

DANMARKS NATIONALBANK

15 MARCH 2023 — NO. 3

MONETARY AND FINANCIAL TRENDS – MARCH 2023

Monetary policy will cool down the economy



The global monetary policy tightening continues

Monetary policy has been tightened in the past six months. Central banks in, for example, the euro area and the United States have hiked interest rates markedly and signalled further rate hikes to bring down inflation.



Danmarks Nationalbank has raised interest rates

Like the European Central Bank (ECB), Danmarks Nationalbank has raised its monetary policy interest rates five times since summer 2022. On two occasions by less than the ECB to counter an appreciation pressure on the krone.



Tighter financial conditions are expected to dampen economic growth significantly

The tighter financial conditions affect the economy gradually and are expected to dampen economic growth significantly in 2023 and 2024.

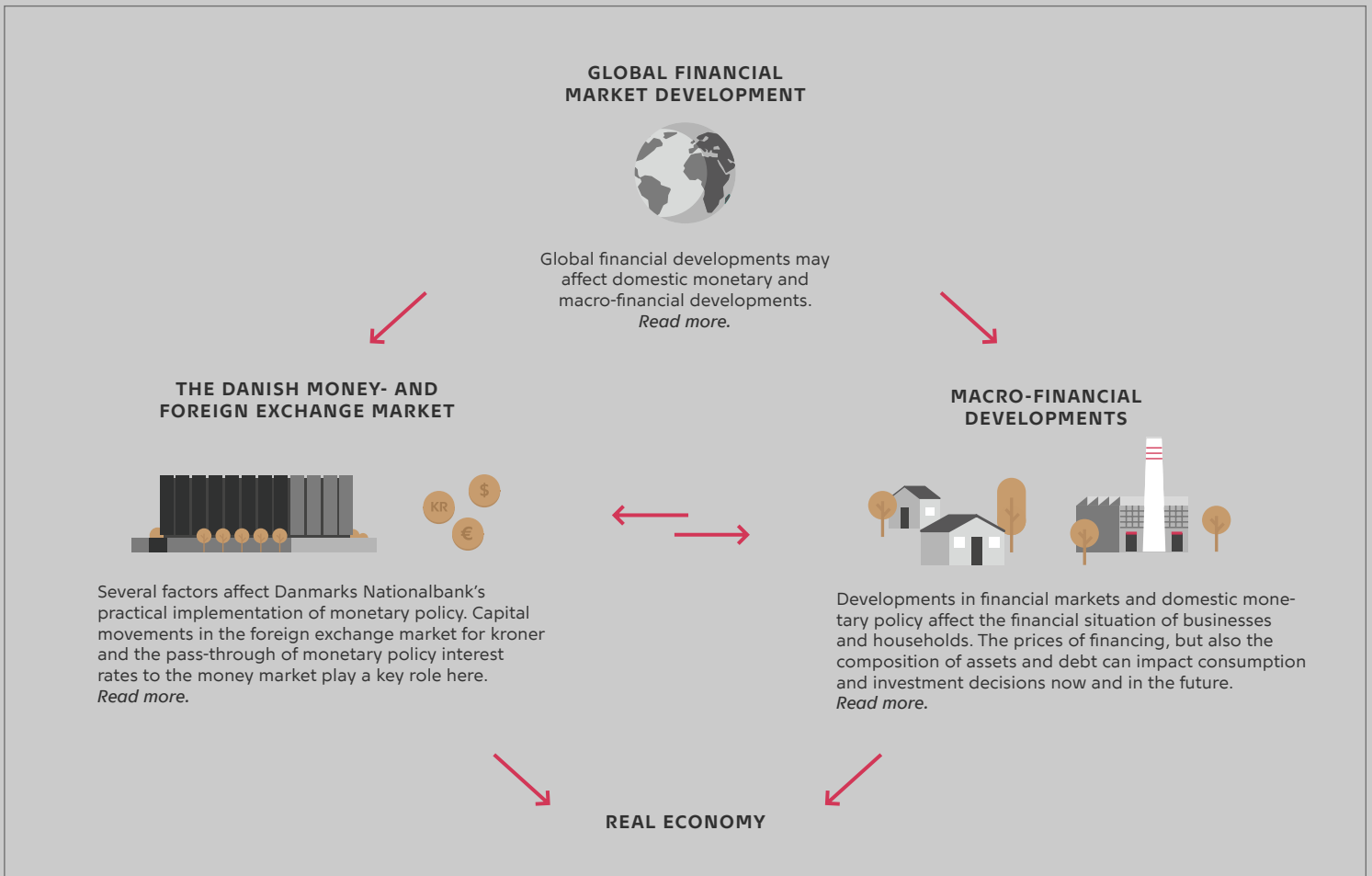
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Danmarks Nationalbank publishes the *Monetary and financial trends* analysis twice a year.

The Danish fixed exchange rate policy means that monetary policy is tailored towards ensuring a stable krone exchange rate against the euro. Denmark is a small open economy and closely integrated into the international financial system. Global financial developments can affect the demand for Danish kroner and thus the fixing of monetary policy interest rates by Danmarks Nationalbank. The fixed exchange rate policy also means that monetary policy in the euro area has a major impact on Denmark.

An important element of the analysis is the assessment of how the fixed exchange rate policy, in interaction with developments in the global financial markets, affects financial conditions in Denmark. The financial conditions are important for Danmarks Nationalbank's assessment of the current state of the Danish economy and the outlook for the future. Financial conditions also affect the potential build-up of macro-financial imbalances.



Global financial market development

The development in inflation, central banks' monetary policy, and macroeconomic releases still guide the financial markets and affect risk appetite among investors. Risk premia in financial markets have fallen across asset classes since autumn. This has happened as inflation in, for example, the euro area has ceased to rise and subsequently has begun to decrease. For example, European equities have increased markedly during autumn and winter, while the dollar has weakened.

Monetary policy interest rates in the United States and the euro area have been raised sharply since summer 2022. At the same time, market participants' expectations for further interest rate hikes have increased. This has happened in response to communication from central banks, that the surprisingly strong economic development entails a need for higher interest rates for a prolonged period to bring down inflation. The tightening of monetary policy through interest rate hikes and expectations that more hikes are to come have increased short-term government bond yields, while long-term government bond yields have increased to a lesser extent.

Since autumn, interest rates on long-term fixed-rate Danish mortgage bonds have been largely unchanged. Expectations of higher monetary policy interest rates have been pulling yields upwards for some time, while slightly lower market volatility has pulled downwards. Yields on short-term mortgage bonds and variable-rate bonds have increased significantly as a result of higher monetary policy interest rates. The 10-year Danish-German government yield spread has fallen by approximately 20 basis points as a result of Denmark's Nationalbank having increased monetary policy interest rates by less than the ECB in October and February.

Monetary policy has been tightened further since September 2022

Since the latest Monetary and financial trends in September 2022, one main focus in the financial markets has been the significant tightening of monetary policy to bring inflation down.¹ Inflation has fallen over the period, driven by lower electricity and gas prices, in particular. At the same time, economic activity has turned out to be stronger than expected, especially in the euro area. Falling inflation and the relatively robust economic developments have led to slightly less market volatility and a higher risk appetite. Risk premiums have generally decreased across asset classes. Against this background, European equity prices, among others, have risen significantly, while the dollar has depreciated.

Economic activity, which has been stronger than expected, and some sluggishness in the decline in inflation have entailed that the central banks have tightened monetary policy since September. This has been done by raising the monetary policy interest rates, and the central banks have communicated the need for further tightening. The latter has meant that, relative to September, market participants expect monetary policy interest rates to be hiked further and to remain high for longer.

Short-term bond yields have risen sharply based on expectations of higher monetary policy interest rates. The increase in yields on longer bonds has been lower, reflecting market participants' expectations that monetary policy interest rates will be reduced again over the medium term.

Inflation is falling, but remains too high

Inflation in the euro area and the United States has been too high for a prolonged period. In the United States, inflation has been falling since summer 2022, but remains at a high level. In particular, inflation in services remains high, while inflation in energy and commodity prices has decreased significantly since the peak. In the euro area, inflation has only started to fall in recent months, after having reached 10.6 per cent in October 2022. In February 2023, euro

area inflation had thus fallen to 8.5 per cent. The fall in inflation in the euro area is primarily driven by decreasing energy prices.² Core euro area inflation, which adjusts the inflation rate for the development in food and energy prices, has not yet begun to decrease and was 5.6 per cent in February 2023.

In the current economic situation, the major central banks' main task is to bring down inflation. The central banks' primary tools for combating high inflation are to raise monetary policy interest rates, to roll back unconventional monetary policy measures and communicate the need for further tightening.

Policy rate hikes and quantitative tightening in the United States and the euro area

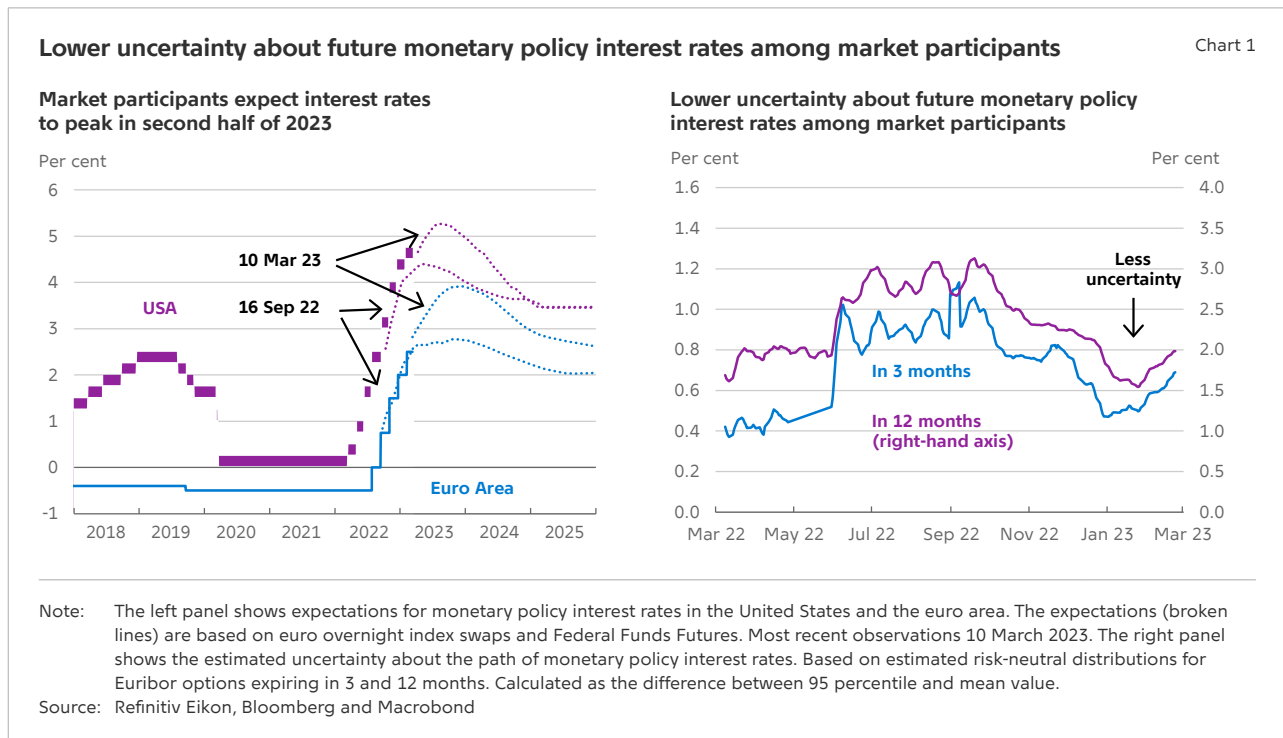
The Federal Reserve has hiked monetary policy interest rates at each of its monetary policy meetings since March 2022, by a total of 4.5 percentage points, see chart 1 (left). Most recently, the Federal Reserve raised its monetary policy interest rate by 0.25 percentage points to 4.50 - 4.75 per cent on 1 February, and it continues to reduce its holdings of bonds from its asset purchase programmes.

Since June 2022, monetary policy interest rates have been raised by 3 percentage points in the euro area, which is the highest and fastest hike in the ECB's history. Most recently, the ECB raised its monetary policy interest rates by 0.5 percentage points with effect from 8 February 2023. In addition, the ECB announced that monetary policy interest rates in all likelihood will be increased by 0.5 percentage points at the Governing Council meeting on 16 March.

In mid-September 2022, at the time of publication of the most recent Monetary and financial trends, market participants expected that there would be a number of significant hikes to a level of 2.5 per cent in March 2023. At that time however, there was significant uncertainty among market participants about how the future monetary policy interest rates would develop, as interest rate hikes had only just

1 This edition is closed for contributions on 10 March 2023.

2 See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.



begun, see chart 1 (right). Consequently, there was uncertainty as to whether the tightening of monetary policy would be implemented as expected. Since then, the ECB's interest rate hikes have been largely as expected by market participants. In conjunction with the ECB repeatedly raising the interest rates, uncertainty about future tightening has once again decreased.

