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The Government
The Ministry of Finance
103 33 STOCKHOLM

Proposal for guidelines for the management of the central government debt

Summary

In this memorandum, the Swedish National Debt Office (SNDO) submits a proposal to the government for guidelines for the management of the central government debt in accordance with the system of governance and evaluation of debt management introduced in 1998.

The target of debt management is to minimise long-term costs while also taking into account the risks to which the management is exposed and constraints imposed by monetary policy. In preparation for the work on this year's guidelines, the SNDO, in consultation with the Ministry of Finance, has further analysed what cost and risk concepts should serve to guide debt management. The results of this analysis has been used as a basis for quantitative analyses of a variety of borrowing strategies with the aid of simulation models. In this report, the SNDO presents the results from an external model describing the entire central government debt and for a model that has been developed within the SNDO, to analyse the selection of the maturity of the nominal krona-denominated debt.

Seen overall, the quantitative calculations do not lead to unambiguous conclusions. In the more general model, the results are so uncertain that it is not possible to assess how costs and risks would be affected by different ways of financing the national debt. The SNDO's own model provides more robust results, which suggests that there is scope to reduce costs without significant effects on the level of risk by shortening the maturity of the debt. However, these results come from a partial model that is not yet fully developed.

The quantitative results must therefore be regarded as indicative. They are included in the material used for the essentially qualitative analysis that serves as a basis for the SNDO's proposals for guidelines. They may be summarised as follows:

- Foreign currency debt should be amortised at a rate corresponding to 35 billion kronor. The SNDO should be free to deviate from this figure by 15 billion kronor in either direction.
- The stock of outstanding inflation-linked loans should in principle not decrease, and should be increased to the extent that this can be done on conditions that are deemed to be compatible with the goals for debt management. However, the stock can be allowed to decrease for market maintenance purposes.
- The gross borrowing requirement should otherwise be financed by means of nominal krona-denominated borrowing.
- The duration of the nominal krona-denominated debt and the currency debt together should be 2.7 years (± 0.3 years) at the end of 2000. Inflation-linked loans should be issued in long maturities.
- The maturity profile should be such that a maximum of 30 per cent of the debt matures within 12 months and a maximum of 15 per cent each year thereafter.

These proposals mean that the breakdown of the debt by type of borrowing will be kept broadly unchanged in 2000. Compared with the guidelines for 1999, the SNDO recommends that the rate at which the currency debt is amortised shall be raised from 25 billion to 35 billion kronor. Given the latest assessments of next year's borrowing requirement, this will (at unchanged exchange rates) lead to a slight decline in the share of currency debt. This will help to offset the increase in currency debt share that will occur in connection with the transfer of assets from the AP Fund to the SNDO on January 1, 2001.

The SNDO also proposes a slightly wider interval for currency borrowing with the object of creating greater flexibility to handle unexpected changes in the borrowing requirement, for example, by varying both the krona-denominated and the foreign currency borrowing. It should be possible within the limits of the technique used by the Riksbank during the past three years to convert kronor into currency debt on the SNDO's account, to handle the fluctuations that could arise in the foreign exchange reserves. The SNDO therefore considers that the proposal is compatible with the constraints imposed by monetary policy.

The proposal also means that the maturity of the kronor debt and the currency debt will be shortened, but here too the change is limited. Measured in terms of duration, which the SNDO recommends as measure of the average maturity of the nominal debt, the reduction in 2000 will be some 0.35 years, in relation to the duration at the end of August 1999. The SNDO's analyses indicate that the long-term strategy should be to further shorten the duration of the nominal borrowing slightly. The target should also be to continue to pay back foreign currency debt during the next few years.

It is not possible to quantify the effects of these proposals on expected costs and risks. However, in view of the limited changes, it is reasonable to suppose that the quantitative effects will also be limited. In qualitative terms, there are grounds for supposing that the expected costs will decline

due to the shortening of the kronor and currency debt. The effect on risk exposure is estimated to be negligible.

The new system for controlling the national debt places great emphasis on the evaluation of debt management at all levels, from day-to-day commercial decisions within the SNDO to the government's decisions on general guidelines. In this report, the SNDO discusses certain evaluation questions in the light of the new proposals for guidelines.

1 Introduction

In the spring of 1998, the Parliament (the Riksdag) decided to introduce new rules in the Act (1988:1387) on State Borrowing and Debt Management. These rules mean, for example, that the government shall establish guidelines for the SNDO's management of the central government debt no later than November 15 each year. Prior to this, the government shall call for proposals from the SNDO. It is stipulated in the instruction for the SNDO that proposals for guidelines shall be submitted to the government no later than October 1.

These rules came into effect on July 1, 1998. Consequently, this is the second occasion on which the SNDO in this way submits a proposal to the government for guidelines for managing the central government debt. The government noted in its bill Management of the Central Government Debt (bill 1997/98:154) that the methods used for identification, quantification and management are changing and that the governance system should be allowed to change with the passing of time. The SNDO also emphasised in last year's guideline proposal that the issues are complex and that few direct models exist. The work of developing the new governance and evaluation system for debt management will therefore take time. Ideas and proposals must be tested and re-tested in the light of experience gained from their practical application.

Since the guidelines came into effect at the start of the year, few entirely new experiences have been gained. This is due partly to the fact that the guidelines for 1999 were very largely characterised by status quo, i.e. the debt has been managed in accordance with the same principles as in the past. However, the SNDO proposes certain changes in the formulation of the guidelines on points where weaknesses in the system in use during the current year have been observed. Moreover, during the past year, the SNDO has developed the reasoning behind the principles for analyses of costs and risks associated with the central government debt. This has resulted, for example, in some changes in the cost concept that should be used at overall level. At the same time, the view regarding what cost and risk concepts are relevant for the control and evaluation of its management within the framework of the overall guidelines has been given greater precision. Some of this work has been described in reports to the government written in consultation with the Ministry of Finance. The principles behind the various cost and risk concepts are covered in *Section 2*.

Last year's proposals for guidelines, and the current guidelines, were influenced by the fact that the SNDO did not have access to quantitative analytical tools for studying the debt as a whole; the interval between the decision on the new system and the presentation of the proposals was too short. The proposal was thus based mainly on qualitative arguments. The SNDO noted that guidelines for complex portfolio management must always be based on qualitative assessments. However, it also emphasised the importance of developing quantitative tools to aid those decisions.

In preparation for this year's proposal for guidelines, therefore, the SNDO has produced results from simulation models with the object of analysing the characteristics – in terms of expected cost and risk – of a variety of borrowing strategies. The principles underlying this model work were described in a report submitted to the government on June 8, 1999.

The SNDO engaged Morgan Stanley Dean Witter (MSDW) to assist in developing quantitative material for its work on guidelines. MSDW has developed a simulation model (originally for other purposes) that includes the interaction between the state of the economy, interest rates, exchange rates, and other factors. The model has been modified to handle analyses of Sweden's government debt. With the aid of stochastic simulations of the model, MSDW has developed measures of the risks and costs associated with different borrowing strategies.

Key aspects of the MSDW model are confidential for commercial reasons. If a model is to function as an important tool in the work on guidelines, it is essential that it can be understood and interpreted by the SNDO and other parties. As noted in the government report, the aim is therefore to develop within the SNDO, possibly with the aid of external parties, simulation models that are to be used in work on guidelines. The experience from using the MSDW model confirms how difficult it is to interpret results of a model with a complex structure of which only parts are known to the SNDO.

As a first step in its work on internal models, the SNDO has developed a simulation model for analysing the decision on the average maturity of the nominal krona-denominated debt. The model is thus partial, but the SNDO believes that it is necessary to begin with partial models designed for studying narrower areas, if it is to be possible eventually to develop more comprehensive models. Otherwise, there is a risk of the model being so complex and non-intuitive that it would not be accepted as a basis for decisions.

The underlying characteristics of the simulation models, the simulated borrowing strategies, and the results of the simulations are covered in *Section 3*. The simulation results should be regarded as illustrative. The SNDO nonetheless considers that simulations can provide useful points of departure for more detailed discussions regarding the structure of the central government debt. The work of further developing models for analysing debt management will therefore continue in preparation for the guideline proposals for coming years. The SNDO's ultimate goal is to develop simulation tools that can be used as an integrated element in the day-to-day work within the SNDO and for the preparation of proposals for guidelines.

A simulation model of this type provides a picture of possible effects on costs and risks of the choice of borrowing strategy. On the other hand, it does not provide any information about what strategy should be adopted, i.e. it does not serve as an optimisation or decision-making model. The information obtained from the model must be complemented before decisions can be made on how the debt shall be managed. Not least, the decision-makers must assess the trade-offs between expected cost and risk. Assessments of this type are both complex and highly qualitative, especially as there are several aspects of risk that may also need to be weighed against each other. Moreover, the attitude towards risk is influenced by other factors such as the state of public finances (the stronger public finances are, the greater the resilience against unfavourable outcome and the lower the risk aversion). This means that it cannot be assumed that there is any one given borrowing strategy that is optimal in all situations. The qualitative judgements also include assessing the reasonableness of simulation results generated by models. The SNDO's deliberations and its proposal for guidelines are presented in *Section 4*.

According to the Act on State Borrowing and Debt Management, the government's debt policy shall, in addition to the risks that debt management involves, take into account constraints imposed by monetary policy. These monetary policy considerations are covered in *Section 5*.

In the new system for debt management great importance is attached to evaluating the management at all levels, from the day to day decisions within the SNDO to the government's decisions on overall guidelines. Evaluation issues have also been taken up in reports submitted by the SNDO to the government in 1999. The means and scope of such evaluations are influenced by the content and formulation of the guidelines. In *Section 6*, the SNDO presents some ideas and proposals relating to evaluation questions on the basis of the new proposal for guidelines.

Finally, in *Section 7*, the SNDO takes up some of the main aspects of its coming work on developing principles and methods for the preparation of proposals for guidelines for coming years.

2 Concepts of cost and risk

2.1 Introduction

The Act on State Borrowing and Debt Management stipulates that the goal of debt management is to minimise the long-term cost of the debt while also taking risks into account. The Act also stipulates that the debt shall be managed subject to the constraints imposed by monetary policy.

The Act does not contain any precise rules on how costs shall be measured or what risk considerations should be included. In the bill, the government notes that there may be grounds for regarding the risk of higher costs measured in real terms as the main parameter, but that further analysis is

required in order to convert a real concept of risk into practical application. In last November's decision on guidelines, the government said that the possibility of using a real concept of risk should be investigated in accordance with a special directive, and the SNDO welcomes such an analysis. For the time being, however, the approach is a nominal one.

However, even within the limits of a nominal approach to costs and risk, several complex questions remain. These were analysed in connection with the work on last year's guidelines and in a government report written in consultation with the Ministry of Finance. This section summarises and, on certain points, complements the conclusions in that government report.

2.2.1 Cost concept for decisions on the structure of the government debt

The debt management goal relate to *the absolute cost* of the government debt. The analysis in the report to the government leads to the conclusion that these should be measured in terms of the volume-weighted average of the yields to maturity at which the debt was incurred. This concept can be referred to as *running yield to maturity*. The weighting by volume means that the concept takes into account the volume of the loan that was issued at a given yield, which means it will function as a measure of cost even though it is expressed in percentage terms. Running yield can be converted into kronor by multiplying it by the outstanding debt.

Running yield is interpreted intuitively as the average yield (cost) of the debt at any given time. In the case of debt in nominal kronor that is held until maturity, the cost measured in this way is known and fixed when the loan is issued. If the entire debt were financed in nominal kronor and held until maturity, the risk of variations in the running yield would depend on the volume maturing (and the net borrowing requirement) and the uncertainty regarding future loan conditions. The greater the gross borrowing requirement per unit of time, and the greater the volatility of market yields, the greater will be the risk of variations in interest costs. If one disregards the uncertainty over the borrowing requirement, perpetual bonds would eliminate the risk of variations in future borrowing costs measured in terms of the running yield.

In the case of debt denominated in a foreign currency and inflation-linked debt, the issue conditions will determine the yield in terms of the foreign currency and real kronor respectively.¹ The realised cost measured in terms of nominal kronor thus depends on changes in exchange rates and the price level, respectively, throughout the term of the loan. Given that these magnitudes are unknown at the time of issue, the risk of variations in borrowing costs is unequivocally greater in the case of currency loans and inflation-linked loans than for the corresponding nominal loans. This is a reasonable attribute, given that the costs are measured using nominal kronor

¹ As the currency debt is controlled by a benchmark in terms of exposures, in many cases the actual exposure in relation to the loan that is raised will be changed. The running maturity should here be calculated inclusive of the effects of the transactions carried out to adjust the position to the benchmark.

as the common unit.² When measuring risk *ex ante*, account must be taken of the fact that the running yield of loans denominated in any other unit than nominal kronor is uncertain. This can be done by calculating the expected interest costs and risks in terms of nominal kronor with the aid of expected exchange rates and inflation, respectively, and the uncertainty concerning these magnitudes. The uncertainty about exchange rates and the price level in the future contributes to the uncertainty about the yield and the final payment that will actually be made for the currency and inflation-linked loans, respectively.

