RIKSGÄLDEN
SWEDISH NATIONAL DEBT OFFICE

2024-09-23

Central government debt management

Proposed guidelines 2025–2027

Reg.no 2024/388

The Debt Office's assignment

One of the Swedish National Debt Office's primary duties is to borrow money on behalf of the central government and manage the central government debt. The objective is to minimise the cost over the long term while taking account of risk. The central government debt shall be managed within the framework of monetary policy requirements.

At the general level, debt management is governed by the Swedish Budget Act and the Ordinance Containing Instructions for the Swedish National Debt Office. These statutes set out, for example, the permitted purposes of central government borrowing and the objective of the debt management. In addition, the Swedish Government adopts guidelines for this management, which govern matters including the composition and maturity of the debt.

The Government adopts new guidelines each year no later than 15 November. This decision is taken after the Debt Office has submitted proposed guidelines on which the Riksbank has been given the opportunity to deliver an opinion.

The operational role of the Debt Office thereafter includes borrowing the money required, in accordance with the framework set up, to finance deficits in the central government budget and replace loans that mature.

After the end of the year, the Debt Office submits a report with a basis for evaluation of its debt management to the Government in February. The Government then presents an evaluation to the Riksdag (the Swedish Parliament) in April every two years.

The proposed guidelines and the basis for evaluation are published on riksgalden.se.

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Summary

The Debt Office proposes changes to the guidelines in regard to both the debt's composition and its term to maturity. The composition proposal involves reducing the inflation-linked debt. The other proposal is for duration as a measure of term to maturity to be replaced by average time to refixing (ATR).

- The central government debt has been on a declining trend for the last two decades. Most significantly, this is due to the design of the fiscal policy framework. The trading volume of government bonds has decreased for several years as a result of both the shrinking government debt and the Riksbank having purchased a large proportion of government bonds. In light of this, the investor base has also decreased and market liquidity deteriorated. Therefore, to minimise the cost over time, the Debt Office sees a need to even more clearly prioritise nominal government bonds in the borrowing.
- The Debt Office proposes a change to the composition of the central government debt: for the outstanding inflation-linked debt to be decreased from 20 per cent. The main reason for the proposed change is that the current proportion neither contributes to reducing the overall costs nor the risks associated with the debt. Since both the total central government debt's progression and inflationary developments are outside the Debt Office's control, it is also proposed that the inflation-linked debt be steered towards a target value expressed as a nominal amount instead of as a proportion.
- The Debt Office proposes transitioning from using duration to measure the term to maturity of the debt to using average time to refixing (ATR) instead. Like duration, ATR is a maturity measure for interest rate refixing risk – but without being affected by changes in the market interest rate that can lead to undesirable steering signals. The Debt Office does not see any reason at present to alter the steering interval and proposes that it remain at 3.5–6 years measured as ATR.

Proposed guidelines 2025–2027

Below are the Debt Office's proposed guidelines for central government debt management in 2025–2027. For 2026–2027, the proposed guidelines are preliminary. Where the proposal involves changes to the steering as compared with the current guidelines, we present these in bold type in the opening text of the guideline point. Relevant and updated parts of the Budget Act (2011:203), the Ordinance Containing Instructions for the National Debt Office (2023:909), and the Sveriges Riksbank Act (2022:1568) are also included to provide an overview of the framework. The grounds for the Debt Office's proposed changes to the steering are described in separate chapters in the report.

Objective for the management of central government debt

1. The central government debt shall be managed in such a way as to minimise the cost of the debt over the long-term while taking the risk associated with its management into account. The management of the debt shall be conducted within the framework of monetary policy requirements (Chapter 5, Section 5 of the Budget Act).

Debt Office's task and purposes of the borrowing

2. The task of the Debt Office is to raise and manage loans for central government in accordance with the Budget Act (Section 3 of the Ordinance containing Instructions for the National Debt Office).

3. Upon special authorisation given for one fiscal year at a time, the Government or the Debt Office as decided by the Government may raise loans for the central government in order to:

    - finance current deficits in the central government budget and other expenditure based on decisions of the Riksdag (the Swedish Parliament),
    - provide such credits and perform such guarantees as decided by the Riksdag,
    - amortise, redeem, and purchase central government loans, and
    - meet the need for government securities at different maturities in consultation with the Riksbank

    (Chapter 5, Section 1 of the Budget Act).

The Debt Office shall raise loans for central government to meet the Riksbank's need for borrowing in order to:

- fulfil its obligations in relation to the International Monetary Fund, and
- fund the foreign currency reserve.

(Chapter 6, Section 4 and Chapter 10, Section 4 of the Sveriges Riksbank Act [2022:1568]).

Guidelines process

4. The Debt Office shall submit proposed guidelines for central government debt management to the Government Offices by 1 October each year (Section 30, point 6 of the Ordinance containing Instructions for the National Debt Office).

5. The Government shall give the Riksbank the opportunity to state an opinion on the Debt Office's proposed guidelines (Chapter 5, Section 6 of the Budget Act).

6. The Government shall adopt guidelines for the Debt Office's management of the central government debt by 15 November each year (Chapter 5, Section 6 of the Budget Act).

7. The Debt Office shall submit information for the evaluation of the management of the central government debt to the Government by 22 February each year (Section 30, point 1 of the Ordinance containing Instructions for the National Debt Office).

8. The Government shall evaluate the management of the central government debt every two years. The evaluation shall be presented to the Riksdag by 25 April (Chapter 5, Section 7 of the Budget Act).

9. The Debt Office's board shall decide on principles for the implementation of the guidelines for central government debt management adopted by the Government (Section 41 of the Ordinance containing Instructions for the National Debt Office).

10. The Debt Office is to adopt internal guidelines based on the Government's guidelines. These decisions are to concern the use of the mandate for position-taking, the term to maturity of individual debt types, the currency distribution of the foreign currency debt, and principles for market support and debt maintenance.

Composition of central government debt

11. **Proposed new wording:** The Debt Office shall issue inflation-linked bonds. The outstanding stock is, however, to be gradually reduced. The inflation-linked debt is to be calculated as a nominal amount without inflation compensation. At the end of 2029, the inflation-linked debt is to be approximately SEK 80 billion.

Present wording: The share of inflation-linked krona debt is to be 20 per cent of the central government debt over the long term. The shares of the debt types in the central government debt are to be calculated as nominal amounts at the present exchange rate including accrued inflation compensation.

12. The foreign currency exposure of the central government debt is to be gradually phased out and attain the target value of zero as of 2027. The foreign currency exposure may, however, vary as a result of the Debt Office making currency exchanges in accordance with point 35.

13. The Debt Office is to set a target value for the distribution of the foreign currency debt among different currencies.

14. In addition to inflation-linked krona debt and foreign currency debt, central government debt is to consist of nominal krona debt.

Term to maturity of central government debt

15. The term to maturity of the central government debt is to be between 3.5 and 6 years.

16. The Debt Office is to determine a term-to-maturity interval for the nominal krona debt, the inflation-linked krona debt, and the foreign currency debt.

17. The term to maturity of the central government debt may deviate temporarily from the maturity interval stated in point 15.

18. **Proposed new wording:** Term to maturity is to be measured as average time to refixing (ATR).

    Present wording: Term to maturity is to be measured as duration.

Cost and risk

19. The trade-off between expected cost and risk is to be made primarily through the choice of the composition and term to maturity of the central government debt.

20. The main measure of cost is to be the average issue yield. The cost is to be calculated using the valuation principle of amortised cost taking accrued inflation and exchange rate changes into account.

21. The main measure of risk is to be the variation of the average issue yield.

22. The Debt Office is to take account of refinancing risks in the management of the central government debt, including by issuing instruments with more than twelve years to maturity.

23. Borrowing is to be conducted in a way that ensures a broad investor base and diversification in a range of funding currencies in order to maintain good borrowing preparedness.

24. **Proposed new wording:** Positions are not to be included when calculating composition and term to maturity.

    Present wording: Positions are not to be included when calculating debt shares and term to maturity.

25. When taking positions, market values are to be used as the measure of the costs and risks in the management of the debt.

Market support and debt maintenance

26. The Debt Office is to contribute, through its market support and debt maintenance, to the effective functioning of the government securities market in order to achieve the objective of long-term cost minimisation while taking account of risk.

27. The Debt Office is to adopt principles for market support and debt maintenance.

Position-taking

28. The Debt Office may take positions in foreign currency and the krona exchange rate.

    Positions in foreign currency may only be taken using derivative instruments. Positions may not be taken in the Swedish fixed income market.

    Positions refer to transactions that are intended to reduce the costs of the central government debt while taking account of risk, or to reduce the risks for the central government debt while taking account of cost, and that are not motivated by underlying borrowing or investment requirements.

    Positions may only be taken in markets that permit the management of market risk through liquid and otherwise well-developed derivative instruments that are also potentially a borrowing currency in the context of debt management.

29. Positions in foreign currency are limited to SEK 300 million, measured as daily Value-at-Risk at 95 per cent probability.

    The Debt Office shall decide how much of this scope may be used at most in day-to-day debt management.

30. Positions in the krona exchange rate are limited to a maximum of SEK 7.5 billion. When the positions are built up or phased out, this is to be done gradually and announced in advance.

    The Debt Office is to decide how much of this volume may be used at most in its day-to-day debt management in connection with exchanges between the krona and other currencies. This volume is to be of limited size, and the positions do not need to be announced in advance.

