RIKSGÄLDEN
SWEDISH NATIONAL DEBT OFFICE

Central Government Debt Management

Proposed Guidelines 2009–2011

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Contents

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Summary

In this memorandum, the Swedish National Debt Office presents its proposals for the overarching guidelines for the management of central government debt as provided for in the Instruction for the National Debt Office (2007:1447). The proposal is based on the Act (1988:1387) on Central Government Borrowing and Debt Management, according to which the central government debt is to be managed in such a way as to minimise the long-term cost of the debt while taking into account the risks inherent in such management. In addition, management shall take place within the constraints imposed by monetary policy.

This year's proposed guidelines start with a discussion on the development of the central government debt and the consequences for central government debt management. We have once again experienced a year with a sharp reduction in central government debt. This reduction in central government debt is largely due to the high level of economic activity and the Government's decision to sell certain state-owned companies and shares[1]. We look into the future with the aid of calculations where we indicate the consequences for the development of central government debt, on the basis of the Riksdag's and the Government's surplus target for general government net lending. We also review the forecasts of the central government net borrowing requirement made by the Government, the National Institute of Economic Research and the National Financial Management Authority. The overall picture is that central government debt may fall sharply during the period covered by the proposed guidelines. The proposed guidelines have thus been prepared on the basis of central government debt being in the range of SEK 900–1,000 billion in 2009, and which may further decrease to around SEK 800 billion during 2010–2011.

The gradually falling debt level affects the direction of central government debt management. It changes the view of the balance between expected cost and risk, given that there is more scope for taking risk in exchange for lower expected costs. Lower central government debt also means that the debt management eventually has to be adjusted so that the liquidity of the instruments is upheld. However, our assessment is that there is no need to change the basic loan strategy or supply of type of debt in the next few years. In this respect, our assessment is the same as last year. The development of the central government debt has to date reinforced our view of the possibility of increasing risk-taking in exchange for lower expected costs within the framework of efficient central government debt markets.

[1] *It should be noted that we are referring here to the state of the economy in the previous year since central government payments are affected with a time lag.*

We also discuss how a lower central government debt, in particular the fast reduction, affects the control system that has developed since the start of the guideline process. By definition, the control system contains the variables that the Government includes in the annual guideline decisions. In the current state of the economy and public finances, problems arise in exercising the same extent of control as to date. We therefore recommend that the Government in future should set separate maturity targets for each of the three types of debt, unlike today when decisions are made on one target for the aggregate maturity of the debt. We furthermore propose that the control of the debt percentages should be put on a more long-term footing. Both these proposals aim at reducing the need for expensive adjustments, which are difficult to justify from the point of view of risk.

We then present the proposed guidelines for central government debt management for 2009–2011. Based on the analyses and considerations that we have made in this year's work on the guidelines, we propose that the maturity of the nominal SEK debt should be shortened from the present 3.5 years to 3.2 years. This maturity shall be achieved at the latest by the end of 2010. As we noted before, lower central government debt provides scope to take higher risk in exchange for lower expected costs. Our analyses indicate that a shorter maturity should lead to lower costs without an appreciable increase in risk. However, a crucial aspect is the long-term nature of the yield curve. All in all, we consider that it is justified to expect that the yield curves on average will have a positive slope in the future, which provides the prerequisites for lower costs with shorter maturities. We also consider that it is possible to maintain sufficient issue volumes in the bond market to ensure good liquidity. We are not proposing any changes of the maturity in the foreign currency debt and in the inflation-linked debt compared with the basis for previous proposed guidelines.

We see no reason to propose changes in the target percentages for types of debt. As shown above, we do consider, however, that the debt percentages should be put on a more long-term footing. We do not either find reason to change the guidelines for position-taking, market and debt maintenance or retail market borrowing.

Finally, we present the ongoing work of drafting a main document on central government debt management. The aim is to produce a comprehensive description of the current direction of central government debt management with the intention of facilitating overview and understanding. It should be underlined that the document will not replace the proposed guidelines and guideline decisions, but serve more as a reference book and source.

In the guideline decision for 2008, the Government instructed the Debt Office to review the analysis underlying the target percentages for the foreign currency and real debt. The main document, as described below, will serve as a natural starting point for this review. This year, we have concentrated on the issue of the maturity of the nominal debt, where the analysis leads to proposed changes of the guidelines. Furthermore, there is at present very little scope for steering the share of inflation-linked debt. All in all, we have therefore opted to wait with a review of the percentages.

The Government also instructed us to analyse the performance and design of the repo facility and to review the composition of the foreign currency debt. The Government also drew to attention that the proposed guidelines in autumn 2008 were to include a report on the development work carried out to date. A separate report will be made on the analysis of the repo facility in October, however. The review of the composition of the foreign currency debt is in process.

1. The future development of central government borrowing

The size and development of the central government debt affects the direction of central government debt management. We therefore start the proposed guidelines, in the same way as last year, with a discussion on the development of the central government debt and the consequences that this development may have.

1.1 The central government borrowing requirement

During the period 1991–2007, the central government debt exceeded SEK 1 000 billion, most often by a broad margin. The debt increased when growth was weak in the economy and decreased when growth was strong. This pattern is explained by low income and a high level of expenditure for the state coinciding with weak economic activity, while the converse applies with a high level of economic activity. The last few years GDP has grown sharply and at present, the state budget is showing large surpluses and the central government debt is decreasing in nominal terms and in relation to GDP. As from 2009, the debt is expected to be lastingly below SEK 1,000 billion.

The political aim to maintain a surplus in central government finances over a business cycle is expected to lead to a continued shrinking of central government debt. This aim is based on the development of the composition of the population with a more or less long period with a higher proportion of elderly people. This will lead to a greater burden of support for those economically active in the next few decades. This burden can be alleviated by allowing the state budget to be in deficit at that time, which assumes a low level of central government debt in the initial position. If the target of the Riksdag and the Government of a one per cent surplus in general government net lending, over a business cycle, is achieved, the central government debt will decrease by SEK 15–30 billion per year.

The forecasts from the National Financial Management Authority (FMA), the National Institute of Economic Research (NIER) and the Government also indicate a development with decreasing central government debt. This is due to an expectation of relatively good years for public finances, despite the slackening of economic activity. Furthermore, sale of state-owned companies will produce income in the state budget. The scenario is unequivocal despite the forecasts being made with different calculation assumptions, in particular as regards the extent to which changed tax and allowance rules have been taken into account.

1.1.1 The surplus target and the borrowing requirement

The surplus target for general government net lending entails a slow decrease in central government debt in the long term. In this section, we provide an outline of the effect of different surplus outcomes on the development of the central government debt. It is important to point out that these calculations should not in any way be compared with the Debt Office's ordinary forecasts, which are published three times a year. Those forecasts are made in a quite different way and only extend over the present and coming year. Accordingly, the calculations presented here do not serve as the basis for any operational loan plans in the Debt Office's debt management. However, these calculations form part of the assessment of the future size of the central government debt.

On the basis of the Riksdag's and the Government's target for a surplus equivalent to one per cent of GDP on average over a business cycle, it is possible to produce a rough estimate of the state's net borrowing requirement. The surplus target relates to the whole general government net lending, which consists of the state, the old age pension scheme and the local government sector.[2] By first calculating net lending in the old age pension scheme and the municipalities and county councils, a figure for central government net lending up to the equivalent of one per cent of GDP can be arrived at. The central government net borrowing requirement is subsequently calculated as net lending for the state, with reversed signs, adjusted for those payments that affect the borrowing requirement but not net lending.

Net lending in *the old age pension scheme*, which consists of the pension insurance (AP) funds, is expected to decrease gradually during 2008–2015. This reduction is attributable to the relatively substantial increase in pensions paid, partly due to an increasing number of old age pensioners. This year, net lending amounts to the equivalent of 0.7 per cent of GDP. Next year, net lending in the

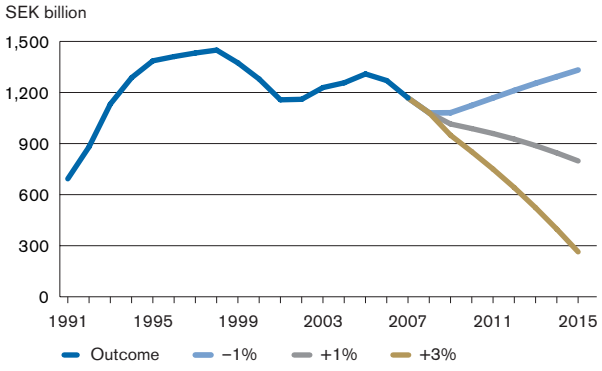
[2] *The local government sector consists of municipalities and county councils.*

old age pension scheme is estimated to have decreased to the equivalent of 0.5 per cent of GDP, to gradually decrease to the equivalent of –0.1 per cent of GDP by 2015.[3]

This year and next year, net lending in the local government sector is expected to amount to the equivalent of 0.2 and 0.1 per cent of GDP respectively.[4] As from 2010, we assume, however, that local government net lending is zero. While the municipalities and county councils have reported an overall surplus in recent years overall, it is difficult to conceive that they can sustainably maintain positive net lending at the same time as the requirements for public services grow apace with the demographically-conditioned needs. It is expected that the county councils and municipalities will generally comply with the requirement for a balanced budget but not more than so. This assumption seems reasonable in the light of the fact that the net lending of municipalities and county councils averaged –0.1 per cent in relation to GDP during the period 1993–2005.

Consequently, net lending for *the central government* for 2008–2015 is calculated at the equivalent of 0–1.1 per cent of GDP. Since the surplus in central government payments (and thus the change in central government debt) corresponds in principle to net lending for central government, there will correspondingly be annual central government surpluses of SEK 0–47 billion. The exception is sales income from privatisation of state-owned companies, which is expected to increase the surpluses in 2008 and 2009 by an additional SEK 86 and 50 billion respectively. All in all, this will result in a gradually reduced level of central government debt from the current level of around SEK 1,000 billion to around SEK 800 billion in 2015 (see figure 1).

Figure 1. DIFFERENT ASSUMPTIONS ON THE SURPLUS TARGET AND THE DEVELOPMENT OF CENTRAL GOVERNMENT DEBT



In the projections of the development of central government debt, it is appropriate to take deviations into account (we can, for example, regard this as temporary surplus targets) by introducing an interval around the formal surplus target of one per cent. Let us therefore assume a deviation of two percentage points above and below the target. This interval can be compared with the historical development. Since the surplus target was introduced in 2000, the state's budget balance has on average totalled 0.9 per cent of GDP, with a standard deviation of 2.3 percentage points. The assumed deviation above means that while the debt can be expected to decrease in the course of the next few years by an amount in the range of SEK 200 billion repeated deviations in the same direction during this period will entail an uncertainty interval of SEK ±500 billion kronor at the end of the period (see figure 1). If these deviations move in different directions, which may be regarded as most probable, the interval will be narrower.

It must be added to the above reasoning that the Government may opt to deviate from the long-term target during relatively long periods of time. At present, the forecasts indicate that the surplus in general government net lending during the current business cycle will exceed the surplus target.

1.1.2 Forecasts vary but all indicate reduced central government debt

An alternative way of looking into the future is to start from available forecasts. By replacing the Riksdag's and the Government's aim for general government net lending by forecasts of the central government borrowing requirement, it is possible to obtain a supplementary picture of the development of central government debt in the next few years. The greatest benefit of this forecast information is, of course, in the short term (within a couple of years), while, in the longer term, it is similar to a consequence estimate where development is permitted to be guided by, for example, demographic changes.

The Debt Office publishes forecasts of the central government borrowing requirement for the current and following year. According to the most recent report from 27 June 2008, the net borrowing requirement will be negative in both years, and the central government debt will accordingly continue to decrease.