In addition to tightening monetary policy through higher monetary policy interest rates and communication, the ECB has announced that holdings of bonds in its Asset Purchase Programme (APP) will gradually be reduced. The reduction of the Asset Purchase Programme contributes to raising medium and long-term bond yields and thus financing costs in the economy.³ From March to June, the ECB will reduce its bond holdings by an average of 15 billion euro per month. The size of the monthly reduction of the APP holding will then be reassessed. As something new, reinvestments under parts of the APP will be tilted more strongly towards bonds issued by companies with a better climate performance. Bonds

maturing under the pandemic emergency purchase programme (PEPP) will still be fully reinvested until the end of 2024.

Since September, the central banks have been communicating about a further tightening

The US labour market remains strong, and, for example, an unexpectedly large number of new jobs continued to be created at the beginning of the year. The strong labour market increases the risks that the current expected tightening of monetary policy will not be sufficient to dampen capacity pressures in the US economy. Consequently, this opens the door for further monetary policy tightening. By extension, the Federal Reserve has communicated that the central bank will act more aggressively if necessary to ensure that inflation is brought down to around 2 per cent, including by hiking interest rates by more and for longer than investors expect.⁴

The communication from the Federal Reserve about a future tight monetary policy, along with positive key economic indicators, have led market participants to

³ See, for example, speech given by Isabel Schnabel, Member of the Executive Board of the ECB, Quantitative tightening: rationale and market impact, 2 March 2023 ([link](#)).

⁴ See conversation between Federal Reserve Chair Jerome Powell and David Rubenstein in The Economic Club, 7 February 2023. ([link](#)).

gradually revise their monetary policy interest rate expectations upwards during autumn and winter 2022-2023. The current expectation is that the benchmark interest rate will briefly be increased to approximately 5.25 per cent in the second half of 2023, after which it will gradually be reduced again. By comparison, in September 2022 market participants expected monetary policy interest rates to peak at around 4.5 per cent in winter 2022-2023.

During autumn and winter, the resilience of the euro area economies has surprised positively and growth has been stronger than expected. Strong demand and sluggish development in core inflation in particular have led to expectations of further monetary policy tightening by the ECB. For example, members of the ECB's Executive Board have stated that monetary policy interest rates need to be raised further and that they need to remain at a higher level for longer before future inflationary risks have been balanced. Furthermore they have communicated that monetary policy must remain restrictive until there is clear evidence that core inflation is on its way down towards 2 per cent.^{5,6}

Since September, market participants have therefore revised their expectations for monetary policy interest rates upwards so that they now expect higher interest rates for a longer period, see chart 1 (left). At the present time, market participants expect the ECB's benchmark interest rate to be hiked to around 4 per cent in the second half of 2023. In comparison, in September 2022 market participants expected the ECB's benchmark interest rate to peak at a level of around 2.75 per cent at the end of 2023.

The effect of tighter monetary policy is gradual

Monetary policy tightening, for example in the form of higher monetary policy interest rates, and expectations of further increases have already contributed to lower activity and inflation, see the section *Macro-financial developments*. The tightening of monetary policy increases companies' and households' financing costs, thereby dampening aggregate

demand. The pass-through of monetary policy to the economies is expected to be somewhat delayed, and there is uncertainty about the magnitude of the effects. Due to this uncertainty, and the risk that very rapid interest rate hikes could have unintended negative effects, both the Federal Reserve and the ECB have raised interest rates more gradually at their recent monetary policy meetings.⁷ If monetary policy has less effects on the economy than expected or the decrease in inflation is more sluggish than assumed, the central banks will tighten monetary policy further, including through communication about the need for an even tighter monetary policy. Both in the euro area and in Denmark, rising interest rates are expected to have significant impacts on the economy in 2023 and 2024.⁸

Confidence in central banks to bring inflation down

As the effects of monetary policy gradually occur and the ECB raises monetary policy interest rates further, the market participants expect inflation in the euro area to fall back down to around 2 per cent. Market-based inflation expectations indicate that inflation is projected to decline to just above 3 per cent by the end of the year, primarily driven by falling energy prices, and then to be about 2.5 per cent the following year, see chart 2 (left).

Long-term market-based inflation expectations have risen slightly since September 2022, indicating that market participants are expecting the decline in inflation to be more sluggish than expected six months ago (blue), see chart 2 (right). The sluggishness should be seen in the context of the relatively strong economic development in the euro area. This is confirmed by the Survey of Professional Forecasters, which indicates that core inflation will fall to approximately 3.3 per cent in the 4th quarter of 2023 and to approximately 2.5 per cent in the 4th quarter of 2024.

In the past decade, long-term market-based inflation expectations have typically been significantly

5 See interview with ECB's Chief Economist Philip Lane, 12 January 2023 ([link](#)).

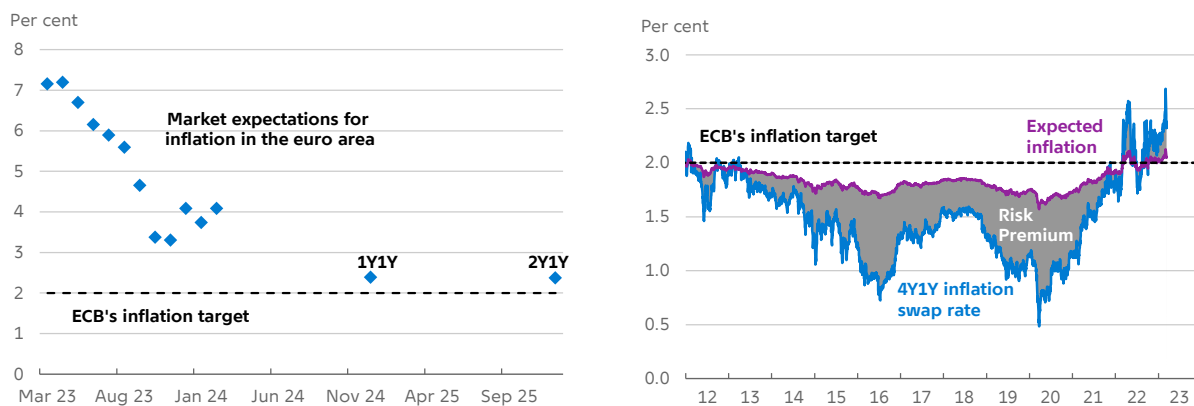
6 See presentation by Isabel Schnabel, member of the ECB's Executive Board Monetary policy in times of pandemic and war, 7 February 2023 ([link](#)).

7 See, for example, speech by the ECB's Chief Economist, Philip Lane, Monetary policy in the euro area: the next phase, 29 August 2022 ([link](#)).

8 See the section *Macro-financial developments* and speech by the ECB's Chief Economist, Philip Lane, The euro area hiking cycle: an interim assessment, 16 February 2023 ([link](#)).

Market participants expect euro area inflation to decrease in 2023 and 2024

Chart 2



Note: The left-hand chart shows expected inflation based on HICP inflation swaps and is not adjusted for risk premiums, data from 10 March 2023. The right-hand chart shows expected euro area inflation, derived from inflation swaps, in four to five years from now. The difference between the blue and purple lines is the inflation risk premium (grey area). Decomposed using a dynamic yield curve model, see Scott Joslin, Kenneth J. Singleton and Haoxiang Zhu, A new perspective on Gaussian dynamic term structure models, *The Review of Financial Studies* 24.3, pp. 926-970, 2011. Most recent observations 10 March 2023.
 Source: Bloomberg and Danmarks Nationalbank.

below 2 per cent and have now risen to just under 2.5 per cent. Overall, the anchoring of the level indicates that market participants are confident that the central banks will ensure price stability in the medium term. When adjusted for the estimated inflation risk premium (grey), inflation expectations (purple) are anchored around the ECB's target of 2 per cent.⁹

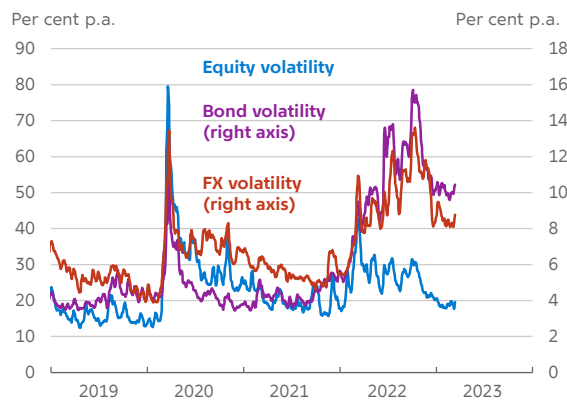
Volatility in international financial markets have diminished slightly

Financial markets characterised by periodically large fluctuations

The high inflation and uncertainty among market participants about the future path of monetary policy interest rates have resulted in significant volatility in government yields throughout 2022, see chart 3. Other markets, such as the equity and

Bond market volatility remains high

Chart 3



Note: Implied volatility for German government bonds, the Eurostoxx 50 stock index and the euro-dollar exchange rate. Five-day moving average. Most recent observations 10 March 2023.
 Source: Bloomberg.

⁹ Market-based inflation expectations contain a risk premium for exposure to uncertainty about future inflation, called the inflation risk premium. Economic theory points out that the inflation risk premium is typically positive during times of high growth and risk of overheating, and is similarly negative during times of low economic activity.

foreign exchange markets, also experienced periodic high volatility throughout 2022. Volatility in government bond and foreign exchange markets remains at a high level, but has been diminishing slightly in autumn and winter 2022-2023. This should be seen in the context of market participants' expectations that inflation will gradually fall throughin the course of 2023 and that the major part of the monetary policy interest rate increases have already been implemented. In the autumn of 2022, there was also a nervousness about the possible negative market effects of the central banks' ongoing and future reductions of bond holdings. So far, however, there have been no signs of significant adverse effects, either in the United States, where the balance sheet reduction started in June 2022, or in the euro area, where the balance sheet reduction started in March 2023, see above.¹⁰

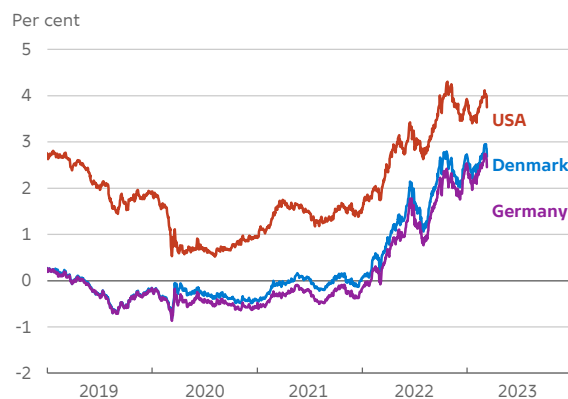
Higher short government yields driven by monetary policy expectations

During autumn and winter, German and US short-term government yields, e.g. 2-year yield, have risen more than long-term government yields, see chart 4. As a consequence, German 2-year government yields are now higher than 10-year government yields – a so-called yield curve inversion. The US government yield curve had already inverted in September.

The level of government yields primarily reflects market participants' expectations of higher monetary policy interest rates in the short term (the 2-year point) followed by slightly lower monetary policy interest rates, as inflation declines (the 10-year point), see the model-based decomposition in chart 5.¹¹ Expectations for average monetary policy interest rates in German and US 10-year government yields are 1.8 per cent and 3.4 per cent, respectively. If inflation declines to around 2 per cent in 2024 and onwards, as market prices

Wide fluctuations in 10-year government yields during autumn

Chart 4

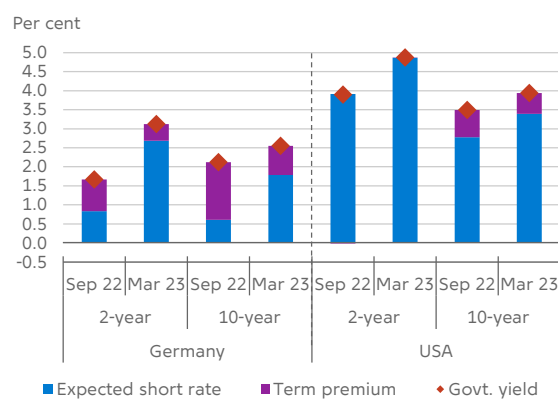


Note: 10-year par yields. Most recent observations 10 March 2023.

Source: Nordea Analytics and Danmarks Nationalbank.

Expectations for short interest rates have increased since autumn

Chart 5



Note: Zero coupon rates decomposed using an AFNS model. See Jens Christensen, Francis X. Diebold and Glenn D. Rudebusch, The affine arbitrage-free class of Nelson-Siegel term structure models, *Journal of Econometrics*, 164.1, pp. 4-20, 2011. Most recent observations 10 March 2023.

Source: Danmarks Nationalbank and San Francisco Fed.

10 See A. Lee Smith and Victor J. Valcarcel, The financial market effects of unwinding the Federal Reserve's balance sheet, *Journal of Economic Dynamics and Control*, vol. 146, 2023.

11 The model decomposes observed government yields into an interest rate risk premium (the term premium) and the expected average short interest rate. The short interest rate is interpreted as the monetary policy interest rate. The development in term premium captures changes in risk premiums and reflects the risk compensation demanded by investors for holding a long bond rather than rolling over a series of short bonds over the same period.

currently indicate, this corresponds to the expected real short interest rate being on average around -0.45 per cent in the euro area and 1.0 per cent in the United States from in two years to in ten years. This is slightly higher than most estimated equilibrium real interest rates for the United States and the euro area. The relatively high implied real interest rates mean that, other things being equal, monetary policy is expected to be neutral or restrictive for several years. This may indicate that market participants expect a certain persistence in high inflation, for example in the form of a relatively soft landing for the economies rather than a classic recession scenario.

