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New inflation-linked bond helps to ensure a broad investor base



New inflation-linked bond

In 2022, the central government opens a new inflation-linked bond maturing in 2034.

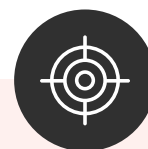
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Broad investor base

Central government inflation-linked bonds help to ensure a broad investor base and low financing costs.

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Kr. 40-60 billion

The future target for the outstanding volume of central government inflation-linked bonds will be kr. 40-60 billion.

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In the 2nd half of 2022, the central government opens a new inflation-linked bond maturing in 2034, see 'Central government borrowing strategy 2022' ([link](#)).

Inflation-linked bonds issued by the central government enable investors to invest in a safe asset whose return tracks Danish consumer prices. Inflation-linked bonds are described in detail in box 1.

Investors tend to see assets whose nominal return is closely linked to price changes as a separate asset class. Therefore, inflation-linked bonds attract a different group of investors than nominal bonds. This means that inflation-linked bonds help to broaden and stabilise the investor base for central government issuances. A broad investor base is key to ensuring access to financing in all situations and to maintaining low long-term government borrowing costs. So, the main reason why the central government continues to issue inflation-linked bonds is to ensure a broad and stable investor base.

For the central government, inflation-linked bonds provide a good supplement as, in addition to broadening the investor base, they diversify the risk of the central government debt portfolio.¹

The central government introduced its first inflation-linked bond in 2012, maturing in 2023 (DGBi 2023). In 2018, the central government opened another inflation-linked bond, maturing in 2030 (DGBi 2030). Danish inflation-linked bonds are indexed to the Danish consumer price index. The total inflation-adjusted outstanding volume of the two bonds is about kr. 48 billion, equivalent to just under 8 per cent of the total outstanding volume of domestic bonds.

The background for the central government's continued issuance of inflation-linked bonds is described in detail below.

Continued demand for Danish inflation-linked government bonds

Broad investor base for central government inflation-linked bonds

For many years, Danish inflation-linked bonds have been held by a broad group of investors. But the ownership distribution for the inflation-linked bond maturing in 2023 has changed from being partly dominated by foreign investors to being dominated by the Danish insurance and pension sector (I&P), see chart 1 (left). Throughout the period, the inflation-linked bond maturing in 2030 has been held mainly by investment funds and I&P, see chart 1 (right).

Like central government nominal bonds, inflation-linked bonds are included in international indices of inflation-linked bonds, also helping to ensure the foreign investor base.²

The outstanding volume of the inflation-linked bond maturing in 2023, DGBi 2023, remains relatively high compared with the inflation-linked bond maturing in 2030, DGBi 2030. The difference in the time to maturity of the two inflation-linked bonds has made it difficult to shift investor interest from DGBi 2023 to the existing on-the-run issue, DGBi 2030.

Keener competition from European issuers

Since the opening of the first inflation-linked bond in 2012, the outstanding volume of inflation-linked bonds has been surging across the euro area. Euro area government debt management agencies with inflation-linked bond programmes include Italy, France, Belgium, Spain and Germany. In this context, Germany has the most comparable combination of credit ratings and inflation developments.

The outstanding volume of inflation-linked bonds issued by the German central government has doubled since the opening of the DGBi 2023 in 2012, see chart 2. Most European inflation-linked bonds are issued with reference to the European Harmonised Index of Consumer Prices, HICP (excluding tobacco). As a result, investors may achieve exposure to the same price index, but for different central govern-

¹ See Danmarks Nationalbank, chapter 10 in *Danish Government Borrowing and Debt 2012*, 2012.

² For instance, Bloomberg Global Inflation-Linked Index (Series-L).

What is an inflation-linked bond?

Box 1

Inflation-linked bonds are bonds whose principal is linked to a price index so that payments are in real amounts. This allows investors to preserve their purchasing power and avoid the inflation risk of nominal bonds.

