DANMARKS NATIONALBANK

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The Danish mortgage bond market is dominated by few market participants

The Danish mortgage bond market is robust but the liquidity is affected by interest rate fluctuations. At the same time the market is characterised by the fact that it consists of a few large market participants that could potentially influence the market significantly through large-scale divestments. The big investors are however also diverse, and in recent periods of stress, their opposite trading interests have reduced the risks.

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The Danish mortgage bond market has been liquid during periods of stress, but the liquidity is affected by interest rate fluctuations

The Danish mortgage bond market is a liquid market characterised by daily trading regardless of market conditions. Market liquidity in Danish mortgage bonds deteriorates in periods of stress, which mainly can be explained by increased fluctuations in interest rates.

In times of stress, market-makers act more like brokers in long-term callable bonds

During periods of large interest rate fluctuations, long-term callable bonds are most affected. One consequence of interest rate fluctuations is that banks with market-making activities act more like brokers, i.e. they find a buyer or seller before entering into a trade. This should be seen in light of the fact that some banks have had allocated less risk capacity for market-making in recent years. This gives a new market situation that the investors and mortgage credit institutions should be aware of.

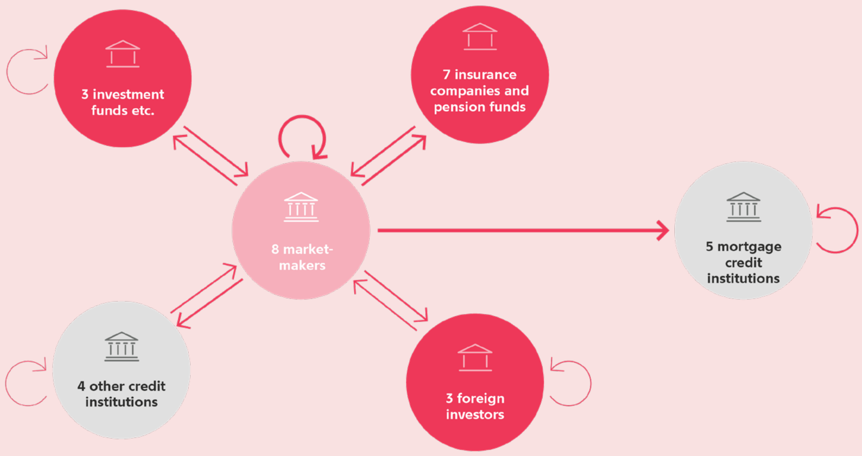
The Danish secondary mortgage bond market is highly concentrated

The secondary Danish mortgage bond market is concentrated among a few large investors. Large divestments from these investors can significantly impact the market. Market participants should take this risk into account in their risk management. However, large investors are diverse and do not always react in the same way to market conditions, which increases the likelihood that some investors will buy all or part of a large divestment. Nevertheless, there is a risk that in times of stress, investors may react similarly, creating more pressure to sell.

Why is it important?

A well-functioning Danish mortgage bond market is important for financial stability in Denmark. It reflects that Danish mortgage bonds are issued daily to finance property purchases for households and businesses. Financial entities, such as banks and pension funds, also use mortgage bonds to allocate liquidity and as an important part of their liquidity reserves. Their market behaviour affects the liquidity of mortgage bonds and thus how robust and well-functioning the Danish mortgage bond market is.

Main chart: The mortgage bond market is concentrated among a limited number of market participants, with 8 market-makers as intermediaries



Note: The chart shows the market participants that accounted for more than 0.5 per cent of purchases in the secondary mortgage bond market in 2023. The thicker a line is, the more trading activity it indicates. A circle next to a sector indicates trades between companies in the same sector.
Source: MiFIR data and own calculations.

Keywords

Banking and mortgage credit

Financial stability and financial risks

Financial markets

01
Turmoil on international markets affects Danish mortgage bonds

Mortgage bonds are the primary source of financing for property purchases in Denmark, making the mortgage bond market important for financial stability. The Danish mortgage bond market is robust, and even during periods of significant turmoil it has been possible to issue new mortgage bonds on the primary market and trade the bonds on the secondary market[1] on a daily basis. This is in contrast to several other countries, where turmoil in bond markets has caused the volume of new issues to decrease sharply or completely stopped. In other countries it can also be difficult (if not impossible) to trade bonds on the secondary market during periods of turmoil.

In addition to being an investment product, mortgage bonds are critical for liquidity management of Danish financial companies, where they are held in the liquidity buffer and as collateral in repo transactions. The ability to trade the bonds is therefore important to ensure they remain liquid. This is especially true in times of stress, when raising cash may be necessary. If there are multiple episodes of lower market liquidity, the use of bonds as a liquidity instrument in the market can be compromised. This could potentially also have regulatory consequences in the form of lower liquidity status for the bonds in the LCR.

Danish mortgage bonds have experienced periods of widening credit spreads since 2020

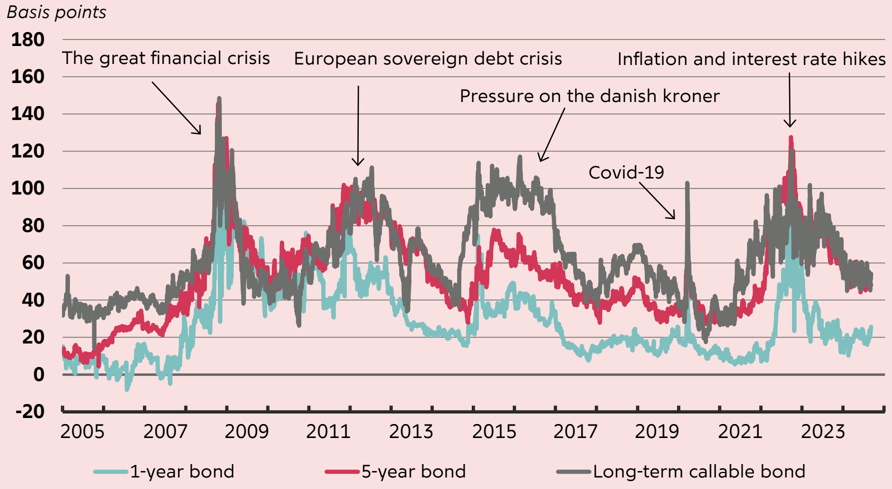
There have been two periods in particular since 2020 when the yield spread between government bonds and mortgage bonds widened. First in connection with the covid-19 lockdowns in 2020 and later in relation to the uncertainty about the developments in inflation and monetary policy interest rates in 2022 and 2023, see chart 1. Mortgage bond yield spreads widened significantly for a short time during covid-19.[2] The various measures adopted by central banks around the world helped stabilise the funding markets[3], which may have had an indirect effect on trading in Danish mortgage bonds.[4] However, the widening of yield spreads from 2020 onwards was no greater than during previous periods of turmoil, such as the financial crisis, the European debt crisis and the pressure on the Danish kroner in 2015, see chart 1. It is difficult to compare the severity of the shocks, but this indicates that the market for Danish mortgage bonds remains robust and liquid despite changes in the investor base over the past 15 years and increased capital and liquidity requirements for Danish banks, including market-makers[5] in Danish mortgage bonds. The increasing