The Danish-German 10-year government yield spread has decreased

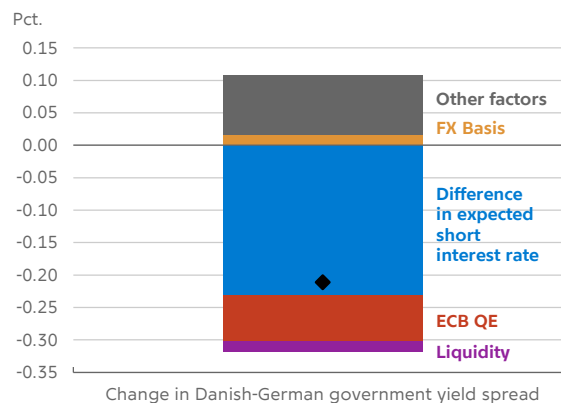
Like the ECB, Danmarks Nationalbank has hiked its monetary policy interest rates five times since summer 2022. On two occasions, Danmarks Nationalbank has raised interest rates by less than the ECB by a total of 0.3 percentage points to counteract the strong krone exchange rate, see the section *The Danish money and foreign exchange markets*. This has affected the spread between yields on Danish and German government bonds.

The yield on Danish 10-year government bonds is still slightly above the yield on German 10-year government bonds. However, the spread between them has fallen by approximately 0.2 percentage points since September 2022. A model-based decomposition of the yield spread between Danish and German 10-year government bonds shows that the larger difference between monetary policy interest rates in Denmark and the euro area is the primary explanation, see chart 6 (blue column). The halt to purchases under the ECB's asset purchase programmes as well as the imminent reduction of holdings have contributed to reducing the 'scarcity premium' on German government bonds. Seen in isolation, this has narrowed the Danish-German government yield spread (red column).¹²

¹² The krone duration in the Danish bond market, including in the Danish mortgage credit market, which contributed to the widening of the spread during 2021, has been flat since September and has been entered in the 'Other' column in the chart together with estimated effects from differences in credit risks, volatility and currency risks. FX basis measures the relative difference in funding costs in euro and kroner, and the liquidity column measures differences in bid-ask spreads on Danish and German 10-year government bonds.

Danish-German government yield spread has fallen since September 2022

Chart 6



Note: Decomposition of contributions to yield spread change from 30 September 2022 through 28 February 2023. Estimated for zero-coupon government yields. Based on Asger Munch Grønlund, Jonas Ladegaard Hensch and Simon Thinggaard Hetland, Explaining the Danish-German sovereign yield spread, *Danmarks Nationalbank Economic Memo*, No. 7, June 2022.

Source: Danmarks Nationalbank

Higher short-term mortgage rates

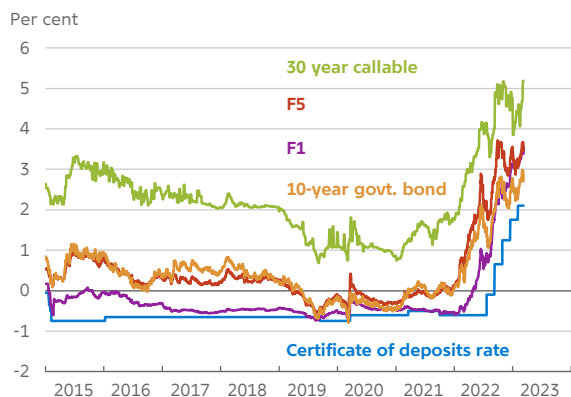
Long-term Danish mortgage rates have been virtually unchanged since September, but have still risen sharply since autumn 2022. The slightly lower interest rate volatility since autumn 2022 has meant that the spread between long-term mortgage rates and government yields has narrowed slightly, see chart 7.¹³ Interest rates on short mortgage bonds and variable rate bonds have risen sharply, which, like for short government bond yields, is due to higher monetary policy interest rates.

Foreign investors have reduced their holdings of Danish mortgage bonds

During 2022, foreign investors sold off parts of their holdings of Danish callable mortgage bonds equal to approx. 21 per cent of their holdings, see chart 8.

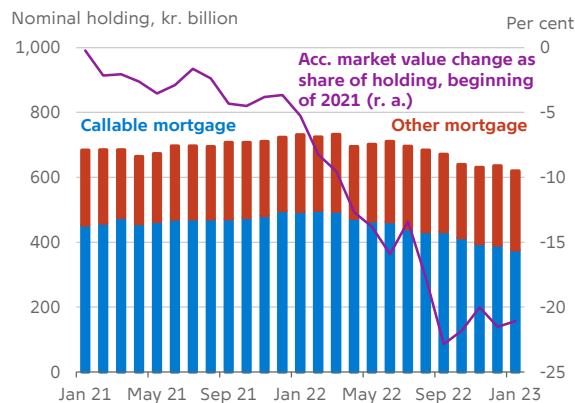
¹³ The yield on 30-year callable mortgage bonds is directly affected by the expected market volatility due to the value of the built-in option, which makes it possible to redeem the bond at par.

Short-term mortgage rates have risen since autumn, whereas long-term mortgage rates are virtually unchanged Chart 7



Note: 30-year callable is the Association of Danish Mortgage Banks' benchmark rate. Most recent observations 10 March 2023.
Source: The Association of Danish Mortgage Banks, Nordea Analytics, Refinitiv Eikon and Danmarks Nationalbank.

Foreign investors have sold off Danish mortgage bonds Chart 8



Note: Foreign investors' total nominal holdings of Danish callable and other mortgage bonds issued in kroner as well as the accumulated loss of value in their holdings since January 2021.
Source: Danmarks Nationalbank.

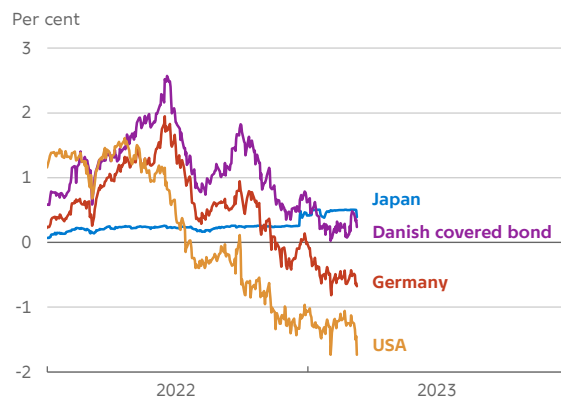
At the beginning of 2022, foreign investors owned Danish mortgage bonds amounting to kr. 723 billion. The rising interest rates during 2022 resulted in significant lower market values. The lower market values may have contributed to foreign investors selling off significant parts of their callable bonds. Due to the lower value, foreign investors have also reduced their currency hedging on their bond holdings in Danish kroner. The hedging reduction has resulted in a krone purchase, see the section *The Danish money and foreign exchange markets*.

There has previously been high demand for Danish mortgage bonds from, for example, Japanese investors due to a relatively high return relative to government bonds, see chart 9. Statistics from the Japanese Ministry of Finance show that Japanese investors sold mortgage bonds for a market value of approximately DKK 35 billion during 2022. One of the reasons for this may be that rising currency hedging costs make it less profitable for Japanese investors to hold foreign bonds, see below.

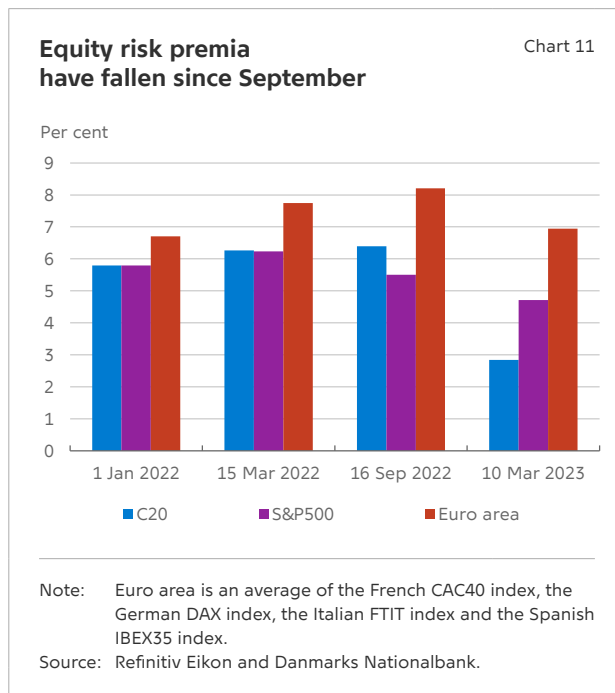
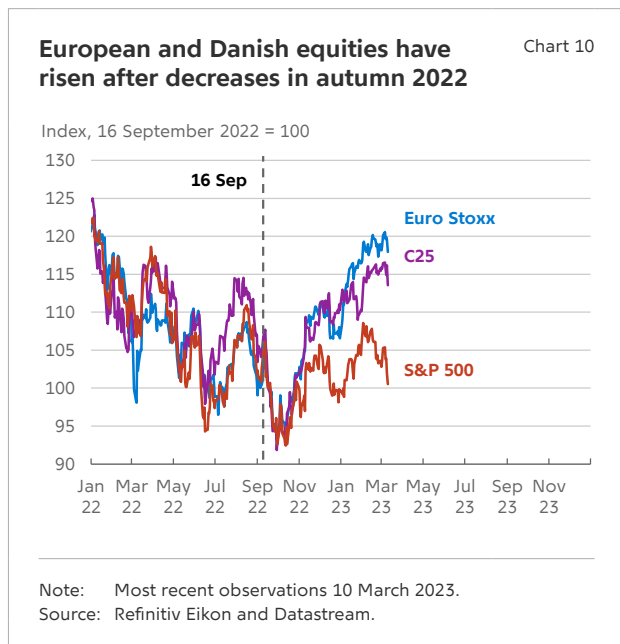
Equity prices have risen lately

Since mid-September 2022, the US S&P500, the Eurostoxx for the euro area and the Danish OMXC25 index have increased between 0 and 18 per cent, see chart 10. The rise in European equities is due to a number of factors, including higher risk appetite,

Japanese investors now achieve a higher yield at home than abroad Chart 9



Note: Yield to maturity for 10-year government bonds hedged with 3-month FX forwards to yen. Yield to maturity for Danish mortgage bonds is calculated as 10-year government yields plus OAS (option adjusted spread) from Nykredit's TotalIndex. Most recent observations 10 March 2023.
Source: Nykredit, Refinitiv Eikon and Danmarks Nationalbank.



generally positively surprising European economic indicators and a weakening of the dollar against the euro.

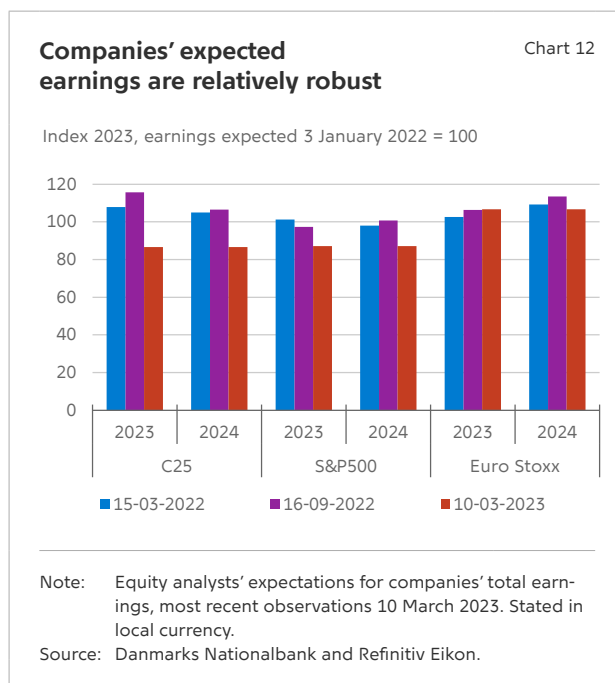
Equity risk premiums have fallen

Equity risk premiums in the United States, the euro area and Denmark are assessed to have fallen as a result of the increased risk appetite during autumn and winter, see chart 11.

As a result of the decrease in the equity risk premium, it is assessed that companies' cost of equity financing has increased less than, for example, government bond yields in the past year, see the section *Macro-financial developments*.