Over the life of an inflation-linked bond, its principal will vary with consumer prices. When the bond matures, the redemption amount is the indexed principal. However, inflation-linked bonds usually have a deflation floor, ensuring that investors at least receive the nominal principal back in full. Expressed in per cent, the interest on an inflation-linked bond remains fixed, but as the actual interest payable is calculated on the basis of the inflation-adjusted principal, the amount will vary over time. Coupon payments are always linked to the indexed principal, and this means that the deflation floor does not concern coupon payments.

When the central government issues inflation-linked bonds, future central government interest costs in real terms are known already at the time of issuance. But, in contrast to

central government nominal bonds, nominal payments will remain unknown until the bond matures. *Break-even inflation* is a key concept in assessing the central government's expected costs of issuing inflation-linked bonds relative to nominal bonds.

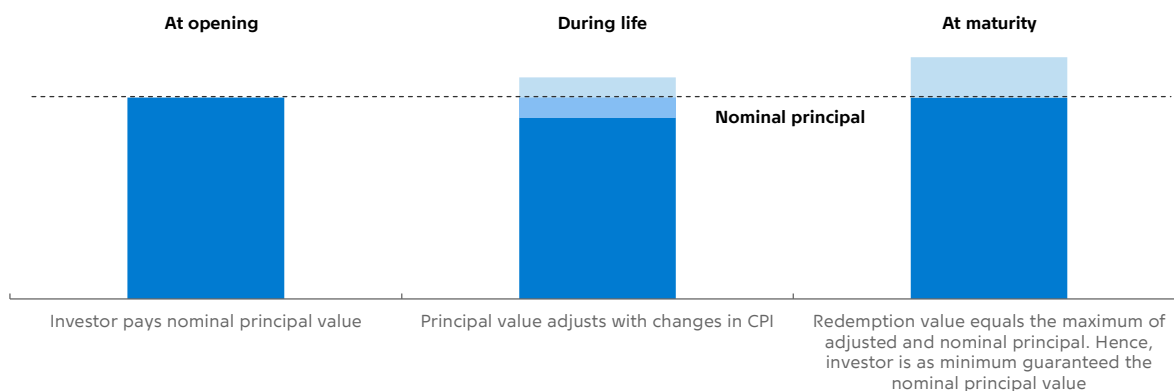
Break-even inflation is an expression of the future average realised inflation level at which the central government's costs of issuing inflation-linked and nominal bonds are the same. In practice, break-even inflation is often calculated as the yield spread between nominal and inflation-linked bonds with the same maturity:

$$\text{Break-even inflation} \approx \text{nominal yield} - \text{real yield}$$

If the realised average inflation turns out to exceed the break-even inflation rate (observed at issuance), viewed in isolation, it would have been cheaper for the central government to issue nominal bonds rather than inflation-linked bonds, and vice versa.

Principal value and coupon payments vary with the development in the price index from opening to maturity of the bond

Principal



Coupon payments

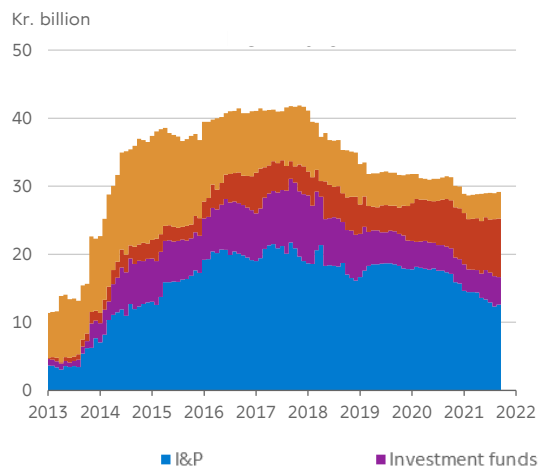


Note: The chart is an illustration. CPI is an abbreviation for consumer price index.