[1] Mortgage credit institutions mainly sell their newly issued mortgage bonds to a distinct group of banks. The bonds are then resold to other market participants in the secondary mortgage bond market. For more information on the primary mortgage bond market, see Eistrup and Bentsen (2023), Mortgage credit institutions must ensure that they can always sell their bonds, *Danmarks Nationalbank Analysis*, no. 18, November 2023 (*link*).
[2] See Halsnæs, Hensch and Loncar (2020), Danish mortgage bond liquidity briefly impacted by covid-19, *Danmarks Nationalbank Analysis*, no. 22, November 2020 (*link*).
[3] Pandemic central banking: the monetary stance, market stabilisation and liquidity, speech, ECB, May 2020 (*link*) and Danmarks Nationalbank (2020), Stabilisation of financial markets after covid-19 turmoil, *Danmarks Nationalbank Analysis (Monetary and financial trends),* no. 11, June 2020 (*link*).
[4] See for example Brunnermeier and Pedersen (2009), Market Liquidity and Funding Liquidity, *The Review of Financial Studies*, Vol. 22, for spillover effects between funding liquidity and asset prices under stress.
[5] A description of the role of market-makers can be found at box 1.

requirments on banks may have had an impact on their role and behaviour in the Danish mortgage bond market.[6]

CHART 1

Yield spreads on Danish mortgage bonds



Note: The chart shows the additional yield on Danish mortgage bonds compared to government bonds for one- and five-year bonds behind adjustable rate loans and long-term callable bonds, respectively. For long-term callable mortgage bonds, the yield spread is adjusted for the price of the conversion right (option-adjusted yield spread). The most recent observations are from the end of September 2024.
Source: Nykredit Markets, Nordea Analytics and own calculations.

Increased interest rate volatility in the euro area reduces liquidity in the Danish mortgage bond market

The Danish mortgage bond market has seen less liquidity during periods of increased yield spreads relative to Danish government bonds, see chart 2. Liquidity is measured here as price sensitivity, i.e. the price difference between two consecutive trades on the same day in the same bond series.[7] That means that as price differences between two trades increase, liquidity is defined as lower. When liquidity decreases, investors demand an increased liquidity premium. This lowers the price of mortgage bonds and increases the yield spread relative to Danish government bonds.

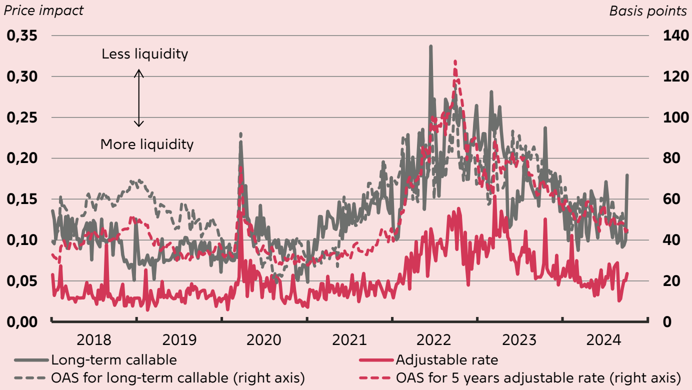
During periods of less liquidity on the Danish mortgage bond market, interest rate volatility in the euro area was significantly higher, for example in March-

[6] For a brief discussion of the impact of changes in banking regulation on market-makers in Danish mortgage bonds, see Belling and Madsen (2023), Will the end of the ECB's asset purchase programmes impact the Danish mortgage bond market?, *Danmarks Nationalbank Economic Memo,* no. 6, June 2023 (*link*).
[7] In this analysis, price sensitivity is found by looking at the changes in the prices of individual trades within the day. Price sensitivity is calculated by finding the percentage price difference between the two most recent trades. Price sensitivity can be interpreted as how much the price needs to change from the last trade for the buyer and seller to enter into a trade. If the change is low, it indicates good liquidity, as the bond can be bought or sold without significant price impact. For further description, see Halsnæs, Hensch and Loncar (2020), Danish mortgage bond liquidity briefly impacted by covid-19, *Danmarks Nationalbank Analysis*, no. 22, November 2020 (*link*).

December 2022, see chart 3.[8] In March 2020, there were signs that liquidity was more sensitive to changes in interest rate volatility than in the period of sharp interest rate rises in 2022. However, the high interest rate volatility in March 2020 was for a short period, see chart 1. This indicates that since 2018, the changes in the liquidity in the Danish mortgage bond market to a great extent reflects the increased interest rate volatility. This shall be seen in context with the fact that investors, including market-makers, want to be compensated for interest rate volatility. Market-makers (see box 1) will widen the bid-ask spread[9] to compensate for the extra risk of price drops during the period between purchase and sale. Price expansions on the US government bond market have also been observed during periods of increased interest rate volatility.[10]

CHART 2

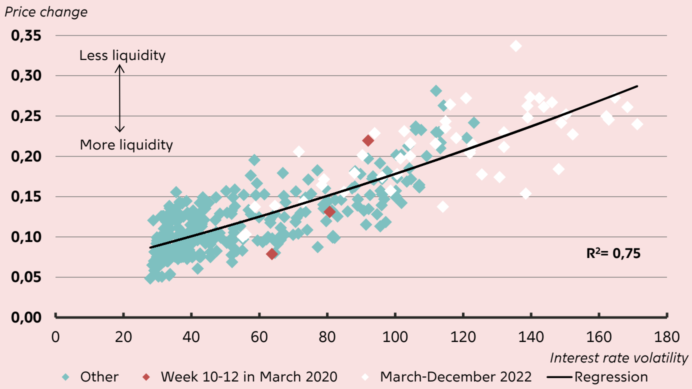
Liquidity and yield spreads have followed each other closely



Note: The chart shows price sensitivity measures defined by absolute relative price change between two trades within the same day (left axis) and yield spreads relative to government bonds (right axis). For long-term callable bonds, the spread is adjusted for the borrower's conversion right. The most recent observations are from the end of September 2024.
Source: MiFIR data, Nykredit Markets, Nordea Analytics, Danmarks Nationalbank and own calculations.

CHART 3

Periods of reduced liquidity in mortgage bonds are largely explained by increased interest rate volatility in the euro area



Note: The chart shows a scatter plot of implied euro area interest rate volatility derived from 10-year euro interest rate swaptions (x-axis) against the price sensitivity of long-term callable mortgage bonds (y-axis). "Other" is data for the period between January 2018 and September 2024.
Source: MiFIR data, Refinitiv Eikon, Danmarks Nationalbank and own calculations.

[8] This can be seen by using transaction data reported to the Danish Financial Supervisory Authority. This data is reported via the Markets in Financial Instruments Regulation (hereinafter referred to as MiFIR data).
[9] Bid-ask spreads cannot be observed from the trades in MiFIR data. But several studies point to a strong correlation between bid-ask spread and price sensitivity. See e.g. Fleming (2003), Measuring Treasury Market Liquidity, *Economic Policy Review*, Vol. 9 no. 3, September 2003 (*link*).
[10] See Duffie et al. (2023), Dealer Capacity and U.S. Treasury Market Functionality, *Federal Reserve Bank of New York, Staff reports no. 1070*, August 2023 (*link*).

BOX 1

Primary dealers and market-makers

Mortgage credit institutions have entered into agreements with certain primary dealers, requiring them to bid on the institution's bonds, for a fee, when the mortgage credit institution issue them on the primary market. This is to ensure that there are always buyers in the market. Seven banks and one investment fund have entered into primary dealer agreements[1] with one or more mortgage credit institutions to buy their mortgage bonds on the primary market. The primary dealers then sell the mortgage bonds on to investors on the secondary market.