Corresponding assessments are made by FMA, NIER and by the Government.[5] Unlike the Debt Office, they also make slightly longer-term forecasts. The methods for these

[3] *Source: The National Institute of Economic Research, The Swedish Economy, August 2008, The Swedish Economy 2010–2015. The corresponding information on net lending in the old age pension scheme is also reported by the Government in both the Budget Bill and the Spring Fiscal Policy Bill.*

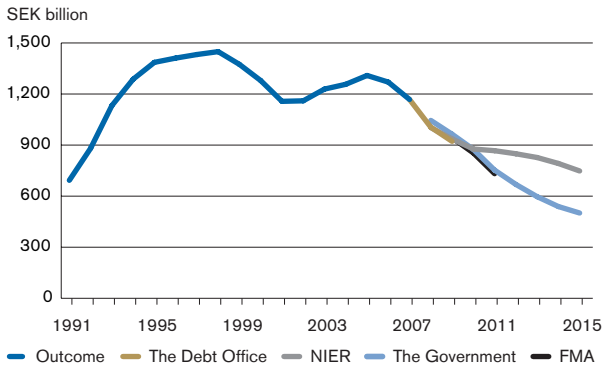
[4] *Source: The National Institute of Economic Research, The Swedish Economy, August 2008.*

[5] *The forecast from FMA is contained in Budget Forecast 2008:3. NIER refers to data reported in The Swedish Economy, August 2007 and the Government's forecast comes from the Budget Bill for 2009.*

forecasts differ, however, from the methods for short-term forecasts. Among other things, models are used according to which, the economy is adjusted in a few years' time to balanced resource utilisation. Furthermore, the forecasts are sometimes adjusted to the Riksdag's and the Government's target for general government net lending, possibly taking demographic conditions into account. In these circumstances, FMA will produce forecasts until 2011, while both NIER and the Government produce forecasts until 2015.

In common for all forecasts is that central government debt is expected to decrease in the next few years (see figure 2). As from 2009, the central government debt is expected to be less than SEK 1 000 billion.[6] The differences between the forecasts with respect to the size of central government debt for the years up to and including 2010 are negligible with respect to the guidelines. The forecasts for the following years show relatively different trends with respect to the development of the debt. NIER makes the assessment that the debt will decline somewhat slower compared with the years covered by the short-term forecast. In 2011, the debt reduction is almost negligible; thereafter the debt reduction accelerates gradually. FMA and the Government consider, however, that the debt will decrease slightly more quickly in 2011 compared with previous years. FMA does not make any forecast for the following years, while the Government's forecast from 2012 onwards indicates a gradual reduction in the rate of decrease up until 2015. The difference in the development rates leads to NIER's forecast concluding with a central government debt of SEK 750 billion in 2015, at the same time as the Government's forecast decreases to SEK 500 billion. For the year 2011, which is the last year covered by these proposed guidelines, the forecasts indicate a central government debt of roughly between SEK 700–900 billion.

Figure 2. THE DEVELOPMENT OF CENTRAL GOVERNMENT DEBT, OUTCOME 1991–2007 AND FORECASTS 2008–2015



To make best use of the forecasts, it is essential to note that they differ in a number of important ways. To start with, the forecasts are published at different times, which mean that they can be based on different macroeconomic information and different regulatory frameworks.[7] FMA and the Government make forecasts for the first three years assuming unchanged tax and allowance rules, and an unchanged direction of public consumption. The exception is that the government, in the budget bill, include the effects of the proposals. FMA does not make a forecast for the subsequent years, while the flexibility of the Government's forecast increases. Among other things, the Government's forecast reflects the effects of a demographically conditioned need of care and social services. This means that public consumption will be adapted so as to maintain the standard per recipient unchanged.

However, NIER makes an assessment of the direction of fiscal policy for all coming years. Measures that affect net lending are allocated to income, expenditure and public consumption with the support of standardised methods. In the longer term, in the so-called medium-term estimate up to the end of 2015, only data for public consumption and transfers to households are adjusted. By that means, net lending is adjusted so as to amount to 1 per cent of GDP at the end of the period, i.e. the Government is assumed in time to comply with the surplus target.

These method differences entail that FMA and the Government anticipate a relatively sharper reduction in the central government debt by 2011 compared with NIER, since NIER has placed successive measures in the budget which entail an adaptation to the surplus target. In the following years, for which the Government no longer reports details of income titles and expenditure areas, the rate of decrease of the development of central government debt is slowed down in the Government's forecast. The difference in the amount of central government debt continues to grow compared with NIER, although not as rapidly as before. The different development rates can somewhat simplified be described as NIER steering the forecast towards the surplus target while the Government's forecast reflects the effect of increased public consumption due to a growing proportion of elderly people.

1.1.3 Conclusion

We have shown that there are a number of different assessments of the development of central government debt. These indicate that the central government debt

[6] *Variations in the borrowing requirement during the year mean that the central government debt may be less than SEK 1 000 billion already during 2008, and furthermore exceed this level temporarily during 2009. The information stated for the forecast refers to the size of the debt as at 31 December.*

[7] *In technical terms, the Government reports forecasts for both the budget balance and consolidated central government debt. NIER, on the other hand, only provides a forecast of central government net lending, from which it is possible to approximately estimate the budget balance and central government debt.*

roughly amounts to SEK 700–900 billion in 2011 and to SEK 500–750 billion in 2015. The results are equivalent to an annual general government net lending of one to two per cent of GDP. Viewed in a historical perspective, this corresponds to a very high level of the budget balance.

The differences between the forecasts show that there is considerable uncertainty attached to forecasts of future development. One factor that contributes to this uncertainty is the interpretation of the Riksdag's and the Government's aim with respect to general government net lending. To what extent will this goal be set off against other political priorities? Another factor that contributes to uncertainty is the development of the business cycle. In a few years' time, the borrowing requirement is assumed to result from an economy with balanced resource utilisation. However, at present, the borrowing requirement is lower than normal, partly due to the cyclically high tax income from capital and work.[8]

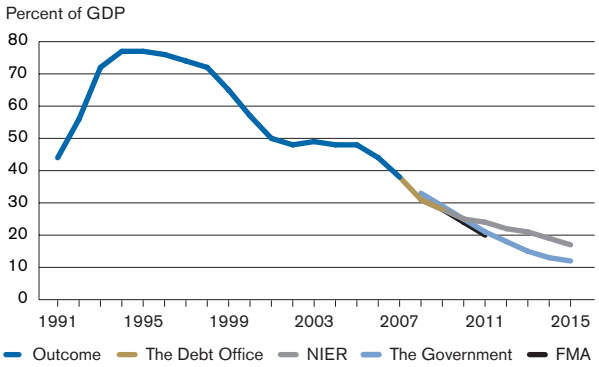
All in all, the available information indicates that the central government debt will fall during the period covered by the proposed guidelines. This development is not wholly unlike that which took place in the early 2000s, although we cannot find support in the present situation for the decline being slowed down in the same way as in 2002–2003. Accordingly in the following we will base our proposed guidelines for central government debt management on a debt in the range of SEK 900–1,000 billion during 2009, which may reduce further to about SEK 800 million during 2010–2011.

1.2 Central government debt management and a shrinking debt

In last year's proposed guidelines, we discussed how central government debt management is affected by a reduced debt. We noted that the positive development increases the scope for taking risk per borrowed krona within the framework of an overall risk limitation. We make the same assessment this year. The development with large surpluses in central government payments has continued and the information we now have indicates an additional reduction in central government debt in relation to GDP (see Figure 3), which strengthens our view of the possibility of increasing risk in exchange for lower expected costs.

[8] *It should be noted that the level of tax payments this year depends to a certain extent on the level of economic activity in recent years.*

Figure 3. DEVELOPMENT OF CENTRAL GOVERNMENT DEBT AS PERCENT OF GDP, OUTCOME 1991–2007 AND FORECASTS 2008–2015



We further discussed the effects on the practical management of the debt. Among other things, we noted that the developed infrastructure with liquid markets, good investor confidence and well-established dealers which contribute to long-term lower costs should be taken care of. As last year, we make the assessment that there is no need to change the basic loan strategy or issuance of types of debt during the coming years. If the central government debt develops according to the description in section 1.1 up to 2011, the Debt Office can adapt its actions within the proposed guidelines without deviating from the goal of keeping costs to a minimum, despite volumes and perhaps also the number of maturities being reduced.

In time, central government debt management may, however, be faced with a decision to choose between market segments and instruments that we use. However, it is far from certain that the central government debt reaches levels which call for more far-reaching changes. Bearing in mind, the uncertainty of the forecasts, there is also some probability that the debt will increase again. In this situation, it would be beneficial if the infrastructure that has developed over the years is still available. Experience shows that it requires both time and money – in the form of more expensive borrowing – to build up efficient markets and a good infrastructure.

All in all, this indicates that there is at present scope to increase risk in exchange for lower expected costs within the framework of efficient markets for government securities. However, the conclusion does not provide any guidance as to the size of the risks that should be taken. We will come back to this issue in section 3.2, where we discuss our choice of maturity.

2. Adjustments of the control system

The Debt Office's proposals

The debt percentages shall be controlled in a long-term perspective. The deviation interval for the inflation-linked percentage shall be abolished. The Government shall continue to decide on a deviation interval for the percentage of foreign currency debt.

The Government shall make decisions on the maturity for the respective type of debt. The Debt Office shall decide on operational deviation intervals.

Decision-making levels and decision-making parameters are set through the control system for central government debt management. The starting point is the Central Government Borrowing and Debt Management Act (1988:1387) where goals and an overall division of responsibility are established. The Government then controls the cost and risk of the central government debt at a superior level, mainly by establishing the composition and maturity of the debt. The Government delegates the task of managing the debt to the Debt Office within set frameworks. A further aspect of the control system is the design of decisions, for example, the time frame in which a benchmark is to be reached.

Bearing in mind the expected development of the central government debt, it is appropriate to make certain adjustments in the control system. Henceforth, it is also about controlling the composition of the debt and its maturity. However, it is fit for the purpose to view the goals in a longer time perspective and to control the management through the Government making decisions on a slightly different set of variables. We will discuss this in more detail below.

2.1 The current control system

The foundation for the present control system – that the Government shall decide on the composition and maturity of the debt – was stated already in the Bill where the transition to annual guidelines was suggested. The exact design of the decision has subsequently been developed over the years.

In the guidelines for 2007, the Government established that it controls debt management by specifying the target values for the percentages of foreign currency and inflation-linked debt and a control interval for the percentage of foreign currency debt.[9] Furthermore, the Government set a target value for the maturity of the aggregate debt. Table 1 shows a compilation of the control variables that the Government makes decisions on and some of the variables that the Government has instructed the Debt Office to make decisions on.

Table 1. THE CURRENT CONTROL SYSTEM FOR CENTRAL GOVERNMENT DEBT MANAGEMENT

Government decision	•Target value, percentage foreign currency debt • Control interval, percentage foreign currency debt • Target value, percentage inflation-linked SEK debt • Target value, (residual), percentage nominal SEK debt • Target value, average interest-rate refixing period, (AIP), total debt
The Debt Office (board decision)	• Deviation interval, percentage inflation-linked debt • Benchmark, AIP (foreign currency, inflation-linked, nominal) • Deviation interval, AIP (foreign currency, inflation-linked, nominal)

2.2 New prerequisites

The current state of the economy with large budget surpluses and rapidly decreasing central government debt entails problems with the application of the current control system. Today's design is well-suited to a relatively large debt, which – above all – develops at an even pace. We now see another development ahead of us. In section 1.1, we have shown that the central government debt can be expected to decrease in the next few years. We discuss here how the control system can be modified to correspond better to current and future conditions.

