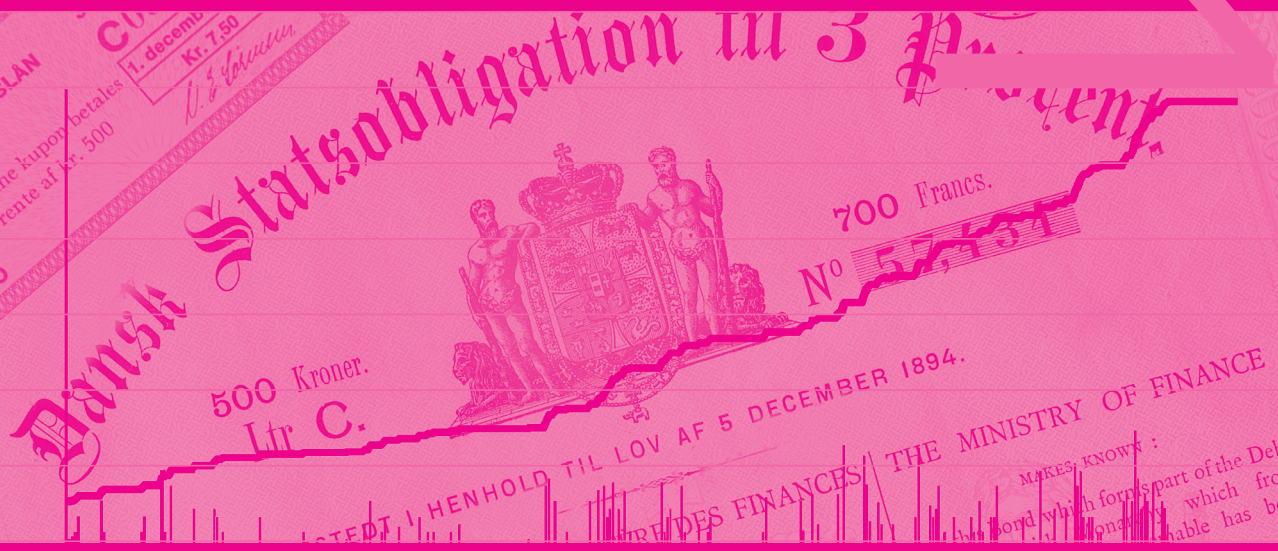
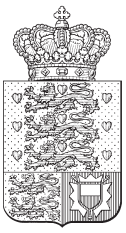
Danmarks Nationalbank

Danish Government Borrowing and Debt

2001





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Explanation of Symbols
- \- Magnitude nil
- 0 Less than one half of unit employed
- • Category not applicable

In tables figures may not add because of rounding.

This publication is based on information available up to 4 February 2002.

This publication is a translation of "Statens låntagning og gæld 2001".

Contents

APPENDICES

Foreword

In connection with the management of the Danish central-government debt Danmarks Nationalbank issues the publication "Statens låntagning og gæld" (Danish Government Borrowing and Debt). The publication describes the development during the preceding year and reports on other issues of relevance to debt management.

The aim of the publication is to give a deeper understanding of Denmark's government debt policy. *Key Elements of the Government Debt Policy in 2001 and the Strategy for the Next Years* summarises the strategy for the government debt policy and highlights aspects of the chapter on primary dealers.

Chapter 1 gives a general presentation of the *key principles* for the government debt policy.

Chapters 2-6 constitute the *report section.* They present the considerations and factors governing borrowing and debt management during the preceding year, as well as an account of the strategy for 2002. Chapter 2 describes domestic borrowing and Chapter 3 foreign borrowing. Chapter 4 gives an account of the management of the assets of the Social Pension Fund, while Chapter 5 reports on the development in the government debt and the debt of a number of government-guaranteed entities. Chapter 6 describes risk management.

The special-topic section comprises Chapters 7-9. Chapter 7 focuses on government debt policy and the financial markets at a time of sustained budget surpluses and a decreasing requirement for issuing of government securities.

In most OECD countries the use of primary dealers is part of government debt policy. Especially the EU member states have in recent years increased the number of foreign banks among primary dealers in order to obtain an internationally oriented sales organisation. Another characteristic is that more and more market making takes place electronically. In Chapter 8 it is discussed whether the introduction of electronic market making, possibly within the framework of a primary dealer system, might help to strengthen liquidity and competition in the Danish market for government securities.

Cost-at-Risk (CaR) has been developed since 1997 and is an important tool in the weighing of interest-rate risk and cost on the government

debt. Chapter 9 reviews alternative interest-rate models for CaR. The empirical results are provisional and should primarily be seen as an illustration of the issues, relevant in a CaR context.

The Appendix presents announcements relating to central-government borrowing and debt. In addition, there is a comprehensive Appendix of Tables with detailed central-government borrowing and debt statistics. Finally, a glossary presents explanations of a number of terms and concepts related to Danish institutional arrangements that are often used in the publication.

Key Elements of the Government Debt Policy in 2001 and the Strategy for the Next Years

FALLING GOVERNMENT DEBT AND INTEREST COSTS

In the period 1997-2001 the central government's budget surplus has gradually reduced the central government's debt. At the end of 2001, the central-government debt amounted to DKK 513 billion, which is a reduction by DKK 25 billion from the previous year.

The interest expenditure on the government debt in 2001 amounted to DKK 36 billion. The interest expenditure has been declining since 1996. The decrease is related to the reduction of the government debt, as well as lower market interest rates that have allowed the central government to refinance debt at relatively high interest rates with debt at lower interest rates.

Domestic government securities for almost DKK 88 billion were issued in 2001. As in most recent years, government securities were issued in the 2-, 5- and 10-year maturity segments, with the greatest proportion in the 10-year benchmark bond. In May 2001 the Treasury bill programme was expanded to include a 12-month bill. The strong interest in the new 12-month Treasury bill led to a positive financing contribution from the Treasury bill programme in 2001.

Buy-back of government securities is an integrated part of the instrument of the government debt policy. In 2001, buy-backs were supplemented with the first switch auction whereby market participants could switch older government bonds for the 10-year on-the-run issues.

All government on-the-run securities were replaced at the beginning of 2002, in view of the short remaining maturity and the suitable level of the outstanding volume.

At the end of third quarter 2001 the non-resident ownership share of domestic government securities was almost 35 per cent. This share has declined moderately in recent years. Moreover, in 2001 the group of non-resident investors has rearranged its holdings of Danish domestic government securities from long-term to short-term. Among other factors this was due to demand from the Danish pension sector for

securities of long duration which results in a narrowing in the yield differential to Germany for long-term government securities.

In 2001 the central government raised foreign loans for almost DKK 18 billion, and larger loans were issued than in previous years. The loans were raised in dollars and swapped to euro. For the first time the central government supplemented direct foreign borrowing with domestic borrowing combined with currency swaps from kroner to euro.

At the beginning of 2001 the central-government foreign debt denominated in other foreign currencies than euro was converted to euro. This rearrangement is related to Denmark's fixed-exchange-rate policy vis-à-vis the euro. In future, only foreign loans with exposure to euro will be raised – either directly, or via currency swaps.

STRATEGY FOR BORROWING

The budget surpluses of recent years have reduced the central government's requirement for sale of krone-denominated bonds. The government debt policy has been adjusted continuously in order to maintain an attractive range of on-the-run issues, with emphasis on liquid securities. This includes the continued objective of an outstanding volume of at least DKK 60 billion in the 10-year on-the-run issue.

As part of the government debt policy, buy-backs can be made in a wide range of government off-the-run securities. The purpose is to support the objective of a range of liquid on-the-run issues, since these issues refinance the securities that are bought back. It is planned to hold several switch auctions in 2002.

The liquidity of the long-term on-the-run issues is also supported by the use of interest-rate swaps in Danish kroner. These make it possible to separate the issue policy from the management of the interest-rate risk on the government debt, and thereby gives greater flexibility to the overall government debt policy.

To support liquidity in on-the-run issues a securities lending facility for government securities in the range of on-the-run issues was established in 1998. This facility was supplemented in 2001 with a securities lending facility for a number of government securities in the Social Pension Fund's portfolio. The majority of government loans is thus covered by securities lending facilities.

In recent years, the central government has exclusively applied simple loan structures, and no longer raises structured loans. At the same time, the currency exposure has been rearranged to solely comprise euro.

Furthermore the focus of foreign borrowing will in the years to come be on raising larger loans primarily in euro to cover most of the foreign

borrowing requirement. The objective is to issue euro loans for approximately EUR 1½-2 billion per year, depending on the borrowing requirement and demand. The preferred maturity of the large euro loans is 5-7 years.

To supplement larger loans, currency swaps from kroner to euro are used in combination with the issue of domestic krone-denominated bonds. Foreign borrowing of this type supports the domestic on-the-run issues.

RISK MANAGEMENT

The borrowing and debt of the central government expose it to a number of risks, primarily interest-rate, exchange-rate and credit risks. Risk management is part of the central government's ongoing debt management.

Duration and redemption profile are elements of the management of the interest-rate and refinancing risk on the government debt. At the end of 2001 the duration of the government debt was 3.4 years, which was approximately unchanged from the level at the beginning of the year. In recent years, the duration has gradually decreased, primarily motivated by the diminishing debt. The duration band for the government debt in 2002 remains set at 3.5 years +/- 0.5 years. To determine the duration band, Cost-at-Risk is used to measure the trade-off between interest costs against risk. Furthermore the objective is a smooth redemption profile so as to reduce the refinancing risk to the central government.

As part of the overall planning of the government debt policy, scenario analyses are prepared to show the effect of various borrowing strategies on the duration and redemption profile of the government debt in the longer term.

In view of Denmark's fixed-exchange-rate policy vis-à-vis the euro, the exchange-rate risk on the foreign government debt is reduced by the central government solely raising euro loans or loans swapped to euro.

When the central government transacts swaps there is a risk of the counterparty's default on its obligations, which may cause a loss to the central government. The management of the central government's credit exposure on the swap portfolio is based on requirements of counterparty rating and collateral agreements. Swaps are only transacted with counterparties with a high rating that have signed an agreement with the central government on unilateral pledging of collateral. At the end of 2001 the central government has entered into collateral agreements with 19 counterparties, so that around 80 per cent of the principal of the central government's swap portfolio is covered by collateral agreements.

RECENT TRENDS IN PRIMARY DEALER SYSTEMS

Primary dealers are financial institutions, which by agreement with the government issuer, and in return for direct payment or special rights, undertake certain obligations in the primary and secondary markets for government securities. Some of the key functions of primary dealers are to market government securities to investors and contribute to the bond market's liquidity by quoting two-way prices for government securities on a current basis (market making).

In most OECD countries the use of primary dealers is part of the government debt policy. Recent years' development in primary dealer systems in the EU member states has been characterised by two key trends: First of all, the increasing integration of the national financial markets has increased the proportion of foreign participants among primary dealers in order to obtain an internationally oriented sales organisation. Secondly, the greater use of electronic market making has helped to increase the efficiency of the government securities markets and reduced the costs of participating in market making.

The structure of the Danish government securities market has a number of similarities with, but also differences from, a primary dealer system. Even though no agreement on rights and obligations has been established between the government issuer and market participants, the market participants have mutually agreed on telephone-based market making.

The concentration of the Danish market for government securities has increased in recent years. The six largest market participants thus take up around 95 per cent of government securities issues. It is currently being considered whether the introduction of electronic market making – possibly within the framework of a primary dealer system like those seen in the other EU member states – might help strengthening liquidity and competition in the Danish market for government securities.

GOVERNMENT BORROWING REQUIREMENT IN 2002

In the Budget Review of January 2002 the central government's gross domestic borrowing requirement for 2002 is estimated at DKK 78.9 billion. The overall strategy of the government debt policy is to build up and maintain an attractive range of on-the-run issues. This is done by building liquid series in the 2-, 5- and 10-year segments.

At the beginning of the year the on-the-run securities were replaced. In January 4 per cent Treasury notes 2004 and 4 per cent government bonds 2008 were opened as new series in the 2- and 5-year maturity

segments. In February, the new 10-year issue, 5 per cent government bonds 2013, opened. As before, the objective is an outstanding volume of at least DKK 60 billion in the 10-year series.

Buy-backs can be made in a wide range of securities. Buy-backs are used to smooth the gross financing requirement from year to year, and to maintain a range of liquid, market-conforming on-the-run issues.

One or more switch operations are planned for the first half of 2002. Switch operations give investors the opportunity to replace older issues with new on-the-run issues. Switch operations supplement the central government's use of buy-back of older issues.

The central government's foreign borrowing requirement in 2002 is DKK 22.4 billion. Foreign government borrowing is based on raising larger loans denominated primarily in euro. This is supplemented with currency swaps from kroner to euro.

Further Information on Government Borrowing and Debt

Danmarks Nationalbank regularly publishes information on Danish government borrowing and debt.

Information concerning government debt and government debt policy can be viewed on Danmarks Nationalbank's Web site (www.nationalbanken.dk). It is possible to be notified directly of new information and updates concerning government borrowing and debt by joining Danmarks Nationalbank's subscription service (see under www.nationalbanken.dk/nb/nb.nsf/alldocs/Fcontact_us_info). Most information is available in both Danish and English.

On a daily basis, details of sale (screen no. 51) and buy-back (screen no. 58) of domestic government securities on the preceding trading day are released via DN News[1]. These pages are reproduced by e.g. Reuters (pages DKNA-51 and DKNA-58).

On the first banking day of each month an announcement is sent to Copenhagen Stock Exchange on the sale and buy-back of domestic government securities during the preceding month, as well as the central government's transaction of currency swaps from kroner to euro. Furthermore, via DN News information on the central government's domestic borrowing is released together with the most recent estimate of the gross domestic borrowing requirement (screen no. 54). The last-mentioned information is reproduced by e.g. Reuters (page DKNA-54).

On the second banking day of each month Danmarks Nationalbank issues a press release with details of e.g. the central government's actual financing requirement, etc. in the preceding month.

At the monthly Treasury bill auctions announcements are issued via DN News (screen no. 53) on the progress of the auction. This information is also sent to Copenhagen Stock Exchange and reproduced by e.g. Reuters (page DKNA-53).

The estimated central-government financing requirement is presented in the Budget Reviews of the Ministry of Finance that are normally issued in May, August and December. After each Budget Review Danmarks

[1] Danmarks Nationalbank's system for transmission of information to connected news agencies.

Nationalbank publishes a monthly breakdown of the estimated net and gross financing requirements. On the penultimate banking day of each month, a day-to-day distribution of the liquidity impact of central-government payments during the coming months is released.

Every six months – normally in June and December – an announcement is sent via Copenhagen Stock Exchange with details of central-government borrowing, including on-the-run government issues. The announcement also presents more general information on the central government's debt policy.

Prior to the opening of new government securities series, an announcement is sent via Copenhagen Stock Exchange with details of e.g. the coupon, due date, year of maturity and opening day of the new loan. This information may be included in the biannual announcement on central-government borrowing. On the opening day an announcement is sent to Copenhagen Stock Exchange on the initial opening volume offered and the maximum sale on the opening day. This announcement is also released via DN News (screen no. 55) and reproduced by e.g. Reuters (DKNA-55).

Once a year, normally in February, Danmarks Nationalbank issues Danish Government Borrowing and Debt. The English edition is normally published in March. This publication describes the management of the government debt during the preceding year, and reports on other issues of relevance to debt management.

Please direct any enquires concerning Danish government borrowing and debt to Danmarks Nationalbank, Financial Markets, Government Debt Management, by e-mail: kma@nationalbanken.dk.

Main Principles

CHAPTER 1

Main Principles of Government Borrowing

SUMMARY 1.1

The overall objective of the government debt policy is to achieve the lowest possible long-term borrowing costs, while taking various factors into account, including the risks associated with the debt.

The overall strategy for government borrowing is laid down at quarterly meetings of the Ministry of Finance and Danmarks Nationalbank on the basis of proposals from Danmarks Nationalbank. The responsibility for government debt policy is held by the Minister of Finance, while Danmarks Nationalbank is responsible for the management of the government debt. Within Danmarks Nationalbank the work is undertaken by Government Debt Management in cooperation with other departments of the bank.

The framework for the central government's domestic and foreign borrowing is set out in the norm for central-government borrowing. Domestic borrowing is undertaken in order to finance redemptions on the domestic government debt and to cover any central-government budget deficit. The purpose of foreign borrowing is to maintain an adequate foreign-exchange reserve.

Domestic borrowing takes place primarily by issue of government bonds and Treasury notes on the Copenhagen Stock Exchange. In addition, Treasury bills are issued at monthly auctions. The strategy for domestic borrowing is to build up liquid government securities series in the 2-, 5- and 10-year maturity segments. Liquidity premiums contribute to ensuring low borrowing costs to the central government. Interest-rate swaps, buy-backs and switch operations, as well as securities lending, are supplementary instruments.

All foreign loans are raised directly in euro or swapped to euro. It is sought to cover the foreign borrowing requirement by raising larger euro-denominated loans. Direct borrowing in foreign currency is supplemented with domestic borrowing combined with swaps from kroner to euro.

The central-government debt entails exposure to a number of risks, including interest-rate, exchange-rate and credit risks. The management of these risks is a key element of current debt management.

MANAGEMENT OF THE GOVERNMENT DEBT 1.2

The overall objective of the government debt policy is to achieve the lowest possible long-term borrowing costs. This objective must be pursued while taking various factors into account, including the risks associated with the debt and the objective to support a well-functioning domestic financial market, cf. Box 1.1. The objectives of Danish government debt management are in line with international practice.

The government debt is compiled as the total domestic and foreign debt less the assets of the Social Pension Fund (SPF) and the balance of the central government's account with Danmarks Nationalbank. At the close of 2001, the government debt was DKK 513 billion in nominal terms, corresponding to 38 per cent of GDP. The debt as a ratio of GDP has been falling since its level of 57 per cent in 1995. The domestic and foreign debt totalled respectively DKK 611 billion and DKK 84 billion in nominal terms at the close of 2001. Both the domestic and foreign debt have been given the highest rating, Aaa and AAA, by Moody's and Standard & Poor's respectively.

The statutory basis for government borrowing is set out in the Act on the authority to raise central-government loans. The Act empowers the Minister of Finance to raise loans on behalf of the central government

OBJECTIVES OF THE GOVERNMENT DEBT POLICY Box 1.1

The objectives of the government debt policy are set out in the remarks to the bill for the Act on the authority to raise loans on behalf of the central government and in the agreement on division of work in the area of government debt between the Ministry of Finance and Danmarks Nationalbank. The Act on the authority to raise loans was adopted by the Folketing (Parliament) in December 1993 (Act No. 1079 of 22 December 1993).

The overall objective of the government debt policy is to achieve the lowest possible long-term borrowing costs. The objective is supplemented by other considerations:

- To keep the risk at an acceptable level
- Overall to build up and support a well-functioning, effective financial market in Denmark
- To ease the central government's access to the financial markets in the longer term.

The risk elements pertaining to the debt are:

- Interest-rate risk
- Exchange-rate risk
- Credit risk
- Other risks, e.g. operational.

up to a maximum of DKK 950 billion, which is the maximum limit for the total domestic and foreign government debt.

Since 1991 Danmarks Nationalbank has undertaken all functions related to the management of the government debt. The division of responsibility is set out in an agreement between the Ministry of Finance and Danmarks Nationalbank.

The strategy for government borrowing is laid down at quarterly meetings of the Ministry of Finance and Danmarks Nationalbank. At the meeting in December the overall strategy for the following year is determined. The strategy is drawn up on the basis of proposals from Danmarks Nationalbank. The Nationalbank handles the management of the debt portfolio in accordance with the adopted strategy, as authorised by the Ministry of Finance.

Danmarks Nationalbank's management of the government debt is undertaken by Financial Markets, Government Debt Management, in cooperation with other departments of the bank, primarily Market Operations, Accounting and Audit.

THE NORM FOR DOMESTIC AND FOREIGN BORROWING 1.3

The distribution and the extent of the central government's domestic and foreign borrowing are managed via the central-government borrowing norm, which is set out in an agreement between the government and Danmarks Nationalbank. There is a norm for both domestic and foreign borrowing, and together they ensure the separation of fiscal policy and monetary policy.

In overall terms the domestic norm states that domestic borrowing in kroner covers the central government's gross domestic financing requirement, i.e. the central government's current deficit and redemptions on the domestic debt, cf. Box 1.2. The norm for foreign borrowing implies that redemptions on the foreign debt are refinanced by new foreign loans.

In accordance with the EU Treaty's prohibition of monetary financing the central government's account with Danmarks Nationalbank may not show a deficit. The central government's borrowing is therefore planned to ensure an appropriate balance on the central government's account which can absorb the considerable fluctuations in the central government's receipts and payments. Uncertainty concerning the balance of the central government's account around the turn of the year may cause the central government's financing in a calendar year to exceed the borrowing requirement, in order to allow the loan proceeds to serve as an extra buffer on the account.

THE GROSS DOMESTIC FINANCING REQUIREMENT Box 1.2

The gross domestic financing requirement is defined as:

– Receipts to the central government
+ Expenditures by the central government
= *Net financing requirement:*
+ Redemptions on the domestic debt
+ Net bond purchases by the Social Pension Fund
= *Gross domestic financing requirement*

Receipts and expenditures include the value in kroner of the central government's current payments, including interest, as well as re-lending of krone-denominated government loans. The krone leg of the central government's swaps from kroner to euro is booked as redemption of the domestic debt when the swap is transacted and as borrowing when the swap expires.

The *gross domestic financing requirement* is covered by sale of government bonds, Treasury notes, net sales of Treasury bills and any reduction of the central government's account with Danmarks Nationalbank. The central government's *gross domestic borrowing requirement* is the proportion of the gross domestic financing requirement which is planned to be financed by issuing domestic government securities.

Sale of government securities is based on the estimated gross borrowing requirement published in the budget reviews of the Ministry of Finance.

The central government can also continue to issue government securities even though the borrowing requirement for the year has been financed, e.g. if market conditions are favourable. In that case these issues will cover part of the financing requirement for the next year.

The purpose of the central government's foreign borrowing is to maintain an adequate foreign-exchange reserve. Deviations from the norm for foreign borrowing may therefore occur in situations where the foreign-exchange reserve either decreases or increases more than is found appropriate. If the foreign-exchange reserve increases more than is considered necessary, the norm for foreign borrowing can be reduced if the balance of the central government's account makes this expedient. Moreover, the foreign borrowing requirement may be redistributed between different years in order to ensure appropriate planning of borrowing, e.g. when building a large euro-denominated loan.

STRATEGY FOR CENTRAL-GOVERNMENT BORROWING 1.4

The strategy for domestic borrowing is centred on building up large liquid bond series in the 2-, 5- and 10-year maturity segments. Liquid bonds can be traded without significantly affecting the price, and with a

narrow bid/offer spread. Investors are therefore usually willing to pay a premium for liquid bonds. This liquidity premium reduces the central government's borrowing costs.

Internationally, the 2-, 5- and 10-year segments are the key maturity segments. The central government's issuing strategy therefore contributes to making government securities issues attractive to resident as well as non-resident investors. International demand for domestic government securities makes a key contribution to supporting liquidity and helps to ensure low interest costs on the government debt.

At the short end of the maturity range, the central government issues Treasury bills at monthly auctions. A new 12-month issue is opened every third month. Issue takes place in the series for as long as the remaining maturity is 3 months or more.

Besides the issuing strategy the government debt policy comprises a number of supplementary instruments such as interest-rate swaps, buy-backs and switch operations, as well as securities lending.

The central government uses interest-rate swaps to shift between fixed and floating interest rate exposure. To some extent, interest-rate swaps make it possible to separate issue in liquid bond series from the management of the interest-rate risk on the government debt.

Buy-back of government securities before ordinary redemption can help to smooth the central government's borrowing requirement within a particular year or between years. The purpose is to ensure a certain stability of the central government's redemptions and borrowing over time, and thereby reduce the risk of a large borrowing requirement for the central government coinciding with periods when loan terms are particularly unfavourable. In its switch operations, the central government sells on-the-run bond issues for bonds that are eligible for buy-backs. Buy-backs and switch operations can help to ensure that new liquid bond series are built up quickly.

The central government and the Social Pension Fund (SPF) have established securities lending facilities that support liquidity in domestic government securities. Together the facilities cover most domestic government securities.

It is sought to cover the central government's foreign borrowing requirement primarily by issuing larger euro loans. The objective is to build up a range of euro loans. If the issue of euro loans is not advantageous in the given market conditions, it may become relevant to issue in other currencies. These loans will be swapped to euro, since all foreign debt has exposure in euro. Borrowing directly in foreign currencies is supplemented with issue of domestic bonds combined with swaps from kroner to euro. This contributes to improving liquidity in the

current domestic on-the-run issues. The foreign borrowing strategy is based on the same considerations as the domestic borrowing strategy.

MARKET CONDITIONS AND PRACTICAL ASPECTS OF BORROWING 1.5

Government bonds and Treasury notes are issued on tap via the Copenhagen Stock Exchange. The members of the Copenhagen Stock Exchange may buy government bonds and Treasury notes directly from the Nationalbank via the Stock Exchange's electronic trading system, Saxess.

Treasury bills are issued at monthly auctions. Licensed traders on the Copenhagen Stock Exchange and Danmarks Nationalbank's monetary counterparties may bid at the auctions.

All domestic government securities are listed on the Copenhagen Stock Exchange. Sales of government bonds and Treasury notes, as well as Treasury bills, are described in further detail in Boxes 1.3 and 1.4.

There are market maker arrangements for government securities under the auspices of the Copenhagen Stock Exchange and the Danish Securities Dealers Association respectively. Participants in these arrangements are obliged to quote two-way prices for a certain amount of the appropriate bonds on a current basis. The market maker arrangements help to support liquidity in the government securities series. Under the Stock Exchange arrangement prices are only quoted in the 10-year benchmark, while the arrangement of the Danish Securities Dealers Association also comprises other liquid government securities. More information on the Copenhagen Stock Exchange is available at the Web site www.xcse.dk.

Government bonds, Treasury notes and Treasury bills are registered electronically in the Danish Securities Centre (VP). Danish government securities may also be held in Euroclear and Clearstream. To facilitate easy transfer of securities between VP and Euroclear without loss of trading days there is a direct link between Euroclear and VP. Government securities trades are normally settled in VP, but may also be settled in Euroclear and Clearstream. More information is available at VP's Web Site www.vp.dk.

When large foreign government loans are raised, a group of international banks is contacted in order to let one or more of the banks arrange the loans.

TRADING AND ISSUE OF GOVERNMENT SECURITIES ON THE COPENHAGEN STOCK EXCHANGE — Box 1.3

Danmarks Nationalbank issues government bonds and Treasury notes on behalf of the central government via the Copenhagen Stock Exchange. All licensed traders on the Copenhagen Stock Exchange may purchase government securities directly from the Nationalbank via the electronic trading system of the Stock Exchange, Saxess.

The Copenhagen Stock Exchange's market for government securities is divided into four submarkets: the ordinary market, the market for new issues, the electrobroker market and the interest market.

Government bonds and Treasury notes are issued on tap in the ordinary market. Tap sale implies that government securities are issued when a borrowing requirement exists, and the markets are favourable. It is sought to ensure transparency in the tap sale. Sale and buy-back of government securities on the preceding day are published on a day-to-day basis. Trading in the ordinary market takes place via accept match, which entails that a placed order can be fully or partly accepted by a counterparty. There is thus no automatic matching of trades.

New series of government bonds are opened on the submarket for new government securities issues on the Copenhagen Stock Exchange. The procedure for the opening of new series of government bonds and Treasury notes is that 1-2 weeks before the issue opens, information on the new loan is published via the Copenhagen Stock Exchange with details of coupon, maturity and opening day. On the opening day, an announcement is published on the maximum sale on the opening day. The opening price is based on the current market conditions and experience from previous openings of government-securities issues. The announced maximum amount for sale gives market participants greater certainty of the course of sale on the opening day. The stated maximum is not a target for the sale on the opening day, but indicates the upper limit for sale. Trading in the market for new issues is by auto-match, where bid and offer prices are matched automatically on a continuous basis.

The electrobroker market is reserved for trade among market makers in the system of the Danish Securities Dealers Association. Trading in this market is by accept match. Price quoting in the Danish Securities Dealers Association's market maker system is done by telephone, with subsequent reporting of trades to the Copenhagen Stock Exchange.

The interest market is a trade supporting system that functions like an electronic bulletin board giving all members of the Copenhagen Stock Exchange access to mark their trading interests electronically. Furthermore, in this market, members of the Danish Stock Exchange's market maker system list their prices for the 10-year benchmark.

There is no requirement for bond trading in Denmark to take place via the Copenhagen Stock Exchange's electronic trading system. A large proportion of trades thus take place via the telephone market, with subsequent reporting of trades to the Copenhagen Stock Exchange. All members of the Copenhagen Stock Exchange are obliged to report bond trading outside the Stock Exchange within a short period of time.

ISSUE OF TREASURY BILLS Box 1.4

Treasury bills are issued at monthly auctions. The short maturity of the Treasury bills gives a short build-up period, so that auction is found to be the most appropriate method of sale.

All licensed traders on the Copenhagen Stock Exchange and Danmarks Nationalbank's monetary-policy counterparties that meet the requirements set for participation in the electronic auction system can bid at the auctions. Bids are made for interest rates. All bids at or below the fixed cut-off interest rate are met at the cut-off interest rate (uniform pricing). Bids at the cut-off interest rate may be subject to proportional allocation. A period of half an hour elapses from the deadline for submission of bids to the announcement of the result of the auction.

RISK MANAGEMENT OF THE GOVERNMENT DEBT 1.6

The borrowing and debt of the central government expose it to a number of risks, primarily interest-rate, exchange-rate and credit risks. Risk management is part of the central government's ongoing debt management.

Interest-rate risk

The interest-rate risk on the central-government debt is the risk of higher interest costs as a consequence of an upward shift in interest rates. The interest-rate risk is managed by a target for duration and the shape of the redemption profile. To measure the trade-off between costs and interest-rate risk Cost-at-Risk (CaR) is used. CaR quantifies interest-rate risk.

The *duration* of the government debt expresses the average fixed-interest period of the assets or liabilities. Short duration means that changes in market interest rates will quickly affect the actual borrowing costs of the central government. On determining the duration target, the sensitivity of costs to changes in interest rates is weighed against the expected interest costs. Since the term structure of interest rates is normally rising, short-term loans that are refinanced at frequent intervals typically entail relatively low interest costs. This is an argument for short duration. On the other hand, long-term borrowing fixes interest rates for a longer period, thereby reducing the variation in the annual interest costs, just as long-term interest rates normally fluctuate less than short-term interest rates. This is an argument for long duration.

The *redemption profile* is used in the management of the government debt to reduce the refinancing risk. This is the risk that a large redemption coincides with a temporary high level of interest rates, or a period

when the central government has to refinance the debt on particularly unfavourable market terms. Ensuring a smooth redemption profile without excessive fluctuations in the annual redemptions reduces the refinancing risk.

Cost-at-Risk (CaR) quantifies the interest-rate risk and is used as a supplementary tool in the management of interest-rate risk. On the basis of numerous scenarios of the future development in interest rates the expected future interest costs are calculated, as well as the highest interest costs that can be expected with a probability of 95 per cent. CaR can therefore contribute to a more consistent assessment of the trade-off between interest costs and interest-rate risk under different borrowing strategies. Currently, CaR is applied solely to the domestic debt, which accounts for the largest part of the government debt.

Exchange-rate risk

Exchange-rate risk is the risk that the value of the debt will increase as a consequence of the development in exchange rates. In view of Denmark's fixed-exchange-rate policy vis-à-vis the euro the exchange-rate risk on the government debt is reduced by the central government solely raising debt denominated in euro, or debt which is swapped to euro. The purpose of the central government's foreign borrowing is to ensure that the foreign-exchange reserve of Danmarks Nationalbank has an adequate level. The foreign-exchange reserve is predominantly placed in euro.

Credit risk

A swap is an agreement between two parties to exchange payments during a specific period. When a swap is transacted, it normally has a market value of zero. After it is transacted, fluctuations in interest and exchange rates can cause the swap's market value to deviate from zero. In a situation where a counterparty defaults on its obligations, the central government will therefore sustain a loss equivalent to the market value of the swap. This risk of loss is called the credit risk.

In order to limit the credit risk, the central government only transacts swaps with counterparties holding a rating of AA-/Aa3 or higher. For interest-rate swaps in Danish kroner and currency swaps from kroner to euro the minimum requirement is A-/A3. Moreover, the central government only enters into swap transactions with counterparties which have signed an agreement on unilateral pledging of collateral. According to the agreements a counterparty must pledge securities as collateral to the central government if the actual exposure on the counterparty exceeds a certain limit.

There have been no examples of the central government sustaining losses on swaps due to counterparty default.

Other risks

Besides the risks described above, the central-government debt also entails exposure to other risks.

Operational risks are minimised by separating the various functions of government debt management; and by using simple, well-known debt-management instruments and by the use of well-established procedures. Legal risk is minimised by using standardised contracts.

Report Section

CHAPTER 2

Domestic Borrowing

SUMMARY 2.1

In 2001 sale of Danish government securities totalled DKK 87.7 billion. The gross domestic financing requirement was DKK 81.1 billion.

Domestic issues by the central government comprised 5 per cent Treasury notes 2003, 5 per cent government bonds 2005, 6 per cent government bonds 2011, and Treasury bills. In the last part of the year issues were concentrated in the 10-year series, in view of the low yields for long-term government securities. In May 2001, the Treasury bill programme was expanded to include a 12-month bill. The strong interest in the new 12-month Treasury bill contributed to a positive financing amount of DKK 9.9 billion in total from the Treasury bill programme in 2001.

All central-government on-the-run issues were replaced at the beginning of 2002, in view of the short remaining maturity of the existing on-the-run issues, and the fact that the issues had reached an appropriate outstanding volume.

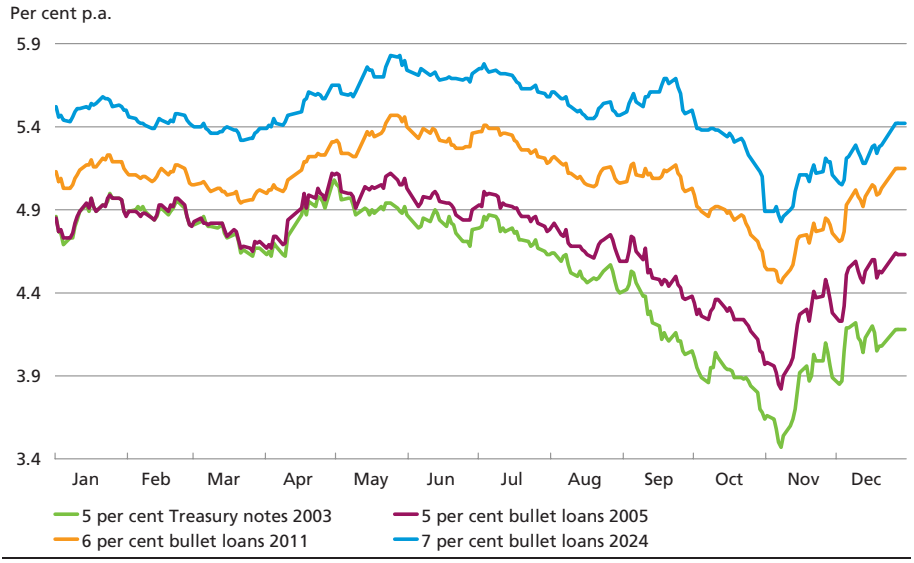
In the Budget Review of January 2002 the gross domestic borrowing requirement in 2002 is set at DKK 78.9 billion. As in 2001, sale of Treasury notes and government bonds in 2002 will be in the 2-, 5- and 10-year maturity segments. Buy-backs and interest-rate swaps will remain important instruments of the government domestic debt policy. Further switch operations are planned for 2002.

DEVELOPMENT IN INTEREST RATES 2.2

Yields on long-term government securities fell during the autumn of 2001, cf. Chart 2.2.1, but then rose to close the year at the level of the beginning of the year. Short-term interest rates fell considerably after monetary policy was relaxed in the euro area, cf. Chart 2.2.2.

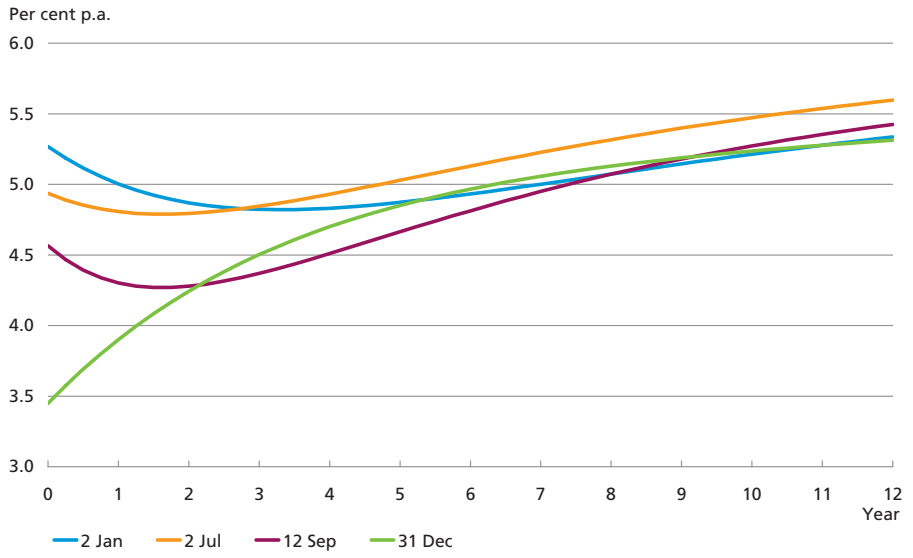
Denmark's yield differential to Germany narrowed during 2001 to reach a low level viewed in a historical perspective. In January 2001, the yield differential was around 35 basis points, falling to below 20 basis points in December, cf. Chart 2.2.3. A factor contributing to the narrow yield differential is greater demand from Danish institutional investors for

YIELDS ON SELECTED DANISH GOVERNMENT SECURITIES IN 2001 Chart 2.2.1

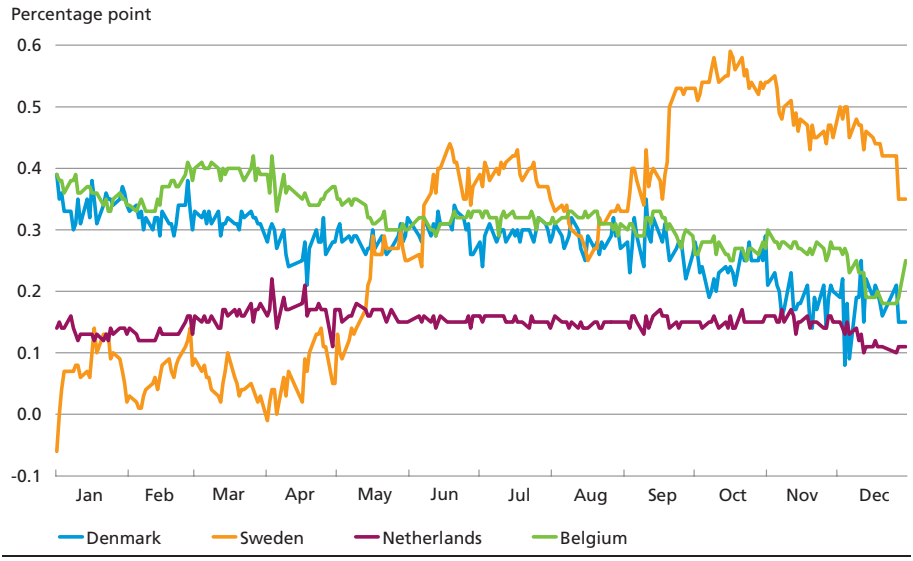


long-term Danish government bonds. The general low level of interest rates exposes mortgage-credit bonds to a relatively high conversion risk, and thereby low duration. As a consequence, pension funds, etc. have increased their portfolios of long-term government bonds. The narrowing of the yield differential has led to a reduction of the non-resident ownership share of the 10-year benchmark bond, cf. Section 2.4.