Projected profits for coming years have fallen slightly

In the United States, analysts have revised their outlook for corporate earnings in 2023 and 2024 slightly downwards over the past year, see chart 12. This probably reflects the analysts' expectations of lower economic activity, including as a result of tighter monetary policy. Euro area earnings expectations have remained relatively stable for 2023 and 2024. In Denmark, expectations for the coming years have not been revised significantly downwards, except for the transport sector as a result of due to lower freight rates as the supply chains normalise. In the euro area, corporate earnings surprised positively in 4th quarter 2022, which is also reflected in equity



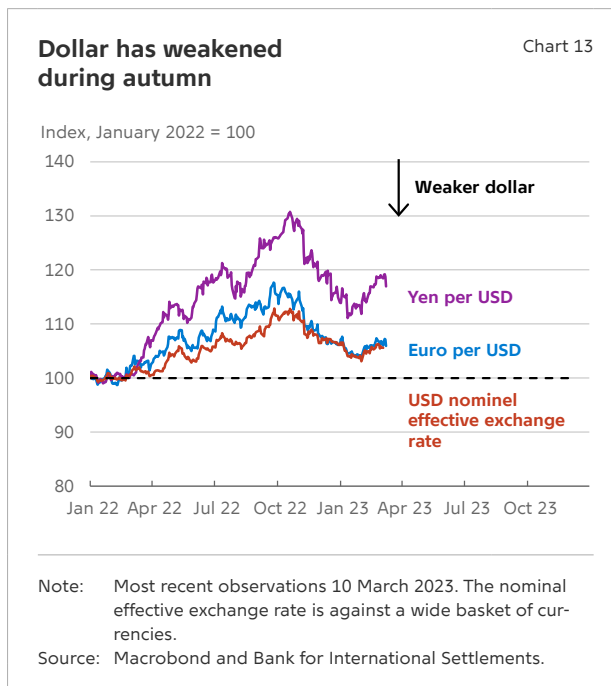
prices, see above. In the United States, corporate earnings were approximately as expected in 4th quarter 2022. Danish companies' earnings were also robust during 2022. This may indicate that companies have passed the higher costs resulting from the currently high inflation on to their sales prices. In a Danish context, this picture is confirmed by the provisional national accounts data.¹⁴

Weakened, but still strong dollar

During autumn and winter 2022-2023, the US dollar has depreciated significantly against the euro, the Japanese yen and a wide basket of currencies, see chart 13. This is the result of several factors, including a generally higher risk appetite in the financial markets, as the dollar is typically considered to be a 'safe haven' for investors during periods of market turmoil.

The weakening of the dollar against the euro is likely driven by better figures than expected for economic activity in the euro area. In addition, monetary policy tightening in the euro area has accelerated, and there are also increased expectations for future monetary policy interest rates, see above.

During the autumn, the Bank of Japan intervened in foreign exchange markets to strengthen the Japanese yen. In addition, the weakening of the dollar against the Japanese yen can also be seen as an expression of expected tighter monetary policy in Japan in the long term.



¹⁴ See the inflation theme in Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

The Danish money- and foreign exchange market

Danmarks Nationalbank has followed the ECB and raised its monetary policy interest rates three times since September 2022 and a total of five times since the interest rate hikes started in summer 2022. The higher interest rates have been transmitted smoothly to the Danish money market.

The exchange rate of the krone against the euro has been strong for a prolonged period. Since the latest Monetary and financial trends, this has triggered both intervention sales of kroner and two widenings of the monetary policy interest rate spread to the ECB to a more negative level. The strong krone demand has been driven by both temporary and more persistent factors. The demand has been broad-based and comes from, among other factors, Danish companies that made large profits abroad in 2022.

Around the turn of the year 2022-2023, Danmarks Nationalbank intervened to stop an appreciation pressure on the krone. The volume of intervention was significantly smaller than at the previous year-end. One of the reasons for the lower volume of intervention is that year-end effects in the money markets were subdued relative to the previous year. The appreciation pressure on the krone was instead driven by Danish companies' demand for kroner.

Danmarks Nationalbank has raised monetary policy interest rates

Danmarks Nationalbank has followed the ECB and raised monetary policy interest rates three times since the latest Monetary and financial trends in September. Danmarks Nationalbank follows the ECB's interest rate hikes in accordance with the fixed exchange rate policy and thereby imports the tightening of monetary policy. This contributes to ensuring stable prices in Denmark. On two occasions Danmarks Nationalbank has raised interest rates by slightly less than the ECB to counter a persistent appreciation pressure on the krone against the euro.

Interventions and a wider interest rate spread by Danmarks Nationalbank

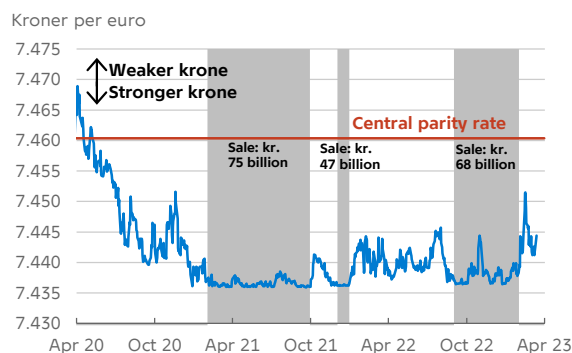
The exchange rate of the krone against the euro has been on the strong side of the central rate since May 2020, see chart 14. Since the latest Monetary and financial trends in September 2022, Danmarks Nationalbank has both intervened in the foreign exchange market and twice widened the monetary policy spread to the ECB to a more negative level.

In September and October 2022, Danmarks Nationalbank intervened by selling kroner for a total of kr. 45.3 billion. On the back of the foreign exchange interventions, Danmarks Nationalbank announced the first widening of the monetary policy interest rate spread to the ECB from -10 basis points to -25 basis points on 27 October. The widening of the spread was announced in conjunction with the ECB's decision to raise its monetary policy interest rates on the same day. The widening of the spread resulted in a weakening of the krone, which was, however, reversed in the following weeks.

The interventions and the widening of the spread during this period were necessitated by persistent krone demand, especially from non-financial corporations, institutional investors and foreign investors, see below. In addition, the autumn also saw an increased krone demand due to market conditions in the European money and bond markets, where the pass-through of the ECB's monetary policy interest rate hikes to short-term euro market rates was reduced, see box 1.

Krone on the strong side of central rate

Chart 14



Note: Exchange rate of the krone against the euro. Grey areas indicate months in which Danmarks Nationalbank has intervened. Most recent observations 10 March 2023. The official fluctuation bands for the exchange rate are 7.62824 and 7.29252 kroner per euro, see ERM II.
 Source: Danmarks Nationalbank.

Danmarks Nationalbank intervened again in November, December and January for a total amount of kr. 22.7 billion. The majority of these interventions occurred during the months around the turn of the year, see below. Following the interventions, Danmarks Nationalbank announced another widening of the monetary policy interest rate spread to -40 basis points on 2 February 2023. This happened in connection with the ECB decision to raise its monetary policy interest rates. The widening of the spread has subsequently weakened the krone exchange rate moderately.

Less appreciation pressure on krone compared to previous turn of year

In the months around the turn of the year 2022-2023, Danmarks Nationalbank intervened for a total of kr. 19.0 billion to counter an appreciation pressure on the krone, i.e. a strengthening of the krone exchange rate against the euro. However, the volume of intervention was significantly smaller than at the turn of the previous year, 2021-2022, when Danmarks Nationalbank intervened for kr. 47.0 billion. At the turn of the previous year, euro area money markets,

Inadequate transmission in the euro area money market contributed to krone pressure

Box 1

The ECB's asset purchase programmes following the covid-19 outbreak sharply increased excess liquidity in the euro system to around 4,500 billion euro, see chart A. The increase in liquidity has led to a higher demand for short, secure investment options.

Interest rate cap on deposits in Eurosystem made investments in Danish kroner attractive and contributed to demand for kroner

In August and September 2022, interest rates on short, secure euro-denominated investment fell significantly relative to monetary policy interest rates, making it attractive for euro area investors to place funds in foreign currencies, including kroner. The lower European short-term market rates thus contributed to a temporary strengthening of the krone, which ultimately gave rise to Danmarks Nationalbank's interventions in September and October.

The decrease in European short-term market rates relative to monetary policy interest rates was a consequence of a combination of the shift from negative to positive monetary policy interest rates in the euro area and zero rates of return on certain Eurosystem deposits, including government deposits. The return on these deposits, which was equal to around euro 1,100 billion, was limited upwards to zero at the time. A close substitute for deposits in the Eurosystem is investment in short-term money market products, such as repo transactions and T-bills. Concomitantly with rising monetary policy interest rates in the euro area, it became more attractive to allocate part of the deposits to market-based alternatives. The increased demand pushed short-term money market rates down to levels below monetary policy interest rates, with one effect being a significant narrowing of the spread of euro T-bills against swaps in the period, see chart B.

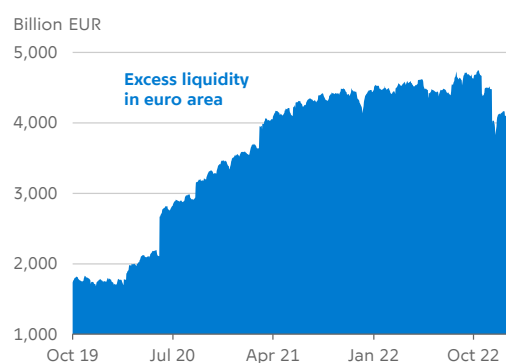
The low short-term euro market interest rates meant that part of the excess liquidity was also allocated to investments in Danish kroner, thus contributing to appreciation pressure on the krone exchange rate. The situation in the euro area money market was similar to that around the turn of the year 2021-2022, when higher short-term rates in kroner than in euro created appreciation pressure and resulted in interventions by Danmarks Nationalbank.¹

Multiple measures remedy European money market situation

When developments in short-term rates no longer follow monetary policy interest rates closely, this constitutes a weakening of monetary policy transmission. Against this background, on 8 September 2022 the ECB's Governing Council temporarily suspended the zero interest rate cap on, for example, central government deposits in the Eurosystem and also implemented a number of measures aimed at easing money market pressures.² These measures include the possibility of early redemptions of TLTRO loans, where, for example, government bonds have been used as collateral, and an increased threshold on securities lending per counterparty, where bonds from the Eurosystem portfolios can be borrowed against cash collateral.

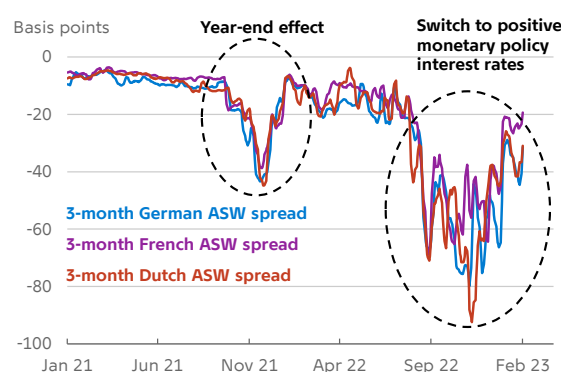
On 7 February 2023, the ECB announced another change in the interest rate cap on, for example, government deposits, to a rate of €STR minus 20 basis points from and including 1 May 2023. This will, for example, give states better opportunities to reduce their Eurosystem deposits gradually. This can help reduce pressure on the European money market interest rates and create better transmission of monetary policy through an implicit floor for how far repo rates deviate from the ECB's monetary policy interest rates.

Chart A: High excess liquidity in euro area's banking system



Note: Excess liquidity is the banks' liquidity placed in the Eurosystem less their reserve requirements.
 Source: Eurostat.

Chart B: Pressure on short-term European investment options



Note: ASW stands for asset swap spread and is the interest rate difference between T-bills and €STR swaps.
 Source: Bloomberg and own calculations.

1. Danmarks Nationalbank, Rising inflation and Russian invasion has increased volatility, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 4, March 2022. The deposits then bore interest at the lower of either the interest rate on the ECB's deposit facility or €STR.
 2. The deposits then bore interest at the lower of either the interest rate on the ECB's deposit facility or €STR.

among others, were affected by so-called year-end effects.¹⁵

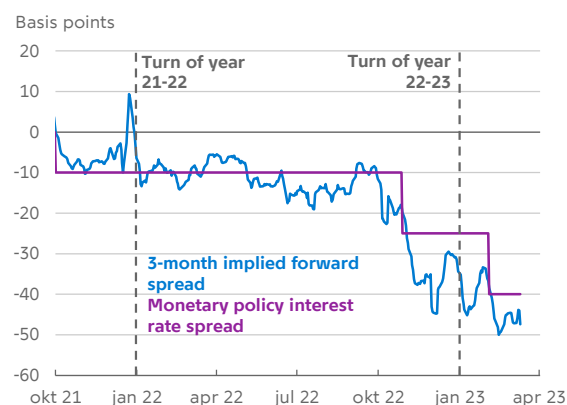
Year-end effects in the money markets may occur when banks adjust their balance sheets towards the end of the year in preparation for the presentation of financial statements and the calculation of regulatory key figures and financial ratios.¹⁶ At the turn of the year 2021-2022, these adjustments in the euro area led to large increases in the price of short-term deposits of euro liquidity over the turn of the year, i.e. large drops in interest rates on short-term financial instruments. This meant that the yield spread to corresponding Danish interest rates as well as the implicit yield spread in the foreign exchange forward market between kroner and euro were significantly widened, see chart 15. The widened spreads provided an incentive to buy kroner at the turn of the year, thereby contributing to appreciation pressure on the krone.

The latest turn of the year was less marked by year-end effects, one reason being that the banks did not have the same need to reduce their year-end balance sheet totals as previously.¹⁷ In addition, during autumn 2022 the ECB had taken measures to improve European money market conditions, see box 1. Together with Danmarks Nationalbank's widening of the monetary policy interest rate spread to a more negative level in October, this meant that there was a smaller appreciation pressure on the krone than at the turn of the previous year.