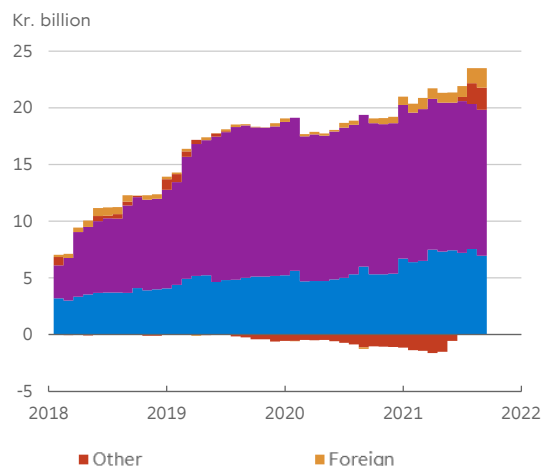
I&P and investment funds hold largest part of central government inflation-linked bonds

Chart 1

DGBi 2023



DGBi 2030



Note: Ownership distribution of the DGBi 0.1 per cent 2023 to the left and ownership distribution of the DGBi 0.1 per cent 2030 to the right. *Other* includes monetary financial institutions, public management and service, households, non-financial corporations, holding companies and other Danish investors.
 Source: Danmarks Nationalbank.

ment issuers with different credit premia, liquidity premia etc.

The Danish fixed exchange rate regime helps to ensure strong correlation between inflation in the euro area and in Denmark. With the strong correlation between price indices, investors are able to invest across the euro area, although their liabilities are linked to the national or regional price index. But hedging of investor liabilities is not optimal when price indices are not the same.

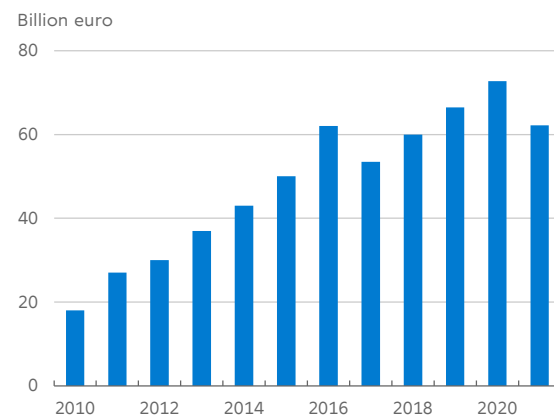
Just as foreign investors may be interested in Danish inflation-linked bonds, I&P may also hedge their liabilities by investing in inflation-linked bonds denominated in euro. But this entails increased risk as the price index does not correspond to the indexation of the sector's liabilities.

I&P's holdings of central government inflation-linked bonds denominated in euro have been constant, fluctuating around kr. 8-10 billion in recent years. So, it cannot be concluded that I&P has replaced Danish inflation-linked bonds with euro area issuances.

However, although Danish inflation-linked bonds provide inflation protection with the lowest possi-

Germany has doubled outstanding volume of inflation-linked bonds since the opening of the DGBi 2023 in 2012

Chart 2



Note: Nominal outstanding volume of inflation-linked bonds issued by the German central government, determined at the beginning of the year.
 Source: Bloomberg.

ble credit risk, the limited foreign interest in Danish inflation-linked bonds observed in recent years must be expected to continue to some extent.

Large volume of maturing inflation-linked mortgage bonds in the coming decades

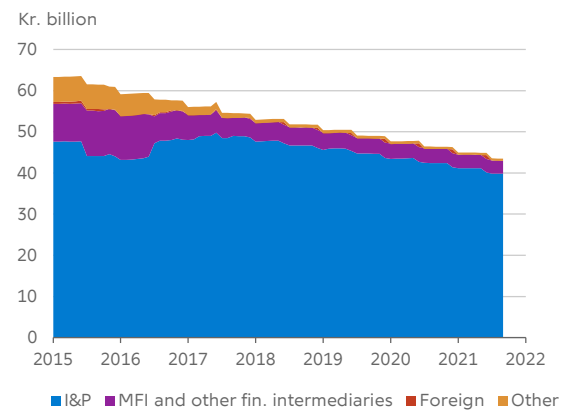
Throughout the 1980s and 1990s, mortgage credit companies issued inflation-linked bonds to finance subsidised housing (IS bonds).³ During the same period, inflation-linked agricultural loans and ship finance loans were also issued. The market benefited from the exemption from real interest tax, which led to strong pension sector demand. Moreover, maturities of the longest bonds were up to 50 years.