When borrowers want to restructure or redeem their loans, they contact their bank or mortgage credit institution. Either the market-maker buys the mortgage bonds on the secondary market in the series behind the loan and sells them to the mortgage credit institution, or the mortgage credit institution places a buy order with its primary dealers, who then buy the bonds on the secondary market and sell them to the institution. Once the mortgage credit institution has purchased the bonds, they can be cancelled.

On the secondary market, financial institutions involved in market-making regularly provide bid and ask prices for given volumes of mortgage bonds. These prices are available for other investors to trade on. This ensures that there is always a buyer or seller when investors want to trade. This can help even out any buying or selling pressure in the market. Market-makers will generally buy bonds on the secondary market in the expectation of selling them later at a higher price and thus profit from the difference between the bid and ask spread. Market-makers can also act as a broker, where they find a buyer or seller before making the trades. This means that the market-maker only owns the bonds for a very short period of time.

In the analysis, market-makers will generally be net sellers of mortgage bonds on the secondary market, as they are also primary dealers, as they sell the bonds they have bought on the primary market. However, there are times when market-makers are net buyers in the secondary market. This is typically during periods of high volatility where they absorb selling pressure on the market and hold the bonds for a shorter or longer period until they can sell them again.

[1] The primary dealers are: Danske Bank, Jyske Bank, Nordea Bank, Nykredit Bank, SEB, Spar Nord Bank, Sydbank and Fondsmæglerselskabet Marselis. In this analysis, primary dealers are referred to as banks with 'market making'. Fondsmæglerselskabet Marselis became a primary dealer in 2023.

BOX 2

Banks with market-maker activities own mortgage bonds for liquidity and market making

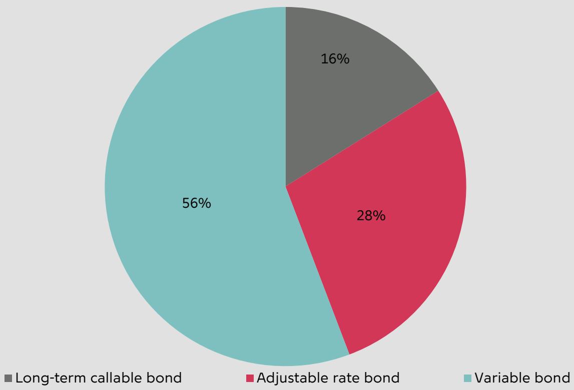
Banks with market-maker activities primarily own mortgage bonds for two purposes:

1. source of liquidity, which is part of normal banking operations, and
2. market making.

As a source of liquidity the assets are held by banks to fulfil liquidity requirements and to provide liquidity during periods of stress. The majority of the bonds are held for liquidity purposes, mainly with short maturities. Banks therefore primarily own variable rate bonds and adjustable rate bonds, see the chart on the right. When banks buy mortgage bonds for liquidity purposes, they are typically held for longer periods of time and bonds hold as a source of liquidity therefore gives rise to relatively limited bond trading.

Banks are market-makers in bonds with both short and long maturities. It is not possible to determine how much of their bonds are owned due to market making. However, most long-term callable bonds are presumed to be held for market making purposes, as bonds with long maturities have relatively high interest rate sensitivity, making them less attractive as an instrument in banks' liquidity management. Long-term callable bonds are also subject to a higher capital requirement. When buying bonds for market making, the aim is to sell them again and profit from the difference between the bid and ask spread. A large part of bank trading activity in the mortgage bond market is due to their market making. However, there are big differences between banks in terms of how much market-maker activity they have.

Holdings of mortgage bonds by banks with market-maker activities



Note: The chart shows the holdings of mortgage bonds broken down by bond type for banks with market-maker activities. Data is for end-2023.
Source: Danmarks Nationalbank's securities statistics.

02
Market-makers are the key market participants in the mortgage bond market

Banks with market-maker activities in Danish mortgage bonds (hereafter 'market-makers'[11]) play an important role in the Danish mortgage bond market, acting as intermediaries between the various market participants. A large part of the trading activity in the mortgage bond market is thus linked to the banks functions as market-makers, see box 1 and box 2. The following is a closer look at the role of market-makers on the Danish mortgage bond market.

Market-makers are the intermediaries between the market participants in the mortgage bond market

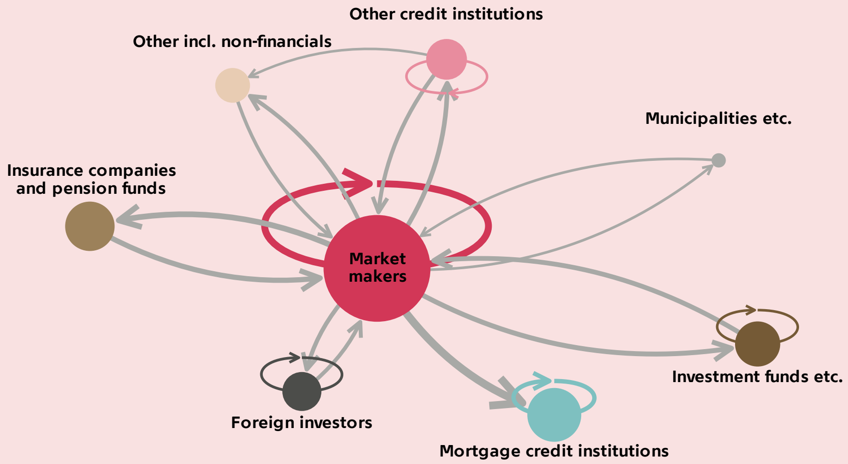
In the secondary mortgage bond market, bonds are regularly bought and sold by various market participants until they are either repurchased by the mortgage credit institution in connection with the borrower restructuring or redemptions, or until the bond expires. Market-makers are the key market participants in the network that makes up the secondary mortgage bond market, see chart 4. In 2023, approximately kr. 4,000 billion was traded on the secondary market, with market-makers involved in nearly 90 per cent of the trades, either as buyers or sellers. In addition to the market-makers, mortgage credit institutions bought the most, which is because they repurchase the bonds in connection with borrower restructurings and redemptions. The two sectors that market-makers otherwise sold the most to were Danish insurance companies and pension funds and Danish investment funds (including Danish hedge funds). They accounted for approximately 10 per cent and 9 per cent of total market purchases in 2023, see table 1 in the Appendix.

In addition to acting as intermediaries between the market participants on the Danish mortgage bond market, market-makers have increased their holdings of mortgage bonds during periods when there has been an increase of selling interest in the market.[12] A larger holding can either occur by not reselling all the bonds bought on the primary market[13] or by buying more on the secondary market than they sell. The central role the market-makers have on the Danish mortgage bond market can lead to that if one or more of them fail to act as a intermediaries between investors, it may change market access for some investors. This can put increased pressure on other market-makers during periods of turmoil. In such a situation, the market and thus the mortgage credit institutions, market-makers and investors will have to adapt to the new conditions and there may be increased fluctuations in bond prices. This could potentially have a negative impact on the market liquidity.