SELECTED ZERO-COUPON-YIELD STRUCTURES FROM 2001 Chart 2.2.2



10-YEAR YIELD DIFFERENTIALS TO GERMANY, 2001 Chart 2.2.3



SALE OF GOVERNMENT SECURITIES AND FINANCING REQUIREMENT 2.3

Sale of Danish government securities totalled DKK 87.7 billion in 2001. The gross domestic financing requirement was DKK 81.1 billion, cf. Table 2.3.1. The excess sale of DKK 6.6 billion was reflected in an increase in the balance of the central government's account with Danmarks Nationalbank.

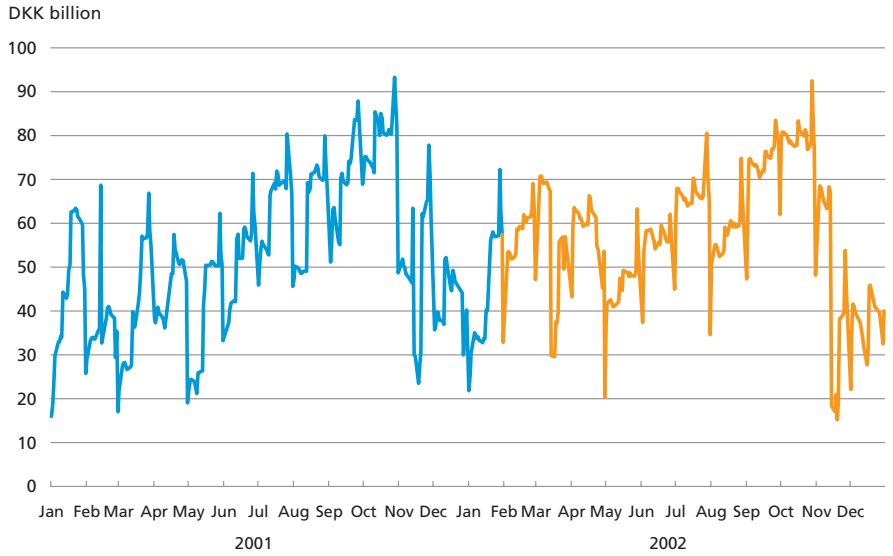
THE CENTRAL GOVERNMENT'S CIL, NET CASH BALANCE AND GROSS DEFICIT Table 2.3.1

DKK billion	1998	1999	2000	2001
Current, investment and lending budget	31.4	9.1	30.7	22.2
Re-lending of government loans	0.3	-1.6	-2.8	-3.2
Distributed capital losses on issue and due interest	2.1	3.2	1.4	0.4
Other capital items	0.1	0.2	-2.3	1.6
Net cash balance	34.0	10.9	27.0	21.0
Redemptions on domestic government debt	79.0	75.9	91.3	101.2
Redemptions on foreign government debt	37.4	20.0	15.7	17.8
Gross deficit (-)	-82.5	-85.0	-80.0	-98.0
Gross domestic financing requirement[1]	64.4	67.9	62.3	81.1
Sale of government securities, market value	68.0	68.8	65.7	87.7

Source: 1998-2000 are figures from the central-government accounts. Provisional figures for 2001 are based on the forecast in the Budget Review, January 2002, and the provisional central-government accounts.

[1] Based on Danmarks Nationalbank's statistics at year-end. The figures may therefore deviate from the accounting figures.

BALANCE OF THE CENTRAL GOVERNMENT'S ACCOUNT 2001-2002 Chart 2.3.1



Note: The blue curve denotes actual figures, while the yellow curve is based on the proposal for the Finance Bill 2002.

In view of the increased uncertainty of the level of central-government payments towards the close of the year, it was necessary to increase the balance of the central government's account at the end of 2001. Chart 2.3.1 shows the balance of the central government's account.

ISSUES ON-THE-RUN AND ISSUING STRATEGY 2.4

Domestic government borrowing takes place via the issue of government bonds, Treasury notes and Treasury bills. Government bonds are issued in the 5- and 10-year maturity segments, while Treasury notes are issued in the 2-year maturity segment. Treasury bills are the short-term on-the-run issues, with a maturity of up to 12 months on issue.

Government bonds and Treasury notes

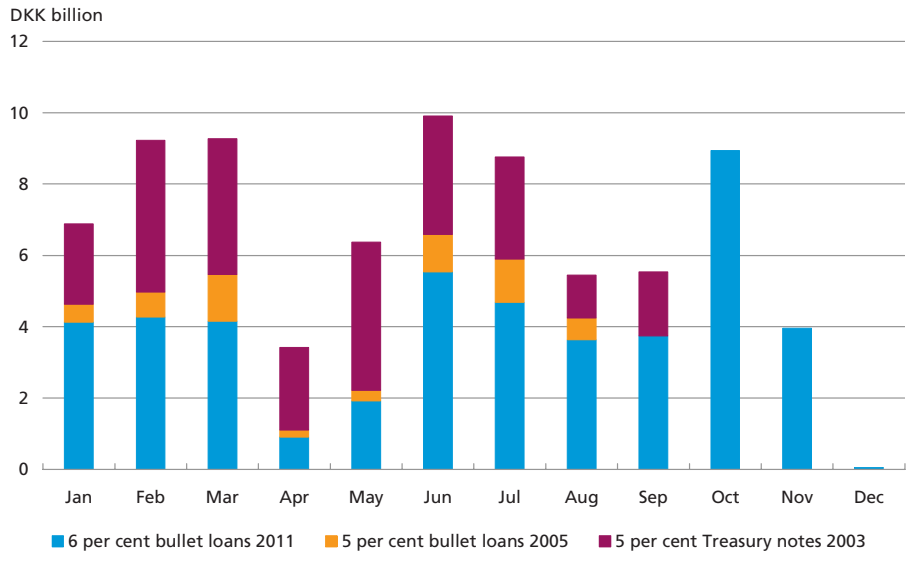
Government bonds and Treasury notes are fixed-rate bullet loans. This is the type of loan predominantly used internationally by government issuers. Sales take place via the Copenhagen Stock Exchange's trading system, Saxess, and are concentrated on a relatively small number of buyers. In 2001, six members bought around 95 per cent of the total issues.

In 2001 issues took place in 5 per cent Treasury notes 2003, 5 per cent bullet loans 2005, and 6 per cent bullet loans 2011, cf. Table 2.4.1. The distribution of issues over the year is presented in Chart 2.4.1. In the last part of the year, issues were concentrated in 6 per cent bullet loans 2011, in view of the decrease in yields on long-term government securities.

DOMESTIC GOVERNMENT BORROWING IN 2001 — Table 2.4.1

DKK million	Issue			Nominal outstanding end-2001
	Nominal	Market value	Capital loss	
6 per cent bullet loans 2011	42,833	45,930	-3,097	58,528
5 per cent bullet loans 2005	5,850	5,880	-30	57,510
Government bonds, total	48,683	51,810	-3,127	
5 per cent Treasury notes 2003	25,861	25,968	-107	36,688
Treasury notes, total	25,861	25,968	-107	
Bonds and Treasury notes, total	74,544	77,778	-3,234	
Treasury bills 2002 IV	5,460	5,272	188	5,460
Treasury bills 2002 III	13,866	13,335	531	13,866
Treasury bills 2002 II	21,792	21,018	774	21,792
Treasury bills 2002 I	8,106	7,864	242	8,106
Treasury bills 2001 IV	18,626	18,049	577	
Treasury bills 2001 III	5,832	5,698	134	
Treasury bills 2001 II	1,015	1,000	15	
Redemptions	62,319	62,319		
Treasury bills, net	12,378	9,917	2,461	
Sales of government securities, total	86,922	87,695	-773	

SALE OF GOVERNMENT BONDS AND TREASURY NOTES IN 2001, MARKET VALUE — Chart 2.4.1



On 8 and 22 January respectively, 4 per cent Treasury notes 2004 and 4 per cent bullet loans 2008 were opened for sale. On the opening day, 4 per cent Treasury notes 2004 for nominal DKK 4.3 billion were sold, while sale of 4 per cent bullet loans 2008 amounted to nominal DKK 6 billion.

Sale of 5 per cent bullet loans 2013 opened on 19 February. All government on-the-run issues were replaced at the beginning of 2002, in view of the short remaining maturity of the existing on-the-run issues and the fact that the issues had reached an appropriate outstanding volume.

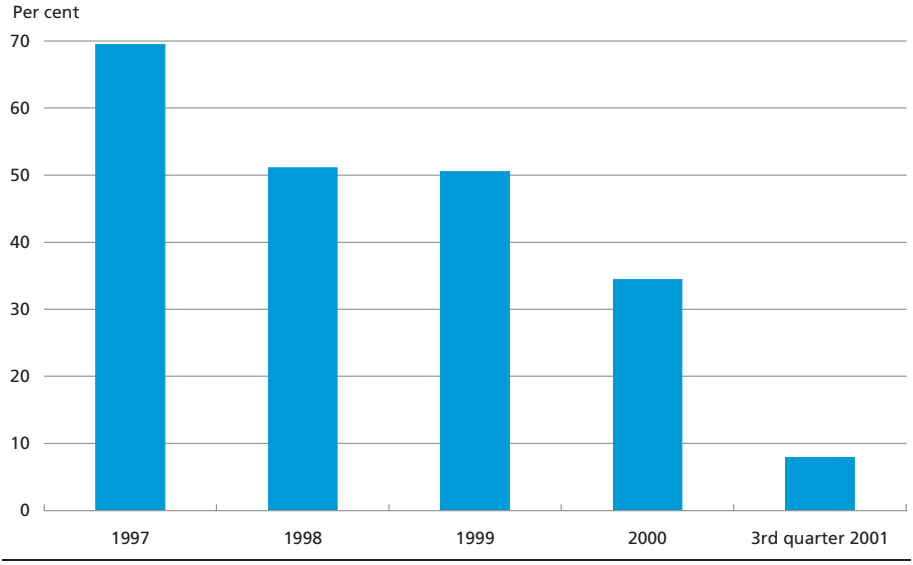
The demand from Danish institutional investors for long-term government securities has led to a narrowing of the 10-year yield differential to Germany. As a consequence of the narrowing, the non-resident ownership share of the 10-year benchmark bond has declined in recent years, cf. Chart 2.4.2. Instead, non-resident investors have focused on the shorter maturity segments which are subject to a wider differential, cf. Chart 2.4.3.

Treasury bills

Treasury bills are zero-coupon paper, i.e. the yield on Treasury bills is the difference between issue below par and redemption at par. Treasury bills are sold at monthly auctions in which a few large participants buy most of the Treasury bills.

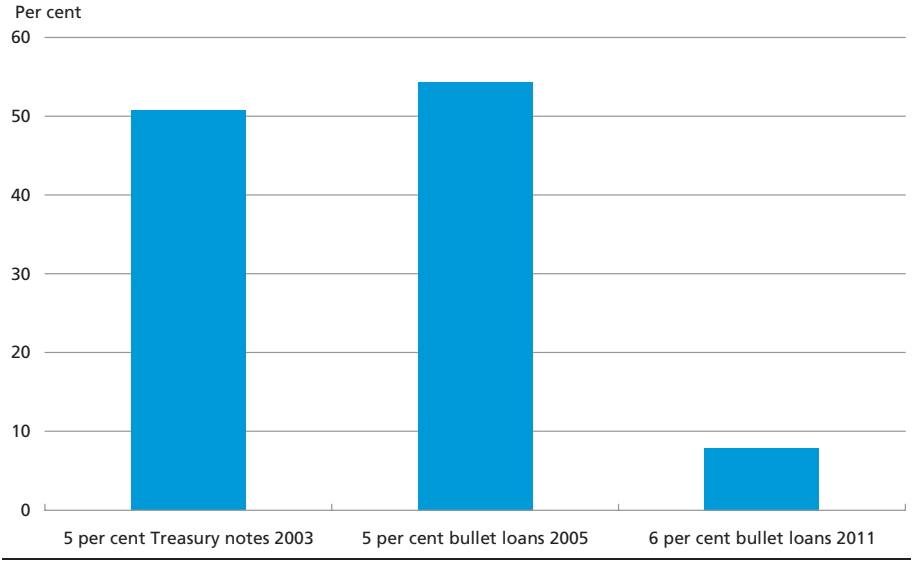
NON-RESIDENT OWNERSHIP SHARE OF THE 10-YEAR BOND, NOMINAL VALUE, YEAR-END

Chart 2.4.2



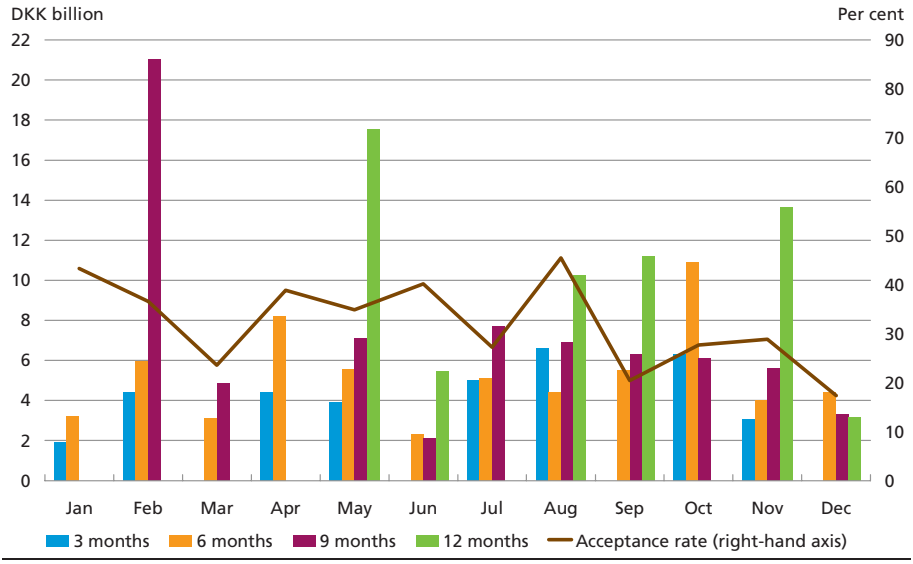
Source: Statistics Denmark. Adjusted for repurchase agreements between Danish banks and non-residents. Moreover, adjustments are made on an estimated basis for residents' holdings on safekeeping accounts abroad.

NON-RESIDENT OWNERSHIP SHARE OF SELECTED DOMESTIC GOVERNMENT SECURITIES, END OF 3RD QUARTER 2001 — Chart 2.4.3



Source: Statistics Denmark. Adjusted for repurchase transactions between Danish banks and non-residents. Also estimated adjustment for residents' holdings in safekeeping accounts abroad.

BID VOLUMES AND ACCEPTANCE RATES AT TREASURY BILL AUCTIONS IN 2001 — Chart 2.4.4



Note: 3 months includes securities with remaining maturities of 3 and 4 months; 6 months includes securities with remaining maturities of 5, 6 and 7 months; and 9 months includes securities with remaining maturities of 8, 9 and 10 months; while 12 months includes securities with remaining maturities of 11 and 12 months.

Chart 2.4.4 presents bid volumes and acceptance rates. The bid volumes are generally higher than in the previous year.

In May 2001, the central government's Treasury bill programme was expanded to include a 12-month Treasury bill. So far the longest remaining maturity of Treasury bills has been 9 months. There was considerable interest in the new Treasury bill, and this positive response contributed to higher sale. The phasing-in of the new Treasury bill contributed to a financing amount of DKK 9.9 billion from the Treasury bill programme in 2001.

In view of the phasing-in of the new 12-month Treasury bill, the Treasury bill programme is likewise expected to make a positive contribution to net financing in 2002.

BUY-BACKS AND SWITCH OPERATIONS 2.5

Via buy-backs the central government repurchases outstanding government securities from the secondary market. If the outstanding securities are switched for other government securities, this is called a switch operation. Securities are only bought back or switched if this is deemed advantageous on the basis of an overall evaluation of government debt policy. As a general rule bonds that are bought back are cancelled immediately thereafter. The methods and motives for buy-backs are described in Box 2.1.

BUY-BACKS OF DOMESTIC GOVERNMENT SECURITIES IN 2001 Table 2.5.1

DKK million	Buy-backs		Nominal outstanding end-2001
	Nominal	Market value	
Buy-backs, redemption dates in 2001	19,335	19,518	
Of which			
8 per cent bullet loans 2001	19,335	19,518	
Buy-backs, redemption dates after 2001	18,585	20,143	
Of which			
7 per cent bullet loans 2007	537	602	52,068
8 per cent bullet loans 2006	4,100	4,697	65,900
7 per cent bullet loans 2004	7,350	7,956	67,100
8 per cent bullet loans 2003	5,390	5,713	60,360
6 per cent bullet loans 2002	150	153	38,757
4 per cent Treasury notes 2002	975	975	34,100
3.5 per cent government loans 1909[1]	22	13	16
3.5 per cent government loans 1901[1]	21	13	8
3 per cent government loans 1894[1]	39	20	17
3.5 per cent government loans 1886	1	1	45

[1] The loans are included as foreign loans in the debt portfolio.

METHODS AND MOTIVES FOR BUY-BACKS AND SWITCH OPERATIONS Box 2.1

Motives for buy-backs and switch operations

Reduction of government borrowing costs

- Direct fiscal savings may be obtained from buy-backs in non-market conforming, or less liquid government securities series, and on-the-run issues.
- Buy-backs and switch operations can be used to build up government securities series faster, and in order to achieve a larger outstanding volume in on-the-run issues than would otherwise be possible. This enhances liquidity, and the liquidity premium reduces government borrowing costs.

Smoothing of the redemption profile

- Buy-backs can be used to smooth the redemption profile, and thereby reduce the re-financing risk within a fiscal year or between fiscal years.
- Buy-backs in government securities maturing in the same year bring forward the financing requirement within the year. If a large issue matures in a given fiscal year, buy-backs in this issue can spread the financing requirement across the year.
- Buy-backs in government securities maturing in the following year bring forward the financing requirement to the buy-back year. If there are e.g. large redemptions in the coming year compared to the current year, buy-backs in issues falling due in the coming year can smooth redemptions and the financing requirement between the 2 years.

Methods for buy-backs and switch operations

Buy-backs and switches can take place on tap, or via auctions or a "window". By the tap method the central government buys back or switches securities in the market on a current basis.

At auctions, the securities available for buy-back or switch operations are announced. Auction participants can then submit combinations of volume and price they wish to sell or switch at. The auctions are pre-announced to the market. The period between announcement and the actual auction enables participants to prepare for the auction.

In a buy-back or switch window, within a pre-announced period market participants can sell or switch a government paper at a fixed price or a fixed switch ratio determined by the issuer. The price may be subject to ongoing revision during the switch period. Hereby the issuer gains more control over price and volume, and the method resembles the tap method.

In 2001, buy-back at market value of 8 per cent bullet loans 2001 totalled DKK 19.5 billion. The loan fell due on 15 November 2001, and the buy-backs therefore smoothed the financing requirement within the year.

Table 2.5.1 presents the central government's buy-backs maturing after 2001. Buy-backs totalled DKK 20.1 billion at market value, which exceeds the level in recent years, cf. Table 2.5.2. In addition to the central government's buy-backs, the Social Pension Fund bought government bonds for DKK 13.6 billion at market value for its own portfolio.

BUY-BACKS BY THE CENTRAL GOVERNMENT, 1997-2001, MARKET VALUE Table 2.5.2

DKK billion	1997	1998	1999	2000	2001
Redemption dates within the same year.....	12.1	21.3	23.2	31.5	19.5
Redemption dates in following years	14.4	4.6	5.5	17.8	20.1
Total buy-backs	26.5	25.9	28.7	49.3	39.7

On 18 June, the central government held the first switch auction for government securities. The auction gave access to switch from respectively 6 per cent bullet loans 2009 and 7 per cent bullet loans 2007 to 6 per cent bullet loans 2011.

Only a moderate volume of 7 per cent bullet loans 2007 was switched to 6 per cent bullet loans 2011. The moderate volume switched is related to the fact that during the period after the auction was announced, the price spreads for the securities in the switch auction took a course unfavourable to the central government compared to price spreads to equivalent German bonds. Investors apparently expected a better than market price, which was not the intention.

Buy-backs will continue to be part of the domestic government debt policy in 2002, and further switch operations are planned. The buy-back issues at January 2002 are stated in the announcement on Central-Government Borrowing in 2002 reprinted in the Appendices to this publication.

DOMESTIC INTEREST-RATE SWAPS 2.6

Domestic interest-rate swaps are used primarily to separate the issuing in liquid bond series from the management of the interest-rate risk on the central-government debt. So far, the central government has swapped fixed-rate debt to floating-rate debt. Only standardised interest-rate swaps, called plain vanilla interest-rate swaps, are used. The central government does not wish to influence the market and transacts interest-rate swaps for only small amounts at a time. As an alternative to domestic interest-rate swaps, the central government can transact foreign interest-rate swaps as part of its risk management, cf. Chapter 6.

Domestic interest-rate swaps for a notional amount of DKK 6.5 billion were transacted in 2001. They are distributed on 27 different swap transactions, of which 10 were with Danish counterparties. The central government's total outstanding domestic interest-rate swaps rose to DKK 27.4 billion at the end of 2001. The domestic interest-rate swaps all had a maturity of 10 years. The central government pays 6-month Cibor

and receives 10-year fixed interest on the swap. Table 4a of the Appendix of Tables presents the individual swaps.

Again in 2002, interest-rate swaps will be an important government debt policy instrument. A more detailed presentation of domestic interest-rate swaps is given in Chapter 8 of Danish Government Borrowing and Debt 1998.

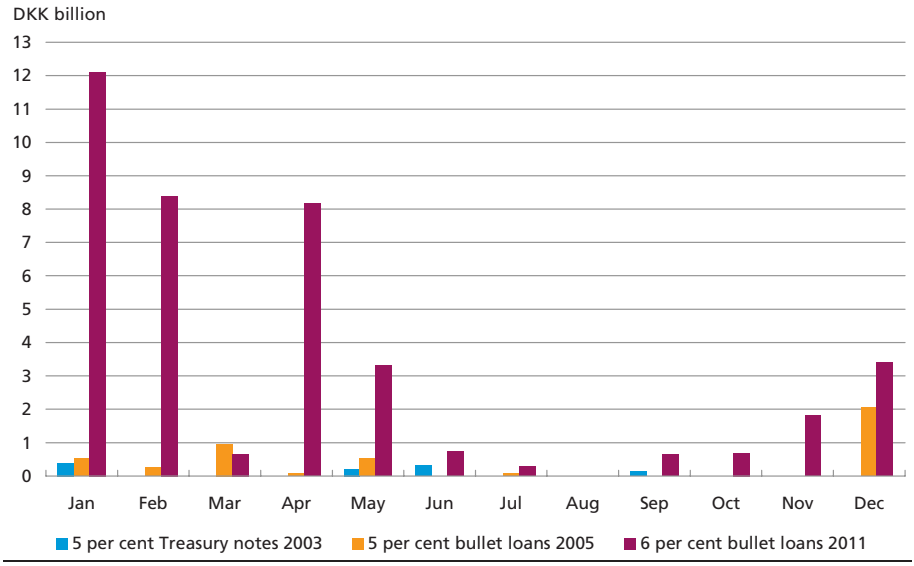
SECURITIES LENDING FACILITY 2.7

The government issuer's securities lending facility comprises the on-the-run government issues. However, a paper can be retained in the facility for a certain period after it becomes an off-the-run issue. Securities lending in other government securities is available via the Social Pension Fund's securities lending facility, cf. Chapter 4.

The government issuer's securities lending facility was established in 1998 in order to support liquidity in newly-opened government securities. In 2001, the central government's Treasury bills were included in the facility. Appendix 1 to the announcement on Danish central-government borrowing, etc. 29 March 2001 presents the detailed terms of the government issuer's securities lending facility. This announcement is reprinted in the Appendices to this publication.

Use of the facility is subject to a fee. The fee is set so as to give market participants an incentive to reserve the facility for special situations. Securities traders licensed to trade on the Copenhagen Stock Exchange

SECURITIES LENDING IN 2001 Chart 2.7.1



may borrow securities for up to 5 trading days. Collateral in other government securities must be provided.

In 2001 lending was primarily in 6 per cent bullet loans 2011, cf. Chart 2.7.1. Most lending took place during the first 5 months of the year, which was around the time when the bond became the market benchmark.

CHAPTER 3

Foreign Borrowing

SUMMARY 3.1

In 2001 the central government raised foreign loans for DKK 17.6 billion. The central government's foreign borrowing requirement in 2002 amounts to DKK 22.4 billion, equivalent to the redemptions on the foreign government debt.

The focus of the borrowing in the coming years will be on raising larger loans primarily in euro. The objective is over time to build a range of larger euro issues. The aim is to issue loans for approximately EUR 1½-2 billion each year, depending on the borrowing requirement and demand. If the prevailing market conditions make it less advantageous to issue euro loans, it may be relevant to issue in other currencies. The preferred maturity of the larger loans is 5-7 years.

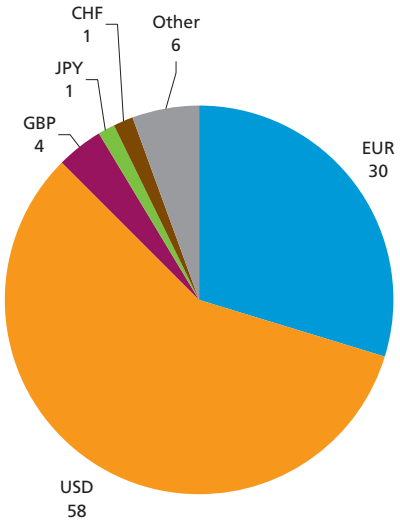
The strategy of raising larger loans is supplemented with currency swaps from kroner to euro. This type of foreign borrowing is currently available on attractive price terms, and moreover supports the domestic on-the-run issues.

BORROWING IN 2001 3.2

In 2001, the central government raised more larger loans than previously. The loans were raised in dollars and swapped to euro. The central government has supplemented direct foreign borrowing with domestic borrowing combined with the new instrument of currency swaps from kroner to euro.

At the beginning of 2001 the part of the foreign government debt that was denominated in other foreign currencies than euro was converted to euro. In view of Denmark's fixed-exchange-rate policy vis-à-vis the euro this restructuring reduces the exchange-rate risk on the foreign government debt. In future, the central government is only expected to raise foreign loans with exposure in euro – either directly or via currency swaps. Chart 3.2.1 presents the currency distribution of the foreign government debt before currency swaps to euro.

CURRENCY DISTRIBUTION OF THE CENTRAL-GOVERNMENT FOREIGN DEBT BEFORE CURRENCY SWAPS TO EURO, END-2001, IN PER CENT Chart 3.2.1



In 2001 the central government raised loans for DKK 17.6 billion, of which currency swaps from kroner to euro were DKK 4.8 billion. Table 3 of the Appendix of Tables presents the loans in further detail.

The central government raised two larger loans in 2001. The first loan, of USD 0.5 billion with maturity in 2004, was issued in May. The loan was swapped to Euribor-20 basis points. The second loan, of USD 1 billion with maturity in 2006, was raised in September. It was swapped to Euribor-18 basis points. Box 3.1 presents the investor breakdown of this loan. During the summer opportunities to raise a larger euro loan were investigated. However, the current market conditions made a loan in dollars significantly more attractive, and the latter was chosen. On comparing the loans denominated in respectively euro and dollars it was taken into consideration that the central government avoids a currency swap by issuing directly in euro. Transaction of currency swaps increases the credit risk on the central government's swap portfolio. This credit risk therefore carries weight when different loan options are compared – even in cases where collateral is required.

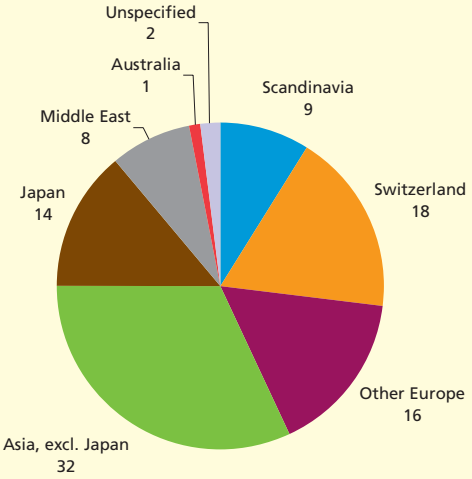
In 2001 the central government transacted currency swaps from kroner to euro for DKK 4.8 billion. The borrowing levels were in the range of Euribor-41 basis points to Euribor-22 basis points, and were thus attractively priced. Moreover, this type of borrowing supports domestic on-the-run issues. The narrowing of the swap spread during the year made the borrowing levels gradually less attractive, cf. Box 3.2.

INVESTOR BREAKDOWN OF DOLLAR LOAN IN SEPTEMBER 2001 Box 3.1

In September 2001 the central government raised a loan of USD 1 billion with maturity in 2006, with Dresdner Kleinwort Wasserstein and Nomura as lead managers. The loan was swapped to euro. The issue drew considerable interest from central banks and institutional investors.

The breakdown of the loan by investor country is presented below. The issue was widely distributed across several continents, and the largest proportion was taken up by investors in Europe and Asia.

DOLLAR LOAN IN SEPTEMBER 2001 – GEOGRAPHICAL DISTRIBUTION, IN PER CENT



Source: Dresdner Kleinwort Wasserstein and Nomura International.

The liquidity in the market for currency swaps from kroner to euro is limited. The central government is therefore cautious not to influence the market for currency swaps with its transactions. In 2001, the central government transacted currency swaps from kroner to euro with 5 counterparties, all major international investment banks. Further details of the advantageousness of currency swaps from kroner to euro are presented in Box 3.2.

In November, the central government issued Commercial Papers maturing in the same month for DKK 0.7 billion in order to test the contingency measure for short-term borrowing. Short-term borrowing is typically used if there is a need to increase the foreign-exchange reserve quickly, or to safeguard a positive balance on the central government's account.

ADVANTAGEOUSNESS OF CURRENCY SWAPS FROM KRONER TO EURO Box 3.2

In a currency swap from kroner to euro the central government receives interest in kroner at a floating rate and pays interest in euro at a floating rate. Principals are exchanged at both the start and close of the swap. The central government thus receives euro and pays kroner on transaction of the swap. When the swap expires the central government pays back euro and receives kroner. The issue of krone-denominated bonds combined with a currency swap to euro can be regarded as borrowing in euro.

When the central government transacts a currency swap from kroner to euro - and is thus to pay kroner equivalent to the principal at the start of the swap - the gross domestic financing requirement is increased. Using currency swaps from kroner to euro therefore supports domestic on-the-run issues. Moreover, the currency swap can be combined with an interest-rate swap whereby the central government receives interest at a fixed rate and pays interest at a floating rate. The treatment of currency swaps from kroner to euro in the central-government accounts is presented in Chapter 5, while the management of the credit risk related to currency swaps is described in Chapter 6.

The central government will only use currency swaps from kroner to euro if this type of borrowing is considered to be more advantageous than other foreign borrowing. Whether the currency swap is more advantageous can be determined by calculating the borrowing level of the total "package" of interest payments on domestic securities, the interest-rate swap and the currency swap from kroner to euro. It should be noted that this "package" can be composed in different ways in terms of the domestic issue, the interest-rate swap and the currency swap. The central government transacts interest-rate swaps in kroner as well as euro. The composition of the total "package" affects the calculated net borrowing costs.

The Table below presents an example of how the advantageousness of the central government's first currency swap from kroner to euro with a maturity of 5 years can be determined. The interest payments and the related interest rates are presented in the Table. It is assumed that domestic borrowing and the transaction of the interest-rate swap coincide with the transaction of the currency swap. Normally, this would not be the case.

INTEREST-RATE LEVEL ON DOMESTIC BORROWING COMBINED WITH SWAP TO EURO

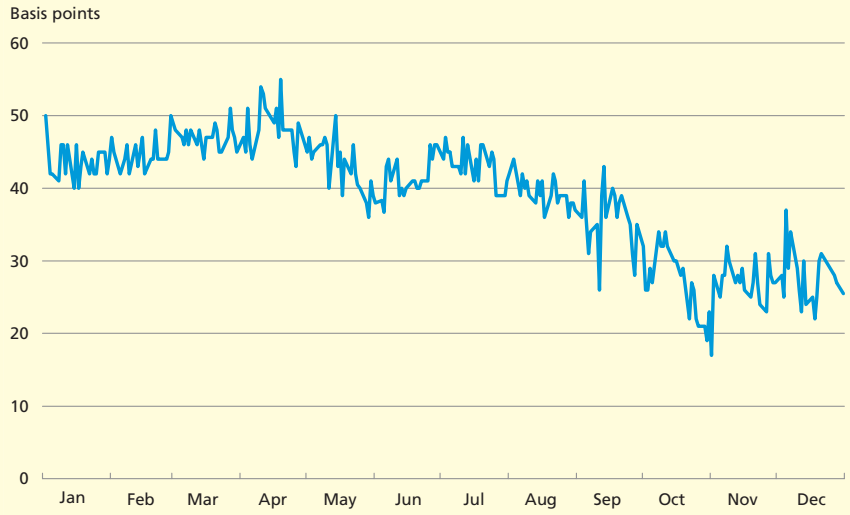
Instrument		Interest payment
Sale of government bond:	+ Central government pays DKK at a fixed 5-year interest rate	4.93 per cent
Interest-rate swap:	– Central government receives DKK at a fixed 5-year interest rate	5.36 per cent
	+ Central government pays DKK at a floating rate	6-month Cibor
Currency swap:	– Central government receives DKK at a floating rate	6-month Cibor-1.75 bp.
	+ Central government pays EUR at a floating rate	6-month Euribor
Borrowing costs, net		Euribor -41 bp.

Note: It is assumed that the interest-rate swap is transacted on the domistic market, and that the interest-rate swap has a 5-year maturity. The 5-year interest payment on the domestic securities is in 8 per cent government bonds 2006.

CONTINUED Boks 3.2

The spreadover (the swap spread) is the difference between the swap interest rate and the yield to maturity on the government securities. The greater the spreadover, the more advantageous the interest-rate swap will be. The Chart below shows the development in the 10-year spreadover in 2001.

10-YEAR SPREADOVER (SWAP SPREAD) IN 2001



The Chart shows that it was most advantageous for the central government to transact 10-year domestic interest-rate swaps in the 1st half of 2001. In the 2nd half of 2001 the spreadover declined, which among other factors can be explained by greater demand from several government issuers for long-term interest-rate swaps.

In 2001, the central government, as an element of the duration management, transacted portfolio interest-rate swaps from fixed 10-year to floating euro interest rates of EUR 150 million, cf. Table 4d of the Appendix of Tables.

STRATEGY FOR FOREIGN BORROWING IN COMING YEARS 3.3

Raising larger loans

In recent years, the central government has exclusively applied simple loan structures, and the central government no longer raises structured loans. At the same time, the currency exposure has been rearranged to

solely comprise euro. Furthermore the objective over time is to build up a range of larger euro issues. Major international investors typically demand liquid securities, and are therefore interested in relatively large euro issues. On building up a range of euro loans the strategy for foreign borrowing will more closely resemble the strategy for domestic borrowing.

In coming years, borrowing will be focused on raising larger loans, primarily in euro, to cover the largest part of the foreign borrowing requirement. The intention is to issue loans for approximately EUR 1½-2 billion each year, depending on the borrowing requirement and demand. If it is not advantageous to issue euro loans in view of the prevailing market conditions, issues in other currencies may become relevant.

Raising loans directly in euro ensures a simple loan structure. In cases where the central government raises a loan in another currency besides euro, the loan is swapped to euro. Currency swaps impose a credit risk on the central government, even though the swaps are subject to a collateral requirement. It can therefore, as stated, be advantageous to the central government to raise loans directly in euro, even if an equivalent loan in another currency combined with a currency swap to euro costs a few basis points less.

The preferred maturity of the large euro loans is 5-7 years. In view of the foreign debt of DKK 84 billion, 5-year issues will represent annual redemptions of DKK 15-20 billion, so that a range of loans with an ample outstanding volume can be built up. The special focus of domestic borrowing is on building up the 10-year series. Concentrating foreign borrowing in the medium-term maturity segment spreads the risk. On the other hand, a range of loans with maturity of 2-3 years will entail a relatively high refinancing risk, since it will be necessary to refinance relatively large annual redemptions.

As for any other type of borrowing, it is important to consider costs. In this case it is relevant to compare the issue's expected yield differential to Germany with equivalent issues by a peer group of other government issuers. Moreover, the level of costs after swap to Euribor can be compared with alternative types of loan whereby the central government pays Euribor, e.g. currency swaps from kroner to euro or issues in other currencies swapped to euro.

When larger foreign government loans are raised, a group of international banks is contacted in order to let one or more of the banks arrange the loans.

Currency swaps from kroner to euro

As a supplement to raising larger loans, currency swaps from kroner to euro will continue to be used. This type of foreign borrowing has been available on attractive price terms for a period, and supports the domestic on-the-run issues, see Section 3.2.

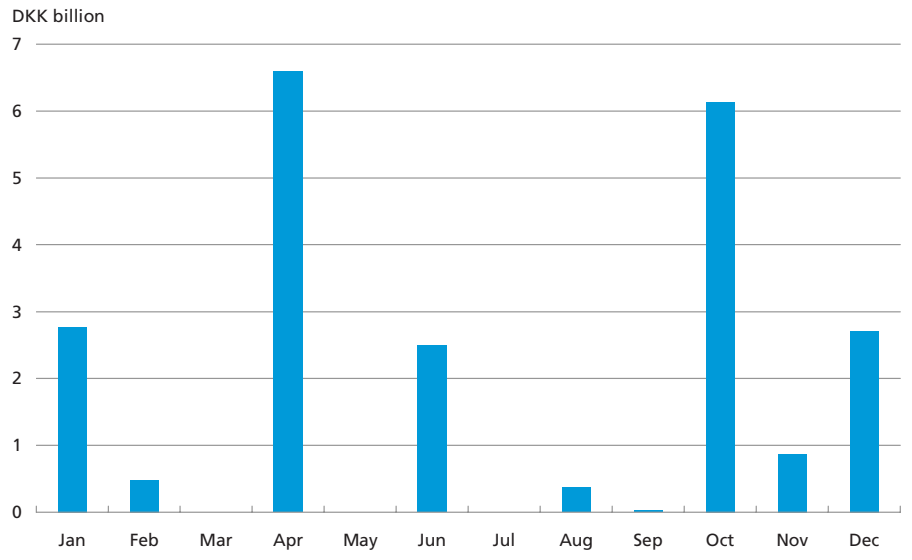
FOREIGN BORROWING IN 2002 3.4

The central government's foreign borrowing requirement amounts to DKK 22.4 billion in 2002, equivalent to the redemptions on the central government's foreign debt. The central government's foreign borrowing requirement is covered by raising larger loans, primarily in euro. If it is not advantageous to raise euro loans in the given market conditions, issues in other currencies with swaps to euro can be relevant. Currency swaps from kroner to euro are used as a supplement to raising larger loans. The strategy is described in Section 3.3.

As an element of duration management fixed-rate loans will often be swapped to euro floating rate. Moreover, the central government can also transact portfolio interest-rate swaps in the euro market as part of the duration management.