Borrowing to meet need for government loans

31. The possibility of raising loans to meet the need for government loans under Chapter 5, Section 1 of the Budget Act may only be used if necessary in the event of a threat to the functioning of the financial market. The Debt Office may have outstanding loans with a maximum nominal value of SEK 200 billion for this purpose.

32. Investment of funds raised through loans to meet the need for government loans should be guided by the principles set out in the Preventive Government Support to Credit Institutions Act (2015:1017) and concerning the Stability Fund.

Management of funds etc.

33. The Debt Office shall place its funds, to the extent that they are not needed for outgoing payments, in an account at the Riksbank, a bank or a credit market company, or in government securities or other debt instruments with a low credit risk. Investments may be made abroad and in foreign currency (Section 5 of the Ordinance containing Instructions for the National Debt Office).

34. The Debt Office shall cover the deficits that occur in the government central account (Section 7 of the Ordinance containing Instructions for the National Debt Office).

35. The management of exchanges between Swedish and foreign currency (currency exchanges) is to be predictable and transparent (Section 6 of the Ordinance containing Instructions for the National Debt Office).

Consultation and collaboration

36. The Debt Office shall consult with the Riksbank on matters concerning the components of its borrowing operations that may be assumed to be of significant importance for monetary policy (Section 12 of the Ordinance containing Instructions for the National Debt Office).

37. The Debt Office shall collaborate with the National Institute of Economic Research and the National Financial Management Authority on matters concerning the Debt Office's forecasts of the central government borrowing requirement (Section 11 of the Ordinance containing Instructions for the National Debt Office).

38. The Debt Office should obtain the Riksbank's views on how the funds borrowed to meet the need for central government loans are to be invested.

Evaluation

39. Evaluation of the management of the central government debt is to be carried out in qualitative terms in light of the knowledge available at the time of the

decision. Where possible, the evaluation is also to include quantitative measures. The evaluation is to cover five-year periods.

40. **New point:** The Debt Office shall define how the proposed changes to the guidelines are to be evaluated. The basis for evaluation is to be described as specifically as possible in regard to the principles presented in point 39.

41. **The point is renumbered from 40 to 41:** The evaluation of the operational management is to include borrowing in and management of the different types of debt, market support and debt maintenance measures, and management of currency exchanges.

42. **The point is removed.** For inflation-linked borrowing, the realised cost difference between inflation-linked and nominal borrowing is to be reported.

42. Gains and losses are to be recorded continuously for holdings within a position-taking mandate and evaluated in terms of market values.

43. The phasing out of the foreign currency exposure of the central government debt is to be evaluated in relation to a steady pace of reduction over the period from the beginning of 2023 to the end of 2026. The evaluation is to follow the same principles that apply for positions within the position-taking mandate (point 42). Only transactions that are carried out for the purposes of phasing out the foreign currency exposure of the central government debt are to be included in the evaluation.

Conditions for managing central government debt

The way in which the central government debt should be managed is affected by, among other things, how the debt's size and different risk premia develop over time. The debt has shrunk over the last two decades, contributing to a reduction of the trading volume of government bonds. That in turn has affected both the investor base and the liquidity premium. These developments are a reason to transition from diversifying the borrowing to instead prioritising the most important borrowing channels.

The objective of central government debt management is to minimise the long-term cost while taking into account the risk. A long-term perspective entails guidelines designed to achieve a low cost for the entire debt over time, as opposed to in individual issues or instruments. It is important to consider how the debt portfolio (exposure) should be structured in regard to different debt types and maturities. The guidelines also contain points that focus more directly on the borrowing (funding), such as in taking refinancing risks into account, maintaining good borrowing preparedness, and contributing to a well-functioning government securities market.

In the guidelines, a balance between cost and risk is determined based on long-term structural factors. One of these is the progression of the size of the debt over the long term. Another is how different risk premia develop. A risk premium that the Debt Office continually follows is the term premium. So is the liquidity premium, which is connected to how investors proceed and how the government securities market functions. The debt's size can also play a role for the liquidity premium.

Small debt at outset

The main characteristic of the conditions for managing the central government debt is that the debt has hovered around a slight declining trend for just over two decades. Having a small debt is favourable because it involves low interest cost. The size of the debt affects the cost directly as well as indirectly through strong central government finances laying the foundation for a high credit rating and thereby lower borrowing costs. A low level of debt at the outset also provides room for managing a crisis without creating fiscal problems.

A smaller debt, which brings with it lower interest cost, also contributes to lower risk in the form of reduced variation in interest cost (expressed in kronor). Lower interest-cost variation thereby has a smaller impact on the central government's

budget. It also becomes less important to keep down the refinancing risk through issuing government bonds with longer maturities. This is because the central government's prospects for replacing maturing loans at a continued low cost are good, as the borrowing requirement is small and Sweden has the highest credit rating.

But a historically low central government debt that is on a downward trend also presents challenges for debt management, such as if the liquidity premium and borrowing preparedness are affected. For example, a low debt means that it may become difficult to maintain a large enough trading volume of all debt types in order to enable liquid secondary markets, which contributes to a lower borrowing cost over time. This may merit going from diversifying the borrowing to instead prioritising the most important borrowing channels in order to reduce the cost over time.

Central government debt is affected by fiscal policy framework

The design of the fiscal policy framework is the most important reason for the central government debt having been on a declining trend. Since 2019, the surplus target has been one-third of a per cent of GDP over a business cycle, whereas prior to that it was 1 and 2 per cent, respectively. The surplus target is determined on the basis of the consolidated public sector's net lending – which, in addition to the central government, includes the municipal sector and the national public old-age pension system. The framework includes a debt anchor – a target value (benchmark) – of 35 per cent of GDP that applies to the entire public sector's consolidated gross debt.

The framework has led to net lending for both the central government and the general government sector as a whole averaging close to zero in the 2000s, at the same time as GDP has more than doubled. This means that even though the debt measured in kronor has adhered to a slight declining trend, it has fallen rapidly as a share of GDP.

The framework's design entails that the surplus target is to be achieved over time and that it is mainly the central government that must correct fluctuations in the total net lending and thus also take into account developments for the municipal sector and the old-age pension system. Consequently, although the framework creates stability for the general government sector, its structure makes the effects more uncertain for the central government.

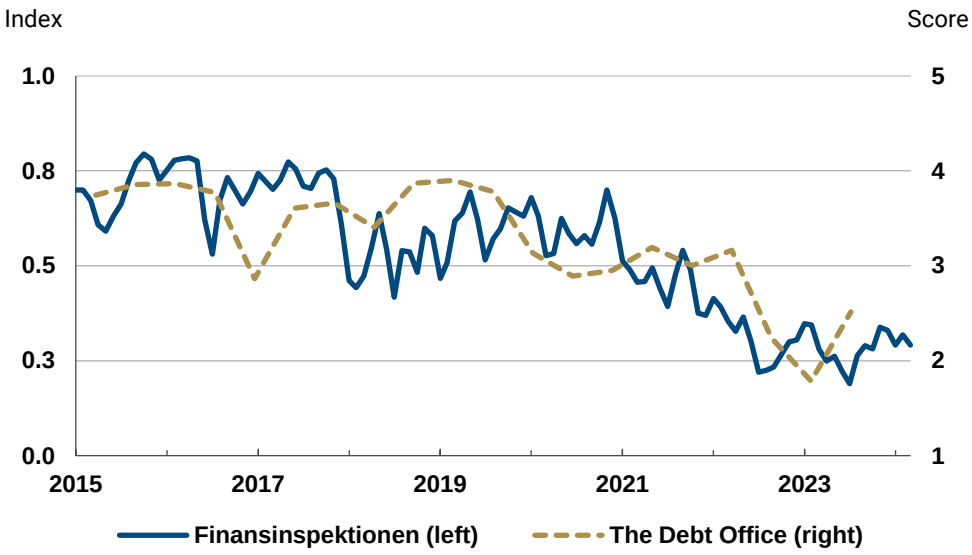
An important component of the fiscal policy framework is the regular review of the surplus target conducted every eight years. The target was previously adjusted in 2007 and 2019, and the results of the ongoing review will be reported in November 2024. A potential adjustment of the surplus target is significant because it could affect the future progression of the central government debt. The central government debt and the Debt Office's borrowing are also affected by developments in the two other sectors under the framework.

Liquidity premium affects cost of debt

For approximately a decade, surveys and quantitative measures have shown deterioration in liquidity in the secondary market for government securities. If investors perceive market liquidity to be poor, they may demand an extra return for holding government securities, i.e. require a higher liquidity premium, which in turn increases the borrowing cost for the central government.

Last year's results of the Debt Office's qualitative survey show some improvement in market liquidity, yet the score remains low.[1] Although the quantitative measure used by Finansinspektionen (the Swedish Financial Supervisory Authority) – which weighs together a number of indicators in an aggregate measure of market liquidity for nominal government bonds – shows some stabilisation, this is also at a low level. The progression of both measures is shown in figure 1.

Figure 1 Measures of market liquidity



Note: Finansinspektionen's liquidity measure is an aggregation of indicators for nominal government bonds with benchmark status. Higher values correspond to higher liquidity. The figure shows a two-month moving average of the index. The Debt Office's measure shows average scores for liquidity, in terms of volume and spread for nominal government bonds, given by primary dealers and investors in the annual Prospera survey by Kantar. The rating scale is 1–5, where 4 and higher is interpreted as excellent and lower than 3 as unsatisfactory. The figure shows the average of the scores for spread and volume.