[11] In this analysis, primary dealers are referred to as banks with 'market-making'. Fondsmæglerselskabet Marselis became a primary dealer in 2023 and is included in this analysis in the 'investment funds' sector up to and including 2022 and from 2023 as a market-maker. In the rest of the analysis, banks with market-maker activity are referred to only as 'market-makers', even though they have trades other than market-making. Separating market-maker trades from the other trades made by the banks is not possible in the data.
[12] See Halsnæs, Hensch and Loncar (2020), Danish mortgage bond liquidity briefly impacted by covid-19, *Danmarks Nationalbank Analysis*, No. 22, November 2020 (link).
[13] For an analysis of the primary marked, see Eistrup and Bentsen (2023), Mortgage credit institutions must ensure that they can always sell their bonds, *Danmarks Nationalbank Analysis*, no. 18, November 2023 (link).

CHART 4

Almost 90 per cent of trades in 2023 went through market-makers



Note: The chart shows trades across all types of bonds with a total of at least kr. 5 billion traded between or within the sectors shown in 2023. The thicker a line is, the more trading activity it indicates. A circle next to a sector indicates trades between companies in the same sector. The following are not included in the chart: 1) Primary market trades, i.e. sales from mortgage credit institutions to banks that have primary dealer agreements. 2) Trades where the retail sector or Danmarks Nationalbank is the counterparty. See table 1 in the Appendix for an overview of the trades in 2023.
Source: MiFIR data and own calculations.

Market-makers absorb less selling pressure in long-term callable bonds during turmoil

Market-makers resell a large proportion of the bonds on the same day they are bought, see chart 7. How much where is sold on the day of purchase and the days after depends on whether it is a long-term callable bond, adjustable rate bond or variable rate bond. This reflects that the three types of bonds have different characteristics (see box 3), including supply and demand for the different bonds.

Market-makers resell between 30 and 40 per cent of the adjustable rate bonds and variable rate bonds on the day of purchase, see chart 5. A large proportion of these sales reflect market-makers reselling the bonds on the same day as the refinancing auction has taken place. After the purchase date, the bonds are continuously sold, so that after 10 trading days, almost 60 per cent have been sold.

For long-term callable bonds, market-makers resell around 30 per cent of the bonds on the day of purchase. In the following days, significant sales are made, with around 70 per cent sold out after 10 trading days. In 2022 and 2023, when interest rate volatility was high, market-makers sold long-term callable bonds faster than usual, see chart 6.[14] This should be seen in light of the fact that the price of long-term callable bonds is more sensitive to changes in interest rates than other bond types where the interest rate is fixed for a shorter period of

[14] During periods of low interest rate volatility, it takes approximately 0-12 days for market-makers to resell the bonds, while during periods of higher interest rate volatility it takes between 2-6 days, see chart 6.

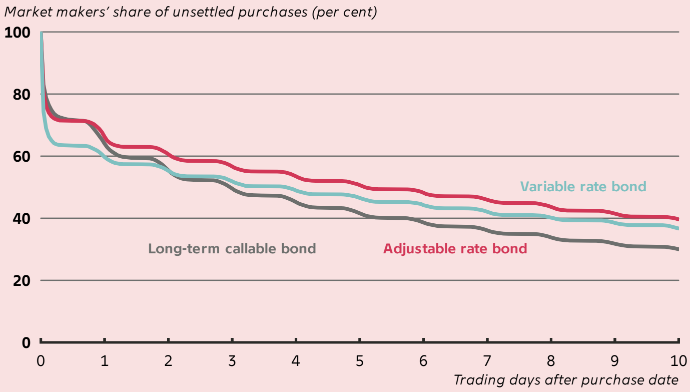
time, see chart 2 and chart 3. Similarly, market-makers do not change their behaviour in terms of how quickly adjustable rate and variable rate bonds are resold during periods of high interest rate volatility.[15]

During periods of high interest rate volatility and price fluctuations, market-makers hold the long-term callable bonds for a shorter period, see chart 6. This indicates that market-makers are moving more over to broker behaviour, i.e. the market-maker finds a buyer or seller before entering a trade. This means that the market-maker only owns the bond for a short period of time and thus minimises its risk of a possible price loss.

As brokers, market-makers continue to act as a intermediaries between investors, but in that case they are not absorbed a possible buying and selling pressure to the same extent as before. This can cause greater price fluctuations in order to ensure an equilibrium between buying and selling.

CHART 5

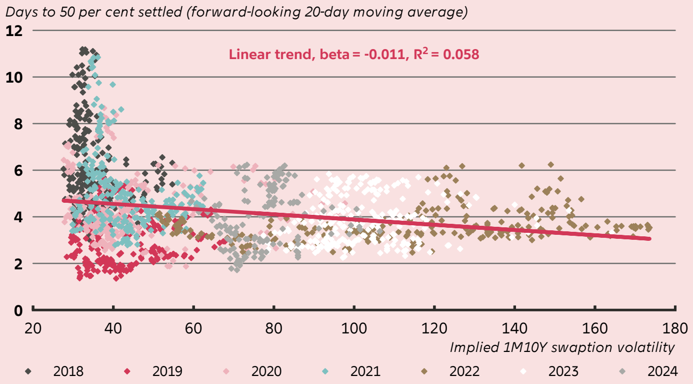
Market-makers resell the most long-term callable bonds



Note: For each trading day after purchase, the chart shows the percentage of purchases that have not been sold on. For each purchase transaction, the length of time the market-makers hold the bond is calculated using a last-in, first-out principle, meaning that the last purchase is the first one sold. When a purchase is fully settled, we record the time it took from purchase to last sale. To exclude positions that are part of a long-term portfolio, we condition purchases to be settled within 60 trading days. All averages are weighted by the nominal value of the purchase. Data is from January 2018 to August 2024.
Source: MiFIR data and own calculations.

CHART 6

Market-makers resell long-term callable bonds faster during periods of high interest rate volatility

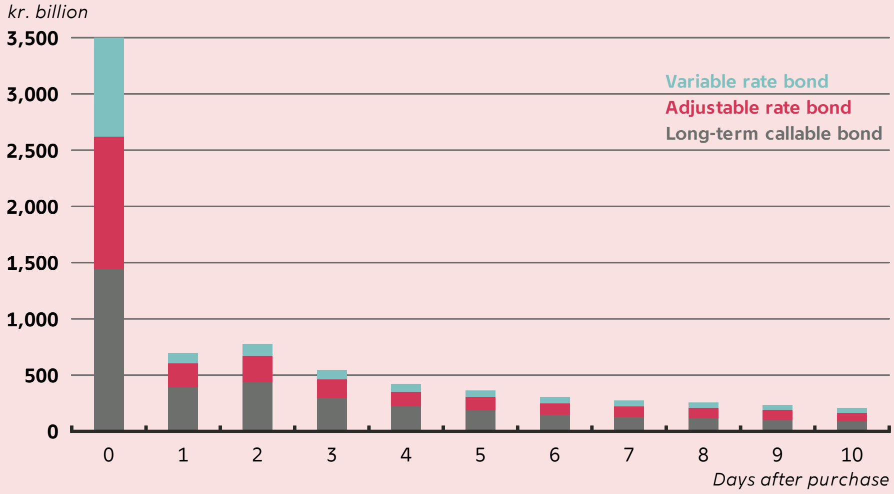


Note: The chart shows a scatter plot between implied euro area interest rate volatility derived from interest rate swaptions (x-axis) and the time it takes from when market-makers buy until 50 per cent of the purchase is sold (y-axis). Each point represents a time of purchase. Data is from January 2018 to August 2024. The method is the same as chart 5.
Source: MiFIR data and own calculations.