2.2.1 Control of percentages

When the net borrowing requirement moves from being positive to negative, this makes adjustments of debt percentages more difficult. This is because we generally retain loans to maturity since buybacks may be expensive for the state and there are no derivative instruments to affect the size of the inflation-linked debt. This means that we are able to affect the debt percentages mainly by new borrowing.

[9] *The Government also noted that percentage control of the foreign currency debt should apply from the time that the target value had been achieved. The justification for waiting with percentage control of the foreign currency debt was that the actual percentage markedly exceeded its benchmark. The target was achieved in 2008 and the Government decided on 28 August 2008 (Fi2008/3736) that percentage control would also apply to the foreign currency debt.*

In this way, the gross borrowing requirement, which is defined as the total of the net borrowing requirement and maturing loans, is crucial for the ability to steer the percentages towards their respective target. When central government debt gradually decreases – the net borrowing requirement is negative – the quantity of maturities also decreases, and thus the gross borrowing requirement. Borrowing will then be a small percentage of the total debt and a weak instrument, making control difficult.

Deviations from the target percentages generally become larger the larger the central government budget is in relation to the size of central government debt. This is because a larger central government budget often gives rise to large, in absolute terms, fluctuations in the budget balance, which in turn leads to larger percentage changes in the central government debt. Moreover, deviations can become greater and more enduring if the central government budget has been in surplus for a long period of time. All in all, this makes it difficult in the future to steer debt percentages rapidly towards the target values. Instead, the percentages must be permitted to temporarily deviate from the respective target to avoid unjustified costs in connection with forced buybacks.

In practice, it is the percentage of inflation-linked debt that is difficult to steer towards its target value. The long average maturity of inflation-linked bonds means that the proportion of maturities during a particular year is often zero. There are also no derivative instruments which would make it possible to exchange the inflation-linked undertakings at a reasonable cost. It is accordingly not possible to rapidly decrease the percentage of inflation-linked debt without carrying out buybacks.

The percentage of inflation-linked debt is at present around 30 per cent, i.e. outside the upper interval limit of 27 percent. If we extend the time perspective, our calculations indicate that the inflation-linked percentage will probably be at levels above 30 per cent. The percentage of inflation-linked debt will decrease to a greater extent only when the loans mature. Loan 3106 matures in 2012 although the percentage, despite this, will still be above the target percentage of 25 per cent. The next large maturity is 2015 when loan 3105 matures. This loan is large and the proportion of inflation-linked debt therefore decreases considerably. It is therefore quite possible to reduce the percentage to around 25 per cent by 2015. With reference to this and to the uncertainty concerning the development of the borrowing requirement in the longer term, we have made the assessment that the control of inflation-linked percentages should be carried out with a long-term approach.

It follows from the above discussion that the Debt Office is now pointing out the need to extend the time for adjustment of the inflation-linked debt and the percentages of the nominal SEK debt.[10] The justification is to avoid unnecessarily high transaction costs and to create predictability in borrowing and management. As far as predictability is concerned, it is important to point out that this is in the first place about avoiding short-term irregularities in the issue volumes.

We also propose that the deviation interval around the percentage of inflation-linked debt be abolished. The Government has instructed the Debt Office to establish a deviation interval in which the inflation-linked debt is permitted to vary for operational reasons. This interval reflects that there are no prerequisites, either in the short or medium-term, for controlling the inflation-linked debt other than roughly. The interval is also a reflection, as we noted in previous proposed guidelines, that the choice of percentage is arbitrary to some extent.[11] The expected development of the inflation-linked share, in combination with the actual difficulties of controlling the percentage, means, however, that the deviation interval cannot be expected to have any real function within the time period of the proposed guidelines (2009–2011).

Moreover, we propose, in accordance with the present guidelines, that deviations from the target percentage should not be subject to quantitative evaluation. The reason for this is that deviations depend on operational limitations in the ability to control the debt, not on position-taking based on assessments of the future. The development of the percentage of inflation-linked debt should continue to be carefully monitored, of course.

2.2.2 Control of maturity

The development of the central government debt also entails problems with controlling maturity. According to the current system of control, the Government decides on an aggregate maturity for the central government debt and allows the Debt Office to distribute this maturity to the three different types of debt. It should be noted that the aggregate maturity is not a control variable in the operational management but a decision-making variable for the Government.[12]

[10] *The percentage of the nominal SEK debt consists of a residual of the percentages of the foreign currency and the inflation-linked debt. A change in the control of inflation-linked debt also affects the nominal debt therefore. A more detailed description is contained in the proposed guidelines for 2007. (Proposed Guidelines for Central Government Debt Management, 2007–2009, dnr 2006/1679).*

[11] *It is, for example, difficult to say with certainty that, for example, a percentage of 25 per cent would produce a more beneficial diversification effect than a percentage of 30 per cent. However, there should theoretically be a level where the percentage, despite everything, is too large or too small to contribute to a diversification effect, which could then be reflected in the interval size. However, it may be noted that it is very difficult to establish this level.*

[12] *See last year's guideline proposal (Central Government Debt Management, proposed guidelines 2008–2010, dnr (ref. no.) 2007/1397) for a detailed description.*

In theory, this approach is attractive, since it can provide a clear picture of the direction of debt management. One benchmark for the maturity of the whole debt enables the Government to express the trade-off between expected cost and risk at a superior level. At the same time, the opportunities increase, at least theoretically, to balance increased risk-taking in one type of debt with a reduction of risk exposure in another component of the debt. The Debt Office accordingly would, through an extension of the maturity of one type of debt and a shortening of the maturity of another type of debt, in principle be able to reduce the expected costs at the same time as the level of risk is maintained unchanged.

In practice, however, such trade-offs are difficult to make other than at an overall level and in qualitative terms. This is because of the marked differences in the characteristics of the different types of debt and conditions in the various markets where the instruments are traded. In the first place, the maturity of the foreign currency debt is very short (0.125 years). Changes of the maturity can thus in practice only be made as extensions. In the second place, the maturity of the inflation-linked debt cannot in practice be affected in any other way than through new issues, exchanges and buy-backs. With reference to the targets for the debt percentages and the liquidity of the inflation-linked market, it follows that the passage of time, which brings outstanding bonds closer to maturity, is the predominant factor controlling the maturity of the inflation-linked debt.

A third aspect is the difficulty of countering fluctuations in the debt percentages. The interest-rate refixing period for the respective type of debt is what affects the aggregate maturity in combination with the size of the percentages. There may be deviations from the target percentages in the practical management of the central government debt. These may be based, for example, on unforeseen fluctuations in the borrowing requirement. If the Debt Office had been given the task of controlling the aggregate maturity, on the basis of the actual debt percentages, we would have been obliged to counter the deviations from the percentages by changes in the maturities of one of the types of debt. Adjustments of this kind could lead to unjustified transaction costs, which would not be in proportion to the benefits of an aggregate maturity measure.

By instead weighting together the maturity of the target percentages, it would have been possible to avoid expensive adaptations. This is practical and in addition informative as long as the actual percentages are close to the targets. This is usually the case when the debt is developing at an even pace. When the debt is instead, changing rapidly and the actual debt percentages are no longer close to the target percentages, it follows that the real maturity of the aggregate debt has little to do with the maturity that we report. This is the situation we have today, which has made the aggregate maturity measure difficult to interpret. It should also be noted that when the debt percentages deviate from their target values, it is possible to achieve the target set by the Government for aggregate maturity despite the actual aggregate maturity being higher or lower. This in turn means that the balance between the expected cost and risk of the central government debt can de facto deviate from the mix desired by the Government.

2.3 Proposed adjustment of the control system

Based on the above discussion, we propose certain modifications of the control system.

Firstly, we propose that the time horizon for achieving the target percentages be extended. In practice, this means that the debt percentages should be permitted to deviate from the targets over a longer period of time. As discussed above, it is therefore reasonable for the control system to have a long-term time horizon. In this context, we also propose that the deviation interval around the percentage of inflation-linked debt be abolished.

Secondly, we propose that the Government make a decision on the maturity for the respective type of debt. Separate target values will give a clear picture of the balance between expected cost and risk for the three types of debt. Moreover, separate target values will have the advantage that undesirable deviations in a particular type of debt are not compensated for by a further undesired deviation in another type of debt. However, to be able as before to provide a reasonably clear picture of the balance between expected cost and risk in the whole central government debt, it is appropriate for the Debt Office to continue to calculate and report an aggregate debt maturity measure, based on the actual debt percentages.

With reference to the above discussion, the Debt Office advocates an arrangement on the lines of table 2.

Table 2. PROPOSED NEW CONTROL SYSTEM FROM 2009 ONWARDS

Government decision	• Target values, debt percentages (foreign currency, inflation-linked) • Control interval, debt percentage (foreign currency) • Target values, average interest-rate refixing period, AIP (foreign currency, inflation-linked, nominal)
The Debt Office (board decision)	• Deviation interval, AIP (foreign currency, inflation-linked, nominal)

3. Proposed guidelines

3.1 The composition of central government debt – percentages

The Debt Office's proposals

The percentage of foreign currency debt should be 15 per cent of the central government debt. The control interval around the benchmark should be ±2 percentage points.

Inflation-linked SEK debt should be steered in the long-term towards a percentage of 25 per cent of the central government debt.

In addition to inflation-linked SEK debt and foreign currency debt, the central government debt should consist of nominal debt in SEK. The target percentage of the nominal SEK debt, as a direct consequence of the targets for other debt percentages, will be 60 per cent of the central government debt.

The debt is allocated to foreign currency debt, inflation-linked SEK debt and nominal SEK debt.[13] By allocating the debt to several types of debt, we can reduce the risk of the debt, i.e. we obtain a diversification effect. However, we do not consider that there are any strong reasons to estimate that the expected costs will be affected to any great extent by the choice between nominal SEK debt, inflation-linked SEK debt and foreign currency debt.

3.1.1 The percentage of foreign currency debt

Current guidelines and proposals

The Debt Office's proposals correspond to the current guidelines.

Considerations

Since the end of the 1990s, the state has endeavoured to reduce the percentage of foreign currency debt. To control the pace of reduction of the foreign currency debt, the Government previously proposed an annual benchmark for the amortisation. In the guidelines for 2005, the Government also set the target for the percentage of foreign currency debt at 15 per cent.

The target of 15 per cent foreign currency debt was achieved in mid-2008. The Government therefore decided on 28 August 2008 (Fi2008/3736) to rescind the previous decision on a benchmark for the pace of amortisation. At the same time, it was confirmed that the Debt Office should steer the foreign currency debt towards 15 per cent with a control interval of ±2 percentage points.

We recommend that the foreign currency share should continue to be 15 per cent of the total central government debt. Previous analyses have indicated that this percentage may be considered to be a reasonable trade-off between positive diversification characteristics and the exchange rate risk attached to foreign currency debt. We do not consider that any new factors have arisen to alter the previous conclusion.

In last year's proposed guidelines, we wrote that we intended to review the composition of foreign currency debt in 2008, a measure which the Government supported. We considered that there were reasons in the analysis of the currency composition of the foreign currency debt to shift the focus from the aim of endeavouring to obtain a low currency risk to striving for lower expected costs. The background to this was that we noted that a smaller central government debt provides scope for increased risk, given that expected costs decrease at the same time. Changing the composition of the foreign currency debt was regarded as an appropriate way to achieve this. The review of the composition of the foreign currency debt is in process and will be considered by the board of the Debt Office in the normal way.

The change in the composition of the foreign currency debt does not change our view of the percentage of foreign currency debt. We noted already last year that a foreign currency percentage of 15 per cent was still well balanced in a situation where the state is willing to bear slightly greater risks.

We further recommend that the control interval around the target value continue to be ±2 percentage points. The reason for applying a control interval is mainly to avoid costs due to controlling measures which would only be occasioned by temporary exchange rate changes.

