium. Over time, imports must correspond to the sum of exports and the return on net foreign assets. The level of the real exchange rate consistent with current account equilibrium will depend on structural factors, both in the Norwegian economy and in trading partner countries.

The real krone exchange rate is not fixed over time. Some variability reflects short-run volatility, but we also see movements that may reflect more protracted cycles. For Norway, the petroleum industry has likely played an important role. An analysis of long-run driving forces in the Norwegian economy from the 1970s to the present points to two factors that have a particular impact on the long-term trend in the real exchange rate. One is productivity growth in Norway relative to other countries, the other is the petroleum industry's importance for the Norwegian economy.[4] The development of the Norwegian petroleum industry, combined with high oil prices, likely strengthened the krone over a longer period. Over the past decade, the fall in oil prices and the petroleum industry's diminished importance for the Norwegian economy may have contributed to weakening the krone.

With a floating exchange rate, the krone exchange rate could also act as a shock absorber. This was observed, for example, after the fall in oil prices in 2014, when both the real exchange rate and the nominal exchange rate

3 The real exchange rate measures the relative price of the goods in the respective price index basket. Different price indexes may generate somewhat different real exchange rates at a given point in time.

4 See Bjørnland et al (2024).

depreciated sharply. If more of the adjustment to lower oil prices had been made via a lower domestic wage and price level, as a fixed exchange rate would have required, activity and employment would have had to decline more than they did. With a floating exchange rate, the policy rate could be set with the aim of dampening the downturn in the Norwegian economy.

3.3 Neutral monetary policy and indicators of monetary tightness

In order to assess whether monetary policy is expansionary or contractionary, a "zero point" is needed, where the effect of monetary policy on demand in the economy is neutral. It is not obvious how "neutral monetary policy" should be defined, but the most common measure is the "neutral real interest rate"[19]. It is defined as the level of the real interest rate that is neither expansionary nor contractionary. The neutral real interest rate is thus a key concept for assessing monetary tightness. As the neutral real interest rate cannot be observed, estimations of it will be uncertain.

3.3.1 Literature and international practice

The term was introduced by Wicksell (1898), who defined the neutral real interest rate as the interest rate that is consistent with stable developments in commodity prices. In Wicksell's view, the general price level would rise or fall as long as the real interest rate deviated from the neutral real interest rate. The concept was subsequently formalised and developed further in Woodford (2003). Here the neutral real interest rate was defined as the rate that would arise in an economy without nominal rigidities, ie where prices and wages are fully flexible. In Woodford's definition, any shock regardless of duration will affect the neutral real interest rate, something that could potentially entail wide fluctuations in the neutral real interest rate even in the short term.[20]

In other words, the various definitions of the neutral real interest rate in the literature differ primarily with regard to the persistence of the shocks included. In the conduct of policy, there is good reason to disregard factors regarded as transitory in a definition of the neutral interest rate. Transitory shocks are demanding to identify in real time, and a measure of the neutral real interest rate that differs widely from one quarter to the next is not suitable as a reference point for monetary policy. It is especially important to distinguish the neutral real interest rate from what is called the long-run equilibrium interest rate. The long-run equilibrium interest rate is determined by fundamental economic factors, such as potential

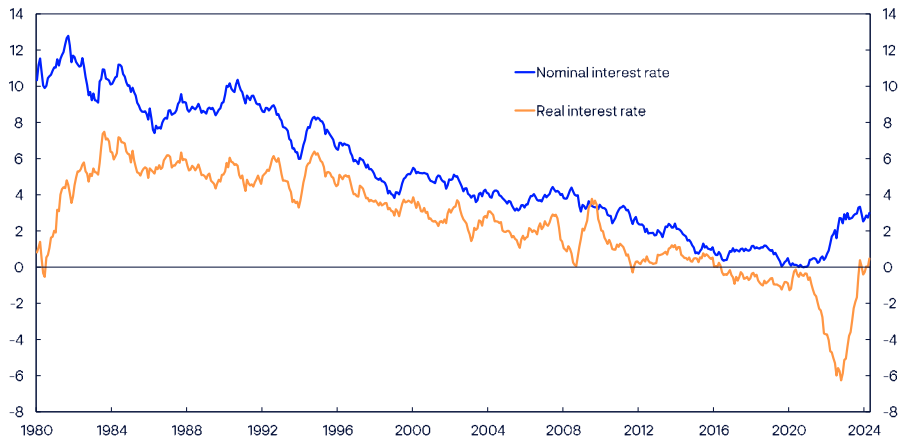
19 The terms "neutral real interest rate", "natural real interest rate" and "normal real interest rate" are used interchangeably in the literature. In this paper, the term "neutral real interest rate" is used.

20 See Brubakk et al (2018b).

growth and consumers' saving behaviour. However, the neutral real interest rate is also determined by various shocks that affect the supply and demand sides of the economy in the medium run. In the long run, the neutral real interest rate will correspond to the equilibrium interest rate inthe economy, while it may deviate from it in the short and medium run. In a world of high capital mobility, it is reasonable to assume that the long-run equilibrium interest rate will be a global variable.[21]

Since the mid-1980s and up to 2021, long-term global interest rates have shown a clearly falling trend (Chart 3.3). The decline in the first part of the period reflects lower actual and expected inflation. In the latter decade of the period, most of the decline in nominal interest rates was probably the result of the decrease in real interest rates. As it is unlikely that monetary policy can influence the real interest rate over time, developments must primarily be interpreted as a fall in the neutral real interest rate. The substantial movements in the real interest rate, as defined in Chart 3.3, towards the end of the series primarily reflect a broad rise in global inflation and are largely unaffected by changes in the neutral interest rate.

Chart 3.3 Yields on 10-year government bonds[1]
Percent. January 1980 – April 2024



1 The following countries are included in addition to Norway: Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, the UK, Switzerland and the US. Unweighted average. Real interest rate is nominal interest rate less average inflation in current year.

Sources: LSEG Datastream and Norges Bank

Central banks differ in their practices in publishing their estimates of the neutral real interest rate. The Bank of Canada (BoC) reviews its estimates of the neutral real interest rate every year and uses various approaches to arrive at its estimates. In 2024, the BoC revised down the neutral nominal interest rate in Canada[22] to lie in the range of 2.25 to 3.25%.[23] The US Federal Reserve has not explicitly defined the neutral interest rate[24], but the median of FOMC members' projections for the federal funds rate

21 See Bernhardsen and Gerdrup (2006).

22 Defined as the neutral real interest rate plus the inflation target.

23 See Adjalala et al (2024).

24 The Federal Reserve Bank of New York publishes updated estimates of the neutral real interest rate as estimated in Laubach and Williams (2003) and Holston, Laubach and Williams (2017).

over the long term is often regarded as a possible estimate. Various estimation methods suggest that the long-term neutral nominal interest rate in the US may lie in the range of 2.25 to 3.25%.[25] According to different estimates, the neutral real interest rate in the euro area has been between -0.75% and 0.5% since the second half of 2023.[26]

One objection to exclusively regarding the deviation between the actual real interest rate and the neutral real interest rate as an indicator of monetary tightness is that it does not capture other financial conditions, such as credit standards, credit supply, asset prices and the exchange rate. The importance of the different factors can vary across countries owing to differences in the financial system and participants' funding structures. The nominal interest rate can also have an impact over and above the real interest rate as it affects households' and businesses' cash flows. Financial conditions also affect demand and can be regarded as part of monetary policy in a broader sense.