The distribution of redemptions within the year is presented in Chart 3.4.1. There are relatively large redemptions in April (when the euro loan issued in 1992 matures) and October. Depending on the market conditions, it may become relevant to issue a larger loan in the spring of 2002.

REDEMPTION PROFILE FOR CENTRAL-GOVERNMENT FOREIGN DEBT, 2002 Chart 3.4.1



CHAPTER 4

The Social Pension Fund

SUMMARY 4.1

At the close of 2001 the nominal value of the bond portfolio of the Social Pension Fund (SPF) was DKK 141.1 billion. Government bonds accounted for 78 per cent of the portfolio. The remainder was invested mainly in mortgage-credit bonds. At the close of 2001 the duration of SPF's portfolio was 3.8 years.

SPF's income from interest totalled DKK 9.3 billion. An amount of DKK 7.9 billion was transferred to the Ministry of Social Affairs to cover pension improvement measures undertaken with reference to SPF, while DKK 1.5 billion was paid as pension-fund tax.

In 2001, a securities lending facility was established for all members of the Copenhagen Stock Exchange. Lending is in SPF's portfolio of government securities that are bullet issues against collateral in other government securities and payment of a fee to SPF. The facility also supports liquidity in off-the-run government issues.

SPF's CAPITAL 4.2

The principles for the management of SPF's capital are set out in regulations, cf. Box 4.1. SPF's capital is placed in stock-exchange-listed bonds. The regulations state that the funds are to be invested primarily in government bonds.

SPF invests in off-the-run government issues. It is sought to ensure that SPF's purchases are made without significantly affecting the formation of interest rates in the bond market, including the spread between yields on respectively mortgage-credit and government bonds.

In 2001 SPF's income from interest was DKK 9.3 billion, cf. Chapter 5. An amount of DKK 7.9 billion was transferred to the Ministry of Social Affairs to finance pension improvement measures. Pension-fund tax of DKK 1.5 billion was paid. Table 4.2.1 presents SPF's revenue and expenditure.

Bonds for a total of DKK 12.5 billion were drawn and sold in 2001. The net interest revenue added to the proceeds from drawings and sale was placed in government bonds, while a minor amount was placed in index-linked bonds.

BACKGROUND TO AND MANAGEMENT OF SPF — Box 4.1

SPF was established in 1970 by the Social Pension Fund Act, whereby a special national retirement pension contribution was introduced. The proceeds were allocated to SPF and invested in bonds. With effect from 1982 the Act was amended, and the payments to SPF ceased. SPF was continued as an asset of the central government.

SPF is part of the remit of the Ministry of Social Affairs and the Ministry of Finance. The management of SPF's capital is handled by a committee with representatives from the Ministry of Finance, the Ministry of Social Affairs and Danmarks Nationalbank. The day-to-day management of the assets of SPF is handled by Danmarks Nationalbank.

The principles for the management of SPF's capital are set out in regulations. The regulations state that the aim is to achieve a satisfactory return on SPF's assets while taking due account of the overall budgetary consequences of SPF's transactions. Moreover, the regulations state that the capital is to be invested primarily in government bonds.

The interest on SPF's bond portfolio after payment of pension-fund tax is used to finance pension improvement measures, or is allocated to SPF. SPF's core capital can be used to finance pension improvements, should the costs of such measures exceed SPF's income from interest.

The Danish Finance Act stipulates the amount to be transferred from SPF to the Ministry of Social Affairs on a current basis to cover the costs of the pension improvement measures taken with reference to SPF.

SPF's REVENUE AND EXPENDITURE — Table 4.2.1

DKK billion	2000	2001
Revenue		
Interest, etc.	10.0	9.3
Expenditure		
Transfer to the Ministry of Social Affairs	8.2	7.9
Pension-fund tax	2.3	1.5
Net	-0.4	-0.1

At the close of the year SPF's bond portfolio totalled DKK 141.1 billion at nominal value, cf. Table 4.2.2. The nominal value and the market value of the portfolio both increased by around DKK 1.5 billion during

BOND PORTFOLIO OF SPF, YEAR-END 1996-2001 — Table 4.2.2

DKK billion	1996	1997	1998	1999	2000	2001
Nominal value	148.8	146.8	143.6	141.6	139.6	141.1
Market value	156.6	157.4	159.8	150.7	149.1	150.5

Note: The figures for nominal value include index-linked bonds at indexed values.

SPF's BOND PORTFOLIO DISTRIBUTED BY BOND TYPES, END-2001 Table 4.2.3

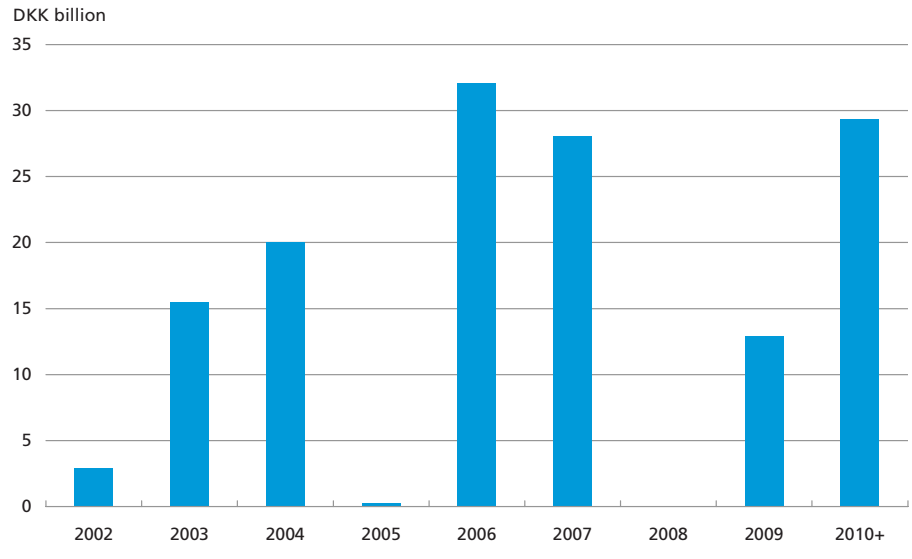
Nominal value	DKK billion	Per cent
6 per cent bullet loans 2002	2.8	
8 per cent bullet loans 2003	15.5	
7 per cent bullet loans 2004	18.2	
8 per cent bullet loans 2006	32.0	
7 per cent bullet loans 2007	27.6	
6 per cent bullet loans 2009	11.8	
10 per cent serial loans 2004	1.6	
Government bonds, total	109.5	77.6
Mortgage-credit bonds, etc.[1]	23.5	16.6
Index-linked bonds[2]	8.2	5.8
Total	141.1	100.0

[1] Mortgage-credit bonds, etc. comprise mortgage-credit, municipal, Fisheries Bank and Ship Credit Fund bonds that are not index-linked bonds.
[2] Indexed value.

2001. The increase is primarily related to the fact that a minor share of the reinvestment requirement from 2000 was not invested until the beginning of 2001.

Government bonds account for nearly 78 per cent of the total bond portfolio, cf. Table 4.2.3. In certain cases SPF owns around 50 per cent of the total outstanding volume in a government securities series. The remainder of the portfolio is invested mainly in mortgage-credit bonds and index-linked bonds.

SPF's BOND PORTFOLIO DISTRIBUTED BY YEAR OF MATURITY, END-2001, NOMINAL VALUE Chart 4.2.1



The government securities in the portfolio mature by 2009 at the latest, while most of the mortgage-credit and index-linked bonds mature after 2009. The distribution of SPF's portfolio by year of maturity is presented in Chart 4.2.1.

During 2001, minor amounts were invested in index-linked bonds with long remaining maturity. This contributes positively to the duration of SPF's portfolio.

SPF's SECURITIES LENDING FACILITY 4.3

SPF's securities lending facility was established on 1 May 2001 and comprises SPF's portfolio of government bonds that are bullet issues. Lending is to members of the Copenhagen Stock Exchange against collateral in other government securities. The detailed terms of SPF's securities lending facility are stated in Appendix 2 to the announcement on Danish central-government borrowing, etc. 29 March 2001, reprinted in the Appendices to this publication.

Lending is subject to a fee to SPF. The facility supports liquidity in off-the-run government issues. Lending in 2001 was concentrated in 7 per cent bullet loans 2007. This is related to the fact that SPF holds more than 50 per cent of the total outstanding volume in 7 per cent bullet loans 2007. The volume of lending was moderate from May to October, but towards the end of the year the level of activity was relatively strong.

DURATION OF SPF's BOND PORTFOLIO 4.4

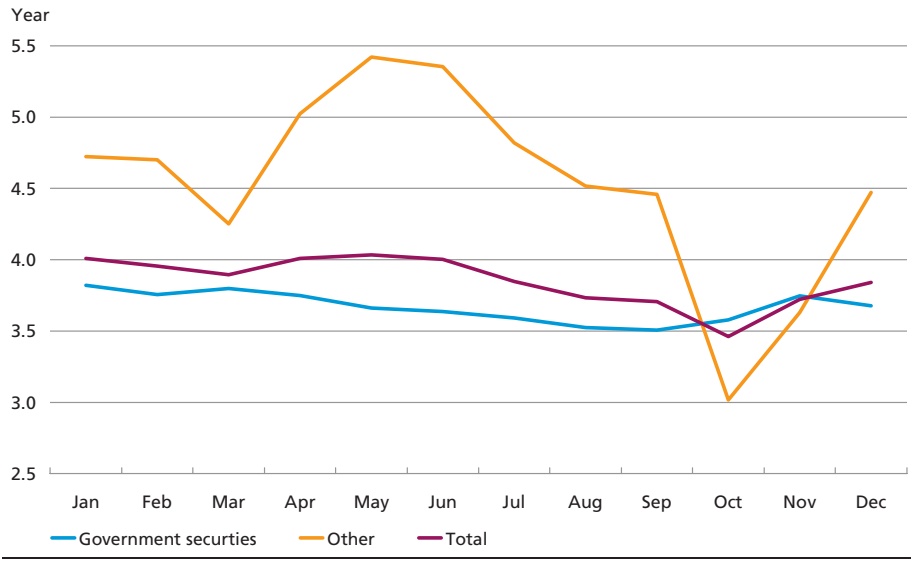
At the close of 2001 the duration of SPF's bond portfolio was 3.8 years, cf. Table 4.4.1. The duration of the portfolio of government bonds decreased by 0.2 years. Investments in government securities in 2001 were placed mainly in 6 per cent bullet loans 2009. The duration of this series was 6.5 years, which did not completely offset the reduction of the maturity of the rest of the government securities portfolio.

DURATION OF SPF's BOND PORTFOLIO Table 4.4.1

Year	End-2000	End-2001
Government bonds	3.9	3.7
Mortgage-credit bonds, etc.	3.8	2.8
Index-linked bonds	8.4	9.6
Total portfolio	4.1	3.8

Note: For callable mortgage-credit bonds an option-adjusted duration is used, while the duration of index-linked bonds is calculated using an inflation assumption of 2 per cent per year.

DEVELOPMENT IN DURATION FOR SPF IN 2001 Chart 4.4.1



The declining level of interest rates in 2001 led to a decrease in the option-adjusted duration of the callable mortgage-credit bonds, cf. Chart 4.4.1. The option-adjusted duration of callable bonds is highly sensitive to changes in the level of interest rates, and callable bonds constitute more than 15 per cent of SPF's portfolio.

Investments in index-linked bonds have increased the duration of SPF's portfolio of index-linked bonds by 1.2 years from end-2000 to end-2001. This is a result of the fact that SPF has invested in long-term index-linked securities. Due to the relatively small proportion of index-linked bonds, however, an increase in the duration of index-linked bonds only moderately affects the overall duration.

CHAPTER 5

Government Debt

SUMMARY 5.1

In the period 1997-2001 central-government budget surpluses have led to a gradual reduction of the central-government debt. At the end of 2001 the central-government debt was DKK 513.4 billion, which is a decrease of DKK 24.9 billion from 2000. The general-government debt compiled in accordance with the EU Treaty is estimated at DKK 586.3 billion, or 44 per cent of GDP, at the close of 2001.

In 2001 the interest costs on the central-government debt amounted to DKK 35.7 billion. The interest costs have been falling since 1996 as a consequence of the reduction of the central-government debt, as well as a lower average interest rate on the debt.

The non-resident ownership share of government securities was 34 per cent at the end of the 3rd quarter of 2001.

At the close of 2001 the government-guaranteed entities held a total debt of DKK 87.6 billion with government guarantee.

GOVERNMENT DEBT AND INTEREST COSTS 5.2

The central-government debt is defined as the assets and liabilities of the central government which are managed by Government Debt Management at Danmarks Nationalbank. In other contexts, e.g. for statistical purposes, the central-government debt can be defined differently. There are also broader definitions of government debt which include the debt of local government, etc. An example of an often-used broader definition of the debt is the gross debt of the general-government sector (EMU debt). This definition is presented in Section 5.3.

Government debt

The central-government debt is compiled as the total domestic and foreign debt of the central government less the assets of the Social Pension Fund (SPF) and the balance of the central government's account with Danmarks Nationalbank, cf. Box 5.1.

At the close of 2001 the central-government debt was DKK 513.4 billion, which is a decrease of DKK 24.9 billion from 2000, cf. Table 5.2.1.

The decline in the central-government debt can be attributed to the surplus on central-government finances. Since 1996 central-government debt as a ratio of GDP has fallen from 57 to 38 per cent, cf. Chart 5.2.1. In 2001, currency swaps from kroner to euro were introduced as an instrument in Danish government debt policy, cf. Chapter 3. Box 5.2 describes the treatment of currency swaps in the central-government accounts.

Interest costs

Interest costs on the central-government debt in 2001 totalled DKK 35.7 billion, equivalent to a decrease of DKK 0.9 billion from 2000, cf. Table 5.2.2. In 2002 a reduction of interest costs by DKK 5.3 billion against 2001 is expected.

Recent years' decline in the central government's interest costs is attributable firstly to the decreasing debt, cf. Table 5.2.1. Secondly, lower

NET BORROWING AND CHANGES IN THE GOVERNMENT DEBT, 1998-2002 Table 5.2.1

DKK billion	1998	1999	2000	2001	2002
Net borrowing					
Domestic borrowing	-10.2	-7.1	-27.8	-14.0	4.7
Foreign borrowing[1]	-21.7	1.5	-5.2	-1.0	0.0
Drawing on the central governments account at Danmarks Nationalbank	-1.3	-4.8	3.9	-8.9	0.2
Net borrowing at market value	-33.1	-10.3	-29.1	-23.9	5.0
Capital losses					
Domestic capital losses on issue[2]	-0.5	-0.8	3.2	1.0	2.5
Foreign capital losses on issue[2]	0.1	0.0	-0.0	0.0	0.0
Exchange-rate losses, etc.	-0.3	0.2	0.4	-0.4	-
Net borrowing at nominal value	-33.8	-11.0	-25.5	-23.3	7.5
Balance-sheet items, year-end, nominal value					
Domestic debt	656.4	648.6	624.0	611.0	618.2
Foreign debt	88.3	90.0	85.2	83.8	83.8
Central government's account at Danmarks Nationalbank[3]	-30.4	-35.2	-31.3	-40.2	-40.0
The Social Pension Fund[4]	-143.6	-141.6	-139.6	-141.1	-140.9
Government debt at nominal value	570.8	561.7	538.3	513.4	521.1

Source: Central-government accounts 1998, 1999 and 2000. For 2001, provisional figures from the central-government accounts. The forecast figures for 2002 are based on the proposal for Finance Bill for 2002.

[1] 1999, including proceeds of DKK 0.5 billion as a consequence of the early redemption of 2 foreign interest-rate swaps. The amount is set off against exchange-rate losses. For 2000, including proceeds of DKK 1.0 billion received in connection with the reduction of the market value of a swap.

[2] Including capital losses on buy-backs.

[3] For 2001, the central government's account is compiled in accordance with the monthly balance sheet of Danmarks Nationalbank.

[4] The Social Pension Fund's portfolio of index-linked bonds is compiled at indexed value.

COMPILATION OF CENTRAL-GOVERNMENT DEBT AND INTEREST COSTS Box 5.1

The *central-government debt* is compiled as the nominal value of domestic and foreign debt minus the central government's account with Danmarks Nationalbank and the assets of the Social Pension Fund (SPF).

The change in the central-government debt corresponds to the net borrowing at nominal value minus the change in SPF's assets. The net borrowing is compiled as domestic and foreign borrowing and drawing on the central government's account with Danmarks Nationalbank. The net borrowing at nominal value comprises borrowing at market value with addition of value adjustments.

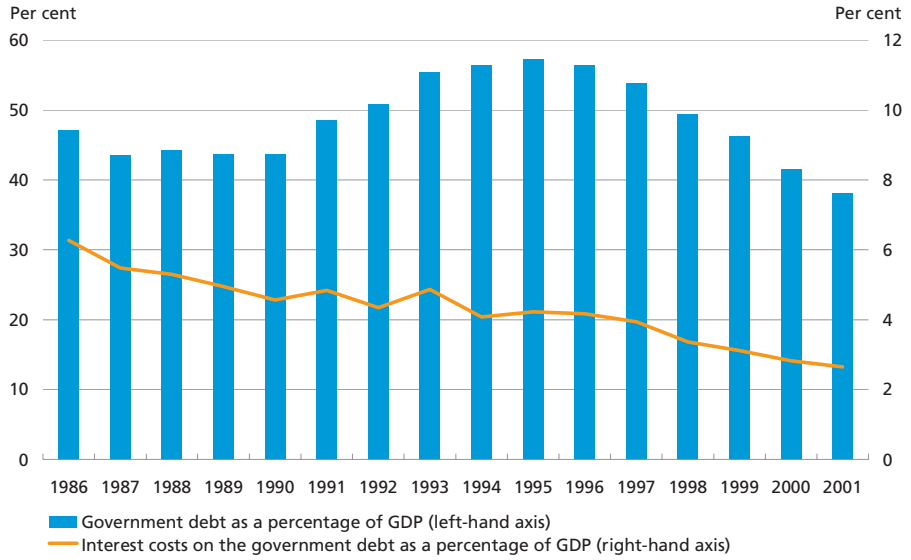
The distribution on respectively domestic and foreign borrowing and debt is based on currency. Domestic debt is krone-denominated debt, while foreign debt is currency-denominated debt. The distribution is made after currency swaps.

Interest costs related to the central-government debt comprise interest, distributed capital losses on issue and realised exchange-rate losses.

Interest and capital losses on issue are accrued on the basis of an earnings principle. The interest costs are compiled as a ratio of the interest credited for year equivalent to the number of days that a loan has run in that year. The capital loss on issue is the difference between the nominal value and market value on issue and is distributed over the time to maturity of the loan in accordance with the interest costs on the loan.

market interest rates have enabled the central government to refinance debt at relatively high interest rates with debt at lower interest rates, thereby reducing the total interest costs. The compilation of the interest costs on the central-government debt is presented in Box 5.1.

DEVELOPMENT IN GOVERNMENT DEBT AND INTEREST COSTS Chart 5.2.1



INTEREST COSTS ON THE GOVERNMENT DEBT, 1998-2002 Table 5.2.2

DKK billion	1998	1999	2000	2001	2002
Domestic debt					
Interest	45.7	43.7	42.4	39.8	36.0
Distributed capital losses on issue	3.5	2.9	2.3	2.7	1.9
Interest costs, total	49.1	46.6	44.7	42.5	37.9
Foreign debt					
Interest	4.8	4.0	3.9	4.0	4.1
Realised exchange-rate losses on redemptions	-1.3	-0.3	0.0	0.8	-0.4
Distributed capital losses on issue	0.1	0.1	0.0	0.0	-0.0
Interest costs, total	3.6	3.8	4.0	4.7	3.6
Interest concerning					
Central government's account at Danmarks Nationalbank	-1.7	-1.8	-2.1	-2.2	-1.8
The Social Pension Fund	-12.2	-10.8	-10.0	-9.3	-9.3
Total	38.9	37.8	36.6	35.7	30.4

Source: Central-government accounts 1998, 1999 and 2000. For 2001 provisional figures from the central-government accounts. The forecast figures for 2002 are based on the proposal for Finance Bill for 2002.

THE GROSS DEBT OF THE GENERAL GOVERNMENT (EMU DEBT) 5.3

Besides the central-government debt, the general government's gross debt includes the local-government debt. The central-government debt accounts for a majority of the gross debt of the general-government sector.

The general-government gross debt is compiled in accordance with the EU Treaty. The debt is compiled on a gross basis, but the general-government sector may consolidate the debt with claims on itself. This e.g. means that the portfolio of government securities of the Social Pension Fund (SPF) may be deducted from the debt, but not SPF's portfolio of mortgage-credit bonds, etc., or the balance of the central government's account with Danmarks Nationalbank.

BUDGET BALANCE AND GENERAL-GOVERNMENT DEBT, 1998-2002 Table 5.3.1

	1998	1999	2000	2001	2002
General-government balance in DKK billion	13.1	38.2	32.7	26.0	26.1
General-government balance as a percentage of GDP	1.1	3.2	2.5	1.9	1.9
Gross debt in DKK billion	649.7	639.7	606.3	586.3	596.0
Gross debt as a percentage of GDP	56.2	52.7	46.8	43.5	42.9

Source: Ministry of Economic Affairs, *Economic Survey*, January 2002.

The gross general-government debt thus deviates from the central-government debt as compiled in Table 5.3.1 by including the entire general-government sector and being compiled on a gross basis.

The Ecofin Council monitors the development in the budgetary situation of the member states in order to assess whether budgetary discipline is maintained. This evaluation is based on the criteria which are set out in the Stability and Growth Pact and in the EU Treaty. According to the Stability and Growth Pact, all EU member states must aim at a general-government budget that is close to balance or has a

TREATMENT OF CURRENCY SWAPS FROM KRONER TO EURO IN THE CENTRAL-GOVERNMENT ACCOUNTS — Box 5.2

Currency swaps from kroner to euro were introduced as an instrument of government debt management in 2001. When a krone-euro currency swap is transacted, both the domestic and foreign debt are influenced.

In a currency swap the principals are exchanged at the start and expiry of the swap. At the start, the central government pays a krone amount (the krone asset leg) and receives an equivalent amount in euro (the euro liability leg). On expiry, the transaction is reversed. The central government receives kroner and pays euro. During the term of the currency swap the central government receives 6-month Cibor on the krone asset leg, and pays 6-month Euribor on the euro liability leg.

At the start, the krone asset leg is booked in the central-government accounts as a redemption of the domestic debt. The debt is reduced by the amount equivalent to the value of the krone asset leg. The redemption increases the central government's gross domestic financing requirement. On expiry, the krone leg is booked as domestic borrowing. This contributes to covering the central government's domestic borrowing requirement in that year.

The euro liability leg is booked to the foreign debt in the opposite way. At the start this corresponds to raising a loan, thereby fulfilling part of the foreign borrowing requirement, and the foreign debt is increased. On expiry, the redemption of the euro liability leg is booked as redemption of the debt. The redemption increases the central government's foreign borrowing requirement in that year.

An overview of how the transactions are booked in the central-government accounts is given below:

At the start of the currency swap:

Domestic debt: Redemption of domestic debt

Foreign debt: Raising of foreign debt

On expiry of the currency swap:

Domestic debt: Raising of domestic debt

Foreign debt: Redemption of foreign debt

According to the above, the gross domestic financing requirement increases when the loan is raised. Financing the foreign debt by transacting currency swaps thereby contributes to maintaining outstanding amount and liquidity in domestic on-the-run issues at a time when the domestic financing requirement is otherwise declining, cf. Chapter 7.

surplus in the medium term. According to the EU Treaty, the general-government deficit as a general rule may not exceed 3 per cent of GDP, while the general-government gross debt as a general rule may not exceed 60 per cent of GDP.

At the close of 2001 the general-government gross debt compiled in accordance with the EU Treaty was estimated at DKK 586.3 billion, or 43.5 per cent of GDP.

OWNERSHIP STRUCTURE OF DOMESTIC GOVERNMENT SECURITIES 5.4

The overall objective of the government debt policy is to achieve the lowest possible long-term borrowing costs, while e.g. holding the risk at an acceptable level. One means to achieve this is to ensure a broad investor base for the government's securities. Table 5.4.1 presents the ownership distribution of Danish krone-denominated government securities. During 2001 the share owned by non-resident investors has been in the range of 31-34 per cent. Excluding the Social Pension Fund's holdings of government securities the share owned by non-residents was 40 per cent at the end of the 3rd quarter of 2001. The development in the non-resident ownership share consists of a small decline in the ownership share of government bonds, while the ownership share of Treasury notes and especially Treasury bills has risen. Viewed over a longer period, the foreign ownership share has been declining, cf. Chart 5.4.1.

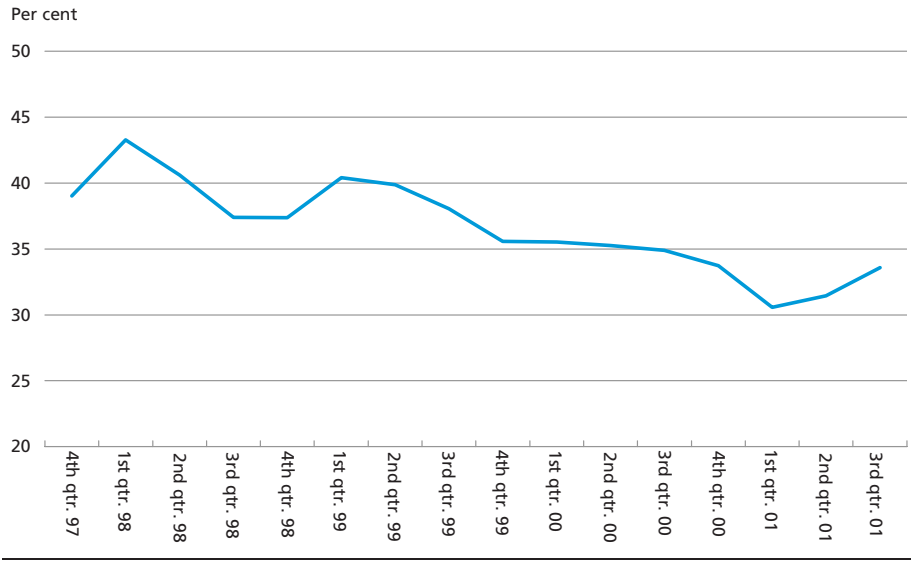
DISTRIBUTION BY OWNERSHIP OF CIRCULATING KRONE-DENOMINATED GOVERNMENT SECURITIES, 2000-2001 Table 5.4.1

Per cent of nominal outstanding volume	4th qtr. 00	1st qtr. 01	2nd qtr. 01	3rd qtr. 01
Non-financial companies	5	5	4	4
Financial institutions, including Danmarks Nationalbank	22	24	24	23
Insurance companies and pension funds	10	11	11	12
General-government sector	24	24	23	21
Private, non-dividend-paying institutions	3	2	2	2
Households	1	1	1	1
Non-residents	34	31	31	34
Not stated	2	2	2	3
Total	100	100	100	100
Total nominal outstanding value, DKK billion	627.4	617.4	628.1	655.2
Total market value, DKK billion	684.1	657.7	660.1	697.4

Note: The Table shows percentage of nominal outstanding value. Danmarks Nationalbank has adjusted the figures for repurchase agreements between Danish banks and non-residents. Moreover, adjustments are made on an estimated basis for the residents' holdings on safekeeping-accounts abroad.
Source: Statistics Denmark, based on data from the Danish Securities Centre.

NON-RESIDENT OWNERSHIP SHARE OF DOMESTIC GOVERNMENT SECURITIES, END OF QUARTER

Chart 5.4.1



Note: The Chart shows percentage of nominal outstanding volume. Danmarks Nationalbank has adjusted the figures for repurchase agreements between Danish banks and non-residents. Moreover, adjustments are made on an estimated basis for the residents' holdings on safekeeping-accounts abroad.

Source: Statistics Denmark, based on data from the Danish Securities Centre.

The generally constant non-resident ownership share in 2001 covers a shift from long-term to short-term bonds. This was a consequence of e.g. the Danish pension sector's demand for securities of long duration,

DISTRIBUTION BY COUNTRY OF NON-RESIDENTS' HOLDINGS OF DOMESTIC GOVERNMENT SECURITIES, PER CENT

Table 5.4.2

Investor countries/Government issuer	Belgium	Denmark	Finland	Netherlands	Sweden
Denmark, Finland, Norway and Sweden	2	0	1	2	1
Germany	27	27	29	17	25
Belgium, Netherlands and Luxembourg	14	35	10	13	14
UK	7	6	5	12	14
France	24	2	34	15	3
Italy	15	11	4	24	7
Ireland, Portugal, Spain and Austria	4	5	2	7	5
Switzerland	4	7	13	7	9
Canada and USA	4	6	2	3	22
Total	100	100	100	100	100

Note: The Table comprises government securities denominated in each country's own currency. For each country, the Table is based on government securities held by non-residents. Data comprises government securities with initial maturity exceeding one year and is compiled for the period 3rd quarter 2000 - 4th quarter 2001. The number of financial institutions covered by the database ranges from 5 (Liechtenstein) to 3,030 (USA). The investor countries are shown by the rows of the Table, while the issue countries are shown by the Table columns. The Table e.g. shows that investors from the Netherlands and Luxembourg hold 14 per cent of domestic Belgian government securities owned by non-Belgian investors.

Source: Capital Access International.

which led to a narrowing of the yield differential to Germany for long-term government securities, cf. Chapter 2.

The distribution by country of non-resident investors' holdings of domestic government securities is presented in Table 5.4.2. Here, the distribution for Danish domestic securities is compared with the equivalent distributions of domestic securities for Belgium, Finland, the Netherlands and Sweden. The figures are based on Capital Access International's database of the bond holdings of a number of financial institutions in Europe, the USA and Canada. With regard to Denmark, the figures cover around 25 per cent of non-residents' total holdings of krone-denominated government bonds. Therefore the figures should be interpreted with some reservation. The Table shows that Denmark has relatively high ownership shares in Germany, as well as in Belgium, the Netherlands and Luxembourg.

GOVERNMENT-GUARANTEED ENTITIES 5.5

The central government provides guarantees for the borrowing and related financial transactions of a number of companies. These are typically structured as government-owned limited-liability companies, and their tasks are defined in an act or legal document which gives access to government guarantees for loans within a certain limit. The board of directors and management of each government-guaranteed entity are responsible for the entity's financial transactions, risk management, etc. The guidelines for borrowing by government-guaranteed entities are described in Box 5.3.

GUIDELINES FOR BORROWING BY GOVERNMENT-GUARANTEED ENTITIES Box 5.3

The guidelines for borrowing by government-guaranteed entities are stated in a set of agreements comprising three elements. An agreement between respectively the Ministry of Finance or the Ministry of Transport and Danmarks Nationalbank; an agreement between the Ministry and the individual entity; and finally a list of acceptable loan types. The list is drawn up and updated jointly by the Ministry of Finance and Danmarks Nationalbank.

The list of acceptable loan types is based on the following criteria:

- Transactions must be customary, i.e. known and used in the market by reputed borrowers.
- Transactions must be built up from simple elements that make them transparent. This applies to transactions before swaps, and to swaps and other derivatives.
- It is emphasised that the management of the credit risk should take place on the basis of a rating-based limit system.
- It is recommended to take steps to establish agreements on the provision of collateral (CSA agreements) in order to minimise the credit risk at all times.
- The currency exposure should as a general rule be limited to euro.

A government guarantee is attractive to the borrower since it reduces borrowing costs. When a loan is guaranteed by the central government, the lender's credit risk on the loan will be reduced, so that the lender will typically be willing to lend at a lower interest rate.

The government-guaranteed entities are Storebæltsforbindelsen (Great Belt), Øresundsforbindelsen, Øresundsbron (Øresund Bridge), Hypotekbanken (the Mortgage Bank of the Kingdom of Denmark), DSB (the Danish State Railways) and Danmarks Radio (The Danish Broadcasting Corporation).

As from 2002, Storebæltsforbindelsen and Øresundsforbindelsen have the opportunity to borrow via re-lending in government bonds and Treasury notes which are on-the-run issues, and in a number of other government bonds. The list of issues available for re-lending is determined by Danmarks Nationalbank and revised when necessary. Re-lending is described in more detail in Box 5.4.

Together with Sweden, the Danish central government also guarantees the debt of Øresundsbron. The borrowing, etc. of Øresundsbron is subject to guidelines laid down by Sweden and Denmark.

The government-guaranteed debt of the entities at the close of 2001 totals DKK 87.6 billion, cf. Table 5.5.1.

In addition to the above entities, Ørestadsselskabet is subject to the guidelines for borrowing by government-guaranteed entities. However,

RE-LENDING OF GOVERNMENT SECURITIES — Box 5.4

Storebæltsforbindelsen, Øresundsforbindelsen and Ørestadsselskabet have access to an re-lending facility whereby the companies borrow from the central government.

The central government grants on-lending to precisely mirror an existing government securities series. Coupon, due date and expiry date will thus be identical with those for an existing series. The companies must pay a price for the loan equivalent to the average price of the underlying government securities for "member trades" on the Copenhagen Stock Exchange three trading days before the loan is settled.

The list of government securities in which the central government can grant loans is called the re-lending list. This list is determined by Danmarks Nationalbank and includes government bonds and Treasury notes which are on-the-run issues, as well as a number of other government bonds.

Lending by the central government to the companies increases the gross borrowing requirement in the year of re-lending and is therefore financed by on-the-run government issues. Re-lending thus does not entail issues in government securities that are off-the-run.

The re-lending facility should be considered as an opportunity for the companies to obtain inexpensive financing. As the central government already guarantees the debt of the companies, direct lending by the central government does not entail any further credit risk.

GOVERNMENT-GUARANTEED DEBT — Table 5.5.1

DKK billion	End-2001
Hypotekbanken	8.2
Storebæltsforbindelsen	42.3
Øresundsforbindelsen	8.5
Øresundsbron	24.3
DSB and DSB S-tog A/S	3.5
Danmarks Radio	0.8
Total	87.6

Note: The debt of Øresundsbron is guaranteed jointly by Denmark and Sweden.

since the entity is a general partnership of which the central government is co-owner no government guarantee is provided for the entity's borrowing. Ørestadsselskabet has had access to re-lending for a number of years. In 2001, the company's re-lending limit was raised, and can now be up to 100 per cent of the company's debt, in contrast to the previous 45 per cent. The debt of Ørestadsselskabet at end-2001 was around DKK 10.0 billion, of which DKK 5.8 billion is re-lending.

CHAPTER 6

Risk Management

SUMMARY 6.1

Via its borrowing and debt the central government is exposed to various risks, including interest-rate, exchange-rate and credit risk.

The interest-rate risk is managed via objectives for duration and the redemption profile. Duration indicates the average fixed interest period for the debt. The duration band of the government debt for 2002 is set at 3.5 +/- 0.5 years, which is unchanged from 2001. The objective for the redemption profile ensures stable annual redemptions, in order to reduce the central government's refinancing risk. Cost-at-Risk (CaR) is used to quantify the interest-rate and refinancing risk.

The exchange-rate risk on the central government's foreign debt is reduced by exclusively holding euro debt, or debt swapped to euro. Moreover, Danmarks Nationalbank's foreign-exchange reserve is predominantly exposed in euro.

The credit risk on the central government's swap portfolio is managed on the basis of rating requirements and collateral agreements. The credit exposure on the central government's swap portfolio increased from DKK 8.3 billion to DKK 9.9 billion in 2001, which was mainly attributable to the dollar's strengthening against the euro. The market value of the swap portfolio increased by DKK 4.4 billion. However, the increase was offset by the fact that the central government's counterparties pledged collateral for a large proportion of the swap portfolio's value. The central government now has 19 collateral agreements, which contribute to limiting the credit exposure in swaps. Swaps are only transacted with counterparties with which a unilateral collateral agreement has been signed.

INTEREST-RATE AND REFINANCING RISK 6.2

Duration

Debt of long duration means that the annual interest costs are less sensitive to changes in the level of interest rates, cf. Box 6.1. On the other hand, long duration can entail higher average costs. It is therefore necessary to weigh costs against risk.

INTEREST-RATE RISK AND DURATION OF THE CENTRAL-GOVERNMENT DEBT Box 6.1

The central-government debt is compiled at nominal value, and disregarding buy-backs, the debt is redeemed at nominal value. Changes in the market value of the debt therefore do not in themselves significantly affect the cost of the debt to the central government. The central-government debt entails an interest-rate risk because the debt is subject to current refinancing at future unknown interest rates. An increase in the interest rates thus increases the central government's future interest costs, thereby affecting the central-government budget.

The concept of duration can be defined in different ways. Duration indicates the average fixed interest period for an asset/liability or portfolio, and also expresses the sensitivity of the market value to changes in interest rates. The latter is relevant to the risk management of a portfolio's market value. Long duration means that changes in interest rates lead to large price fluctuations, and thereby a high risk in terms of market value. However, for the government debt, of which the market value is not of central importance to risk management, it is the definition of duration as the average fixed interest period that is of relevance. The longer the maturity of the central government's fixed-rate bullet issues, the longer the duration, all other things being equal. Long maturity entails long intervals between the central government's refinancing requirement, thereby binding the interest on the debt for a longer period, just as long-term interest rates are typically less volatile. This reduces the variation in the annual interest costs. In relation to the interest-rate risk on the government debt, long duration thereby entails low risk.

The duration of the government debt is calculated according to the Macaulay formula (V_{Mac}) defined as:

$$V_{Mac}(s, i_s) = \sum_t (t-s) \frac{C_t (1+i_s)^{-(t-s)}}{\sum_u C_u (1+i_s)^{-(u-s)}}$$

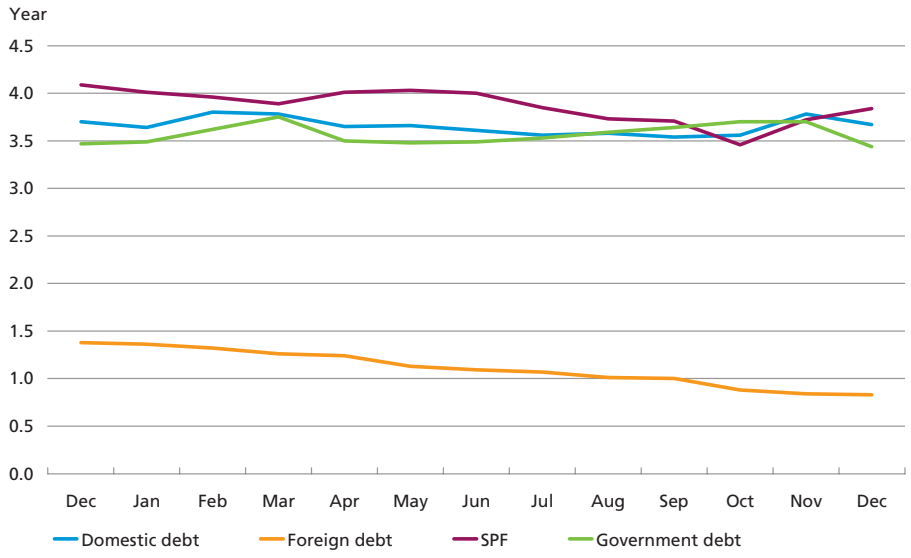
where s is the time of calculation, i_s is the discount rate, and t is the time of the future payment C_t. Duration can also be expressed by Σ_t (t-s) w_t, where w_t is the payment at time t as a proportion of the total present value of the payments. The Macaulay duration is thus a weighted average of the length of the periods to each payment, where the weights are the relative sizes of the individual payments (the sum of the weights is 1).