It should be emphasised that the running yield is intended to be used as a measure of cost in an assessment of a desirable structure for the central government debt. When decisions concerning the structure of the debt at overall level have been made, it is possible to define benchmark portfolios for controlling the day-to-day debt management. These must be specified in far greater detail than the overall guidelines if they are to serve at operative level as control and evaluation instruments. However, benchmark portfolios must also be designed on the basis of the goal of minimising the long-term cost, defined as the running yield to maturity. This means, for example, that decisions concerning the structure of a foreign debt portfolio, both its relative exposure to various currencies and the maturity in each currency, must take into account how these magnitudes affect the running yield of the currency debt and the relevant risk concept. In this way, it can be assured that the operative management is governed by benchmarks that are derived from the goal of minimising absolute costs. The SNDO will revert to what effect this has on the formulation of guidelines in Section 4.

2.2.2 Risk concepts for decisions on the structure of government debt

With the running yield as the measure of long-term costs, the relevant definition of overall risk is the long-term variability in the running yield. We can call this the *Running-Yield-at-Risk*, abbreviated RYaR. The main risk that has to be taken into account is the risk of higher costs, since there are limits on the size of deficits while surpluses reduce the debt without any formal restrictions.

As will become apparent in Section 3, there are empirical grounds for assuming that short yields are lower than long yields over on average long periods of time. If the goal was merely to minimise the running yield, the government debt would be predominantly financed by means of short-term borrowing. However, according to the Act, the risk associated with debt management must also be taken into account. As the government debt is long term, borrowing short would cause considerable imbalance between the debt itself and its financing. Such mismatching gives rise to risks. Short-term borrowing means, since the debt is not to be paid back at the same rate, that substantial refinancing requirements will arise in each period. The conditions on which maturing loans can be refinanced are by definition unknown. Consequently, RYaR will depend on the gross borrowing

² If instead one decides to measure the costs in real terms, then inflation-linked loans have the characteristic that the running yield is fixed. In this case, perpetual inflation-linked loans will be, in principle, risk free.

requirement, among other factors. The higher the proportion of the debt that is to be refinanced, and the larger the budget deficit during any given period, the greater the uncertainty about the running yield in the future. To this it should be added that in many cases short-term interest rates are more variable than long rates. Consequently, a RYaR restriction justifies *lengthening* of the debt in relation to a situation where the sole goal is to minimise costs.

Even if the risk of variations in the long-term cost of the debt is the main concern, other risks have to be taken into account in the debt management. The government notes in its decision on guidelines that the deficit in public sector financial savings is limited by the terms of the EU's growth and stability pact. Domestic budget policy goals are also expressed in terms of financial savings. Consequently, an unexpected reduction in financial saving is a risk factor that has to be taken into account in the debt management. This risk can be called *Financial-Savings-at-Risk*, or FSaR.

The level of financial savings is influenced by the cost of interest on the government debt.³ The risk of variations in annual interest costs depends on how large a proportion of the debt is to be financed during any given period. Consequently, an FSaR restriction also sets a lower limit to the maturity of the debt. As the budget policy goals and restrictions are annual, this risk dimension must be taken into consideration on an annual basis, whereas RYaR is primarily a long-term restriction.

As noted above, both RYaR and FSaR set lower limits to the maturity of the debt. It is not self-evident, however, that the overall level of risk is minimised if the debt is financed by means of very long loans. Admittedly, the SNDO can lock in the running yield by issuing long bonds. However, if public finances begin to generate such large surpluses that they exceed the value of maturing bonds, the SNDO has to buy back outstanding bonds. This will be done at market values. If the market value of the debt has risen (yields have fallen), capital losses will be incurred. Other things equal, it is better to select a portfolio with a lower *Value-at-Risk*, abbreviated to VaR.⁴ In portfolios containing fixed income securities, VaR will increase with the maturity of the debt, other things equal. Consequently, a VaR restriction sets an upper limit to the maturity. An upper limit to the maturity also means that

³ Financial savings is not the same as the budget balance as the latter is expressed in terms of cash-flows and is thus influenced by payments of interest. Differences arise mainly as a consequence of realised capital losses, which only influence the payments. Moreover, premiums and discounts on issues and accrued interest on zero-coupon bonds are also uniformly periodised across the duration of the loans when costs are calculated. As capital losses are the most volatile component, and interest payments are periodised across the life of the bond, it may be assumed that the financial saving varies less than the budget balance due to the effects of the central government debt.

⁴ It should be noted that the market values at risk that are relevant in an analysis of the structure of the state debt are significantly longer term than those captured by conventional VaR models, which normally have a time perspective of no longer than one month. Such VaR models can, however, have a part to play in the management within the framework of a benchmark portfolio

the state avoids committing itself to paying the prevailing – and possibly high – rates of interest for a very long period of time.⁵

The preceding paragraph covered the effects of changes in interest rates on the market value of the debt. Unrealised price effects due to changes in interest rates do not affect the official definition of the government debt. If the perspective is broadened to include foreign currency debt, it must be kept in mind that the currency debt is measured in kronor, translated at prevailing exchange rates on a daily basis. Consequently, a high share of borrowing in foreign currencies means that the value of the government debt, when expressed in kronor, can vary significantly over time, if the value of the krona changes in relation to foreign currencies. This means that the structure of the debt influences the risk of fluctuations in *the recorded level of the state debt*. This is so even if the currency movements are temporary and thus have no influence on long-term costs. As the level of the state debt is a major influence on the consolidated gross debt, which (as a proportion of GDP) is a magnitude used in both national budget goals and the excessive deficits procedure within the EU, this source of fluctuations in market value should also be taken into account in decisions on the structure of the debt. In practice, this sets a restriction on the share of foreign currency debt and creates an aversion to currencies with high volatility.

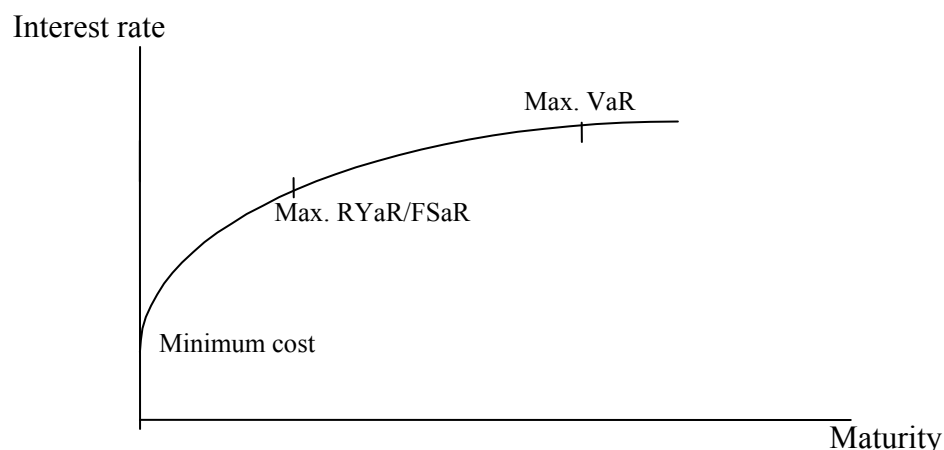
2.2.3 Summary

To sum up, the arguments above imply that debt management should be guided by the goal of minimising long-term costs defined as running yield to maturity. Decisions on the structure of the debt portfolio are constrained by three risk restrictions. Firstly, the risk of a long-term rise in the running yield to maturity has to be taken into account. This restriction can be expected to lead to the maturity of the debt being lengthened, other things equal, in relation to the use of a straightforward cost minimisation goal. Secondly, debt management must take into account the risk that payments of interest on the debt will cause a deterioration in public sector financial savings. This restriction will also tend to lengthen the maturity. Thirdly, the risk of variations in the market value of the debt should be taken into account. In qualitative terms, this sets an upper limit to the maturity of the debt. Moreover, concern for the market value of the debt means that the share of foreign currency debt in general and the exposure to volatile currencies in particular should be limited.

These considerations can be illustrated in stylised form in the figure below, which only includes the selection of maturity. This is based on the assumption that the expected costs are minimised if the debt is financed on a short-term basis. However, the shortest acceptable duration is limited by the RYaR restriction (which, for the sake of simplicity, is assumed to equal FSaR). The longest possible maturity is set by the VaR restriction. The

⁵ The other side of this coin could be that the state is not able to extend the debt significantly in a situation when long yields are at historically low levels. Such factors, which have more to do with expectations than the underlying characteristics of the portfolio, should, however, be primarily taken into account at a more tactical level of debt management, i.e. when taking positions in relation to benchmark portfolios.

possible interval is thus limited by these two restrictions, but the optimal maturity is determined in this case by RYaR; i.e. the aim should be to go as short as possible without the risk of variations in cost becoming too great.



The figure illustrates only the basic principles. The reason for analysing the choice of portfolio using simulation models is to attempt to quantify these relations – including the effects of the choice of nominal debt, inflation-linked debt and currency debt – and to permit systematic comparisons between the cost and risk profiles of different borrowing strategies.

The reasoning regarding relevant definitions of risk has been put forward here solely in nominal terms for reasons mentioned in the introduction. However, the SNDO does take up in Section 4.5 the question of how the proposal for guidelines can be presumed to influence the real risks associated with the government debt.

3 Models for simulation of costs and risks in debt management

3.1 Background and conditions for a model-based analysis of debt management

In last year's decision on guidelines the government noted that the short time available for preparing the proposals and the decision on them meant that no quantitative information was available to assess how changes in the structure of the debt influence expected costs and risks. The government instructed the SNDO to develop, in consultation with the Ministry of Finance, simulation methods for analysing what effect different structures for the central government debt portfolio would have on costs and risks.

A report on this work was submitted to the Ministry in June 1999.⁶ It describes the demands that should be made on a simulation model for the analysis of the composition of the national debt. It also includes an outline of how such a model could be constructed. The report points out that the objective of the exercise is to develop a model that provides *information for*

⁶ Methods for analysing the structure of the central government debt portfolio, June 8, 1999. (The report is available (in English) on the SNDO's web site (www.sndo.se)).

decision making and not a tool that more or less automatically generates an optimal government debt portfolio that can then be converted into a concrete decision on guidelines. A model can be used to derive a debt portfolio that, *on the basis of given assumptions* regarding the characteristics of the economy, the correlations between interest rates, exchange rates, inflation etc., possesses certain characteristics. The uncertainty regarding how well the model accords with the real world in which the costs are actually incurred prevents it from being applied mechanically. Decisions on guidelines for the management of the national debt must therefore be made on the basis of *assessments of a qualitative nature* in which the quantitative results of simulation models are included as part of the information upon which decisions are based.

The report emphasises that the SNDO intends to develop a model on the basis of its own specific requirements, but that this model development process will take some time. In preparation for the decision on this year's guidelines, therefore, the SNDO, as mentioned in the introduction, has engaged external consultants to present quantitative results from already developed models. Following a simplified procurement procedure, in which four international investment banks were invited to submit tenders, of which two responded, the office decided to engage Morgan Stanley Dean Witter (MSDW).

This choice was justified partly by the fact that MSDW had developed (originally for other purposes) a simulation model that was ready and that was based on principles similar to those described in the government report. The model was then modified in some respects and augmented to handle analyses of the Swedish government debt. In principle, the model allows all parts of the state debt to be analysed simultaneously. The aim is thus to obtain a picture of how total costs and risks are affected by the choice of financing strategy. It should be noted that as the parts of the model that generate paths for interest rates, exchange rates etc. are subject to confidentiality for commercial reasons the SNDO does not have a complete picture of how the model is constructed.

Alongside the analysis in co-operation with MSDW, the SNDO has developed internally a model for analysing the selection of average maturity for the nominal krona-denominated debt. This work is the first step in the development of a model based on the SNDO's specific needs. The SNDO considers, in some respects on the basis of its experience of the MSDW model (see also below), that a stepwise approach involving simple sub-models to illustrate various aspects of the structure of the debt, will provide a better understanding of the mechanisms influencing the costs associated with the debt than a complex total model would. In the latter case, it may be difficult to interpret and understand the results. This would then make it difficult to place enough confidence in the results for them to function as a source of information for making decisions. This is particularly the case if one does not have a clear picture of how the various parts of the model function together. The SNDO has summarised the results of the analyses made of the various models in the following sections.

3.2 The Morgan Stanley Dean Witter model

3.2.1 Background

The model and the simulation results are described in MSDW's report, which is attached to this memorandum; see appendix 1. The presentation here is therefore brief and primarily focused on summarising and to some extent complementing the interpretations of the results presented in MSDW's report.

The MSDW model is based on an ambitious approach whose object is to model interest rates and exchange rates for a large number of countries on the basis of their individual characteristics. Rather than functioning as a forecasting model, its purpose is to simulate reasonable statistical distributions for the variables of interest on the basis of stylised facts for the state of the economic cycle and changes in financial variables during the cycle. These distributions are then used to quantify the expected costs and their uncertainty.