An alternative method of measuring monetary tightness is a Financial Conditions Index (FCI). Movements in financial variables are often not synchronous, and the macroeconomic impact of changes in one variable can be offset by another. While an increase in the monetary market rate will normally signal tighter financial conditions, the overall effect can be reversed if for example the price of risk falls in securities markets. The aim of an FCI indicator is to summarise the effect of changes in various financial variables and make it easier to interpret the macroeconomic effect of these changes. FCI indicators are used actively by many countries' central banks, institutions and major banks.[27] Norges Bank's FCI indicator[28] is used in the *Monetary Policy Report* as a measure of whether financial conditions, beyond those implied by the policy rate, are tighter or looser than a historical average.

3.3.2 Norges Bank's interpretation of the neutral real interest rate

Norges Bank has chosen to define the neutral real interest rate as the rate consistent with balanced economic developments in the medium term when the impact of transitory shocks has unwound (normally within five to ten years). Balanced economic developments refer to output in line with potential output and inflation at target. The neutral real interest rate, according to this definition, is primarily determined by structural conditions. In a small open economy such as Norway, underlying conditions are influenced to a great extent by international developments. This means that the neutral real interest rate in Norway will likely remain close to the global neutral real interest rate over time.

In *Monetary Policy Report* 2/2024, the neutral real money market rate was assumed to lie in the interval between 0 and 1%. Norges Bank uses both economic models and market-based measures to estimate the neutral

25 See Adjalala et al (2024).

26 See Brand et al (2024)

27 See Alsterlind et al (2020) for an example from Sveriges Riksbank and references to other institutions producing FCIs. Jensen and Pedersen (2019) analyses financial conditions in Denmark.

28 See Bowe et al (2023).

real interest rate. The various estimates all indicate a persistent decline in the neutral real interest rate over the 20 years preceding the pandemic. See box below.

Norges Bank's estimates of the neutral real interest rate[1]

Norges Bank uses a range of methods to estimate the neutral real interest rate. Model estimates are now used in addition to purely market-based measures. Long-term market rates provide an indication of market expectations of future interest rates. As the effects of past transitory shocks to the economy can be expected to unwind in the course of five to ten years, it can be assumed that their effect on long-term interest rate expectations is limited. Adjusted for expected inflation, implied long-term interest rate expectations can express market estimates of the neutral real interest rate.[2]

The model estimates are based on two types of empirical model, two vector autoregressive (VAR and BVAR) models and different state-space (SS) models. The models mainly differ in their degree of theoretical foundation.

The VAR model is a purely statistical model with time-varying parameters.[3] The model is based on the interplay between output, inflation and the real interest rate, but includes time variation in these relationships. The neutral real interest rate is defined as the model's current estimate of the actual real interest rate five years ahead.

The Bayesian VAR model (BVAR) is also a purely empirical model, where the underlying trend (the deterministic component) in the nominal interest rate and inflation are used to estimate a trend for the real interest rate.

The SS models rely to a greater extent on economic theory.[4] In these models, there is a direct relationship between the level of capacity utilisation in the economy and the difference between the actual and the neutral real interest rate (IS curve). Capacity utilisation in turn affects inflation via the Phillips curve[5] [6]. The neutral real interest rate depends on both potential output and other unspecified factors that influence saving and investment decisions. Based on data and the assumed

1 This box is based on Brubakk et al (2018b).

2 For Norway, the analysis uses inflation expectations five years ahead for economists as a whole from Norges Bank's Expectations Survey.

3 For a description of the method, see Lubik and Matthes (2015).

4 The model is inspired by Holston et al (2017).

5 According to papers published by A.W. Phillips in 1958, a country could choose between low unemployment and low inflation. This choice is often referred to as the Phillips curve.

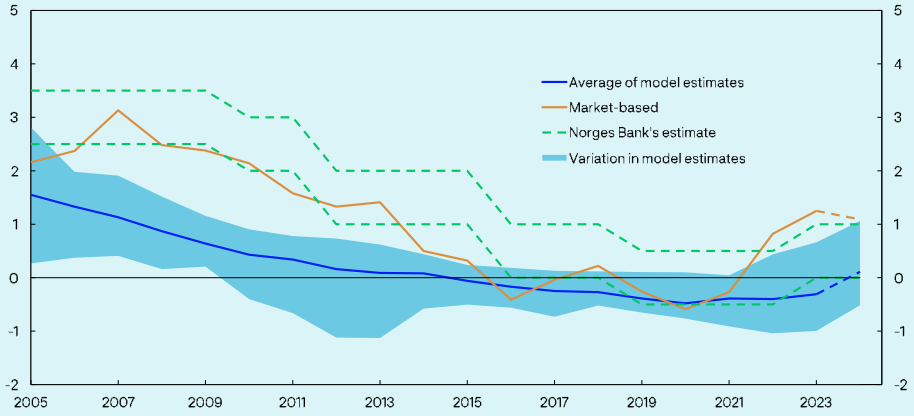
6 The data used are for the rise in prices for domestically produced goods and services that have historically been higher when correlated with domestic capacity utilisation than aggregate consumer price inflation. Norges Bank also estimates a version of the model where wage growth is used as the observable variable.

relationships, the most likely historical path of the neutral real interest rate can be estimated using statistical methods.[7]

The models are estimated using data from 1994 up to and including 2024.[8] For 2024, data and short-term estimates of economic variables from *Monetary Policy Report* 2/2024 are used. The estimation period includes the sharp fall in GDP during the pandemic. Such a sharp fall is difficult for standard models to explain. Adjustments to the models were therefore made in order to explain these extraordinary developments.[9]

Chart 1 shows estimates of the neutral real interest rate using the different methods described above. All the estimates suggest a downward trend until recently. In some periods, not least around the time of the financial crisis, the estimates vary quite substantially. In addition, individual model estimates are highly uncertain. Towards the end of the period, the model estimates are in the range of -0.5% to 1.1%, while the market-based estimate lies slightly above 1%. The Bank estimates the neutral real interest rate to be in the range of 0 to 1%. There is considerable uncertainty regarding both the current level of the neutral real interest rate and developments in the coming years.