[13] *The calculation of the debt percentages is based on the measure* the central government debt's aggregate cash flows*, see proposed guidelines for 2007, The Debt Office's proposed guidelines for 2007 (dnr 2006/1679) and the Debt Office's Financial and Risk Policy for 2008 (dnr 2008/621).*

If the foreign currency share goes beyond the interval limit due to exchange rate changes, measures should be undertaken with the aim of bringing the percentage back within the interval rather than moving the percentage to the benchmark. In the case of other types of deviations, however, the percentage should be brought to the benchmark. The speed of adjusting the currency percentage depends on a number of factors. An adjustment should take place in small steps and over a long period to avoid unnecessarily high costs, while creating transparency and predictability. In comparison with other types of debt, the availability of instruments for managing the foreign currency debt (for example, swaps and currency forwards) is very good. This means that the foreign currency debt can be adjusted without excessively high transaction costs. It is thus possible to return relatively rapidly to the percentage that is considered to produce a beneficial trade-off between positive diversification characteristics and the exchange rate risk associated with the currency debt. All in all, the steering is considered to fit in well within the framework of our ordinary forecast and planning horizon (at present, around two years).[14]

3.1.2 The percentage of inflation-linked debt

Current guidelines and proposals

According to the current guidelines, the share of inflation-linked debt should be 25 per cent of the central government debt. The Debt Office is to set a deviation interval around the percentage of inflation-linked debt.

We are not proposing any change in the target value for the percentage. However, we recommend that the target be reformulated. In order to reflect the actual possibilities that exist to control the percentage of inflation-linked debt, the target should indicate that control should take place in the long term. We also propose that the demand to stipulate a deviation interval be abolished.

Considerations

Previous discussions and analyses have indicated that 25 per cent may be considered as a reasonable benchmark from a cost and risk perspective. According to the Debt Office, nothing at present indicates any other target percentage.

However, we are proposing a change in the formulation of the goal. In section 2, we pointed out that steering of the inflation-linked percentage towards the target should take place in a long-term perspective. We also pointed out that the deviation interval around the percentage of inflation-linked debt should be abolished. Consequently, we propose that the goal formulation be changed to reflect these changes.

At present, the inflation-linked share is around 30 per cent. As described in section 2, the percentage of inflation-linked debt will not decrease to any great extent before the loans mature. Large loans mature in 2012 and 2015. It is therefore expected that it will be possible to restore the percentage of inflation-linked debt to around 25 per cent in 2015. Our calculations also indicate that the share will increase further during the next few years. This is due to the percentage of inflation-linked debt increasing when central government debt decreases. The reason for this is that there are no tools at present for steering the percentage towards its benchmark at reasonable cost. Furthermore, we consider that some presence in the primary market is important for the inflation-linked market to continue to perform well and serve as a possible source of funding in the future.[15]

3.1.3 The percentage of nominal SEK debt

Current guidelines and proposals

In the current guidelines, the Government has decided that the central government debt should consist of a nominal SEK debt as well as inflation-linked debt and foreign currency debt. The target share for the nominal SEK debt will be 60 per cent of the central government debt as a direct consequence of the targets for the other debt percentages.

Considerations

The guidelines for central government debt management are based on the debt consisting of inflation-linked debt, foreign currency debt and nominal SEK debt. With guidelines set for the percentage of inflation-linked debt and foreign debt, it follows by definition that the remaining part of the debt would consist of nominal SEK loans.

[14] *See the Debt Office's Proposed Guidelines for 2007 for a detailed discussion of the size of the interval. (Proposed Guidelines for Central Government Debt Management 2007–2009, dnr 2006.1679).*

[15] *We are therefore intending to issue inflation-linked bonds for SEK 3 billion in 2008.*

3.2 The maturity of the central government debt

The Debt Office's proposals:

The maturity of the nominal SEK debt shall be 3.2 years. This maturity shall be achieved at the latest by the end of 2010. The preliminary benchmark for 2011 shall also be 3.2 years.

The benchmark for the maturity of the foreign currency debt during 2009 shall be 0.125 years. The preliminary benchmark for 2010 and 2011 shall also be 0.125 years.

The benchmark for the inflation-linked SEK debt maturity at the end of 2009 shall be 10.1 years. The preliminary benchmark for the maturity at the end of 2010 and 2011 should be 9.6 years and 8.9 years respectively.

The Debt Office shall state the operational deviation interval for the respective benchmark.

The choice of maturity is of key importance for the balance between expected cost and risk. This year, we are focusing the discussion on the maturity of the nominal SEK debt. The maturity of the foreign currency debt is discussed in detail in the proposed guidelines for 2007, which led to the Government deciding to shorten the aggregate maturity to a corresponding extent. The maturity of the inflation-linked debt can, as shown below, only be affected to a limited extent. There is therefore no reason to make a deeper analysis of this debt maturity at present.

3.2.1 The maturity of the nominal SEK debt

Current guidelines and proposals

The maturity of the central government debt is now controlled by the Government setting a benchmark for the whole debt. The benchmark for the whole debt is based in practice on the nominal SEK debt having a maturity of 3.5 years.

As shown in section 2.3, we propose that the Government set separate benchmarks for the individual types of debt. We propose that the benchmark for the interest-rate refixing period of the nominal SEK debt be shortened to 3.2 years. This maturity is to be achieved at the latest by the end of 2010. The preliminary benchmark for 2011 should also be 3.2 years.

Considerations – introduction

In last year's proposed guidelines, we discussed in detail how the state's risk propensity should be affected by the state of public finances. We concluded that the state's scope for risk-taking, in exchange for lower expected costs, increases apace with the strengthening of central government finances. The Government drew the same conclusion in the guideline decision.

The choice of maturity is crucial for the trade-off between expected cost and risk, i.e. the two dimensions of the overall objective.

The trade-off between expected cost and risk depends on the characteristics of the yield curve, however. We are therefore beginning this section with a descriptive analysis of the yield curve.

The characteristics of the yield curve

The characteristics of the yield curve which are of interest are the level, the slope and the volatility. The expected costs of the central government debt depend mainly on expectations of the future level of the yield curve. The trade-off between expected cost and risk depends, however, on the slope of the yield curve and its volatility at different maturities. As we will see, the choice of maturity is mainly governed by the trade-off, which is explained by the guidelines relating to the long-term management of the central government debt. The immediate impact of costs from a change in the level of interest rates will, of course, depend on the maturity chosen through the maturity determining how large a part of the interest on the debt is refixed in every period. However, if we believe that rises and falls in interest rates eventually cancel one another out, the gain from having a long-term debt when interest rates rise will be set off by the losses that arise when the yield curve moves downwards again. This reasoning leads to the conclusion that the level per se is of subordinate importance for the choice of maturity and that the choice of maturity should be primarily governed by the trade-off situation, i.e. the slope of the yield curve, and our ability to bear rapidly rising interest rates in the short term.

The risk of rapidly rising interest rates depends in turn on interest rate volatilities but also on the current level of interest rates. If we were to find that current levels are extremely high or low, we should also take this into consideration in the proposals that we make to the Government even if the guidelines mainly reflect the long-term conditions.

However, it is very difficult to determine what a normal level of interest rates is. If we study historical interest rates (Figure 4), we can see that current levels are not especially remarkable. During the past decade, the yield on the

ten-year government bond has fluctuated roughly between four and six per cent. If we look even further back, we see that current interest rates are considerably lower than in the 1970s and 1980s although direct comparisons are made difficult by current fixed-income markets not having many similarities with the tightly regulated markets that were characteristic of that period.

However, this picture is not significantly changed if we look at the US fixed interest market (Figure 5), which was not regulated in the same way as the Swedish.

As regards the level of the yield curve, we do not see, to sum up, anything that strongly argues that current levels are particularly unusual. Thus the choice of maturity will not be based on an assessment of future interest rates.

Figure 4. TEN-YEAR AND THREE-MONTH GOVERNMENT BOND RATES 1918–2007, SWEDEN

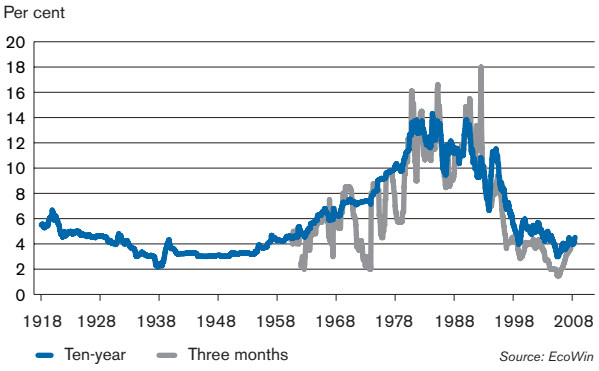
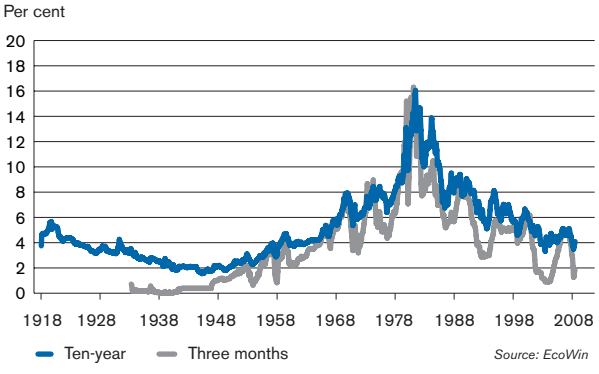


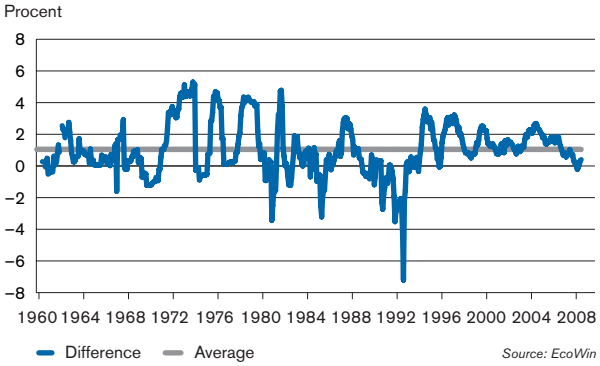
Figure 5. TEN-YEAR AND THREE-MONTH BOND YIELDS, UNITED STATES



We can now continue to study the slope and volatility of the yield curve in more detail. If we supplement the information on the development of the ten-year rate with information about the three-month rate (see Figure 4), it can be seen that the level of the interest rate for the two maturities coincides well with one another. They both rise and fall at approximately the same time. We also note that the three-month interest rate is markedly more volatile than the ten-year rate, in particular for the years up to the mid-1990s. One explanation of this may be the new monetary policy regime introduced in November 1992, with a floating exchange rate and an inflation target of two per cent. The fall in interest rates may be explained by the same changeover.

To study the difference between long and short interest rates in more detail, i.e. the slope of the yield curve, we calculate the difference between the ten-year rate and the three-month rate (see figure 6). The intention is to see whether there is a stable historical pattern. Initially, we can note the lack of a clear connection between the level and slope of the yield curve. It is also evident that the yield curve has normally had a positive slope. On average, the ten-year rate has exceeded the three-month rate by over 1 percentage point.[16] The present flat yield curve is therefore deviant to some extent. However, it is at the same time not possible to say that the current situation is exceptional in any way. The difference between the two yield series shows that flat or even negatively sloping yield curves recur periodically. In addition, we can note that negatively-sloping yield curves relatively quickly return to a positive slope.