End of financial year led to high krone demand from Danish companies

Krone purchases by Danish companies were a principal reason for Danmarks Nationalbank's intervention around the turn of the year 2022-23. Many Danish

Negative forward spread has made it expensive to hold kroner Chart 15



Note: The implicit yield spread between kroner and euro in the forward exchange market and the monetary policy interest rate spread. Most recent observations 10 March 2023.
 Source: Refinitiv Eikon.

companies with global operations have had high earnings in 2022. This has contributed to a record surplus on the balance of payments. During the year, the companies have exchanged part of their earnings abroad for kroner, see below. However, there are signs that companies are repatriating significant profits in foreign currency towards the year-end to hold kroner at the end of the financial year.¹⁸ In addition, part of the reason for the krone purchases was that some companies entered into forward contracts at year-end to hedge the currency risk of future earnings abroad. The intervention around the turn of the year 2022-2023 can to a great extent thus be attributed to, for example, the high balance

15 For further details, see Danmarks Nationalbank, Rising inflation and Russian invasion have increased volatility, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 4, March 2022.

16 See, for example, Danmarks Nationalbank Monetary Review 4th quarter 2014, December 2014.

17 One reason for this that, as from 2022, the banks have had to calculate their leverage ratio as an average over all days, rather than only as at the last day of a given quarter. In addition, the banks have not had an incentive to reduce their business volume at the turn of the year in connection with payments to the Single Resolution Fund. The fund is being built up in the period 2016-2023, and the banks' contribution to the fund in 2023 has been calculated on the basis of year-end 2021. For further details, see Danmarks Nationalbank, Rising inflation and Russian invasion have increased volatility, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 4, March 2022.

18 The liquidity comes from earnings abroad, sales of foreign subsidiaries and general liquidity redistribution in international groups.

of payments surplus, which has led to companies demanding kroner, see below. This is in contrast to the appreciation pressure around the turn of the year 2021-2022, which was largely driven by temporary market conditions.

Higher monetary policy interest rates transmitted smoothly to Danish money market

As a result of the ECB's interest rate hikes in October and December 2022 as well as in February 2023, Danmarks Nationalbank has raised the Danish monetary policy interest rates. Overall, Danmarks Nationalbank's certificate of deposit, current account and lending rates have been raised by 1.45 percentage points from and including October. This should be viewed in relation to the ECB having raised its interest rates by 1.75 percentage points in the same period.

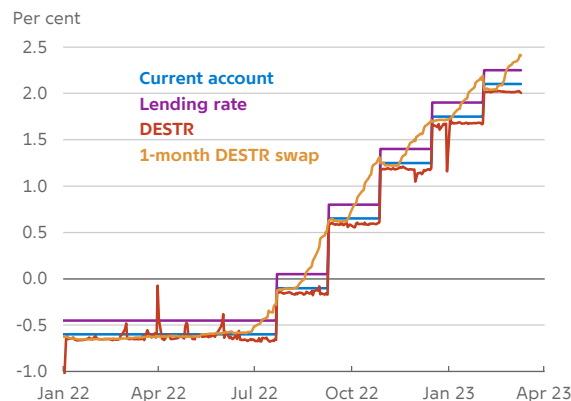
The higher monetary policy interest rates have been transmitted smoothly to the Danish money market. The overnight reference rate, Denmark Short-Term Rate (DESTR), has followed the monetary policy interest rate increases and has remained stable slightly below the current account rate, see chart 16. Short-term Danish swap rates also still remain close to Danmarks Nationalbank's current account rate. The widening of the monetary policy interest rate spread to the ECB has meant that Danish money market rates have not risen to the same extent as corresponding interest rates in the euro area. The effect of the widened spread is strongest for short-term swap rates and diminishes the longer the contract term is.

Broad-based krone demand

During 2022, the demand for kroner from Danish non-financial corporations, institutional investors and foreign investors has gone in the same direction – towards net purchases of kroner. The demand has thus been broad-based and can be explained by current economic and financial trends, see below. The strong krone exchange rate should also be viewed in the context of the insurance and pension sector having been the only significant net seller of kroner during the period. Persistent high demand and few sellers of kroner have contributed to Danmarks Nationalbank intervening and widening the monetary policy interest rate spread, see the previous section.

Five interest rate hikes since mid-2022

Chart 16



Note: Denmark Short-Term Rate (DESTR) is a short-term transaction-based reference rate for the Danish money market. Before 1 February, the 1-month-DESTR-swap was calculated as the 1-month-cita-swap rate less 19 basis points. Most recent observations 10 March 2023.
 Source: Danmarks Nationalbank and Refinitiv Eikon.

Danish companies' high earnings led to krone purchases

In 2022, Danish companies had extraordinarily high earnings abroad, which they exchanged for kroner. The balance of payments surplus has been positive for a number of years and was record high in 2022 at around kr. 360 billion, see chart 17. The increase in the surplus comes mainly from the balance of services (red), where the shipping industry has benefited from high global freight rates. The extraordinary earnings in 2022 have meant that the Danish non-financial corporations have made significant purchases of kroner on an ongoing basis when bringing their earnings back from abroad. The companies exchange their earnings to kroner for a number of purposes, including tax payments, Danish salaries, dividends, share buybacks or other investments. The earnings are both repatriated to Denmark via direct payments for goods as well as income in the form of current dividend payments from foreign subsidiaries. The companies' krone purchases have continued into 1st quarter 2023.

Foreign investors have bought kroner following losses on Danish mortgage bonds

The market value of foreign holdings of Danish mortgage bonds decreased in 2022 due to rising interest rates. In response to the drop in market value, the foreign investors have reduced their currency hedg-

ing in order not to hedge more than what the assets are worth. This has resulted in net krone purchases from foreign investors, see box 2. In addition, foreign investors have sold off Danish mortgage bonds, see the section *Global financial market development*. Sales of bonds do not entail a krone demand if the investors have fully hedged the currency risk on the bonds. It is assessed that the main part of foreign purchases of Danish bonds are made with hedging of the currency risk.

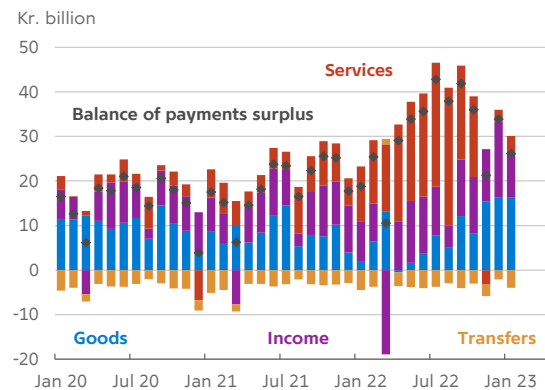
Danish institutional investors have bought kroner due to divestments of foreign shares

Danish institutional investors made net purchases of kroner for kr. 41 billion in 2022. The krone purchases were primarily driven by Danish investment funds' sales of foreign shares for kr. 121 billion, see chart 18 (green). Conversely, the insurance- and pension sector (IP) net sold kroner during the year. The main reason for this is that the sector had to pledge more currency as collateral in its derivatives transactions due to rising interest rates and dollar exchange rate increases (red) in 2022. Purchases of foreign currency were made throughout the year, which may indicate a build-up of liquidity reserves in foreign currency. Overall, the effect of the above opposing movements is a net purchase of DKK from Danish institutional investors in 2022, see chart 18.

IP usually reduces currency hedging when the value of their foreign shares decreases. Reductions of currency hedging entail a sale of kroner. In 2022, US equity prices fell sharply, but this did not give rise to

Danish companies had extraordinarily high earnings abroad in 2022

Chart 17



Note: Balance of payments surplus, broken down on items since January 2020. Last observation is January 2023.
 Source: Statistics Denmark.

Changes in investors' currency hedging affect krone exchange rate

Box 2

When a foreign investor buys securities issued in Danish kroner with the expectation of reselling them in the future, the investor will typically enter into forward contracts to eliminate the risk of the investor's domestic currency appreciating against Danish kroner. A forward exchange contract is an agreement between two parties to exchange an agreed amount between two currencies at an agreed exchange rate.

Changes in the value of the securities may make the investor change the hedging and thus buy or sell kroner. If, for example, a Japanese investor has bought Danish mortgage bonds for kr. 100 million and has entered into forward contracts to convert kr. 100 million into yen in a year, changes in the market value of the bonds may lead to an adjustment of the currency hedging. If the value of the bonds falls to kr. 50 million, the investor still has an agreement to exchange kr. 100

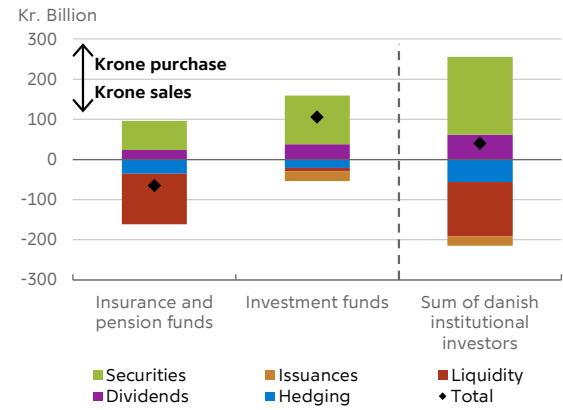
million for yen in a year and thus lacks kr. 50 million. In this connection, the investor can enter into a forward contract and commit to exchanging yen for kr. 50 million at the same time on which the original contract expires.

The new contract will have an immediate effect on the krone exchange rate, as the bank, which is the counterparty to the transaction, can be expected to buy kr. 50 million in the foreign exchange market immediately. They do this because they do not want to remain with the risk of exchange rate changes until the delivery of the currency is to take place. An increase in the market value of the bonds to kr. 150 million could likewise lead to a krone sale of kr. 50 million. A corresponding mechanism often plays a major role in the insurance and pension sector's hedging of holdings of foreign equities.

any significant adjustment of currency hedging by IP. There are a number of reasons for this, including that the dollar exchange rate appreciated significantly during 2022, partially offsetting the value loss from declining US equity prices.

Danish institutional investors have had positive overall krone demand in 2022

Chart 18



Note: Net krone purchases and net krone sales in 2022 stated according to the direct reason for the purchase. Institutional investors comprise Danish insurance and pension companies as well as Danish investment funds. The figures have been adjusted for major internal redistributions of assets between the insurance and pension sector and their investment funds.

Source: Danmarks Nationalbank.

Macro-financial developments

The monetary policy interest rate hikes and expectations of further hikes have tightened financial conditions in Denmark. The effects are gradually transmitted to the Danish economy and are expected to be significant in 2023 and 2024.

The increases in Danish market interest rates are gradually being passed through to households and companies. This occurs as debt fixes at new higher interest rates and assets decrease in value, in particular as a result of falling house prices. Higher interest payments will contribute towards lower consumption and investments. In addition, other central banks' actions dampen activity in the world economy, thereby impacting Danish exports.

The pass-through from the higher interest rates to outstanding loans with interest rate fixation periods of 1-5 years occurs gradually, but a significant share of loans has already been fixed at new interest rates in the 1st quarter of 2023. Households with fixed-rate loans are generally less affected by interest rate increases. A large share of these borrowers have realised net wealth gains through buy-backs of mortgage loans, which supports their consumption opportunities. This may slightly dampen the effect of rising interest rates on private consumption.

Tightening of financial conditions will dampen economic growth significantly

Higher monetary policy rates contribute to slowdown in growth and lower inflation

High inflation has led central banks worldwide to tighten monetary policy, and interest rates have risen significantly, both in Denmark and in the rest of the world, see the section *Global financial market development*. The tighter financial conditions reduced GDP growth already in 2022, and the effects are expected to dampen economic growth this and next year. By dampening economic growth, the interest rate hikes contribute to reducing inflation abroad and in Denmark.

Higher interest rates dampen growth in Denmark by reducing both domestic and foreign demand. Domestic demand is primarily reduced by higher interest rates lowering the consumption and investment appetite of Danish households and companies, see chart 19. The timing of the impact from the tighter financial conditions depends greatly on the structures of the economy, see the next section. For example, Danish households' mortgage loans have relatively long fixed-interest periods. This suggests that the tighter financial conditions will have a grad-

ual effect on the economy. Economic activity in Denmark is also dampened by global tightening of financial conditions reducing foreign demand. The lower growth worldwide reduces both Danish exports and Danish business investment, which also results in a reduction in domestic activity and inflation.