The contribution to the duration of the government debt from interest-rate swaps whereby interest at a fixed rate is received and interest at a floating rate is paid, is calculated as the duration of the floating leg, equal to the time to the next due date, less the duration of the fixed leg.

The duration of the total government debt is calculated by weighting together the duration of the sub-components of the government debt with their respective proportions of the total debt. The duration of the portfolio's liabilities is calculated with sign positive, while the duration of the portfolio's assets is calculated with sign negative.

SPF's holdings of callable mortgage-credit bonds make it necessary to apply an option-adjusted duration. Callable bonds are included with a smaller duration than equivalent non-callable securities. The duration of the balance of the central government's account with Danmarks Nationalbank is 0 years.

DEVELOPMENT IN DURATION IN 2001, END OF MONTH — Chart 6.2.1



Note: The duration of SPF's portfolio is included with sign negative in the calculation of the duration of the total government debt, since this is an asset to the central government. The duration of the balance of the central government's account with Danmarks Nationalbank is 0 years.

The duration objective is determined as a duration band for the total government debt. As in 2001, the duration band for 2002 is set at 3.5 +/- 0.5 years. On determining the duration band, account is taken of the objective to build up liquid on-the-run issues in the 2-, 5- and 10-year maturity segments.

Chart 6.2.1 illustrates the development in the duration of the government debt and its sub-components. The duration of the total government debt is found by weighing together the duration of the sub-components, i.e. the domestic debt, the foreign debt, the assets of the Social Pension Fund (SPF), and the balance of the central government's account with Danmarks Nationalbank. The duration of the total government debt has been reduced by around 1 year since 1998, cf. Table 6.2.1.

Interest-rate swaps make it possible to some extent to manage duration independently of the maturities of the central-government issues. Issues in liquid bonds can thus to some extent be separated from the

DEVELOPMENT IN THE DURATION OF THE GOVERNMENT DEBT — Table 6.2.1

Year	1995	1996	1997	1998	1999	2000	2001
Duration	3.5	3.9	4.1	4.4	3.8	3.5	3.4

management of the interest-rate risk. The restructuring of fixed-rate debt to floating-rate debt via interest-rate swaps contributes to reducing duration.

In 2001, domestic interest-rate swaps for a total notional value of DKK 6.5 billion were transacted, cf. Table 4a of the Appendix of Tables. In the domestic interest-rate swaps the central government receives a fixed 10-year rate in return for 6-month Cibor. Concurrently with the four foreign loans raised in 2001, the loans were swapped to floating interest rates. Furthermore, the central government transacted two euro-denominated interest-rate swaps for a total notional value of EUR 150 million, whereby a fixed 10-year rate is received and 6-month Euribor is paid.

Redemption profile

Duration is an average measure of the fixed interest period for the debt, and does not shed light on the spread of the payments on the debt. The duration measure is therefore combined with management of the redemption profile of the debt.

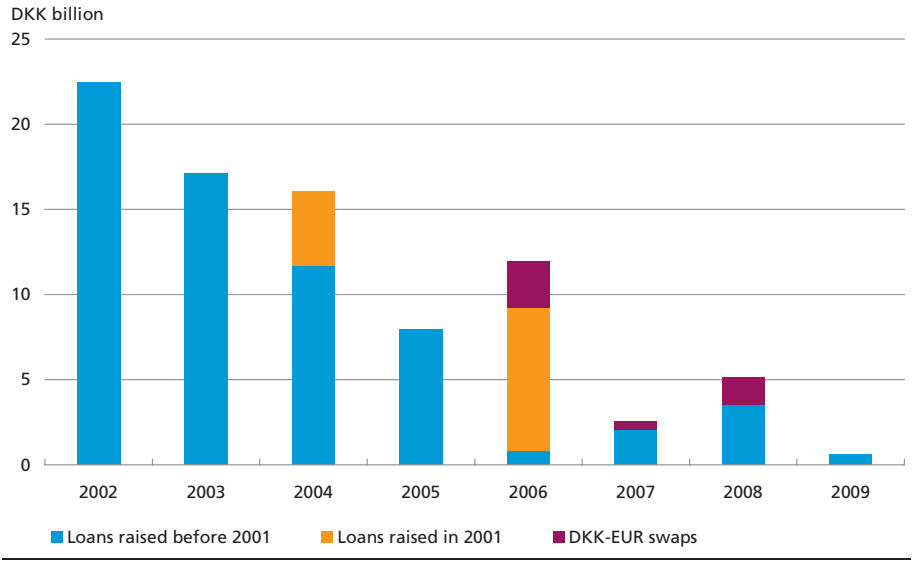
The central government aims at stable annual redemptions of the debt in order to minimise the refinancing risk, i.e. the risk of the central government having to refinance a large proportion of the debt on particularly unfavourable borrowing terms.

The redemption profile for the central-government domestic debt is shown in Chart 6.2.2. The redemptions comprise the proportion relating

REDEMPTION PROFILE – CENTRAL-GOVERNMENT DOMESTIC DEBT, END-2001 Chart 6.2.2

Note: Excluding Treasury bills.

REDEMPTION PROFILE – CENTRAL-GOVERNMENT FOREIGN DEBT, END-2001 Chart 6.2.3



to borrowing before 2001, and the proportion relating to domestic issues in 2001. The volume of swaps from kroner to euro transacted in 2001 is also shown. The central government has transacted swaps from kroner to euro maturing in 2006, 2007 and 2008. On maturity, the central government receives kroner against payment of euro. This reduces the central government's need to issue domestic securities in the year of expiry of the swaps, cf. Chapter 5.

Stable annual redemptions of the domestic debt are ensured via the objective of a smooth redemption profile. The chosen issuing strategy takes this objective into account. Moreover, the redemption profile is managed actively via buy-back and switch operations.

The redemption profile for the central-government foreign debt is shown in Chart 6.2.3. The redemptions comprise the proportion relating to borrowing before 2001, the proportion that can be attributed to borrowing in 2001, and swaps from kroner to euro transacted in 2001.

Over time, the strategy for foreign borrowing, with focus on large loans in the medium-term maturity segments, will give a smooth redemption profile. The previous objective of a falling redemption profile likewise entailed fairly constant annual redemptions of the debt, since current borrowing was distributed smoothly on the individual maturity segments.

Cost-at-Risk

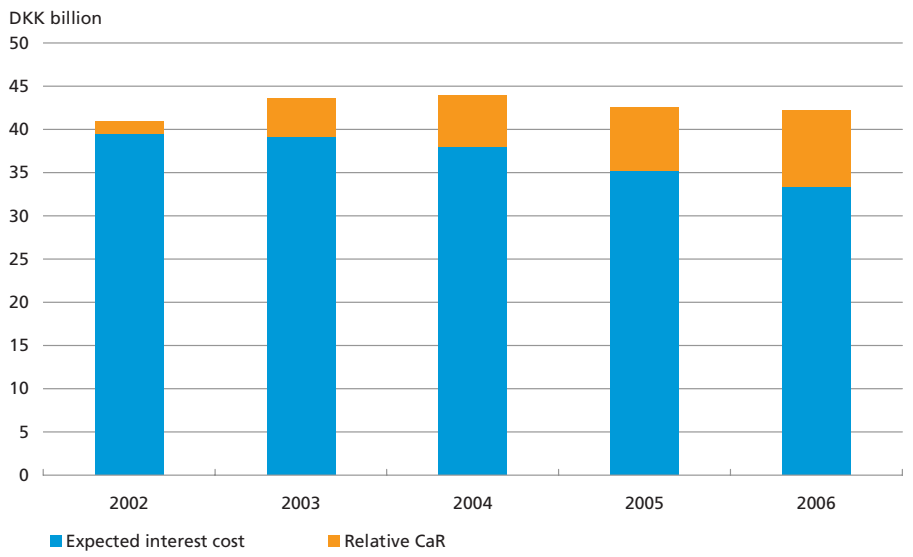
Duration and redemption profile do not quantify the interest-rate risk related to the government debt. In order to compile and assess the risk, it

is necessary to specify the probability of various development courses for the future costs of the debt. With regard to the domestic debt, which accounts for most of the government debt, Cost-at-Risk (CaR) is therefore used as a supplement to duration and redemption profile. CaR operates with a large number of scenarios of the future development in interest rates. On this basis, the expected future interest costs can be calculated, as well as the maximum interest costs that can be expected with a probability of 95 per cent, subject to varying assumptions concerning e.g. issuing strategy and development in the current central-government budget.

Chart 6.2.4 presents CaR figures for the interest costs on the domestic government debt up to 2006. The figures are based on the assumption of an average annual central-government budget surplus of DKK 17 billion for the period 2002-2006. A central-government budget surplus reduces the government debt and the interest costs. Subject to these assumptions, the expected interest costs decrease from DKK 39.5 billion in 2002 to DKK 33.4 billion in 2006.

The uncertainty of the estimated interest costs increases as the time frame widens. This is because a larger proportion of the existing debt will be refinanced at unknown future interest rates. With a 95 per cent probability the interest costs in 2006 will not exceed DKK 42.3 billion (absolute CaR). Measured by relative CaR, which is the difference between the 95th percentile and the mean value, the uncertainty relating to the

COST-AT-RISK FOR THE CENTRAL-GOVERNMENT DOMESTIC DEBT — Chart 6.2.4



Note: The calculations are based on the central government transacting interest-rate swaps in order to achieve a duration of around 3.5 years, in accordance with the duration midpoint for 2002. Absolute CaR is defined as the sum of the expected interest cost and relative CaR.

interest costs is thus DKK 8.9 billion in 2006. The uncertainty of the estimated interest costs depends on the volatility of the interest-rate scenarios on which the calculations are based. Different interest-rate models can therefore give varying estimates of uncertainty, cf. Chapter 9. The interest costs are also sensitive to changes in the assumptions concerning the future central-government budget surpluses.

EXCHANGE-RATE RISK 6.3

Exchange-rate risk is the risk that the value of the debt will increase as a consequence of the development in exchange rates. Since the beginning of 2001 all foreign debt has been exposed in euro. Borrowing takes place directly in euro, or via loans that are swapped to euro. In view of Denmark's fixed-exchange-rate policy vis-à-vis the euro, this ensures a low exchange-rate risk. The purpose of the central government's foreign borrowing is to maintain an adequate foreign-exchange reserve, which is also placed predominantly in euro.

Since the government debt is now exposed solely in euro, and the foreign-exchange reserve is denominated primarily in euro, the formalised coordinated management of the exchange-rate exposure of the central government and Danmarks Nationalbank has been discontinued as from 2001. It is still the objective not to borrow in one currency and thereafter place the proceeds in another, so that the central government is not exposed to a significant indirect exchange-rate risk via Danmarks Nationalbank.

CREDIT RISK ON SWAPS 6.4

The central government uses swaps to adjust the currency and interest-rate terms for government debt. A swap is an agreement between two parties to exchange payments for a defined period. The total value of these cash flows is typically zero when the swap is transacted, but the development in interest and exchange rates can lead to a market value of the swaps in the central government's favour. The central government thus has a claim on a counterparty, and is thereby exposed to that counterparty's ability to pay. This is called the credit exposure, and the risk of defaulted claims is called the credit risk. Box 6.2 describes the key principles for management of the central government's credit risk.

The credit risk of the swap portfolio at the close of 2001

In 2001 the central government transacted 47 new swaps for a total principal of almost DKK 26 billion. Of these, 10 were currency swaps

KEY PRINCIPLES FOR MANAGING THE CREDIT RISK ON THE CENTRAL GOVERNMENT'S SWAPS — Box 6.2

The management of the credit risk on the central government's swaps is based on principles intended to spread and reduce the credit risk. The following focuses on the most important.

Swaps are only transacted with counterparties with a high credit standing. A counterparty must thus have a rating of minimum Aa3/AA- from at least two recognised rating agencies (Moody's, Standard & Poor's and Fitch). For interest-rate swaps in Danish kroner and currency swaps from kroner to euro, however, counterparties with a rating of at least A3/A- are permitted. Moreover, if a counterparty's rating falls to BBB+/Baa1 after the swap is transacted, all swaps with that counterparty can be terminated. This also applies if the central government's rating falls to the same level. The central government's credit exposure to a given counterparty is compiled as the current positive market value of the portfolio less any pledged collateral, as well as a supplement, the *potential credit exposure,* which takes into account that the portfolio can gain incremental market value due to market trends.

In order to ensure the spread of the credit exposure, lines for maximum credit exposure per counterparty are allocated. Lines depend on counterparty rating.

As further protection against credit losses, the central government only transacts swaps with counterparties with whom an agreement on unilateral pledging of collateral has been concluded, so that the central government's counterparty must pledge collateral should the market value of the swap portfolio exceed a certain threshold value. On the other hand, the central government is not required to pledge collateral if the market value is in the counterparty's favour. The threshold value depends on the counterparty's rating.

For a more exhaustive discussion of risk management of central-government swaps, see *Government Borrowing and Debt 2000*, Chapter 11.

from kroner to euro with a total principal of DKK 4.8 billion. During 2001 33 swaps expired, and 9 swaps were terminated prematurely. At end-2001 the number of swaps was 233, with a total principal of DKK 121 billion, cf. Table 6.4.1.

THE CENTRAL GOVERNMENT'S SWAP PORTFOLIO, YEAR-END 1999-2001 — Table 6.4.1

	1999	2000	2001
Number of counterparties	36	34	33
Number of swaps	192	228	233
		DKK billion	
Interest-rate swaps, Danish kroner	8.0	21.0	27.4
Interest-rate swaps, other currencies	54.2	40.3	27.6
Currency swaps, excluding DKK-EUR swaps	55.1	57.5	59.5
DKK-EUR swaps	-	-	4.8
Structured swaps	3.5	1.7	1.7
Principal, total	120.7	120.5	121.0

EXCHANGE-RATE AND INTEREST-RATE SENSITIVITY OF THE SWAP PORTFOLIO, END-2001 Table 6.4.2

DKK billion	Increase in market value on appreciation by 1 per cent vis-à-vis DKK	Increase in market value on a decrease in interest rates by 1 percentage point
DKK	•	2.1
EUR	-0.6	-0.3
USD	0.5	1.2
GBP	0.0	0.1
Other currencies (net)	0.1	0.1
All currencies (net)	0.0	3.2

The market value of the central government's swap portfolio depends on the development in interest and exchange rates. Table 6.4.2 shows that the market value of the swap portfolio will increase by DKK 0.5 billion should the dollar appreciate by 1 per cent against the Danish krone. As the dollar has appreciated against the Danish krone during 2001, the market value of the swap portfolio has increased significantly since the end of 2000.

Table 6.4.3 shows that the market value of the swap portfolio has increased from DKK 5.2 billion to DKK 9.6 billion. The increase relates predominantly to currency swaps in other currencies than between kroner and euro, of which the market value has increased from DKK 4.1 billion to DKK 7.9 billion. In addition there has been a small increase in the market value of interest-rate swaps in Danish kroner.

The increase in market value in favour of the central government means that collateral is pledged by several of the central government's counterparties, and the pledging of collateral contributes to reducing the credit exposure of the central government, cf. Table 6.4.4. At the close of the year just under half of the active counterparties to the central government pledged collateral totalling DKK 4.0 billion. The

NET MARKET VALUE OF THE SWAP PORTFOLIO, 1999-2001 Table 6.4.3

DKK billion	1999	2000	2001
Interest-rate swaps, Danish kroner	-0.2	0.7	1.3
Interest-rate swaps, other currencies	-0.4	0.3	0.1
Currency swaps, excluding DKK-EUR swaps	4.8	4.1	7.9
DKK-EUR swaps	-	-	0.0
Structured swaps	0.3	0.1	0.3
Total	4.4	5.2	9.6

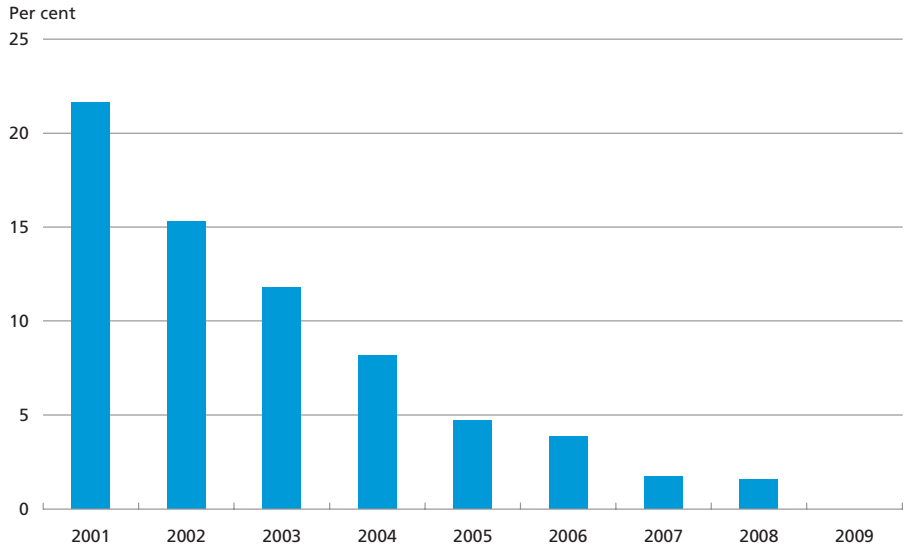
CREDIT QUALITY OF THE SWAP PORTFOLIO, YEAR-END 1999-2001 Table 6.4.4

Rating	1999		2000		2001	
	Number of counter-parties	Credit exposure (DKK billon)	Number of counter-parties	Credit exposure (DKK billon)	Number of counter-parties	Credit exposure (DKK billon)
AAA	9	2.9	10	2.2	9	2.4
AA+	5	1.9	4	0.9	3	1.1
AA	3	1.8	3	1.6	5	2.1
AA-	13	4.5	12	3.0	12	3.6
A+	5	0.3	4	0.6	3	0.3
A	1	0.0	1	0.1	1	0.3
A-	-	-	-	-	-	-
Total	36	11.4	34	8.3	33	9.9
Of which:						
- Current market value		5.5		5.9		10.0
- Collateral pledged		-0.2		-2.2		-4.0
- Potential exposure		6.0		4.6		4.0

Note: Credit exposure comprises both actual credit exposure, equivalent to positive market values, and potential credit exposure, which is an estimate of future positive market values. Pledged collateral is deducted in the calculation. For a more detailed description of the technique applied to calculating credit exposure, see *Government Borrowing and Debt, 2000,* Chapter 11.

credit exposure has therefore only increased from DKK 8.3 billion at the end of 2000 to DKK 9.9 billion at the end of 2001, despite the considerable increase in market value.

PROPORTION OF SWAPS NOT COVERED BY COLLATERAL AGREEMENTS, YEAR-END Chart 6.4.1



Note: The calculations are based on the assumption of an unchanged total principal.

Collateral agreements have thus already proved to play an important role in limiting the credit exposure of the central government. At the close of the year the central government had signed collateral agreements with 19 counterparties, while a smaller number of agreements is expected to be negotiated and signed during 2002. The proportion of the swap principal covered by collateral agreements was almost 80 per cent by the end of the year. As more agreements are established, and existing swaps that are not covered by collateral agreements expire, the proportion covered by collateral agreements increases. Chart 6.4.1 shows how the number of swaps not covered by collateral agreements will decrease as the swaps expire. By the end of 2002 the proportion covered will already be close to 85 per cent.

Special-Topic Section

CHAPTER 7

Consequences of Budget Surpluses for Government Debt Policy

SUMMARY 7.1

In recent years the economic consequences of a declining government debt have been discussed in a number of international fora. This discussion e.g. arose as a consequence of the budget consolidation in Europe and the USA, which has led to a stabilised or declining government debt.

A smaller government debt has a number of positive effects on the government budget and on the national economy, such as lower interest costs for the central government. In overall terms, this helps to widen the national economic scope for manoeuvre.

Lower debt reduces the pressure on government borrowing, giving greater leeway in planning government debt policy strategies. A reduced borrowing requirement can make a number of adjustments to the government debt policy strategy appropriate as the current requirement for issuing diminishes.

In the longer term, if the debt approaches zero, the question arises of whether government bonds should still be issued when there is no immediate borrowing requirement. This depends primarily on whether the existence of government bonds is considered to be a prerequisite to maintaining a well-functioning financial market.

In the Danish financial market, the mortgage-credit market is the obvious successor to the benchmark role of government securities. It is thus not necessary to maintain government-bond issues in the absence of a borrowing requirement. For euro-area member states with little debt there are likewise few arguments to support maintaining issues of government bonds for as long as euro-area member states with high debt maintain the supply of euro-denominated government bonds. Other countries can be expected to continue to issue government bonds even if they have no government debt. This is currently the case for e.g. Norway, whose central government holds net assets, but continues to issue government bonds.

BACKGROUND 7.2

In recent years, a number of international fora have focussed on the economic consequences of a declining government debt. These discussions have e.g. taken place under EU auspices and within the OECD's government-debt group. Reports published in 2000 included one from the Giovannini Group. The Giovannini Group advises the EU on issues related to financial markets. This report e.g. considers the question of coordinated issues[1]. Furthermore, the economic consequences of a declining debt have been considered in a number of theoretical articles.

Discussion of the consequences of a diminishing government debt has been based on the following:

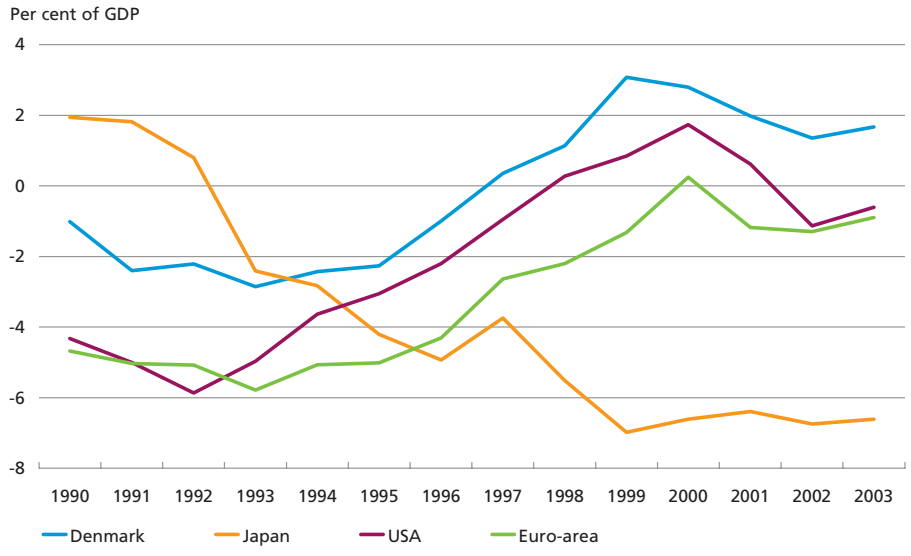
- The USA has had a government-budget surplus since 1998, and until recently a considerable decline in the government debt within a foreseeable period was estimated in prognoses.
- Within the EU government budgets have been subject to significant consolidation in the period up to the introduction of the euro.
- In a number of other OECD states, including Canada, Australia and New Zealand, government debt has stagnated or been reduced during the 1990s.
- Japan has a substantial budget deficit and a growing debt. From 1992 to 2001 gross debt as a ratio of GDP has more than doubled.

Chart 7.2.1 presents the consolidation of government budgets in the euro area and the USA, as well as for Denmark and Japan. Within the EU, Finland, Sweden, Ireland, the UK and Denmark have achieved government-budget surpluses since the end of the 1990s, while the deficits of the other EU member states have primarily been reduced. With regard to Denmark, the turning point came in around 1997. In the period 1997-2001, the government debt has been reduced by almost DKK 90 billion. In that same period, the nominal outstanding volume in domestic bonds has fallen by around DKK 55 billion.

The budget consolidation prompted a number of adjustments to the government debt policies of European countries at the end of the 1990s. The new policies are adapted to the greater competition among issuers and the lower issuing requirement. This increased competition can be attributed primarily to the run-up to and the introduction of the euro, creating a European financial market with a single currency. The core concept is to issue in a small number of series with a large outstanding

[1] The Giovannini Report can be downloaded at www.europa.eu.int/comm/economy_finance/publications/giovannini/giovannini081100en.pdf.

DEVELOPMENT IN GOVERNMENT-BUDGET BALANCES Chart 7.2.1



Source: OECD, *Economic Outlook* 70, December 2001.

volume and high liquidity. To a great extent the member states pursue identical strategies.

Besides the design of the government debt policy the diminishing government debt affects the national economy, as well as the functioning of the financial markets. The topics discussed in this area include:

- The relation between greater public savings, private savings, interest rates, growth and employment.
- The consequences of a reduced supply of government bonds for the efficiency and functioning of the financial markets.
- The design of government debt policy in a situation where the issuing requirement is reduced as a consequence of transition from deficit to surplus.
- Whether it entails costs for a country to re-enter the market for government bonds after a period with no issues.

The future development in government debt, and thereby in the supply of government bonds, depends on many factors that are mutually related, and is therefore subject to considerable uncertainty.

How the debt develops depends primarily on fiscal policy, and to some extent on the cyclical development, which is generally subject to great uncertainty. Moreover, in most OECD countries, the ageing of the population and a diminishing labour force are predicted to be the trend

in coming years. Increased expenditure on measures to provide for the elderly can thus postpone or prevent the reduction of net debt.

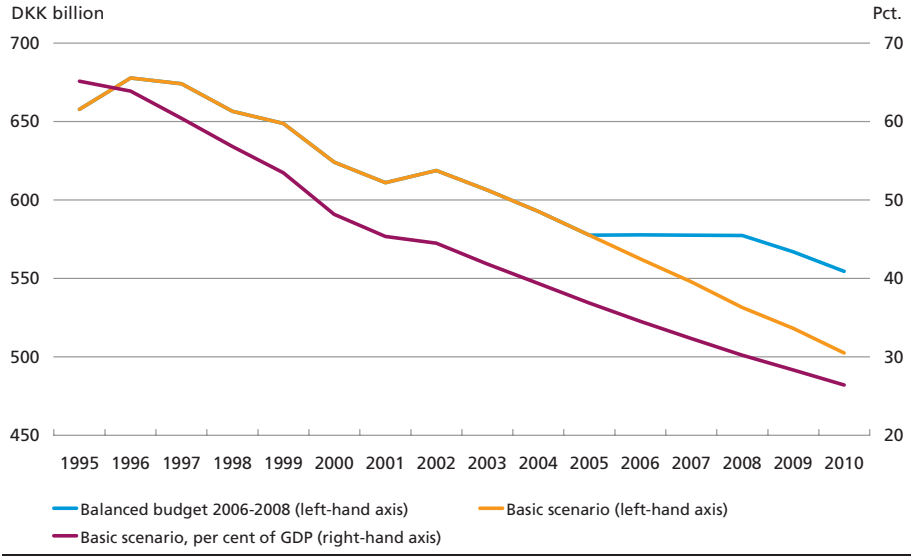
A calculation of Denmark's government debt up to 2010 is presented in Chart 7.2.2. It is based on the Ministry of Finance's medium-term projection of the development in government debt and shows an average government-budget surplus of around DKK 12 billion in the period 2002-2010, thereby reducing the debt by around DKK 100 billion.

The Chart also shows an alternative scenario where the budget is balanced in the period 2006-2008 and thereafter develops in line with the basic scenario. The difference between the two scenarios for the government debt increases over the period from just over DKK 46 billion in 2006 to just over DKK 52 billion in 2010, as a consequence of dynamic interest-rate effects. The larger the surplus, the smaller the debt, and the more interest costs are reduced. This in turn leads to larger surpluses, etc. In other words, a number of years with a balanced budget or deficit can considerably delay the settlement of the debt.

If the targets of the basic scenario are achieved, the Danish government debt will decrease, but still be at a considerable level.

Discussion of government debt policy in a surplus scenario should generally be based on two factors in both Danish and international contexts. Any elimination of the debt will often take place over an extended period, and the surplus scenario will often be subject to a degree of uncertainty.

PROJECTION OF DEVELOPMENT IN THE DOMESTIC GOVERNMENT DEBT Chart 7.2.2



Note: Actual figures for the period 1995-2001. For 2002-2010, calculation based on the medium-term projection of the Ministry of Finance of the development in the government debt, Economic Report, January 2002.

A lower government debt affects the economy primarily via the government budget and a reduced supply of government bonds. The effects are national economic, but also market-related, due to changes in the composition and supply of instruments in the financial market. Reducing the government debt has a number of positive effects on a country's economy, since it increases the national economic scope for manoeuvre. The national economic effects are described in more detail in a number of articles[1]. In the following, the focus is on how a declining government debt affects the financial markets.

Impacts on financial markets

Government bonds are often characterised by high liquidity and low credit risk. Government bonds are described as the liquid, "risk-free" asset in the financial markets. The low credit risk is a consequence of e.g. the central government's right to levy taxes.

High liquidity and low credit risk ensure government bonds a key role in the financial markets, thereby helping to increase the efficiency and completeness of the markets.

The most important function of government bonds is as a liquidity and hedging instrument. Government bonds are also the underlying asset used in a number of derivative instruments, and are a key investment object for risk-averse investors. They are also used by central banks in their monetary-policy operations. Finally, via the zero-coupon yield curve, government bonds are used to price privately issued financial instruments.

A situation with a decreasing outstanding volume in government bonds affects the financial markets to the extent that close substitutes do not exist or arise to replace government bonds in the aforementioned areas. The obvious alternatives to government bonds include bond issues from the following sources:

- *Credit institutions.* Freddy Mac, Fanny Mae, Deutsche Pfandbriefe and Danish mortgage-credit bonds.
- *Business enterprises.* Issues of corporate bonds by companies with a high rating and thereby a low credit risk.
- *Government-guaranteed and supranational entities.* Øresundsforbindelsen and Great Belt (Storebæltsforbindelsen) are Danish examples of issuers of government-guaranteed bonds. EIB (the European Investment Bank), NIB (the Nordic Investment Bank) and the World Bank are examples of supranational bond issuers.

[1] See e.g. "The Economic Consequences of Disappearing Government Debt" by Reinhart and Sack in Brookings Papers on Economic Activity, 2:2000.

These are examples of bond issues which have the potential to take over the role of government bonds in the financial markets, including as pricing instruments.

Pricing can also be based on the swap curve. The swap curve indicates the relation between the interest rate on the fixed leg of an interest-rate swap and the maturity of the swap. The market for interest-rate swaps has been growing in recent years to become a large liquid market. Pricing in the financial markets thus does not necessarily require large underlying government-bond issues.

Due to the low credit risk and large outstanding volumes, mortgage-credit bonds are the most obvious successors to the current role of government securities in the Danish market. If the government debt continues to diminish, it is therefore possible that, at some point, mortgage-credit securities will resume the benchmark role they held up to the start of the 1990s.

It is also possible that the supply of bonds from other issuers will increase in step with the reduction of the supply of government bonds. This primarily relates to a greater supply of highly-rated corporate bonds. In recent years the growth in the international corporate-bond market has made it possible to price corporate bonds on the basis of zero-coupon yield curves derived from other corporate bonds with the same rating.

The debate of whether a country's financial markets are affected by a declining supply of government bonds must consider the development stage of the financial market. The existence of government bonds can play a significant role in a situation where the financial market is still being built up, where government bonds are the "foundation stone" of the market. This will usually be the case in a number of developing countries.

ADJUSTMENTS TO GOVERNMENT DEBT POLICY 7.4

A declining government debt affects the government debt policy to the extent that the policy requires adjustment to ensure that its objectives are met.

The objectives of government debt policy can often be divided into two areas. One is related to achieving low long-term borrowing costs with due consideration of the risks that the debt entails, and the second is to maintain a well-functioning domestic financial market.

Issuing policy in a situation with a declining debt

For the central government, a smaller debt generally reduces the pressure to borrow, thereby giving greater scope in planning government debt policy. This leads to lower costs and fewer risks. Moreover, a

reduced borrowing requirement can make it reasonable to carry out a number of adjustments to the government debt policy strategy in step with the reduction of the current issuing requirement.

International practice is to base the issuing policy on liquid benchmark issues in order to reduce the average borrowing costs via a liquidity premium.

When a country turns a budget deficit into a surplus, the outstanding volume in each on-the-run issue will be negatively affected, making it necessary to adjust the policy in order to maintain the benchmark strategy. Key adjustments and instruments used for maintaining the benchmark strategy in the scenario of a declining debt are:

- Concentration of issues in fewer bond series and instrument types
- Longer issue periods for individual securities
- Buy-back and switch operations
- Market making schemes
- Lending facilities
- Interest-rate and currency swaps
- Consolidation of public borrowing

Box 7.1 presents the individual items in relation to Danish government debt policy.

The aforementioned instruments and adjustments can help to maintain the benchmark strategy in a situation where the debt is declining, thereby ensuring low average borrowing costs, while some of the initiatives, viewed separately, at the same time can entail an increase in the risk on the debt. Examples are a concentration of issues and longer issuing periods since fewer securities reduce the government's issuing opportunities, and moreover can result in a less even redemption profile. Increased disparity of the redemption profile can subsequently be set off via active use of buy-backs. All in all, a lower government debt reduces the absolute risk on the debt, i.e. the risk measured in kroner, as the central government has to borrow less, cf. Chapter 6.

Most countries are expected to maintain a prolonged benchmark strategy via active use of the aforementioned instruments, even though their debt is declining.

An alternative to adjustments to the individual countries' government debt policy would be closer cooperation between countries with a relatively small issuing requirement, in order to maintain liquidity in on-the-run issues.

An impression of the differences with respect to government debt among the European countries is given in Chart 7.4.1. This was part of the background to the discussion in the Giovaninni Report of the need

for coordinated government issues in Europe. The overall objective of coordination is to enhance liquidity in the different countries' securities, and thereby reduce the interest costs to the participating countries.

ADJUSTMENTS TO DANISH GOVERNMENT DEBT POLICY FOR A LOWER GOVERNMENT DEBT Box 7.1

Concentration of issues on fewer bond series and instrument types. Since the start of the 1990s Denmark's government debt policy has focused on issues in a small number of series and maturity segments. Bonds are issued only in the 2-, 5- and 10-year segments. In the period 1997-99 only very few issues took place in the 30-year segment. At the close of 2000 the 30-year paper became an off-the-run issue. Previously, several different types of loan were used, including serial loans, premium bonds and floating-rate loans. In the current strategy, only bullet loans are used.

Longer issue periods. Currently, issues are made in the 5- and 10-year bonds for approximately 2 years. The 10-year bond traditionally opens with a remaining maturity of e.g. 11-12 years, and closes when the remaining maturity is around 10 years. In the 2-year segment, the securities are open for issue for approximately 1 year. Moreover, the series can be re-opened at a later time.

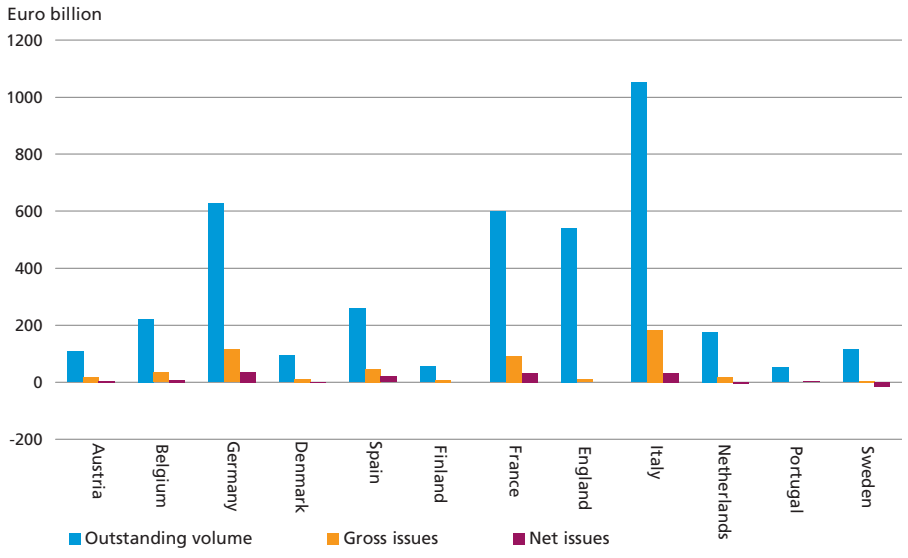
Greater use of buy-back and switch operations. Buy-backs have been used actively for several years. Buy-back of securities before normal redemption makes it possible to move the financing requirement to the buy-back year where issues in a small number of series can be made. Switch auctions were launched as part of Danish government debt policy in 2001.

Use of interest-rate and currency swaps. Domestic interest-rate swaps were introduced in Danish government debt policy in 1998. To some extent, interest-rate swaps separate the duration objective from the issuing policy. In this way, the issues can be concentrated in e.g. the 10-year segment, and duration is managed independently thereof by transacting interest-rate swaps. In 2001 currency swaps from kroner to euro were introduced in Danish government debt policy. Via currency swaps, foreign loans can be raised by issuing domestic bonds and then swapping the proceeds to foreign currency. Currency swaps from kroner to euro thereby increase the domestic borrowing requirement.

Lending. A alternative method to support liquidity is to lend government securities against collateral. This supports turnover and thereby liquidity, since a shortfall in a given bond is prevented. It can be argued that the required outstanding volume in a given series (critical level) becomes lower if there is an efficiently functioning lending facility. As part of Danish government debt policy, two lending facilities have been established under the auspices of respectively the central government and the Social Pension Fund (SPF). The two facilities together cover most of the domestic government bonds.

Re-lending to government-guaranteed entities. As from 2002, the government-guaranteed entities Øresundsforbindelsen and Storebæltsforbindelsen have had access to a re-lending facility in government loans, cf. Chapter 5. Re-lending entails that the government-guaranteed entities borrow via the central government, which finances the loans by issuing bonds. In a number of other countries, government borrowing has been consolidated, by e.g. including the financing of local-government debt in overall general-government borrowing.

DEBT, GROSS AND NET ISSUES IN 2000 Chart 7.4.1



Source: Central Government Debt, *Statistical yearbook*, 1980-2000, OECD

The Giovannini Report concludes that especially the small euro-area member states would benefit from coordinated issues. The report outlined four different proposals with varying degrees of coordination, cf. Box 7.2.

THE GIOVANNINI REPORT ON COORDINATED ISSUES Box 7.2

The Giovannini Report outlines four initiatives entailing varying degrees of greater coordination of the government debt policy. The four initiatives can be summarised as:

Coordination of technical aspects. This proposal entails the smallest degree of integration and concerns exchange of information concerning issuance calendars, identical coupon and maturity dates, a common primary dealer system, and a common clearing and settlement system. Coordination of technical aspects already takes place among issuers in Europe. One example is the exchange of information on auction dates under the auspices of the EU's Brouhns Group. Information is available at www.europa.eu.int/comm/economy_finance/efc_en.htm.

Shared debt instruments with country-specific tranches. A number of countries join forces to issue e.g. a 10-year loan. The proposal entails that each country is allocated one tranche of the loan, which is guaranteed by that country. A precondition for the proposal is that the participating countries have the same rating.

A common debt instrument with a common guarantee. The participating country guarantees the entire issue ("joint and several guarantees"). One problem with this proposal is that it is in conflict with Article 103 of the EU Treaty which prohibits bail out.

Supranational issues. A supranational government-debt unit is established which grants loans in its own name and re-lends to the member states.

Financial market considerations in a situation with no government debt

The need for a well-functioning domestic financial market can be a vital parameter determining whether a country ceases to issue government bonds when the government debt has fallen to a very low level or been eliminated completely.

Whether a small outstanding volume in government bonds or a situation without government bonds presents a challenge to the functioning of the financial market depends, as previously stated, on whether close substitutes to government bonds exist, Section 7.3.