Sources: Finansinspektionen and the Debt Office.

In line with the central government debt having fallen as a share of GDP, the investor base has also decreased. Another factor that has affected the investor base is the Riksbank's purchases of government bonds. Those who still own and trade Swedish government securities are doing so to an increasing lesser extent, both in terms of total turnover and the average ticket size.

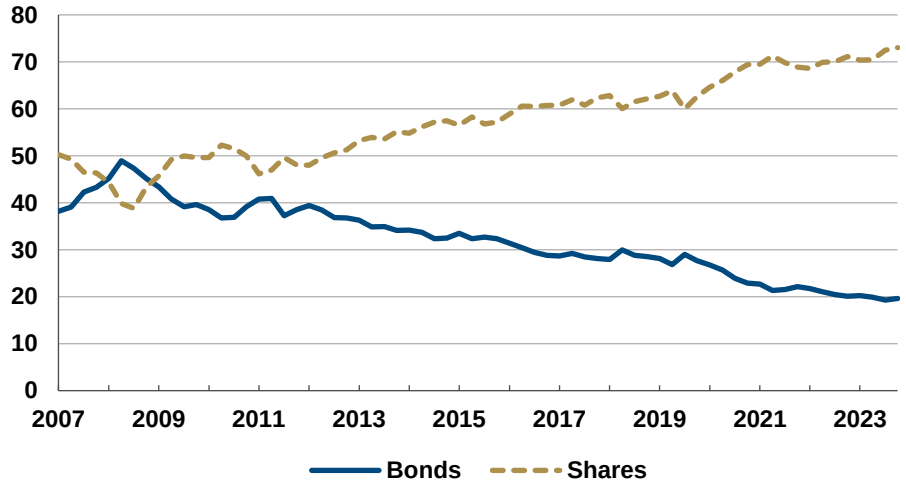
[1] For more information, see "Förtroende för Riksgälden 2023 (Confidence in the Debt Office 2023)", in Swedish, Prospera survey by Kantar.

A broad investor base ideally consists of a large number of market participants with various reasons and needs for trading, which leads to buying and selling interests matching over time. Market participants being able to purchase the desired volume at the expected price within a reasonable amount of time helps keep the liquidity premium as low as possible. A smaller investor base, however, does not automatically mean worse liquidity and a higher liquidity premium, even if the risks increase the greater the decrease becomes.

Two concurrent factors have affected the trend among the larger domestic investors for more than a decade. First, using insurance companies as an example, there has been a gradual reallocation between asset classes, from bonds to shares (see figure 2). Second, there has been a shift within the asset class of bonds from government bonds to other bonds. The latter shift reflects a change in relative supply, in which the outstanding amount of tradeable government bonds has decreased sharply in absolute terms, but even more so relative to covered bonds, the amount of which has instead gone up substantially.

Figure 2 Insurance companies' holdings of bonds and shares

Per cent



Note: Proportion of total assets.

Sources: Statistics Sweden

It is in light of the decrease in the tradable volume of government bonds that market liquidity and the investor base have developed in this way. All else being equal, the fewer investors who want to buy and sell a bond, the worse the prospects for market liquidity become. A possible effect of the investor base having shrunk over a long period is that it has reduced the resilience of the market, i.e. its ability to continue to function satisfactorily if a major negative shock were to occur.

In April 2023, the Riksbank began selling off its holdings of government bonds. It is not making any additional purchases, rather the holdings are decreasing in pace with the sales and bond redemptions. This, along with the Debt Office increasing the issuance volume in the near future, is causing the volume available for trading

to gradually increase. Many market participants see this as a contributing factor to liquidity having recently improved.[2]

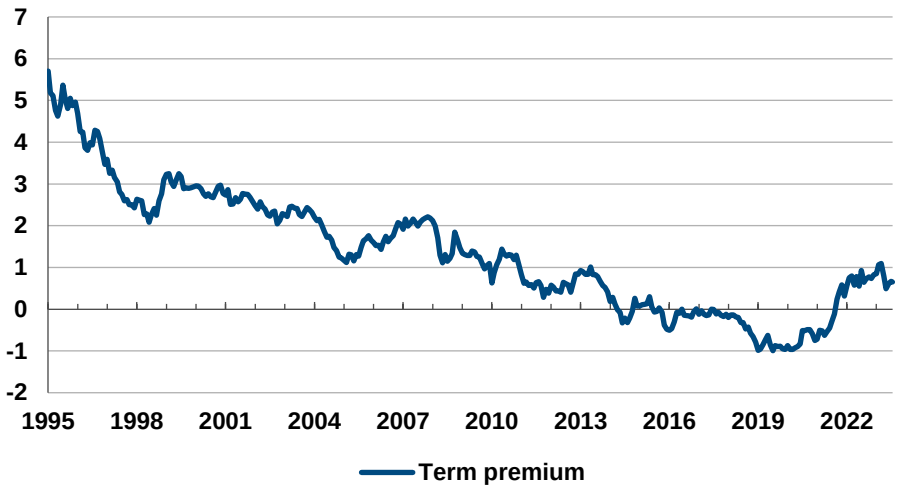
Term premium remains at low level

Another risk for which investors in securities demand an extra return is term-to-maturity risk. This is why the term premium is an important factor to consider when managing the maturity of the central government debt. For the central government, loans with longer maturities entail reduced risk of cost variation for the central government debt. At the same time, term premia have historically been positive, which has meant that the Debt Office has paid an expected additional cost for borrowing in longer maturities.

To estimate the Swedish term premium, the Debt Office uses a yield model developed by the US Federal Reserve. The model's calculations are based on data for swap rates between one and ten years from August 1995 to March 2024. When the term premium is positive, the Debt Office is expected to pay a higher cost for borrowing in longer maturities.

Figure 1 Swedish ten-year term premium

Percentage points



Note: The term premium, presented on a monthly basis, is the premium for Swedish ten-year swap rates. The period extends from August 1995 to March 2024.

Sources: Refinitiv and the Debt Office's own calculations.

Figure 3 also shows a declining trend for the Swedish term premium between 1995 and 2021 and a rapid increase afterwards. The term premium was negative during 2015 to 2021, a period when the Riksbank carried out an expansionary monetary policy. Thereafter, inflation escalated and the Riksbank tightened its monetary policy. Securities purchases, which were a part of the previously expansionary monetary policy, decreased in 2022 to then cease entirely and be replaced by sales

[2] For more information, see for example the Riksbank's Financial Markets Survey, April 2024.

in 2023. The sale and disposal of the portfolio through redemptions has continued and increased in volume in 2024.

Figure 3 also shows the variation in the term premium over time. The increase in 2022 is large for a single year, but the level is low historically speaking and the term premium has been at around 1 per cent since then. In the Debt Office's assessment, it is too soon to draw any conclusions about the term premium in the longer term based on the recent increase.

Conditions are reason to prioritise

The above description of the conditions for central government debt management largely stems from how the structural factors have developed historically and what the situation is currently. A low central government debt and inadequate market liquidity place demands on prioritising the most important borrowing channels in order to minimise the cost of the debt over time. Although there is some uncertainty about the future progression of the central government debt, for instance due to the review of the fiscal policy framework and the debt development for the municipal sector and the old-age pension system, this does not affect the grounds for the changes proposed in the guidelines.

Reduced inflation-linked debt

The Debt Office proposes that the outstanding inflation-linked debt be reduced and steered as a nominal amount instead of a proportion. The outstanding volume is to be reduced from SEK 177 billion to around SEK 80 billion until the end of 2029. This is mainly because the current share neither contributes to lower cost nor lower risk. A low central government debt and inadequate market liquidity are also reasons to prioritise the market for nominal government bonds instead.

When the Debt Office introduced inflation-linked government bonds in 1994, they were expected to reduce the cost of the central government debt. The assessment was that investors were prepared to pay extra for insurance against changes in the inflation rate. Another reason was that inflation-linked bonds could diversify the debt portfolio and thereby contribute to lower cost variation and a broader investor base. A broad investor base helps maximise demand over time, because different types of investors seek different kinds of instruments and trade them to varying extents.

The cost of inflation-linked borrowing fluctuates with time. But according to the Debt Office's calculations, there is no clear savings over nominal borrowing. Our analysis also shows that inflation-linked bonds do not reduce the total risk associated with the debt portfolio either.

The Debt Office therefore proposes that the inflation-linked debt be reduced, although not phased out entirely. The debt type should be kept as a smaller part of the composition of the central government debt. Our motivation for this is to have access to additional borrowing channels if a greater need for borrowing arises, but also because inflation-linked bonds could bring expected cost savings in periods ahead.

Given the current conditions of a low debt and deteriorated market liquidity, the Debt Office also considers it difficult to maintain a liquid secondary market for both nominal and inflation-linked bonds. We therefore see a reason to prioritise nominal government bonds.

No cost advantage, limited effect on risk

The Debt Office has analysed the current composition of the central government debt and concluded that there is not a cost advantage to having a 20 per cent share of inflation-linked debt. The analysis also shows that the diversification effect is limited – inflation-linked bonds do not appreciably lower the total cost variation.