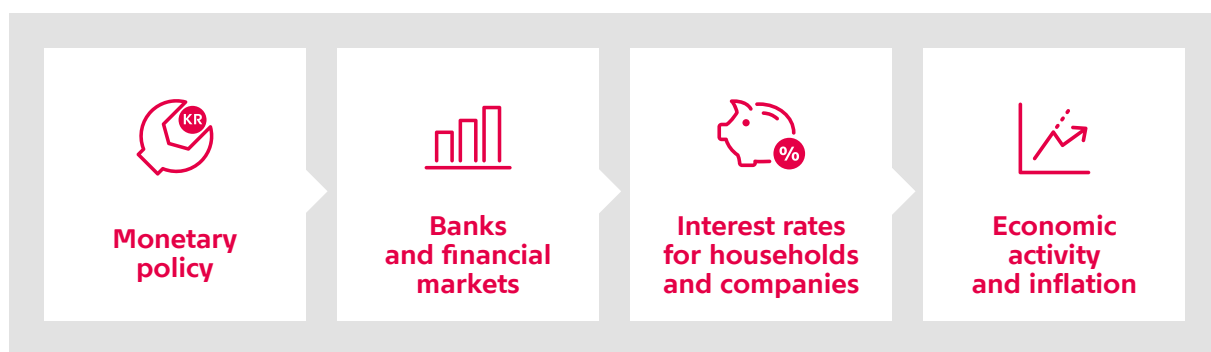
Tightening of monetary policy is gradually transmitted to the economy

Higher bond yields in Denmark since 2021, bank interest rates have only increased later

Long-term mortgage bond yields began to rise already in 2021, see chart 20 (purple), as market participants expected tighter monetary policy, see the section *Global financial market development*.¹⁹ Shorter market rates, such as the mortgage bond yield of, for example, F1 loans (blue), subsequently rose as the expected monetary policy rate hikes approached (red).

Monetary policy affects economic activity and inflation through financial conditions

Chart 19



Note: Simplified illustration of monetary policy transmission through the effect on loan rates. In addition, monetary policy has effects on, for example, the formation of inflation expectations and price formation in the energy markets, see Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023. Through these channels, monetary policy can also contribute to dampening inflation.

Source: Danmarks Nationalbank.

¹⁹ See also Danmarks Nationalbank, Tighter monetary policy has made financing more expensive, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 10, September 2022.

There is a relatively close correlation between interest rates on newly issued mortgage debt and yields in the bond markets, because new mortgage loans in Denmark are granted on the basis of bond issuances on market terms. This is in contrast to many European countries, where housing financing is primarily done through banks, which can set interest rates on a discretionary basis. However, the higher market rates have so far only impacted the average interest rate on Danish companies' and households' outstanding mortgage loans to a lesser extent (black), see chart 20. This is due to relatively long interest rate fixation periods on mortgage loans, see below. Interest rates on outstanding bank loans of households and companies (orange) have only risen after Danmarks Nationalbank has raised interest rates, and the increases have occurred gradually. Interest rates on bank deposits (green) have so far risen more slowly than interest rates on bank loans, which has increased the banks' interest margin.

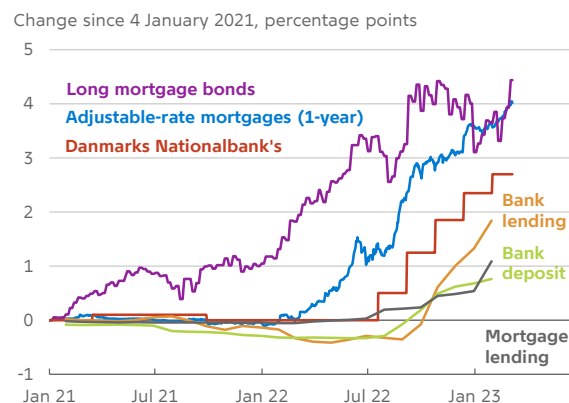
Since September, Danmarks Nationalbank has twice widened the monetary policy interest rate spread to a more negative level, see the section *Danish money and foreign exchange markets*. This has caused slightly lower interest rate increases on loans to Danish companies and households relative to a scenario in which Danmarks Nationalbank had followed the ECB's interest rate hikes 1-to-1. The widenings of the spread have dampened the increase in short-term interest rates in particular, see the section *Global financial market development*, but only to a minor extent relative to the overall interest rate increases in the period.²⁰ The widenings of the spread have thus only had a minor impact on the overall effect of the interest rate hikes on Danish activity and inflation.

Tighter monetary policy is reflected in Danish real interest rates

Financing costs in the economy have increased both nominally and in real terms. The latter reflects

Long-term market rates rose before other interest rates

Chart 20



Note: The long mortgage bond yield is an average interest rate on issuances. The interest rates on adjustable rate loans are estimated par yields. Interest rates on bank deposits and lending and outstanding mortgage lending are an average of interest rates paid by households and non-financial corporations and are only available on a monthly basis.

Source: Finance Denmark, Nordea Analytics, Danmark Nationalbank and own calculations.

that nominal interest rates have generally risen faster than expectations of inflation derived from market prices. For example, current and expected future short-term interest rates on government bonds are higher than before inflation began rising in 2020, see chart 21. Since September 2022, short real interest rates have also increased markedly based on lower inflation expectations. Realised short-term real rates, which measure nominal interest rates less realised inflation, have also increased since September 2022, as inflation has declined over the period.²¹

A recent analysis from Danmarks Nationalbank indicates that the equilibrium real interest rate in Denmark is between -0.5 per cent and -2.5 per cent, although the estimate is associated with a high

20 The effect on longer term interest rates resulting from the negative monetary policy interest rate spread is limited. For example, Danish government bond yields are still above the yield on German government bonds, see section *Global financial market development*.

21 There is uncertainty connected with whether realised or expected real interest rates have the greatest impact on the economy. In addition, big decisions for households, such as taking out a mortgage, and big corporate investments in, for example, buildings, machinery or equipment predominantly have a long time frame, and the development in longer real interest rates can therefore be assumed to have the greatest impact on this. See Jakob Adolfsen, Mikkel Bess and Jesper Pedersen, Real interest rates are affected by inflation expectations, *Danmarks Nationalbank Analysis*, No. 19, October 2020.

degree of uncertainty.²² The equilibrium real interest rate is the interest rate that ensures balance between the desired savings and investments and makes monetary policy as measured by the short-term interest rate neutral for activity in the economy.²³ At the present time, the whole curve of implied short real interest rates is higher than the estimated equilibrium real interest rate in Denmark. Other things being equal, this indicates that monetary policy interest rates are dampening the activity in the Danish economy.

New debt has become significantly more expensive, equity has not

Higher market interest rates have contributed to a significant increase in the total weighted cost of raising new debt financing for households and companies, see chart 22. The increases in total costs have occurred from a low level.

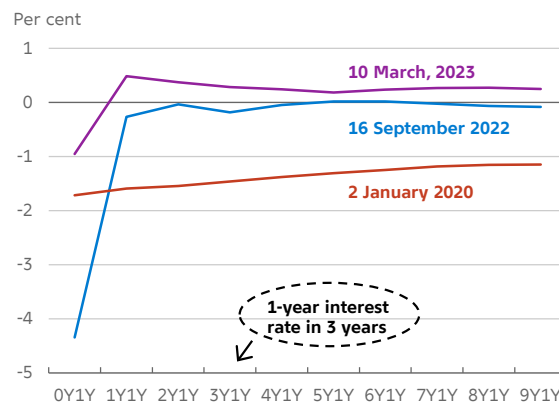
Despite higher risk-free interest rates, the price of companies' total external financing has only increased to a minor extent (purple). Total external financing also include financing with equity, and the required return on equities has only increased slightly relative to the increases in interest rates. Higher risk-free interest rates have thus been partially offset by declines in the equity risk premium demanded by investors, see the section *Global financial market development*. Relatively cheaper equity issues relative to debt have not resulted in a substitution of companies' external financing towards more equity issuance. This should be viewed in the context of, for example, large fluctuations in the equity markets and a potentially lower need to make investments in the near future.

Interest rate pass-through to outstanding mortgage debt is more sluggish than to new loans

While interest rates on new mortgage debt have increased significantly, interest rates on outstanding mortgage debt have not yet increased to the same extent, see chart 23. This is due to the fact that mort-

Higher real interest rates relative to period before rise in inflation

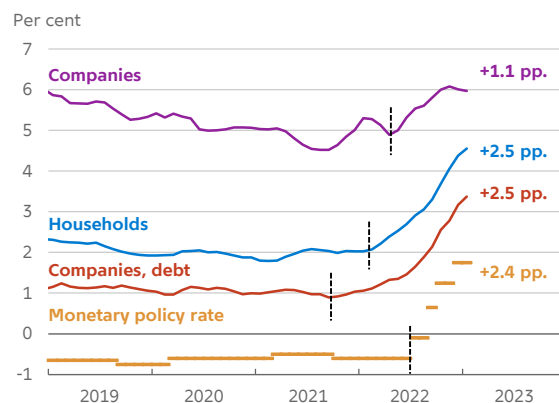
Chart 21



Note: The chart shows the real Danish forward government yield curve. Real interest rates are derived from zero-coupon government yields as well as European inflation compensation. This is thus an ex ante real interest rate curve.
 Source: Scanrate Rio, Danmarks Nationalbank and own calculations.

Total financing costs have increased, especially on debt

Chart 22



Note: Balance sheet-weighted costs of raising external financing for households and companies. Companies rely heavily on equity financing, which goes a long way towards explaining their relatively high costs. The latest month is January 2023. For further details on the methodology, see box 1 in Danmarks Nationalbank, Decline in interest rates and refinancing boom, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 19, September 2019. Figures to the right indicate percentage point increases since the time of the first increases in the respective series.
 Source: Statistics Denmark, Refinitiv Datastream and Eikon, Danmarks Nationalbank and own calculations.

22 The low equilibrium real interest rate is explained by a number of factors, including demographic trends, high savings and declining productivity. See Simon Thinggaard Hetland, Rasmus Bisgaard Larsen, Marcus Mølbak Ingholt and Morten Spange, Real interest rates in the context of inflation and higher government debt, *Danmarks Nationalbank Analysis*, No. 2, February 2023.

23 The equilibrium real interest rate is compatible with a stable price and wage development based on the actual economic activity being at its structural level.

gage debt in Denmark typically is issued with a long maturity, and to a large extent with a medium-term or long-term interest fixation period.

In January 2023, 27 per cent of households' outstanding mortgage debt consisted of variable-rate loans with a fixed-interest period of less than one year (loans based on reference rates), 25 per cent were variable-rate loans with a fixed-interest period of between 1 and 5 years (adjustable-rate loans) and 47 per cent were loans with a longer fixed-interest period (primarily 30-year fixed-rate loans). The corresponding distribution for companies was 43, 17 and 40 per cent.

Every third mortgage loan gets a new interest rate within a year

The pass-through to outstanding mortgage loans from higher market-based and monetary policy rates will be significant in 2023. One of the reasons for this is that the interest rates behind outstanding variable-rate mortgage loans are only gradually adjusted, see chart 24. At the beginning of 2022, the higher market rates only affected interest costs on a minor part of households' existing loans, while the effect was greater for companies, which typically have a shorter interest fixation period.

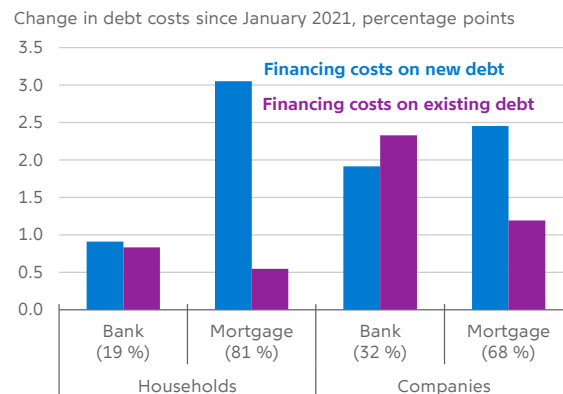
Since the beginning of 2022, 22 per cent of households' mortgage debt has been interest rate adjusted at least once. Only after approximately five years has the gradual pass-through to variable rate mortgage loans been fully phased in, as the majority have a fixed-interest period of maximum five years. If households' refinancing of fixed rate mortgage loans is included, 49 per cent of their mortgage debt will have received a new interest rate in 2022. Loans with very short interest rate fixing periods have been fixed at new interest rates several times during the year.