In 1999, mortgage credit legislation was changed. The changes provided, among other things, for financing of subsidised housing through nominal mortgage bonds and for the transition to taxation of pension savings under which inflation-linked bonds were no longer exempt from real interest tax. As a result, inflation-linked mortgage bonds were no longer issued. So since then, the market has been limited to trading in existing bonds.

The inflation-adjusted nominal outstanding volume of existing bond series amounts to about kr. 43 billion, a large portion of which is held by I&P, see chart 3. The inflation-linked bonds mature at regular intervals until 2054.⁴ If investors want to retain their holdings of krone-denominated inflation-linked bonds, there will be a continuing increase in demand for other inflation-linked bonds denominated in Danish kroner. The central government will presumably be the only issuer of krone-denominated inflation-linked bonds in future, and may accommodate a large portion of this demand.

No new issuance implies a gradual decline in outstanding volumes of inflation-linked mortgage bonds

Chart 3



Note: Inflation-adjusted nominal outstanding volume of inflation-linked mortgage bonds and municipal bonds. MFIs and other financial intermediaries are mainly monetary financial institutions and investment funds.

Source: Danmarks Nationalbank.

Danish demand is to drive interest going forward

The transition to pension schemes without nominal guarantees has, to some extent, changed the focus of investment strategies. The aim is more to preserve the purchasing power of pensions than to achieve fixed nominal returns. In addition, a number of hedging portfolios are linked to products that are regularly indexed to inflation. This means that inflation-hedged assets are in structural demand from I&P. Within inflation-hedged assets, investments are made, for instance, in properties, commodities and infrastructure, and inflation-linked bonds are also a significant element of these portfolios. In recent years, insurance and pension companies –

³ See Danmarks Nationalbank, J.V. Andersen and J. Gyntelberg, *Index-linked mortgage bonds, Danmarks Nationalbank Monetary Review, 1st quarter 1999, 1999.*

⁴ The longest outstanding inflation-linked mortgage bonds will be fully amortised by 2054. Most of these bonds were issued after the legislative change in connection with the 1990 Finance Act, when the maximum maturity for IS bonds was extended to 50 years and redemption payments were fixed at 2.4 per cent of the indexed original loan amount every six months. But as a result of inflation developments since the issuance of the bonds, the IS bonds are likely to be fully amortised well before the maximum maturity. IS bonds account for most of the outstanding volume of inflation-linked mortgage bonds.

along with investment funds – have been the primary buyers of issuances, which supports the structural demand, see chart 1.

The balance sheets of Danish insurance and pension companies have been expanding rapidly for many years and have now reached a level of 112 per cent of GDP.⁵ Growing balance sheets and focus on market rate products are likely to continue to support the demand for inflation-linked bonds denominated in Danish kroner.

I&P responses also indicate that investors are still interested in central government inflation-linked bonds. The volume of inflation-linked products varies from one company to the next, but several companies have inflation-linked liabilities, resulting in structural demand for inflation-linked bonds with reference to the Danish consumer price index. Other types of portfolios may also to some extent demand inflation-linked bonds for tactical or strategic reasons.

Inflation-linked bonds provide for lower central government financing costs

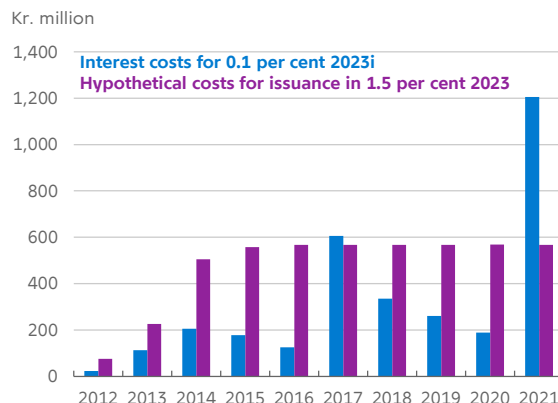
So far, inflation-linked bonds have reduced central government financing costs

After the bonds have matured, the actual costs of issuing inflation-linked bonds may be compared with the central government’s hypothetical costs of issuing nominal bonds with the same maturity. So far, the accumulated interest costs of the DGBi 2023 have been about kr. 1.5 billion lower than the hypothetical interest costs of issuing a nominal government bond with the same maturity, see chart 4. This is also verified by the break-even inflation rate, which has been higher than the average realised inflation rate for most of the period since the opening of the DGBi 2023, see chart 5.