Chart 1 Estimates of the neutral real interest rate in Norway
Percent. 2005–2024



Sources: LSEG Datastream and Norges Bank

7 Norges Bank uses the Kalman filter (see eg Hamilton (1994)).

8 In the models, a time series for the expected real interest rate is used, which is constructed by using three-month Nibor less inflation expectations 12 months ahead for economists as a whole from Norges Bank's Expectations Survey from 2002 to 2012. After 2012, Norges Bank's own short-term forecasts for underlying inflation are used to calculate expected real interest rates (Chart 4.5 in *Monetary Policy Report* 2/2024).

9 See Primiceri and Lenza (2020) and Holston et al (2020) for a description of the methods used to adapt the models to the Covid pandemic.

3.4 Monetary policy response to shocks

3.4.1 Literature

In principle, the optimal interest rate response to different types of shocks can be derived if a core model is used that adequately captures the monetary policy transmission mechanism, in both qualitative and quantitative terms, and has a specified loss function (see box on trade-offs on page 42). An exercise of this type can be a useful guide to how monetary policy should be oriented. In addition, it can serve as an aid to ensuring that a central bank's response pattern is consistent over time. For these reasons, Norges Bank uses model simulations based on an optimal policy as input to its analyses and projections. The exact interest rate response derived from such simulations is naturally highly model-dependent and should therefore not be taken literally. However, the qualitative results from such optimal policy simulations are usually relatively general, particularly how Bank should respond to demand- and supply-side shocks respectively.

Demand shocks result in little or no conflict between the objective of stabilising inflation and the consideration of stabilising the real economy.[29] A fall in demand reduces employment and normally also leads to lower inflation. It will then be appropriate to reduce the policy rate to counter the fall in the level of activity and inflation. Similarly, it will normally be appropriate to raise the policy rate in the event of a positive demand shock.

Supply shocks can lead to a conflict in the short term between the objective of keeping inflation stable around the target and the objective of keeping employment high and stable. The extent of the conflict depends on the type of supply shock that occurs and its duration. A rise in production costs due to higher input prices or lower productivity will normally lead to higher inflation. In addition, it may lead to lower production, both because investments are reduced when profitability declines and because households reduce consumption in response to higher prices. The rise in inflation implies a rise in the policy rate, but a higher policy rate will at the same time amplify the decline in demand. Such a shock will nevertheless normally imply some increase in the policy rate to ensure that inflation is brought down to target within a reasonable time horizon. The appropriate increase in the policy rate depends on the extent to which the shock itself is projected to reduce the level of activity. Similarly, lower production costs will normally imply that the policy rate should be reduced somewhat in order to bring inflation gradually up to target.

One type of supply shock that does not engender the same degree of conflict between the objective of achieving the inflation target and the consideration of high and stable employment is an increase in wage growth beyond normal given the economic situation. Higher wage growth

29 In an open economy, demand shocks produce some conflict between targets due to the exchange rate channel. See Røisland and Sveen (2018).

contributes to higher inflation but may at the same time lead to higher demand because higher real wages increase household income in the short term. It will then normally be appropriate to increase the policy rate somewhat more than if costs other than labour costs had increased.

Exchange rate shocks have elements of both demand and supply shocks. A weaker krone normally fuels demand, and thereby leads to higher employment, because competitiveness improves when domestic goods prices fall in relation to foreign goods prices. This expansionary effect will normally be greater than the contractionary effect of a decline in real wages due to the depreciation, which in isolation reduces consumption. Increased demand will in turn push up inflation. In addition, an exchange rate depreciation will push up inflation directly through an increase in prices in NOK for imported consumer and intermediate goods. Improved export sector profitability can also contribute to higher wage growth, and in turn to a faster rise in prices for domestically produced goods and services.

Both the demand effect and the direct effect on imported price inflation imply that the policy rate should normally be raised when the exchange rate depreciates, and correspondingly lowered when the exchange rate appreciates. As with wage shocks, it will not be possible to fully counteract a rise in inflation due to an exchange rate depreciation without curbing the level of activity in the economy.

An exchange rate depreciation may have a larger impact on inflation if there is a lack of confidence among FX market participants that Norges Bank will stabilise inflation. That would create a risk of a further depreciation when inflation rises, thereby fuelling wage-price spirals. It may then be appropriate to increase the policy rate more than would otherwise have been the case.[30]

In general, economic theory suggests that a shock resulting in higher wage and price inflation should be addressed by a rate increase. Most models indicate that the policy rate increase should be of a magnitude that more than counteracts the isolated fall in the real interest rate (nominal interest rate less expected inflation) that follows from higher inflation prospects, so that the real interest rate rises.[31] The magnitude of an interest rate change in response to a supply-side shock, or more generally shocks that lead to a conflict between inflation stability and real economic stability, depends on the central bank's trade-offs between the objectives.

Uncertainty poses a challenge to monetary policy when it comes to determining the appropriate monetary policy response to different shocks. There are many different types of uncertainty. One way of distinguishing between them is to ascertain whether the uncertainty is quantifiable, often referred to as Knightian uncertainty, named after the

30 See Røisland (2023a) and (2023b)

31 Called the Taylor principle.

US economist Frank Knight (1885–1972), who distinguished between quantifiable risk and uncertainty. Knightian uncertainty is more fundamental and difficult for economic policy to manage. A common strategy to address this type of uncertainty is the minimax principle whereby one seeks to minimise the likelihood of, or cost of, the worst conceivable outcome. The implications of Knightian uncertainty for monetary policy are not entirely unequivocal, but findings generally suggest that central banks should respond more aggressively when facing such uncertainty.[32]

Quantifiable uncertainty (which Knight called "risk") is more manageable in principle. A distinction is often drawn between additive and multiplicative uncertainty. Additive uncertainty is not affected by monetary policy. An example of additive uncertainty is uncertainty about future developments in oil prices, global economic cycles, weather conditions and other types of variables that are not influenced by monetary policy. In linear models with additive uncertainty, certainty equivalence applies. That means that the degree of uncertainty should not matter for the monetary policy stance, so that monetary policy can regard projections of uncertain variables as though they were not uncertain.

Linear models are often useful, particularly when there are relatively limited economic fluctuations close to the economy's long-term equilibrium level. But in some situations, it may be important to take non-linearities into account. In that case, certainty equivalence does not apply, even in the case of additive uncertainty. A relevant example is a situation where the policy rate is not far from the effective lower bound. The lower bound for the policy rate is an obvious non-linearity, increasing the risk of the policy rate reaching the lower bound where it is no longer effective as a stabilisation instrument. An intuitive strategy for reducing that risk can be to "keep the ammunition dry" by responding less than otherwise to shocks, leaving some room to respond if a severe negative shock were to arise. Economic theory, on the other hand, suggests that the opposite response is appropriate: one should respond more aggressively to shocks in order to underpin inflation and the activity level.[33] This will reduce the likelihood that the lower bound becomes binding and reduce the depth of a downturn.