The largest interest rate increases on outstanding variable rate mortgage loans are expected to occur this year

At the respective due dates this year, average interest rates on household and corporate loans which need to be adjusted are expected to rise by up to approx. 2.0 and 1.5 percentage points, respectively, see chart 25. Some households and companies will have the interest rate on their loans adjusted several times in one year. The expectation for the development in interest rates on loans is based on the composition of outstanding mortgage debt as well as expectations for future interest rate fixing rounds based on

Increase in interest rates on new loans takes time to pass through to outstanding debt

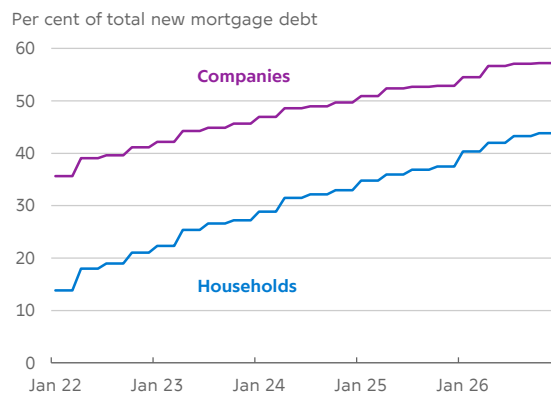
Chart 23



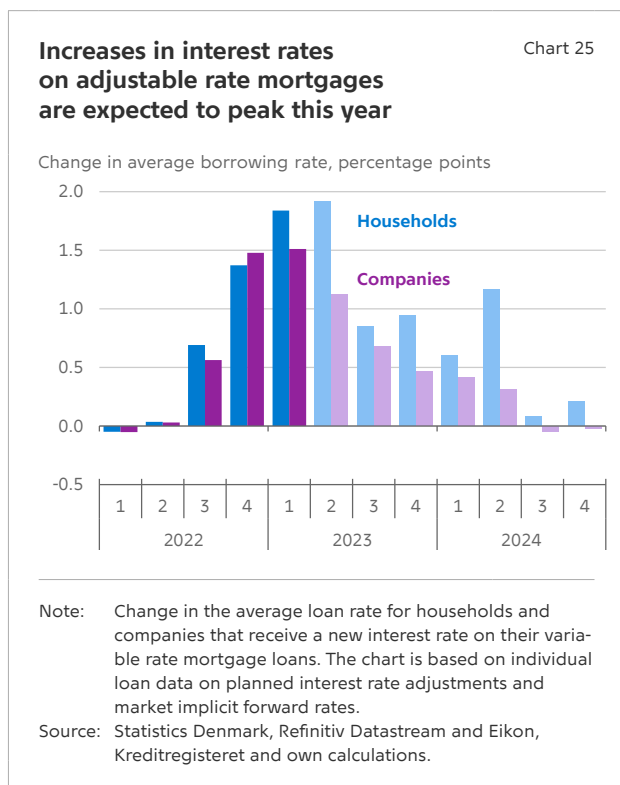
Note: Percentages indicate share of debt financing from Danish banks and mortgage credit institutions (the MFI sector).
 Source: Statistics Denmark, Refinitiv Datastream and Eikon, Danmarks Nationalbank and own calculations.

Gradual interest rate pass-through to existing mortgage debt

Chart 24



Note: Share of outstanding mortgage debt that has received a new interest rate at least once since January 2022. Data are based on the date of future interest rate adjustments at loan level and the loan composition based on beginning of January 2022. Each loan only counts once, even if loans with a shorter fixed-interest period receive a new interest rate several times during the 5-year period.
 Source: Own calculations based on the credit register.

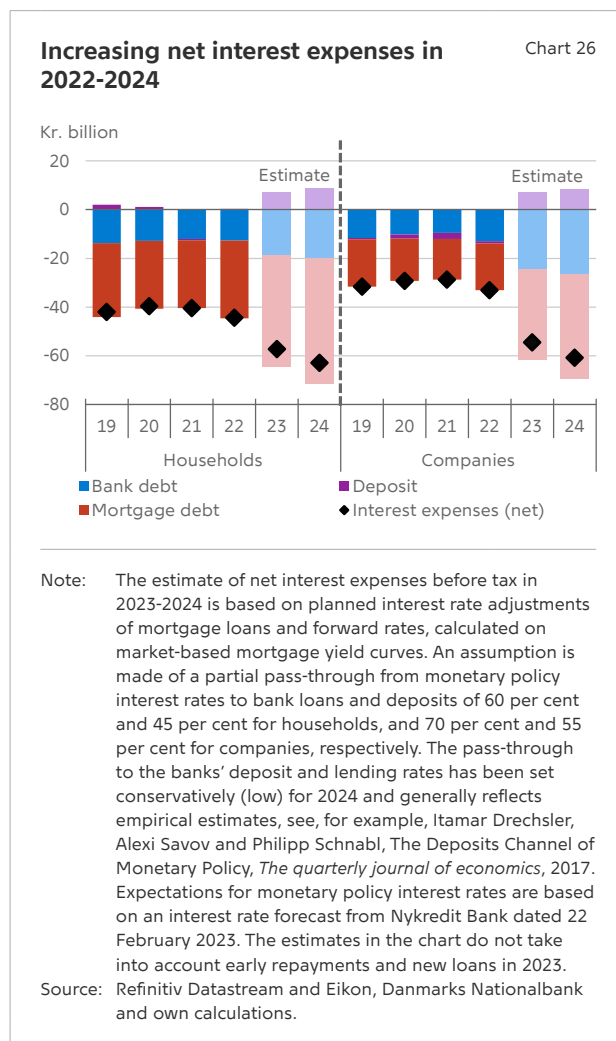


market-implicit forward rates. Large-scale refinancing terms in the first half of 2023 mean that the average loan rate for the entire household and corporate segment increased significantly in January and is also expected to rise significantly in April. In turn, the increase in loan rates was subdued throughout most of 2022. Interest expenses thus only increased significantly from the 4th quarter, which illustrates that the interest rate pass-through is gradual in Denmark.

Based on market expectations, short market rates are expected to decrease slightly during 2024, thereby reducing the average expected interest rate increases in 2024. However, there are still mortgage loans with longer fixed-interest periods, such as F3 and F5 loans, which will be refinanced at significantly higher interest rates in 2024. Overall, the observations confirm that increases in household and corporate interest expenses on the outstanding loan composition are highest during 2023 and will then gradually diminish.

Minor increase in net interest expenses in 2022, large increases expected in 2023

Overall, the increase in average deposit and lending rates for households and companies has resulted in higher net interest expenses before tax of kr. 3.9 billion and kr. 4.4 billion, respectively, in 2022. This



corresponds to an increase in net interest expenses of 10 and 15 per cent, respectively, relative to the previous year, see chart 26. The higher expenses constitute 0.3 per cent of households' total disposable income and 0.6 per cent of companies' gross profits, respectively, in 2022. With average interest rates expected to rise gradually in the future, net interest expenses are expected to increase further in 2023 and 2024. Net interest expenses are expected to increase by kr. 13 billion and kr. 22 billion, respectively, corresponding to an increase of 29 and 65 per cent from 2022 to 2023 for households and companies, respectively. The main reason for the larger increase in interest expenses for companies is that their debt has a shorter fixed-interest period and that households have relatively large deposits, which gradually achieves a higher interest rate. The majority of interest rate adjustments are expected to occur during 2024, thereby increasing net interest expenses by a further approx. 10 per cent.

Effect of rising interest rates may be dampened by loan refinancing

In 2022, Danish households realised capital gains totalling kr. 44.7 billion due to refinancing of fixed-rate mortgage loans.²⁴ The prices of the bonds underlying households' fixed rate loans have fallen significantly as interest rates have risen. Households have been able to buy back the bonds at the lower market prices. It is estimated that 30 per cent of the amount of buy backs has been released as liquid funds, equal to DKK 13.5 billion. The funds can be used to increase savings or to support private consumption at a time when household purchasing power is under pressure from higher inflation and higher borrowing costs.

However, the release of liquidity is at the expense of higher future interest rates on the new loan. In addition, 1 in 3 homeowners chose to convert to a variable rate mortgage in the loan refinancing rounds during 2022. This gives rise to higher interest rate sensitivity going forward, and the interest rate pass-through will be slightly faster from here onwards than it was in 2022.

Effects of tighter financial conditions on growth in Danish economy

Tighter financial conditions are expected to dampen economic growth significantly

Tighter financial conditions on a global scale have contributed to lower growth in the Danish economy in 2022. The expectations by market participants of higher monetary policy rates for a longer duration period compared to September has implied higher market rates since then, see the section *Global financial market developments*. Consequently, the expected dampening effects on the economic growth have become stronger during the past half year. This is particularly pronounced for 2024, since

the effects of higher interest rates are expected to occur with a lag.

The dampening effects on growth are expected to become substantial this year and next year, putting downward pressure on, among other things, private consumption and investments relative to a situation where interest rates had not risen. In addition, there is an effect through lower demand in the Danish export markets as a result of the tighter foreign monetary policy. For this and other reasons, a slowdown in the growth of the Danish economy is expected, which will bring the Danish business cycle close to neutral by the end of 2023.²⁵

Most of the understanding about households' and companies' reactions to interest rate increases is based on older, historical data, where economic and financial conditions were significantly different. For that reason, there is uncertainty associated with the size and timing of the effects from the global monetary policy tightening on the Danish economy. There is particularly great uncertainty in the current situation, as interest rate increases have been significant and have occurred after a prolonged period of historically low interest rates. The ECB and the Federal Reserve have addressed the uncertainty surrounding the transmission of monetary policy by gradually tightening monetary policy to be able to assess the effects of the tightening cycle on an ongoing basis.²⁶

Models indicate negative contribution to growth in Denmark of 0.8-2.5 percentage points in 2023

On the basis of a model-based scenario analysis approach, the ECB in a preliminary assessment finds that its preliminary monetary policy tightening thus far is likely to have significant negative impacts on real GDP growth in the euro area this year. Estimates from the ECB's models indicate an effect on GDP growth in the euro area of 0.9 - 5.4 percentage points in 2023 with an average across the models of 2 percentage points.²⁷ In addition, the average of the ECB's models suggests that the effects in the euro area will peak this year.

24 See Henrik Yde Andersen; Erik Grenestam, Marcus Bjerregaard Læssøe, Alexander Meldgaard Otte and Sigurd A. M. Steffensen, Refinancing behaviour by households in Denmark when mortgage rates rise, Danmarks Nationalbank Economic Memo, No. 2, February 2023.

25 See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

26 See speech by Philip Lane, Monetary policy in the euro area: the next phase, August 2022.

27 See Lane Philip, speech, The euro area hiking cycle: an interim assessment, February 2023, and Philip Lane, speech, Transmission of monetary policy, October 2022.

Scenario analyses from three macro-econometric models indicate that the effects on GDP growth in Denmark of tighter financial conditions in Denmark and abroad will become substantial this year and be in the range of 0.8-2.5 percentage points, see box 3 and box 4. The effects on growth in 2024 are also expected to become substantial. Compared to half a year ago, the expected effects for 2024 have increased by 0.5 percentage points. This entails that the expected growth in GDP would have been substantially higher this year and next year, had interest rates not increased and equity prices not fallen in Denmark and abroad.

The effects are calculated by comparing the expected economic development in two scenarios. Specifically, a scenario based on the actual development (including the market-implied expected developments implied given by current market pricing) is compared to an alternative scenario, in which the interest rates remained low and equity prices remained high in the short run. The alternative scenario does not necessarily reflect the expected financial development in absence of tightened monetary policy. The alternative scenario only constitutes a modelling tool to quantify the isolated effects of tighter financial conditions, relative to a scenario where financial conditions remained accommodative in the short run.²⁸

The estimated effects on the Danish economy are to be attributed to the development in the *overall* financial conditions in Denmark and abroad. This means that the development can be attributed both to tighter monetary policy and other factors. In addition, some of the effects reflect that, seen in iso-

lation, interest rate increases abroad are dampening the growth in Danish export markets.²⁹

The estimates from the stylised model calculations constitute one of several inputs in the assessment of the effects.³⁰ The strength of the models is that they take into account historical economic relationships. The models provide an estimate of the isolated (partial) effects of tighter financial conditions. However, the model estimates cannot stand alone in the assessment, as households' and companies' reactions to tighter financial conditions may deviate from their historical behaviour, on which the models are based. The assessment thus also takes into account the current macro-financial developments and their importance according to other literature, see the following section.

Negative contribution from interest rates on consumption is partly offset by rising real wages

Private consumption is negatively affected by higher interest rates. Historically, households have reduced their consumption when they have had to pay higher interest rates or in anticipation of higher interest rates in the future.³¹ Households' interest expenses are expected to increase by significantly more this year than in 2022, see above. The expected increase is kr. 20 billion in interest expenses and kr. 13 billion in net interest expenses in 2023. This corresponds to 1.6 per cent and 1.0 per cent of households' disposable income, respectively. Household consumption is expected to be negatively affected in 2023 due to higher interest expenses. In addition, higher interest income accrues disproportionately to households with large deposits, which are assumed to have a low propensity to consume.³² In addition, household

28 The lower interest rates would contribute to significant growth in the Danish economy in the short term. However, the growth becomes at the expense of a risk of adverse inflation dynamics and economic instability.

29 The scenario analyses for the Danish economy and the ECB's scenario analyses for the euro area are thus not directly comparable, as the ECB's effects on the euro area economy only come from its monetary policy tightening measures. To estimate the effects of the ECB's monetary policy alone, the ECB chooses to focus on a smaller part of the movements in the financial conditions, while not taking into account the effects of tighter financial conditions outside the euro area.

30 A similar approach is adopted in the ECB's assessment of higher interest rates. See Philip Lane, speech, Transmission of monetary policy, October 2022, and Philip Lane, speech, The euro area hiking cycle: an interim assessment, February 2023.

31 See Jeppe Druedahl, Emil Bjerre Jensen and Søren Leth-Petersen, The intertemporal marginal propensity to consume out of future persistent cash-flows: evidence from transaction data, *Working Paper*, 2022.