The break-even inflation rate of the central government’s two inflation-linked bonds has been moving

Lower interest costs for issuance of inflation-linked bonds than for nominal bonds

Chart 4

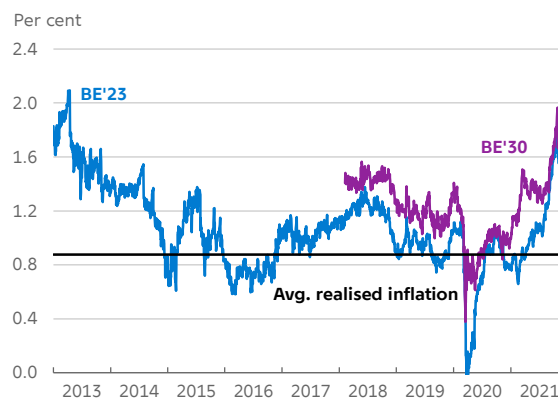


Note: Accounting interest costs. Early redemptions are not taken into account.

Source: Own calculations.

Step increase in break-even inflation since the outbreak of covid-19

Chart 5



Note: The chart shows the seasonally-adjusted break-even inflation rate (BE) for the DGBi 2023 and the DGBi 2030. Average inflation is calculated as a simple average of annual inflation rates based on monthly observations from March 2012 to October 2021.

Source: Bloomberg, Statistics Denmark and own calculations.

⁵ GDP calculated for 2020 and I&P’s total assets calculated for the 4th quarter of 2020. Sources are Statistics Denmark and Danmarks Nationalbank, respectively.

in the range between 0.5 and 1.5 per cent for a long period of time, see chart 5. But in the course of 2021, the break-even inflation rate has increased sharply, driven by rising inflation expectations and a higher inflation risk premium, among other factors.

Risk premia on inflation-linked bonds impact market-based inflation expectations

As described in box 1, break-even inflation is an expression of the future average realised inflation level at which the central government's costs of issuing inflation-linked and nominal bonds are the same. Therefore, break-even inflation is often used as a market-based measure of expected future inflation. Central government inflation-linked bonds help to provide a strong indicator of market-based inflation expectations in Denmark. But break-even inflation not only describes the expected average inflation over the time to maturity, but also investor willingness to pay an inflation risk premium and demand a liquidity premium relative to a corresponding nominal bond:

$$\begin{aligned} BEIR^6 = & \textit{expected average inflation} \\ & + \textit{inflation risk premium} \\ & - \textit{relative liquidity premium} \end{aligned}$$

Neither the inflation risk premium nor the relative liquidity premium is directly observable in the market. The inflation risk premium and the relative liquidity premium may have both a negative and a positive sign, but the relative liquidity premium will often contribute to lower break-even inflation, while the inflation risk premium will contribute to higher break-even inflation. Whether, on average, it will be advantageous for the central government to issue inflation-linked bonds depends on whether or not investors will pay more to hedge the inflation risk than the premium they demand to compensate for poorer liquidity.

Higher liquidity premium on inflation-linked bonds than on nominal bonds ...

Liquidity of existing inflation-linked bonds is assessed to be poorer than the liquidity of nom-

inal bonds. So, the central government will likely pay a higher liquidity premium on the issuance of inflation-linked bonds than on nominal benchmark securities.