3.2.2 Strategies investigated

As a starting point for the analysis, MSDW and the SNDO agreed to carry out ten experiments in which issuance schedules with different maturities and compositions by type of debt were investigated.⁷ As reference alternatives, a borrowing strategy was used whereby the portfolio would retain the same structure as in the initial position (Strategy 1). In the other nine, changes of both the choices between nominal debt, inflation-linked debt and currency debt and different maturities of these three types of debt were investigated. In relative terms, the inflation-linked debt is varied from 0 % to 30 %, and the currency debt between 0 % and 50 %. The maturities were varied by assuming in one case (Strategy 7) that all kronor and currency borrowing was arranged in the form of ten-year bonds and in another (Strategy 8) that only three-month bills and two-year bonds were issued. The idea was to begin with radically different, and in some cases unrealistic, strategies for new borrowing as a means of obtaining a better understanding of the mechanisms in the model and of the interaction between the different types of financing. The plan was then to adjust the strategies as a means of approaching, in some sense optimal portfolios, given a variety of assumptions. However, the second step was never taken for reasons that will be explained below.

MSDW supplemented these simulations with a further four strategies, characterised by a high level of currency debt and a focus on borrowing in low interest rate currencies, i.e. Swiss francs and yen. In Strategy 5, 10 per cent of the total debt was placed in each of these currencies and in Strategies 12 and 13, around 40 per cent. In Strategy 14, more than 80 per cent of the debt is denominated in yen by the end of the simulation period.

3.2.3 Simulation results

⁷ These are described in the report as strategies 1-4 and 6-11.

A general observation regarding the results for the ten original strategies is that differences are very small, in terms of expected cost as well of reported risk measures. Nor are the cost differences significant on the basis of conventional statistical criteria. This is also true of the more extreme of these strategies. For instance, the model indicates that it would make very little difference if the borrowing was shortened radically. Strategy 8 generates average interest payments of 61.3 billion kronor, only 1.5 billion kronor lower than in Strategy 1, even though the maturity is shortened from 3.8 to 1.3 years. In this case, the probability of the shorter borrowing becoming more expensive is almost 30 per cent.

Nor do variations in the relative level of currency debt have a particularly large effect. This is probably partly due to the assumption that Sweden enters EMU in the relatively near future in most simulations, in combination with the currency debt initially being dominated by euro. From and including Sweden's affiliation to EMU, krona and euro yields perform identically. In this case, therefore, in reality the currency debt is relatively low for much of the 20 years covered by the simulation, as it takes time for new borrowing in dollars, etc. to restore the share of currency debt to the steady state level. In practice, therefore, the differences in the structure of the debt are not as great as implied by the differences in the shares of the various types of debt.⁸

Increasing the share of inflation-linked debt lowers the expected costs but here too the effect is slight. The average variation in borrowing costs over time (called TSV2 in the report) is also slightly lower if the debt includes a higher proportion of inflation-linked borrowing.

In the absence of financially and statistically significant results in the original strategies, MSDW, as mentioned above, has introduced some more extreme cases with a higher proportion of low interest rate currencies. It is one of these - Strategy 5 – that is highlighted in the conclusions in the report. MSDW notes that the expected cost is 2.6 billion kronor lower than in the initial portfolio and that the probability of the costs being higher is only 2 per cent. The largest expected saving is obtained by concentrating the debt on yen. However, MSDW observes that this strategy is not to be recommended.

MSDW observes that the analysis indicates that three measures would reduce the expected costs:

- to raise the proportion of inflation-linked debt
- to raise the proportion of yen-denominated debt
- to shorten the maturity of the nominal debt

3.2.4 The SNDO's appraisal of the results

⁸ This characteristic means that MSDW's conclusion that the euro is far too like the krona to influence costs and risks should be qualified. This result is probably primarily due to the modelling of EMU accession and not to fundamental similarities between the euro and the krona.

The MSDW model has properties which have made it difficult to obtain clear-cut results on the basis of the stylised strategies examined. The noise that emerges from the model in terms of high variance in most cases drown the differences in the expected costs of different borrowing strategies, despite their radically different compositions.

One possible interpretation of this result is that the model provides an accurate picture of the uncertainties prevailing in the establishment of guidelines for debt management in the present context. In that case, neither the choice of composition nor maturity for the debt would matter much, as the expected gains or losses from one or the other strategy would all lie within the normal fluctuations around the mean of any strategy.

Another possible interpretation (which does not exclude the first) is that the model does not highlight the differences between the different strategies to a sufficient extent. Instead, the differences drown in model generated uncertainty which stems from attempts to model aspects of the underlying economic reality that are not relevant in the present context. The reason for this would then be that the MSDW model has such high ambitions when trying to capture various mechanisms that the results become difficult to interpret. As the SNDO does not have access to those parts of the model that generate paths for interest rates and exchange rates, it is difficult to make precise judgements in this respect. However, the SNDO's assessment is that the uncertainty inherent in the model is likely to be one of the main reasons why the results are so unclear.

In this connection, it is worth noting that in those experiments where the MSDW model used the same set of instruments as the SNDO's own model, i.e. Strategies 9 and 10 in which only government securities in nominal Swedish kronor are issued, the MSDW model generates a far greater variance in the running yield than the SNDO model. This is so even though the SNDO's model is no less sophisticated than MSDW's when it comes to modelling the Swedish yield curve.

The SNDO's view is that it would have been useful to attempt to investigate the importance of the model's properties for the result, e.g. by generating interest rate and exchange rate paths in simplified and thus more easily interpreted versions of the model. MSDW has instead opted to investigate more extreme borrowing strategies. Although these generate more clear-cut results they are of less relevance to the practical aspects of managing the central government debt.

To sum up, the SNDO notes that the quantitative results in MSDW's report do not lead to any clear conclusions. The borrowing strategies that the SNDO requested MSDW to investigate have, according to the model, broadly the same costs. The differences, if any, are not statistically significant, i.e. there is a serious risk that a strategy with a lower expected cost nonetheless turns out to be more expensive. Consequently, no unambiguous quantitative conclusions can be drawn from these simulations.

Some of the borrowing strategies that MSDW itself proposed generates (expected) cost reductions. These strategies are based on a high proportion

of foreign currency debt with emphasis on low interest rate currencies such as the yen and the Swiss franc. Compared with the present benchmark portfolio, the share of these currencies was raised from 4 to 33 per cent each in the most cautious of these strategies, namely Strategy 5. The cost reductions are to a large extent due to (strong) assumptions in the model. In the case of loans in these currencies, the MSDW model generates lower expected yields than for loans in other currencies. At the same time, the model regards these currencies as over-valued and thus incorporates a long-term depreciation against the krona from the current level.

However, these strategies also involve a higher degree of risk, which is only partly encapsulated in the measures described. As the SNDO notes above, the risk of variations in the market value of the debt must be taken into account in connection with borrowing in foreign currencies. The MSDW report also presents the ratio between the market value and the nominal value at a given time (year 10). As the measure of risk, it uses the standard deviation in the mean value calculated for the five thousand simulations) and an extreme value, the 99th percentile.⁹ In this regard, Strategy 5 does not differ significantly from the initial portfolio, whereas Strategy 14 generates high values for both, as expected. However, the distribution of the ratio between market value and nominal value at any given time is a partial measure of risk, one, moreover, that is influenced by variations that are due to the uncertainty inherent in the model. It would be more interesting to study changes in the ratio with time. By calculating variations along the simulated paths, and taking the average for these, one can obtain a measure of variations in the market value of the debt from period to period¹⁰.

The SNDO's opinion is that the MSDW model's results mainly illustrate the difficulties inherent in quantitative exercises of this type. Moreover, they illustrate the need of a simpler model to generate quantitative results that can be used to discuss the structure of the central government debt. The MSDW model is not the intuitive tool that the SNDO described in its report to the government. To that extent, these experiences confirm our conviction that the SNDO must develop its own model.

The qualitative implications of MSDW's analysis, on the other hand, appear reasonable. This is also true of the conclusion that the expected costs can be lowered by borrowing in low interest rate currencies. The SNDO considers that there may be grounds, when making decisions on the structure of the currency debt, to take this possibility into account. However, the risks must also be analysed in more detail, and the SNDO makes the assessment that the strategy of placing two-thirds of the currency debt in yen and/or Swiss francs is without practical relevance.

3.3 Swedish National Debt Office's model for analysing the choice of maturity for the nominal krona-denominated debt

⁹ The latter can be interpreted to mean that there is a 99 per cent probability that the ratio will end up below the level stated.

¹⁰ It is the same line of reasoning that leads MSDW to augment the borrowing cost analysis with the TSV2 measure.

3.3.1 Model set-up

As SNDO's own model for simulating refinancing strategies is in all essentials based on the principles outlined in the report SNDO sent to the government in June of this year, the description of the model given below is brief and above all intended to draw attention to differences in relation to the MSDW model. (A more detailed description of the model and the simulations, including some sensitivity analyses, is given in Appendix 2.)

The SNDO model, like the MSDW model, is a regime-switching model in which the economy being modelled changes cyclically between various regimes, in this case only two corresponding to booms and recessions. One significant difference here is the greater simplicity that comes from the fact that the model does not generate different monetary policy regimes, nor does it include any oil crises. This approach to modelling could perhaps be criticised in so far as it may appear to be too simple and thus not sufficiently realistic. However, given the great uncertainty caused by the complexity of the MSDW model, SNDO is firmly convinced that it is a better modelling strategy to start from a stylised model and then add more realism by successively extending the model. This approach gives the model builder control over the important mechanisms and the contribution to the overall uncertainty caused by the addition of each new component to the model.

The SNDO model only covers nominal krona-denominated debt. Consequently, there is no modelling of either exchange rates or inflation. The aim of the model is thus not to attempt to say anything about the composition of the debt as a whole but to provide a partial analysis of one of the most important subsidiary problems, namely the selection of maturity for the nominal krona-denominated debt.

In its present form, the SNDO model consists of three sub-components: a model for the business cycle, a model for the yield curve, and a model for the government borrowing requirement. A number of central assumptions are required in the three sub-components. These are described in turn below.

a) Business cycles

In common with the MSDW model, it is assumed that the probability of being in any given regime in the next period is determined by what regime is prevailing during the current period. The variable that determines the cyclical regime is then said to follow a Markov chain. A typical parameterisation of such a model could be that the probability that a quarter of strong economic growth in Sweden will be followed by a further quarter of economic growth is 90 per cent. The stated probability corresponds to the observation that on average a boom lasts for ten quarters ($1/[1-0.9] = 10$), which is an empirically testable implication. Slightly simplified, this is also what happens when the model is estimated. In the estimation, the switching probability parameter is given a value such that the separate models of the two regimes together give rise to fitted values for the observable variables

that match, as close as possible, the data which we actually observe.¹¹ The SNDO's estimates produce a result in which the typical length of a recession is 15 months, while the typical length of an economic upswing is 60 months, which is the basic parameterisation that has been chosen.¹²

b) Yield curve

The yield curve is constructed with the aid of a simple two-factor model. These two factors, the short rate and the spread between the long and short term rates (ten years and three months respectively), are parameterised to give the yield curve two distinct appearances, one for each regime.

The point of departure for the selection of parameters is provided by historical data for which the main model is a study by Ang and Bekaert.¹³ They present stylised facts describing the behaviour of the short rate and the yield spread across an economic cycle for the USA, Great Britain and Germany. Using its own estimates, SNDO has produced parameters for the Swedish yield curve that agree in qualitative terms with the empirical results arrived at by Ang and Bekaert. This parameterisation, together with the assumption that periods of strong growth are on average longer than recessions, results in a yield curve that on average has a positive slope. In the baseline parameterisation, a yield curve with a low short rate (expected value 4 %) and a wide yield spread (+ 3 %) has been chosen for the growth regimes and a yield curve with a high short rate (8 %) and a narrow yield spread (+0.5 %) for recessionary regimes. In the MSDW model, interest rates are simulated for intermediary maturities with the aid of linear interpolation. In the SNDO model, a typical yield curve is created using econometric methods.

c) Central government borrowing requirement

The net central government borrowing requirement is also modelled with the aid of the two regimes. As the simulations extend over 20 years, it was not felt to be worthwhile to make explicit forecasts. The point of departure for the parameterisation was instead simplistic and based on the target of a financial savings surplus corresponding to 2 per cent of GDP across a complete economic cycle. Using similar stylised methods, a sum corresponding to 1.5 per cent of GDP was assumed to take the form of savings in the national pension system and the local government sector,

¹¹ In the parameterisation of the various sub-components in the model, historical data have been used primarily. Even though this assumption is not exactly free of problems, the SNDO has opted to use historical data as a sort of benchmark. Sensitivity analyses in the form of experiments with the various alternative parameterisations have then been carried out. The result of this analysis is presented in brief below; see also Appendix 2.