32 See Edmund Crawley and Andreas Kuchler, Consumption Heterogeneity: Micro Drivers and Macro Implications, *American Economic Journal: Macroeconomics*, vol. 15, no. 1, 2023.

consumption may be adversely affected by declines in wealth. Rising market rates have already contributed to significant declines in Danish house prices, and house prices are expected to decline further.³³

Household consumption is expected to be less impacted by interest rate increases now compared to what has been the case in the past. Firstly, this is due to households having reduced their interest and instalment payments relative to their incomes over the past decade leading up to 2022.³⁴ The recent shift towards variable rate mortgage debt thus comes from a basis with low interest sensitivity. Secondly, households have accumulated large amounts of savings over the past decade, including large deposits, which can be used to absorb fluctuations over time, for example in interest expenses.³⁵ Thirdly, the current decline in house prices follow large increases in house prices during 2020-2021, which has given homeowners a significant buffer in the form of increased home equity.³⁶

Finally, one in four homeowners with fixed rate mortgage loans have refinanced their fixed-rate mortgage loan in 2022 to realise a capital gain. In connection to that, many households have extracted liquid funds which can support future private consumption. Households with limited liquid assets were both more inclined to refinance their loans and to extract liquidity if they actually realised a capital gain when refinancing. This indicates that homeowners who want to increase or maintain a certain level of consumption now or in the coming years have, to a greater extent, realised capital gains as a result of the rising interest

rates and thus increased their consumption options. On this basis, it is assessed that, *seen in isolation*, the high level of refinancing of fixed-rate mortgage loans may dampen the contractive effects of rising interest rates on private consumption.

In spite of the downward effects resulting from rising interest rates, real private consumption is expected to increase by 0.2 per cent this year. This is due to an expected increase in households' disposable real incomes this year, which is, however, partially offset by higher interest rates. From next year, private consumption is expected to rise in line with continued increases in disposable real incomes.³⁷

Lower investments this year

In 2023, interest rate increases are expected to reduce housing and corporate investments in particular. Housing and corporate investments are typically some of the more interest sensitive parts of the economy. Thus, tighter financial conditions are expected to have a faster and stronger impact hit on investments than on private consumption.³⁸

Lower growth in Denmark's export markets

Monetary policy has been tightened throughout the world, including in Europe and the United States, which has contributed to dampening growth in several of Denmark's important export markets. Lower demand for Danish exports will therefore also put downward pressure on growth in the Danish economy in 2023.³⁹ Danish exports are expected to increase in 2024-25.

33 See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

34 See Stine Ludvig Bech, Simon Juul Hviid and Jakob Guldbæk Mikkelsen, Measuring household interest-rate sensitivity in Denmark, *Danmarks Nationalbank Working Paper*, No. 183, November 2021. However, it should be noted that households have also been and continue to be affected by declining purchasing power resulting from higher inflation, which may have separate negative effects on consumption growth. It cannot be concluded that this has an effect on whether households will therefore react more strongly to interest rate increases in the present situation.

35 This is confirmed by Danish households' consumption having followed the development in disposable income since 2015. The consumption quota has thus been stable and only affected by fluctuations in interest rates etc. to a minor extent.

36 See Per Andersen, Pernille Valentin Borgensgaard, Andreas Kuchler and Bjørn Bjørnsson Meyer, Housing wealth and consumption during Covid-19, *Danmarks Nationalbank Economic Memo*, No. 1, 2023.

37 Households' post-tax net interest expenses are deducted in the calculation of households' disposable real incomes. See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

38 See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023. In real terms, private consumption decreased in 2022, while home and corporate investments increased significantly in real terms. To a great extent, however, the decrease in consumption is due to other factors than tighter financial conditions, including, in particular, that higher inflation has reduced household purchasing power.

39 See Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

Macro-econometric models contribute to assessment of effects of tighter financial conditions on the Danish economy

Box 3

Models indicate overall negative growth contributions from financial conditions in 2022-2024

Three macro-econometric models indicate overall a significant contractive effect on economic activity and economic growth in 2022-2024 as a result of tighter financial conditions globally, see chart A and B. The estimates from the three models show a dampening effect on growth of 0.4 - 2.3 percentage points in 2022, 0.8 - 2.5 percentage points in 2023 and -0.1 - 2.4 percentage points in 2024. The effect on *growth* is highest in 2023 in two of the three models. The effects on the *level* of GDP are substantial in the near future and will peak in 2024. Over a longer time span than shown in the charts, the effect on the level of GDP is approximately zero. The estimates from the scenario analyses should be regarded as isolated effects of tighter financial conditions, and not seen as an overall projection for the Danish economy.

The estimates come from scenario analyses on Danmarks Nationalbanken's macro-econometric model MONA, a dynamic stochastic general equilibrium model (DSGE model) as well as an econometric structural VAR model with an

index of financial conditions (FCI-SVAR), see Box 4.^{1,2} In the scenario analysis on the MONA model and the DSGE model, respectively, the estimated effects are due to the actual interest rate increases on a global scale as well as the expected interest rate trajectories over the coming years based on market expectations.^{3,4}

This interest rate trajectory is compared to a trajectory with significantly lower short and long-term interest rates in the short term to estimate the effects of the interest rate increases. In the longer term, there is no difference between the interest rate levels in the different trajectories. The estimates from the FCI-SVAR model show the effects on the economy resulting from a tightening in an index of the financial conditions. In 2022-2025, the effects from FCI-SVAR are at the lower end relative to the other models. One of the reasons for this is that, in addition to market rates, the index attaches considerable importance to developments in the Danish equity market, where the price development has been relatively moderate.

Continues...

Chart A: Model estimates indicate negative contributions to activity in Danish economy

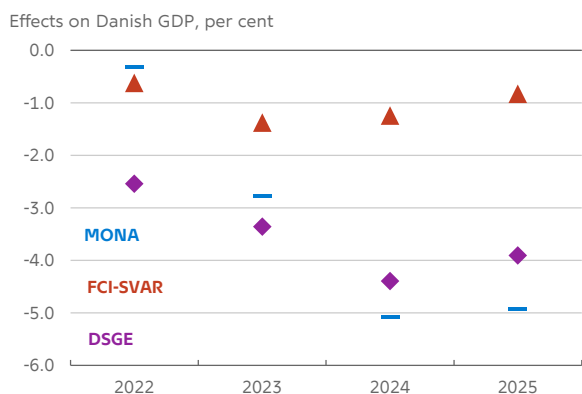
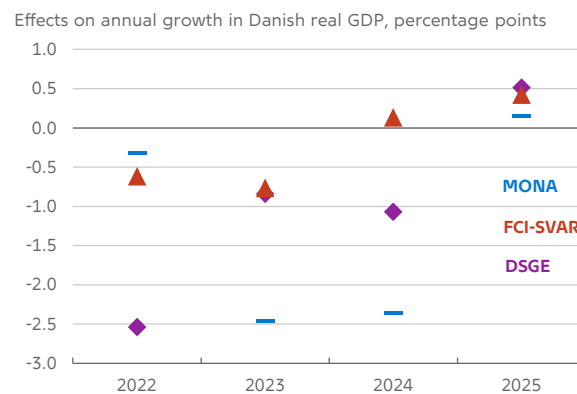


Chart B: Model estimates indicate negative contributions to growth in Danish economy



Note: Estimates based on three models. Over an extended time frame, the effect on the level of GDP moves towards zero. In the MONA and DSGE models, which are both quarterly models, activity is measured by real GDP. FCI-SVAR is a monthly model that uses industrial output (excluding pharmaceutical) as an indicator of monthly activity in the Danish economy. Since 2000, annual growth in industrial output (excluding pharmaceutical) and GDP has had a correlation of 0.84. However, industrial output (excluding pharmaceutical) represents a smaller share of total production. When converting the effect to effects on GDP, adjustments are made for the growth in industrial output having shown greater fluctuations than the growth in GDP, see Box 4.

Source: Own calculations based on the respective models.

- For an explanation of the differences between the MONA and DSGE models, see box 4 in Danmarks Nationalbank, Tighter monetary policy has made financing more expensive, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 10, September 2022.
- For more information, see the following sources: MONA: Danmarks Nationalbank, MONA – a quarterly model of the Danish economy, 2003. Danmarks Nationalbank's DSGE model: Jesper Pedersen, An Estimated DSGE model for Denmark with Housing, Banking and Financial Frictions, *Danmarks Nationalbank Working Paper*, No. 108, October 2016.
- The scenario analyses take into account the effect on foreign activity and prices from foreign central banks' tightening.
- See appendix to Danmarks Nationalbank, Falling, but still high, inflation, *Danmarks Nationalbank Analysis (Outlook for the Danish economy)*, No. 4, March 2023.

Macro-econometric models contribute to assessment of effects of tighter financial conditions on the Danish economy

Box 3

... Continued

A suite-of-models approach supports robust assessments

Each model offers an estimate of the effects of tighter financial conditions on the economy based on historical economic relationships and economic theory. Each model has its strengths by, for example, having a comprehensive description of the Danish economy (MONA), having an thorough theoretical foundation of household and corporate behaviour (DSGE) or being an empirical high-frequency model (FCI-SVAR). The use of a suite-of-models thus supports

more robust model conclusions. However, the economic reaction in the current situation may differ from previous reactions and thus from the predictions in the models. Therefore the models only constitute one of several inputs in an overall assessment of the effects, which also takes into account current developments and other insights from the literature. The overall assessment of current and future effects is, of course, subject to uncertainty, as, for example, the realisation of the monetary policy tightening in the future may deviate from current market expectations.

Econometric model projects decrease in activity based on developments in financial conditions

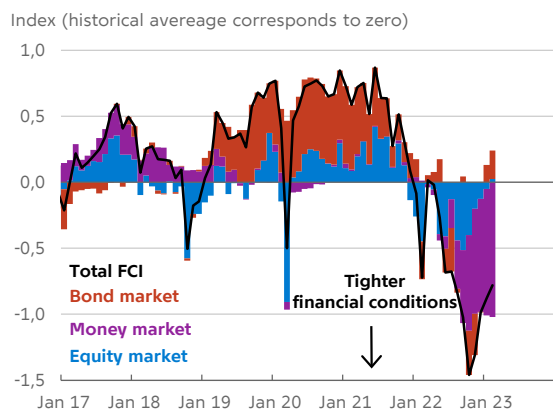
Box 4

The development in Danish financial conditions across the equity, bond and money markets can be summarised in a financial conditions index (FCI), see chart A. Overall, the index points to a significant tightening since autumn 2021. The financial conditions index is particularly well suited to highlight the transmission of tighter monetary policy, as it captures the effects on different market prices through different monetary policy channels.

The impact of tighter financial conditions on economic activity growth is estimated using a structural VAR (SVAR) model. SVAR models are widely used in empirical macroeconomics, as the model class is able to estimate empirical correlations between the included variables across time. To identify the causal relationships, a so-called 'short-term identification' is used.¹

Continues ...

Chart A: Tighter conditions in Danish financial markets since mid-2021



Note: Monthly index. Latest data are for January 2023. For further information, see appendix 1 in Danmarks Nationalbank, Accommodative financial conditions strengthen economic upswing, *Danmarks Nationalbank Analysis (Monetary and financial trends)*, No. 23, September 2021.

Source: Refinitiv Eikon and Datastream, Nykredit and own calculations.

Chart B: Tighter financial conditions dampen growth in industrial production



Note: Industrial production excluding pharmaceutical production. Contributions have been calculated using a structural VAR model. It is assumed that the financial conditions will remain unchanged in 2023 and will then move towards their long-term level of zero.

Source: Statistics Denmark, Danmarks Nationalbank and own calculations.

1. The so-called structural shocks of the model are identified through short-term identification (also called Cholesky identification). It is assumed that the financial conditions can react to the other variables in the model immediately, while the other variables can react to a change in the financial conditions after a month.

Econometric model projects decrease in activity based on developments in financial conditions

Box 4

... Continued

The estimated effects should be seen as an average effect on economic growth from a tightening of financial conditions, while the tightening cannot be explained by the other variables in the model.

In order to capture the structural relationships between the included variables optimally, the growth in the Danish economy is approximated by industrial production (excluding pharmaceutical production) rather than by GDP growth. The reason for this is that industrial production (excluding pharmaceutical production) has greater variation than GDP growth. In addition, the variable is available at a monthly frequency, whereas GDP growth is available on a quarterly basis. Historically, there has been a close correlation between GDP growth and growth in industrial production (excluding pharmaceutical production). In the model comparison in Box 3, the estimated effects are adjusted for the higher volatility in industrial production.²

In addition to the growth in industrial production (excluding pharmaceutical production), the model includes consumer

price inflation, total lending to households and companies and the financial conditions index. The model is estimated based on monthly data for the period 2005-2021 and contains two lags of the variables in the model.

The model indicates that the tighter financial conditions since autumn 2021 gradually reduced the annual growth in Danish industrial production (excluding pharmaceutical production) during 2022, see chart B.³ According to the model, the negative contribution to annual growth will peak at 3 percentage points at the beginning of 2023 and will then slowly fade again (see blue curve). The positive effects on growth at the end of the period reflect that the tightening in FCI is assumed to be temporary and that the effect on the level of industrial production (excluding pharmaceutical production) will be approximately zero in the longer term. The chart also shows that growth in industrial production (excluding pharmaceutical production) began to slow down during 2022 (see purple curve). It should also be viewed in the context of other factors that affect industrial production, such as a general economic slowdown and eroded household purchasing power due to higher inflation.

² When the effects are converted from being on industrial production to being on GDP, they are revised downwards by a factor of 2.5., because the growth in industrial production is 2.5 times as volatile as GDP. It is thus assumed that the relatively lower sensitivity of GDP in general is also the case for tightening of financial conditions.

³ Industrial production as a whole is also dragged down by tighter financial conditions. However, the effects on production in the pharmaceutical industry are not clear and have therefore been omitted.

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