The relative liquidity premium on inflation-linked bonds relative to nominal bonds may be estimated using the z-spread, see box 2. Because the swap market for inflation with reference to the Danish consumer price index is highly limited, German

Z-spreads and liquidity premium

Box 2

The z-spread is the premium (positive or negative) to be added to the discount curve to equate the present value of the bond's cash flows to its price including accrued interest – the so-called 'dirty price'. The premium (z-spread) may be interpreted as the sum of the bond's liquidity and credit risk premia.

Two bonds issued by the same issuer and with the same time to maturity may be assumed to carry the same credit risk premium. If the z-spreads of two bonds are compared with the same time to maturity, the difference is the liquidity premium. So, the difference between the z-spreads of an inflation-linked bond and a corresponding nominal bond with the same time to maturity may be interpreted as the liquidity premium on the inflation-linked bond relative to the corresponding nominal bond.

The z-spread difference may be approximated as follows:

$$Z_{nom} \approx y_{nom} - swap_{nom}$$

where Z_{nom} is the z-spread for the nominal bond, y_{nom} is the yield to maturity on the nominal bond and $swap_{nom}$ is the nominal swap rate. Similarly, the z-spread for the inflation-linked bond may be approximated as:

$$Z_{infl} \approx y_{real} - swap_{nom} + swap_{infl}$$

where Z_{infl} is the z-spread for the inflation-linked bond, y_{real} is the real yield to maturity on the inflation-linked bond and $swap_{infl}$ is the inflation swap rate. Hence, the difference in z-spread can be written as:

$$\Delta Z = Z_{infl} - Z_{nom}$$

$$\begin{aligned} \Delta Z & \approx y_{real} - swap_{nom} + swap_{infl} - y_{nom} - swap_{nom} \\ & \approx swap_{infl} - BEIR \end{aligned}$$

where break-even inflation, BEIR, is approximated as

$$BEIR = y_{nom} - y_{real}$$

It should be noted that the break-even inflation rate must be seasonally adjusted.

6 BEIR is the break-even inflation rate. Seasonal effects also impact the BEIR, but these effects are deterministic and, to some extent, predictable. So, the BEIR is adjusted for seasonal effects (for a technical review, see chapter 10 of *Danish Government Borrowing and Debt 2012*, Danmarks Nationalbank).

bonds are used as indicator.⁷ In 2021, the relative liquidity premium on German government bonds has ranged from 10 to 40 basis points, implying that the liquidity premium on the inflation-linked bond has been higher than on the nominal bond.⁸ The relative liquidity premium has been declining throughout 2021, and in November it is estimated to be about 10 basis points. So, the lower liquidity premium may also be an explanatory factor of higher break-even inflation in 2021. The relative liquidity premium is expected to be higher on Danish government bonds.

Other relevant liquidity indicators for inflation-linked bonds are the bid-ask spread and turnover. On average, the bid-ask spread for the DGBi 2030 has been about 0.4 points higher than for the 10-year nominal benchmark bond, see chart 6. Consequently, investors face higher costs when buying and selling inflation-linked bonds compared to nominal bonds.

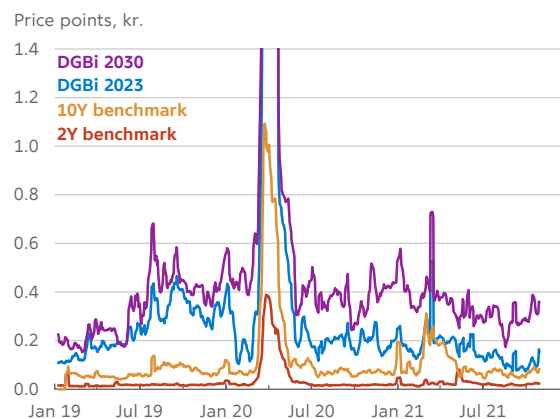
... but may be offset by a higher inflation risk premium

While a high liquidity premium reduces break-even inflation, a higher inflation risk premium increases break-even inflation. So, if the inflation risk premium is sufficiently high, it will be able to offset the higher liquidity premium on inflation-linked bonds compared with nominal bonds.