Multiplicative uncertainty is influenced by monetary policy. Examples of multiplicative uncertainty is uncertainty about the effect of the policy rate on the exchange rate and demand, uncertainty about the slope of the Phillips curve and uncertainty about expectations formation. The monetary policy response pattern can influence this type of uncertainty. A key finding in the literature is that uncertainty about the effect of monetary policy on target variables would suggest a more cautious response to economic shocks,[34] because with this type of uncertainty, monetary policy can also contribute to unintended changes in the target variables if the monetary policy effect is not as expected. Responding

32 Gerke et al (2009).

33 See Reifschneider and Williams (2000).

34 This is commonly referred to as the Brainard principle. See article by Brainard (1967).

less (ie more cautiously) to shocks reduces the extent of such unintended changes. This must be weighed against the fact that the achievement of monetary policy objectives improves by responding adequately to shocks if the effect proves to be as expected. Because there will always be a degree of uncertainty about the effects of monetary policy, the precautionary principle will always apply to a certain extent, even if the degree of uncertainty may vary with the economic situation and interest rate level.

A cautious response is often associated with a gradual approach in monetary policy, but cautious is, at least in theory, not exactly the same thing as gradual. A cautious response means that the central bank responds less to a shock than otherwise. A gradual response means that the response to a shock is normal, but that the response comes in a series of smaller increments over time. There may be reasons to change policy rates gradually, but those reasons are not directly related to uncertainty.

A gradual approach can improve the central bank's ability to affect long-term interest rates and can have a favourable effect on inflation expectations.[35] A gradual approach may also be warranted if it increases the central bank's knowledge about the effects of a change in the policy rate.[36] In practice, however, it is not as easy to distinguish between a cautious and a gradual approach, and the distinction is unlikely to be as sharp in policymakers' judgement-based assessments as it is in theory.

Not all multiplicative uncertainty suggests a more cautious response. If, for example, there is uncertainty about the extent to which inflation expectations depend on previous actual inflation outcomes, theory argues that the response to shocks affecting inflation should be more aggressive.[37]

Model uncertainty is a type of uncertainty that has elements of both Knightian uncertainty and multiplicative uncertainty but is difficult to specify. Models are always simplifications and build on assumptions with varying degrees of realism. A common response to model uncertainty is to use several different models that build on different assumptions. The model-based predictions can then be taken into account on a discretionary basis. The challenge is that there are no good objective guidelines on how to combine information from different models on a discretionary basis.

Another strategy to address model uncertainty is to use simple rules as a guide to interest rate setting. The Taylor rule is an example of such a simple rule.[38] Research shows that certain simple rules for monetary policy, if properly designed, can be relatively robust to model uncertainty.[39]

35 See Goodfriend (1991) and Woodford (2003).
36 See Sack (1998).
37 See Söderström (2002).
38 See Taylor (1993).
39 See Taylor and Williams (2011).

Simple rules are commonly used as cross-checks by central banks, even if reference is not always made to the use of such rules in monetary policy reports and the like. The US Federal Reserve is the central bank that most actively uses simple monetary policy rules in its communication.[40]

3.4.2 Norges Bank's practice and communication

Norges Bank is one of the few central banks that publishes a policy rate forecast (see SSection 3.1 for further details on the policy rate path). When a shock occurs, the Bank will normally respond by changing the policy rate and/or the policy rate path. The policy rate and the policy rate path are not independent of each other, however, as the rate path represents the forecast for the average policy rate in each quarter. Since Norges Bank usually changes the policy rate stepwise, often by quarter percentage points, the average policy rate will often differ slightly from the level in the policy rate path. The Bank bases its decisions on the assumption that the uncertainty surrounding the rate path is symmetrical, ie if the path is, for example, closer to 1.50% than 1.75%, it is more likely that the policy rate will be 1.50% than 1.75% in the relevant period.

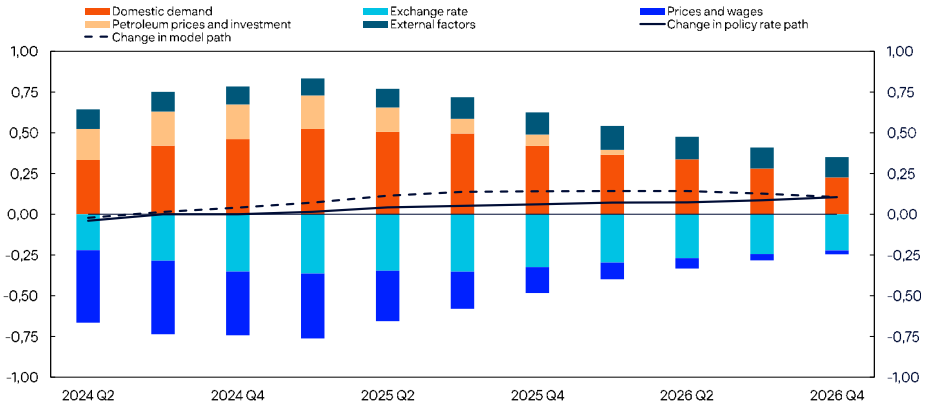
The rate path is derived using the macroeconomic model NEMO, but judgement-based assessments and information from other models also influence the Bank's policy rate forecasts. There is considerable uncertainty about the policy rate forecast. If the economic outlook, the risk outlook or Norges Bank's assessment of how the economy functions change, the policy rate will be set at a different level than implied by the rate path.

A single rate path provides little information about the monetary policy response pattern. But a change in the path from one *Monetary Policy Report* to the next reflects the Bank's reaction to new information since the preceding report and any new assessments of economic relationships and the risk outlook.

As a guide to the response pattern for the public and market participants, the Bank publishes a decomposition of the different factors (different shocks) behind the change in the rate path from one report to the next. The macroeconomic model NEMO is used as an aid to identify and quantify such shocks, but there is no mechanical relationship between the projections for the shocks and the effects on the policy rate path. Chart 3.4 shows the decomposition in *Monetary Policy Report* 1/2024. The columns show the different factors' contributions to change in the model-based path. The solid line shows the actual change in the rate path.

40 See the Monetary Policy Report to the Congress and the Cleveland Fed's 7 simple monetary policy rules (which are also used to forecast the policy rate).