[15] See appendices for charts showing market-makers' resell of adjustable rate and variable rate bonds during periods of high interest rate volatility, see appendices chart 14 and chart 15.

CHART 7

Market-makers resell large volumes of purchases on the same day the purchase is made



Note: Distribution of bond holdings by how many trading days the market-makers own the bond. Data is from January 2018 to September 2024.
Source: MiFIR data and own calculations.

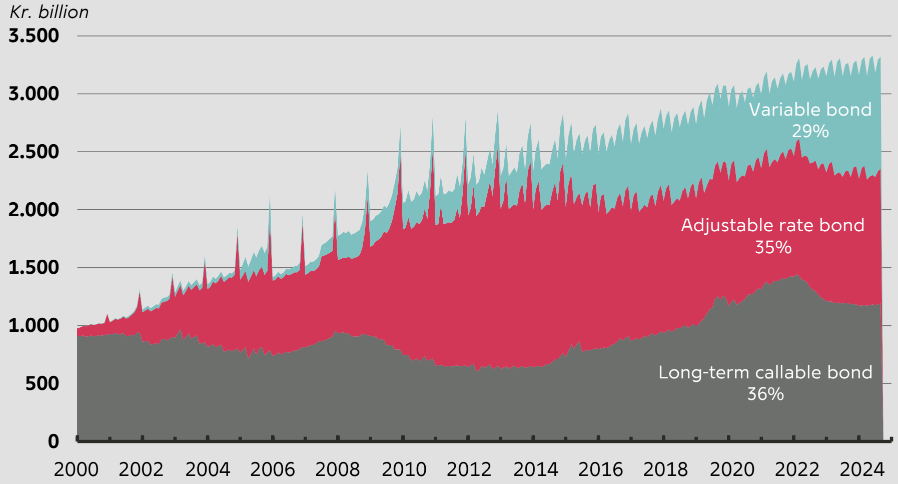
BOX 3

Bond types in the Danish mortgage bond market

Danish mortgage bonds with a total nominal value of almost kr. 3,500 billion have been issued, see the chart below. The outstanding amount is primarily divided into three types of bonds, namely long-term callable bonds, bonds backed by adjustable rate loans and variable rate bonds.[1] The bonds have different characteristics and therefore attract different types of investors, see the charts below.

Long-term callable mortgage bonds have been issued in Denmark for over 200 years. Adjustable rate bonds were introduced in 1996 and became particularly popular in the years leading up to the financial crisis, while the share of variable rate bonds increased sharply after the financial crisis, see the chart below.

The outstanding amount of mortgage bonds has increased significantly



Note: The chart shows the outstanding nominal value of bonds broken down by bond type. Latest observation is from the end of September 2024. Spikes in the period 2001-2015 are due to refinancing auctions.
Source: Danmarks Nationalbank's securities statistics.

Long-term callable bonds are issued with different maturities from 10 to 33 years, but the majority, around 85 per cent of the outstanding amount, have a maturity of 30-33 years at issuance. The bonds are issued with a fixed interest rate and an option that allows the borrower to redeem the loan at price 100. When interest rates fall, the borrower has the option to redeem their loan at price 100 and take out a new loan to get a lower interest rate. If the option is exercised, the bond investors will be repaid at price 100. The likelihood of the option being exercised increases with falling interest rates. As long-term callable bonds have a long maturity, they are typically well suited for investors with long-term commitments. Danish insurance companies and pension funds have long-term commitments with payouts to customers and are also the largest investors in long-term callable Danish mortgage bonds. The foreign investor group consists many different types of investors, who mutually own a large share of Danish long-term callable bonds.

Adjustable rate bonds have a maturity of between 1 and 10 years, typically 3 or 5 years, while the borrower has a longer loan, such as a 30-year loan. An adjustable rate bond has a fixed interest rate throughout the maturity of the bond. Insurance companies and pension funds are the largest investors in adjustable rate bonds, which may be because these bonds are well suited to handle their liabilities of up to 10 years, as adjustable rate bonds have a fixed interest rate throughout the maturity of the bond. In addition, these bonds are also well suited for liquidity management due to their shorter maturity.

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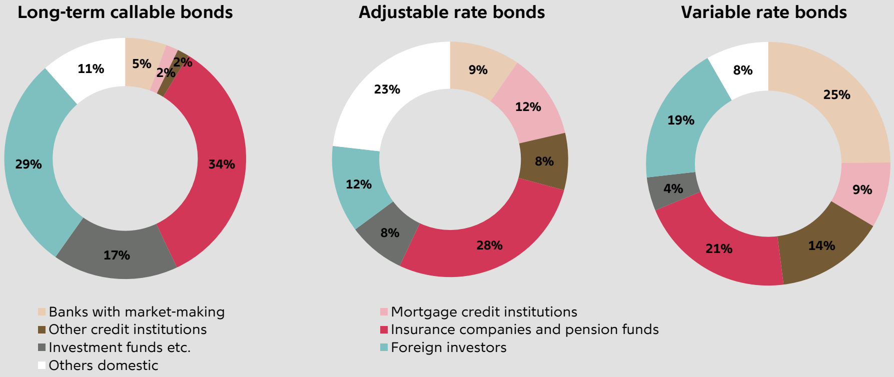
Variable rate bonds typically have a maturity of between 1 and 10 years. Variable rate bonds typically have an interest rate that adjusts every three or six months, while the borrower has a longer loan, such as a 30-year loan. The interest rate is set based on a reference rate typically linked to the money market, such as CIBOR or CITA, plus an interest surcharge. The interest surcharge is fixed throughout the maturity of the bond and is set when the bond is first sold on the primary mortgage bond market. Banks are the largest investors of these bonds, especially those bonds with a relatively short maturity, i.e. less than 5 years, as they are well suited to liquidity management.

Ownership breakdown of:



Note: Data is from end of December 2023.
Source: Danmarks Nationalbank's securities statistics.

[1] Index bonds and capped bonds have also been issued. By the end of September 2024, these bonds accounted for approximately 3 per cent of the total outstanding nominal amount of mortgage bonds.

03

The largest investors behaviour can affect the mortgage bond market

The largest investors behaviour in the Danish mortgage bond market affects prices, especially during periods of high volatility and lower market liquidity. Large divestments from major market participants can thus contribute to a less stable market. If market liquidity in the Danish mortgage bond market deteriorates significantly, it may affect the function of bonds as a high quality liquid assets.

However, there are factors that minimise this risk. Poorer market liquidity will especially affect the largest investors due to their ownership of many mortgage bonds. A large sale from one or more investors can thus have a derived negative effect on the investor's remaining bonds. Investors thus have an incentive to limit their sales to avoid significant negative market impacts. Large investors are also diverse and therefore do not always react in the same way to market conditions. This increases the likelihood of there being investors to buy up all or part of a large divestment. Nevertheless, there is a risk that in times of stress, investors may react similarly, creating more pressure to sell.