Figure 6. THE DIFFERENCE BETWEEN THE TEN-YEAR AND THE THREE-MONTH GOVERNMENT SECURITY YIELD, SWEDEN



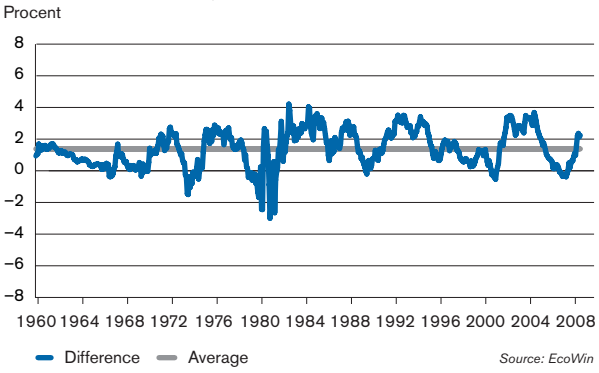
The variation in the interest rate gap has been low since the mid-1990s compared to the period before that. This may be an effect of the new monetary policy regime with a floating exchange rate, an independent central bank and a clear and credible inflation target. To the extent that investors rely on the inflation target being met, the variation in inflation expectations should decrease, which would in turn reduce the nominal returns required by investors for

[16] *If we disregard the effects of defence of the krona during the crisis of the 1990s, the average difference between the ten-year and the three-month bill is around 1.5 percentage points.*

long-term investments. One possible effect of an independent central bank and an inflation target is thus that the average variation in the interest rate gap will continue to be lower than during the 1970s and 1980s when inflation was very high at times.

We note again that the data material covers a period with different monetary and currency policy regimes and it may accordingly be useful to study conditions in the US fixed-income market (Figure 7).

Figure 7. THE DIFFERENCE BETWEEN THE TEN-YEAR AND THE THREE-MONTH YIELD ON GOVERNMENT SECURITIES, UNITED STATES

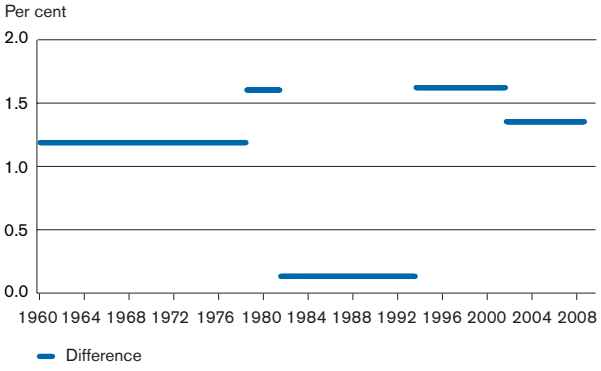


We again see that the basic pattern is the same. Long interest rates have been markedly higher over time than short interest rates, and periods with flat and inverted curves periodically recur. One difference in the pattern which may be worth mentioning is that we do not see any reduction in the variation of the interest rate gap in the United States. This is possibly an indication that the rearrangement of Swedish monetary policy has led to a reduction in volatility in the Swedish fixed-income market.

The next question we ask is whether the difference between the short-term and long-term interest rates, viewed over a business cycle, has diminished over time. If this were to be the case, a shortening of the maturity of the debt would mean less for the trade-off in the form of lower expected cost. If we study the business cycles, which we have experienced since 1960, we find no support, however, for this hypothesis (see Figure 8). Our assessments rather indicate the opposite. The average slope of the yield curve has been higher during the past two business cycles compared with the average for the three previous cycles.

To summarise the descriptive analysis of the characteristics of the yield curve, we can in the first place note that interest rates do not seem unusually low at present. They may be both high and low for long periods. Secondly, we can note that the slope is generally positive and does not

Figure 8. AVERAGE SLOPE OF THE YIELD CURVE DURING THE MOST RECENT BUSINESS CYCLES



The source for the years when business cycles start and stop: Edvinsson, R. 2005: Growth, Accumulation, Crisis: With New Macroeconomic Data for Sweden 1800–2000. A link to this data can be found on the Riksbank's website. Please note that the first business cycle in the figure started as early as 1953. The period 2001 to 2008 is assumed to be one cycle.

seem to have any direct connection with the level of interest rates. It should accordingly be possible to reduce the expected costs of the central government debt by shortening the maturity of the debt. This is, of course, provided that the yield curves in the future have the same characteristics as during the period analysed. Of course, we do not know whether this will be the case. However, we do not either see any decisive reasons that indicate that these characteristics will change.

All in all, this means that the long-term costs of the debt will probably fall if the maturity of the debt is shortened. However, a shortening also means a higher interest-rate refixing risk, which we will return to in the next section.

Modelling

We have noted that there are reasons – a yield curve that in general has a positive slope and strong central government finances – that indicate that the maturity of the debt should be reduced. The question then is which maturity in the nominal SEK debt that can be considered as being well-balanced under current conditions. As starting point for this discussion, we have used a simulation model as an aid.[17]

In the model, we generate interest rates (for nominal and inflation-linked SEK debt as well as for foreign currency debt), inflation and the exchange rate and calculate the cost and risk of different borrowing strategies. The cost of a strategy is measured as the average running yield and the risk as the variation of this cost. More exactly, we

[17] *In the work with this year's proposed guidelines, we have modified the stochastic simulation model which we developed for the 2007 guidelines. There is a more detailed description of this modification contained in the appendix. A more detailed description of the simulation model can be found in our proposed guidelines for 2007 and in Central Government Borrowing – Forecast and Analysis 2006:3.*

define the risk as the difference between the median and the 95th percentile in our simulated cost distribution. The measure of risk – the Running Yield at Risk (RYaR) – shows how much higher than expected the running yield can be at five per cent probability.

It should be borne in mind that the results of the model must be interpreted with caution. The result is a direct result of how the parameters are set for the model. We estimate and parameterise the model on the basis of data from the period 1996 to 2008. In our assessment, this period – during which we have had a uniform monetary and currency policy framework – says more about what we can expect in the future than previous periods do.

The model results indicate small differences in expected costs and risks in the different maturity strategies used in the model. For example, a shortening of the interest rate refixing period of the nominal SEK debt from the present three and a half years to one year entails that the expected running yield for the debt as a whole within a one-year time horizon will decrease by around 0.14 percentage points. With a debt of around SEK 1,000 billion, this means that we reduce the expected interest costs by around SEK 1.4 billion. The risk measured as RYaR in a one-year time horizon increases by as much, i.e. by 0.14 percentage points. This means that the risk for high costs in SEK will be almost unchanged. While RYaR increases – the distance between the median and the 95th percentile of the cost allocation – the 95th percentile remains unchanged.

However, it is not surprising that the effects in a one-year time horizon are so modest. The reason is that we start simulations from the current yield curve. Since the curve is very flat at present and we have some persistence in interest rate levels, it follows that the effect on the curve will be small in the short term. In the long term, the simulations indicate greater savings since the slope of the yield curve will be steeper again in time. A shortening as above entails for example that the expected annual cost of the debt (the average running yield) will decrease in the long term by around 0.4 percentage points, i.e. by almost three times as much as in a one-year time horizon.

All in all, the results from the model simulations indicate that the increase in risk of a shorter maturity in the nominal SEK debt is limited. This is also in line with previous results from self-developed and externally developed simulation models.[18] However, it should be pointed out that changes in maturity of the size that we calculate with above are not realistic. The outstanding debt is still too large for it to be practically possible or desirable to carry out such an extensive change. However, the example provides an indication that shortening of maturity can provide cost savings even when risk is taken into consideration.

Conclusion

The overall assessment of the Debt Office is that the maturity of the nominal SEK debt should be shortened. We consider that we should be guided by a long-term approach and find it probable that long interest rates will be higher than short rates over time. We further consider that our simulations provide support for cost saving exceeding the increase in risk when shortening the maturity. However, it is difficult to determine the maturity that is appropriate.

As we discussed in detail in last year's proposed guidelines, there are also practical factors that limit the ability to reduce the maturity of the nominal SEK debt. For example, we pointed out that the infrastructure with a liquid bond market that has been built up over a long period of time is a prerequisite for ensuring the ability to borrow at low cost. A decision on shortening must therefore take into consideration that the liquidity of the bond market must be maintained. However, shortening can be achieved with the use of interest rate swaps which mean that it is possible to shorten the maturity without needing to reduce bond borrowing to the same extent.

The extent to which swaps can be used is ultimately limited by the depth of the swap market, however. During periods of relatively large budget deficits, extensive swap transactions are required to maintain a short maturity. Large swap volumes can entail that the conditions for swaps deteriorate so that profitability disappears and we would have a wholly dominant position in the market. Given that these proposed guidelines are based on continued surpluses and a decreasing central government debt, it is now possible to swap a relatively large part of the bond issues. Surpluses, or small deficits, thus give us greater flexibility in the swap market. This flexibility can be used by shortening the maturity with the help of swaps.

All in all, we consider that this shortening can appropriately take place by reducing the average interest re-fixing period of the nominal SEK debt from 3.5 to 3.2 years. However, we make the assessment that it is difficult to carry out the whole reduction during 2009 because consideration must be given to the volume of swaps that it is possible to carry out without profitability deteriorating. Moreover there is great uncertainty around the development of the borrowing requirement, where a more unfavourable development would reduce the possibility of affecting the maturity with swaps. We therefore propose

[18] *See proposed guidelines for 2000, 2001 and 2006.*

that the maturity of the nominal SEK debt should be 3.2 years and that this maturity should be achieve at the latest by the end of 2010.

3.2.2 The maturity of the foreign currency debt

Current guidelines and proposals

The maturity of the central government debt is now controlled by the Government setting a benchmark for the whole of the debt. The current benchmark for the debt is in practice based on the maturity of the foreign currency debt being 0.125 years.

As shown in section 2.3, we propose that the Government set separate benchmarks for the individual types of debt. We propose that the benchmark for the interest-rate refixing period of the foreign currency debt should continue to be 0.125 years.

Considerations

In the guidelines for 2007, the Government stated that there was scope to shorten the maturity of the central government debt. The Government considered it most appropriate in terms of cost and risk to shorten the maturity of the foreign currency debt. The benchmark for the maturity that the Government set therefore entailed that the Debt Office should shorten the maturity of the foreign currency debt from 2.1 years to 0.125 years.

The Government's assessment rested to a great extent on the analysis of the maturity of the central government debt contained in the Debt Office's proposed guidelines for 2007. Since this decision was made, developments have not motivated any change in our assessment. We therefore recommend that the maturity of the foreign currency debt be kept at 0.125 years. We consider it most appropriate in terms of cost and risk to have such a short maturity in the foreign currency debt. Due to the foreign currency debt consisting of five currencies, we will at the same time automatically have a good risk spread within this type of debt. Moreover, the effect on the aggregate costs of any short-term interest rate shock will be limited since the foreign currency debt only accounts for 15 per cent of the debt portfolio. Access to a broad and deep derivative market also makes it feasible to achieve such a short maturity.

3.2.3 The maturity of the inflation-linked debt

Current guidelines and proposals

The maturity of the central government debt is currently controlled by the Government setting a benchmark for the whole debt. The current benchmark for the whole debt is based in practice on the inflation-linked debt having a maturity of 10.6 years at the end of 2008.

As shown in section 2.3, we propose that the Government should set separate benchmarks for the individual types of debt. We propose that the benchmark for the inflation-linked debt at the end of 2009 should be 10.1 years. The direction for the end of 2010 and 2011 should be 9.6 and 8.9 years respectively.

Considerations

*I*n the guidelines for 2007, the Debt Office's mandate to decide on the maturity benchmarks of the individual types of debt was extended to also include the inflation-linked debt. Since then, the Debt Office has opted for practical reasons – as shown below – to allow the benchmark for the inflation-linked debt to fall apace with the outstanding loans approaching maturity.