Chart 3.4 Factors behind changes in the policy rate forecast between MPR 4/23 and MPR 1/24
Cumulative contribution. Percentage points



Source: Norges Bank

To some extent, the decomposition provides a fairly detailed description of Norges Bank's response to different shocks, but it only quantifies the implications of these shocks for the rate path itself. If the Bank's estimates of the size of the different shocks are known to the public, the decomposition would in principle be a complete description of the response pattern. But the size of the shocks, as estimated and interpreted by the Bank, are not communicated in full, partly because there is no unequivocal way of identifying and quantifying shocks. The decomposition must therefore be seen as an aid to help the public and market participants understand the main features of the response pattern and not as a complete and detailed description of it. In addition, a complete description of the response pattern is probably nether desirable, nor possible, as it would give the impression of a level of precision that does not reflect the monetary policy assessments in practice. Among inflation-targeting central banks, Norges Bank is probably the central bank that goes farthest in specifying the normal monetary policy response pattern.

The policy rate path can deviate from the market's policy rate expectations. This does not necessarily mean that Norges Bank's response pattern is not well understood by market participants. Analyses show that revisions of the market's interest rate expectations from one publication date to just ahead of the next (the day before), which typically reflect new information between the publication dates, are strongly correlated with revisions of the Bank's policy rate path.[41] This indicates that market participants have a good understanding of the Bank's response pattern and how monetary policy will react to news about economic developments.[42] If market participants believe that economic developments will differ from those assumed by the Bank, their policy rate expectations might differ from the rate path, even if the market has perfect knowledge of the Bank's response pattern.

41 See Brubakk, ter Ellen and Xu (2017).
42 Households also seem to understand the Bank's response pattern, see Erlandsen and Langbraaten (2018).

Analyses nevertheless indicate that publication of the policy rate path influences market expectations in the desired direction. The rate path and the decomposition also reflect the Bank's assessment of uncertainty and the implications of that uncertainty for the policy rate, as well as the implications for policy rate setting of the risk associated with financial imbalances, as discussed in Section 2.3. The Monetary Policy and Financial Stability Committee's monetary policy strategy statement describes how the Bank generally takes account of uncertainty: "*The policy rate affects inflation and the real economy with a lag, and the effects are uncertain. The uncertainty surrounding the effects of the policy rate normally implies that monetary policy will respond less forcefully to shocks than would otherwise have been the case. Moreover, the policy rate will normally be changed gradually to enhance the predictability of monetary policy and reduce the risk of undesirable financial market volatility and unexpected reactions of households and firms.*"

In the period following the global financial crisis in 2008, when domestic and international interest rates fell to historically low levels, Norges Bank gave particular weight to caution in policy rate setting. The uncertainty about the effects of policy rate changes is greater than normal in such situations both because there is generally a more limited empirical basis for quantifying the effect of policy rate changes when the rate is at abnormal levels, and in particular because little is known about how policy rate changes pass through to banks' deposit and lending rates when the policy rate is close to the lower bound. When inflation rose sharply in 2021 and 2022, the Bank raised the policy rate more cautiously than the standard optimal policy would imply (see box on page 42). The Committee gave weight to the uncertainty surrounding the effects of rate hikes, which could entail a risk that monetary policy itself could contribute to economic instability.

In the Monetary Policy and Financial Stability Committee's monetary policy strategy statement, reference is also made to situations where a more aggressive response may be appropriate: "*In situations where the risk of particularly adverse outcomes is pronounced, it may be appropriate to react more forcefully than normal in interest rate setting. Examples of particularly unfavourable outcomes could be that inflation expectations become de-anchored, which could make it costly to bring inflation back to target, or that employment falls sharply, which could persist through hysteresis effects.*" This minimax principle was given weight when the policy rate was cut sharply in spring 2020 in response to the considerable uncertainty that arose when society was locked down at the beginning of the pandemic. Similarly, the policy rate was also reduced sharply in 2008 during the global financial crisis.

Scenario analysis is one way of describing parts of the response pattern, particularly for situations that are not considered part of normal cyclical fluctuations. On a few occasions, Norges Bank has used scenario analysis as part of its monetary policy strategy and communication. One example

is the box in MPR 4/19, which describes potential effects, including monetary policy reactions, of different outcomes of the international trade conflict.[43]

The Bank uses simple monetary policy rules to some extent as cross-checks in interest rate setting. The role of such cross-checks in the monetary policy decision-making process and in communication has varied somewhat in practice over time. Many of the monetary policy reports have presented different simple rules, showing how the policy rate would have evolved in the near term had those rules been followed. In addition, the market's interest rate expectations are used as a cross-check for the policy rate forecast. The Bank continuously works on analysing and developing good cross-checks for interest rate setting and projections for inflation and activity levels for use in the decision-making process. The aim is to be as certain as possible that the rules used as cross-checks are actually robust to model uncertainty, so that they can be given a clearer role in monetary policy assessments and communication.

3.4.3 Monetary policy response to large, unusual shocks

Most of the evolution of monetary policy theory and practice has up until recently focused on monetary policy's role during more or less normal business cycles. But large, unusual shocks sometimes occur that challenge conventional thinking about the role of monetary policy and its instruments. Over the past 15 years, the global economy has been hit by three large unusual shocks: the global financial crisis of 2008–2009, the pandemic that broke out in 2020 and the inflation shock in 2021

There are two aspects of large, unusual shocks that have implications for the monetary policy strategy. One is that the policy rate can move down to the effective lower bound, where a further cut in the policy rate will not pass through to market rates. The central bank must then consider alternative instruments, described in more detail in Section 3.5 below. The other aspect is that such shocks can necessitate the use of additional measures from other policy areas, in particular fiscal and macro-prudential policy.

The global financial crisis showed that price stability does not necessarily lead to financial stability and that international financial markets are so closely integrated that financial market stress in one country can rapidly transmit to the rest of the world. During the global financial crisis, the main challenge was primarily the size of the shock and not its characteristics. The downturn can be regarded as a traditional, negative Keynesian demand shock caused by a financial crisis. The lower bound for the policy rate prevented monetary policy in many countries from becoming sufficiently expansionary to counteract the shock. Many central banks therefore used alternative instruments (see Section 3.5).

43 It was emphasised that these monetary policy reactions are based on model simulations in the core model NEMO and are therefore not based on an assessment by decision makers of what an appropriate monetary policy response in the different scenarios would be.