Trades in the mortgage bond market is concentrated among a limited number of market participants

The Danish mortgage bond market consists of several different bond types, see box 3. The largest owners of Danish mortgage bonds are Danish insurance companies and pension funds and foreign investors, see chart 8 and box 3. By the end of September 2024, they owned approximately 29 and 20 per cent of the total outstanding nominal amount of mortgage bonds, respectively. The 'foreign investors' category is made up of many different types of investors. Overall, they own a larger share of long-term callable bonds compared to short-term bonds. This is probably because the 'foreign investors' category is largely made up of investors with a long-time horizon, such as foreign pension funds and long-term foreign investment funds and hedge funds.

The volume of trades is concentrated among a limited number of market participants although there are a large number of traders, including householdings. Almost 77 per cent of the purchase volume was distributed across 30 different market participants in six different sectors in 2023, chart 9.[16]

Most of the buying activity in the secondary mortgage bond market comes from the market-makers, due to their role as intermediaries in the market, see section 02. Mortgage credit institutions are the second-largest buyer group, reflecting their repurchases in connection with borrower restructurings and redemptions. Other credit institutions own particularly mortgage bonds as a source of liquidity. The other three major buyer sectors are Danish insurance companies and pension funds, Danish investment funds (including Danish hedge funds) and foreign investors (hereafter 'the three largest investor sectors'). The three largest investor sectors generally buy the bonds in order to hold them for a long period

[16] In total, around 1,600 different Legal Entity Identifier (LEI) codes in MiFIR data are registered with at least one trade over kr. 5 million in 2023.

of time. There are 13 large investors, and in 2023 they bought a total of 13 per cent of the market (see chart 9), i.e. more than half of what all market participants in the three largest investor sectors bought in total, see chart 4 and table 1 in the Appendix. The Danish mortgage bond market is thus concentrated among a few large market participants, which can make the market vulnerable to sales pressure from those market participants, see chart 9. The largest investors behaviour in the market has an impact on prices due to their large volume of buying and selling, especially during periods of high volatility, which should be included in investors' risk management.

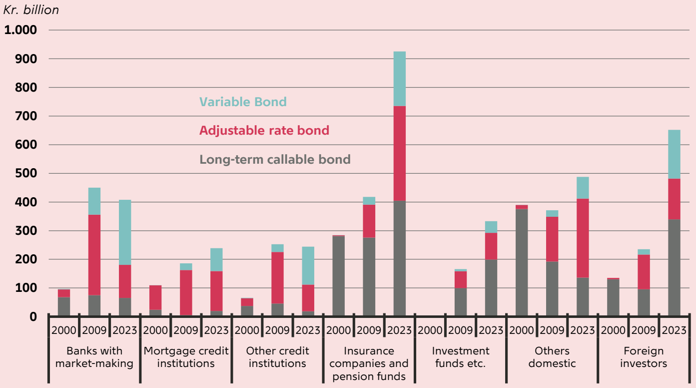
A diverse investor base contributes to balance in the mortgage bond market

Investors in Danish mortgage bonds have different investment objectives and risk mandates. A heterogeneous investor base helps to even out demand and thus stabilise the market, which increases the robustness of the Danish mortgage bond market, see chart 8 and box 4.

During the market turmoil in 2020 and 2022, the investor composition in the Danish mortgage bond market meant that some market participants were willing to buy, while others wanted to sell, see below in chart 10 - chart 13. Especially during periods of turmoil in the mortgage bond market, situations can arise where more investors want to sell bonds than there are buyers to absorb the selling pressure at the given prices. If there is strong selling pressure, it may require price drops to redress the equilibrium between buyers and sellers, which could challenge liquidity in the Danish mortgage bond market during the adjustment. This should be a part of the investors' risk management, especially in times of stress.

CHART 8

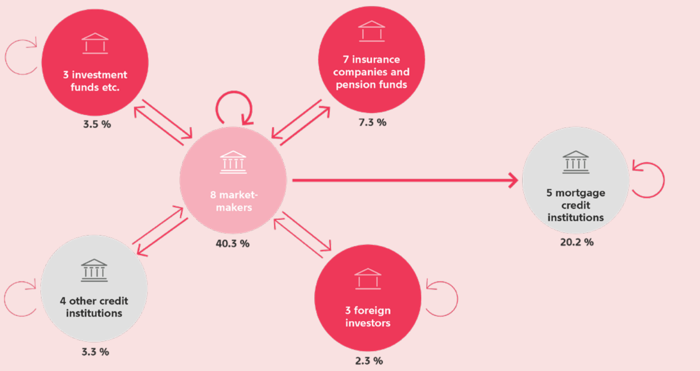
The largest investors of mortgage bonds are Danish insurance companies and pension funds and foreign investors



Note: The chart shows the holdings of Danish mortgage bonds in nominal value by investor group at the end of 2000, 2009 and 2023. However, for mortgage credit institutions in 2009, the data is for the end of January 2010 due to refinancing. Other credit institutions consist of Danmarks Skibskredit, KommuneKredit and banks that have not entered into primary dealer agreements. In 2000, the investment funds owned mortgage bonds totalling kr. 1 billion, which is too little to be visible in the chart.
Source: Danmarks Nationalbank's securities statistics.

CHART 9

The mortgage bond market is concentrated among a limited number of market participants



Note: The chart shows the market participants that accounted for more than 0.5 per cent of purchases in the secondary mortgage bond market in 2023. The percentages indicate the share that these market participants, calculated per sector, bought in total in 2023. The thicker a line is, the more trading activity it indicates. A circle next to a sector indicates trades between companies in the same sector.
Source: MiFIR data and own calculations.

BOX 3

Grouping of insurance companies and pension funds

Danish insurance companies and pension funds are a relatively heterogeneous group of companies, largely due to differences in business models and product types offered to their customers. Some companies need to carefully manage their duration, i.e. their interest rate risk. They may therefore need to make adjustments to their portfolios during periods of increases in the duration of long-term callable bonds. This can have a direct impact on their decisions to buy and sell Danish mortgage bonds. However, it is also possible to reduce duration via interest rate swaps. We divide the companies into four groups according to their balance sheet coverage in September 2022. The companies are divided into groups with i) balance sheet hedging, ii) partial hedging, iii) no hedging and iv) other. [1]

Balance hedging: These pension funds and life insurance companies offer guaranteed average rate products to their customers, of which guaranteed benefits make up over 90 per cent of reserves. This product type implies that companies' investment strategies are often more constrained relative to the other groups, as to maintain their interest rate hedging they must continuously balance the duration of their total balance sheet, i.e. the interest rate risk between assets and liabilities.

Partial hedging: These pension funds and life insurance companies offer long-term conditionally guaranteed benefits to their customers, of which guaranteed benefits make up to around 30 to 60 per cent of the reserves, whereas the remaining 40 to 70 per cent are freely investible. This makes the investment strategy less constrained relatively to the balance sheet hedging companies, enabling more flexibility in terms of achieving a return target in the medium to long term.

No hedging: These pension funds and life insurance companies include those that primarily offer market rate products to their customers and thus do not need to hedge the duration.

Other: The remainder of insurance companies and pension funds are categorised as 'Other' and include non-life insurance companies.

[1] The grouping in this analysis are taken from box 1 in Achord et al., Domestic bond portfolio adjustments during duration jumps, *Danmarks Nationalbank Economic memo*, no. 10, December 2021 (*link*).

The investors behaviour during covid-19 in March 2020

The Danish mortgage bond market was affected by the turmoil in March 2020 in the form of credit spread widening and volatility, see section 01. The different investor groups in Danish mortgage bonds meant that while some investors sold, others were interested in buying. This helped stabilise the market.