As shown by section 2.3 above, the Debt Office recommends that the current regulatory framework be changed in such a way that the Government, after proposals from the Debt Office, makes decisions on the maturity of each of the types of debt. However, we do not see any reason for the Government to depart from the current praxis with respect to the maturity of the inflation-linked debt. This is because the maturity of the inflation-linked debt can only be controlled in practice by new issues, exchanges and buybacks. Since the market for inflation derivatives is relatively undeveloped, we consider that it is far too expensive in the present situation to steer the maturity of the inflation-linked debt through derivatives. Part of the picture also is that the issue volumes of inflation-linked debt are small in relation to the size of the inflation-linked debt, which means that issues have little impact on the maturity. The inflation-linked bond market is furthermore not as deep as the market for nominal bonds, which means that, for reasons of cost, we cannot always choose to issue in maturities that would steer the debt towards a particular benchmark.

This means that the passage of time, as the outstanding bonds approach maturity, is the wholly dominant factor controlling the maturity of the inflation-linked debt. The maturity of the outstanding stock will thus gradually decrease. The Debt Office therefore recommends that the benchmark for the maturity of the inflation-linked debt be permitted to fall in the coming three years as the outstanding inflation-linked loans approach maturity. [19]

[19] *The extent to which the maturity of the inflation-linked debt can be stabilised in the longer term is determined to a large extent by the future borrowing requirements. See Proposed Guidelines for Central Government Debt Management 2008–2010 for a more detailed discussion of long-term maturity of the inflation-linked debt.*

3.2.4 The aggregate maturity of the debt

We show here how the aggregate maturity can be expected to develop. This calculation is based on our proposals for the maturity of the three types of debt at the end of 2009, 2010 and 2011.[20] The weighting is based on our estimates of the future percentages.

Table 3. ESTIMATE OF THE AGGREGATE MATURITY OF THE DEBT AT THE END OF 2009–2011.

	2009	2010	2011
Aggregate maturity	4.8 years	4.6 years	4.4 years

Other guidelines

3.2.5 Taking of position

The Debt Office's proposals: *The Debt Office shall be able to take active positions, while taking into account risk, in order to be able to reduce the costs of the central government debt. These positions shall be taken with derivative instruments. The extent of position-taking is limited by the Government specifying a highest level of risk measured in terms of daily Value-at-Risk. The risk limitation shall cover all positions except those relating to the exchange rate of the krona in relation to other currencies.*

The limit for the Debt Office's position-taking shall be SEK 600 million, measured as daily Value-at-Risk at 95 per cent probability. The Debt Office shall decide how the risk mandate is to be distributed between the strategic and operational level.

The Debt Office's proposals correspond to the current guidelines. We take the view that this control of the Debt Office's position-taking is working well. Nothing has emerged to indicate that the limit for position-taking should be changed. There is therefore no reason for us to propose any change.

3.2.6 Market and debt maintenance

The Debt Office's proposals: *Through market and debt maintenance, the Debt Office shall contribute to an efficient market for government securities with a view to maintaining the long-term cost minimisation target while taking risk into consideration.*

This proposal corresponds to current guidelines. The goal formulation provides good guidance for the work of the Debt Office on improving the performance of the market.

3.2.7 Retail market borrowing

The Debt Office's proposals: *The Debt Office shall, through retail market borrowing, contribute to reducing the costs of the central government debt.*

The proposal corresponds to current guidelines. The goal for retail market borrowing is basically self-evident. Unless retail market borrowing provides lower borrowing costs than alternative borrowing, it is not possible to justify borrowing by special instruments directed at the retail market since corresponding funds are available via the conventional instruments.

[20] *According to our proposal, the maturity of the nominal SEK debt shall be 3.2 years and this maturity is to be achieved at the latest by the end of 2010. We assume for 2009 for the purpose of calculation that the maturity of the nominal SEK debt is 3.35 years.*

4. Work in progress – Central Government Debt Management, a main document

The Debt Office is at present working on compiling a description of the current direction of central government debt management. The intention is to provide a comprehensive picture of decisions taken over the years and which affect current management. The aim is for the document to facilitate understanding of current guidelines and avoid proposed guidelines having to contain repetitions of previous discussions. Experience indicates that a long series of guideline decisions are most often needed to obtain a coherent picture of debt management. Unlike the proposed guidelines and guideline decisions, which often clarify the management issues that have come to the fore in the current year, the document will therefore provide a review of previous decisions and standpoints.

For example, based on the Government's views in a number of guideline decisions, the goal in the State Borrowing and Debt Management Act (1988:1387) will be discussed. Furthermore, the concepts of cost and risk will be dealt with based on the discussions that have taken place over the years. In addition, the document, in order to create the necessary overview, will state the debt percentages and maturities according to current guideline decisions.

The document will only reflect decisions and standpoints. The formally correct description of the direction of management will continue to be stated in the Government's guideline decision. The idea is for the Debt Office, after the Government has taken a decision in guidelines issues, to reflect these in the document. The underlying discussion will also then be shown.

The document is expected to be available in early 2009 It will also include relevant parts of the Government's guideline decision for central government debt management for 2009–2011.

Appendix – cost, risk and maturity

In the work with this year's proposed guidelines, we have updated and modified the stochastic simulation model that we developed for the guidelines for 2007. A more detailed description of this model can be found in our proposed guidelines for 2007 and in Central Government Borrowing – Forecast and Analysis 2006:3.

The model consists of two parts; one part where we generate interest rates, inflation and the exchange rate and another where we test different borrowing strategies. We then calculate for every chosen borrowing strategy – with the aid of the simulated paths for our financial variables – the cost and risk associated with the strategy.

Besides an updating of the model with data up to May 2008, we have, in particular, modified the part that takes up borrowing strategies. In the earlier version of the model, we assumed that we borrowed equally long in all types of debt (nominal SEK debt, inflation-linked SEK debt and foreign currency debt) and that we rolled over bonds with a particular maturity to achieve a desirable average interest refixing period of the debt. Accordingly, to achieve an average interest rate refixing period of, for example, five years, we only issued ten-year (zero coupons) bonds. We have dropped that assumption in this year's version. We furthermore distinguish between bonds and T-bill borrowing in the nominal SEK market (in practice, we are introducing T-bills as a fourth type of debt). The significance of this is that the borrowing strategies in the model can be made to more closely resemble our actual borrowing. To achieve a particular interest refixing period of the nominal SEK debt, we are no longer tied to a particular maturity of the issues but we can also vary the proportion of short and long nominal debt in the modelling.

As regards the simulation part, this year we have opted for another strategy for the starting position of the simulations. Whereas previously we started from the average values of the variables, we have now chosen to start the simulations from current interest rates, inflation and exchange rate. In this way, we obtain a better picture of the short-term effects of changes in maturity. In the longer term, the starting position is naturally less important since the variables in the model follow stationary stochastic processes.

The results indicate small differences in expected costs and risks in the different maturity strategies used in the model. For example, a dramatic shortening of the interest rate refixing period of the nominal SEK debt, from the current three and a half years to one year, would entail that the expected running yield for the debt as a whole in a one-year time horizon would fall by 0.14 percentage points. With a debt of approximately SEK 1 000 billion, this means that we reduce the expected interest costs by SEK 1.4 billion in a one-year time horizon. The risk measured as RYaR in a one-year time horizon increases by as much, i.e. by 0.14 percentage points. This means that the probability of high costs in SEK is estimated to be practically unchanged. While RYaR increases – the distance between the median and the 95th percentile – the 95th percentile per se remains unchanged.

It is not surprising that the estimated cost effects are so modest in a one-year time horizon. This is because we start the simulations based on the current yield curve. Since the curve is at present very flat and there is some persistency in interest rates, it follows that the short-term effect will be small. In the longer term, the model indicates larger savings since the yield curve will become steeper in the course of time. A shortening as above entails, for example, that the expected long-term annual cost of the debt (the average issue rate) will decrease by around 0.4 percentage points, that is to say almost three times as much as within a one-year time horizon.

All in all, the results from the modelling indicate that the risk increase with a shorter maturity in the nominal SEK debt is limited. This is also in line with the earlier results both from the simulation models we have developed and those externally developed.[21] However, it should be pointed out that changes in maturity of the size we are calculating with above cannot be implemented in practice. The outstanding debt is still far too large. However, the increase does provide an indication that shortening of maturities can provide cost savings where risk has been taken into account as well.

[21] *See proposed guidelines for 2000, 2001 and 2006.*

1 Cost and risk for the different types of debt

In accordance with the Government guidelines, costs are measured as the running yield (RY) and the risk as the variation in running yield. More exactly, we define our risk measure as the difference between the median and the 95th percentile in our simulated distribution of costs. This measure is referred to as Running Yield at Risk (RYaR) and it shows how much higher than expected the running yield can be at 5 per cent probability

It is straightforward to calculate the running yield for the nominal SEK debt. However, to obtain a fair measure of the cost and risk of the inflation-linked and foreign currency debt, we must also take into account the effect of inflation and exchange rate changes.

In the normal case, inflation-linked borrowing and foreign currency borrowing are associated with greater risk than nominal SEK borrowing because we measure the cost of the central government debt in terms of nominal SEK. The amount of costs that we lock in (i.e. how much risk we assume) when we issue a bond will thus depend our choice of type of debt.

When we issue a nominal SEK bond, we undertake to pay a given nominal yield to the investor. The investor accordingly bears both the real interest risk and the inflation risk.

When we issue inflation-linked bonds, the state bears the inflation risk. We undertake to pay a set real yield and to compensate the investor for inflation during the time to maturity of the inflation-linked bond. An inflation-linked bond may be regarded as a combination of a bond, with a fixed charge corresponding to the real yield at the time of issue, and variable borrowing, the cost of which corresponds to realised inflation. By only fixing the real interest rate at the time of issue of an inflation-linked bond, the risk is greater compared with if we issue a nominal bond with the same maturity.

To calculate the costs per unit of debt for the inflation-linked debt, we adjust the real running yield (r^r) for inflation during the period $(\Delta p/p_t)$ and add upward inflation adjustment of the debt. The costs of inflation-linked debt for the period t to $t+1$ expressed in nominal terms are thereby given by:

$$i^r = r^r(1+\Delta p/p_t)+\Delta p/p_t. \qquad (1)$$

When we borrow in foreign currency, we set the foreign nominal yield during the time to maturity of the loan. The cost expressed in SEK depends on how the exchange rate develops. The volatility of the exchange rate means that foreign currency borrowing is associated with greater risk than nominal SEK borrowing. We calculate the cost per unit of currency debt by adjusting the foreign running yield (r^{fx}) by the change in the exchange rate $\Delta fx/fx_t$ and add the change in market value caused by a changed exchange rate. The cost of the foreign currency debt for the period t to $t+1$ can then be written as:

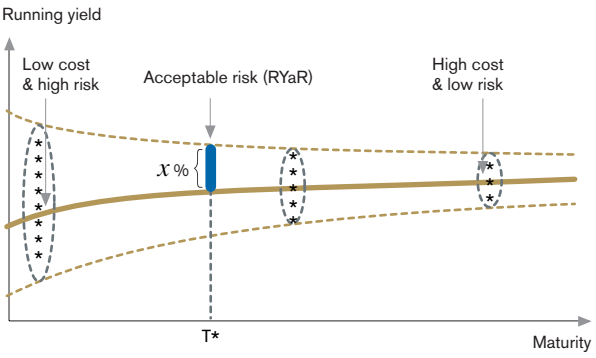
$$i^{fx} = r^{fx}(1+\Delta fx/fx_t)+\Delta fx/fx_t\ . \qquad (2)$$

2 The link between risk and maturity

The risk we are interested in controlling is to avoid the running yield becoming excessively high. Loans with short time to maturity generally give rise to a more volatile running yield than loans with a long maturity. This is because short loans have to be renegotiated often which increases exposure to fluctuations in the general level of interest rates.