The pandemic was both a large and an unusual shock. Widespread business closures and mobility restrictions led to a sharp fall in the level of activity. At the same time, this was in a sense a desirable fall as it was considered necessary for containment-related purposes. The business closures and mobility restrictions represented in isolation a negative supply shock. At the same time, the drop in output, and thereby income, also had negative consequences for demand. In an influential article, Guerrieri et al (2022) introduce the term "Keynesian supply shock" about the type of shock the pandemic represented. Their point is that the negative supply shock created a fall in demand that was greater than the initial fall in supply. The net effect was therefore deficit demand in the Keynesian sense, at the same time as supply was limited. In contrast to traditional negative supply shocks, where a tighter economic policy is needed to bring aggregate demand down to match lower potential output, a Keynesian supply shock requires an economic policy that is more expansionary. There is no academic consensus on whether the pandemic was mainly a traditional supply shock or a Keynesian supply shock.

Another distinguishing feature of the pandemic was that monetary policy was far from adequate to counteract its effects. This was to some extent because the lower bound for the policy rate restricted monetary policy, as it did during the global financial crisis, but primarily because Covid-related restrictions created a need for measures targeting those more directly hit by the restrictions. Fiscal support measures and redistribution are primarily a fiscal policy responsibility, and fiscal measures were used on a large scale both in Norway and in other countries. In Norway, monetary policy's most important role at the beginning of the pandemic was to ensure well-functioning credit markets and lower borrowing costs for enterprises and households. Even though economic activity was severely reduced as a result of Covid-related restrictions, the policy rate cuts supported activity in those segments of the economy that were not directly hit by the restrictions. Expansionary monetary policy, for example, contributed to a high level of housing investment, which offset some of the fall in the level of activity in those segments of the economy that had been closed down. Nevertheless, fiscal policy and its direct support measures must be said to have been the most important policy instrument during the pandemic. The interactions between monetary policy and fiscal policy are described in more detail in Section 3.6.

The inflation shock of 2021, which was mainly caused by a sharp increase in energy and food prices as a result of Russia's invasion of Ukraine, but also partly by bottlenecks and pent-up demand after the pandemic, was not as acute a shock as the global financial crisis and the pandemic. Central banks had learned from similar shocks in the 1970s and raised policy rates at a relatively rapid pace to prevent high inflation from becoming entrenched, as it had occurred in the 1970s and parts of the 1980s.

3.5 Alternative instruments

The economy may, at times, be subjected to such large negative shocks that the policy rate alone is not sufficient as a tool. There is a limit to how low the policy rate can be set and still pass through to banks' lending and deposit rates. It is uncertain where this level lies for Norges Bank's policy rate, but based on the experience of other central banks, it is likely somewhat below zero. The effect of negative interest rates on parts of the financial market may also be uncertain. As an alternative to further reducing the policy rate, the central bank can utilise other instruments.

After the GFC in 2008, monetary policy was stretched far by many of our trading partners, and even further in a number of countries in connection with the Covid pandemic. Some lowered their policy rates to below zero. A number of central banks also used their balance sheets to underpin economic activity and inflation. A few central banks also intervened in the FX market to counteract currency over-appreciation.

When the economy is exposed to shocks that increase the risk of inflation becoming entrenched at a high level, it is far less appropriate to use alternative instruments as there is no upper limit for the policy rate. In some cases, however, central banks in economies with floating exchange rates have implemented measures in the FX market to prevent a weaker exchange rate from amplifying the rise in inflation.

3.5.1 International experience

Central banks have used their balance sheet in different ways to stimulate demand. The most common measures have been asset purchases, mainly government bonds, and extraordinary loans to banks.

The purpose of central bank purchases of bonds is to push down long-term interest rates. The purchases push up prices, and push down effective yields, on the bonds purchased. To the extent that the bond sellers shift demand towards other securities, for example higher-yielding bonds or equities, these prices may also increase. Central banks' securities purchases can also have an impact by signalling continued low policy rates.

Extraordinary loans to banks have been used to support credit growth by giving banks lower and more predictable funding costs. Such loans feature special terms and normally have substantially longer maturities than loans provided to manage liquidity in the banking system in a normal situation. Many central banks have provided extraordinary loans with interest rate terms linked to whether banks sustain or boost growth in credit to households and enterprises.

Several studies indicate that alternative instruments in other countries have had an impact on interest rates and financial prices. The measures also appear to have stimulated activity, supported banks' credit provision and underpinned inflation expectations. But it is difficult to precisely

estimate the magnitude and duration of the effects. The choice of method and assumptions influences the results, and the estimates tend to vary. Studies also suggest that alternative instruments have the strongest effect in a situation with market imbalances and high risk premiums. As interest rates and risk premiums decline, or when the policy rate nears its lower bound, the effect appears to have weakened.

Some central banks take measures in the foreign exchange market to achieve their inflation targets, either to prevent a too strong exchange rate from contributing to too low inflation, or a too weak exchange rate from contributing to too high inflation. Rather than being a substitution for higher policy rates, the interventions have been a supplement to using the policy rate as a tool, which is also in line with recommendations from the academic literature.[44]

Research and analysis on the effect of FX market interventions show that interventions usually have small and short-term effects on the exchange rate.[45] There are few examples of effects beyond a few days, weeks or months at best, and since the effects are minor, intervention amounts must be substantial in order to achieve the desired effect. The results also indicate that interventions have little effect in advanced economies with an inflation targeting regime. In these economies, capital mobility is high and there is considerable turnover in FX markets. Even extensive currency interventions may then account for only a small share of the daily turnover in the relevant market. The effect is therefore minor. Moreover, to the extent central banks generally communicate openly about their objectives, assessments and plans for the use of policy instruments, interventions will provide market participants with little new information.[46]

3.5.2 Alternative instruments in Norway

During both the GFC in 2008 and in connection with the pandemic in spring 2020, Norges Bank implemented extraordinary measures to mitigate market volatility and avoid destabilising effects on the economy. During both crises, lending to banks was substantially higher than normal. Loans with longer maturities and loans in USD were also provided. The list of securities eligible as collateral for loans from Norges Bank was also expanded. During the GFC, Norges Bank administered a swap arrangement on behalf of the government, where banks could temporarily swap covered bonds against short-term government securities. During the crisis in March 2020, Norges Bank communicated that intervening in the FX market could be appropriate for maintaining a well-functioning NOK market, and a limited amount of NOK was subsequently purchased.

44 See Cavallino (2019) and IMF (2023).

45 Studies show that interventions in billions of US dollars typically change the exchange rate by less than one percent. These exchange rate effects are less pronounced or in line with the effect of an interest rate change of 0.25 percentage point. See Bache (2023) and Cwik and Winter (2024).

46 See Dominguez (2006), Fratzsher et al (2019) and Arango-Lozano et al (2020).

Negative policy rate

The policy rate is the normal monetary policy instrument. Evidence suggests that a downturn in the Norwegian economy should initially be addressed by lowering the policy rate. In May 2020 the policy rate was reduced to zero percent. This reduction passed through to money market rates and, to a great extent, also to banks' lending rates. Central banks in a number of other countries have set their policy rates below zero. Negative policy rates have systematically passed through to money market rates. This is because cash is a costly alternative to electronic money in the money market.