¹² The estimate was arrived at with the aid of seasonally adjusted quarterly data from the Swedish national accounts for the years 1970–98. The estimation was carried out with the aid of the MSVAR 0.99 program for Ox2.10. (See H.-M. Krolzig (1998), "Econometric Modelling of Markov-Switching Vector Autoregressions using MSVAR for Ox", working paper, Institute for Economics and Statistics, Oxford University.)

¹³ See A. Ang and G. Bekaert (1998), "Regime Switches in Interest Rates", working paper, Graduate School of Business, Stanford University.

which leaves 0.5 per cent for amortisation of the central government debt.¹⁴ The length of the economic cycle as well as the growth rate in booms and recessions, respectively, are determined by the regime switching model described in point a). The level of the borrowing requirement for a typical month in each regime is then fixed so that during the course of a typical cycle, including one period of recession and one of strong economic growth, the government would be able to amortise a sum corresponding to 0.5 per cent of the average gross domestic product.

It should be noted that the shift in the yield curve is assumed to take place at more or less the same time as the borrowing requirement changes. A more appealing characteristic would be to allow changes in the yield curve to precede the corresponding changes in the borrowing requirement. This would reflect that the economy changes direction as a result of monetary policy being tightened, while the borrowing requirement does not rise until after the economy has changed direction. The SNDO intends to incorporate this mechanism into its modelling work in the future.

The model generates 1,000 possible developments of the economy, the yield curve and the borrowing requirement. Each simulation extends for 20 years, with a month as the minimum interval. The characteristics of the model are such that on average it will generate a given length for economic cycles, a given slope for the yield curve, etc., but its stochastic elements mean that the model will also generate course of events involving extremely long recessions or inverted yield curves. The simulated developments are then used to estimate the costs and risks in the alternative strategies investigated by the SNDO. The construction of these alternative strategies is described in the next section.

3.3.2 Borrowing strategies investigated

The SNDO model, like the MSDW model, uses strategies that are expressed in relative volume of borrowing rather than relative shares in portfolios. The strategies indicate in what way each period's new borrowing (calculated as the simulated borrowing requirement plus the sum of loans maturing during the period in question) shall be allocated to the three-, six- and twelve-month and two-, five- and ten-year maturities. One strategy, for example, could be only to issue bonds in the five-year segment, another could be to continuously arrange 25 per cent of each issue in six-month, two-year, five-year and ten-year securities, respectively. So long as the total borrowing requirement is greater than zero, the new borrowing is distributed in accordance with the stated strategy. In situations where the total borrowing requirement is negative, the model is specified so that the surplus is invested at the short rate until the following month.

¹⁴ In the budget bill, which was presented after these simulations were made, it is pointed out that the central government debt can be expected to increase if the targeted surplus in public sector finances of 2 % of GDP is achieved. Even if this raises the debt (and total costs) relative to the simulations, the ranking of the strategies are unaffected, since the yield curve in the model is independent of the borrowing requirement.

Provided the borrowing strategy is not concentrated on one or two maturities, it can be demonstrated that a given borrowing strategy will eventually lead to a constant maturity profile, even though it may take some time. When the maturity profile is no longer changing over time, the portfolio has reached a steady state. The average maturity of the portfolio will then also in principle have converged at a constant value. In the runs made so far, the SNDO has investigated more than 80 different borrowing strategies, whose average maturity in their steady state spans the range between two months (only three-month bills) and some five years (only ten-year bonds). The initial portfolio for all the strategies investigated is however, the SNDO's actual portfolio of bonds and bills. This portfolio matures gradually and is replaced by new loans in accordance with the borrowing strategy. The half-life of the initial portfolio is around 4.5 years, which means that dependence upon this initial portfolio will not be fully eliminated before the longest bonds mature, which will take 15 years. The difference between the maturities of the different strategies, *on average over the entire 20-year period*, is therefore somewhat less. It is this average maturity over 20 years that is illustrated in figure 2 below.

For each simulated path, the portfolio's maturity profile changes month by month, as all borrowing is arranged in accordance with the refinancing rule of the strategy in question. Each month, running yield, maturity, average interest fixing period, and the ratio between the market value and the nominal value of the outstanding portfolio are calculated. This gives a 20-year time series for each simulation and strategy showing changes in these magnitudes over time. With 1,000 simulations, this means that 1,000 simulated expected values for each of these parameters is obtained *for each strategy investigated*. The model's estimate of the expected cost of any given strategy is then simply the average of these 1,000 expected values for the cost parameter in question.

One principle underlying the measures being taken to develop the debt management is, as the SNDO noted above, that there is no given borrowing strategy or portfolio composition that is optimal in all situations. However, the simulations only cover static borrowing strategies that are independent of the prevailing regime and thus of current interest rates and exchange rates. This reflects the preliminary phase reached by the work of developing quantitative analytical tools. At this stage, the government debt policy landscape is painted with a very broad brush. The next natural step in the development of these modelling activities is therefore to introduce dynamic borrowing strategies. In particular it would be valuable and, in terms of modelling, logical to examine the possibility of allowing the issue strategies to be influenced by the prevailing regime, possibly incorporating some type of time lag. The SNDO intends to develop methods for analysing dynamic strategies by means of simulation models.

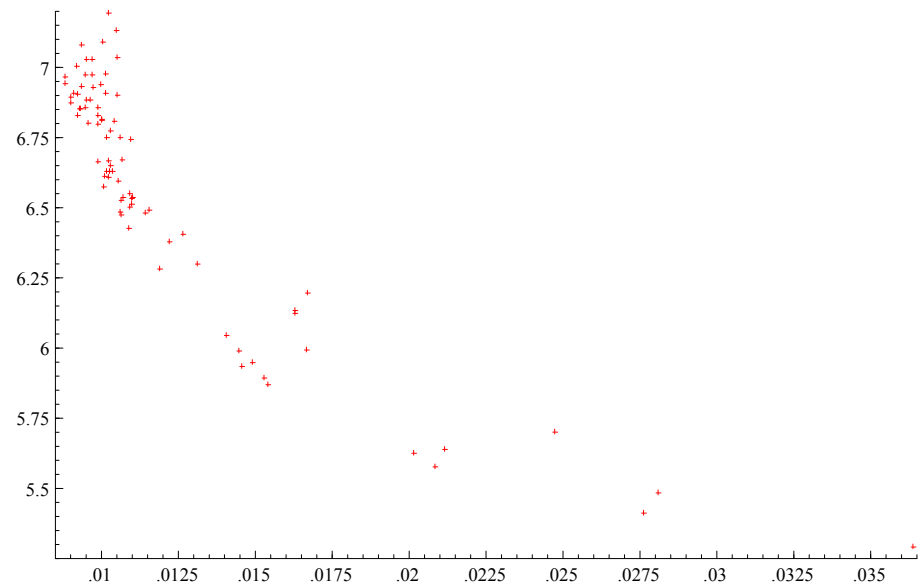
3.3.3 Result of preliminary runs

The estimated values can be analysed in a variety of ways. A typical variant in the context of portfolio selection is to show the various strategies in the dimensions of risk/expected cost. Translated into the SNDO's terminology,

this would correspond to the volatility of the running yield to maturity and the running yield. It has the appearance illustrated in figure 1.

Figure 1: *Expected cost and risk*

Running yield



Risk

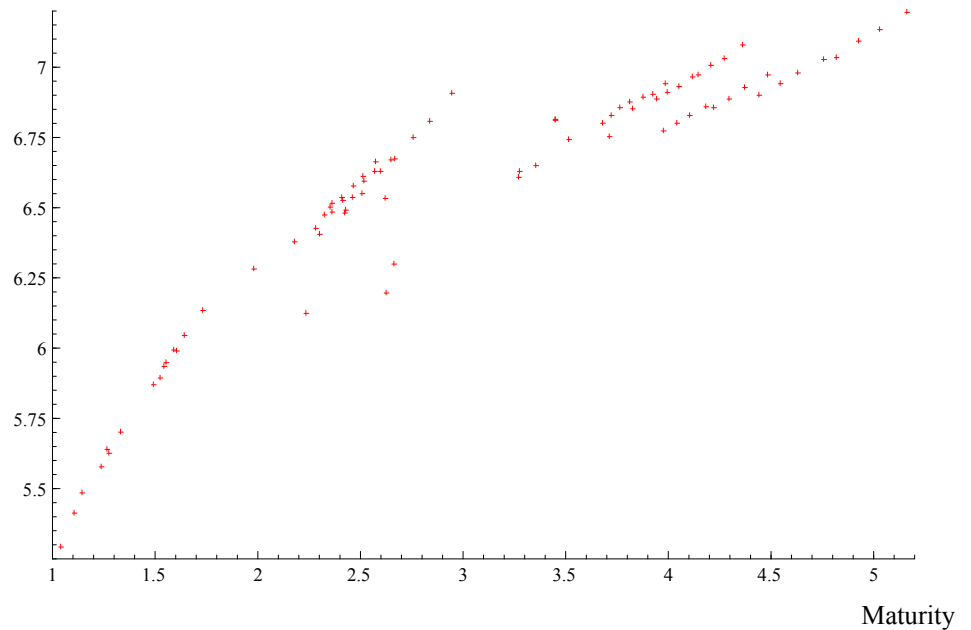
Figure 1 shows that portfolios with low expected costs are generally associated with higher risk, whilst strategies with a higher expected cost tend to be less risky. One explanation for the bend in the cluster of points could be that the various points on the yield curve are not perfectly correlated. A strategy that involves new borrowing in several different segments would therefore absorb an average volatility across the entire curve that is less than the volatility at individual points on the curve.

The curve described by the points in figure 1 could be likened to an efficient frontier. Even if all strategies lay on a single line so that none were inefficient by definition, one could not directly pick out an optimal strategy; switching from one strategy to another does require a balance to be made between the lower expected cost and the higher risk. An unambiguous choice can only be made if there is a clear preference for what level of risk the portfolio should actually have.

Another useful way of analysing the model's result is to examine the connection between maturity and expected costs, which is illustrated in figure 2.

Figure 2: *Expected cost and maturity*

Running yield



It can be seen from figure 2 that there is a distinct positive correlation between maturity and running yield. The relation is not entirely linear, which is due to the ability to achieve the same maturity by means of a variety of different issue strategies. It should also be noted that the slope of the cluster of points is a result of how the model is parameterised. In the experiments in question, the parameterisation used historical data with a yield curve that was on average relatively steep. Yield curves that are on average flatter would give a less positive slope in figure 2.

Would a shortening of the portfolio's maturity lead to a higher risk in the form of wider fluctuations in the running yield to maturity? One way of arriving at an answer to this question is to consider figure 3, in which the strategies investigated are shown along the axes maturity/volatility of running yield to maturity:

Figure 3: *Maturity and risk*

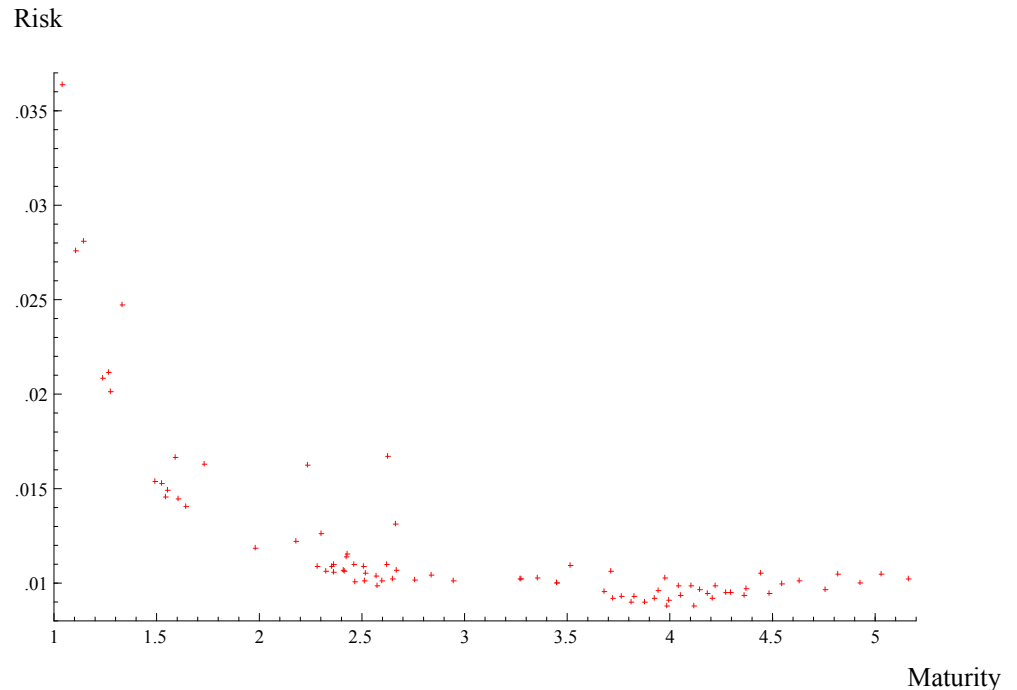


Figure 3 shows that the correlation between maturity and running yield volatility is fairly horizontal for maturities of between 2.5 and five years. The increase in risk that results from shortening the maturity from the present four years to 2.5 years thus appears not to be particularly great. The reason is that the higher risk associated with really short maturities is due to two factors: firstly (in the model and also often in reality) the volatility at the short end of the yield curve is slightly higher, and secondly, if the portfolio has a shorter maturity a larger proportion of the debt will be refinanced each year and thus absorb a considerably higher proportion of this volatility. It is the latter of these effects that appears to predominate.