The inflation risk premium often correlates positively with inflation, and, consequently, the inflation risk premium has expectedly been low during the 2010s when inflation was relatively subdued.⁹ At the same time, fluctuations in expected inflation were also low during this period. Hördahl and Tristani report an average inflation risk premium of 35-40 basis points for French inflation-linked bonds over the period 1999-2013. Like liquidity premia, inflation risk premia may vary considerably over time.

Larger difference between bid-ask for inflation-linked bonds than for nominal bonds

Chart 6



Note: 2Y benchmark is the current 2-year nominal benchmark bond, and 10Y benchmark is the current 10-year nominal benchmark bond.

Source: MTS Denmark and Danmarks Nationalbank.

Low inflation risk may also have caused the need for hedging through inflation-linked bonds to be smaller. This may have reduced both Danish and foreign investor interest in Danish inflation-linked bonds.

Both actual inflation and inflation expectations (measured by break-even inflation) have been increasing sharply since the covid-19 outbreak, see chart 5. Also, higher inflation has caused uncertainty as to whether inflation is temporary or permanent. This uncertainty is likely to contribute to higher inflation risk and, by extension, to a higher inflation risk premium. Other things being equal, this will make it more attractive for the central government to issue inflation-linked bonds, since higher inflation risk will increase the probability that the inflation risk premium will exceed the relative liquidity premium.

⁷ Liquidity is likely to be poorer in Danish inflation-linked bonds than in German inflation-linked bonds.

⁸ The DBRi 0.5 per cent 15/04/2030 has been used as the German inflation-linked bond and compared with the DBR 0.0 per cent 15/02/2030 as the nominal bond.

⁹ See Hördahl and Tristani, *International Journal of Central Banking*, volume 10, issue 3, pp 1-47, Inflation Risk Premia in the Euro Area and the United States (2014).

The future strategy for inflation-linked bonds

More frequent opening of inflation-linked bonds

As described earlier, differences in time to maturity of the current inflation-linked bonds maturing in 2023 and 2030 have been too great to effectively shift investors from the bond maturing in 2023 to the bond maturing in 2030.

In future, differences in time to maturity of new inflation-linked bonds will be reduced, taking the central government's future financing requirements and continued focus on nominal benchmark bonds into account. With the opening of a new inflation-linked bond maturing in 2034, the target is for the time to maturity between new inflation-linked bonds to be four years.

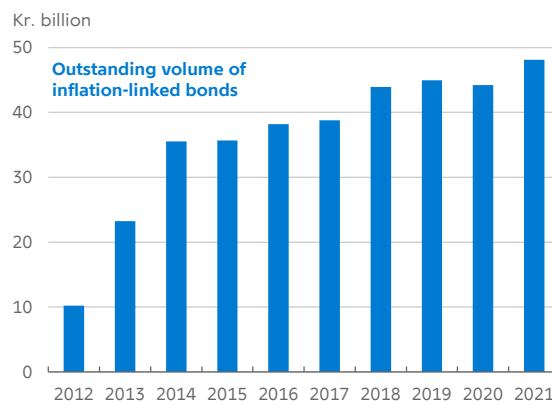
The inflation-adjusted outstanding volume of central government inflation-linked bonds has increased to about kr. 48 billion, see chart 7. The future target for the outstanding volume of inflation-linked bonds will be kr. 40-60 billion.

Better liquidity support

With a four-year difference in the time to maturity, inflation-linked bond liquidity may be better supported through switch auctions. In addition, the possibility of auctioning three bonds at ordinary auctions contributes to a more regular sale of inflation-linked bonds. Following the opening of the new inflation-linked bond, the DGBi 2030 will no longer be included in on-the-run issues, and the central government will be able to buy back the bond. Switch auctions will also be conducted between the DGBi 2030 and the DGBi 2034 to support investors' possibility of moving further along the real yield curve and enable liquidity building in the new bond faster. Buy-backs of the DGBi 2023 will also still be possible.

The future target for outstanding volume of inflation-linked bonds is expected to be kr. 40-60 billion

Chart 7



Note: Inflation-adjusted nominal outstanding volume calculated at year-end. 2021 is calculated at end-November 2021.
Source: Danmarks Nationalbank.

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