Analysis of cost advantage confirms previous results

In previous proposed guidelines, the Debt Office has stated that it has not identified any distinct and persistent cost advantage to inflation-linked versus nominal borrowing. We reached the same conclusion when updating the analysis for this year's proposed guidelines.[3]

The analysis of cost advantages is based on a hypothetical comparison scenario. The evaluation is based on a comparison between the yield on a nominal government bond and an inflation-linked bond with the same term to maturity -- called break-even inflation (BEI). For the cost advantage – or savings – we measure the difference between five-year BEI and the inflation expectations over the same period. The measure thereby shows if any difference in borrowing cost from a forward-looking (ex-ante) perspective can be expected.

In this year's proposed guidelines, we are expanding the analysis by calculating the cost advantage with a ten-year maturity. We extrapolate the inflation expectations from five to ten years with the aid of one-year inflation expectations.[4] Figure 4 shows the estimated expected savings. A positive value for the expected savings means that a lower cost can be expected with inflation-linked borrowing than for nominal borrowing. Since 2022, the savings has been negative and continues to decrease. This development has mainly been driven by a rapidly declining BEI while inflation expectations have been more stable.

What is meant by a negative cost advantage?

By issuing inflation-linked bonds, the central government bears the inflation risk investors face when buying nominal bonds. Thereby, the central government does not have to pay the inflation risk premium that investors otherwise demand in order to buy nominal bonds. However, the central government likely pays a higher liquidity premium for issuing inflation-linked government bonds. This is because inflation-linked bonds are generally less liquid than nominal government bonds in Sweden. If the cost advantage is negative, investors value the protection against high inflation offered by inflation-linked bonds less that they do the advantage of the superior liquidity of nominal bonds.

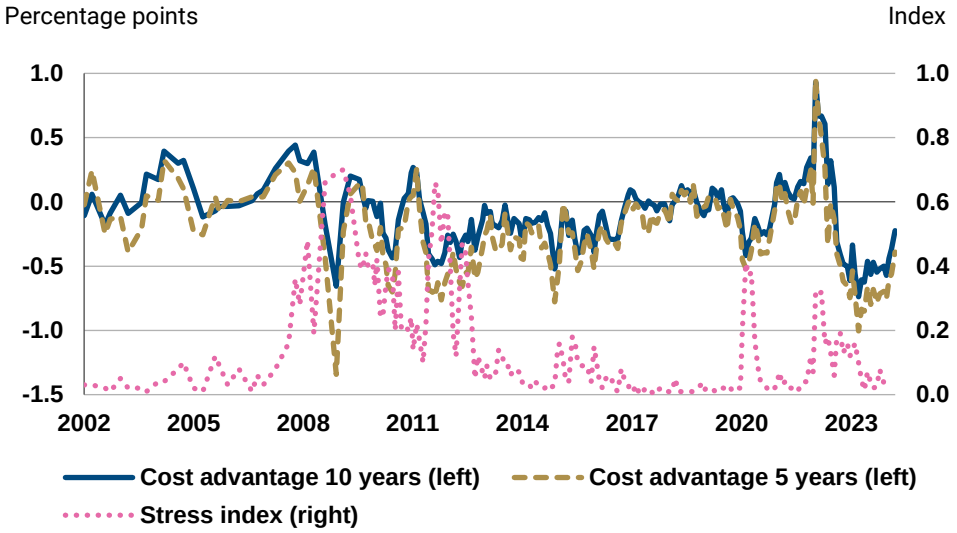
The measure of expected savings indicates whether a difference in borrowing costs between nominal and inflation-linked bonds can be expected looking ahead. What that cost difference will ultimately be depends on the outcome of inflation. In the yearly report *Central Government Debt Management – Basis for Evaluation*, the Debt Office regularly reports the calculated cost of inflation-linked borrowing. We concluded that in 2022, as a result of high inflation, the inflation-linked borrowing cost was SEK 19.8 billion more than for nominal borrowing. In 2023, the inflation-linked debt also gave rise to a negative calculation result – an extra cost – of SEK

[3] A detailed description of the analysis can be found on page 12 of the Debt Office's 2020–2023 proposed guidelines.

[4] For more information, see Andrey Ermolov (2021), "When and Where Is It Cheaper to Issue Inflation-Linked Debt?", The Review of Asset Pricing Studies 11, pp. 610–653.

11 billion. The large additional cost in 2022 and 2023 has cancelled out most of the accumulated positive results since we introduced inflation-linked bonds.

Figure 4 Expected savings from borrowing in inflation-linked vs. nominal bonds



Note: ”Cost advantage 10 years” and “Cost advantage 5 years” show the expected savings for inflation-linked borrowing over five- and ten-year periods, respectively. The stress index, produced by the Riksbank, varies between 0 and 1 and is an indicator of financial stress in Sweden. A higher value indicates a higher level of stress. The series in the figure show values at the time of publication of inflation expectations (quarterly until October 2006 and monthly thereafter). The period is between March 2002 and May 2024.

Source: The Debt Office and the Riksbank.

In summary, the analysis shows that inflation-linked borrowing does not offer a distinct cost advantage over time.

Analysis shows inflation-linked borrowing is associated with higher risk

In order to evaluate how the inflation-linked debt affects the central government debt’s risk, the Debt Office compares the cost variation between different funding strategies on the basis of various economic scenarios. The basic premise is that the central government debt can be funded using nominal and inflation-linked debt instruments with different maturities and that these funding strategies involve different risks for the debt.

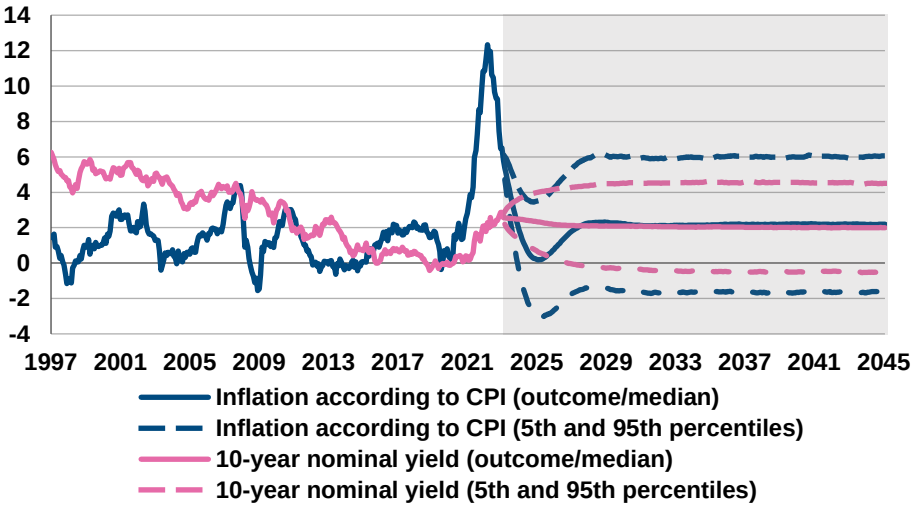
The analysis method involves simulating nominal and inflation-linked zero-coupon yields and inflation 20 years into the future starting in 2024.[5] The first part of the analysis estimates parameters for yield curves for both nominal and inflation-linked bonds. In the next step, we apply a time-series model to examine how these parameters and inflation interact with each other. A detailed description of the

[5] For more information on the method used by the Debt Office, see Diebold, F.; and C. Li, 2006, “Forecasting the term structure of government bond yields”, Journal of Econometrics 130, pp. 337–364.

analysis method is provided in appendix 1 on page 33. With the aid of the model's calculations, we simulate 10,000 future scenarios for both nominal and inflation-linked bonds from a one-year maturity to a ten-year maturity. Figure 5 shows the model simulations for inflation and a ten-year nominal bond.

Figure 5 Simulated ten-year nominal yield and inflation

Percentage points



Note: "Inflation according to CPI (outcome/median)" shows the development of one-year inflation according to the consumer price index (CPI). The grey area shows simulations as of 2024. "5th and 95th percentiles" are the simulated values of the 5th and 95th percentiles each month.

Source: The Debt Office.

In the simulations, the downward trend for the inflation rate continues for several years and then returns to the long-term value of just over 2 per cent. The ten-year yield is also expected to be at around 2 per cent. The figure also illustrates the divergence with the dashed lines for the 5th and 95th percentiles. These are interpreted to show that: in 90 per cent of the scenarios, inflation is between -2 and 6 per cent. In 5 per cent of the scenarios, inflation is higher than 6 per cent and in 5 per cent lower than -2 per cent.

To evaluate the risks for various funding strategies, we first construct borrowing strategies containing individual debt instruments (such as a ten-year nominal bond or a five-year inflation-linked bond). In these funding strategies, the Debt Office issues a constant amount every month. This assumption differs from how we operate in reality, but the simplification facilitates the analysis. The funding strategies are described in more detail in appendix 1 on page 33.

We conduct a monthly cost assessment and the borrowing is conducted at par yield, which is the coupon rate whereby the bond's market price is equal to its face value (see appendix 1 for a detailed description). For nominal bonds, the cost is derived by an annual par yield allocated evenly over 12 months. For inflation-linked bonds, inflation compensation is also paid on the coupon payment and the

additional upward inflation adjustment of the nominal loan amount is expensed each month.

In the next step, the combination of different funding strategies with individual instruments leads to a central government debt with various compositions and maturities. We can for example combine a one-year bond with a ten-year bond and create a portfolio.[6] The risk in the portfolio can be lower than the sum in the individual funding strategies as a result of diversification effects.