The results and their quantitative implications must be interpreted with care. If the results are to give an accurate picture of future interest costs it is necessary for the parameterisation that has been chosen to accurately reflect the relationship between costs and risk in the future. Subject to these reservations, however, shortening the maturity by, say, one year would lead to a reduction in the annual interest cost of the kronor debt corresponding to some 26 basis points, or around 2.5 billion kronor. This may, in this context, appear to be a modest cost saving, but it must, however, be seen in relation to what effect such a strategy of shortening the maturity would have on the level of risk.

Estimating the risk that such a strategy would involve is an even more uncertain process. One possible measure is to calculate the difference in basis points between a typical result and an unfavourable but comparatively unlikely outcome, such as the spread between the median and the 95th percentile. If a given strategy gives rise to a relatively broad spread between these parameters, it would be regarded as more risky. On the basis of this measure, the risk associated with the strategies so far investigated would be

limited. Shortening the maturity by one year would increase the distance between the median and the 95th percentile by only 9 basis points.

The simulations thus indicate that the maturity at which the increase in the risk of further reductions in maturity would become significant is quite a long way from the present maturity of the nominal krona portfolio. This result appears rather robust in relation to alternative parameterisations of the model that the SNDO has tested. Changes in those parameters that determine volatility, the slope of the yield curve and the economic cycle do lead to differences in the levels of expected costs and in the volatility of these costs. However, there is no change in the conclusion that there would be no unambiguous increase in the running yield volatility, even in the event of a fairly radical reduction in the maturity of the nominal krona debt.

3.4 Conclusions

All in all, the quantitative calculations carried out by the SNDO or with its participation do not lead to any unambiguous conclusions of a quantitative nature. In the more general model, the results are associated with considerable uncertainty, while the more robust results that have been obtained were generated by using a partial model, which is at an early stage in its development. However, the work with and discussions of the quantitative models have been of help in bringing precision to the different questions raised by the need to produce guidelines. The indicative quantitative results that have emerged also provide useful information for the analysis, qualitative for the most part, described in Section 4.

4 Proposal for guidelines

4.1 Introduction

It follows from the statutory target that the central government debt should be considered as a totality, i.e. the target relates to the expected *total* costs and the *overall* risk associated with the central government debt. The important point when deciding on guidelines for debt management, therefore, is to find a composition that gives the debt, *seen overall*, desirable characteristics. In this context, an important point is to take into account the interaction between different risks, as the total risk – in contrast to the expected cost – is not equal to the sum of the risks in the sub-portfolios.

The characteristics of the debt are determined in all essentials by the relative proportion of the three basic types of borrowing, nominal krona loans, inflation-linked loans and currency loans, and the selection of maturities and maturity profiles for the three types of debt.¹⁵ It is thus in principle

¹⁵ Over and above this, costs and risks can be influenced by market maintenance activities. These effects are, however, marginal in relation to the selection of the composition of the debt, at least in a country such as Sweden, which already has a well-functioning government securities market. Market maintenance is a means for the SNDO to minimise costs and is not specifically regulated in the guidelines. The SNDO considers that the same principle should apply in the future.

relatively easy to indicate those *magnitudes* that determine the costs and risks of the debt. On the other hand, it is difficult to assess *ex ante* what *values* these magnitudes should be given in order to achieve the target, the lowest possible cost taking risk into account. There is an infinite number of ways of financing the government debt, and the factors that determine costs, primarily interest rates and exchange rates, are governed by complex processes whose properties are only partly known and understood.

The costs for the government debt are, of course, influenced by the size of the debt. There is, however, uncertainty here as well. During the years to come, the debt will diminish sharply, mainly as a consequence of temporary effects, primarily proceeds from privatisation and transfers from the AP fund. According to the budget bill (bill 1999/2000:1, app. 2, p. 69) there is a long run underlying borrowing requirement, i.e. the government debt is expected to increase in nominal terms. Temporary factors are however expected to lead to fiscal surpluses until 2002. The long run plans for the debt composition are affected by expectations of the debt development; i.e. if the debt will increase or decrease. The annual guidelines could also need to take such expectations into consideration.

The purpose of the simulation models discussed in Section 3 is to provide information that can be used to analyse the selection of a suitable portfolio composition by quantifying these correlations. However, given the complexity of the problems and uncertainty regarding the practical capability of the model, the results, as noted above, must be regarded as no more than indicative.

It is important that the overall perspective on the government debt is nonetheless retained. The decision on guidelines is without doubt the factor that has the greatest importance for the long-term costs and risks of the government debt and thus for whether the goal is achieved. The guidelines set the limits for the debt management; that the currency debt should be 35 or 15 per cent of the total debt, or that the maturity should be two or five years, and so on. As only a small proportion of the debt is refinanced each year, these attributes can only be changed gradually, but this does not reduce the effect of the decisions on annual guidelines on the long-term cost. The SNDO's decisions to deviate in one direction or the other within the limits stipulated in the guidelines necessarily represent relatively small changes in relation to the decisions on where these limits should be set. Given the absolute size of the debt, deviations within the limits imposed by the guidelines have significant consequences in terms of kronor, although in relation to the total cost of the debt, the effects are only marginal.

In the report the SNDO submitted to the government in May 1999, it was stated that the proposals for guidelines should be based on a number of stylised but clearly differentiated debt portfolios whose characteristics had been studied with the aid of quantitative models. The possible choices should include the initial portfolio but span a relatively broad spectrum of possible government debt portfolios with the object of illustrating the considerations that have to be taken into account in terms of expected cost and risk. The government can then explain the considerations and assumptions that lie behind its decision to choose a particular portfolio,

possibly with modifications to take into account any further information the government may have.

In this proposal for guidelines, it has not been possible to adopt this approach in all respects. The borrowing strategies simulated in the MSDW model have been constructed to be differentiated alternatives for the total debt. The difficulties in drawing unambiguous conclusions from the MSDW model do, however, prevent the SNDO from recommending that the decision on guidelines be based on the presentation of the characteristics of different borrowing strategies encapsulated in the model. The SNDO's own partial model for analysing the selection of maturity, despite the less complex and more readily understood results, does not provide the information required for a proposal concerning the characteristics of the total debt. In principle, therefore, the proposal for guidelines has the same structure as last year's, viz. the SNDO proposes a number of modifications to the attributes of the debt in relation to its initial position.

In the rest of this section, the SNDO takes up certain points of principle regarding the formulation of the guidelines, along with the concrete proposals.

4.2 The composition of the debt

As noted in the introduction, the costs associated with the government debt and the risk of these increasing are influenced by the mix of nominal krona borrowing, inflation-linked borrowing and currency borrowing. A first question is whether the guidelines should state what mix of the three types of debt the central government debt should have at any time. From a traditional portfolio choice perspective, it may appear natural to indicate guidelines as to what composition the debt portfolio should have at any time. However, this approach can raise the cost of the currency debt, and it is also unmanageable in the case of inflation-linked loans. Nor is the present arrangement, in which the guidelines for currency borrowing are expressed in terms of narrow band expressed in kronor, and only the nominal krona borrowing serves as a buffer in the event of unexpected changes in the borrowing requirement, entirely suitable. The SNDO therefore begins this section with an examination of how the guidelines for the composition of the debt could be formulated.

4.2.1 Methods for controlling the composition of the debt

The disadvantage of stating guidelines in terms of portfolio composition emerges most obviously in the case of the currency debt. If the value of the krona falls, the relative level of currency debt will rise. If the benchmark is stated as a percentage of the debt, the SNDO in order to neutralise this effect would need to repay some of the currency debt at times when these currencies are highly valued. And, vice versa, the state would need to borrow additional amounts in foreign currencies at times when the krona is strong as the relative level of currency debt would then be falling. There are grounds for believing that changes in exchange rates are often temporary and that exchange rates tend to return to some sort of mean value. In such a case, the principle of keeping the relative level of currency debt constant

would mean that the state would be systematically borrowing and amortising the debt at times when it is expensive.¹⁶ This will obviously conflict with the cost target.

It should also be pointed out that the composition of the debt will change significantly when assets from the AP Fund are transferred to the SNDO on January 1, 2001. Some of the assets transferred will be krona-denominated bonds, which will reduce the krona debt correspondingly. Other things equal, the currency debt will rise in relative terms, although it is uncertain by how much. If the share of currency debt then differs from benchmark for the proportion of currency debt at that time as a result of this transfer of assets, the SNDO may be compelled to re-position the debt portfolio at great expense or in some other unsuitable way.

With this in mind, the SNDO considers that currency borrowing should continue to be controlled by guidelines expressed in terms of flows rather than as a proportion of the stock of debt. As a consequence of this, other types of debt cannot be controlled in terms of relative shares of the debt portfolio either.

One step in the direction of a traditional portfolio approach would be to give guidelines for allocating *the gross borrowing* among the three types of debt. This is the approach used in the simulations in Section 3. If for example, 20 per cent of the gross borrowing requirement is covered by currency borrowing for a number of years, the currency debt would ultimately approach 20 per cent of the portfolio, provided that the exchange rate of the krona is not trending.¹⁷ This may thus be regarded as one means of controlling the long-term portfolio composition.

If it were a simple task to forecast the borrowing requirement, it would not matter if the guidelines for currency borrowing were expressed in terms of a share of the gross borrowing requirement or, as at present, in kronor. In practice, however, it is difficult to predict the borrowing requirement. In addition to the general uncertainty over future economic developments, and over how these will influence the state's payment flows, the borrowing requirement can be markedly affected by other factors. This is particularly evident during the present period, as is illustrated by the changes in the SNDO's borrowing requirement forecasts for 1999. In November, when the government made its decision on guidelines, the forecast indicated a surplus

¹⁶ The view that an equilibrium exists around which nominal exchange rates move is a controversial one. A classical reference is R.A. Meese and K. Rogoff (1983), "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?", *Journal of International Economics*, 14, pp. 3-24. The authors argue that exchange rates are best (less worse) described as a random-walk and thus do not return to an equilibrium. A more recent survey of the subject is provided by F. Klaassen (1999) "Long Swings in Exchange Rates: Are They Really in the Data?", working paper, CentER, Tilburg University. The survey provides some support for the idea that exchange rates can be predicted. Moreover, a regime switching model is also presented that has a better explanatory value than the random walk-model. The model appears to be able to predict in what direction exchange rates will move in the longer term, which is a sufficient condition for control based on relative shares of a total portfolio will lead to higher costs.

¹⁷ The portfolio share is also influenced by any differences in the maturities of the types of debt; cf. Section 3.

of 20–30 billion kronor. In May, the surplus was estimated at 80–90 billion kronor, as the introduction of the premium reserve system had been delayed and the government had announced in its spring bill plans for privatisations for 140 billion kronor between 1999 and 2002, of which proceeds of 45 billion kronor would be received in 1999. The government underlined that the time schedule had not been established and the SNDO forecast that proceeds of 35 billion kronor would be received in 1999. In September, the forecast was revised to 50–60 billion kronor as the SNDO no longer expects proceeds from privatisations of any size to be received this year. The forecast for 2000 was raised correspondingly. In the future, the borrowing requirement in any individual year might also be changed with little warning and by significant amounts as a consequence of the privatisation of state enterprises. The SNDO therefore needs flexibility to adjust its borrowing.

According to the current guidelines, only nominal krona borrowing can be used as a buffer in the event of changes in the borrowing requirement, as the currency borrowing is controlled within rather narrow limits in terms of kronor, and inflation-linked loans are suitable neither in principle nor in practice for such purposes. Should the borrowing requirement be higher than expected, the SNDO will therefore be compelled to issue krona-denominated debt, primarily in the form of Treasury bills. This could push up bill yields and raise the cost of the debt. A significant decline in the level of krona borrowing could also have unfavourable effects on liquidity and loan conditions. The present arrangement, therefore, is not suited for the uncertainty that will characterise the borrowing requirement over the next few years. Greater flexibility to raise currency loans would help to reduce both the expected cost of and the risks associated with debt management.

Stipulating a share of the gross borrowing requirement as a means of control would solve this problem, but it does involve other drawbacks. If the gross borrowing requirement is small as a result of limited maturities and/or large budget surpluses, the composition of the debt would change slowly if this method were used.¹⁸ The method consequently functions poorly as a means of short-term control in the current situation in Sweden, which must be taken into account for practical purposes. This is particularly the case with the currency debt, where for reasons that the SNDO elaborates below continued repayments are warranted. If the guidelines are stated in terms of gross borrowing, the volume of amortisations is in practice limited by the volume of debt that matures each year, as the share cannot be set lower than zero.