However, yield curves generally have a positive slope. Accordingly, it is cheaper to borrow on short maturities than on long. The choice of maturity is consequently a trade-off between low cost and high risk for short borrowing and high cost and low risk for long borrowing. Figure 1 shows a stylised picture of this relationship. The oval markings symbolise the spread in the running yield at different maturities. The spread is, as mentioned above, greatest for short maturities and decreases when we increase the maturity.

Figure 1. RUNNING YIELD, RYaR AND MATURITY



Confidence intervals are also shown in the figure. These are to be interpreted as the levels that the running yield will remain within with a given probability. The gap between the yield curve and the confidence interval gives the RYaR for different maturities in the debt. In the figure, a maturity of T* entails a RYaR of x percentage points. The benchmark for the average interest-rate refixing period may be regarded as a combination of short and long borrowing which provides the desired trade-off between cost and risk.

3 The simulation model

In the following section, we present the simulation model in more detail. Readers who are mostly interested in the model results can skip this section and go directly to the results in section 4.

The goal of the model is that it should provide guidance as to the choice of interest rate refixing period. To achieve the goal, we need predictions on the future costs of the different parts of the debt. In other words, we need to model the stochastics of the yields (for the SEK debt and for the foreign currency debt), inflation and the exchange rate.

In the model, we let the variables follow stationary stochastic processes which vary around long-term averages. In the final parameterisation of the simulation model, we rely to a great extent on estimated historical conditions but also on own assumptions about the future.

On the basis of simulated values for our variables, we calculate the nominal cost of the inflation-linked and the foreign currency debt with different maturities according to equation (1) and (2). The cost of the nominal SEK debt coincides, of course, with the average simulated nominal interest rates.

3.1 Specification of the yield curves

In this work, we use a method developed by Diebold and Li to estimate the dynamics of the yield curves of the different types of debt.[22] Diebold and Li assume that the yield curves are of the Nelson-Siegel type and that they have the following functional form:

$$r_t^j(\tau)=\beta_{1t}^j+\beta_{2t}^j\left(\frac{1-e^{-\tau\lambda_t}}{\tau\lambda_t}\right)+\beta_{3t}^j\left(\frac{1-e^{-\tau\lambda_t}}{\tau\lambda_t}-e^{-\tau\lambda_t}\right)+\varepsilon_{t\tau}^j \qquad (3)$$

The Nelson-Siegel curve gives an approximation of the yield to maturity, $r_t^j(\tau)$, on bonds and T-bills with different maturities (τ) in the three types of debt (j) at time t.

The parameters β_{1t}^j, β_{2t}^j, β_{3t}^j are three latent dynamic factors and the parameter λ_t in the weights for β_{2t}^j and β_{3t}^j governs how rapidly the weights move towards zero as the maturity increases. A low value of λ_t gives slowly declining weights and provides a better adaptation of the yield curve for long maturities, while a large lambda means the converse. λ_t also governs the maturity at which the weight for β_{3t}^j is at its maximum.

An important result that Diebold and Li point to in the above-mentioned essay is that the three beta factors can be interpreted as the level, slope and curvature of the yield curve and that the dynamics of the factors (and thus the yield curve) can be estimated with time series models.

3.2 Estimation of the yield curves

We use monthly data from January 1996 to May 2008 inclusive to estimate the yield curves monthly. For maturities below a year, we use the rate on deposits and for maturities of a year or longer, we use swap rates (see Table 1 for descriptive statistics). To avoid having to estimate yield curves for each of the currencies included in the foreign currency debt, we have weighted the rates in these currencies in accordance with the currency benchmark.[23] In this way, we create a time series with "foreign curves".

Since the state mainly uses bonds for its long loans, it would be preferable if we could use (zero coupons) interest rates on government bonds in the estimates. Swap rates tend to be slightly higher and somewhat more volatile than government bond rates. Sufficiently long time series for zero coupon rates are, however, not currently available. There is furthermore information about benchmark rates only for the nominal SEK debt and the currency debt. We discuss how we solve the problem with interest rates on inflation-linked debt in section 3.4.

Table 1. DESCRIPTIVE STATISTICS, NOMINAL INTEREST RATES, JAN 1996–MAY 2008

	Swedish interest rates		Foreign interest rates	
Maturity months	Average value, %	Standard deviation	Average value, %	Standard deviation
1	3.7	1.2	3.1	0.8
2	3.7	1.2	3.1	0.8
3	3.8	1.1	3.2	0.8
6	3.9	1.1	3.2	0.8
12	4.1	1.1	3.3	0.9
24	4.4	1.1	3.5	0.8
36	4.7	1.2	3.7	0.8
48	4.9	1.2	3.9	0.8
60	5.0	1.2	4.1	0.8
72	5.2	1.2	4.2	0.8
84	5.3	1.2	4.4	0.8
96	5.4	1.3	4.5	0.8
108	5.4	1.3	4.6	0.8
120	5.5	1.3	4.6	0.8

When estimating the parameters in equation (3), we comply with usual practice and fix the value of lambda. This enables us to calculated the values of the weights for each maturity and estimate the beta parameters with OLS for each month. Besides the estimates being much simpler, they will also, according to Diebold and Li, be more reliable than if lambda had been estimated as well due to our replacing a number of instable numeral optimisations with robust OLS regressions.

[22] *Forecasting the Term Structure of Government Bond Yields (NBER 2003).*
[23] *65% EUR, 16 % CHF, 10% USD, 5% GBP and 4% JPY.*

Diebold and Li choose to set lambda at 0.0609. Lambda determines the maturity at which the weight on factor β_{3t}^{j} (i.e. the curvature) is greatest. The US yield curve is generally considered to show the greatest curvature at 2-3 years' maturity, the value of lambda that maximises the weight in the middle of the interval, i.e. at 30 months, is exactly 0.0609. If we apply this method to the time period and the markets we are studying, we see that the curvature of the Swedish nominal yield curve reaches its maximum at around 4 years' maturity while the hypothetical foreign yield curve reaches its greatest curvature at around 5 years' maturity. This produces a lambda of 0.037 in the Swedish market and a "foreign lambda" of 0.030.[24]

After we have fixed the lambda parameters and estimated equation (3) month for month for our yield series, we thus obtain three estimated beta values per month for the yield curves. It is these time series with beta values that we use in the next step to estimate the dynamics of the yield curves.

3.3 The dynamics of the yield curves, the exchange rate and inflation

The variables in the model – the beta parameters, inflation and the exchange rate – follow stationary stochastic processes (known as Ornstein-Uhlenbeck processes). The dynamic equation which we use as a basis is:

$$dX=\alpha(\overline{X}-X)dt+\sigma dz\,. \qquad (4)$$

Where $\alpha(>0)$ is the speed at which variable X returns to its normal level, $\overline{X}$, from a particular realised value. dz is an increment from a Wiener process with volatility σ. Making equation (4) discrete, we obtain:

$$X_{t+\Delta t}=X_t+\alpha(\overline{X}-X_t)\Delta t+\sigma\sqrt{\Delta t}\varepsilon_{t+\Delta t},$$

$$=\alpha\overline{X}\Delta t+(1-\alpha\Delta t)X_t+\sigma\sqrt{\Delta t}\varepsilon_{t+\Delta t},$$

$$=a+bX_t+\eta_{t+\Delta t}. \qquad (5)$$

X thus follows an ordinary AR(1) process where $\eta_{t+\Delta t}$ is normally distributed noise ($\varepsilon_{t+\Delta t}$ is "standard normal"). To obtain the parameters in the base model, α, $\overline{X}$ and σ, we then accordingly estimate equation (5) with OLS (for each of our eight variables) and then calculate:

$$\hat{\alpha}=\frac{1-b}{\Delta t}, \qquad (6)$$

$$\hat{\overline{X}}=\frac{a}{1-b} \quad \text{and} \qquad (7)$$

$$\hat{\sigma}=\sqrt{\frac{var(\eta_{t+\Delta t})}{\Delta t}}\,. \qquad (8)$$

Since we use annualised monthly data in our estimates, we obtain $\Delta t=1/12$. In the same way as for foreign interest rates, the exchange rate dynamics is estimated on the basis of an index which describes how the krona relates to a weighted average of the currencies included in the foreign currency debt. When estimating inflation, we use seasonally adjusted data (12-month changes).

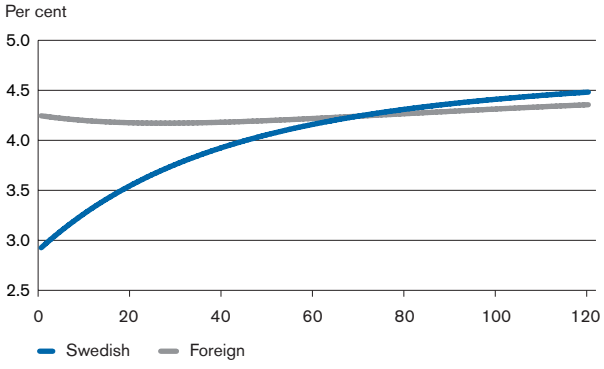
We report the parameter estimates – which after certain modifications are used as input in the simulations – in Table 2. We find that the foreign yield curve is less volatile than the Swedish (which was expected since it is a combination of several yield curves). Further, the results imply that the foreign average yield curve is remarkably flat. We are probably seeing here the impact of the international credit crisis of recent years, which has affected the swap curve to a great extent.[25] By using swap rates and not yields on government securities, we probably underestimate the long-term difference between the short and long rates (the slope) and overestimate the risk in the debt portfolio.

In Figure 2, we reproduce the average yield curves that the model implies.

Table 2. PARAMETER ESTIMATES, STATIONARY PROCESSES, JAN 1996–MAY 2008

Swedish curve	α	$\overline{X}$	σ
β_1^n	0.34	4.85	0.80
β_2^n	0.23	–1.96	1.00
β_3^n	0.94	0.34	2.33
Foreign curve			
β_1^{fx}	0.35	4.70	0.59
β_2^{fx}	0.18	–0.45	0.75
β_3^{fx}	1.13	–0.92	2.25
Inflation (π)	0.32	1.77	1.15
Exchange rate (FX)	0.56	8.30	0.33

Figure 2. AVERAGE YIELD CURVES



[24] *We have retained the lambda values, we used in the 2006 model. The lambda values are thus calibrated on the basis of the period Jan 1996–March 2006.*

[25] *Corresponding calculations for the 2007 proposed guidelines, before the crisis, indicated a considerably steeper yield curve.*

3.4 Calibration of the simulation model

The simulation model consists of eleven equations. We have three equations for each of the three types of debt that control how the yield curve for the respective type of debt develops over time, as well as an equation each for the development of inflation and the exchange rate. In the preceding section, we only estimated eight equations, however; three equations for the real yield curve were lacking.