We evaluate the cost variation with the risk measure "relative Expected Shortfall" (rES) at a 95 per cent confidence level. The measure shows the difference between a high cost (the average annual costs that exceed the 95th percentile) and the average annual costs over all the simulations. A high rES value indicates that the investment strategy has high variation in cost, which indicates a higher level of risk.

The recorded risk in terms of rES for funding strategies based on individual instruments is shown in table 1. The analysis shows that rES is higher for inflation-linked bonds than for nominal bonds. For example, rES over ten years (2024–2033) for a ten-year nominal bond is 0.86 per cent, whereas the risk for a corresponding inflation-linked bond is 2.10 per cent. The higher risk for inflation-linked bonds is driven by the inflation component. For the ten-year inflation-linked bond, the risk is 0.35 per cent from the yield component and 1.74 per cent from the inflation component.

Table 1 rES for various funding strategies by yield component and inflation component

Percentage points

Measure	1Y nom	2Y nom	3Y nom	5Y nom	7Y nom	10Y nom	3Y infl	5Y infl	7Y infl	10Y infl
95%-rES (2024–2033)	1.81	1.80	1.71	1.47	1.21	0.86	2.28	2.26	2.18	2.10
– of which yield	1.81	1.80	1.71	1.47	1.21	0.86	1.16	0.92	0.66	0.35
– of which inflation	0.00	0.00	0.00	0.00	0.00	0.00	1.12	1.34	1.52	1.74
95%-rES (2024–2043)	1.69	1.77	1.78	1.71	1.60	1.43	1.87	1.92	1.89	1.82
– of which yield	1.69	1.77	1.78	1.71	1.60	1.43	1.39	1.33	1.19	0.96
– of which inflation	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.59	0.70	0.87

Note: The table shows rES for various funding strategies with individual instruments over two evaluation periods, between 2024 and 2023 and between 2024 and 2043. "Nom" refers to nominal bonds and "infl" refers to inflation-linked bonds. For example, "1Y nom" refers to the funding strategy of borrowing via a one-year nominal bond and provides a remaining time to maturity of 0.5 years. rES is also calculated for the two subcomponents of the costs: the yield component and the inflation component. Nominal bonds do not provide any inflation compensation, which is why rES for inflation compensation for nominal bonds is 0.

Source: The Debt Office.

[6] The portfolio in the example has a time to maturity of 2.75 years. A funding strategy with a one-year bond has a time to maturity of 0.5 years and a strategy with a ten-year bond a time to maturity of 5 years.

In the next step, we analyse the portfolio's total risk. This is done by searching for weights for individual funding strategies that minimise rES for the entire portfolio with the constraint that the average remaining time to maturity reaches a certain level (e.g. three years). The results for the risk-minimising portfolios for respective time to maturity are shown in table 2.

Table 2 Risk-minimising composition and risk for 2024–2033 period

Percentage points

Strategy	0,5Y	1Y	1,5Y	2Y	2,5Y	3Y	3,5Y	4Y	4,5Y	5Y
1Y nom	100.0	88.9	77.8	66.7	55.6	44.4	33.3	22.2	11.1	0.0
2Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10Y nom	0.0	11.1	22.2	33.3	44.4	55.6	66.7	77.8	88.9	100.0
3Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
rES	1.81	1.70	1.58	1.47	1.36	1.25	1.15	1.05	0.95	0.86

Note: The table shows weights for different funding strategies that provide the lowest rES for the entire portfolio for 2024–2033. The rows show different funding strategies and the columns show different times to maturity. The last row shows the risk level as rES.

Source: The Debt Office.

Table 3 Risk-minimising composition and risk for 2024–2043 period

Percentage points

Strategy	0,5Y	1Y	1,5Y	2Y	2,5Y	3Y	3,5Y	4Y	4,5Y	5Y
1Y nom	100.0	88.9	77.8	66.7	55.6	44.4	33.3	22.2	11.1	0.0
2Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7Y nom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10Y nom	0.0	11.1	22.2	33.3	44.4	54.6	64.6	73.6	82.3	92.7
3Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7Y infl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10Y infl	0.0	0.0	0.0	0.0	0.0	1.0	2.1	4.2	6.5	7.3
rES	1.69	1.66	1.62	1.59	1.55	1.52	1.49	1.47	1.44	1.42

Note: The table shows weights for different funding strategies that provide the lowest rES for the entire portfolio for 2024–2043. The rows show different funding strategies and the columns show different times to maturity. The last row shows the risk level as rES.

Source: The Debt Office.

Table 2 shows that the risk-minimising portfolios only contain nominal funding strategies, more specifically the one-year and the ten-year nominal bond. The combination of these has a diversification effect. For example, a portfolio consisting of 33.3 per cent one-year and the remainder in ten-year nominal bonds provides an rES of 1.15 per cent. The corresponding individual strategy consisting of seven-year nominal bonds provides an rES of 1.21 per cent according to table 1. Inflation-linked bonds do not reduce the risk for the designated period.

When we extend the analysis to a 20-year horizon, the ten-year inflation-linked bonds have a marginal effect on the portfolio's risk. Table 3 shows that the share of the ten-year inflation-linked bond reaches a maximum of 7.3 per cent. Although the risk-minimising portfolio contains inflation-linked bonds, the measured risk is only marginally lower than with the nominal ten-year bond. The risk level for the five-year portfolio with minimised risk is 1.42 per cent. This can be compared with the portfolio with only ten-year nominal bonds, for which rES amounts to 1.43 per cent according to table 1. The difference is thus so small that it lacks economic significance. Therefore, the conclusion is that inflation-linked bonds do not reduce the risk in the debt portfolio.

Nominal government bonds are prioritised

Nominal government bonds are the Debt Office's largest and most important funding source, because they are the instrument with which we have the best prospects for minimising the borrowing cost over time. We therefore prioritise these over other instruments such as inflation-linked bonds – a strategy that becomes even more relevant when the debt is small. Having an inflation-linked share of 20 per cent is high by international comparison. But with such a low government debt by international standards, it is the minimum for maintaining a liquid market, which has for instance been called into attention by the Swedish National Financial Management Authority (ESV).[7]

The Debt Office's borrowing strategy is to build up sufficient volume in certain prioritised government bonds with the aim of maintaining a liquid secondary market and a well-priced yield curve. Given the current conditions, the Debt Office considers it difficult to maintain a liquid secondary market for both nominal and inflation-linked bonds. A reduction of the inflation-linked debt would enable an increased tradable volume in prioritised maturities for nominal bonds. In several evaluations of central government debt management, the ESV has also noted that the current conditions of a low debt and limited borrowing requirement place greater demands on prioritising borrowing in nominal government bonds in order to safeguard that market.[8]

[7] For more information, see "Evaluation of central government borrowing and debt management 2019–2023" ESV 2024:27.

[8] For more information, see "Evaluation of central government borrowing and debt management 2019–2023" ESV 2024:27.

Keep inflation-linked debt but reduce volume

Due to the above, the Debt Office proposes that the inflation-linked debt be reduced. There are, however, grounds for retaining this type of debt as a smaller part of the central government debt. One reason is that the inflation-linked debt could be a cost-minimising element in the future. With the current outstanding volume, the price picture that the Debt Office is encountering as an issuer shows that the proceeds to the central government from selling inflation-linked bonds are low. This means that there is no cost advantage to issuing inflation-linked bonds. The Debt Office therefore proposes that the outstanding inflation-linked debt be reduced to a level that can better match the demand for inflation-linked bonds that is rooted in the need to ensure against the risk of inflation. The hope is that the inflation-risk premium will increase to exceed the relative liquidity premium compared with nominal government bonds. The inflation-linked debt might then help reduce the cost of the central government debt.

Another reason for retaining inflation-linked debt is that the Debt Office may need to drastically increase borrowing at a future time. Borrowing in different debt types would then allow the Debt Office to potentially reach more investors. This was one of the reasons for introducing inflation-linked debt in the 1990s when the borrowing requirement was large. Maintaining a presence in the inflation-linked bond market would facilitate a future significant increase in borrowing if necessary. Inflation-linked borrowing would then contribute to lightening the market load for nominal government bonds and treasury bills.

Gradual reduction and ongoing evaluation

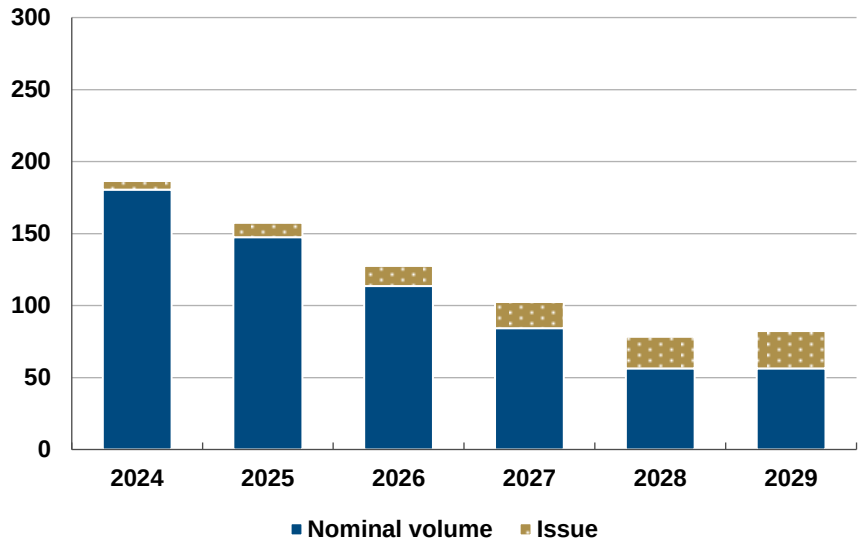
The reasons described above for reducing the debt type do not provide any answers to exactly what level of inflation-linked debt is optimal in the long-term from a holistic perspective. Our assessment is therefore that the inflation-linked debt should be reduced gradually and evaluated continually. There is, however, reason to deliberate about a future level and specify when it should be reached. Above all, this is important in order to have a future target value for annual evaluations, but also for being able to plan the borrowing for the entire central government debt over the years. Being transparent with market participants about the funding plans is an important part of the Debt Office’s borrowing strategy.