In view of this, the SNDO recommends guidelines that combine the goal of reducing the currency debt with the need for flexibility, primarily in order to be able to change the amortisation rate should the borrowing requirement deviate from the forecast. The SNDO therefore proposes that the target for the amortisation of the currency debt should be stated as a given number of kronor, in the same way as this year. In order to provide the necessary degree of flexibility, this figure must be embedded within an interval broader than the one that applies in 1999. An interval of ± 5 billion kronor does not provide any real flexibility when borrowing plans are drawn up, as

¹⁸ As some targets in this respect were not included in the simulated borrowing strategies, there was no reason to take this factor into account in Section 3.

it is swallowed up by the uncertainty regarding what level of capital gains or losses will be realised during the year. The SNDO presents its considerations in this regard along with the recommended interval in the next section.

4.2.2 Proposal for guidelines for the composition of the debt

Currency debt

The SNDO argued in last year's proposals for guidelines in favour of a long-term reduction in the currency debt. The SNDO believes this line of reasoning is still valid. One reason is that there are no grounds for supposing that in the long term there is any systematic difference between the cost of krona-denominated and currency borrowing. In the past, admittedly, currency borrowing has been cheaper than krona borrowing in the long term. This was due to the yield spread between the krona and foreign currencies on average being wider than what corresponded to the depreciation in the value of the krona. This is typical of high interest rate currencies and can be interpreted to mean that during periods of economic policy uncertainty large risk premiums arise which raise the cost of domestic borrowing. The situation has changed in recent years as the result of the stabilisation of Sweden's public finances and low inflation. The yield spread between Sweden and the EMU countries, for example, is still positive, which means that the cost of borrowing in euro (at any given exchange rate) is slightly lower than the corresponding krona loans, but further convergence is quite likely. To this it may be added that currency borrowing involves a higher risk as currency movements have a direct effect on the value of the debt and thus influence the debt ratio.

Currency borrowing is also a flexible instrument. As the SNDO borrows on markets where the Sweden is a small sovereign borrower, the volume of borrowing can be raised or lowered quickly without any significant repercussions on interest conditions or liquidity. However, the use of this flexibility in the upward direction depends on the debt not being too high initially. The existing currency debt was built up over a short period when the borrowing requirement was very high. The risk of Sweden ending up in a similar situation is small, but it is nonetheless important to increase flexibility in terms of debt policy by paying off the currency debt during the next few years when the government's budget is expected to show very large surpluses.

It should also be emphasised that the share of currency debt, given unchanged borrowing, will increase in 2001 when Treasury bonds denominated in kronor are transferred from the AP Fund to the SNDO. This will increase the relative exposure of the central government debt to currency risk. The amortisation rate will therefore have to be raised to offset this increase in the share of currency debt. As changes in the debt composition can only be made gradually, there are grounds for taking this into account in 2000.

In light of this, the SNDO considers that the amortisation of the currency debt should continue. The SNDO's view, taking into account the expected

budget surpluses and the coming transfer of assets from the AP Fund, is that a good case can be made for slightly accelerating the amortisation rate from the 25 billion kronor per year that applied in 1998 and 1999. The SNDO therefore proposes that the target for 2000 should be to amortise 35 billion kronor of the currency debt.

Given an unchanged exchange rate and a surplus according to latest forecast, amortising 35 billion kronor of the currency debt would marginally reduce the share of currency debt in the total debt. As the SNDO has explained above, there are reasons for reducing the proportion of currency debt in the long term, but bearing in mind that the surplus next year will be influenced by large temporary payments, the SNDO considers that this figure is enough to prevent any increase in the share of currency debt. A further argument in favour of adopting a cautious approach to the amortisation of the currency debt is provided by the Swedish EMU rapprochement process. As a large share of the currency benchmark consists of euro – at present 70 per cent – the share of currency debt would fall radically were Sweden to join EMU. As the other conditions affecting the management of Sweden's central government debt would also change as a result of the merging of the krona into the euro, in the long term the guidelines, and not solely those for the currency debt, would need to be reviewed. As noted in section 4.1, there are also reasons to consider the expected development of the government debt level as well as the borrowing requirement when assessing the long run composition of the government debt.

As the SNDO has explained above, the figure in kronor should be embedded in an interval so that unexpected changes in the borrowing requirement, for instance, can be financed by means of currency loans. Other factors that might be expected to affect the balance between domestic currency borrowing include market conditions. If, for example, Swedish yields are volatile and rising, it could be justified to raise the level of currency borrowing slightly to relieve the domestic market. In normal cases, however, it would mainly be variations in the borrowing requirement that might cause deviations from the amortisation rate of 35 billion kronor. The SNDO considers that an interval of ± 15 billion kronor would provide adequate scope to take the pressure off the domestic market in such cases. This means, for example, that, in the event of a deviation of as much as 50 billion kronor from forecast, which even given the uncertainty typical of the borrowing requirement for coming years must be regarded as an extreme result, up to 20 per cent could still be covered by currency borrowing.

It should be noted that the need for flexibility can be expected to be at its greatest in the event of an unexpected increase in the borrowing requirement e.g. if the decision on further privatisations is delayed. It might then be particularly useful if the SNDO could slow down the rate at which the currency debt is amortised as a means of reducing the rate of increase in borrowing on the krona market correspondingly. And vice versa, if there is an unexpected increase in the surplus, it could then be helpful to amortise the currency debt at a slightly faster rate in order to maintain the liquidity of

the krona debt market or to prevent the relative level of currency debt from rising.¹⁹

Inflation-linked debt

When it comes to inflation-linked debt, the SNDO observed in last year's proposals for guidelines that the market for inflation-linked bonds is relatively undeveloped. It was therefore difficult to indicate precise targets for inflation-linked borrowing without the risk of their conflicting with the cost target. The government agreed for the most part with the SNDO's assessment. For the current year, the guidelines stipulate that the stock of inflation-linked borrowing should not decrease, although this could be permitted for purposes of market maintenance.

In 1999, the SNDO has changed from on-tap sale of inflation-linked bonds to an auction procedure, which has allowed a slight increase in the stock of such bonds. This is one aspect of the SNDO's long-term endeavour to increase the level of inflation-linked borrowing. However, the market is still small and demand uncertain at real yields that may be regarded as reasonable in relation to prevailing nominal yields and inflation expectations. This means that inflation-linked bonds at present appear to be a relatively expensive means of borrowing. If the SNDO is instructed to increase the proportion of inflation-linked bonds to a given level in the short term, or to borrow a given amount, the cost of doing so could be high. A slight additional cost could be justified on the ground that inflation-linked borrowing modifies the risk profile of the debt and helps to develop the market in the long term. Flexibility is needed, however, to adjust the level of inflation-linked borrowing to the borrowing costs the SNDO may meet.

The SNDO therefore sees no reason for changing the guidelines for inflation-linked borrowing which state that in principle this type of debt should not decrease. The aim should still be to increase the volume of inflation-linked debt. It may be called for, however, for market maintenance reasons, in the same way as with the nominal krona debt, to bring forward maturities by the repurchase of loans maturing in the near future or by the use of exchanges in which a loan is issued to finance the repurchase of an existing one. In such a case, there could be a slight decline in the reported level of inflation-linked debt.

Nominal krona-denominated borrowing

The major part of the government's borrowing is arranged in nominal krona-denominated loans. Nominal loans are the dominating instrument used on global money and bond markets, and will probably remain so for the foreseeable future. This makes the conditions for creating depth and liquidity particularly favourable on such markets. As the dominant player, the SNDO has the opportunity, and the responsibility, to influence the functioning of the market by the use of market maintenance methods with the object of lowering borrowing costs and reducing refinancing risks.

¹⁹ The SNDO examines monetary policy aspects of the proposed guidelines for currency borrowing in Section 5.

The nominal krona-denominated market is thus the key market for the state's borrowing and should be treated with particular care. Predictability and transparency are therefore important principles applying to the SNDO's actions. This, in turn, is an argument for not absorbing all changes in the borrowing requirement in one year on the krona-denominated market. The flexibility in the management of the currency debt that the SNDO has proposed above can thus be said to promote market maintenance on the domestic krona market.

It follows from the formulation of the existing guidelines for currency and index-linked borrowing that nominal krona-denominated borrowing is determined as a balancing item, which is reflected in the guidelines by the statement that the rest of the borrowing requirement is to be covered by krona-denominated borrowing. This way of describing krona-denominated borrowing, should, for the above reasons, not be construed as implying that the krona market is of marginal interest. It is instead due to the fact that special circumstances must be taken into account when formulating guidelines for the other types of borrowing.

The changes in the formulation of the guidelines proposed by the SNDO above do not alter the fact that in a strictly technical sense the krona-denominated borrowing is still a balancing item in the borrowing. The SNDO therefore proposes that the guidelines for nominal krona-denominated borrowing in this part remain unchanged.

4.3 Maturity

4.3.1 Krona and currency debt

Method of controlling maturity

The maturity of the debt, i.e. the rate at which outstanding loans fall due, can be measured in various ways. In the current guidelines, the maturity is determined by the goal for the average period for which interest rates are fixed being 3.5 years, with an interval of ± 0.5 year, for the nominal krona-denominated and currency debt together. The midpoint conforms with the initial position. However, the maturities of the krona and currency debts were not the same, being 4.0 and 2.5 years respectively. In the benchmark portfolios for both types of debt established by the SNDO's board, this difference in maturity has been retained. The shorter maturity of the currency debt is motivated by the fact that the state borrows in several currencies, and that the exposure to upswings in any one country's interest rates thus is limited. This diversification makes it possible to take advantage of the fact that short-term interest rates are, on average, lower than long-term rates, i.e. have a larger running refinancing requirement, without taking as large a risk as if the krona debt had been financed equally short. The difference is thus mainly motivated by the goal of minimising long-term costs. The current process of amortising the currency debt also makes it reasonable to borrow shorter in foreign currencies.

There is no unambiguous relation between expected cost and risk, on the one hand, and the average maturity of the debt, on the other. This is especially the case since any given average maturity can be arrived at in many different ways. At the same time, it would be inappropriate to include too many details in general guidelines. The choice of average maturity must, therefore, be controlled by judging what is reasonable on the basis of the goal of minimising costs, while also taking risk into account. The SNDO considers that the principle of a joint benchmark for the maturities of the krona and currency debts in the government decision is suitable.

This means that the SNDO, by making decisions on the characteristics of the benchmark portfolios for the krona and currency debts, as in the current year, is able to distribute the maturity mandate in a certain way between the two sub-portfolios. As explained above, it is essential that the decision is guided by the goal of minimising costs, measured in terms of the overall cost concept. It is not until all means of minimising long-term absolute costs have been exhausted that the management can be controlled by the goal of minimising relative costs, including market value effects, i.e. with the aid of complete benchmark portfolios.

In last year's proposal for guidelines, the SNDO argued that the choice of maturity should be determined by the average interest fixing period. The motivation given was, in part, that this concept was judged to be simpler to handle than a conventional concept of duration, mainly because it is not affected by changes in market interest rates. In the benchmark portfolios established by the board for the krona and currency debts, maturity is also measured in terms of the interest fixing period.

In the practical administration, however, it has turned out to be inconvenient to use this definition of maturity as the controlling parameter. As it has also been more clearly established that a market valuation shall be used for evaluating the debt management in relation to defined benchmark portfolios, *duration* (expressed in years) stands out as a more suitable concept than the interest fixing period for controlling average maturity and interest rate risk. This facilitates the co-ordination of the sub-portfolios with the object of ensuring that these together remain within the limits set by the guidelines. In practice, as the differences between the two concepts are relatively small when characterising the particular attributes of the debt, it is of no great significance for the interpretation of the results in Chapter 3 that they are based on the interest fixing period.²⁰ The SNDO therefore considers that the government's decision in respect of the maturity in the aggregate krona and currency debts should be expressed in terms of duration.

As in the current guidelines, an interval should be given around the benchmark duration. The main reason is that it should be possible to construct benchmark portfolios for the krona and currency debts that allow

²⁰ The interest fixing period, like the duration, is a measure of the average time until a bond's future cash flows. The difference between the two concepts is that whilst duration is calculated by weighting the time until each cash flow with the cash flow's current value, the interest fixing period is calculated by weighting the time until each cash flow with the nominal value. Changes in market rates will thus affect the duration of a bond, but not the interest fixing period.

positions to be taken separately in both portfolios. Without an interval, a shortening of the currency portfolio in relation to its benchmark duration must be fully matched by lengthening of the krona portfolio,. This would mean that in its tactical management, the SNDO could only take positions for changes in relative interest rates, and not for absolute changes in any sub-portfolio.