A smaller euro-area member state with little or no government debt will not experience any scarcity of a "risk-free" asset for as long as the overall euro market for government bonds is intact. Hedging and investment, etc., can take place in euro-denominated bonds issued by other euro-area member states.

In situations where the government debt is reduced and has perhaps lapsed completely, the outstanding volume can be maintained by the central government continuing to issue government bonds, placing the proceeds in a portfolio of government assets. An example of a country that uses this strategy is Norway, whose central government holds net assets but nonetheless issues government bonds.

Even if the government debt disappears for a transition period, it may be necessary to increase the debt at a later time. Re-entering the bond market can impose extraordinary costs, however. The re-establishment costs can be related to several factors. Firstly, the market may require a premium due to uncertainty concerning the expected liquidity in the new securities. Rebuilding market making and primary dealer schemes, inaccurate pricing, etc., can also entail additional costs.

Transition periods where the debt is very low might e.g. arise as a consequence of large non-recurring revenue or due to demographic shifts.

The weighting given to the financial market and the possible costs of re-establishment vary between countries. This is natural in view of the large variations in the development stages of the financial markets of the various countries, and the variations in the extent to which the existence of government bonds is critical to the functioning of the financial market. A vital consideration in this respect is whether the country has its own currency.

If Denmark's government debt continues to decrease, making it necessary at some point to consider whether the issue of government bonds should continue or not, financial market considerations are not expected to justify continued issue. Danish mortgage-credit bonds will be able to take back from government bonds the role of benchmark in the Danish bond market, cf. Section 7.3.

Furthermore, it is assumed that any re-establishment costs will be relatively moderate, in view of the rapid development of the financial markets in recent years, with greater integration among the national markets, e.g. following the establishment of multinational trading platforms for bonds and greater use of other financial products. It is therefore the impression that problems with e.g. correct price setting of a new issue will not arise on any future re-entry to the bond market by the central government. All in all, it is therefore very likely that in a situation with no Danish government debt, there will be no requirement to issue Danish government bonds.

CHAPTER 8

Recent Trends in Primary Dealer Systems

SUMMARY 8.1

Primary dealers are financial institutions which, by agreement with the issuer, and in return for direct payment or special rights, undertake certain obligations in the primary and secondary markets for government securities. Some of the key functions of primary dealers are to market government securities to investors and contribute to the bond market's liquidity by quoting two-way prices for government securities on a current basis (market making).

In most OECD countries the use of primary dealers is part of the government debt policy. Recent years' development in primary dealer systems in the EU member states has been characterised by two key trends: first of all, the increasing integration of the national financial markets has increased the proportion of foreign participants among primary dealers in order to obtain an internationally oriented sales organisation. Secondly, the greater use of electronic market making has helped to increase the efficiency of the government securities markets and reduced the costs of participating in market making.

The Danish government securities market has a number of similarities with a primary dealer system. Even though no agreement on rights and obligations has been established between the government issuer and market participants, the market participants have mutually agreed on telephone-based market making.

The concentration of the Danish market for government securities has increased in recent years. It is currently being considered whether the introduction of electronic market making - possibly within the framework of a primary dealer system like those seen in the other EU member states - might help to strengthen liquidity and competition in the market for government securities.

In view of the greater prevalence of electronic trading systems, to which investors to an increasing extent also have access, the future prospects for primary dealers are currently being discussed in international government debt policy fora. It is likely that in coming years primary dealers will continue to play a key role in an efficient govern-

ment securities market, e.g. in connection with market making, despite the gradual evolvement of some of their functions.

BACKGROUND FOR USING PRIMARY DEALERS 8.2

In most countries the objective of government debt policy is to ensure low borrowing costs for the central government, and to keep risk at an acceptable level. This is often supplemented with the objective to sustain and maintain an effective secondary market for government securities, thereby contributing to low borrowing costs and facilitating the central government's future access to the market.

In most OECD countries the central government uses primary dealers as a means to ensure low borrowing costs and well-functioning government bond markets. Primary dealers are financial institutions that, by agreement with the government issuer, and in return for certain rights, or direct payment, undertake certain obligations in the primary and secondary markets for government securities. These rights and obligations are normally set out in an agreement between each primary dealer and the government issuer.

In some countries, designations other than "primary dealer" are used to describe this type of financial institution, e.g. "market makers" or "authorised dealers". Below the designation "primary dealer" (PD) is used.

PDs are normally committed to accepting a certain minimum share of the primary issuance of government securities. This gives the central government the "guarantee" of a certain minimum interest in the issues, even in periods when market trends are negative.

PDs are also committed to actively market the securities to investors. This helps to sharpen the demand for the bonds.

The preferred composition of a group of PDs is normally a combination of national participants with a strong sales network vis-à-vis local investors, and international participants that can sell government securities to a wide range of international investors. An appropriate group of PDs can help to create a broad investor base whose demand contributes to ensuring low borrowing costs and to facilitating future bond issues.

With regard to the secondary market for government securities, the PDs are usually subject to a market making commitment whereby they must quote binding two-way prices for selected bonds vis-à-vis investors and other PDs for certain amounts and within certain spreads between bid and offer prices. This increases the liquidity of the government bond issues, and thereby contributes to an efficient government securities market and low borrowing costs for the central government.

Finally, PDs can be of value to the government issuer due to the information and advice on market trends and issuing of bonds they can make available.

The services provided by the PDs are produced at a certain cost. Firstly, the PDs' commitment to accept a certain proportion of the primary issues exposes them to the risk that the bonds have to be sold on to investors at prices below the issue price. Secondly, current market making exposes PDs to a price risk. If the PDs are required to maintain relatively narrow spreads between their bid and offer prices for government securities, the spreads will not necessarily be sufficient to cover this price risk. Finally, PDs incur a number of necessary costs such as manpower, electronic equipment, etc. for marketing and to fulfil their market making obligations.

PDs are normally granted certain rights as indirect payment for the costs of fulfilling their obligations. In some cases, direct payment can take place. However, payment is rarely an actual monetary amount for each bond accepted by the PD at the time of issue. This is due to the fact that normally these payments tend to be passed on to the investors, and therefore do not contribute to covering the PDs' costs of participation in the PD system. Most countries have designed systems whereby payment is either e.g. annual remuneration for participation in the system, or indirect payment in the form of certain rights granted to PDs. These might be the sole right to participate in special auctions, or to use a securities lending facility.

PRIMARY DEALER SYSTEMS WITHIN THE EU 8.3

Most of the EU member states use PDs to ensure the placement of and liquidity in government securities, cf. Table 8.3.1. Other OECD countries also use PDs as part of their government debt policy.

The EU member states typically have 10-20 PDs, of which around 2/3 are international. The growing integration of the national financial markets has presented a challenge to the European government debt management agencies, which are now competing more directly for investors than before. In recent years countries have tended to increase the proportion of foreign participants in the PD systems in order to achieve a more internationally oriented sales organisation that can market government securities to a broad international investor base.

The introduction of the euro at the beginning of 1999 has strengthened this trend. The euro's introduction eliminated exchange-rate risks among the euro-area member states, and thereby also the convergence trading that had generated turnover and liquidity in the euro-area

PRIMARY DEALER SYSTEMS IN THE EU MEMBER STATES — Table 8.3.1

Number of primary dealers	Total	Of which foreign banks
Belgium	17	13
UK	16[1]	13
Finland	10	9
France	21	13
Greece	11	5
Netherlands	13	10
Ireland	6	3
Italy	16	10
Portugal	13	9
Spain	22	13
Sweden	8[2]	4
Austria	24	18

Source: *Progress Report on Primary Dealership in EU Public Debt Management*, Economic and Financial Committee, 20 November 2000 and the Web sites of the government debt management agencies.

[1] Gilt-edged Market Makers (GEMM). There is also a separate group of primary dealers for government index-linked bonds.

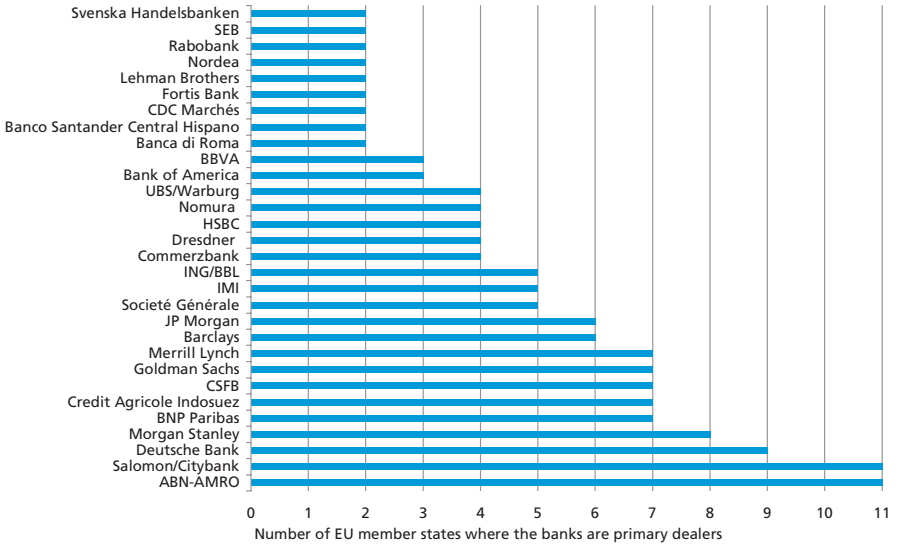
[2] Authorised dealers. There are also authorised dealers for government index-linked bonds.

member states' government securities during the run-up to the introduction of the euro. The single currency also broadened the investment universe of the institutional investors in the euro-area member states. The focus of the debt policy of the smaller euro-area member states in the last few years has been to find "new buyers" for government securities. In this respect the PDs have played a central role as international sales outlets.

Chart 8.3.1 presents the financial institutions that are PDs in more than one EU member state. It should be noted that some financial institutions are PDs in almost every EU member state. The Chart also shows that financial institutions that are only PDs in a few EU member states are often regional banks from the EU member states, or banks from countries such as Japan and Switzerland. These types of financial institutions are typically second-tier PDs together with a number of national banks in countries where a second-tier system is used. Second-tier PDs do not have the same obligations as first-tier PDs, nor do they enjoy the same rights. A two-tier system allows the issuer to use a number of banks as sales outlets to more specialised investor groups, even though these banks often cannot undertake the obligations required to achieve the status of first-tier PD.

PDs are often chosen for a fixed term, with a certain probationary period for new PDs. Regular assessment of whether replacements should be made to the group of PDs ensures competition in the government securities market. When PDs are selected, certain countries give weight to the technical and human resources that the PD allocates to the government bond area, as well as to the PD's financial solidity, etc. In

THE MOST USED PRIMARY DEALERS IN THE EU MEMBER STATES Chart 8.3.1



Note: Includes both "first-tier" and "second-tier" primary dealers.
Source: *Progress Report on Primary Dealership in EU Public Debt Management*, Economic and Financial Committee, 20 November 2000 and the Web sites of the government debt management agencies.

countries where a two-tier system is used the second tier of PDs will often be the group of financial institutions from among which first-tier participants are recruited. Finally, some countries conduct and publish a formal evaluation of the performance of the PDs.

Below the concrete structure of obligations and rights in the EU member states' PD systems is further described and discussed. There is no "international standard" for the structure of a PD system. Different countries' requirements often cover a wide range of systems with more or less extensive obligations. There is also great variation in the rights granted to the PDs in the systems. The fact that a number of international market participants are PDs in several different countries simultaneously has tended to converge the structure of the different systems, since harmonisation reduces the costs of participating in the various countries' PD systems.

Obligations

Box 8.1 summarises the types of obligations to which PDs within the EU are usually subject.

PD systems with numerous obligations entail both drawbacks and advantages. One advantage can be a greater degree of commitment from participants, and a more clearly defined framework for the system's organisation and content. The drawbacks are first of all that the

OBLIGATIONS OF PRIMARY DEALERS IN THE EU MEMBER STATES Box 8.1

Primary dealers in the EU member states are typically subject to the following obligations:

- Commitment to bid at auctions of government securities or to acquire a certain minimum proportion of government bonds issued.
- Market government securities, including preparation of research, etc.
- Market making.
- Keep issuer informed of market trends.
- Regular (quarterly, monthly or weekly) reports on positions and turnover in the secondary market.

Source: *Progress Report on Primary Dealership in EU Public Debt Management*, Economic and Financial Committee, 20 November 2000 and the Web sites of the government debt management agencies.

obligations are cost-intensive for the participants, and an excessive number of obligations can make suitable candidates refrain from becoming primary dealers. Many obligations, and monitoring whether they are fulfilled, can also impose administrative costs on the issuer. Some of the requirements, e.g. that a PD must maintain a certain minimum proportion of the secondary market turnover in a specific bond, can be difficult to monitor, and therefore easy to circumvent. Finally, too many excessively restrictive requirements can make it hard to qualify for PD status, thereby reducing the incentive for existing PDs to perform well.

Most countries require each PD to subscribe for a certain minimum proportion of the amounts issued at auction, or to submit bids for a given minimum volume.

PD systems normally also impose market making obligations whereby PDs must quote two-way prices vis-à-vis investors and other PDs for certain amounts within certain spreads between bid and offer prices. In recent years, the trend has been for electronic market making in inter-dealer trading systems such as EuroMTS and national MTS systems[1]. For the international market participants that are PDs in many EU member states electronic market making is vital since electronic price quoting requires less manpower and is therefore less cost-intensive. Electronic market making has also improved the efficiency of the government securities markets, by being a crucial factor in the narrowing of the bid/offer spreads for government securities.

Other requirements imposed on PDs include the commitment to actively promote sale (e.g. roadshows and investor conferences) and to

[1] A more detailed description of trends in electronic securities trading is given in Birgitte Søgaard Jensen and Lone Natorp, A Changing Stock-Exchange Environment, Danmarks Nationalbank, *Monetary Review* , 2nd Quarter 2000.

provide information (e.g. regular briefings on market trends, advice when new loan series are opened, report on activities in the secondary market, including e.g. the investor breakdown of turnover in individual securities).

Rights

Box 8.2 summarises the categories of rights covered by the EU member states' PD systems.

The title of primary dealer in itself has PR value for a PD with the ambition to be permanently present in a particular bond market. If investors are to enter a market that is unknown territory for them they will usually contact PDs in this market, rather than other financial institutions. The title of primary dealer can be of benefit in marketing related to the PD's own efforts to win other investor business besides trades with government securities.

The status of PD normally entails the exclusive right to subscribe for all or most of primary government securities issues in the primary market. Other categories of rights include exclusive access to securities lending and stripping facilities.

Some countries also give PDs access to participate in special "second-round auctions" where they can subscribe for certain volumes of the securities offered in first-round auctions at "average prices". This is a type of option that can be more or less complex in structure. For example, the maximum amount a PD may subscribe for may depend on the volume purchased by the PD in the most recent auctions. These options are part of the indirect payment to PDs.

Finally, PDs may have the status of "preferred counterparty" in other government-debt operations. This means that good PD performance

RIGHTS GRANTED TO PRIMARY DEALERS IN THE EU MEMBER STATES Box 8.2

The primary dealers in the EU member states are typically granted some of the following categories of rights:

- Sole right to use the title "primary dealer".
- Sole right to participate in the issue, buy-back and switch of government securities.
- Exclusive access to securities lending and stripping facilities.
- Exclusive right to bid in special second-round auctions or similar.
- Status of "preferred counterparty" in other government debt operations, e.g. syndicated bond issues and swap transactions.
- Direct payment.

Source: *Progress Report on Primary Dealership in EU Public Debt Management*, Economic and Financial Committee, 20 November 2000, and the Web sites of the government debt management agencies.

carries weight when the government issuer is to choose among counterparties that rank equal in terms of other criteria, including price competitiveness. For example, lead managers and co-lead managers for syndicated loans are often recruited from among primary dealers.

There can, however, also be certain less positive incentive effects from too close a linkage between PD performance and other government-debt transactions. For example, there can be cases where PDs bid very aggressively ("overbidding") at government securities auctions, thereby topping the list of subscribers to the issue, in order to improve their chances of becoming lead manager for syndicated loans, or winning other business such as swap transactions. In this way, the PD's losses at the auctions can be covered by the commission on the other types of business. An incentive structure of this type can distort price formation at government securities auctions, since in reality the PDs' bids are cross-subsidised by the expected revenue from other business.

THE DANISH BOND MARKET 8.4

In some respects the structure of the market for Danish government securities resembles a PD system. There is a group of market participants who have access buy new issues of government securities directly from the government issuer, and there is also market making in Danish government securities. One of the key differences from PD systems in other EU member states is that in Denmark no agreements on obligations and rights have been established between the government issuer and market participants.

BOND TRADING MEMBERS OF THE COPENHAGEN STOCK EXCHANGE Box 8.3

ABN AMRO Bank	Handelsbanken
Alm. Brand Bank	Henton Børsmæglerselskab
Amagerbanken	Jyske Bank
Amtssparekassen Fyn	Kaupthing Bank
Arbejdernes Landsbank	Landesbank Schleswig-Holstein
Carnegie Bank	Lån & Spar Bank
Danske Bank	Midtbank
Danske Securities	Nordea Bank
Dexia P-H Private Bank	Nykredit Bank
E*Trade	SEB Merchant Banking
Finansbanken	Skandinaviska Enskilda Banken
Forstædernes Bank	Spar Nord Bank
GNI	Sydbank
GP Børsmæglerselskab	WestLB Panmure

Danish government bonds and Treasury notes are issued on the Copenhagen Stock Exchange. The subscribers are the almost 30 members that trade bonds, cf. Box 8.3. The box shows that subscribers to Danish government bonds and Treasury notes are relatively locally based, since the major international investment banks do not trade bonds on the Copenhagen Stock Exchange. The Danish market for government securities thus differs from equivalent markets in the other EU member states whose PDs normally include a large proportion of international market participants, as stated above.

Two market making schemes exist for Danish government securities under the auspices of respectively the Copenhagen Stock Exchange and the Danish Securities Dealers Association, cf. Box 8.4. Participants in these schemes are mutually committed to quote two-way prices for certain amounts of the appropriate bonds within certain spreads between bid and offer prices. The scheme of the Copenhagen Stock Exchange solely comprises the 10-year benchmark bond, while the Danish Securities Dealers Association's scheme also includes other government securities. Both market making schemes are fully or partly telephone-based, and thus differ from the type of electronic market making conducted by PDs in the other EU member states.

The Danish market for government securities appears to function very well. However, both Danish and international market participants have recently expressed concern at the growing concentration of the market. The 6 largest market participants thus subscribe for around 95 per cent of the issue of government bonds and Treasury notes, and the number of market makers in the Danish Securities Dealers Association's scheme is today reduced to 9. In 1996, there were 19 market makers in government bonds. The concentration trends have led to discussion of whether the number of market makers has reached its lower limit if the market is still to function in periods of strong market volatility.

This development gives reason to consider what can be done to ensure the future effectiveness of the Danish government securities market in the face of any further concentration.

A key development trend in the other EU member states is for more and more market making to take place electronically. This saves costs for participants and also often leads to lower spreads between bid and offer prices, and thus a more effective market. Gradual introduction of electronic market making in the benchmark securities can help to maintain and develop an attractive, forward-oriented marketplace for Danish government securities.

Introducing electronic market making is also a precondition for attracting more international participants to the Danish market, which

MARKET MAKING IN DENMARK Box 8.4

There are two market making schemes for the Danish government securities under the auspices of respectively the Copenhagen Stock Exchange and the Danish Securities Dealers Association.

The Copenhagen Stock Exchange's market making scheme has 10 participants. Participants in the scheme are committed to quote two-way prices at any time to the members of the Copenhagen Stock Exchange for at least DKK 10 million in the 10-year benchmark bond, currently 6 per cent government bonds 2011. If the market maker is also part of the Danish Securities Dealers Association's market making scheme, prices for minimum DKK 25 million must be quoted. Price quoting under the Copenhagen Stock Exchange's scheme takes place in the interest market in Saxess with a 16-tick spread between bid and offer prices. Prices are displayed electronically, while trading in this scheme is agreed by telephone.

The Danish Securities Dealers Association's market making scheme for government securities has 9 participants, of whom 5 currently quote prices in all 11 government securities in the scheme, while the rest quote prices in 4-10 securities. The amounts for which prices are quoted vary from participant to participant. Six of them quote prices for minimum DKK 50 million in the 10-year benchmark bond. Price quoting in the Danish Securities Dealers Association's scheme takes place by telephone with spreads of 3-14 ticks, depending on the maturity of the securities.

The following participate in the market maker schemes for government securities of the Danish Securities Dealers Association and the Copenhagen Stock Exchange:

- ABN AMRO Bank
- Alm. Brand Bank (only the Copenhagen Stock Exchange scheme)
- Amtssparekassen Fyn
- Danske Bank
- Landesbank Schleswig-Holstein
- Nykredit Bank
- SEB Merchant Banking
- Spar Nord Bank
- Sydbank
- Nordea Bank

could increase the number of shoulders to bear the market making risk, and help to strengthen liquidity and competitiveness in the Danish market for government securities. Moreover, additional international participants will help to sharpen international investor focus on the Danish government securities market. In step with the increasing standardisation of the products in the bond market it is vital that Danish government securities are given "shelf room" next to government bonds from the other EU member states, i.e. are marketed to investors in order to retain a high non-resident ownership share.

On this basis, Government Debt Management has started to investigate whether electronic market making in Danish government securities, possibly within the framework of a PD system as known in the

other EU member states, can be an appropriate element of ensuring and further developing an efficient, well-functioning market structure for Danish government securities.

Based on experience with PDs in the other EU member states, an number of indicative guidelines for the appropriate design of such systems can be drawn.

In order to safeguard potential competition, it is important to have an open system which facilitates participation by financial institutions that can fulfil the obligations, based on objective criteria. This also means that the number of rights and obligations in the system should be kept at a reasonable level, so that the system does not impose excessive costs on the participating PDs, or an excessive administrative burden on the issuer.

There is ample experience to draw on when designing the rights in a PD system. A system should be established that ensures a reasonable balance between obligations and rights, and that is satisfactory to both the issuer and the market participants. Firstly, the title of "primary dealer" has PR value if a PD wishes to achieve a permanent presence in the market concerned. Secondly, direct payment tends to be passed on to the investors and does not contribute to covering the PDs' costs of participation in the system. Thirdly, cross-subsidisation of the PDs' performance with regard to market making can have unfortunate incentive effects. Finally, systems that operate with such concepts as "preferred counterparties" or similar can curtail the issuer's opportunities to achieve appropriate management of the credit risk on swaps, or to borrow on advantageous terms.

IS THERE A FUTURE FOR PRIMARY DEALERS? 8.5

The greater prevalence of electronic trading systems has started a debate in international government debt policy fora of whether PDs will continue to be an element of the implementation of government debt policy. The argument is that within such systems it will increasingly be technically possible for a government issuer to issue government securities directly to investors.

It seems likely that even if such systems do become prevalent PDs will still have an important role to play in the government bond markets of the years to come. Firstly, investors will continue to require the type of advice and information services (bond market research, etc.) that PDs provide, and which are important to the issuer from a marketing perspective. Secondly, in many cases PDs themselves develop and provide the type of electronic trading systems that enable investors to participate in bond trading more directly. It will be important to the

issuer that securities are included in the relevant trading systems. A balanced group of PDs can help to ensure this. Finally, market making vis-à-vis customers is a key element of an effective, liquid secondary market for government securities that can help to ensure low borrowing costs for the central government. Market making is a task that many countries have structured within the framework of a PD system.

CHAPTER 9

Interest-Rate Models for Cost-at-Risk

SUMMARY 9.1

Cost-at-Risk (CaR) supplements duration and redemption profile in the management of the interest-rate and refinancing risks on the government debt. CaR quantifies the risk on the basis of scenarios for the future development in interest rates. Using these interest-rate scenarios, the interest-rate risk can be determined as the maximum annual interest costs on the domestic government debt with a given probability, typically 95 per cent.

CaR is calculated in a model developed by Government Debt Management at Danmarks Nationalbank. In 2001 development work on the CaR model was focused on two areas. The model is now able to handle buybacks of government securities, as well as swaps from kroner to euro. Moreover, alternative interest input to the CaR model has been modelled, since the CaR results are sensitive to the interest-rate model chosen.

So far, the Cox, Ingersoll and Ross (CIR) model has been used to generate interest-rate input to CaR. As the CIR model is relatively simple, it has difficulties in some areas to reproduce the interest-rate characteristics that are observed empirically. This Chapter presents two examples of alternative interest-rate models: a linear two-factor model and a forward-rate model. Simple statistical characteristics of the simulated interest rates from the three models are compared, and held against the equivalent characteristics of historical interest rates. The empirical results are provisional and should primarily be seen as an illustration of the issues relevant in a CaR context. This Chapter's two appendices present technical descriptions of the two models.

In 2002 the work on interest-rate models for CaR will continue. Moreover, it is the objective to expand CaR to include the foreign debt and the Social Pension Fund (SPF), so that CaR for the overall government debt can be calculated.

METHOD 9.2

Cost-at-Risk (CaR) is used as a supplement to duration and redemption profile to quantify the interest-rate and refinancing risks. In the CaR

CaR DEFINITIONS Box 9.1

In the CaR model expected costs are defined as the mean value of the calculated future interest costs. Absolute CaR for a given year indicates the maximum costs with a probability of 95 per cent. Relative CaR is the difference between absolute CaR and the mean value. Relative CaR thereby indicates the maximum increase in costs in comparison to the mean value for a given year, with a probability of 95 per cent. The evaluation can also be based on other percentiles than the 95th, e.g. the 99th percentile.

model, the future interest costs of the domestic government debt are calculated as expected interest costs, as well as the maximum future interest costs with a 95 per cent probability (absolute CaR) for each year up to a horizon of 10 years. On this basis, relative CaR can be determined as the difference between absolute CaR and the expected costs. Relative CaR thus indicates the maximum costs compared to the expected costs in a given year, and can also be interpreted as a measure of the uncertainty of the expected interest costs, cf. Box 9.1.

CaR is calculated in a spreadsheet model programmed in Excel, and developed by Government Debt Management at Danmarks Nationalbank. The work on the CaR model commenced in 1997. In 2001 the CaR model was further developed for modelling buy-backs and swaps from kroner to euro within the model's framework.

Elements in the CaR model

The basis for calculation of CaR is data concerning the existing debt, and thereby information on the redemption profile together with accrued costs and payments on the debt.

Assumptions of future budget balances are also included. The calculations of CaR include assumptions concerning the government-budget balances before interest costs for the individual years. The interest costs are calculated within the model.

Objectives for duration, redemption profile and outstanding volume in on-the-run issues are additional assumptions included.

Furthermore, the CaR model includes assumptions concerning the use of the government debt-policy instruments, i.e. the distribution of on-the-run issues in the 2-, 5- and 10-year segments, buy-backs, interest-rate swaps and swaps from kroner to euro.

Finally, the model includes input concerning the future development in interest rates. Given the information on the initial composition of the debt, assumptions concerning future budget balances, objectives for duration, redemption profile and outstanding volume, together with

assumptions concerning the use of government debt-policy instruments, the interest costs for various scenarios of the development in interest rates can be calculated.

The generation of a large number of interest-rate scenarios provides a means to set up probability distributions for the future costs. 2,500 scenarios of the future development in the yield curve are generated. The yield curves in a scenario have a quarterly frequency. On this basis, the future annual costs are calculated. These scenarios are used to determine the expected costs as the average of the cost scenarios for each year, and absolute CaR as the 95th percentile of the cost scenarios.

INTEREST-RATE MODELS 9.3

The calculation of the future interest costs for the debt is sensitive to the interest-rate model chosen to generate the future development in interest rates. So far, the interest input has been generated by an interest-rate model developed by Cox, Ingersoll and Ross, also called the CIR model[1]. This interest-rate model is prominent in the finance literature, and it is implementable in practice. Since the model is relatively simple, it has difficulties in describing certain empirical characteristics of historical interest rates. For example, the CIR model implies that interest-rate volatilities decrease more with maturity than is observed empirically. This means that the CIR model tends to underestimate the volatility of the long-term yields. Moreover, the CIR model has certain limitations in terms of its ability to generate various types of yield curve. Therefore two alternative interest-rate models for CaR are considered, each in its own way based on the CIR model. The two models originate from different classes of interest-rate models, i.e. linear factor models and forward-rate models. These two concrete examples of alternative interest-rate models have been chosen as they are comprehensively described in the literature, and fulfil certain key criteria.

Criteria for choice of interest-rate model

The theoretical literature on interest-rate models is very extensive, and a number of different formulations of interest-rate models are available. On selecting an interest-rate model, it is appropriate to focus on the overall characteristics required of the model.

CaR modelling sets requirements of the interest-rate model's ability to describe the shape of the yield curve, as well as the dynamic of the development in interest rates over a longer horizon. This is because

[1] Cox, J. C., Ingersoll, J. E. and Ross, S. A., 1985, A Theory of the Term Structure of Interest Rates, *Econometrica*, vol. 53, no. 2, pp. 385-407.

government securities are issued along the entire yield curve (up to 10 years), and CaR is calculated on the basis of simulated interest-rate developments over a long horizon. The emphasis is on the model's ability to give a good average picture of the structure of and the movements in the yield curve.

It is also important that the interest-rate model is relatively simple to interpret and use. The CaR model is already complex, with dynamic effects over a long horizon. It is important to restrict the complexity in order to ease implementation, including estimation and simulation of the interest-rate model. In this respect it is an advantage if the model has been subject to thorough theoretical analysis, and is generally known and used. This eases communication of the model.

Finally, the interest-rate model must be consistent in economic and financial terms. There are several aspects to this. The model must be able to generate interest rates that move within realistic levels. It must thus be ensured that the interest rates do not "explode". A key characteristic to ensure that the interest rates in the models do not explode is "mean reversion". This implies that the interest rates tend to move towards a given long-term or equilibrium level. Another requirement can be that negative interest rates should not occur. The requirement of the non-negative nominal interest rates can be interpreted as a requirement of non-arbitrage. Instead of placements at a negative interest rate, cash can be held at a zero rate of returns. The interest-rate models are required to be free of arbitrage within the model framework.

The CIR model

The CIR model belongs to the class of linear (affine) factor models. In the CIR model, any interest rate can be described as a linear function of a single stochastic factor, namely the short-term interest rate. The CIR model is a relatively simple model that fulfils the aforementioned criteria. Box 9.2 presents the key characteristics of the CIR model.

A linear two-factor model

Like the CIR model, the first alternative interest-rate model is from the class of linear factor models. In these models, it is assumed that the yield curve and its development can be described by a limited number of factors. The term linear is used for these models because there is a linear relation between the interest rates and the factors.

By introducing additional factors to the CIR model, a more flexible interest-rate model is obtained, which can generate more varied types of yield curve.

THE CIR MODEL Box 9.2

The CIR model is a one-factor model where the stochastic factor is the spot rate (the short-term interest rate). The change in the spot rate is described by the following stochastic process:

$$dr(t) = \kappa(\theta - r(t))dt + \sigma\sqrt{r(t)}\,dW(t)$$

where *r(t)*, is the spot rate at time *t*, θ is the long-term or equilibrium level of the spot rate, σ determines the volatility of the spot rate, and κ is the rate at which the spot rate moves back to equilibrium level θ. In general, if the spot rate is above the long-term level θ, it will move towards a lower level, and vice versa if the spot rate is below θ. The model thus shows mean reversion. The first term of the process for the spot rate is called the drift term, and states the movement in the spot rate if it were not stochastic. The stochasticity in the spot rate is involved via the second term of the process for the spot rate. *W(t)* is a stochastic process – called a Wiener process – where the increment, *dW(t)*, has the mean value *0* and variance *dt*.

In addition to these parameters, the parameter λ called the price of risk, depending on the investor's risk aversion, is included in the determination of longer yields. In the calculations, where the CIR model is the basis for the interest input to the CaR model in Chapter 6, the parameter values are given by θ=0.0692, σ=0.0976 and κ=0.1598. The values of θ, σ and κ are based on estimation from quarterly observations of the spot rate from estimated zero-coupon yields from the period 1987-2001. In this Chapter, interest-rate models are analysed on the basis of interest data from the period 1994-2001. The parameter estimates for this period are θ=0.0419, σ=0.0365 and κ=0.2439. The method used is presented in Overbeck, L. and Rydén, R., 1997, Estimation in the Cox-Ingersoll-Ross Model, *Econometric Theory*, vol. 13, pp. 430-461.

Interest rates with longer maturities than the spot rate are given as a linear function of the spot rate and the fixed parameter values, i.e. when the spot rate has been determined, the interest rates with other maturities are uniquely determined as a function of the short-term interest rate. One implication is that interest rates for various maturities are perfectly correlated, and that there is only one possible value of e.g. the 10-year interest rate for a given level of short-term interest rates.

The factors can be observable, e.g. the short-term interest rate and its volatility, or non-observable. In the latter case, the factors can be interpreted by analysing the co-variation between interest rates and factors.

A small number of factors has proved to give a good statistical description of the interest rates. The prominent factor models described in the literature typically have up to 3 factors. There are only few benefits to the statistical description of the interest rates from adding more factors, which would also increase the model's complexity. Here, a two-factor model developed by Longstaff and Schwartz (LS)[1] is considered, cf. Box 9.3. The LS model can be viewed as an expansion of the CIR model, to which an extra factor has been added.

[1] See Appendix 9.A for a description of the model.

A TWO-FACTOR MODEL: THE LONGSTAFF AND SCHWARTZ MODEL Box 9.3

The two stochastic factors in the LS model, z_1 and z_2, follow the same types of process as the short-term interest rate in the CIR model, cf. Box 9.2.

The linear relationship between interest rates with maturity *n* and factors in the LS model can generally be expressed by the following equation:

$$y_t^n = a(n) + b_1(n) z_{1,t} + b_2(n) z_{2,t}$$

where y_t^n denotes the interest rate with maturity *n* at time *t*, and *a(n)*, $b_1(n)$ and $b_2(n)$ are fixed coefficients dependent on maturity *n*. The coefficients are functions of fixed underlying parameters in the model equivalent to those applying to the CIR model, cf. Box 9.2.

The short-term interest rate (single-period interest rate), r_t, is given as the sum of the two factors, and the conditional volatility of the short-term interest rate is a linear combination of the two factors:

$$r_t = z_{1,t} + z_{2,t}$$

$$Var_t[r_{t+1}] = \sigma_1^2 z_{1,t} + \sigma_2^2 z_{2,t}$$

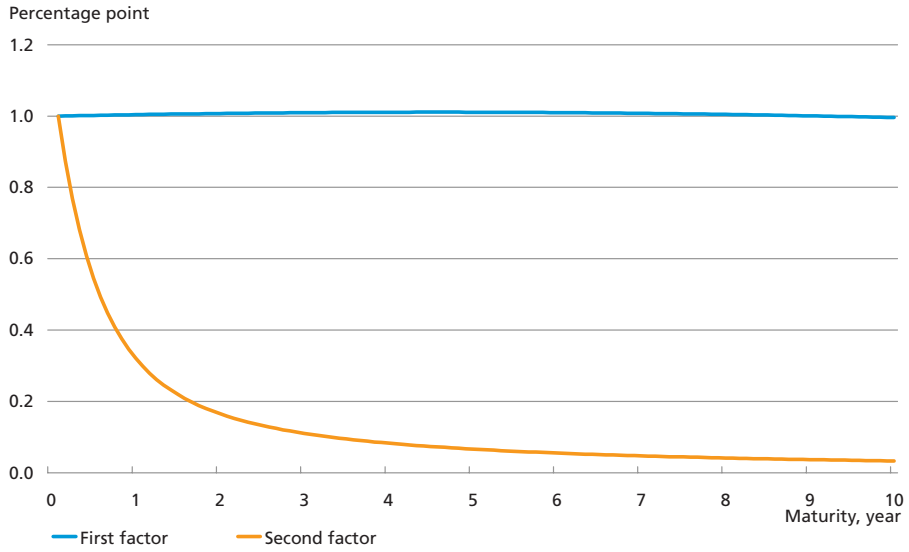
where *Var* denotes the variance, and σ_1 and σ_2 are fixed parameters that determine the volatility of respectively the first and the second factor equivalent to σ in the CIR model, cf. Box 9.2. This means that the short-term interest rate, and its conditional variance, fully describe the model's factors. Even though the two factors cannot be divided directly into a short-term interest rate and the volatility of the short-term interest rate, in principle the two factors can be replaced with a linear combination of the short-term interest rate and its volatility. So volatility can be said to be added as an extra factor to the CIR model.

The two factors can be interpreted by showing their impact on the yield curve. The sensitivity of the interest rates to the two factors is summarised in the coefficients $b_1(n)$ and $b_2(n)$ in Box 9.3. Chart 9.3.1 shows the factors' impact on yields for maturities of up to 10 years. The effect of the first factor on the interest rates is by and large the same for all maturities. If the first factor increases by e.g. 1, all interest rates increase by around 1 percentage point. The first factor can be interpreted as a parallel shift effect on the interest-rate level.

The second factor's effect on the interest rates decreases with maturity. The short-term interest rate is affected significantly more than e.g. the 10-year interest rate. The second factor thus affects the slope of the yield curve, and can be interpreted as a sloping effect on the yield curve.

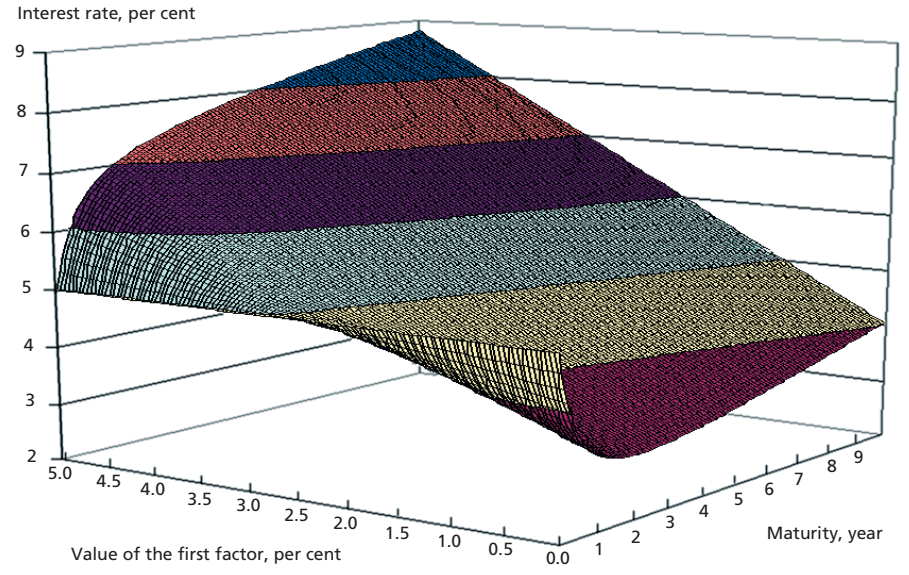
The LS model can generate more varied yield curves than the CIR model. While the CIR model can generate only one type of yield curve for a given level of the short-term interest rate, the two-factor model can generate a number of different types of yield curve. Chart 9.3.2 illustrates the various types of yield curve that can be generated at a

SENSITIVITY OF INTEREST RATES TO A CHANGE OF 1 IN THE TWO FACTORS Chart 9.3.1



short-term interest-rate level of around 5 per cent. The short-term interest rate is equal to the sum of the two factors in the model, cf. Box 9.3. This means that when the value of the first factor is e.g. 3 per cent, the value of the second factor is 2 per cent.

YIELD CURVES FOR A GIVEN LEVEL OF SHORT-TERM INTEREST RATES Chart 9.3.2



A FORWARD-RATE MODEL: THE HJM-RS MODEL Box 9.4

The HJM-RS model uses two state variables to describe movements in the yield curve. One variable is the spot rate, and the second is the integrated volatility factor.