In the Debt Office’s assessment, it would facilitate the steering to measure the inflation-linked debt’s development in volume instead of as a proportion, given that both the total central government debt’s progression and inflationary developments are outside the Debt Office’s control. Since several outstanding inflation-linked bonds will mature up to and including 2028, the volume will go down naturally during this period. The following year, 2029, is therefore a reasonable point for which to aim that gives us a sufficiently long evaluation horizon. The Debt Office will also continue to issue a small volume during this period. This is mainly because we want to be clear about our commitment to retain the debt type. The proposed strategy means that the Debt Office is ensuring that inflation-linked bonds will remain available for investors that need inflation-linked assets.

To plan the borrowing in the years ahead, the Debt Office must quantify the reduction, which leads to a calculated target value at the end of 2029. Our proposed decrease from the current SEK 177 billion to around SEK 80 billion by 2029 is due to the loans that will mature as planned during the period. In nominal terms, these redemptions lead to the outstanding volume decreasing to SEK 56 billion in 2029 (see figure 6). At the same time, we expect to issue inflation-linked bonds in the range of SEK 20 billion to SEK 30 billion in the period, causing the outstanding volume to increase to the proposed target value.

Figure 6 Lower volume of inflation-linked bonds due to redemptions

SEK billion



Note: "Nominal volume" shows the outstanding volume of inflation-linked bonds in nominal terms on 5 Aug 2024. "Issue" shows the outstanding volume as a result of a scenario in which the Debt Office issues an additional SEK 6 billion in nominal amounts during the rest of 2024, and SEK 4 billion each year afterwards. The figure illustrates the progression of the outstanding volume of inflation-linked bonds at the end of 2029. This is based on preliminary assessments and may change.

Source: The Debt Office.

The Debt Office's hypothesis is that the proposed target value for inflation-linked debt will better match investor demand for inflation-protected interest-bearing assets. In that case, the inflation-linked debt would offer a cost advantage in the future. The proposed level is at the same time large enough to maintain the market and stay prepared to increase borrowing as necessary.

As mentioned earlier, the current inflation-linked debt share of 20 per cent is unusual from an international perspective. After the proposed decrease, the inflation-linked share will be around 10 per cent. That is in line with several other countries, such as Denmark, the US, and France.

Expanded evaluation replaces evaluation point for inflation-linked debt

Together with the proposal to decrease the inflation-linked debt, the Debt Office proposes a more comprehensive evaluation of both the strategic and the operative management of the central government debt.

The proposed evaluation follows the principle described in guideline point 39: Evaluation of the management of the central government debt is to be carried out in light of the knowledge available at the time of the decision and, where possible, include quantitative measures. The future basis for evaluation shall therefore include quantitative measures of cost and risk that provide the basis of the current decision for reducing the inflation-linked debt.

We also propose adding a point stipulating how changes to the guidelines are to be evaluated. The basis for evaluation shall be described as specifically as possible in regard to the principles presented in point 39. In terms of the evaluation of reduced inflation-linked debt, we will continue to report the difference in cost between inflation-linked and nominal borrowing (current point 41) as well, but we will also take into account the future expected savings (which we return to in figure 4) and the risk in the central government debt. This means that we will be evaluating the change from a broader perspective.

In order to keep the evaluation points at a general level, we propose removing point 41, which deals specifically with inflation-linked borrowing.

In terms of the operational management, the Debt Office shall show the nominal amount of outstanding inflation-linked bonds in the annual evaluation. This is to ensure that the reduction goes according to plan. That does not require a new evaluation point, since it follows from the principle described in guideline point 40.

New measure of term to maturity

The Debt Office proposes that the measure for the central government debt's term to maturity be changed from duration to average time to refixing (ATR). ATR measures the interest rate refixing risk without being affected by movements in the market interest rate. The Debt Office does not see any reason to alter the steering interval of the debt at present and proposes that it remain at 3.5–6 years measured as ATR.

In addition to the composition of the central government debt, the choice of term to maturity is of great significance for the costs and risks involved in debt management. A short term to maturity has historically led to a lower average cost than a longer term to maturity. This is because short-term interest rates are usually lower than long-term rates. At the same time, a short maturity is associated with higher risk because the variation in interest cost may be greater when the interest rate on the debt is refixed more frequently. This risk is the interest rate refixing risk and referred to here simply as refixing risk.

The Debt Office steers the term to maturity of the central government debt primarily by planning the forthcoming borrowing and distribution of outstanding loans. Since government bonds have long maturities, higher issuance volumes of these lead to a longer term to maturity for the debt, all else being equal. The Debt Office can also use interest rate derivatives to steer maturity. By using interest rate swaps, we can for example shorten the interest-rate fixation period of the nominal debt.

An important part of the strategy for minimising borrowing costs over the long term is to proceed in a predictable manner and to build up sufficient volume in certain prioritised maturities to ensure good liquidity. Therefore, only to a limited extent does the Debt Office adjust the borrowing in government bonds to short-term conditions in the market. Since the Debt Office uses forecasts as a basis for government borrowing, we must sometimes account for unexpected deviations from these. Accordingly, to balance fluctuations in the net borrowing requirement, the Debt Office makes adjustments to the short-term borrowing. This means that the maturity varies within the steering interval.

There are different measures of term to maturity, and their purposes can differ. Regardless of which is used, maturity is a key factor affecting the cost and risk associated with the central government debt. For the Debt Office, refixing risk is

the primary measurement that should be obtained, rather than refinancing risk or market value risk.[9]

Since 2015, the Debt Office has used duration as a measure of maturity. The shortcoming of duration as a measure is that it is affected by movements in the market interest rate. This is turn provides an undesirable steering signal, which could lead to decisions that do not suit the objective. To appropriately measure the refixing risk associated with central government debt management, the Debt Office therefore proposes to instead use average time to refixing (ATR).

Cost is measured as average issue yield

In accordance with the Budget Act, the Debt Office is to minimise the cost of the central government debt over the long term while take into account the risk in its management. A long-term objective means that we conduct the borrowing with a high degree of transparency and predictability, which includes - having a strategy of not repurchasing outstanding bonds.

According to the Government's guidelines, the Debt Office shall measure cost as the average issue yield based on the valuation principle of amortised cost with continual revaluation of inflation and exchange rate fluctuations. This method follows international standards for the reporting of financial liabilities held to maturity and is suited to parties such as the Debt Office that as a rule do not repurchase debt.

A market valuation of the debt, which could serve as an alternative method for measuring the absolute costs, assumes that the debt can be amortised immediately – in full or in large part. It is not until then that an arisen profit or loss in terms of market value can be realised. When bonds, however, are held to maturity, the total cost corresponds to the average issue yield. Potential unrealised value changes then cancel each other out over the term to maturity.

Reporting the unrealised changes in value as a result of interest rate movements is therefore undesirable for a central government debt that is held to maturity. And because the Debt Office does not include value changes in its cost calculations, these should not affect the risk measure either, the purpose of which is to obtain the cost variation.

Maturity as a risk indicator captures cost variation

The term to maturity of the central government debt is an indicator that illustrates the trade-off between cost and risk in managing the debt. There is a distinct connection between the debt's maturity and variation in the average issue yield.

Variation in the average issue yield is driven by two factors:

[9] Refinancing risk refers to the risk entailed in raising new loans at the current interest rate, and at potentially different terms, because of maturing loans. Market value risk refers to the risk of variations in the debt's market value.

1) how often the debt's interest rate is refixed
2) how volatile the interest rate is.

If the debt is funded through loans with fixed interest and long maturities, it is refixed less often than if it is funded through loans with short maturities. If the interest-rate volatility is relatively constant for different maturities, the speed of refixing becomes the decisive factor for the cost variation of the debt. Longer maturity (lower speed of refixing) therefore indicates lower risk, whereas shorter maturity (higher speed of refixing) indicates higher risk. The results in table 2 and table 3 in the chapter "Reduced inflation-linked debt" confirm this relationship: funding strategies with a longer term to maturity have a lower risk.

Right maturity measure for Debt Office's purposes

The purpose of having a maturity interval is to set appropriate conditions for borrowing planning and among other things manage forecast deviations, not to manage changes in the maturity measure due to interest rate movements. The practical implications of the impact of interest rate movements may have been underestimated when duration was introduced in January 2015 as the measure for steering the debt's term to maturity.