Proposal

The analysis in Section 3.3 indicates, given certain stylised characteristics of yield curves and the business cycle, that nominal yield curves can be expected to have positive slopes, on average. This means that a shorter duration ought to give cheaper long-term borrowing. The price to shorten borrowing is that the risk, measured as the volatility in the running yield, may increase. As emphasised above, the model based analysis must be interpreted with caution, but the SNDO considers that there are additional reasons to shorten the duration of the nominal krona and currency debt. This recommendation is based on the following considerations.

Firstly, improved public finances mean that the state can be prepared to increase the risk somewhat in exchange for lower future interest costs. Major surpluses in the oncoming years will reduce the debt and therefore also the interest costs in the long run. Strong public finances motivate a different trade off between cost and risk.

Secondly, the quantitative analyses carried out by the SNDO indicate that the increase in risk from going down in duration from three years for the whole portfolio to, say, 2.5 years is limited; this means that an expected cost reduction can occur with slight increase in risk. How much the risk increases depends on how the volatility in short-term interest rates relative to longer-term rates, but also on how much of this volatility is absorbed in the cost of borrowing. Normally short-term interest rates are considered to be more volatile than long-term rates, but in the SNDO's model in section 3.3 the effect in the form of variations in the running yield is not noticeable until the maturity is reduced towards two years. On the other hand, it is in the really short maturity segment that the cost saving can be expected to be highest since yield curves tend to steeper up to two years. The quantitative models, thus, would support a relatively drastic change of average maturity without the risk increasing significantly.

Thirdly, it is natural to shorten the debt given the increase in the expected surplus during the next few years. The surplus diminishes the net borrowing requirement. Consequently larger redemptions can be accepted (other things equal) without an increase in the total refinancing risk. In addition, the aim to reduce market value risks by matching the debt with its financing means that higher surplus gives room for shorter borrowing.

It can be argued that long-term interest rates can be expected to be especially low in periods when the public finances are healthy, e.g. because the credibility for fiscal policy is strong at such times. If so, the government ought to seize the opportunity to lengthen the debt during surplus periods

and thus need to borrow less than in the event of a deficit.²¹ This mechanism means, in principle, that the government safeguards itself against increased costs as a consequence of future public finance problems in periods when such insurance is cheap in absolute terms. If one only foresees normal economic fluctuations in the borrowing requirement, such an insurance is not very valuable. In such circumstances the risk premiums on long-term borrowing ought not to vary much over time, since the credibility of public finances is never questioned. However, if one fears that the economic boom will turn into a deep downturn, the will to pay for such an insurance increases. In concrete terms it would have been an advantage if the state debt at the start of the crisis in the 1990s had had a longer average maturity.

Government debt management, taking risk into account, must bring both of these scenarios into the calculation. Given the current forecast for the public finances, the office does consider that the motives to shorten the debt in the current situation outweigh other motives.

The SNDO does, however, hold the view that there is reason to change the duration of the debt with care. A major reduction demands extensive restructuring in the borrowing strategy, and may also require far-reaching debt management measures, for example in the form of exchanges. This can lead to large transaction costs and also risks deteriorating the functioning of the market. Expected cost savings, as a consequence of a shorter duration, must therefore be weighed against the need to maintain a long-term borrowing strategy in the market, which in turn promotes liquidity in the government bond market. The fact that quantitative models are marked by uncertainty, requiring that the results from such studies be interpreted with care, also point in favour of a careful strategy. Further, the conditions for government debt policy, as for example the borrowing requirement, are characterised by great uncertainty; major changes from one year to another ought therefore to be avoided.

The conclusion is all the same that both qualitative reasoning and quantitative results favour a reduction of the average duration. The SNDO proposes that the duration at the turn of 2000/2001 ought to be approximately 2.7 years. This corresponds to a reduction by some 0.35 years compared with the situation at the end of August 1999 and by approximately 0.25 years in relation to the forecast duration at the end of 1999. The transition ought to be made gradually over the year so that the change of the duration has been completed by the end of 2000. Otherwise the state risks being burdened with high costs, directly following regular transaction costs, and indirectly because investors can be expected to demand compensation for making correspondingly rapid changes in their portfolios.

An interval of ± 0.3 years ought to be set around the target value. This interval enables the SNDO's board to state independent intervals around the two benchmark portfolios against which the office is assessed in the day-to-day debt management. In addition it is motivated to allow limited variations

²¹ This is an example of a dynamic strategy for borrowing of the kind that will be studied in the future model work.

around the target value as a consequence of, for example, the duration effect of maturing loans and interest rate changes.

It can, in this context, be said that the SNDO's analyses also point in the direction that there ought to be a difference between the duration in nominal krona debt and foreign currency debt. A shorter duration on the currency debt is motivated, for example, by the fact that the SNDO borrows in several currencies, which limits the exposure to upswings in a single country's rates. This diversification makes it possible to take advantage of short-term interest rates being, on average, lower than long-term rates, i.e. to have greater refinancing needs without taking as high a risk as if the krona debt had been financed with similarly short loans. Further there can be reason to consider whether the foreign currency borrowing shall have a greater share of debt in low interest rate currencies, such as the Swiss franc or the Japanese yen. Experiences from the currency management, as well as the MSDW model, indicate that there may be long-term gains in such a strategy. These considerations will influence the construction of the benchmark portfolios for the krona and the currency debt which will be decided on the basis of the government's guideline decision.

4.3.2 The inflation-linked debt

The current guidelines state that inflation-linked borrowing should be concentrated on long maturities. The main arguments behind last year's decision are still valid. The SNDO therefore proposes that the same guidelines apply next year. Since there is a loan which in 2000 will have eight years to maturity and which can be worth issuing, the Office proposes that long maturity is to be interpreted as eight years or more.

4.4 Maturity profile

A specific duration can be attained in innumerable ways, including by concentrating the debt to one or two maturities. Such a measurement does not therefore limit the refinancing risk. In practice, there are other restrictions on debt management which mean that the debt neither should nor can be concentrated to one or two maturities. In particular, it is desirable for market maintenance reasons to have a relatively even maturity profile, since investors can be assumed to want to have access to bonds with different times to maturity.

Despite this, it can be appropriate to indicate in the guidelines how important it is that the SNDO spreads the refinancing requirement. This year, the SNDO has been governed by a maturity profile which states in figures the share of the debt which may mature each single year. This year's guidelines specify that no more than 30 per cent of the entire debt may mature within the following twelve months. Borrowing shall, however, aim on a maturity figure of no more than 25 per cent for the twelve month period. A maximum of 15 per cent may mature each year thereafter.

Despite the fact the Office has proposed a shortening of the government debt, the current limit for the share of maturing debt for the next twelve months is sufficient. The flexibility allowed by the present formulation is important since considerable changes in the borrowing requirement for the coming years can not be excluded as a result, for instance, of postponed privatisations. In such cases, it is important that it is possible to increase short-term borrowing temporarily. In order to provide this flexibility, but also to give sufficient margin for the SNDO when calculating how much is to mature in the following twelve months, it is suggested that a 30 per cent ceiling is set for 2000 as well. The SNDO should, however, try to ensure that no more than 25 per cent matures within the next twelve months. For the periods thereafter, it is proposed that the guideline is, in line with last year's decision, that no more than 15 per cent of the debt may mature each year.

As noted in section 4.3.1, the expected surplus means that the gross borrowing requirement shrinks for a given amount of maturing loans. Consequently, unchanged guidelines for the maturity profile lead to the sensitivity of interest costs to the prevailing level of interest being somewhat less than in 1999.

4.5 The effects of the guideline proposals

The proposals presented above can be summarised as follows:

- Amortisation of the *foreign currency debt* should be made at a rate corresponding to 35 billion kronor. The SNDO should be able to deviate from this amount by 15 billion either way.
- The stock of outstanding *inflation-linked loans* should, in principle, not be decreased and should increase to the extent that this can be done at terms considered consistent with the debt management goal. A reduction in the stock, however, is allowable for reasons of market maintenance.

- The remainder of the gross borrowing requirement should be financed with *nominal krona loans*.
- The *duration* for the nominal krona denominated loan and the foreign currency debt together should by the end of 2000 be 2.7 years (± 0.3 years). Long-term bonds should be used for inflation-linked borrowing.
- The *maturity profile* should be such that no more than 30 per cent of the debt matures within twelve months and at most 15 per cent each year following.

The proposal means that, given current assessments of the borrowing requirement, the distribution of the debt between debt categories is kept more or less unchanged for 2000. Amortisation of the foreign currency debt of 35 billion kronor would, at unchanged exchange rates, lead to a marginal reduction in the foreign currency share of the debt. The objective is to raise the inflation-linked share, but the chances of doing so depend upon developments in the inflation-linked market. It follows that the nominal krona denominated share can also be expected to remain relatively unchanged. The duration of the krona denominated and foreign currency debt is shortened, but here too the changes are limited. The SNDO's analyses indicate that the long-term strategy should be to further shorten the duration of the nominal borrowing slightly. The target should also be to continue to pay back foreign currency debt during the next few years.

It is, as the Office emphasised earlier, impossible to try to quantify the effects of the expected costs and risks of these proposals. Given the modest magnitude of the changes, however, it is reasonable to presume that the quantitative effects are limited. Qualitatively, there is reason to assume that the expected cost will decrease as a result of the shortening of the krona denominated and foreign currency debt. The effects on the level of risk are considered insignificant.

The arguments surrounding the risks of debt management have been conducted throughout in nominal terms. As mentioned in the introduction, there can be reason for shifting in future to a real, i.e. inflation adjusted, view of risk. Despite the fact that it is difficult, for reasons discussed below, to know how the central government debt should be structured in order to take into account the real risks of, it can be claimed that the proposal is neutral, in this respect. Given that the changes in the composition of the debt are small, it is not likely that the real risks will change much either.

However, it can be interesting to discuss what a shortening of the nominal debt can mean, in qualitative terms, for the real risks. Short-term interest rates are linked to inflation via monetary policy. If monetary policy does not manage to stabilise the rate of inflation, but acts late upon inflation impulses, short-term interest rates and inflation will co-vary. In this case, increased use of short-term borrowing would mean that the real costs of the central government debt would be more stable. Short-term nominal borrowing has then, in principle, the same properties as long term inflation-linked bonds. Under these conditions, both the costs and the real risks

would, given the conclusion that the nominal yield curve has a positive slope, be minimised through short-term nominal borrowing.

If, on the other hand, monetary policy acts in a pre-emptive manner, inflation will remain stable and short term interest rates will climb without a corresponding increase in inflation. In this case, short-term nominal borrowing would give rise to greater variation in the real interest costs, not exhibiting the same properties as inflation-linked bonds. Once more the need arises to weigh the expected cost reduction against the risk.

The risk assessment is thus affected by confidence in the capacity of monetary policy to handle inflationary impulses. The example illustrates that before more decisive conclusions about the implications of a real approach to risk can be drawn, it is essential to specify exactly the real risks that are of significance to government finances and to analyse how they are affected by the structure of the government debt. For example, it is important to ascertain how CPI-linked bonds co-vary with the real factors important to government finances.

These complications highlight why further analyses are required before any particular standpoint can be adopted as to how a real approach to debt management is to be applied in practice. The Office therefore looks forward to the investigation of these issues notified by the government.

5 Monetary policy aspects

Article 5 in the Act on State Borrowing and Debt Management stipulates that the central government debt shall be managed subject to the constraints imposed by monetary policy. The SNDO discussed the theoretical and practical links between government debt policy and monetary policy in some detail in last year's proposal for guidelines. The SNDO finds no reason to discuss these issues in such great detail, especially since there is broad agreement on the principle that the two policy fields should, as far as is practicable, be kept apart.

The issue that arouses most interest in this context is the importance of the government's foreign currency borrowing, in particular the degree of flexibility therein.

The purpose of the SNDO's proposal in Section 4 is to create the flexibility needed to permit the use of currency borrowing as a buffer in the event of unexpected fluctuations in the borrowing requirement. The other aspect of such flexibility is that it is not possible to foresee exactly how much of the currency debt will be amortised in any particular year.

In the SNDO's view, the methods used by the Riksbank over the past three years to exchange kronor into currency on behalf of the SNDO should provide the flexibility needed to handle any fluctuations that may occur. In the existing system, the foreign exchange reserves vary during the course of the year, since the SNDO's borrowing and interest payments in currencies

are unevenly distributed over time, while fixed amounts are exchanged each day. The foreign exchange reserves thus act as a buffer enabling daily transactions of a pre-announced amount to take place. Fluctuations in the SNDO's currency payments do not therefore preclude predictability in the exchanges that take place on a daily basis. The balancing item is instead the foreign exchange reserves, which amounted in September 1999 to approximately 150 billion kronor. An interval of ± 15 billion kronor thus corresponds to some 10 per cent of the currency reserve. The variations that can occur are also small in relation to the fluctuations that can be expected to arise in private capital movements.

In the event that the Riksbank judges the total foreign exchange reserves to be too small, special procedures allow the bank to raise foreign currency loans through the SNDO. Such loans are dealt with specifically in the Act on State Borrowing and Debt Management.