The net buyers of adjustable rate bonds in weeks 10-12 were insurance companies and pension funds that fully or partially hedge their long-term liabilities (balance sheet hedging and partial hedging), as well as the group under 'Other', see chart 11.

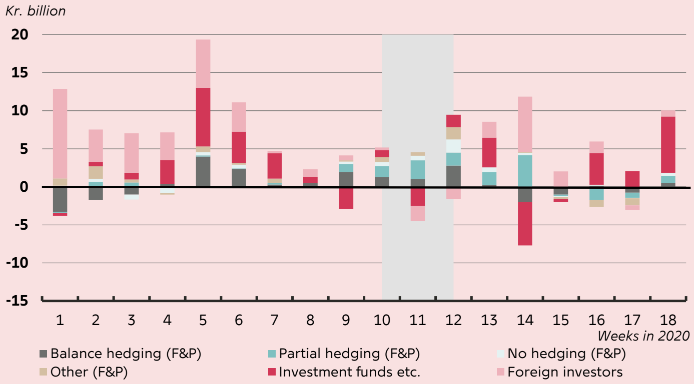
On the other hand, investment funds and insurance companies and pension funds without hedging net sold adjustable rate bonds in weeks 10-12, see chart 11. Their net sales of adjustable rate bonds were significantly higher than the amount of long-term callable bonds they net purchased during the same period, see chart 10. This reduced their total holdings of Danish mortgage bonds. There can be various reasons for this. Like banks, the insurance companies and pension funds without hedging use adjustable rate and variable rate bonds to a certain extent for liquidity risk management. The high uncertainty in March 2020 led to demand for liquidity to withstand stress (dash-for-cash)[17]. Some of these companies decided to sell adjustable rate bonds to raise liquidity rather than raising liquidity through repo transactions, which increased the selling pressure. Some investment funds also have a mandate or investment framework regarding the allocation of the portfolio between equities and bonds (e.g. 60 per cent equities and 40 per cent bonds). Equity prices fell sharply in March 2020, forcing

[17] Dash-for-cash refers to the sale of assets to provide liquidity that can be placed in an account and withdrawn intraday.

some investment funds to sell bonds and buy equities to fulfil their mandates. In addition, a small proportion of investment funds may have had to sell the bonds due to high leverage.[18]

CHART 10

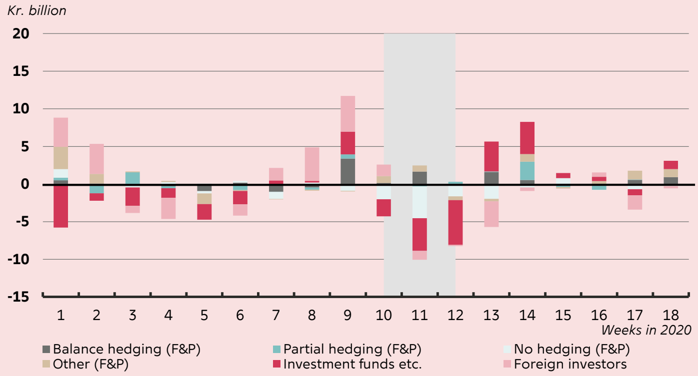
Investment funds, foreign investors, insurance companies and pension funds net purchased long-term callable bonds in March 2020...



Note: The chart shows net purchases in market value in weeks 1-18 2020 of long-term callable bonds from the three largest investor sectors, see box 4 for an overview of the groupings of insurance companies and pension funds. Week 11 saw a lockdown of Danish society due to the corona pandemic. In week 13, a number of central bank measures were introduced around the world, including Danmarks Nationalbank there introduced longer liquidity facilities and facilities in EUR and USD.
Source: MiFIR data and own calculations.

CHART 11

... while investment funds, foreign investors and insurance companies and pension funds without hedging net sold adjustable rate bonds



Note: Net purchases in market value of adjustable rate bonds, otherwise as chart 10. See box 4 for an overview of the groups.
Source: MiFIR data and own calculations.

Market-makers play a central role in the Danish mortgage bond market and are involved in most trades, see section 02. Overall, market-makers increased their holdings of mortgage bonds by kr. 1 billion in weeks 10-12. This should be seen in the context of them also being primary dealers and therefore buying new issues bonds from mortgage credit institutions on the primary market. The bonds are then resold to investors in the secondary market on an ongoing basis. In weeks 10-12, market-makers bought a total of kr. 28 billion in new issues bonds on the primary market.

Market-makers acted differently in weeks 10-12. A few market-makers, one in particular, increased their holdings of mortgage bonds, while the others decreased their holdings.

Interest rate rises in 2022

In connection with the interest rate increases in 2022, the duration (interest rate risk) of long-term callable bonds increased. As a result, some investors ended up with a higher duration in their portfolios than they wanted. To reduce duration, some investors therefore sold long-term callable bonds. This was offset to a relatively large extent by borrowers' restructuring and redemptions, as rising interest rates caused the prices of long-term callable bonds to fall. Many borrowers took advantage of this, and 2022 was the second-largest refinancing

[18] See Danish Financial Supervisory Authority (2023), Leveraged investment funds with investments in Danish mortgage bonds, August 2023 (*link*).

year ever[19], with refinancing totalling kr. 375 billion, including kr. 243 billion in long-term callable bonds. Restructuring by the borrowers meant that they pulled many of the long-term callable bonds with low interest rates out of the market. This reduced selling pressure and caused the overall duration in the mortgage bond market to decrease.

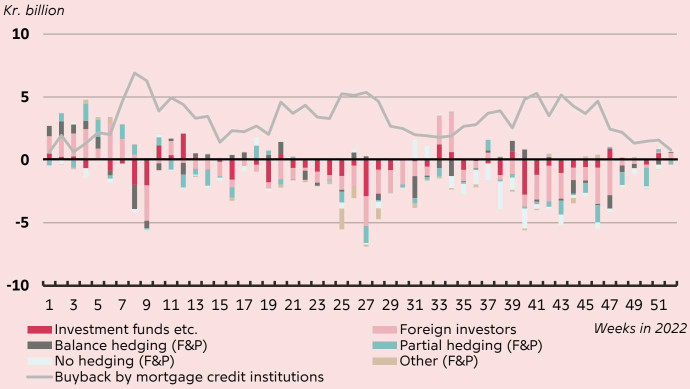
The investors behaviour during interest rate rises in 2022

As in March 2020, the heterogeneity among investors in the mortgage bond market resulted in opposing buying and selling interests in 2022, which helped stabilise the market. Investment funds and insurance companies and pension funds with partial hedging net sold adjustable rate bonds in autumn 2022, see chart 13. This was especially the case in September 2022 (weeks 35-39) when there were large changes in mortgage bond prices, see chart 1. These investors responded to interest rate volatility and market uncertainty by reducing the volume of mortgage bonds. The selling pressure from these investors was mainly offset by purchases from foreign investors and market-makers, see below.