The current steering measure – Macauley duration – is the present-value- weighted average repayment time of a debt instrument and takes into account all cash flows including coupons.[10] The present value is calculated by discounting the terminal value at the current interest rate. Duration is affected by interest rate level; when interest rates rise, the present value of the cash flows further into the future decreases more than for those closer in time. The cash flows in the near future are thus weighted up relative to those that are further ahead and the duration becomes shorter. The reverse occurs when interest rates drop. Although the measure captures the refixing risk by expressing the average remaining time until the interest rate is to be refixed, it can also change as a result of the interest rate environment while the composition of the central government debt stays unchanged.

One of the reasons the Debt Office introduced duration as a maturity measure is that the previous measure of maturity was relatively complicated. At the time, we assessed that the previous measure made it more difficult for outside parties to analyse the effects of a particular borrowing strategy. The Debt Office chose duration instead mainly because it was an established method. We made the assessment that variation in the measure due to movements in the market rate could be managed with the steering interval that was justified for other reasons. If interest rates were to rise or fall significantly over a longer period, the Debt Office could propose an adjusted interval in forthcoming guidelines. By the beginning of 2015 interest rates had already fallen sharply. And after less than three months

[10] In the Debt Office's *Financial and Risk Policy*, Macaulay duration is calculated from an approximation of modified duration. For instruments with complex cash flow structures, the yield may be undefined, and thus modified duration cannot be converted to Macaulay duration. In those cases, Macaulay duration is replaced by modified duration.

with the new guidelines, in an official letter to the Government, the Debt Office proposed to increase the steering interval.[11]

ATR – a better suited measure of refixing risk

As previously mentioned, ATR is another measure of maturity that captures refixing risk. A higher level indicates that it takes longer before a debt may potentially receive a new rate of interest. ATR is calculated as the weighted average remaining time until the interest rate is to be refixed. The weights are based on nominal amounts at the current exchange rate including accrued inflation. Because discounting is not used in this weighting method, ATR is not affected by interest rate level. ATR also captures refixing risk for debt portfolios that contain debt instruments with floating (variable) interest and interest rate derivatives that are relevant for the Debt Office.

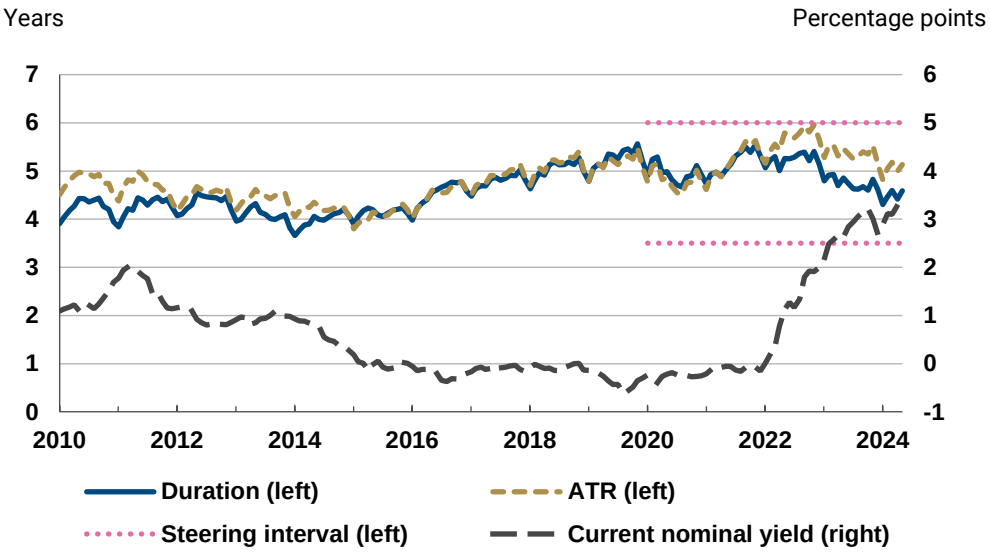
Interest rate sensitivity of duration leads to undesirable steering signal

Figure 7 shows that duration and ATR were close to each other between 2016 and 2021 when the interest rate level was relatively unchanged. Afterwards, interest rates rose drastically causing duration to drop to below ATR now. Both measures are still accommodated within the steering interval, but duration now indicates that the refixing risk should be higher than in 2020, while ATR indicates that it is largely unchanged. The interest rate sensitivity of duration thus provides an undesirable steering signal that could lead to decisions that do not suit the objective – for example, through us adjusting the steering interval to changes in the interest rate environment in order to maintain the same refixing risk. If we were to continue to use duration as a steering measure, we would need to consider lowering the upper and lower limits of the steering interval by approximately 0.5 years in order to take into account the change in interest rates.

Measuring maturity by duration also means that the current interest rate level may have an impact on the borrowing planning. When interest rates rise and duration thereby decreases, this could require us to extend the maturity by borrowing in government bonds with long maturities on that particular occasion. The Debt Office could, in other words, be forced to act on the basis of factors that are not justified by the fundamental debt management strategy. In summary, it is more suitable to have a steering measure that is not affected by changes in market interest rates.

[11] At that time, maturity steering was at a more detailed level and concerned individual segments of the central government debt. The steering interval that was adjusted was for the nominal krona debt's maturity for instruments with up to twelve years to maturity.

Figure 7 Historical development of ATR and duration for the entire central government debt



Note: Duration refers to Macaulay duration. The figure shows a one-month moving average for duration, ATR, and current nominal yield. Current nominal yield is the currently weighted average current yield of all instruments in the central government debt excluding inflation-linked bonds.

Source: The Debt Office.

ATM – a measure that does not capture the entire refixing risk

A measure closely related to ATR is the average debt fixing period or average-time-to-maturity (ATM), which measures the debt's weighted remaining time to maturity (residual maturity). A higher ATM indicates that it takes longer for the debt to reach maturity. ATM does not, however, capture the refixing risk for debt portfolios that contain instruments with floating (variable) interest rates or interest rate derivatives. Because the interest-rate fixation period is shorter than the debt commitment period for debt instruments with floating rates, ATM underestimates the refixing risk. As opposed to ATR, it is not possible to use interest rate derivatives to adjust ATM because the residual maturity cannot be changed in the same way as can the point in time when the interest rate will be refixed. The Debt Office uses interest rate derivatives as a tool for steering maturity, and the absence of that possibility is therefore an undesirable characteristic of a maturity measure.

ATM may, however, be used as an indicator of refinancing risk. This risk is closely associated with refixing risk. But in strict terms it refers to the risk of the central government failing to cover maturing loans, or it having to pay very high yields in order for investors to be prepared to lend money at all. The Debt Office has no quantitative steering target for refinancing risk, which has been motivated by the fact that it can create a cost that is disproportional to the risk we are trying to mitigate. This is the case mainly due to a small central government debt. The Debt Office nevertheless takes into account refinancing risk in accordance with point 22 and point 23 in the guidelines. We strive among other things to maintain an even

maturity profile for both nominal and inflation-linked bonds and contribute to a well-functioning government securities market.

New maturity measure but unchanged steering

The purpose of the Government's guidelines is to steer the trade-off between cost and risk at a general level in managing the central government debt. To avoid any ambiguity in the steering, it is preferable to use only one measure of term to maturity. The Debt Office thus proposes ATR, which is an established measure of refixing risk and still leaves room to adjust the term to maturity via interest rate derivatives. Importantly, the change does not mean that the Debt Office will steer the maturity of the central government debt in a new manner.

The Debt Office's analysis of the term premium (see the chapter on conditions) shows that there would be a small expected cost advantage to shortening the central government debt, but it would also increase the cost variation and thereby the risk. Our assessment is therefore that the current trade-off between cost and risk is appropriate. We will not change our strategy due to the change of maturity measure, and several factors that lead to variation in the term to maturity and affect the borrowing planning remain. We therefore propose that the maturity interval stay at between 3.5 and 6 years for the time being.

Appendix 1: Framework for the risk analysis

This appendix describes the analytical framework that the Debt Office follows in order to examine how the risk associated with the central government debt is affected by the debt's composition. The framework consists of three main parts.[12] The first one models the yield curve for both nominal and inflation-linked government bonds and estimates parameters for the yield (interest rate) curves. In the next step, we apply a time-series model to examine how these parameters and inflation interact. With the aid of the calculations from the time-series model, we can simulate a large number of future market interest rates and inflation paths. In the final step, we evaluate the cost variation for different portfolio choices on the basis of these simulations. Each step is described in more detail below.

A model for the yield curve

We model the yield curve with the aid of the Nelson-Siegel model (NS). The objective is to price both nominal and inflation-linked bonds regardless of maturity. The model describes the zero-coupon yield $r_t(\tau)$ at the time t with maturity τ as follows:

$$r_t(\tau) = \beta_{0,t} + \beta_{1,t} * \left(\frac{1-e^{-\frac{\tau}{\lambda}}}{\frac{\tau}{\lambda}}\right) + \beta_{2,t} * \left(\frac{1-e^{-\frac{\tau}{\lambda}}}{\frac{\tau}{\lambda}} - e^{-\frac{\tau}{\lambda}}\right).$$

Eq. 1

There are four parameters in the model. The first three are time-dependent and can be interpreted as the yield's long-term level $\beta_{0,t}$, slope $\beta_{1,t}$, and curvature $\beta_{2,t}$. The fourth parameter λ is assumed to be constant over time and steers how quickly the function for $\beta_{1,t}$ approaches zero and our function for $\beta_{2,t}$ reaches its maximum. The first three β- parameters are used as state variables in the time-series model below.