The spot rate in the HJM-RS model is described by the following stochastic process, also called a diffusion process:

$$dr(t) = \left\{ \kappa\left(f(0,t) - r(t)\right) + \phi(t) + \frac{d}{dt} f(0,t) \right\} dt + \sigma\, r(t)^{\gamma}\, dW(t)$$

where *r(t)* is the spot rate observed at time *t*, *f(0,t)* is the forward rate observed at time *0*, applying at time *t*. κ, σ and γ are fixed parameters that can be estimated on the basis of historical interest-rate data, and $\phi(t)$ describes the integrated volatility factor, expressed as follows:

$$\phi(t) = \sigma^2 \int_0^t r(u)^{2\gamma}\, e^{-2\kappa(t-u)}\, du$$

The first term of the diffusion process for the spot rate is called the drift term. If the process had not been stochastic, the spot rate would follow the movements in the drift term. The second term of the process for the spot rate is the stochastic term, called the volatility of the process. Note that for $\gamma = ½$ the spot-rate volatility is the same as in the CIR model. The drift term in the spot rate does, however, deviate from the drift term in the CIR model, since it contains information concerning historical interest-rate fluctuations.

When future movements in the spot rate are generated, zero-coupon prices can be calculated using the following formula:

$$P(t,T) = \frac{P(0,T)}{P(0,t)} \exp\left\{ -\frac{1}{2} \left(\frac{1 - e^{-\kappa(T-t)}}{\kappa} \right)^2 \sigma^2 \int_0^t r(u)^{2\gamma} e^{-2\kappa(t-u)}\, du + \frac{1 - e^{-\kappa(T-t)}}{\kappa} \left(f(0,t) - r(t) \right) \right\}$$

where *t* and *T* are time indices for the required zero-coupon price. On the basis of zero-coupon prices, zero-coupon interest rates and the interest input to CaR are calculated.

A forward-rate model

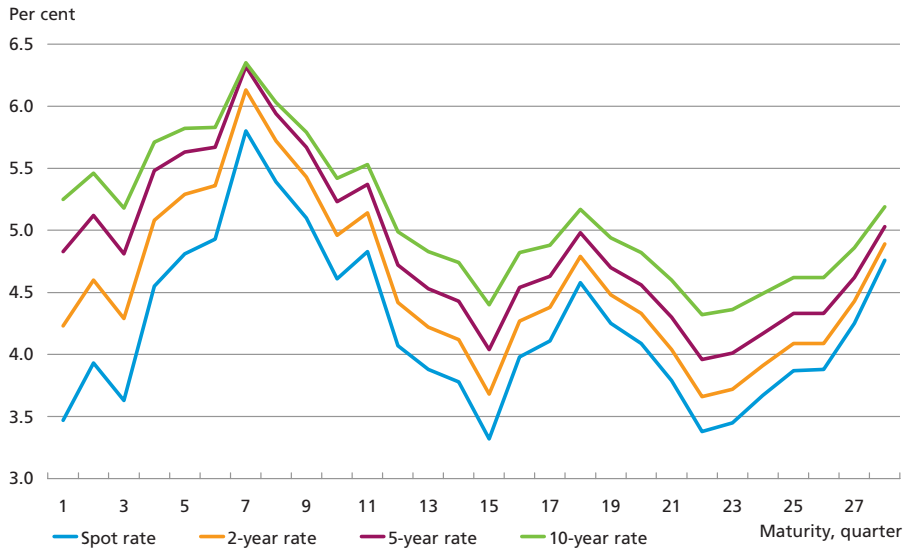
The second class of model studied is the forward-rate model that can be attributed to Heath, Jarrow and Morton (HJM), 1992.[1] The focus of this model is on forward rates and the development in the entire forward yield curve. This approach exploits the fact that a direct formulation in time-dependent forward rates provides a suitable method to model interest-rate volatilities along the entire yield curve.

When this model framework is implemented in practice, certain simplifications of the general framework formulated by Heath, Jarrow and Morton are necessary. The actual model chosen was developed by P. Ritchken and L. Sankarasubramanian, and is referred to as HJM-RS.

In the HJM-RS model, the simplification lies in an assumed structure of interest-rate volatility. It is thus possible to describe the movement in

[1] See Appendix 9.B for a description of the model.

INTEREST-RATE SCENARIO GENERATED BY THE HJM-RS MODEL Chart 9.3.3



the entire yield curve using only two state variables. The two state variables in the model are respectively the spot rate and a volatility factor, cf. Box 9.4. The volatility of the forward rate in the HJM-RS model is assumed to be a function that varies with the remaining maturity of the forward rate and the volatility of the spot rate.

In contrast to the CIR model, the HJM-RS model takes into account the historical development in interest rates in the simulation process via the drift term in the spot rate process. The volatilities of the spot rates in the models are closely resemblant.

Chart 9.3.3 presents an example of an interest-rate scenario. The development shown contains only increasing yield curves. The HJM-RS model can generate yield curves of different shapes, e.g. inverse and humped yield curves.

Overview of the three interest-rate models

Table 9.3.1 summarises some key characteristics of the three interest-rate models.

Data for estimation of interest-rate models

In the estimation of the interest-rate models' parameters, zero-coupon yields based on Danish government securities are used. CaR is normally calculated on the basis of interest rates that go back to 1987. On simulations over a long period, e.g. 10 years, it is reasonable to use a long estimation period. This captures possible developments in interest

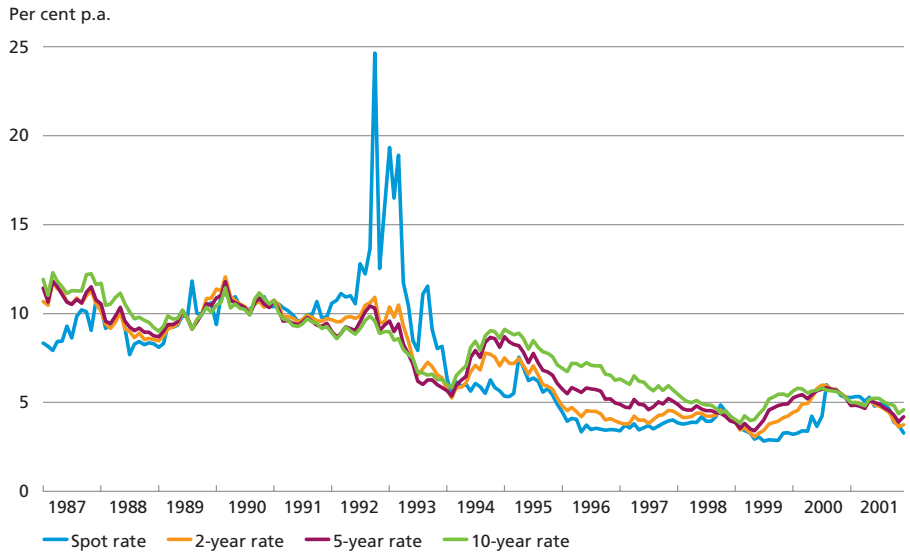
KEY CHARACTERISTICS OF THE THREE INTEREST-RATE MODELS Table 9.3.1

CIR	LS	HJM-RS
Single-factor model. The factor is the short-term interest rate. Interest rates for longer maturities are uniquely determined by the short-term interest rate and fixed parameters in the model.	Two-factor model. Add an extra factor to the CIR model. The sum of the two factors equals the short-term interest rate. Interest rates for longer maturities are uniquely determined as a linear function of the two factors and fixed parameters in the model.	Uses two state variables to describe all yields along the yield curve: the short-term interest rate and a volatility factor.
Relatively simple to interpret and estimate.	Addition of an extra factor makes it possible to replicate empirical characteristics for historical interest rates more closely and generate more varying yield curves than the CIR model.	The model is designed to fit volatility along the entire yield curve and is more flexible than the CIR model in determining volatility.

rates over a long period in the parameter estimations. A long estimation period also improves the precision of the parameter estimations.

The period since 1987 contains intervals of highly volatile short-term interest rates, especially in 1992 and 1993, cf. Chart 9.3.4, and there is relatively large variation in the level of interest rates over the period.

DEVELOPMENT IN SELECTED ZERO-COUPON YIELDS SINCE 1987 Chart 9.3.4



The period 1994-2001 has been chosen in this Chapter to illustrate the significance of the choice of estimation period to the CaR results. 1994 is chosen as the commencement year of the estimation period because interest rates in 1994 were at around today's level. Both the level and the fluctuation in interest rates were higher in the preceding period, 1987-1993, than in the chosen estimation period. There are thus signs of a change of level between the periods 1987-1993 and 1994-2001. The estimation of the interest-rate models on the basis of data from the period 1994-2001 will thus imply a lower level of interest rates and lower interest-rate volatility than the estimation based on data since 1987.

COMPARISON OF INTEREST INPUT 9.4

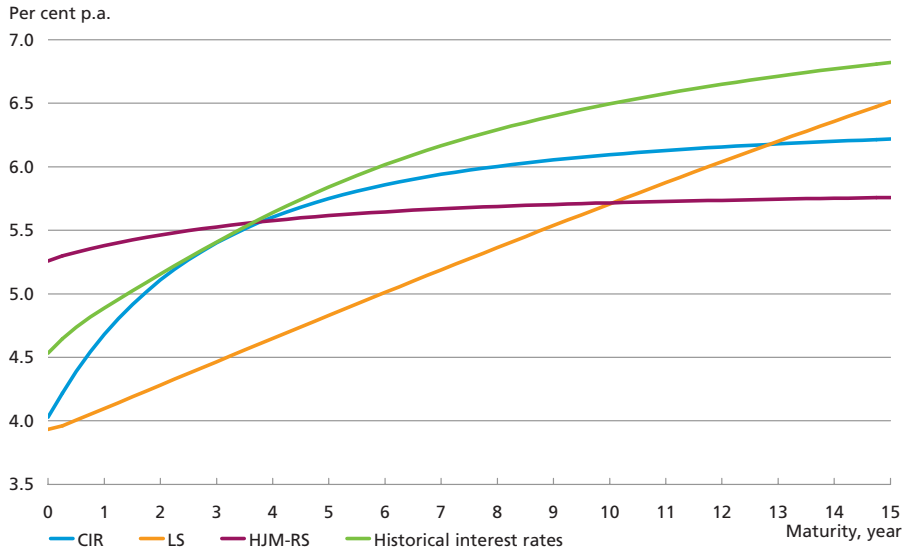
In this section, simple statistical characteristics of simulated quarterly CIR, LS and HJM-RS interest rates are compared with the equivalent characteristics for historical zero-coupon yields from the period 1994-2001, i.e. the interest rates which are the basis for estimation of the three models. The time frame of the interest-rate simulations is 10 years, and 2,500 scenarios of the course of the interest rates are simulated. Comparison is made of the average, the volatility (standard deviation) and the autocorrelation in the simulated and historical interest rates.

The average interest rates determine the expected interest costs in the CaR model. The volatility of the interest rates is essential to the level of CaR, and thereby the interest-rate risk. The autocorrelation in the interest rates reflects their tendency to stay at the same level, i.e. the degree to which the interest rate "tomorrow" depends on the interest rate "today". The greater the autocorrelation, the greater the tendency for the interest rate to stay at the same level. The autocorrelation adds an extra dimension to the comparison of simulated and historical interest rates.

The comparison of historical and simulated interest rates should be seen primarily as an illustration of the significance of the choice of different interest-rate models to the simulation of interest rates in CaR.

Chart 9.4.1 shows the average historical and simulated yield curves. The average of the historical yield curves is higher than for the model-generated interest rates from the CIR and LS models. This is related to the fact that the historical average interest rates with maturities of up to 10 years range from 4.5 to 6.5 per cent, while the starting point for the generation of interest rates in the models is a yield structure with interest rates from 3 to 5 per cent, equivalent to the current level of interest rates. This means that the simulated interest rates in the first periods of the simulation on average lie somewhat below the level of the average historical interest rates. Over time, the simulated interest

AVERAGE YIELD CURVES Chart 9.4.1



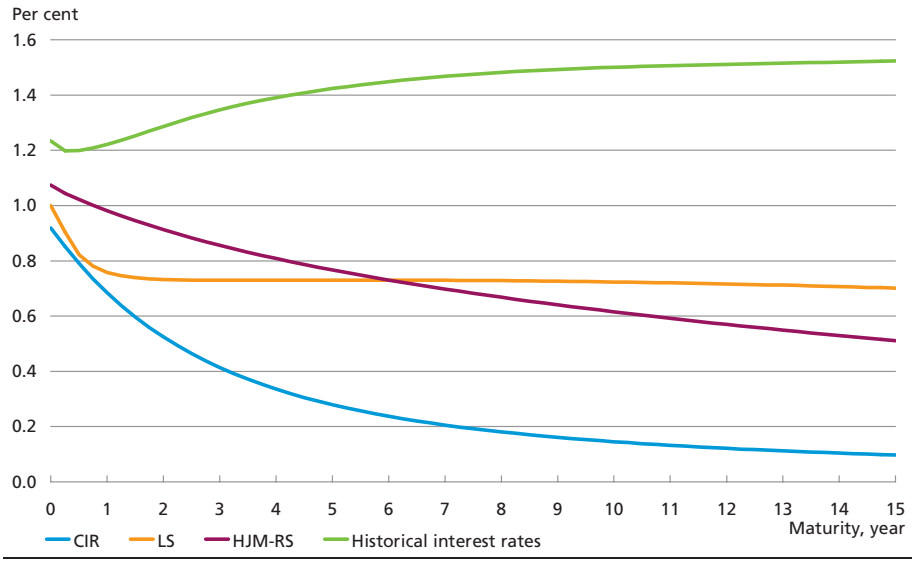
rates will (on average) move up towards the level of the average historical interest rates.

Of the simulated interest rates, the average interest rates from the HJM-RS model are highest for maturities of up to around 4 years. Hereafter, the interest rates generated from the CIR model are highest. The average interest rates in the LS model are lowest for maturities of up to 10 years. It is thus expected that the average interest costs calculated in the CaR model are lowest when the generated yields from the LS model are used.

The volatility of the interest rates is shown in Chart 9.4.2. The volatility of the historical interest rates increases with maturity, while the volatility of the simulated interest rates from the three models decreases with maturity, as is normally observed empirically. Moreover, the volatility of the simulated interest rates is below the volatility of the historical interest rates for all maturities. The volatility of the short-term interest rate is closest to the volatility of the historical interest rates. Hereafter the distance between the volatility of the historical interest rates and of the simulated interest rates increases with maturity.

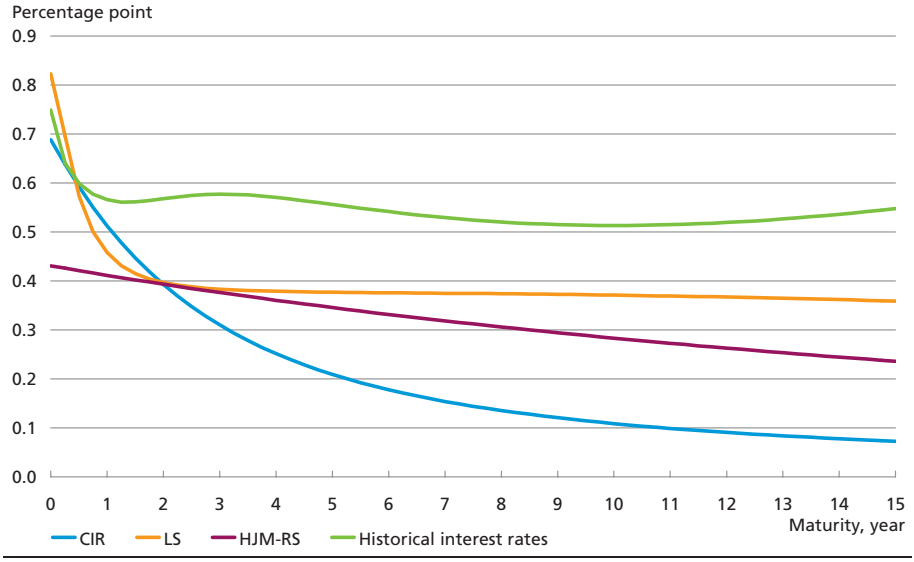
The volatility decreases most strongly for the CIR model. The structure of the volatility curve for the CIR model is related to the fact that CIR is a single-factor model in which all interest rates are a fixed function of the short-term interest rate. When the model is estimated on the basis of the volatility of the short-term interest rate, the volatility of the long-term interest rates will be functionally determined within the model.

VOLATILITY OF INTEREST RATES WITH MATURITIES OF UP TO 15 YEARS Chart 9.4.2



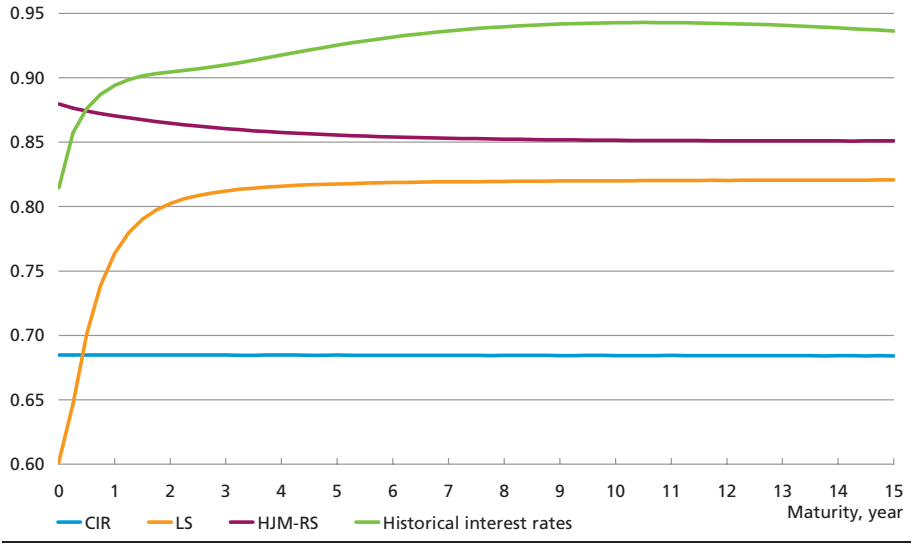
The volatility of the long-term interest rates, in the LS and HJM-RS models, reflects the volatility of the historical interest rates better. An interest input with a spot-rate volatility at the same level as the CIR model, but higher volatility for the long-term interest rates will, other things being equal, imply higher CaR figures.

VOLATILITY OF CHANGES IN INTEREST RATES FOR MATURITIES OF UP TO 15 YEARS Chart 9.4.3



AUTOCORRELATION COEFFICIENTS FOR INTEREST RATES WITH MATURITIES OF UP TO 15 YEARS

Chart 9.4.4



While the volatility of the historical interest rates increases with maturity, the volatility of the historical interest-rate changes decreases with maturity. This characteristic is reflected by all of the simulated interest rates, cf. Chart 9.4.3.

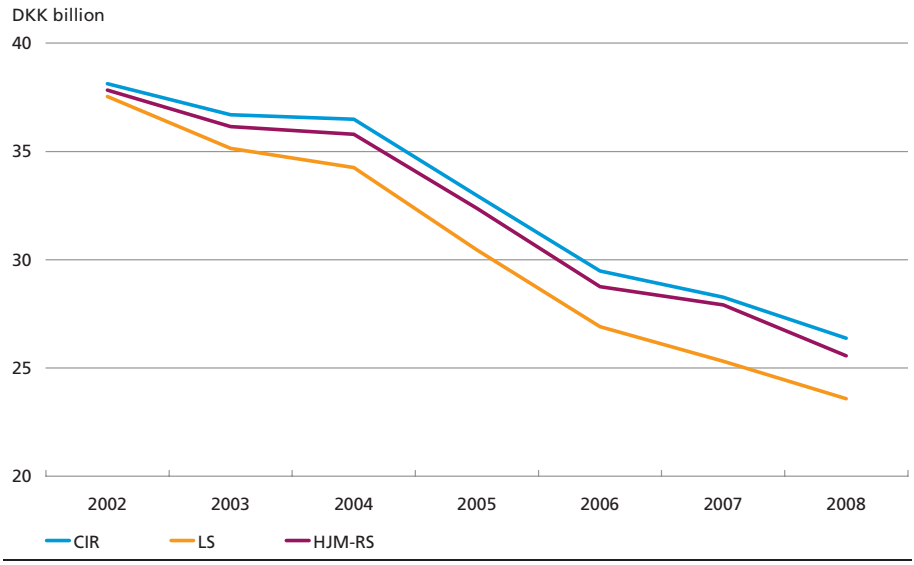
Chart 9.4.4 shows the autocorrelation coefficients for interest rates with maturities of up to 15 years. Interest rates generally show high autocorrelation, i.e. the interest rates tend to remain at the same level from one period to the next. The historical interest-rate autocorrelations show that short-term yields are less autocorrelated than long-term yields.

The autocorrelation in the interest-rate simulations of the HJM-RS model are generally closest to the autocorrelation for the historical interest rates. The LS model can generate interest rates where the autocorrelation increases with maturity, as can be observed empirically. The level of autocorrelation is, however, somewhat below the historically observed level, especially for short maturities.

COMPARISON OF CaR RESULTS 9.5

On the basis of yield curves generated by respectively the CIR, LS and HJM-RS models, CaR figures for a borrowing scenario with 40-20-40 per cent issues in the 2-, 5- and 10-year segments respectively are calculated.

MEAN VALUE OF COSTS Chart 9.5.1



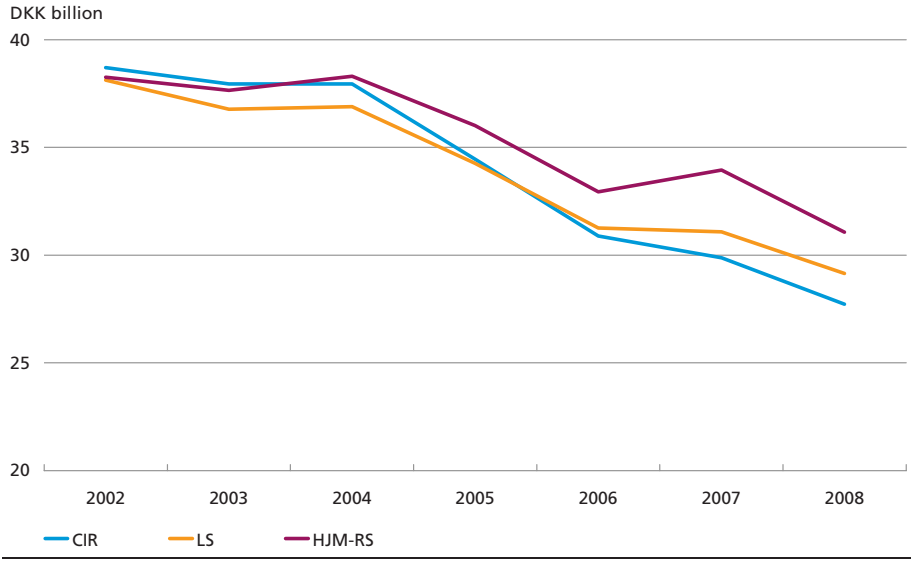
The mean value of interest costs is shown in Chart 9.5.1. For all of the models, the interest costs decrease with the horizon for the calculations. This can be attributed to the assumed future budget surpluses, and thereby the decreasing debt.

The interest costs calculated on the basis of the three interest-rate models are relatively close to each other. The interest input from the LS model gives the lowest interest costs. This result reflects the fact that the average yield curves for the LS model are lowest for maturities of up to 10 years, i.e. in the segments in which issues take place.

Absolute CaR depends on the interest-rate volatility and the mean value of the interest rates in the simulations. The higher the volatility and average interest rates, the greater absolute CaR will be. Absolute CaR based on the HJM-RS model tends to lie highest, cf. Chart 9.5.2. The average interest rates in the HJM-RS model are higher than for the LS model, while the interest-rate volatility is around the same level for the two models. The interest-rate volatility is higher for the HJM-RS model than for the CIR model, while the average interest rates are at the same level in the two models.

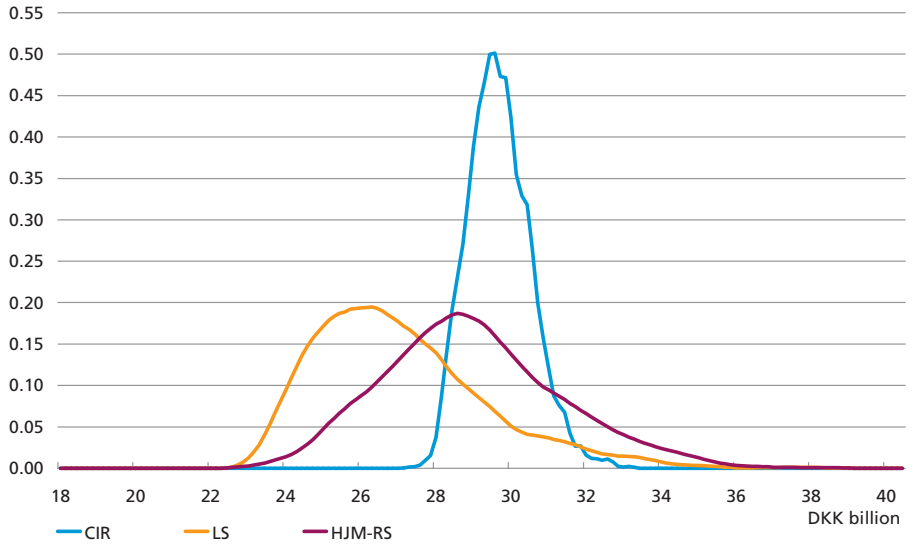
Chart 9.5.3 shows cost distributions in 2006 for respectively CIR, LS and HJM-RS interest input. Flatter and broader curves imply a greater probability of extreme costs, and thereby a greater interest-rate risk. The flatter and broader curves for the cost distribution from the LS and HJM-

ABSOLUTE CaR Chart 9.5.2



RS models compared to the CIR model's relatively centred cost distribution reflect the greater interest-rate volatility implied by these two models. The lower average costs for the LS model mean that the distribution is displaced to the left compared to the distributions for the two other models.

COST DISTRIBUTIONS IN 2006 Chart 9.5.3



FURTHER WORK 9.6

The work on alternative interest input to CaR is still in its preliminary phase. The empirical results for the alternative interest-rate models to the CIR model are thus provisional, and should be seen primarily as an illustration of the issues involved in modelling interest input to CaR.

In 2002, work will continue on alternative interest-rate models to the CIR model within the model frameworks presented in this Chapter.

CaR calculations are made only for the domestic government debt. The objective is to include the development in all components of the government debt in the CaR calculations. Including the foreign debt in the CaR calculations e.g. entails that interest rates and exchange-rate risk related to the foreign debt must be modelled within the CaR model.

APPENDIX: A LINEAR TWO-FACTOR MODEL 9.A

The Longstaff and Schwartz (LS) two-factor model is described below.[1] First, pricing of financial assets with the stochastic discount factor is described. Formulating interest-rate models within this framework ensures a consistent model free of arbitrage. Then the processes for the two factors in the model are examined. The model can be derived on the basis of these two elements. Finally, estimation and simulation of the interest-rate model are described.

A formulation in discrete time is chosen for the presentation of the linear two-factor model. This formulation may be less elegant, but is also less mathematically and technically demanding compared to the formulation in continuous time that is typically used in the literature.

Pricing of bonds

A key theoretical result in finance is that, in a world without arbitrage, there is a positive stochastic variable, M_{t+1}, so that for every asset, *i*, with price P_i, the following pricing equation applies:

$$P_{i,t} = E_t\left[M_{t+1}\, P_{i,t+1}\right]$$

where $P_{i,t}$ is the price at time *t* ("today"), $P_{i,t+1}$ is the price at time *t+1* ("tomorrow") and M_{t+1} is the stochastic discount factor. E_t is the expectation at time *t* when all available information "today" is included when the expectation of "tomorrow" is formed. The equation states that the price of an asset "today" is given by the expectation of the discounted future payments. For an *n* period (zero-coupon) bond at price P_t^n, with price P_{t+1}^{n-1} "tomorrow", the following applies:

$$P_t^n = E_t\left[M_{t+1}\, P_{t+1}^{n-1}\right]$$

Box 9.A.1 gives a more detailed interpretation of the key equation for pricing financial assts.

The process for the factors in the model

The two factors follow a stochastic process equivalent to the process that applies to the short-term interest rate in the CIR model. The processses are formulated in discrete time. A model in discrete time means that the model generates interest rates at discrete intervals, e.g.

[1] The description is based on Longstaff, F. and E. Schwartz, 1992, Interest Rate Volatility and the Term Structure: A two-factor General Equilibrium Model, *Journal of Finance*, Vol. 47, pp. 1259-1282. Longstaff and Schwartz formulate the model in continuous time. The discrete formulation in this Chapter is based on Campbell, J.Y., A.W. Lo, and A.C. MacKinlay, 1997, The Econometrics of Financial Markets, Chapter 11, Princeton University Press, Princeton, NJ and Backus, D., S. Foresi and C. Telmer, 1998, Discrete-Time Models of Bond Pricing, Working Paper Stern School of Business, New York University.

1 month or 1 quarter. Box 9.A.2 describes the relation between a discrete and a continuous formulation.

The two stochastic factors that drive the interest rates in the model, denoted z_1 and z_2, can be described by first-order autoregressive processes using the following formula:

$$z_{t+1} = (1-\varphi)\theta + \varphi z_t + \sigma\sqrt{z_t}\,\varepsilon_{t+1}$$

where the parameters φ, θ and σ are constant, subject to the following restrictions: $0<\varphi<1$ and σ, $\theta>0$. ε is the stochastic shock to the process which is independently, normally distributed over time with mean value *0* and variance *1*. By calculating expressions of the mean value, variance and autocorrelation for the processes, cf. Table 9.A.1, the individual parameters in the processes can be interpreted.

The mean value (unconditional expectation) of the factor θ can be interpreted as the long-term or equilibrium level which the factor will tend to move towards over time.

$1-\varphi$ measures the rate by which the distance between the current level of the factor and the long-term level is reduced, i.e. the strength of "mean reversion". If the factor is e.g. 1 percentage point above the long-term level, and $\varphi = 0.9$, so that $1-\varphi = 0.1$, in the next period the factor will tend to move 0.1 percentage point towards the long-term level, making the distance 0.9 percentage point. If no stochasticity had been involved in the process, the factor would make this movement with certainty.

On the other hand, the first-order autocorrelation coefficient φ indicates the tendency for the factor to have the same value tomorrow as today. The closer φ is to 1, the greater the tendency for the factor "tomorrow" to have the same value as the factor "today". φ is thus a measure of the sluggishness of the process.

The interpretation of σ is related to the volatility of the process. The greater the value of σ, the higher the volatility measured as e.g. the variance of the factors.

The square root in the stochastic term of the process for the factors means that θ (mean value of z) is included in the expression of the unconditional variance of z. In the same way, the conditional variance, $z_t\sigma^2$, depends on the factor's current level. So when the interest rate is close to *0*, stochastic shocks will lead to minor changes in the interest rate, and the probability of negative factor values is very small.

φ is also part of the determination of the unconditional variance. The greater the value of φ, the greater the variance. The intuition is that the greater the value of φ, the smaller the tendency for the factor to remain around a given long-term level. An alternative perception is that the factor approaches a "random walk" when φ is close to 1 (the greater the value of φ).

Calculation rules

On deriving interest-rate models on the basis of the theory on the stochastic discount factor two calculation rules are needed.

Firstly, often continuously compounded interest (log interest) is used in the literature. For a zero-coupon bond with maturity *n* and price P_t^n the continuously compounded interest is given by:

$$y_t^n = -\frac{1}{n}\log P_t^n = -\frac{1}{n}p_t^n$$

where $logP_t^n = p_t^n$. The continuously compounded single-period returns of a zero-coupon bond are expressed by:

$$\log\left(1+R_{t+1}^n\right) = \log\left(\frac{P_{t+1}^{n-1}}{P_t^n}\right) = p_{t+1}^{n-1} - p_t^n = r_{t+1}^n$$

Secondly, the following calculation rule applies to a log-normal process *x*, where *log x* is normally distributed with the mean value μ and variance σ^2,

$$\log E[X] = \mu + \frac{\sigma^2}{2}$$

where *log* denotes the natural logarithm.

Interpretation of the pricing equation

Taking the logarithm to both sides of the pricing equation using the above calculation rules gives:

$$p_t^n = E_t\left[m_{t+1} + p_{t+1}^{n-1}\right] + \frac{1}{2}Var_t\left[m_{t+1} + p_{t+1}^{n-1}\right]$$

where *Var* denotes the variance and $logM = m$. Expressed in terms of returns:

$$0 = E_t\left[m_{t+1} + r_{t+1}^n\right] + \frac{1}{2}Var_t\left[m_{t+1} + r_{t+1}^n\right]$$

For the single-period bond which is certain to give the payment *1* in one period the following applies:

$$-r_t = p_t^1 = E_t\left[m_{t+1}\right] + \frac{1}{2}Var_t\left[m_{t+1}\right]$$

where r_t is defined as the yield, and thereby the returns on a single-period bond. The expected additional returns compared to a single-period bond can then be calculated by subtracting the two equations from each other and using the calculation rule for the variance of two variables, *x* and *y*, $Var[x+y] = Var[x] + Var[y] + 2Cov[x,y]$, where *Cov* denotes the covariance:

$$E_t\left[r_{t+1}^n\right] - r_t = -Cov_t\left[m_{t+1}, r_{t+1}^n\right] - \frac{1}{2}Var_t\left[r_{t+1}^n\right]$$

The equation states that the expected additional yield on a bond compared to the short-term interest rate (the return on a single-period bond) is given by a risk premium (covariance) term and the variance of the yield. The last term is technical and arises because logarithmic (continuously compounded) returns are applied. The covariance term is the interesting one from an economic viewpoint.

CONTINUED Box 9.A.1

In economic and finance theory the discount factor is often represented by a risk-averse investor or consumer's intertemporal marginal-rate of substitution in consumption. Within this framework, a positive covariance between the return of an asset and the stochastic discount factor, implying a low expected return and risk premium, corresponds to a negative covariance between the return and consumption. Such an asset provides good insurance against "bad times" when consumption is low. The reverse applies to assets with a positive consumption covariance. Both the CIR and LS models can be derived within a general equilibrium model with utility-maximising consumers. This interpretation of the model will not be elaborated on further here. For more details, see e.g. Campbell, J.Y., A.W. Lo, and A.C. MacKinlay, 1997, *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ.

In the two-factor model, both factors follow processes of the type described in this section. If there had been only one factor, this factor would be the short-term interest rate, and the model would correspond to the CIR model in discrete time.

CHARACTERISTICS OF THE PROCESSES FOR THE FACTORS Table 9.A.1

Mean value of *z*	θ
Variance of *z*	$\theta\sigma^2/(1-\varphi^2)$
First-order autocorrelation coefficient for *z*	φ
Conditional variance of *z*	$z_t\,\sigma^2$

CONTINUOUS AND DISCRETE TIME FORMULATION Box 9.A.2

The CIR model is originally formulated in continuous time, where the change in the short-term interest rate is described by the following stochastic process, cf. Box 9.2:

$$dr_t = \kappa(\theta - r_t)dt + \sigma\sqrt{r_t}\,dW_t$$

In discrete time, this equation is given by:

$$r_{t+1} - r_t = \kappa(\theta - r_t)\Delta t + \sigma\sqrt{r_t}\,\varepsilon_{t+1}$$

The time range in the model is normalised at *1*, so that $\Delta t = 1$, and if $\kappa = 1-\varphi$ the development in the short-term interest can be described as:

$$r_{t+1} = (1-\varphi)\theta + \varphi r_t + \sigma\sqrt{r_t}\,\varepsilon_{t+1}$$

where ε is normally distributed with mean value *0* and variance *1*.

The Longstaff-Schwartz model in discrete time

By connecting the above individual elements, the overall two-factor model can be described fully, based on the following equations:

$$E_t\left[M_{t+1}\, P_{t+1}^{n-1}\right] = P_t^n$$

$$-m_{t+1} = -\log M_{t+1} = \left(1+\frac{\lambda_1^2}{2}\right) z_{1,t} + z_{2,t} + \lambda_1 \sqrt{z_{1,t}}\, \varepsilon_{1,t+1}$$

$$z_{1,t+1} = (1-\varphi_1)\theta_1 + \varphi_1\, z_{1,t} + \sigma_1 \sqrt{z_{1,t}}\, \varepsilon_{1,t+1}$$

$$z_{2,t+1} = (1-\varphi_2)\theta_2 + \varphi_2\, z_{2,t} + \sigma_2 \sqrt{z_{2,t}}\, \varepsilon_{2,t+1}$$

The pricing equation and the processes for the two factors are described above. The process for the stochastic discount factor is the new element.[1] It is assumed that ε_1 and ε_2 are independently distributed. Assumptions and restrictions for the parameters and the stochastic shocks correspond to the above section. An extra type of parameter is introduced in the process for the stochastic discount factor, λ_1, called the price of risk, cf. the description below.

On the basis of this equation system, the interest rate at a given maturity can be determined as a linear function of the two factors. The solution principle for the model is outlined briefly in Box 9.A.3. The continuously compounded interest with maturity n at time t is denoted as y_t^n, and the following linear relation applies:

$$y_t^n = a(n) + b_1(n) z_{1,t} + b_2(n) z_{2,t}$$

$$a(n) \equiv \frac{A(n)}{n}, \quad b_1(n) \equiv \frac{B_1(n)}{n}, \quad b_2(n) \equiv \frac{B_2(n)}{n} \text{ and}$$

$$A(n+1) = A(n) + B_1(n)(1-\varphi_1)\theta_1 + B_2(n)(1-\varphi_2)\theta_2$$

$$B_1(n+1) = 1 + \frac{\lambda_1^2}{2} + B_1(n)\varphi_1 - \frac{1}{2}(\lambda_1 + B_1(n)\sigma_1)^2$$

$$B_2(n+1) = 1 + B_2(n)\varphi_2 - \frac{1}{2}(B_2(n)\sigma_2)^2$$

where for n=0,1 the following applies:

$$A(0) = B_1(0) = B_2(0) = 0$$

$$A(1) = 0, B_1(1) = B_2(1) = 1$$

[1] For a more detailed interpretation of the process for the stochastic discount factor see the background articles to this Chapter.

DERIVATION OF EXPRESSIONS OF INTEREST RATES Box 9.A.3

In order to determine the model's description of interest rates, first an expression of the short-term interest rate is derived. For a single-period bond the following applies:

$$E_t[M_{t+1}] = P_t^1$$

The logarithm is taken on both sides, which in accordance with Box 9.A.1 gives:

$$E_t[m_{t+1}] + \frac{1}{2} VAR_t[m_{t+1}] = \log P_t^1 = -r_t$$

where r_t is the continuously compounded single-period interest. The expression of (the logarithm to) the stochastic discount factor is inserted in the above equation:

$$-\left(1 + \frac{\lambda_1^{\,2}}{2}\right) z_{1,t} - z_{2,t} + \frac{1}{2}\lambda_1^{\,2}\, z_{1,t} = -r_t$$

giving:

$$r_t = z_{1,t} + z_{2,t}$$

It is then assumed that the following applies:

$$-\log P_t^n = A(n) + B_1(n) z_{1,t} + B_2(n) z_{2,t}$$

By combining the above two equations:

$$A(1) = 0, B_1(1) = B_2(1) = 1$$

The same procedure as above using the calculation rules in Box 9.A.1 and the assumed relation between price and the factors is made for a bond with initial maturity of *n+1*. This gives an expression of $-\log P_t^{n+1}$. By relating coefficients for this expression of $-\log P_t^{n+1}$ with the equivalent coefficients for the assumed relation between price and the factors, the coefficients can be found based on the equation system in the text. For a more detailed review, see Campbell, J.Y., A.W. Lo, and A.C. MacKinlay, 1997, The Econometrics of Financial Markets, Princeton University Press. Princeton, NJ and Backus, D., S. Foresi, and C. Telmer, 1998, Discrete-Time Models of Bond Pricing, Working Paper Stern School of Business, New York University.