The rising interest rates also affected insurance companies and pension funds that hedge their long-term commitments (balance sheet hedging) and therefore needed to match the interest rate risk on their assets and liabilities (rebalancing). These companies therefore to a large extent sold long-term callable bonds with a low interest rate and bought newly issued long-term callable bonds with a higher interest rate to reduce duration. Their purchases and sales of long-term callable bonds broadly cancelled out each other in 2022, with net sales totalling just under kr. 3 billion, see chart 12.[20] The behaviour of these companies supported the borrowers restructurings from long-term fixed-rate loans with low interest rates to long-term fixed-rate loans with higher interest rates, see above.

CHART 12

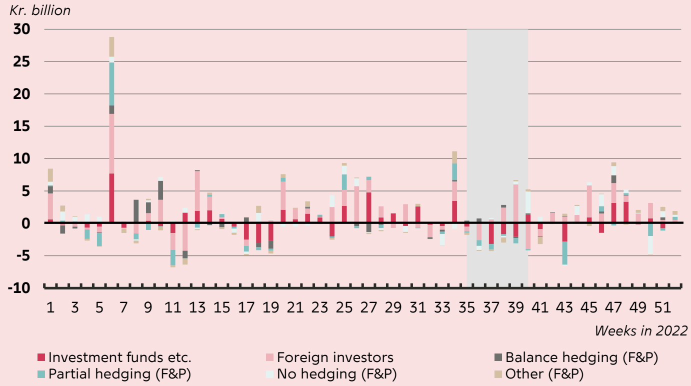
In 2022, most major investor sectors net sold long-term callable bonds...



Note: The chart shows net purchases in 2022 in market value for long-term callable bonds from the three largest investor sectors, as well as mortgage banks' repurchases of bonds in connection with restructurings and redemptions. See box 4 for an overview of the groups.
Source: MiFIR data and own calculations.

CHART 13

... while the net purchased adjustable rate bonds



Note: The chart shows net purchases in 2022 in market value for adjustable rate bonds from the three largest investor sectors. See box 4 for an overview of the groups.
Source: MiFIR data and own calculations.

[19] See Finance Denmark (2023), Boligejere omlagde lån for kr. 375 mia. i 2022 (Homeowners refinanced loans for kr. 375 billion in 2022, in Danish only), *News*, January 2023 (*link*).
[20] They sold long-term callable bonds for approximately 38 billion kroner and bought for approximately kr. 35 billion.

Market-makers increased their holdings of all types of mortgage bonds in September 2022 (weeks 35-39). Overall, they increased their holdings by kr. 23 billion. This reflects the fact that they bought new issues bonds for kr. 78 billion in the primary market and net sold for 55 billion in the secondary market. Virtually all market-makers increased their bond holdings. In particular, some market-makers bought a large share of bonds from the mortgage credit institution they are affiliated with.[21]

[21] See Eistrup and Bentsen (2023), Mortgage credit institutions must ensure that they can always sell their bonds, *Danmarks Nationalbank Analysis*, no. 18, November 2023 (*link*).

04
Appendices

TABLE 1

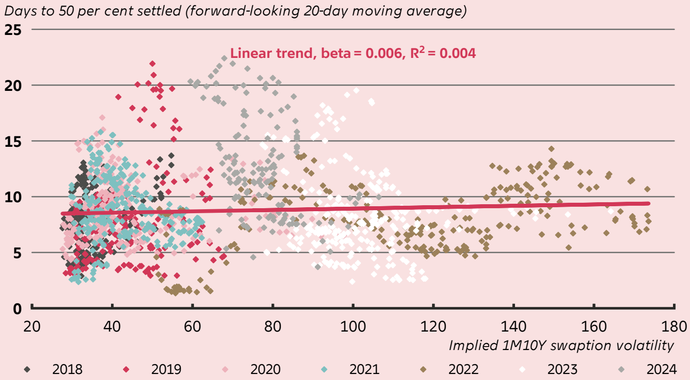
Shares of trading activity by buying and selling sector

2023		Selling Sector								
		Insurance companies and pension funds	Investment funds etc.	Market-makers	Mortgage credit institutions	Municipalities etc.	Foreign investors	Other incl. non-financial	Other credit institutions	**Total**
Buying Sector	Insurance companies and pension funds	0,1	0,2	9,4	0,0	0,0	0,2	0,0	0,0	**10,0**
	Investment funds etc.	0,1	0,6	7,5	0,0	0,0	0,3	0,1	0,1	**8,7**
	Market-makers	7,7	6,8	13,2	0,1	0,4	4,3	3,0	4,3	**39,8**
	Mortgage credit institutions	0,0	0,1	14,4	5,1	0,0	0,0	0,6	0,0	**20,3**
	Municipalities etc.	0,0	0,0	0,5	0,0	0,0	0,0	0,0	0,0	**0,6**
	Foreign investors	0,1	0,3	5,6	0,0	0,0	0,8	0,1	0,0	**7,0**
	Other incl. non-financial	0,0	0,1	5,8	0,7	0,0	0,2	0,0	0,3	**7,2**
	Other credit institutions	0,0	0,1	5,9	0,0	0,0	0,0	0,1	0,3	**6,4**
	Total	**8,1**	**8,1**	**62,4**	**5,9**	**0,5**	**5,9**	**4,0**	**5,1**	**100**

Note: The table shows shares of trading activity, by value, across all types of mortgage bonds, broken down by buying and selling sector in 2023. The retail sector and Danmarks Nationalbank are included in 'Other incl. non-financial'. Trades on the primary market, i.e. sales from mortgage credit institutions to banks that have primary dealer agreements, are not included in the table.
Source: MiFIR data and own calculations.

CHART 14

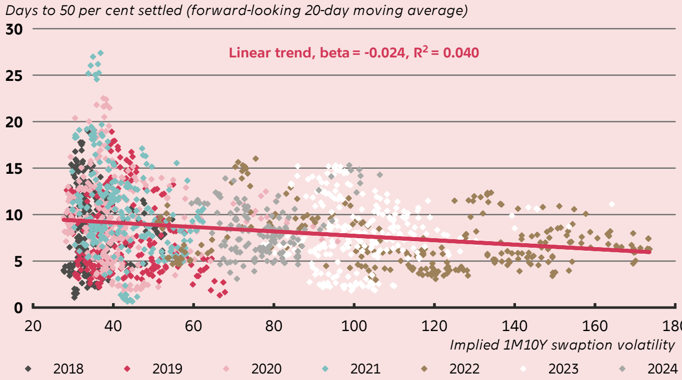
No correlation between interest rate volatility and how long market-makers hold adjustable rate bonds...



Note: The chart shows a scatter plot between implied interest rate volatility in the euro area derived from interest rate swaptions (x-axis) and the number of trading days, including hours, from when the market-maker buys the bond until 50 per cent of the purchase is sold (y-axis). Data is from January 2018 to August 2024. For each purchase transaction, the length of time the market-makers hold the bond is calculated using a last-in, first-out principle, meaning that the last purchase is the first one sold. When a purchase is fully settled, we record the time it took from purchase to last sale. To exclude positions that are part of a long-term portfolio, we condition purchases to be settled within 60 trading days. All averages are weighted by the nominal value of the purchase.
Source: MiFIR data and own calculations.

CHART 15

...and weak correlation for variable rate bonds



Note: The chart shows a scatter plot between implied interest rate volatility in the euro area derived from interest rate swaptions (x-axis) and the time it takes from when the market-maker buys the bond until 50 per cent of the purchase is sold (y-axis). Data is from January 2018 to August 2024. The method is as in chart 14.
Source: MiFIR data and own calculations.

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