Nowadays, market participants are very familiar with the way the existing system of exchanges and smoothing of flows via the foreign exchange reserves functions. The quantitative effects on the foreign exchange reserves of the changes resulting from the SNDO's proposal will probably be small, in absolute terms as well as in relation to the fluctuations that have been absorbed within the limits of the current framework. It should therefore be possible to create scope for greater flexibility in the management of the government debt. In light of this, the SNDO considers the proposals to be consistent with the demands of monetary policy.

6 Evaluation of debt management

Pursuant to the Act on State Borrowing and Debt Management, the government shall evaluate, in a written report to the Riksdag, the management of the central government debt each year. In bill no. 1997/98:154, the government states that the purpose of an evaluation should be to provide insight into and permit an assessment of how the central government debt is actually managed. This is essential, especially from a forward-looking perspective, as such an evaluation provides guidance for future decisions.

There are, in principle, three levels of evaluation. The Riksdag shall evaluate the government's decisions on general guidelines. The government shall assess how the SNDO has managed the debt in relation to these overall guidelines. The SNDO's board shall evaluate the operative decisions taken within the SNDO subject to the limits laid down by the board.

In the bill, the government proposes that the management of the government debt be evaluated on a five-yearly basis. The SNDO assumes that the evaluations will take place for moving five-year periods on all levels of assessment. As emerges from the following sections, however, the methods and focus of the evaluations differ from level to level through the evaluation chain.

6.1 Facts on which to base the Riksdag's evaluation of the government's decision on guidelines

According to the bill, not only the SNDO's activities are to be evaluated, but also those decisions concerning the management of the government debt for which the government is responsible. The government shall carry out this evaluation on the basis of information provided by the SNDO. According to the bill, the evaluation should also include an analysis of how the cost minimisation goal has been achieved. The risks should be analysed, and the costs placed in relation to the risks taken. By way of example, it is stated that an evaluation can be carried out by comparing the result with other possible borrowing strategies.

The matter of how the Riksdag's evaluation of the debt management can be arranged was dealt with in the SNDO's report to the government entitled *Methods for the evaluation of the government's decisions on guidelines for the management of the central government debt* (May 25, 1999).²² The main points of this report are summarised below as a point of departure for a discussion of how an evaluation of the proposed guideline can be arranged.

In an evaluation of the government's decisions, it is important to bear in mind that the Riksdag has specified a goal rather than guidelines for the government's decision. There is thus no obvious point of departure – the equivalent of a benchmark portfolio – for a quantitative assessment of whether the government's decisions are consistent with the goals laid down for government debt management. From this it follows that an evaluation of the government's decisions on guidelines must be qualitative in character. However, the evaluation can be complemented with quantitative elements.

The purpose of the evaluation should be to assess how the government's decisions influence the absolute long-term costs of the central government debt and the level of risk in the debt management. As the government's guidelines have been formulated on the basis of strategic, long-term considerations, the effects of short-term fluctuations in interest rates and exchange rates are of no concern in this part of the evaluation. The evaluation should consequently proceed from an examination of the decision in light of the facts available at the time it was made. It is suggested that the evaluation should then concentrate on whether the analyses and arguments that led up to the government's decision were of sufficiently high quality and logical in nature. One part of the process could also be to examine whether the arguments and discussions behind the decision are still valid at the time of the evaluation, in order to facilitate future decisions. The decision-making process itself can also be an object of examination. Apart from the government's decision, the SNDO's guideline proposal should also be treated as an important part of the basic documentation at this stage of the evaluation process.

The qualitative evaluation on this level should be complemented with a quantitative element. Such analyses can provide valuable *support* for the assessment of whether the government's decision was purposeful; i.e.

²² [Only available in Swedish.]

whether it has helped to reduce costs with an acceptable effect on the risk level of the debt management.

There is no obvious norm for comparison, such as an overall benchmark portfolio, at this general level. The only true standard of comparison at this level would be the portfolio that could be guaranteed to minimise costs over the long term, given a desired level of risk. If this portfolio could be identified, the role of the government would be to ensure that it was reached. No actual evaluation of the government's decision would then be necessary, other than whether the route taken to the optimal portfolio was well chosen, and whether the government had selected a reasonable level of risk.

Such certainty is, however, an unattainable goal, a fact also illustrated by the quantitative studies described by the SNDO above. It is not possible to identify to any degree of certainty portfolios that can be regarded as efficient. Even if this were possible, it would not be clear how the risk level should be decided. It follows that it is not possible to compare the effects of the government's decision with a benchmark portfolio. The government's decision must be evaluated against some other standard of comparison. Since it is not unlikely that this standard is not an efficient portfolio, the quantitative result should be interpreted with caution. Used prudently, such calculations can, however, be a valuable complement in the qualitative evaluation. Not least, the quantitative result can play an important role in the accumulation of experience for future decisions.

The report to the government proposes, using the bill as a model, that the SNDO's proposal for guidelines be based on a number of stylised, but clearly differentiated, debt portfolios, whose characteristics have been studied with the aid of quantitative models. The alternatives should include the initial portfolio, but span a relatively broad spectrum of possible debt portfolios in order to highlight the considerations that must be made with regard to expected costs and risk. The government could then explain which considerations and assumptions lie behind the decision to select any one portfolio, possibly modified with to take into account any further information the government may have. A complementary quantitative evaluation can then be based upon a comparison between the hypothetical costs and risks of these alternative portfolios and the costs and risk that the selected portfolio actually involved.

As is evident from the preceding sections, owing to the difficulties that arose in the creation of the quantitative decision-support models this year, the SNDO cannot present such alternative portfolios as a basis for decision. The quantitative evaluation is thus limited to comparing the costs (and risks) of the chosen borrowing strategy with the costs of an unchanged debt structure.

Provided that the government follows the principles underlying the SNDO's proposal, it is primarily the government's decisions on the duration of the nominal krona-denominated debt and the currency debt, and on the amortisation of the currency debt, that should be subject to evaluation. The alternative calculation would in that case be based upon what the cost (and the risk) would have been had the duration been maintained on the same

level as at the start, and had there been no amortisation of the currency debt.²³

It should be noted that the quantitative evaluation of the government's decision will be based upon a comparison between two hypothetical portfolios. The government's decision lays down the guidelines for the SNDO's decision at the next level. The SNDO then converts these guidelines into two benchmark portfolios, and only then does the practical management of the debt begin, where actual costs are incurred. In the Riksdag's evaluation of the government's decision, the hypothetical costs of an unaltered portfolio can therefore not be compared with the actual costs of the debt, since the actual costs are a function of decisions by both the government *and* the SNDO.

It must be pointed out that the quantitative calculations at this overall level are by nature standardised. Numerous simplifying assumptions are needed to convert, say a decision concerning a particular duration into any given debt and the associated debt composition, the costs of which can be calculated. It will thus be an approximate calculation of a counter-factual nature.

It is also important not to confuse the proposed quantitative calculations with evaluations against a benchmark portfolio. As has been made clear, discussions at this level of evaluation should focus upon the ultimate goal of government debt management: low costs in absolute terms. Although comparisons with benchmark portfolios give precise quantitative results, they still only measure relative costs.

6.2 The government's evaluation of the SNDO's debt management within the framework of the overall guidelines

The next phase in the evaluation concerns the examination of the SNDO's management of the debt within the framework of the guidelines laid down by the government. Decisions concerning the duration and relative volume of borrowing in foreign currencies shall also be evaluated at this level.

Based on the government decision, the SNDO can distribute *the duration* between the different types of debt. The SNDO's decision to select any particular breakdown of the duration mandate should be evaluated in terms of how it influences the long-term *absolute* costs. Consequently, there is no point in trying to define a benchmark portfolio for the aggregate krona-denominated and currency debts that is characterised by having the same durations for all sub-portfolios to then to evaluate the result in *relative* terms.

When it comes to the distribution of durations between the different types of debt, the SNDO will be construct benchmark portfolios with the object of minimising the running yield to maturity taking into account the risk that this will fluctuate. The principle should thus be that the SNDO's choice of

²³ The maturity profile should be seen as straightforward restriction in the duration decision, and therefore be included in the evaluation of this decision. It should consequently not be subject to separate evaluation.

benchmark portfolio is evaluated in relation to the same criteria as the government's guideline decision, i.e. by means of a qualitative analysis complemented with hypothetical quantitative calculations. The motivation for this principle also becomes apparent if it is assumed that the government were to make a decision on the duration of the krona debt and the currency debt, respectively. The decision would then be made on the basis of the goal of achieving the lowest possible long-term cost and it would be evaluated like the other parts of the guideline decision. A decision should be evaluated on the basis of the nature of the decision itself rather than on which body made it.

The SNDO's proposal includes an interval around the proposed duration. This proposed interval is based solely upon practical considerations. It would be neither efficient nor practicable to ensure that the government debt equalled the benchmark value at all points in time. The interval also creates practical conditions for active management of the central government debt within each sub-portfolio at the next level (see below). At this level, there is therefore no point in evaluating deviations from the benchmark value.

According to the SNDO's proposal, the debt in foreign currency shall be amortised during the year. The SNDO is also given the freedom to increase or decrease the amount amortised. The government shall evaluate the SNDO's use, if any, of this flexibility. Quantitatively, this can be done by comparing the hypothetical costs the debt would have incurred had the flexibility not been used with the actual costs of the debt. This is calculated, for example, in the same way as in the method proposed for the Riksdag's evaluation of the government, namely by multiplying the difference in the average yield to maturity of the debt in kronor and of the currency debt by the deviation made.

6.3 Evaluation by the SNDO's board of the day-to-day debt management

Once the benchmark portfolios have been defined, they will govern the SNDO's management of each sub-portfolio. The results will, as usual, be calculated by comparing the market value of the actual krona debt and the currency debt with the market value of the relevant benchmark portfolios. Consequently, the results measure the extent to which decisions to deviate from the benchmark have generated savings or increased costs. These evaluations thus follow the pattern applied this year and in 1998. It is worth pointing out that the ability to interpret the quantitative result will differ for each sub-portfolio.

The krona-denominated debt is so large in relation to the market for debt management instruments that it is not possible to offset all deviations from the benchmark portfolio without incurring high transaction costs. Certain deviations that affect the calculated result, be it on the up- or downside, will thus arise, without it being a reflection of the SNDO taking a position in relation to the benchmark. This means that the result must be considered to be an approximation. Borrowing and debt management in kronor are also influenced by market maintenance considerations. The measures the SNDO takes for purposes of market maintenance are intended to improve the

functioning of the market. The general level of interest rates in Sweden can therefore be expected to fall (other things equal), which will reduce the cost of the government debt. However, the effects of these measures on the result tend to be in different directions and of different magnitudes. The quantitative result of the borrowing and debt management in kronor must, also at this level of evaluation, be interpreted with a measure of caution.

On the other hand, the quantitative result of the management of the currency debt is unequivocal. Partly because positions in relation to the benchmark can be effectively controlled from day to day, partly because the market-maintenance measures have only a negligible impact on the currency debt.

The exact structure of the two benchmark portfolios will be investigated further during the autumn. Decisions on these topics will be made by the SNDO's board once the government has established the general guidelines.

7 Continued development work

The task of developing the new system for controlling and evaluating the debt management activities is complicated. Much development work remains, with experience necessarily leading to regular reviews as it is acquired. This applies to the underlying structure of the guidelines as well as to the tools and models used to produce the necessary information.

The hopes of creating a model that could serve as an effective and efficient means of quantitative support for decision making have only been realised in part during this year's work on guidelines. However, using the experience gained – partly via the co-operation with MSDW, and partly from the development of its own model – the SNDO intends to continue the work of developing a decision support model in preparation for its proposal for guidelines for 2001.

In previous sections, the SNDO has noted that it would be useful to develop a model of the interaction between economic cycle, the yield curve and the borrowing requirement in order to create a more realistic picture. There is also reason to investigate more sophisticated, dynamic borrowing strategies that would relate borrowing decisions to the state of the economy in general and of public finances in particular.

The natural next stage in this work, over and above this, would be to endeavour to produce partial models for the other types of debt and to help in the choice between krona debt and currency debts. Only then will there be any point in attempting to integrate these into a single model for an analysis at the aggregated level of the government debt. It is far from obvious that such a complex model would have any direct use as a basis for decision-making, but it is the SNDO's hope that the development of partial models will facilitate analysis and evaluation in the future.

The decision on this matter has been made by the Board of the Swedish National Debt Office. The matter was presented by Lars Hörngren, Chief Economist. Ingrid Bonde, Deputy Director General, Erik Thedéen, Head of Department, Bengt Rådstam, Head of Debt Management, Pål Bergström, Deputy Chief Economist, Mats Filipsson, Deputy Head of Debt Management and Anders Holmlund, Head of Quantitative Analysis, also participated in the final decision.

Thomas Franzén
Director General

Lars Hörngren
Chief Economist