In this model, the short-term interest rate is given by the sum of the two factors, and the conditional variance of the short-term interest rate is a linear combination of the two factors:

$$r_t = z_{1,t} + z_{2,t}$$

$$Var_t[r_{t+1}] = \sigma_1^2\, z_{1,t} + \sigma_2^2\, z_{2,t}$$

The CIR model can be obtained as a special case of the model by setting θ_2, φ_2 and σ_2 to zero.

λ_1, also called the price of the interest-rate risk, can be interpreted on the basis of the equation in Box 9.A.1., which determines the

expected additional yield on long-term bonds compared to a single-period bond:

$$E_t\left[r_{t+1}^n\right]-r_t=-Cov_t\left[m_{t+1},r_{t+1}^n\right]-\frac{1}{2}Var_t\left[r_{t+1}^n\right]$$

where $r_{t+1}^{\ n}$ and r_t denote the continuously compounded, single-period yield to respectively an n-period and a single-period bond. Inserting the two-factor model's expression of the yield gives:

$$E_t\left[r_{t+1}^n\right]-r_t=-\lambda_1 B_1(n-1)\sigma_1^2 z_{1,t}-\frac{1}{2}\left(\left(B_1(n-1)\right)^2\sigma_1^2 z_{1,t}+\left(B_2(n-1)\right)^2\sigma_2^2 z_{2,t}\right)$$

The last term is an adjustment arising because logarithmic yields and interest rates are used, cf. Box 9.A.1. The first term is the interesting one in economic terms. It expresses the risk premium achieved from placement in bonds at long maturity in a single period compared to investment in single-period bonds with a certain yield over a period. The risk premium is proportional to λ_1, which must be negative to achieve a positive risk premium. This will be the case in a world with risk-averse investors. λ_1 is called the price of the risk, because a greater (numerical) value of λ_1 entails higher average additional returns on long-term (high-risk) bonds compared to safe investment in a single-period bond. The slope of the yield curve thus tends to increase with (the numeric value of) λ_1.

The risk premium is only dependent on the first factor, so that only one price is connected to the volatility originating from the first factor. This assumption originates from Longstaff and Schwartz.

Estimation of interest-rate models

The parameters in the model are estimated using the Generalised Method of Moments (GMM), cf. Box 9.A.4.

The parameters are estimated on the basis of monthly zero-coupon interest rates for government securities accrued continuously since 1994. Quarterly data are used in the CaR model, but estimation based on monthly interest rates provides more information on the interest process than if estimation is based on quarterly interest rates. The estimation assumes that the long-term level of the short-term interest rate (1-month interest rate) is given by the average of the short-term interest rate over the estimation period. This gives an anchor for the interest-rate level in the estimation. It is also assumed for simplification purposes that $\theta_1=\theta_2$. The other parameters are estimated on the basis of the spread to the 1-month interest rate together with the variance in interest rates and interest-rate spreads for selected maturities. Autocorrelation of the 1-month interest rate is also included in the estimation.[1]

[1] The method is inspired by Backus, D., S. Foresi, A. Mozumdar and L. Wu, 2001, Predictable changes in yields and forward rates, *Journal of Financial Economics*, vol. 59, pp. 281-311.

GMM ESTIMATION Box 9.A.4

In GMM estimation, the parameter estimations for a model are found as the values of the parameters which minimise the sum of the average squared distances between the characteristics of the model, and the equivalent empirical properties from data. In the summation of the squared distances, the average of the squared distances (squared moments) is weighted using a weighting matrix. The theory of GMM states the construction of the weighting matrix. See e.g. Campbell, J.Y., A.W. Lo, and A.C. MacKinlay, 1997, *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ, for a review of GMM estimation. GMM minimises the squared expression *Q* of the form:

$$Q = g_T(\beta)' W g_T(\beta)$$

where $g_T(\beta)$ is a vector of the average distances between the model's characteristics and the equivalent empirical characteristics, and β indicates the parameters in the model. $g_T(\beta)'$ denotes the transposed vector to g, and W is a positively defined matrix which weights the squared values of $g_T(\beta)$. The parameter estimates depend on the moments used and the choice of weighting matrix.

The GMM theory states that the statistically optimal weighting matrix, i.e. the weighting matrix which gives the lowest asymptotic variance, is given by the inverse to the autocovariation matrix of the expected moments S^{-1}. The so-called Newey-West estimator is used for estimation of *S*.

GMM estimation takes place in two stages. In the first stage, the parameters are estimated for an arbitrary (positively defined) weighting matrix. This matrix is often chosen to be the unit matrix, *I*. In the second stage of the estimation, the estimate of S is determined on the basis of the parameter estimates from the first stage. The parameters are estimated once more on the basis of the estimate of *S*.

The estimation gives the following parameter estimates: $\theta_1=\theta_2=0.00183$, $\varphi_1=0.987$, $\varphi_2=0.748$, $\sigma_1=0.00467$, $\sigma_2=0.00839$ and $\lambda_1=-2.958$. Annualised in per cent, the value of θ_1 and θ_2 is around 2.2 per cent, implying that the long-term level $\theta_1+\theta_2$ of the short-term interest rate (the 1-month interest rate) is around 4.4 per cent, equivalent to the average 1-month interest rate for the estimation period. The price of risk, λ_1, has the expected negative sign.

Simulation of the model

On the basis of the parameters estimated for monthly data, monthly interest rates are simulated using the equation for the linear relation between interest rates and factors, and the processes for the two factors. Quarterly yield curves are extracted from the monthly interest-rate scenarios used in the CaR calculations.

APPENDIX: FORWARD-RATE MODELS 9.B

This Appendix presents forward-rate models. First, the basic concept for modelling of forward rates proposed by Heath, Jarrow and Morton (HJM) in 1992[1] is described. This is followed by a description of the simplification by Ritchken and Sankarasubramanian (RS)[2] of the HJM model to make it implementable. Finally, the generation of interest rates in practice is described.

Heath-Jarrow-Morton

In 1992, Heath, Jarrow and Morton proposed the modelling of forward rates rather than the traditional modelling of spot rates. Within the HJM framework movements in the entire forward yield curve are modelled simultaneously. The direct formulation in forward rates makes it possible to specify the volatility of the interest rates more flexibly than in traditional interest-rate models.

The forward rate is defined in the model as an interest rate applying at a future point in time. Under HJM, the movement in the forward rate is modelled using the following diffusion process:

$$df(t,T) = \mu_f(t,T)dt + \sigma_f(t,T)dW(t)$$

where $f(t,T)$ is the forward rate observed at time t, applying at time T where $T \geq t$. In other words $f(t,T)$ is the spot rate at time T observed at time t. $\mu_f(t,T)$ and $\sigma_f(t,T)$ are respectively the drift and volatility of the forward rate, and $dW(t)$ is a normally distributed Wiener increment, cf. Box 9.2. Drift indicates the movement in the forward rate if there had been no stochasticity in the process.

Once the forward rate is specified, expressions of spot rate, zero-coupon prices, etc., can be derived.

To ensure an arbitrage-free market under the model, the following condition between drift and volatility, known as the HJM drift condition, must hold in a risk-neutral market, cf. Box 9.B.1:

$$\mu_f(t,T) = \sigma_f(t,T)\int_t^T \sigma_f(t,u)du$$

where drift and volatility can be values, parameters or functions. The HJM drift condition shows that volatility is the key element in the model. Once volatility is known, drift can be calculated, and thereafter the change in the forward rate can be determined.

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[1] Heath, D., Jarrow, R. & Morton, A. (1992), Bond Pricing and the Term Structure of Interest Rates, *Econometrica 60:1*, pp. 77-105

[2] P. Ritcken and L. Sankarasubramanian, Volatility Structure of Forward Rates and the Dynamics of the Term Structure, *Mathematical Finance*, Vol. 5, No. 1 (January 1995), pp. 55-72.

THE HJM DRIFT CONDITION Box 9.B.1

Under HJM it is assumed that forward rates can be described by the following diffusion process:

$$df(t,T) = \mu_f(t,T)dt + \sigma_f(t,T)dW(t)$$

where *df(t,T)* denotes the change in the forward rate. $\mu_f(t,T)$ and $\sigma_f(t,T)$ are respectively the drift and volatility of the forward rate, and *dW(t)* is normally distributed with mean value *0* and variance *dt*, cf. Box 9.2. To ensure arbitrage-free markets in the model, the following condition between drift and volatility – the HJM drift condition – must hold:

$$\mu_f(t,T) = \sigma_f(t,T)\left(\lambda(t) + \int_t^T \sigma_f(t,u)du\right)$$

where $\lambda(t)$ is the market price of the risk at time *t*. Assuming risk neutrality in the market, i.e. $\lambda(t)=0$, the HJM drift condition can be re-written as:

$$\mu_f(t,T) = \sigma_f(t,T)\int_t^T \sigma_f(t,u)du$$

For simplification, it is assumed in the calculations that $\lambda(t)=0$.
For more details, see T. Björk, *Arbitrage Theory in Continuous Time*, 1998, Oxford University Press, Chapters 3, 17,18 and 19.

In its general form the HJM model requires specification of volatilities for all forward rates along the yield curve (infinite in continuous time), in order to simulate the entire yield curve. On practical implementation of the model, the relationship between volatilities for various maturities is simplified.

The HJM-RS model

The P. Ritchken and L. Sankarasubramanian model (HJM-RS model) from 1995 is a simplification of the HJM model. In the HJM-RS model volatility is assumed to have a functional structure, which means that the model can describe movements throughout the yield curve with only two state variables, in contrast to the general HJM's infinite state variables.

It is assumed that the volatility of the forward rate is a function that depends on the remaining maturity for the forward rate and the volatility of the spot rate, i.e. the following volatility restriction:

$$\sigma_f(t,T) = \sigma(r(t))^\gamma e^{-\kappa(T-t)}$$

where $\sigma(r(t))^\gamma$ is the volatility of the spot rate. σ, κ and γ are fixed parameters and *T-t* is the remaining maturity for the forward rate *f(t,T)*. Given this function, the drift of the forward rate can be calculated using the HJM drift condition, and the diffusion equation for the forward rate can be derived. Then expressions of the spot rate and zero-coupon prices can be derived.

CALCULATION OF ZERO-COUPON PRICES AND YIELDS Box 9.B.2

Given the forward rate, the zero-coupon price can be calculated by the following formula:

$$P(t,T) = \exp\left(-\int_t^T f(t,s)\,ds\right)$$

where *P(t,T)* is the zero-coupon price observed at time *t* with maturity *T*. The zero-coupon rate can be calculated from the zero-coupon price:

$$y(t,T) = -\frac{1}{T-t}\ln P(t,T) = \frac{1}{T-t}\int_t^T f(t,s)\,ds$$

where *y(t,T)* is the zero-coupon yield in the period *T-t*.

A spot rate observed at time *t* corresponds to a forward rate observed at time *t*, applying at time *t*, i.e. *r(t)=f(t,t)*. With the RS volatility restriction, the spot rate follows the process:

$$dr(t) = \left\{\kappa\left(f(0,t) - r(t)\right) + \phi(t) + \frac{d}{dt}f(0,t)\right\}dt + \sigma\, r(t)^{\gamma}\, dW(t)$$

where $\phi(t)$ is the integrated volatility factor, cf. below. κ, σ and γ are parameters from the volatility restriction. For γ=½ the spot-rate volatility is the same as in the CIR model, while the drift term of the spot rate deviates from the CIR model since it contains information concerning the development in the interest rate up to time *t*. The integrated volatility factor has the following expression:

$$\phi(t) = \sigma^2 \int_0^t r(u)^{2\gamma} e^{-2\kappa(t-u)}\,du$$

The development in the entire yield curve can be described using the spot rate and the integrated volatility factor in the HJM-RS model. An implementable interest-rate model is thus obtained.

With the parameters from the RS volatility restriction, zero-coupon prices can be calculated by the following expression:

$$P(t,T) = \frac{P(0,T)}{P(0,t)}\exp\left\{-\frac{1}{2}\left(\frac{1-e^{-\kappa(T-t)}}{\kappa}\right)^2 \sigma^2 \int_0^t r(u)^{2\gamma} e^{-2\kappa(t-u)}\,du + \frac{1-e^{-\kappa(T-t)}}{\kappa}\left(f(0,t) - r(t)\right)\right\}$$

where *t* and *T* indicate the time index for the required zero-coupon price. *P(0,t)* and *P(0,T)* are known zero-coupon prices observed at time *0*. This expression is derived on the basis of the zero-coupon formula described in Box 9.B.2.

Estimation of the model's parameters

The parameters σ, κ and γ in the HJM-RS model used in the simulation of interest rates are estimated on the basis of historically observed interest

data from 1994 to 2001. The Generalised Method of Moments (GMM), cf. Box 9.A.4, is used for the estimation.

The GMM estimation of the parameters is based on the formula for zero-coupon prices of the HJM-RS model. Historically observed zero-coupon prices are inserted as input to this formula. The parameters are estimated on the basis of monthly zero-coupon yields for government securities for the period 1994-2001. The estimation gives σ=0.02861, κ=0.08889 and γ=0.4077.

Generating yield curves in the HJM-RS model

With the above equations for the spot rate *r(t),* the integrated volatility factor $\phi(t)$, and zero-coupon prices *P(t,T),* future yield curves can be generated. On generating interest rates in discrete time (e.g. quarterly interest rates) the equations must be re-written.

In discrete time, the required generation period can be divided into a number of equal-length intervals, e.g. *n* intervals. The interval length is Δt, and can e.g. be a month or a quarter.

The zero-coupon price in discrete time is denoted as *P(i,j)*, where *i* is the observation time index, and *j* is the time index for expiry of the bond.

In the same way, the spot rate and the integrated volatility factor are denoted by *r(i)* and $\phi(i)$ for *i=0, 1, …, n* in the discrete version of the model. The change in the spot rate $\Delta r(i)$ over the time interval Δt can be simulated by the following equation[1]:

$$\Delta r(i+1) = \left\{ \kappa\left(f(0,i) - r(i)\right) + \phi(i) + \frac{f(0,i+1) - f(0,i)}{\Delta t} \right\} \Delta t + \sigma\, r(i)^{\gamma} Z(i)$$

where *Z(i)* is a normally distributed variable with mean value *0* and variance Δt. The spot rate in the following period is thus calculated as the spot rate in the current period plus the change in the spot rate, $r(i+1)=r(i)+\Delta r(i+1)$.

The integrated volatility factor has the following expression in discrete time:

$$\phi(i+1) = e^{-2\kappa\Delta t} \left\{ \phi(i) + \frac{\sigma^2 r(i)^{2\gamma}}{2\kappa} \left(1 - e^{-2\kappa\Delta t}\right) \right\}$$

Zero-coupon prices can be re-written to:

$$P(i,j) = \frac{P(0,j)}{P(0,i)} \exp\left\{ -\frac{1}{2} \left(\frac{1 - e^{-\kappa(j-i)\Delta t}}{\kappa} \right)^2 \phi(i) + \frac{1 - e^{-\kappa(j-i)\Delta t}}{\kappa} \left(f(0,i) - r(i)\right) \right\}$$

[1] The method follows Ritchken and Sankarasubramanian (1995). In Ramaswamy, S., 1997, Global Asset Allocation in Fixed Income Markets, Working Paper No. 46, BIS, there is an example of use of the model to simulate interest rates over a horizon of 2 years in order to determine the composition of a bond portfolio.

SIMULATION OF INTEREST INPUT FOR CaR — Box 9.B.3

The input to the simulation is zero-coupon-yield curves:

y(0,0) y(0,1) y(0,2) … y(0,n)

where *y(i,j)* is zero-coupon yields observed in period *i* expiring in period *j*, i.e. with a remaining maturity of *j-i*. If observations are quarterly and the expiry date has a year as the unit, zero-coupon yields can be calculated as follows: *y(0;0) y(0;0,25) y(0;0,5) … y(0,1) … y(0,2) … y(0,10) …*

The zero-coupon yields can be converted to zero-coupon prices and forward rates:

P(0,0) P(0,1) P(0,2) … P(0,n)

f(0,0) f(0,1) f(0,2) … f(0,n)

Then the simulation process begins by simulating the first movement in the spot rate:

$$\Delta r(1) = \left(\kappa\left(f(0,0) - r(0)\right) + \phi(0) + \frac{f(0,1) - f(0,0)}{\Delta t} \right)\Delta t + \sigma\, r(0)^{\gamma} Z(0)$$

where $\Delta r(1)$ is the change in the spot rate from period *0* to period *1*, *r(0)*, *f(0,0)* and *f(0,1)* are known interest rates, σ, κ, and γ are known parameters, $\phi(0)$ is equal to *0* and *Z(0)* is drawn from a normal distribution with mean value *0* and variance Δt. The spot rate in period *1* is calculated by the following equation:

$$r(1) = r(0) + \Delta r(1)$$

The integrated volatility factor for period *1* is thus:

$$\phi(1) = e^{-2\kappa\Delta t}\left\{ \phi(0) + \frac{\sigma^2 r(0)^{2\gamma}}{2\kappa}\left(1 - e^{-2\kappa\Delta t}\right) \right\}$$

Given *r(1)* and $\phi(1)$, $\Delta r(2)$ and $\phi(2)$ can be simulated.

$$\Delta r(2) = \left(\kappa\left(f(0,1) - r(1)\right) + \phi(1) + \frac{f(0,2) - f(0,1)}{\Delta t} \right)\Delta t + \sigma\, r(1)^{\gamma} Z(1)$$

$$\phi(2) = e^{-2\kappa\Delta t}\left\{ \phi(1) + \frac{\sigma^2 r(1)^{2\gamma}}{2\kappa}\left(1 - e^{-2\kappa\Delta t}\right) \right\}$$

If the above simulation is repeated *n* times, spot rates and integrated volatility factors for *n* periods forward in time are found. Then the following zero-coupon prices can be calculated.

$$P(1,2) = \frac{P(0,2)}{P(0,1)} \exp\left\{ -\frac{1}{2}\left(\frac{1 - e^{-\kappa(2-1)\Delta t}}{\kappa} \right)^2 \phi(1) + \frac{1 - e^{-\kappa(2-1)\Delta t}}{\kappa}\left(f(0,1) - r(1)\right) \right\}$$

$$P(1,3) = \frac{P(0,3)}{P(0,1)} \exp\left\{ -\frac{1}{2}\left(\frac{1 - e^{-\kappa(3-1)\Delta t}}{\kappa} \right)^2 \phi(1) + \frac{1 - e^{-\kappa(3-1)\Delta t}}{\kappa}\left(f(0,1) - r(1)\right) \right\}$$

etc. An interest-rate scenario will thus contain the following zero-coupon prices:

P(1,2)	*P(1,3)*	*P(1,4)*	…	*P(1,n)*
P(2,3)	*P(2,4)*	*P(2,5)*	…	*P(2,n+1)*
⋮				
P(120,121)	*P(120,122)*	*P(120,123)*	…	*P(120,n+120)*

where *P(1,·)* contains information on interest rates in period *1* in the future, *P(2,·)* contains interest information in period 2, etc. Zero-coupon prices can thereafter be converted to zero-coupon yields.

Future yield curves can be simulated from the above three equations in discrete time. Input to the simulation is the current term structure and the estimated parameters κ, σ and γ from the HJM-RS model, cf. Box 9.B.3.

Appendices

Announcements on the Central Government's Borrowing and Debt (Translations)

OPENING OF 5 PER CENT BULLET LOANS 2013, 4 FEBRUARY 2001

On 19 February 2002 a new series of government bonds, 5 per cent bullet loans 2013, will be opened. The interest payment date will be 15 November and the coupon rate 5 per cent (ID Code DK000992089-4). The government bonds will be repaid in full on 15 November 2013.

Sale of 5 per cent bullet loans 2013 will commence at 11.00 a.m. on 19 February 2002 via the submarket for government securities issues at the Copenhagen Stock Exchange. Further details of the amounts offered on the first day will be announced at 9.00 a.m. on 19 February 2002.

A description of the terms of borrowing in Danish and English for 5 per cent bullet loans 2013 can be ordered on tel. (+45) 33 63 61 05 or viewed on Danmarks Nationalbank's Web site (www.nationalbanken.dk) under Government Debt.

Sale of 6 per cent bullet loans 2011 will be discontinued on 18 February 2002.

Securities lending

5 per cent bullet loans 2013 will be included in the central government's securities lending facility from 19 February 2002. 6 per cent bullet loans 2011 will be maintained in the central government's securities lending facility. From 19 February 2002 5 per cent Treasury notes 2003 and 5 per cent bullet loans 2005 will no longer be included in the central government's securities lending facility.

The Social Pension Fund's securities lending facility comprises the fund's portfolio of government bonds of the type bullet loans. 5 per cent bullet loans 2005 is included in the government bond portfolio of the Social Pension Fund, while it cannot be expected, that 5 per cent Treasury notes 2003 will be included in the fund's portfolio.

Further information

For further information concerning the aforementioned please contact Danmarks Nationalbank, Financial Markets, Ove Sten Jensen, Head of Government Debt Management, on tel. (+45) 33 63 61 02.

Information on the government debt management can be found on Danmarks Nationalbank's Web site (www.nationalbanken.dk) under Government Debt.

CENTRAL-GOVERNMENT BORROWING IN 2002, 18 DECEMBER 2001

Central-government domestic borrowing in 2002

In Budget Review, August 2001 by the Ministry of Finance, the central government's gross domestic borrowing requirement for 2002 is estimated at DKK 76.2 billion. A new estimate for the central-government's borrowing requirement is expected to be published by the Ministry of Finance by end January 2002. The borrowing requirement will be covered by issuing domestic government securities.

The overall strategy for the government debt policy is to build and maintain attractive on-the-run issues. This is done by building liquid series in the 2-, 5- and 10-year maturity segments.

The on-the-run issues will be replaced in 2002, as they have been open for a long time and have suitable outstanding amounts.

On 8 January 2002 a new series of Treasury notes 2004 will be opened. The interest payment date will be 15 November and the coupon rate 4 per cent (ID Code DK000992062-1). The Treasury notes will be repaid in full on 15 November 2004.

Sale of 4 per cent Treasury notes 2004 will commence at 11.00 a.m. on 8 January 2002 via the submarket for government securities issues at the Copenhagen Stock Exchange. Further details of the amounts offered on the first day will be announced at 9.00 a.m. on 8 January 2002.

In connection with the test of the submarket for government securities issues on 12 November 2001 the Copenhagen Stock Exchange issued a description of the submarket's functionality. A copy of this description can be obtained from the Copenhagen Stock Exchange, Customer Desk, telephone (+45) 33 77 04 09.

On 22 January 2002 a new series of government bonds 2008 will be opened. The interest payment date will be 15 August and the coupon rate 4 per cent (ID Code DK000992070-4). The government bonds will be repaid in full on 15 August 2008.

Sale of 4 per cent bullet loans 2008 will commence at 11.00 a.m. on 22 January 2002 via the submarket for government securities issues of the Copenhagen Stock Exchange. Further details of the amounts offered on the first day will be announced at 9.00 a.m. on 22 January 2002.

A description of terms of borrowing in Danish and English for respectively 4 per cent Treasury notes 2004 and 4 per cent bullet loans 2008 has been prepared. It can be ordered on telephone +45 33 63 61 05 or viewed on Danmarks Nationalbank's Website (www.nationalbanken.dk).

The sale of 5 per cent Treasury notes 2003 and 5 per cent bullet loans 2005 will be discontinued on 7 and 21 January 2002 respectively.

A new series of government bonds in the 10-year segment is expected to be opened in 1st quarter 2002. A separate announcement concerning

ISSUES ON-THE-RUN JANUARY 2002

Series	Interest payment date
Government bonds	
6 per cent bullet loans 2011	15 November
4 per cent bullet loans 2008 (open on 22 January 2002)	15 August
5 per cent bullet loans 2005 (discontinue on 21 January 2002)	15 August
Treasury notes	
4 per cent Treasury notes 2004 (open on 8 January 2002)	15 November
5 per cent Treasury notes 2003 (discontinue on 7 January 2002)	15 November
Treasury bills	
Treasury bills 2002 IV	1 November
Treasury bills 2002 III	1 August
Treasury bills 2002 II	1 May

the terms of the issue will be published prior to the opening. The outstanding amount of this issue is aimed to be at least DKK 60 billion.

In 2002 new 12-months Treasury bills will be opened at auctions with the settlement dates of 1 February, 1 May, 1 August and 1 November.

Buy-back and switch

There can be buy-backs in a wide range of securities. Buy-backs are used to smooth out the gross borrowing requirement between the years and to support a range of liquid market-conform on-the-run issues.

It is the intention to hold one or more switch operations in 1st half of 2002. A separate announcement will be published prior to a switch operation. Switch operations give investors the opportunity for direct exchange of off-the-run issues with on-the-run issues. Switch operations are used as a supplement to the central government's buybacks in off-the-run issues.

Securities will only be bought back or switched if this is considered advantageous on the basis of an overall evaluation of government debt policy.

As of 1 January 2002 the list of issues subject to buy-backs is as follows:

All issues maturing in 2002
All issues maturing in 2003
7 per cent bullet loans 2004
5 per cent bullet loans 2005 (from 22 January 2002)
8 per cent bullet loans 2006
7 per cent bullet loans 2007
6 per cent bullet loans 2009
10 per cent serial loans S 2004
5 per cent serial loans S 2007
4 per cent serial loans S 2017

3.5 per cent 1886 perpetual
3 per cent 1894 perpetual
3.5 per cent 1901 perpetual
3.5 per cent 1909 perpetual

The central government's and the Social Pension Fund's securities lending facilities

The central government's securities lending facility comprises the following securities in 2002:

Treasury bills
5 per cent Treasury notes 2003
4 per cent Treasury notes 2004 (after opening)
5 per cent bullet loans 2005
4 per cent bullet loans 2008 (after opening)
6 per cent bullet loans 2011

As of 1 January 2002 all governments bonds of the type bullet loans in the Social Pension Fund's bond portfolio can be subject to securities lending.

For more specific information on the securities lending facilities see the announcement of Danish Central-Government Borrowing Etc., 29 March 2001, Appendix 1 and 2. The announcement can be found on Danmarks Nationalbank's Website (www.nationalbanken.dk) under Government debt/Current information.

Central-government foreign borrowing in 2002

The central government's gross foreign borrowing requirement for 2002 is estimated at DKK 22.5 billion in Budget Review, August 2001 by the Ministry of Finance.

The central government's foreign borrowing requirement is covered primarily by raising larger loans, which preferably will be raised in euro. It is the intension to build a range of euro loans in the long run. It is aimed to issue loans in euro for about EUR 1½-2 billion each year depending on the borrowing requirement and the demand for the loans. If issuing in euro loans is not advantageous under the given market conditions, issues in other currencies may occur.

As a supplement to raising larger loans, currency swaps from DKK to euro are used. This form of foreign borrowing contributes to liquidity in the domestic on-the-run issues.

Duration of the government debt

The duration band of 3.5 years +/- 0.5 year for the government debt continues to apply in 2002.

Interest taxation directive

The European Commission has put forward a proposal for Council Directive to ensure taxation of interest received by a person in one EU member state from another EU member state (COM(2001) 400). The intention of the directive is for the authorities of one EU member state to gather information on interest paid from that member state to a person in another EU member state, and to send the information to the authorities in the country in which interest recipients are resident. The directive applies solely to physical persons. Interest payments to companies or other legal entities are not within the scope of the directive. For further information on the proposal for Council Directive reference is made to the Website of the Danish Parliament (Folketinget) (www.folketinget.dk).

Overall, the proposal for Council Directive does not affect the actual taxation of interest received from abroad by persons resident in Denmark who are thereby subject to full tax liability, or interest paid from Denmark to persons resident abroad. However, certain member states have announced that they will introduce a withholding tax on interests for a transition period, instead of exchanging information.

The proposal for Council Directive contains a clause that exempts the existing negotiable securities from the directive's area of application for a transition period of 7 years. The clause applies to all negotiable securities issued for the first time prior to 1 March 2001, or for which the original issue prospectus was endorsed prior to this date.

Whether a government security is subject to the clause is determined by whether further issues in the series take place on 1 March 2002 or thereafter. If there are further issues in the series on 1 March 2002 or thereafter the entire series, i.e. both the original issue and all subsequent issues, will no longer be subject to a clause. This means that interest payments for this series will be included in the exchange of information among the EU member states.

After the 7-year transition period all government securities will be subject to the directive.

The Danish central government will also in the future be able to reopen domestic government securities series and make issues therein. In case issuing is done in reopened government securities after 1 March 2002, the securities will be subject to the directive.

Further information

Information on government debt management can be obtained at Danmarks Nationalbank's Website (www.nationalbanken.dk) under Government debt.

The publication "Danish Government Borrowing and Debt 2001", which sets out the central government's borrowing in 2001 and the strategy for the next years, will be published at the end of February 2002 (Danish edition with English summary).

For further information concerning the aforementioned please contact Danmarks Nationalbank, Financial Markets, Head of Government Debt Management, Ove Sten Jensen, telephone (+45) 33 63 61 02.

CENTRAL-GOVERNMENT DOMESTIC BORROWING IN 2ND HALF OF 2001, 26 JUNE 2001

In Budget Review, May 2001, the central government's gross domestic borrowing requirement for 2001 is estimated at DKK 60.1 billion. The borrowing requirement will be covered by issuing domestic government securities.

ISSUES ON-THE-RUN JULY 2001

Series	Interest payment date
Government bonds	
6 per cent bullet loans 2011	15 November
5 per cent bullet loans 2005	15 August
Treasury notes	
5 per cent Treasury notes 2003	15 November
Treasury bills	
Treasury bills 2002 II	1 May
Treasury bills 2002 I	1 February
Treasury bills 2001 IV	1 November

In the 2nd half of 2001 new 12-month Treasury bills will be opened at auctions with the settlement dates of 1 August and 1 November 2001.

A new series of medium term government bonds is expected to open in autumn 2001. A separate announcement concerning the terms of the issue will be published prior to the opening.

Buy-back and switching

Buy-backs of government securities maturing in 2001 can be used to smooth out the borrowing requirement within the year.

Furthermore, there can be buy-backs in a wider range of securities. Buy-backs are used to smooth out the redemption profile between the years and to support a range of on-the-run issues which comprise liquid market-conform issues.

As of 1 July 2001 the list of issues subject to buy-backs is as follows:

All issues maturing in 2001
All issues maturing in 2002
8 per cent bullet loans 2003
7 per cent bullet loans 2004
8 per cent bullet loans 2006
7 per cent bullet loans 2007
6 per cent bullet loans 2009
10 per cent serial loans S 2004

5 per cent serial loans S 2007
4 per cent serial loans S 2017
3.5 per cent 1886 perpetual
3 per cent 1894 perpetual
3.5 per cent 1901 perpetual
3.5 per cent 1909 perpetual

It is the intention to hold one or more switching operations in 2nd half of 2001. A separate announcement will be published prior to a switching operation.

Switching operations give investors the opportunity for direct exchange of off-the-run issues with on-the-run issues. Switching operations are used as a supplement to the central government's buybacks in off-the-run issues.

Securities will only be bought back or switched if this is deemed advantageous on the basis of an overall evaluation of government debt policy.

The central government's securities lending facility

As of 1 July 2001 the facility thus comprises the following securities:

Treasury bills
5 per cent Treasury notes 2003
5 per cent bullet loans 2005
6 per cent bullet loans 2011

For more specific information on the securities lending facility see the announcement of Danish Central-Government Borrowing Etc., 29 March 2001, Appendix 1. The announcement can be found on Danmarks Nationalbank's Web site (www.nationalbanken.dk) under Government debt/Current information.

The Social Pension Fund's securities lending facility

As of 1 July 2001 the following issues can be subject to securities lending:

8 per cent bullet loans 2001
6 per cent bullet loans 2002
8 per cent bullet loans 2003
7 per cent bullet loans 2004
8 per cent bullet loans 2006
7 per cent bullet loans 2007
6 per cent bullet loans 2009

For more specific information on the securities lending facility see the announcement of Danish Central-Government Borrowing Etc., 29 March

2001, Appendix 2. The announcement can be found on Danmarks Nationalbank's Web site (www.nationalbanken.dk) under Government debt/Current information.

Further information

For further information concerning the aforementioned please contact Danmarks Nationalbank, Financial Markets, Head of Government Debt Management, Ove Sten Jensen, telephone (+45) 33 63 61 02.

SWITCH AUCTION, 6 JUNE 2001

On 18 June 2001 Danmarks Nationalbank on behalf of the Kingdom of Denmark will hold a switch auction.

- At the switch auction the following securities are issued:
  6 per cent bullet loans 2011
  against buy-back in the following securities:
  6 per cent bullet loans 2009
  7 per cent bullet loans 2007
- At the switch auction the maximum nominal amount issued of 6 per cent bullet loans 2011 is DKK 6 billion.

Background

Switch auctions give investors the opportunity for direct exchange of off-the-run issues with on-the-run issues.

Switching from off-the-run issues to on-the-run issues supports the maintenance of liquid, market-conform on-the-run issues. The first switch auction is held in order to support the build-up of the 10-year on-the-run issue. At the switch auction the Kingdom of Denmark issues 6 per cent bullet loans 2011 against buy-back of respectively 6 per cent bullet loans 2009 and 7 per cent bullet loans 2007.

Terms of the switch auction

Securities in the auction

- At the switch auction the following securities are issued:
  6 per cent bullet loans 2011
  against buy-back in the following securities:
  6 per cent bullet loans 2009
  7 per cent bullet loans 2007.
- The switch is "nominal for nominal", i.e. the same nominal amount of 6 per cent bullet loans 2011 will be issued as are bought back in respectively 6 per cent bullet loans 2009 and 7 per cent bullet loans 2007.

Participants in the auction

Auction bids may be submitted by entities authorised to trade on the Copenhagen Stock Exchange.

Opening of the auction

The auction is held on 18 June. The auction begins at 10:00 a.m. when Danmarks Nationalbank on behalf of the Kingdom of Denmark via the Copenhagen Stock Exchange announces a price for the switch auction

for the securities issued, i.e. 6 per cent bullet loans 2011. The price is also announced via DN News (screen no. 57) and reproduced by e.g. Reuters (DKNA-57).

Bidding procedures

After the announcement of the issuing price for 6 per cent bullet loans 2011, auction bids may be submitted to Danmarks Nationalbank. Each bid must consist of:

- a price of the securities bought back by the Kingdom of Denmark, and
- the corresponding nominal amount of the securities that the auction participant wishes to switch at that price.

The price must be specified to two decimal places, while the nominal amount must be in round DKK millions.

The bids must be submitted via fax in a bid form. The fax number is (+45) 33 63 71 06. The bid form is enclosed [not reprinted] and can also be found on Danmarks Nationalbank's Web site (www.nationalbanken.dk) under Government debt/Current information. Bids for respectively 6 per cent bullet loans 2009 and 7 per cent bullet loans 2007 must be submitted in separate forms.

Bids must be received by Danmarks Nationalbank not later than at 11:00 a.m. Only bids that have come to the knowledge of Danmarks Nationalbank before the deadline will be considered for the auction. Immediately after the deadline Danmarks Nationalbank will contact the bidders by telephone to confirm the receipt of the bids.

Determination of the result of the auction

On the basis of the bids received a cut-off price will be fixed. Bids at the cut-off price or below will be accommodated at the cut-off price. A pro-rata allocation of bids at the cut-off price may be applied. The auction can be terminated without allocation.

For the auction as a whole, the maximum nominal amount switched to 6 per cent bullet loans 2011 is DKK 6 billion.

Accommodated bids for the nominal amount of 6 per cent bullet loans 2009 are switched to the same nominal amount of 6 per cent bullet loans 2011. Correspondingly, accommodated bids for the nominal amount of 7 per cent bullet loans 2007 are switched to the same nominal amount of 6 per cent bullet loans 2011.

Announcement of the result of the auction

The result of the auction will be announced at 12:00 a.m. via the Copenhagen Stock Exchange. The result of the auction will also be announced via DN News (screen no. 59) and reproduced by e.g. Reuters (DKNA-59).

After the announcement of the result of the auction Danmarks Nationalbank will contact the accommodated participants via fax with information on their allocated amounts.

The issue of 6 per cent bullet loans 2011 and the buy-back of 6 per cent bullet loans 2009 or 7 per cent bullet loans 2007 is settled and reported as two separate securities transactions. When reporting to the Copenhagen Stock Exchange the securities transactions must be classified as "Non Standard" and "Changed Market Conditions".

Further information

For further information concerning the aforementioned please contact Danmarks Nationalbank, Financial Markets, Head of Government Debt Management, Ove Sten Jensen, telephone (+45) 33 63 61 02 or Kim Abildgren, telephone (+45) 33 63 61 36.

For further information concerning participation in the switch auction please contact Danmarks Nationalbank, Market Operations, telephone (+45) 33 63 67 03.

DANISH CENTRAL-GOVERNMENT BORROWING ETC., 29 MARCH 2001

Adjustments to the Treasury Bill Programme

As stated in the announcement on central-government borrowing in 2001 of 15 December 2000 a 12-month Treasury bill is introduced in the Danish Treasury bill programme. The first issue of a 12-month Treasury bill will be on 1 May (auction date 27 April). As before new Treasury bills are opened for sale in February, May, August and November.

The adjustments imply:

- that 2 new Treasury bills are opened for sale at the May 2001 auction:
  9 month Treasury bills 2002 I expires on 1 February 2002,
  (ISIN-code DK000981028-5)
  12 month Treasury bills 2002 II expires on 1 May 2002,
  (ISIN-code DK000981036-8)
- that in the 2nd half of 2002 a new 12 month Treasury bill is opened for sale at the auctions in August and November respectively.

Treasury bills are sold at monthly auctions. The procedure is unchanged. At the auctions Treasury bills with a remaining maturity of 3 months or more are offered for sale.

An amended description of the Treasury bills programme can be ordered on telephone (+45) 33 63 61 05 or be viewed on Danmarks Nationalbanks Web site: www.nationalbanken.dk under Government Debt/Terms of borrowing.

The central government's securities lending facility

The Treasury bills are included in the central government's securities lending facility. Securities lending in Treasury bills is possible as from the trading date 1 May 2001. New Treasury bills are included in the facility as from the first value date of the issue in question, and lending is possible up to and including the last auction date.

The terms of lending otherwise adhere those for lending of other central-government securities, cf. Appendix 1.

Buybacks and switching operations

The current list of central-government securities that may be subject to buy-back operations is expanded to include 6 per cent bullet loans 2009 and the central-government perpetuals.

As of 2 April 2001 the list of issues subject to buy-backs is as follows:

All issues maturing in 2001

All issues maturing in 2002

8 per cent bullet loans 2003

7 per cent bullet loans 2004
8 per cent bullet loans 2006
7 per cent bullet loans 2007
6 per cent bullet loans 2009
10 per cent serial loans S 2004
5 per cent serial loans S 2007
4 per cent serial loans S 2017
3,5 percent 1886 perpetual
3 per cent 1894 perpetual
3,5 per cent 1901 perpetual
3,5 per cent 1909 perpetual

In addition to buy backs switching operations between the issues in the above list and on-the-run issues may be used. A separate announcement in this respect will be made during the spring of 2001.