Since there is not sufficiently abundant data on real yields, we have opted to calibrate the real yield curve on the basis of the Swedish nominal curve. This means that the average difference between the curves amounts to expected inflation (i.e. the Riksbank's two per cent inflation target). As regards the slope and curvature of the real yield curve, we assume that these will coincide with the nominal yield curve on average. The significance of this is that it is as expensive to borrow inflation-linked as nominally in the model – on average – given a particular maturity. We have estimated the variance in the real yield curve (the three beta factors) to half of the variance in the nominal yield curve by comparing the volatility of a synthetic 10-year inflation-linked bond with a 10-year nominal bond.[26]

We have also opted to parameterise the simulated foreign yield curves on the basis of the average Swedish curve. In other words, we use the "Swedish" beta and lambda values for the foreign yield curve. The meaning of this is that we assume that the average cost for borrowing in foreign currency coincides with borrowing in SEK. While it may, bearing in mind the yield curves in the previous section, seem to be a strong assumption, since we are studying the effects of changes in maturity of the nominal SEK debt, this assumption will not alter the conclusions.
The results in section 2.3 and the assumption of the appearance of the future average yield curves then produce the following dynamic processes:

$$\begin{bmatrix} \beta_{1t+1}^{n} \\ \beta_{2t+1}^{n} \\ \beta_{3t+1}^{n} \\ \beta_{1t+1}^{r} \\ \beta_{2t+1}^{r} \\ \beta_{3t+1}^{r} \\ \beta_{1t+1}^{fx} \\ \beta_{2t+1}^{fx} \\ \beta_{3t+1}^{fx} \\ \pi_{t+1} \\ FX_{t+1} \end{bmatrix} = \begin{bmatrix} \beta_{1t}^{n} \\ \beta_{2t}^{n} \\ \beta_{3t}^{n} \\ \beta_{1t}^{r} \\ \beta_{2t}^{r} \\ \beta_{3t}^{r} \\ \beta_{1t}^{fx} \\ \beta_{2t}^{fx} \\ \beta_{3t}^{fx} \\ \pi_{t} \\ FX_{t} \end{bmatrix} + \begin{bmatrix} 0.34 \\ 0.23 \\ 0.94 \\ 0.34 \\ 0.23 \\ 0.94 \\ 0.35 \\ 0.18 \\ 1.13 \\ 0.32 \\ 0.56 \end{bmatrix} \cdot \begin{bmatrix} (4.85-\beta_{1t}^{n}) \\ (-1.96-\beta_{2t}^{n}) \\ (0.34-\beta_{3t}^{n}) \\ (2.85-\beta_{1t}^{r}) \\ (-1.96-\beta_{2t}^{r}) \\ (0.34-\beta_{3t}^{r}) \\ (4.85-\beta_{1t}^{fx}) \\ (-1.96-\beta_{2t}^{fx}) \\ (0.34-\beta_{3t}^{fx}) \\ (2.0-\pi_{t}) \\ (8.30-FX_{t}) \end{bmatrix} + \begin{bmatrix} 0.80\,\varepsilon_{1t+1}^{n} \\ 1.00\,\varepsilon_{2t+1}^{n} \\ 2.33\,\varepsilon_{3t+1}^{n} \\ 0.56\,\varepsilon_{1t+1}^{r} \\ 0.70\,\varepsilon_{2t+1}^{r} \\ 1.63\,\varepsilon_{3t+1}^{r} \\ 0.59\,\varepsilon_{1t+1}^{fx} \\ 0.75\,\varepsilon_{2t+1}^{fx} \\ 2.25\,\varepsilon_{3t+1}^{fx} \\ 1.15\,\varepsilon_{t+1}^{\pi} \\ 0.33\,\varepsilon_{t+1}^{FX} \end{bmatrix} \quad (9)$$

We introduce stochastics into the processes by drawing a random number, ε, from a multivariate standard normal distribution for each one-year time step. The random numbers lack autocorrelation and are correlated in accordance with Table 3.

The correlation between error terms has been calculated on the basis of residuals from the estimated time series models. In order to obtain correlations between the parameters for the real curve and other parameters, we have created "real residues" which are standard normal distributed and have a correlation of 0.7 with the corresponding nominal error term.

Table 3. CORRELATION MATRIX, INPUT IN THE SIMULATIONS

	ε_1^n	ε_2^n	ε_3^n	ε_1^r	ε_2^r	ε_3^r	ε_1^{fx}	ε_2^{fx}	ε_3^{fx}	ε^{π}	ε^{FX}
ε_1^n	1	–0.82	–0.25	0.71	–0.58	–0.17	0.50	–0.48	0.09	0.28	0.02
ε_2^n		1	0.23	–0.58	0.71	0.15	–0.42	0.53	–0.07	–0.20	0.09
ε_3^n			1	–0.18	0.17	0.70	–0.29	0.34	0.65	–0.16	0.07
ε_1^r				1	–0.41	–0.12	0.36	–0.34	0.06	0.20	0.02
ε_2^r					1	0.11	–0.30	0.38	–0.05	–0.14	0.08
ε_3^r						1	–0.19	0.22	0.45	–0.10	0.03
ε_1^{fx}							1	–0.82	–0.55	0.29	0.03
ε_2^{fx}								1	0.50	–0.29	0.02
ε_3^{fx}									1	–0.23	0.08
ε^{π}										1	–0.09
ε^{FX}											1

4 The simulation results

In the simulations, we "despatch" 20,000 paths for our stochastic variables; the simulation horizon is 30 years. In order to obtain a measure of the running yield already from year one, we need a loan history which is as long as our longest loan strategy. Volatility arises when a loan is rolled over and the market rate at time *t* replaces the rate on the instrument that matures. We use the yield curves that we have produced from the model for the years 1996 to 2008 for the nominal SEK debt and foreign currency debt. This time period is sufficient to calculate the running yield for the nominal SEK debt and the foreign currency debt already from year one (that is 2009).

Obtaining historical real yield curves is, however, more problematic. To model our inflation-linked borrowing, which has an average interest rate refixing period of around 10 years, we need to go 20 years back in time. This is naturally difficult since there is insufficient complete real yield curve data even for the period when we have issued inflation-linked bonds (since the mid-1990s). We solve the problem by allowing the level of the real yield during the

[26] *We create the inflation-linked bond by weighting together the existing inflation-linked bonds to a hybrid bond with a ten-year maturity.*

period 1996–2008 to correspond to the yield on the longest inflation-linked bond. For the period 1988 till 1995, we allow the real yield to be on average as in 1996. We introduce volatility in the yields by allowing the yield level to vary randomly around the average. As regards the slope and curvature of the inflation-linked curve, we stipulate that these, for the period 1996–2008, coincide with the slope and curvature of the nominal yield curve. For the years 1988 to 1995, we obtain these parameters by drawing from a distribution with average value and variation in accordance with the corresponding nominal parameters.

We also make some simplifying assumptions as regards the borrowing strategies which we have studied. In the first place, we base ourselves on the current target shares for the debt, according to which 25 per cent of the debt is inflation-linked debt, 15 per cent is foreign currency debt and the rest nominal SEK debt. In the second place, we assume the whole of the foreign currency debt is subject to interest-rate refixing every year (The average interest rate refixing period (AIP) of the foreign currency debt will be 0.5 years), that we roll over 20-year inflation-linked loans (AIP of ten years), and that we allocate the nominal SEK borrowing between T-bills (AIP of 0.5 years) and ten-year bonds (AIP of five years) so as to achieve the desired average interest rate refixing period of the nominal SEK debt.

With these assumptions, it is possible – on the basis of the cost definitions in section 1 and the simulated distributions – to calculate the maturity and horizon-dependent risk associated with the central government debt.

The results (see Table 4) indicate small differences in expected costs and risks in the different maturity strategies used in the model. For example, a dramatic shortening of the average interest rate refixing period of the nominal SEK debt, from the present three and a half years to one year, would entail that the expected running yield for the debt as a whole in a one-year horizon would decrease by 0.14 percentage points. With a debt of around SEK 1,000 billion, this means that we reduce the expected interest costs by around SEK 1.4 billion. The risk measured as RYaR in a one-year time horizon would increase by as much, that is by 0.14 percentage points. This means that the probability for high costs calculated in SEK will be almost unchanged. While RYaR increases – the distance between the median and the 95th percentile in the cost allocation – the 95th percentile as such is unchanged.

However, it is not surprising that the estimated cost effects will be so modest in a one-year time horizon. This is because we start the simulations from the current yield curve. Since the curve at present is very flat and we have some persistence in interest rate levels, it follows that the effect will be small in the short term. In the long term, the calculations indicate greater expected savings since the yield curve will in time become steeper again. A shortening as above would, for example, entail that the expected annual cost of the debt (the running yield) would decrease in the long term by around 0.4 percentage points, that is almost three times as much as in a one-year time horizon.

We have tested the sensitivity of the results by increasing the volatility of the yield processes. We doubled the volatility in the parameters which control the slope and curvature of the yield curve (parameters which are central with respect to the risk of shortening the maturity). The results in Table 5 show, of course, that it will be more risky to shorten the maturity in the event of a change of this kind. An extreme shortening as in the above example – from an average interest rate refixing period of three and a half years to one year – entails that RYaR would increase in a one-year time horizon by around 0.5 percentage points. Combined with an expected cost reduction of around 0.15 percentage points, this means that the 95th percentile of the cost allocation will shift upwards by 0.35 percentage points in a one-year time horizon. If we examine more realistic shortening alternatives, for example, three years' average interest rate refixing period in the nominal SEK debt, the increase in risk does not appear particularly intimidating, however.

All in all, the results from the simulations indicate that the increase in risk with a somewhat shorter maturity in the nominal SEK debt is limited. This is in line with previous results, both from self-developed and externally developed simulation models.[27]

[27] *See proposed guidelines for 2000, 2001 and 2006.*

Table 4. COST AND RISK AT DIFFERENT MATURITIES IN THE NOMINAL SEK DEBT

Cost and risk of different portfolios

				Difference to AIP 3.5 years	
AIP	Year	RY	RYaR	RY	RYaR
3.5	1	5.18	1.14		
3.5	5	4.43	1.44		
3.5	10	4.23	1.47		
3.5	20	4.13	1.48		
3.5	30	4.14	1.47		
3.0	1	5.15	1.17	–0.03	0.03
3.0	5	4.38	1.47	–0.05	0.03
3.0	10	4.15	1.48	–0.08	0.01
3.0	20	4.05	1.49	–0.08	0.01
3.0	30	4.07	1.47	–0.07	0.00
2.0	1	5.11	1.20	–0.07	0.06
2.0	5	4.28	1.54	–0.15	0.10
2.0	10	3.98	1.56	–0.25	0.09
2.0	20	3.88	1.57	–0.25	0.09
2.0	30	3.91	1.55	–0.23	0.08
1.0	1	5.04	1.28	–0.14	0.14
1.0	5	4.17	1.61	–0.26	0.17
1.0	10	3.82	1.66	–0.41	0.19
1.0	20	3.75	1.66	–0.38	0.18
1.0	30	3.76	1.68	–0.38	0.21
0.5	1	5.02	1.29	–0.16	0.15
0.5	5	4.12	1.67	–0.31	0.23
0.5	10	3.74	1.68	–0.49	0.21
0.5	20	3.67	1.68	–0.46	0.20
0.5	30	3.67	1.72	–0.47	0.25

Table 5. COST AND RISK AT DIFFERENT MATURITIES IN THE NOMINAL SEK DEBT, HIGH VOLATILITY

Cost and risk of different portfolios – high volatility

				Difference to AIP 3.5 years	
AIP	Year	RY	RYaR	RY	RYaR
3.5	1	5.20	1.20		
3.5	5	4.44	1.69		
3.5	10	4.22	1.74		
3.5	20	4.13	1.73		
3.5	30	4.15	1.75		
3.0	1	5.17	1.26	–0.03	0.06
3.0	5	4.40	1.79	–0.04	0.10
3.0	10	4.15	1.82	–0.07	0.08
3.0	20	4.08	1.85	–0.05	0.12
3.0	30	4.06	1.86	–0.07	0.13
2.0	1	5.12	1.47	–0.08	0.27
2.0	5	4.29	2.06	–0.15	0.37
2.0	10	3.98	2.15	–0.24	0.41
2.0	20	3.91	2.14	–0.22	0.41
2.0	30	3.91	2.17	–0.22	0.44
1.0	1	5.04	1.68	–0.16	0.48
1.0	5	4.18	2.39	–0.26	0.70
1.0	10	3.85	2.48	–0.37	0.74
1.0	20	3.75	2.49	–0.38	0.76
1.0	30	3.76	2.49	–0.37	0.76
0.5	1	5.02	1.80	–0.18	0.60
0.5	5	4.10	2.63	–0.34	0.94
0.5	10	3.73	2.63	–0.49	0.89
0.5	20	3.67	2.67	–0.46	0.94
0.5	30	3.68	2.63	–0.45	0.90

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