In Norway, most borrowing is at a floating rate which means that most of banks' funding is also at floating rates. Lower money market rates are therefore rapidly reflected in banks' wholesale funding rates. The transmission to interest rates facing the general public may weaken, however, when the policy rate approaches zero and turns negative. This is because banks are reluctant to set negative rates on deposits that customers can withdraw and keep as cash at little cost. This means that the effect of a policy rate cut on banks' funding costs fades when the policy rate is reduced to below zero. In isolation, this suggests that the transmission from the policy rate to interest rates facing the general public is likely weaker in that case than when the policy rate is reduced from higher levels. At the same time, evidence suggests that the effect of a policy rate cut on the exchange rate is sustained when the policy rate is negative. However, the effect of a negative policy rate on the financial markets is uncertain, and there is a risk that undesirable and unintended effects may occur.

Extraordinary loans to banks

Norges Bank provides loans to banks on a regular basis in connection with the implementation of monetary policy. The purpose of the loans is to manage overall liquidity in the banking system so that the shortest money market rates are kept close to the policy rate. The purpose of extraordinary loans, on the other hand, is to make monetary policy more expansionary by stimulating credit growth and economic activity.

Long-term loans to banks, with or without credit growth requirements, will likely be most effective in a situation where premiums in banks' funding markets are high or banks face funding problems. The instrument works by lowering funding costs for banks and can contribute to facilitating household and corporate access to credit.

A situation may also arise where it may be appropriate to provide loans in order to bring Nibor rates down towards the policy rate. This may be the case if the policy rate is low and further cuts are not deemed appropriate, at the same time as Nibor is markedly higher owing to high risk premiums.

Extraordinary loans to banks will add more reserves to the banking system than the sum of banks' quotas in Norges Bank's liquidity management system. To prevent the shortest money market rates from

falling below the policy rate, (i) the extra liquidity supplied must be withdrawn by providing F-deposits, the reserve rate must be raised and set equal to the policy rate or (iii) the quotas must be increased so that all deposits bear interest within the quota. During the Covid pandemic, extraordinary loans were provided to banks with terms of up to one year. Norges Bank announced in advance that the extra liquidity supplied would be withdrawn using intraday F-deposits. This gave banks daily access to the extra liquidity, while maintaining the quota system for liquidity management (see box on page 53).

As in the case of Norges Bank's ordinary loans to banks, extraordinary loans can only be provided against eligible collateral. The value of the collateral, after a risk haircut, determines the size of the lending facility. If large loans are needed, the volume of eligible collateral can constitute a limitation of the size. In such a situation, the Bank must determine whether the range of eligible collateral should be expanded, and whether it is in keeping with statutory requirements for adequate loan collateral.

Purchases of securities

For borrowers with floating-rate loans, long-term interest rates are relevant primarily as a signal of short-term interest rate expectations. In countries with a higher proportion of fixed-rate loans, changes in long-term interest rates can have a more direct effect on credit demand and disposable income.

The Norwegian bond market is small, with foreign investors accounting for a large share of bondholders. Although Norwegian government securities have the highest rating, rates can vary fairly widely in relation to other Norwegian rates, partly owing to variations in liquidity premiums over time. It is uncertain whether lower long-term government bond yields would have had a broad impact on interest rates facing households and enterprises. An effect via lower expected policy rates would probably have had an impact, but it is more uncertain whether lower term premiums on Norwegian government bonds would impact other interest rates. Purchases of government securities can result in a weaker krone if foreign investors divest their positions, but the magnitude of such an effect is difficult to predict.

Measured in terms of volume outstanding, covered bonds constitute a bigger market than government securities in Norway. Most NOK-denominated covered bonds are issued with a floating rate. Banks own a large share as part of their liquidity portfolios. In other countries, central banks have purchased covered bonds when risk premiums have been high. In Norway, covered bonds were used in the swap arrangement offered from November 2008 to October 2009. Covered bond purchases or swaps can be seen as an alternative to long-term loans to banks.

Exchange rate measures

Under the monetary policy regime introduced in 2001, the krone floats freely and Norges Bank does not have a policy target for the krone exchange rate. The policy rate is the Bank's most important tool.

The foreign exchange reserves are Norges Bank's contingency funds in international currencies and are to be available for use in FX market transactions as part of the conduct of monetary policy, with a view to promoting financial stability and meeting the Bank's international commitments. This means that the Bank can intervene in the FX market by buying or selling NOK, for example to ensure the functioning of the NOK FX market. Under the current policy regime, this has only happened on one occasion, in March 2020 in response to extraordinary conditions in the NOK market.

On behalf of the government, Norges Bank executes currency conversions associated with the government's spending of petroleum revenues.[47] These transactions are planned, smoothed over the year, announced in advance monthly and are independent of monetary policy and the work to promote financial stability.

Norges Bank's assessments

A set of overriding principles underpins Norges Bank's use of instruments. The Bank must by law require adequate collateral for credit. Adequate collateral is defined in principle as the securities approved in the Bank's system for collateral and related haircut rates. Any measures that entail credit risk materially beyond this should in principle be approved by the political authorities and be recognised in the central government's balance sheet, even if the Bank is responsible for operational implementation. Furthermore, any extraordinary measures should be designed to be as neutral as possible, ie the measures are targeted at well-defined groups of counterparties rather than at individual institutions, so that counterparty institutions can participate on equal terms. As a main rule, auctions should be used when implementing extraordinary measures.

Norges Bank will normally be very reluctant to set a negative policy rate, partly because it may have an undesirable and unintended impact on financial markets.

It is less relevant for Norges Bank to use instruments such as government bond purchases to influence long-term rates because the share of fixed-rate loans is relatively low and Norway's government bond market is much smaller than in many other countries. The Bank's assessment is that the costs of using such instruments will likely outweigh the benefits.

There is also a very high threshold for Norges Bank to intervene in the FX market in the form of purchases or sales of NOK with a view to influencing the NOK exchange rate. The effects of such intervention are uncertain. International experience indicates that the effects of interventions are

47 See Norges Bank (2021c)

small and short-lived at best, and the central bank may easily find itself in an undesirable game situation with market participants. However, interventions can have an effect when markets do not function, as was the case in March 2020 when the Bank intervened to stabilise the market.

In Norway, alternative monetary policy instruments appear most appropriate in situations with substantial market turbulence or if a risk of deflation were to arise. An important reason why Norges Bank is more reluctant to use of alternative instruments is that there is substantial room for manoeuvre in fiscal policy in Norway and a tradition for fiscal policy to contribute to stabilisation policy (See Section 3.6 for a detailed discussion of the interaction between monetary and fiscal policy).