A time-series model for the state variables

In the second step, we model the state variables' development over time with the aid of a time-series model (vector autoregressive, VAR) as follows:

$$Y_t = \mu + \phi Y_{t-1} + \varepsilon_t.$$

Eq. 2

Where Y_t is a vector of monthly time series for eight state variables: inflation pace (inf_t), industrial growth (ipg_t), three parameters for nominal yields $(\beta^N_{0,t}, \beta^N_{1,t}, \beta^N_{2,t})$,

[12] For more information on the method that the Debt Office uses, see Diebold, F.; and C. Li, 2006, "Forecasting the term structure of government bond yields", Journal of Econometrics 130, pp. 337–364.

and three parameters for real yields *($\beta^R_{0,t}, \beta^R_{1,t}, \beta^R_{2,t}$).* The six parameters for the yield curves are estimated according to the NS model described in step one. The inflation pace is calculated on the basis of the consumer price index (CPI) over a one-year horizon. The VAR (1) model allows the state variables to affect each other with a one-month lag.

With the aid of the estimated μ and ϕ as well as a series for the stochastic error term ε_t, we can simulate the state variables' future values *(at t+1, t+2, etc)*. Y_{t+1} for example is expressed as follows:

$$Y_{t+1} = \hat{\mu} + \hat{\phi} Y_t + \varepsilon_{t+1}.$$

Eq. 3

We apply what is called a bootstrap method for creating ε_{t+1}, which means that ε_{t+1} is a random selection with replacement of the historical error terms according to equation 2. This method better captures periods with relatively high volatility, such as during the financial crisis of 2008 and the coronavirus pandemic, than the usual method whereby the error terms are assumed to be normally distributed.

With the simulated state variables, we calculate the zero-coupon yields according to equation 1 in the NS model.

Evaluation of risk for different compositions

To evaluate risk in different portfolio compositions based on the simulations, we first construct different funding strategies that form the basis for various compositions. We then calculate cost- and risk-measures in order to compare the risk between these compositions. Finally, we apply portfolio optimisation in this analysis to identify weights for a debt portfolio for which the risk is minimised.

Funding strategies

Funding strategies can vary in terms of maturity and share of inflation-linked bonds. Each instrument-specific funding strategy entails borrowing in either a nominal or an inflation-linked bond with fixed maturity. The borrowing occurs once a month and each strategy's nominal amount over time amounts to one krona. We pay the interest expenses on the central government debt via the central government generating a surplus in the other budget items.[13] The monthly refinancing requirement is thus a reciprocal value of the chosen fixed maturity expressed in months. A funding strategy with ten-year nominal bonds for instance involves borrowing 1/120 krona every month.

Different combinations of these instrument-specific funding strategies lead to different compositions of central government debt. The costs of such a combination are a weighted sum of costs for the individual funding strategies.

[13] The reverse is true if the funding strategies generate revenues, i.e. negative costs.

Costs

For each simulation, we calculate monthly costs of the funding strategies with different maturities for nominal as well as inflation-linked bonds. We use the sum of these monthly costs at an annual level to form the basis for the evaluation of risk. The borrowing costs are based on par yield. Par yield is defined as the coupon rate whereby the bond's market price is equal to its face value. For zero-coupon yields, the par yield is expressed as follows:

$$c_n = \frac{1 - \frac{1}{(1+y_n)^n}}{\sum_{i=1}^{n} \frac{1}{(1+y_i)^i}}$$

Eq. 4

Where c_n is the par yield with a maturity of *n* years and y_i is the zero-coupon yield with a maturity of *i* years. The formula is applied for both nominal and inflation-linked yields.

Both the coupon and the par value (nominal amount of the bond) are indexed with CPI with a three-month lag for inflation-linked bonds. The costs between month *t* and *t*+1 for an inflation-linked bond with par yield *c* and par value 1 are thus:

$$K_{t,t+1} = \underbrace{\frac{I_t}{I_b} * c * \left(\frac{I_{t+1}}{I_t} * \tau_{t+1} - \tau_t\right)}_{\text{Change in accrued coupon}} + \underbrace{\frac{\max(I_{t+1}, I_b) - \max(I_t, I_b)}{I_b}}_{\text{Change in accrued inflation compensation on par value}}.$$

Eq. 5

Where I_t (I_{t+1}) is CPI-lagged by three months at month t $(t+1)$, I_b is the bond's base index that is measured at the time of issue, c is par yield, and τ_t is expressed in years and is the length of time between month *t* and when the most recent coupon payment was made (i.e., $\tau_t = \frac{t}{12}, \tau_{t+1} = \frac{t+1}{12}$).[14]

For inflation-linked bonds, we adjust the calculation so that the CPI used to adjust the par value is not lower than the base index. This is to take into account the deflation protection the Debt Office offers investors that purchase inflation-linked bonds.

Evaluation of risk

By calculating the costs for a large number of simulations according to the above, we can create an empirical distribution of the average costs of each funding

[14] Below is an example in which we calculate the cost for January 2024 ($I_t = 408$) for a bond issued in January 2020 ($I_b = 336$) with par yield c at 2%. Otherwise, the coupon payment occurs in December so $\tau_t = \frac{1}{12}$ and $\tau_{t+1} = \frac{2}{12}$ and that $I_{t+1} = 409$. The cost is then:

$$\underbrace{\frac{408}{336} * 2\% * \left(\frac{409}{408} * \frac{2}{12} - \frac{1}{12}\right)}_{\text{Change in accrued coupon}} + \underbrace{\frac{409-408}{336}}_{\text{Change in accrued inflation compensation on par value}} = 0{,}5\%$$

strategy over a chosen evaluation period. Based on this empirical distribution, we can calculate different risk measures, as illustrated in figure 1.

We measure risk with relative Expected Shortfall (rES) at a 95 per cent confidence level. The measure shows the difference between a high cost (the expected average annual costs that exceed the 95th percentile) and an average of the annual costs obtained as follows:

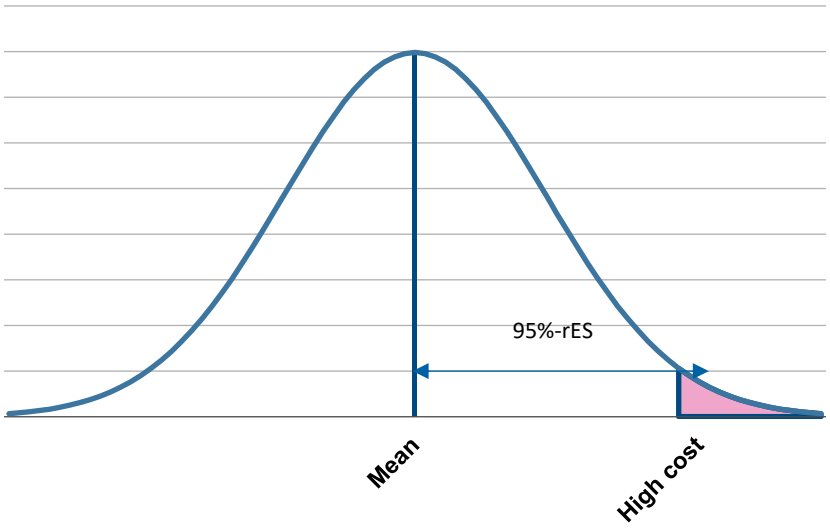
$$rES_{\alpha} = \frac{\sum_{K_s(t,t+\tau) \geq CaR_{\alpha}} K_s(t,t+\tau)}{(1-\alpha)*S} - \frac{\sum_{s=1}^{S} K_s(t,t+\tau)}{S},$$

Eq. 6

Where K_s is the average annual cost of simulation s and S is the number of simulations, τ is the evaluation period, and α is the chosen confidence level of 95 per cent. The first term measures the average cost of the simulations that are above the confidence level. The other term measures the average cost of all simulations. A high rES value indicates that the investment strategy shows high cost variation, which indicates a higher level of risk.

To evaluate how inflation affects an inflation-linked bond's risk, we break down the cost of inflation-linked bonds into two components: an interest component and an inflation component. The interest component is the cost that arises due to inflation-linked yields. The inflation component arises when CPI changes. With the aid of the two subcomponents, we can calculate the rES contribution from each individual component.

Chart 1 Distribution of average annual costs and risk measures



Note: The chart illustrates the distribution functions and relative Expected Shortfall (rES) with a confidence level of 95 per cent. The purple area indicates the part of the distribution function that forms the basis for the calculation of rES.

Source: The Debt Office.

Portfolio optimisation

We are exploring whether the risk associated with the central government debt can be reduced by combining different funding strategies. For this purpose, we use portfolio optimisation. A debt portfolio with a certain term to maturity can be achieved using a combination of different instruments. For example, a ten-year funding strategy can be combined with a one-year funding strategy in equally large parts, giving this portfolio an average time to maturity of 2.75 years. When performing portfolio optimisation, we look for weights for individual funding strategies that minimise rES for the entire portfolio with the constraint that the average residual maturity reaches a certain level (e.g. 3 years) and that the weights add up to one. Negative weights are not allowed.

The Swedish National Debt Office is the central government financial manager and the national resolution and deposit insurance authority. The Debt Office thus plays an important role in the Swedish economy as well as in the financial market.

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