3.6 Interaction between monetary policy and fiscal policy

In general, there are arguments in favour of using both monetary and fiscal policy to stabilise the economy. The Tinbergen principle states that there must be a tool for each policy goal if all the goals are to be achieved. With two tools – monetary and fiscal policy – two goals can be achieved, at least if the tools are coordinated, for example price stability and real economic stability. However, this is not necessarily the case in a closed economy, where monetary and fiscal policy can be seen as perfect substitutes in stabilisation policy.[48] In an open economy, on the other hand, monetary policy has a greater relative impact on inflation than on the real economy than fiscal policy, owing to the exchange rate channel of monetary policy transmission. An appropriate policy mix can then contribute to better overall performance, and the optimal mix will depend on the type of shock.[49]

There are, however, some institutional challenges associated with coordinating monetary and fiscal policy, primarily with regard to central bank independence. Granting independence to central banks was a way to bring soaring inflation in the 1970s and 1980s under control. By shielding policy rate decisions from the political sphere, it was easier to achieve a sufficiently contractionary monetary policy to bring down inflation. International experience, supported by extensive political economy research, shows that there is a risk of expansionary bias when politicians decide on economic policy because short-term considerations, such as high economic growth, may be prioritised ahead of long-term considerations in order to win votes. This bias can lead to high inflation and excessive public debt. While central bank independence and explicit mandates about price stability solved the first problem, fiscal rules were a means to prevent bias in the form of excessive budget deficits. Because such rules, which restricted government spending, also entailed limitations on the extent to which fiscal policy could be used to stabilise the economy (apart from via automatic stabilisers), central banks came to

48 See eg Wolf (2021).
49 See Røisland et al (2023).

play the main role in cyclical policy, to the extent this did not conflict with price stability objectives.

In Norway, fiscal policy has historically had a somewhat larger role in stabilisation policy than in many other countries. Before inflation targeting was introduced in Norway, fiscal policy was the main stabilisation tool. The introduction of an inflation target for monetary policy in 2001 gave monetary policy a larger role in stabilisation policy. The regulation issued in 2001 states that *monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment.* But fairly soon after the regulation had been issued, the description of the division of labour between monetary policy and fiscal policy changed and was replaced by formulations that monetary policy is the "first line of defence" in stabilisation policy.

A fiscal rule for the spending of petroleum revenues was introduced at the same time as inflation targeting was formalised. Norway's fiscal rule is only based on cross-party consensus and has no legal foundation. The rule was introduced to ensure a gradual phasing-in of oil revenues while providing room for flexibility by allowing for temporary deviations from the rule based on cyclical considerations. Even though monetary policy has been the first line of defence, fiscal policy has also had a role in smoothing the business cycle, both in the form of traditional automatic stabilisers within the fiscal rule and in the form of discretionary deviations from the rule to stabilise the economy.

There has been little or no coordination of monetary-fiscal policy interactions. Interaction since 2001 can perhaps be most accurately described as a kind of Stackelberg equilibrium where fiscal policy is the leader and the central bank is the follower and where fiscal policy setting has internalised the central bank's response pattern.[50] The policy mix produced by the Stackelberg equilibrium is generally not as good as that resulting from policy coordination, but can be better than a Nash equilibrium, where the policy areas seek to achieve their respective goals independently of each other.

The view of the division of roles between monetary policy and fiscal policy has been characterised by the type of shocks thought to be the most important. With a pure demand shock, there is no conflict between price stability and real economic stability, at least in a closed economy, and in principle only one instrument is required. Fiscal policy will then only have a role if the room for manoeuvre in monetary policy has been exhausted and further stimulus is needed.

When inflation targeting was introduced, the business cycle was expected to be driven by demand shocks to a greater extent than subsequently proved to be the case. With supply shocks (such as China's strong export growth through the 2000s), monetary policy alone could not achieve the inflation target and fulfil the objective of stability in the

50 For an analysis of such an interaction between monetary and fiscal policy, see Steigum (2000).

real economy at the same time. In an open economy, where the exchange rate affects imported price inflation, there will also be some degree of conflict between the two objectives during demand shocks. Experience of inflation targeting has shown that the central bank must as a rule make a trade-off between different objectives and considerations in the short term.[51]

The Covid-19 pandemic has changed the way economists internationally think around the role of fiscal policy. While the primary emphasis used to be on ensuring the sustainability of public finances through rules-based fiscal policy, there is now greater focus on the role of fiscal policy as a stabilisation tool and not least on the allocation of risk via transfers and redistribution when large shocks impact different groups in different ways, as when businesses closed down during the pandemic. Experience showed that in the face of extreme shocks, such as the pandemic, neither monetary policy nor fiscal policy alone can shield the economy from a severe downturn. The need for an appropriate monetary-fiscal policy interaction was the theme of the Geneva report in 2021[52] and was also one of the topics researched by the ECB in preparing its strategy review[53].

The National Budget for 2022[54] notes that fiscal policy was able to very quickly provide income support to households and enterprises hard hit by Covid-related restrictions through direct transfers and liquidity support. The policy rate, on the other hand, is a blunt instrument and cannot be used to target individual sectors in the same way. According to the National Budget, it is therefore important that in crisis situations the two policy areas are considered together. Fiscal policy will also be important in situations where a downturn is having a broad impact on the economy, but where the room for further policy rate cuts has been exhausted.

How far different countries will go in implementing closer monetary-fiscal policy interaction is so far unclear. Even though the pandemic has shown that some situations require the active use of both monetary and fiscal policy instruments, close interaction also presents challenges. Some have voiced concern that the central bank's independence might be threatened. A related concern is that owing to the high level of public debt in many countries, which increased further as a result of the pandemic, there is a risk of fiscal dominance, which is a situation where the central bank cannot or will not raise the policy rate to stabilise inflation because this will further exacerbate the government's debt situation. As a result, the level of inflation is in practice determined by fiscal policy and not monetary policy. In Norway, however, there is little risk of fiscal dominance as the government is in a net asset position because of the oil revenues saved in the Government Pension Fund Global.

51 See Norges Bank (2017).

52 See Razin (2024).

53 See ECB (2021c).

54 See Meld. St. 1 (2021–2022) – regjeringen.no (in Norwegian only). Information in English: The National Budget 2022 – regjeringen.no

Even though there are reasons for monetary policy and fiscal policy not to be coordinated, in the sense that that the two instruments are wielded in tandem, there are good reasons for adequate information sharing between the policy areas, which Norges Bank also highlights in its monetary policy strategy. The Bank emphasises in the strategy the particular benefits of good communication of the monetary policy response pattern, so that the fiscal authorities can take this into account when making decisions. This is in accordance with the “Stackelberg solution” mentioned above.

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