The Social Pension Fund securities lending facility
As from 1 May 2001 the Social Pension Fund may lend securities from its portfolio of central government bullet loans within the framework of a securities lending facility. Lending is against collateral in other securities issued by the Danish central government. As of 1 May 2001 the following issues can be subject to securities lending:

8 per cent bullet loans 2001
6 per cent bullet loans 2002
8 per cent bullet loans 2003
7 per cent bullet loans 2004
8 per cent bullet loans 2006
7 per cent bullet loans 2007
6 per cent bullet loans 2009

For more specific information on the securities lending facility see Appendix 2.

Further information
For further information concerning the aforementioned please contact Danmarks Nationalbank, Ove Sten Jensen, Head on Government Debt Management, on tel. (+45) 33 63 61 02.

Appendix 1. The central government's securities lending facility

1. Lending is in on-the-run central-government securities. The specific terms for lending in the individual government securities series are published in the central government's announcements concerning on-the-run issues. If deemed appropriate, no lending facility will be established for certain on-the-run issues of government securities.
2. Lending in government securities is to all members of Copenhagen Stock Exchange.
3. In normal circumstances the maximum lending in each paper is DKK 2 billion. However, this limit may be raised in the event of abnormal price formation on the private market for securities lending. The securities lending facility can be terminated at any time. Lending in individual government bond series will lapse when the bonds cease to be on-the-run. In certain cases the facility may continue after a paper has become an off-the-run issue.
4. Securities lending transactions are settled on the following trading day. The securities may be borrowed for a period from 1 to 5 trading days. Transactions can be made during the day between 9.00 a.m. and 3.30 p.m., but as far as possible should be concluded before 2.00 p.m. Lending in securities is granted in the order that requests to Danmarks Nationalbank are received from securities dealers on the relevant day. The right to make discretionary allocations is reserved if deemed appropriate.
5. Danish government securities (bullet loans) denominated in Danish kroner issued via the Danish Securities Centre (VP) in series with an outstanding amount of at least DKK 3 billion are accepted as collateral.
6. Collateral is provided by deducting 5 points from the market price of the securities provided as collateral by the borrower.
7. Transactions are settled as trading transactions in the VP system.
8. The fee is 0.5 per cent per year. The fee can be changed without further notice.
9. Transactions are reported as two or more separate repurchase agreements to Copenhagen Stock Exchange under code 30.
10. Any enquiries concerning securities lending transactions should be made to Danmarks Nationalbank, Market Operations, on tel. (+45) 33 63 67 13 or (+45) 33 63 67 14.

Appendix 2. The Social Pension Fund's securities lending facility

1. Lending is in Danish central-government bullet loans.
2. Lending in government securities is to members of Copenhagen Stock Exchange.
3. The securities lending facility can be terminated at any time.
4. Securities lending transactions are settled on the following trading day. The securities may be borrowed for a period from 1 to 5 trading days. Transactions can be made during the day between 9.00 a.m. and 3.30 p.m., but as far as possible should be concluded before 2.00 p.m. Lending in securities is granted in the order that requests to Danmarks Nationalbank are received from securities dealers on the relevant day. The right to make discretionary allocations is reserved if deemed appropriate.
5. Danish government securities (bullet loans) denominated in Danish kroner issued via the Danish Securities Centre (VP) in series with an outstanding amount of at least DKK 3 billion are accepted as collateral.
6. Collateral is provided by deducting 5 points from the market price of the securities provided as collateral by the borrower.
7. Transactions are settled as trading transactions in the VP system.
8. The fee is 0.5 per cent per year. The fee can be changed without further notice.
9. Transactions are reported as two or more separate repurchase agreements to Copenhagen Stock Exchange under code 30.
10. Any enquiries concerning securities lending transactions should be made to Danmarks Nationalbank, Market Operations, on tel. (+45) 33 63 67 13 or (+45) 33 63 67 14.

EXTRACT OF ANNOUNCEMENT ON REDUCTION OF TIME INTERVAL BETWEEN BIDS AND RESULT AT TREASURY BILL AUCTIONS, 30 MARCH 2000

Appendix: Conditions for Treasury bill auctions

Treasury bills are issued at auctions which are normally held on the penultimate trading day of each month.

Before an auction, Danmarks Nationalbank issues announcement thereof on behalf of the central government. The announcement is issued via the Copenhagen Stock Exchange and contains deadline for submission of bids, time for announcement of the auction result and information on the bills offered for sale. Normally the ultimate deadline for submitting bids will be 11:30 a.m. on the auction day with subsequent announcement of the auction result at 12:00 a.m. At the auctions bids are received in the series which have a remaining maturity of minimum 3 months.

Auction bids may be submitted by entities authorised to trade on the Copenhagen Stock Exchange and by Danmarks Nationalbank's monetary-policy counterparties which fulfil the requirements for the electronic Treasury bill auction system. Bids that have come to the knowledge of Danmarks Nationalbank before the deadline for submission, and that are entered in the electronic auction system, will be considered at the auction.

The bid must be for a yield specified to two decimal points. On the basis of the bids received, a cut-off yield will be fixed. Bids for this yield or below will be accommodated at the cut-off yield. A pro-rata accommodation of bids at the cut-off yield may be made. The cut-off yield will be converted to a price according to current money-market practice. The price will be rounded up or down to the nearest whole krone amount. An auction can be terminated without accommodation.

The cut-off yield, any percentage pro-rata allocation and the total allocation will be published by Danmarks Nationalbank on the auction day. Settlement will normally take place in accordance with the current market convention.

In case of technical difficulties preventing the auction to be held within the normal framework, the auction will be terminated without accommodation. Should it be decided to hold a new auction on the same day, the submission of bids will take place by telephone with confirmation by fax and with a time interval of 1 hour between the submission of bids and the announcement of the result. Notice of the new auction will be given by an announcement via the Copenhagen Stock Exchange.

Appendix of Tables

CENTRAL-GOVERNMENT DEBT, YEAR-END 1991-2001 Table 1

DKK Million	1991	1992	1993
A. Debt			
Domestic debt denominated in DKK[1]			
- Fixed-rate bonds	252,481	316,690	357,346
- Floating-rate bonds	85,010	57,147	41,241
- Lottery bonds	1,200	1,200	1,200
- Compulsory savings	392	-	-
- Treasury notes	74,050	71,150	94,200
- Treasury bills	49,250	55,485	58,339
- Currency swaps from DKK to EUR	-	-	-
- Government securities held by the central government	-1	0	-
- Interest-rate swaps, notional amount			
from fixed rate	-	-	-
to floating rate	-	-	-
Domestic debt denominated in DKK, total	462,382	501,672	552,326
Domestic debt denominated in EUR[2 3]			
- Fixed-rate bonds	-	9,827	9,824
- Government securities held by the central government	-	-	-
Domestic debt, total	462,382	511,499	562,150
Foreign debt			
- in USD	17,103	37,802	50,889
- in CHF	15,785	13,952	20,914
- in JPY	1,866	3,159	5,612
- in EUR[3]	54,955	48,237	73,621
- in other currencies	2,630	1,482	14,575
- Government securities held by the central government[4]	-1,374	-1,151	-1,338
Foreign debt, total	90,965	103,482	164,274
Domestic and foreign debt, total	553,347	614,981	726,424
B. Government deposits with the central bank[5]	-11,649	-30,927	-88,781
C. The Social Pension Fund			
- Government securities	-38,872	-43,611	-45,270
- Other securities	-86,836	-88,583	-93,105
The Social Pension Fund, nominal value, total[6]	-125,708	-132,194	-138,375
Central-government debt, total (A+B+C)	415,990	451,860	499,268
Central-government debt, per cent of GDP	48.5	50.9	55.5

Note: +denotes liabilities, - denotes assets.

[1] Does not include the holdings of the central government under the location-swap facility. The facility was established in July 1993 and ended in April 1998.

[2] In connection with the introduction of new accounting principles for the government debt the 8.5 per cent EUR bullet loan 2002 has been reclassified as foreign debt instead of domestic debt as of 1 January 1998.

[3] Comprises loans in EUR, currencies of the euro-area member states and XEU.

[4] Recorded at acquisition price. From 1993 exchange-rate-adjusted.

CENTRAL-GOVERNMENT DEBT, YEAR-END 1991-2001 Table 1

1994	1995	1996	1997	1998	1999	2000	2001
409,565	466,608	516,812	556,874	550,989	537,289	506,992	494,875
30,345	20,722	16,760	9,848	4,346	-	-	-
1,200	1,200	1,200	1,200	1,000	900	900	900
-	-	-	-	-	-	-	-
111,705	102,697	84,499	49,140	58,830	74,040	81,257	70,788
56,238	58,385	51,234	50,001	41,255	36,350	36,846	49,224
-	-	-	-	-	-	-	-4,800
-	-	-	-	-	-	-2,000	0
-	-	-	-	-500	-7,950	-20,950	-27,400
-	-	-	-	500	7,950	20,950	27,400
609,053	649,612	670,505	667,063	656,420	648,579	623,995	610,987
9,697	9,244	9,597	6,634	-	-	-	-
-970	-1,138	-2,372	-	-	-	-	-
617,781	657,719	677,730	673,697	656,420	648,579	623,995	610,987
24,913	6,425	4,562	1,514	1,336	1,187	0	0
18,393	13,836	6,179	3,974	1,094	3,616	3,822	0
10,419	9,329	2,396	1,047	562	2,453	1,672	0
64,887	69,975	88,826	90,661	84,982	82,386	79,287	83,753
12,954	11,599	6,519	6,418	365	383	428	42
-1,784	-5,516	-6,986	0	0	0	0	0
129,782	105,647	101,495	103,613	88,338	90,025	85,209	83,795
747,563	763,366	779,225	777,310	744,758	738,604	709,204	694,782
-55,266	-33,677	-31,052	-29,024	-30,400	-35,231	-31,332	-40,241
-50,143	-68,889	-83,435	-92,453	-100,135	-105,432	-106,312	-109,474
-96,689	-82,517	-65,336	-54,368	-43,468	-36,207	-33,244	-31,621
-146,832	-151,406	-148,772	-146,821	-143,603	-141,640	-139,556	-141,095
545,465	578,283	599,401	601,465	570,755	561,733	538,316	513,446
56.5	57.3	56.5	53.9	49.4	46.3	41.5	38.1

[5] For 2001 the central government's account is compiled in accordance with the monthly balance sheet of Danmarks Nationalbank.

[6] Index-linked bonds are at indexed value.

DOMESTIC GOVERNMENT SECURITIES ISSUED IN 2001	Table 2
No. 358, 6 per cent government bonds 2011 (6 pct. stående lån 2011)	
Issued in 2001, DKK million	42,833
Interest payable	15 Nov
Stock exchange code	0991996
Issue commenced	4 May 2000
Redemption date	15 Nov 2011
No. 286, 5 per cent government bonds 2005 (5 pct. stående lån 2005)	
Issued in 2001, DKK million	5,850
Interest payable	15 Aug
Stock exchange code	0991945
Issue commenced	14 Jan 1997
Redemption date	15 Aug 2005
No. 371, 5 per cent Treasury notes 2003 (5 pct. statsgældsbevis 2003)	
Issued in 2001, DKK million	25,861
Interest payable	15 Nov
Stock exchange code	0992003
Issue commenced	29 Jun 2000
Redemption date	15 Nov 2003
No. 421, Treasury bills 2002 IV (Skatkammerbevis 2002 IV)	
Issued in 2001, DKK million	5,460
Interest payable	-
Stock exchange code	0981052
Issue commenced	1 Nov 2001
Redemption date	1 Nov 2002
No. 415, Treasury bills 2002 III (Skatkammerbevis 2002 III)	
Issued in 2001, DKK million	13,866
Interest payable	-
Stock exchange code	0981044
Issue commenced	1 Aug 2001
Redemption date	1 Aug 2002
No. 401, Treasury bills 2002 II (Skatkammerbevis 2002 II)	
Issued in 2001, DKK million	21,792
Interest payable	-
Stock exchange code	0981036
Issue commenced	1 May 2001
Redemption date	1 May 2002
No. 400, Treasury bills 2002 I (Skatkammerbevis 2002 I)	
Issued in 2001, DKK million	8,106
Interest payable	-
Stock exchange code	0981028
Issue commenced	1 May 2001
Redemption date	1 Feb 2002

DOMESTIC GOVERNMENT SECURITIES ISSUED IN 2001	Table 2
No. 391, Treasury bills 2001 IV (Skatkammerbevis 2001 IV)	
Issued in 2001, DKK million	18,626
Interest payable	-
Stock exchange code	0981001
Issue commenced	1 Feb 2001
Redemption date	1 Nov 2001
No. 385, Treasury bills 2001 III (Skatkammerbevis 2001 III)	
Issued in 2001, DKK million	5,832
Interest payable	-
Stock exchange code	0980803
Issue commenced	1 Nov 2000
Redemption date	1 Aug 2001
No. 373, Treasury bills 2001 II (Skatkammerbevis 2001 II)	
Issued in 2001, DKK million	1,015
Interest payable	-
Stock exchange code	0980781
Issue commenced	1 Aug 2000
Redemption date	1 May 2001

CENTRAL-GOVERNMENT FOREIGN BORROWING TRANSACTIONS IN 2001[1] Table 3

Loan no.	Accept-ance date[4]	Issue date[4]	Nominal rate of interest, per cent p.a.	Type of loan	Maturity date[4]	Nominal amount in million	Lead manager/Lender
949	26-04-01	10-05-01	5	EMTN	10-11-04	500 USD	Dresdner / Nomura
950	18-05-01	25-05-01	0	EMTN	17-05-04	15 USD	UBS Warburg
951	18-05-01	25-05-01	0	EMTN	18-05-04	15 USD	UBS Warburg
952[2]	06-09-01	24-09-01	5.125	EMTN	28-12-06	1,000 USD	Dresdner / Nomura
10001[3]	26-06-01	03-07-01		CS	03-07-06		
10002[3]	06-08-01	10-08-01		CS	10-08-06		
10003[3]	08-08-01	15-08-01		CS	15-08-06		
10004[3]	04-10-01	08-10-01		CS	08-10-08		
10005[3]	09-10-01	15-10-01		CS	15-10-08		
10006[3]	09-10-01	16-10-01		CS	16-10-06		
10007[3]	31-10-01	05-11-01		CS	05-11-07		
10008[3]	08-11-01	12-11-01		CS	12-11-08		
10009[3]	13-11-01	19-11-01		CS	19-11-08		
10010[3]	20-11-01	26-11-01		CS	26-11-06		
298	01-11-01	05-11-01	0	ECP	30-11-01	31 USD	UBS Warburg
298	01-11-01	05-11-01	0	ECP	30-11-01	25 USD	Deutsche Bank
298	01-11-01	05-11-01	0	ECP	30-11-01	25 USD	Citibank International

[1] Including swaps, if any, in connection with new issues.
[2] Two attached swaps each of USD 500,000,000.
[3] EUR-leg of currency swap from DKK to EUR.
[4] Date format: dd-mm-yy.

CENTRAL-GOVERNMENT FOREIGN BORROWING TRANSACTIONS IN 2001[1] Table 3

Issue price	Commissions and expenses, per cent	Start date[4]	Counterparty	Notional amount in million	Nominal rate of interest	Amount in DKK million
100.8585	1.375	10-05-01	Dresdner Bank	555.25 EUR	6-month Euribor -0.20%	4,144.6
86.4	0.227	25-05-01	UBS	17.02 EUR	6-month Euribor -0.22%	126.9
86.4	0.227	25-05-01	UBS	17.08 EUR	6-month Euribor -0.22%	127.4
99.784	0.1	24-09-01	Dresdner Bank	565.85 EUR	6-month Euribor -0.18%	4,211.4
		24-09-01	MLCMB	563.70 EUR	6-month Euribor -0.18%	4,195.4
		03-07-01	Citibank N.A.	67.09 EUR	6-month Euribor -0.415%	499.4
		10-08-01	Deutsche Bank	67.15 EUR	6-month Euribor -0.334%	499.8
		15-08-01	UBS Warburg	134.35 EUR	6-month Euribor -0.353%	999.9
		08-10-01	Citibank N.A.	47.08 EUR	6-month Euribor -0.2575%	350.0
		15-10-01	Citibank N.A.	47.08 EUR	6-month Euribor -0.3005%	350.1
		16-10-01	BNP Paribas	40.35 EUR	6-month Euribor -0.3095%	300.1
		05-11-01	Citibank N.A.	67.16 EUR	6-month Euribor -0.2215%	500.2
		12-11-01	Deutsche Bank	53.69 EUR	6-month Euribor -0.229%	400.0
		19-11-01	Deutsche Bank	67.13 EUR	6-month Euribor -0.239%	499.7
		26-11-01	ABN AMRO Bank	53.73 EUR	6-month Euribor -0.2305%	399.9
99.85022						254.0
99.85022						204.8
99.85022						204.8

CENTRAL-GOVERNMENT DOMESTIC INTEREST-RATE SWAPS, 2001 Table 4a

Loan no.	Start date[1]	Termination date[1]	Amount in DKK million
390	26-01-01	26-01-11	200
392	14-02-01	14-02-11	200
393	20-02-01	21-02-11	250
394	21-02-01	21-02-11	200
395	05-03-01	05-03-11	200
396	23-03-01	23-03-11	200
397	26-03-01	26-03-11	200
398	02-04-01	04-04-11	200
399	19-04-01	19-04-11	200
402	04-05-01	04-05-11	200
403	10-05-01	10-05-11	200
404	15-05-01	16-05-11	200
405	22-05-01	22-05-11	200
406	23-05-01	23-05-11	200
407	12-06-01	14-06-11	200
408	14-06-01	14-06-11	200
409	19-06-01	20-06-11	500
410	21-06-01	21-06-11	200
411	27-06-01	27-06-11	200
412	29-06-01	29-06-11	300
413	13-07-01	13-07-11	200
414	16-07-01	16-07-11	200
416	03-08-01	03-08-11	200
417	05-09-01	05-09-11	500
418	05-10-01	05-10-11	500
419	16-10-01	17-10-11	200
420	17-10-01	17-10-11	200
Total			6,450

Note: The Kingdom of Denmark receives 10-year fixed interest and pays 6-month Cibor on all domestic interest-rate swaps entered into in 2001.
[1] Date format: dd-mm-yy.

CENTRAL-GOVERNMENT DOMESTIC INTEREST-RATE SWAPS
AS OF 31 DECEMBER 2001 Table 4b

Termination year	Notional amount in DKK million
2008	500
2009	7,450
2010	13,000
2011	6,450
Total domestic interest-rate swaps	27,400

Note: The Kingdom of Denmark receives 10-year fixed interest and pays 6-month Cibor on all domestic interest-rate swaps.

CENTRAL-GOVERNMENT SWAPS FROM DKK TO EUR, 2001 Table 4c

Loan no.	Start date[1]	Receiving			Paying			Termination date[1]	Fee in DKK million
		Currency	Million	Interest	Currency	Million	Interest		
10001	03-07-01	DKK	500.0	6-month Cibor -0.0175%	EUR	67.1	6-month Euribor	03-07-06	-0.6
10002	10-08-01	DKK	500.0	6-month Cibor -0.02%	EUR	67.2	6-month Euribor	10-08-06	-0.2
10003	15-08-01	DKK	1,000.0	6-month Cibor -0.02%	EUR	134.4	6-month Euribor	15-08-06	-0.1
10004	08-10-01	DKK	350.0	6-month Cibor -0.0325%	EUR	47.1	6-month Euribor	08-10-08	0.0
10005	15-10-01	DKK	350.0	6-month Cibor -0.0325%	EUR	47.1	6-month Euribor	15-10-08	0.1
10006	16-10-01	DKK	300.0	6-month Cibor -0.0325%	EUR	40.3	6-month Euribor	16-10-06	0.1
10007	05-11-01	DKK	500.0	6-month Cibor -0.0375%	EUR	67.2	6-month Euribor	05-11-07	0.2
10008	12-11-01	DKK	400.0	6-month Cibor -0.0375%	EUR	53.7	6-month Euribor	12-11-08	0.0
10009	19-11-01	DKK	500.0	6-month Cibor -0.0425%	EUR	67.1	6-month Euribor	19-11-08	-0.3
10010	26-11-01	DKK	400.0	6-month Cibor -0.0325%	EUR	53.7	6-month Euribor	26-11-06	-0.1

[1] Date format: dd-mm-yy.

CENTRAL-GOVERNMENT FOREIGN SWAPS UNCONNECTED TO NEW ISSUES, 2001 Table 4d

Loan no.	Start date[2]	Receiving			Paying			Termination date[2]	Fee in DKK million
		Currency	Million	Interest	Currency	Million	Interest		
946[1]	06-02-01	CHF	20.8	0	EUR	13.8	0	15-02-02	0.0
947[1]	06-02-01	CHF	30.0	0	EUR	19.8	0	15-02-02	0.0
948	01-03-01	GBP	25.5	13	EUR	40.7	6-month Euribor +7.84%	31-12-05	3.4
953	18-10-01	EUR	75.0	4.985	EUR	75.0	6-month Euribor	18-10-11	0.0
954	19-10-01	EUR	75.0	4.985	EUR	75.0	6-month Euribor	19-10-11	0.0

[1] Foreign-exchange forward transaction. Exchange of notional amounts at maturity only.
[2] Date format: dd-mm-yy.

CENTRAL-GOVERNMENT FOREIGN-EXCHANGE FORWARD TRANSACTIONS WITH DANMARKS NATIONALBANK, 2001[1] Table 4e

Loan no.	Start date[2]	Receiving on the termination date USD million	Paying on the termination date EUR million	Termination date[2]
955	05-11-01	81.0	89.3	30-11-01

[1] Foreign-exchange transactions connected to Commercial Paper issue.
[2] Date format: dd-mm-yy.

CENTRAL-GOVERNMENT DOMESTIC DEBT AS OF 31 DECEMBER 2001 Table 5

Serial no.	Coupon, per cent	Name Issue Period[1]	Redemption date	Outstanding amount, DKK million
Government bonds, fixed interest rate				
Bullet loans				
246	8	Stående lån 2003 2 Jan 1992-30 Dec 1993	15 May 2003	60,360.0
257	7	Stående lån 2004 25 May 1993-5 Dec 1994	15 Dec 2004	67,100.0
264	7	Stående lån 2024 6 Apr 1994-31 Dec 2000	10 Nov 2024	25,000.0
269	8	Stående lån 2006 5 Dec 1994-10 Apr 1996	15 Mar 2006	65,900.0
279	7	Stående lån 2007 10 Apr 1996-30 Dec 1997	15 Nov 2007	52,068.0
280	6	Stående lån 2002 18 Jun 1996-30 Dec 1998	15 Nov 2002	38,757.0
286	5	Stående lån 2005 14 Jan 1997-21 Jan 2002	15 Aug 2005	57,510.0
291	6	Stående lån 2009 14 Jan 1998-4 May 2000	15 Nov 2009	66,645.0
358	6	Stående lån 2011 4 May 2000-18 Feb 2002	15 Nov 2011	58,528.0
Serial loans				
14	5	S 2007 20 Oct 1953-12 Sep 1958	15 Sep 2007[2]	33.0
16	4	S 2017 29 Nov 1955-12 Sep 1958	15 Jun 2017[2]	84.2
57	10	S 2004 10 May 1983-30 Aug 1985	15 Oct 2004	2,844.0
Perpetuals				
1	3.5	Dansk Statslån 11 Dec 1886	perpetuals[2]	45.0
80	5	Dansk-Islandsk Fond 1918 20 May 1919	perpetuals	1.0
Government bonds, fixed interest rate, total				494,875.2

CENTRAL-GOVERNMENT DOMESTIC DEBT AS OF 31 DECEMBER 2001 Table 5

Serial no.	Coupon, per cent	Name Issue Peiod[1]	Redemption date	Outstanding amount, DDK million
Treasury notes				
Bullet loans				
319	4	Statsgældsbevis 2002 7 Jul 1999-19 Jun 2000	15 Mar 2002	34,100.0
371	5	Statsgældsbevis 2003 29 Jun 2000-7 Jan 2002	15 Nov 2003	36,688.0
Treasury notes, total				70,788.0
Treasury bills				
Zero-coupon loans				
400	0	Skatkammerbevis 2002 I 1 May 2001-1 Nov 2001	1 Feb 2002	8,106.0
401	0	Skatkammerbevis 2002 II 1 May 2001-1 Feb 2002	1 May 2002	21,792.0
415	0	Skatkammerbevis 2002 III 1 Aug 2001-	1 Aug 2002	13,866.0
421	0	Skatkammerbevis 2002 IV 1 Nov 2001-	1 Nov 2002	5,460.0
Treasury bills, total				49,224.0
Lottery bonds				
20	7	Præmieobligationslån af 1965/2010 22 Sep 1965	22 Sep 2010	100.0
21	7	Præmieobligationslån af 1969/2009 1 Oct 1969	31 Dec 2009	100.0
24	8	Præmieobligationslån af 1977/2002		
		I 14 Apr 1977	15 Feb 2002	100.0
		II 3 Jun 1977	15 May 2002	100.0
		III 24 Jun 1977	15 Jun 2002	100.0
		IV 28 Jul 1977	15 Jul 2002	100.0
		V 30 Aug 1977	15 Aug 2002	100.0
39	10	Præmieobligationslån af 1980/2005 28 Oct 1980	1 Jul 2005	200.0
Lottery bonds, total				900.0
Domestic government securities, total				615,787.2
Swap from DKK to EUR				-4,800.0
Central-government domestic debt, total				610,987.2

[1] The issue period refers to the period the series has been open for issue. For Treasury bills the dates refer to settlement date. Series still open for issue are marked with "-" after the first day of issue. Certain securities are only sold on one single date. For these securities only this date is stated.

[2] May be redeemed by the central government at three months' notice.

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount, DKK million (1)	Note
AUD loans					
838	3.46	1997/07 AUD(interest on 33.86 million)/JPY (redemption)	0.0	0.0	
-	3.46	1997/07 swap to DEM with floating rate	-0.0	-0.0	
869	5.625	1998/03	100.0	429.6	
-	5.625	1998/03 swap to DEM with floating rate	-100.0	-429.6	
Total AUD			0.0	0.0	
CAD loans					
802	6	1997/02	100.0	528.7	
-	6	1997/02 swap to DEM with floating rate	-100.0	-528.7	
876	5.25	1998/03	100.0	528.7	
-	5.25	1998/03 swap to DEM with floating rate	-100.0	-528.7	
Total CAD			0.0	0.0	
CHF loans					
313	0	1987/02	50.8	254.9	
796	2.25	1997/04	200.0	1,003.3	
-	2.26688	1997/04 swap to DEM with floating rate	-200.0	-1,003.3	
946	0	2001/02 swap to EUR with fixed rate	-20.8	-104.4	
947	0	2001/02 swap to EUR with fixed rate	-30.0	-150.5	
Total CHF			0.0	0.0	
CZK loans					
871	13.75	1998/02	1,000.0	234.1	
-	13.75	1998/02 swap to DEM with floating rate	-1,000.0	-234.1	
Total CZK			0.0	0.0	
DKK loans					
1	3	1894 perpetual	17.0	17.0	(3)
2	3.5	1901 perpetual	8.4	8.4	(3)
3	3.5	1909 perpetual	16.3	16.3	(3)
Total DKK			41.6	41.6	

[1] All loans are repaid at maturity unless otherwise stated.
The outstanding amount of some loans has been reduced during the term of the loan through buy-backs to which asset swaps often have been connected.
The redemptions are in some cases structured, i.e. they are calculated according to a certain formula and can be bigger or smaller than the outstanding amounts mentioned in the Table.

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
EUR					
BEF loans					
619	0	1995/03 swap to floating rate	-5,000.0	-921.7	(2)
-	float.	1995/03 swap from fixed rate	2,705.3	498.7	(2)
Total BEF			-2,294.8	-423.0	
DEM loans					
509	8.345	1992/02 swap from floating rate	100.0	380.2	
-	float.	1992/02 swap to fixed rate	-100.0	-380.2	
512	8.3	1992/02 swap from floating rate	100.0	380.2	
-	float.	1992/02 swap to fixed rate	-100.0	-380.2	
515	8.285	1992/02 swap from floating rate	50.0	190.1	
-	float.	1992/02 swap to fixed rate	-50.0	-190.1	
516	8.31	1992/02 swap from floating rate	50.0	190.1	
-	float.	1992/02 swap to fixed rate	-50.0	-190.1	
524	8.03	1992/02 swap from floating rate	100.0	380.2	
-	float.	1992/02 swap to fixed rate	-100.0	-380.2	
646	6.46	1995/02 swap from floating rate	100.0	380.2	
-	float.	1995/02 swap to fixed rate	-100.0	-380.2	
647	6.44	1995/02 swap from floating rate	100.0	380.2	
-	float.	1995/02 swap to fixed rate	-100.0	-380.2	
648	6.4	1995/02 swap from floating rate	100.0	380.2	
-	float.	1995/02 swap to fixed rate	-100.0	-380.2	
649	6.39	1995/02 swap from floating rate	100.0	380.2	
-	float.	1995/02 swap to fixed rate	-100.0	-380.2	
713	float.	1996/06 swap from FRF with floating rate	146.6	557.4	
714	float.	1996/02 swap from EUR with floating rate	94.0	357.2	
716	float.	1996/02 swap from EUR with floating rate	93.7	356.1	
717	float.	1996/02 swap from EUR with floating rate	188.0	714.9	
721	float.	1996/02 swap from EUR with floating rate	189.0	718.5	
723	8.05	1996/02 swap from EUR with fixed rate	283.2	1,076.8	
725	float.	1996/02 swap from EUR with floating rate	284.4	1,081.1	
735	6.3875	1996/06 swap from floating rate	146.6	557.4	
-	float.	1996/06 swap to fixed rate	-146.6	-557.4	
772	float.	1996/06 swap from USD with fixed rate	29.9	113.8	
780	4.75	1997/02	474.5	1,804.0	
790	5.925	1996/06 swap from floating rate	29.9	113.8	
-	float.	1996/06 swap to fixed rate	-29.9	-113.8	
793	float.	1997/02 swap from USD with fixed rate	591.6	2,249.2	
794	float.	1997/07 swap from JPY with structured rate	13.6	51.8	
795	4.75	1997/02	656.2	2,494.7	
796	float.	1997/04 swap from CHF with fixed rate	228.7	869.4	
798	4.885	1997/02 swap from floating rate	326.6	1,241.5	
-	float.	1997/02 swap to fixed rate	-326.6	-1,241.5	
799	5.73	1997/07 swap from floating rate	13.6	51.8	
-	float.	1997/07 swap to fixed rate	-13.6	-51.8	
800	5.275	1997/04 swap from floating rate	228.7	869.4	
-	float.	1997/04 swap to fixed rate	-228.7	-869.4	
802	float.	1997/02 swap from CAD with fixed rate	121.5	461.9	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
EUR - continued					
DEM loans – continued					
812	4.748	1997/02 swap from floating rate	121.5	461.9	
-	float.	1997/02 swap to fixed rate	-121.5	-461.9	
835	float.	1997/07 swap from JPY with fixed rate	69.4	264.0	
838	float.	1997/07 swap from AUD(interest)/JPY (redemption) with fixed rate	44.3	168.6	
841	float.	1997/03 swap from USD with fixed rate	862.5	3,279.1	
842	5.826	1997/07 swap from floating rate	69.4	264.0	
-	float.	1997/07 swap to fixed rate	-69.4	-264.0	
843	5.0625	1997/03 swap from floating rate	862.5	3,279.1	
-	float.	1997/03 swap to fixed rate	-862.5	-3,279.1	
844	5.6925	1997/07 swap from floating rate	44.3	168.6	
-	float.	1997/07 swap to fixed rate	-44.3	-168.6	
845	5	1997/03	471.5	1,792.5	
849	float.	1997/04 swap from USD with fixed rate	926.0	3,520.5	
850	float.	1997/07 swap from JPY with structured rate	31.0	117.9	
852	5.4675	1997/04 swap from floating rate	926.0	3,520.5	
-	float.	1997/04 swap to fixed rate	-926.0	-3,520.5	
853	float.	1997/07 swap from JPY with structured rate	7.6	28.8	
854	5.25	1997/04	1,000.0	3,801.8	
855	float.	1997/07 swap from JPY with fixed rate	49.3	187.3	
862	float.	1997/07 swap from USD with fixed rate	43.5	165.5	
863	float.	1997/04 swapped to floating rate	125.0	475.2	
864	5	1998/03	424.0	1,612.0	
869	float.	1998/03 swap from AUD with fixed rate	120.0	456.2	
870	float.	1998/05 swap from USD with fixed rate	908.6	3,454.3	
871	float.	1998/02 swap from CZK with fixed rate	53.2	202.1	
873	float.	1998/03 swap from GRD with fixed rate	57.7	219.3	
876	float.	1998/03 swap from CAD with fixed rate	121.5	461.7	
881	float.	1998/07 swap from NOK with fixed rate	74.3	282.4	
888	float.	1998/07 swap from SEK with fixed rate	102.0	387.8	
890	float.	1998/07 swap from SEK with fixed rate	101.5	385.9	
891	float.	1998/06 swap from SEK with fixed rate	81.9	311.4	
Total DEM			9,069.7	34,481.1	
EUR loans					(4)
493	8.5	1992/02	880.8	6,549.7	
510	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.73	1992/02 swap to floating rate	-50.0	-371.8	
511	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.69	1992/02 swap to floating rate	-50.0	-371.8	
518	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.63	1992/02 swap to floating rate	-50.0	-371.8	
519	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.63	1992/02 swap to floating rate	-50.0	-371.8	
520	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.61	1992/02 swap to floating rate	-50.0	-371.8	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
EUR - continued					
EUR loans – continued					
522	float.	1992/02 swap from fixed rate	100.0	743.6	
-	9.29	1992/02 swap to floating rate	-100.0	-743.6	
523	float.	1992/02 swap from fixed rate	50.0	371.8	
-	9.33	1992/02 swap to floating rate	-50.0	-371.8	
529	float.	1992/02 swap from fixed rate	25.0	185.9	
-	9.38	1992/02 swap to floating rate	-25.0	-185.9	
530	float.	1992/02 swap from fixed rate	25.0	185.9	
-	9.4	1992/02 swap to floating rate	-25.0	-185.9	
714	float.	1996/02 swap to DEM with floating rate	-50.0	-371.8	
716	float.	1996/02 swap to DEM with floating rate	-50.0	-371.8	
717	float.	1996/02 swap to DEM with floating rate	-100.0	-743.6	
721	float.	1996/02 swap to DEM with floating rate	-100.0	-743.6	
723	8.5	1996/02 swap to DEM with fixed rate	-150.0	-1,115.4	
725	float.	1996/02 swap to DEM with floating rate	-150.0	-1,115.4	
877	4.05	1998/03 swapped to floating rate	113.0	840.2	
879	4.625	1998/08	475.0	3,532.0	
887	3.105	1999/02 swap from USD with fixed rate	85.5	635.8	
-	3	1999/02 swap from USD with fixed rate	44.0	327.2	
889	3.4	1998/04 swapped to floating rate	89.0	661.8	
895	float.	1999/06 swap to USD with fixed rate (Swap concerning buy-back (USD 20 million) of loan no. 772)	-17.1	-127.0	
896	2.985	1999/02 swap from GRD with fixed rate	31.0	230.7	
906	float.	1999/04 swap from GBP with fixed rate	231.7	1,722.6	
-	float.	2000/04 swap from GBP with fixed rate	79.7	593.0	
907	float.	1999/05 swap from NOK with fixed rate	61.7	459.0	
909	float.	1999/03 swap from USD with fixed rate	233.7	1,737.7	
912	float.	1999/03 swap from SEK with fixed rate	171.4	1,274.1	
913	float.	1999/05 swap from USD with fixed rate	465.0	3,457.6	
-	float.	2000/05 swap from USD with fixed rate	35.1	261.0	
914	5.125	1999/05 swap from floating rate	100.0	743.6	
-	float.	1999/05 swap to fixed rate	-100.0	-743.6	
915	5.1625	1999/05 swap from floating rate	100.0	743.6	
-	float.	1999/05 swap to fixed rate	-100.0	-743.6	
917	float.	1999/02 swap from USD with fixed rate	375.6	2,792.8	
-	float.	2000/02 swap from USD with fixed rate	104.5	777.0	
920	float.	2000/03 swap from USD with fixed rate	309.3	2,299.6	
921	3.4	2000/04 swap from floating rate	4.0	29.7	
-	float.	2000/04 swap to fixed rate (Swap concerning buy-back (EUR 4 million) of loan no. 889)	-4.0	-29.7	
922	3.4	2000/04 swap from floating rate	3.0	22.3	
-	float.	2000/04 swap to fixed rate (Swap concerning buy-back (EUR 3 million) of loan no. 889)	-3.0	-22.3	
923	4.05	2000/03 swap from floating rate	3.0	22.3	
-	float.	2000/03 swap to fixed rate (Swap concerning buy-back (EUR 3 million) of loan no. 877)	-3.0	-22.3	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
EUR - continued					
EUR loans – continued					
924	float.	2000/03 swap from JPY(interest)/USD (redemption) with fixed rate	90.7	674.7	
926	3.4	2000/04 swap from floating rate	4.0	29.7	
-	float.	2000/04 swap to fixed rate (Swap concerning buy-back (EUR 4 million) of loan no. 889)	-4.0	-29.7	
927	4.05	2000/03 swap from floating rate	8.0	59.5	
-	float.	2000/03 swap to fixed rate (Swap concerning buy-back (EUR 8 million) of loan no. 877)	-8.0	-59.5	
930	float.	2000/02 swap from USD with fixed rate	117.3	872.4	
932	float.	2000/02 swap from JPY with fixed rate	49.2	365.8	
933	float.	2000/03 swap to GRD with fixed rate (Swap concerning buy-back (GRD 1,589.5 million) of loan no. 873)	-4.7	-35.1	
939	float.	2000/03 swap from USD with fixed rate	262.9	1,955.1	
941	float.	2000/03 swap from GBP with floating rate	65.0	483.5	
943	float.	2000/03 swap from GBP with floating rate	9.9	73.5	
944	float.	2000/03 swap from ZAR with fixed rate	7.9	59.0	
945	float.	2000/02 swap from USD with fixed rate	345.6	2,569.9	
946	0	2001/02 swap from CHF with fixed rate	13.8	102.3	
947	0	2001/02 swap from CHF with fixed rate	19.8	147.4	
948	float.	2001/05 swap from GBP with fixed rate	40.7	302.5	
949	float.	2001/04 swap from USD with fixed rate	555.2	4,128.7	
950	float.	2001/04 swap from USD with fixed rate	17.0	126.5	
951	float.	2001/04 swap from USD with fixed rate	17.1	127.0	
952	float.	2001/06 swap from USD with fixed rate	1,129.5	8,399.0	
953	float.	2001/11 swap from fixed rate	75.0	557.7	
-	4.985	2001/11 swap to floating rate	-75.0	-557.7	
954	float.	2001/11 swap from fixed rate	75.0	557.7	
-	4.985	2001/11 swap to floating rate	-75.0	-557.7	
10001	float.	2001/06 swap from DKK with floating rate	67.1	498.8	
10002	float.	2001/06 swap from DKK with floating rate	67.2	499.3	
10003	float.	2001/06 swap from DKK with floating rate	134.4	999.0	
10004	float.	2001/08 swap from DKK with floating rate	47.1	350.1	
10005	float.	2001/08 swap from DKK with floating rate	47.1	350.1	
10006	float.	2001/06 swap from DKK with floating rate	40.3	300.0	
10007	float.	2001/07 swap from DKK with floating rate	67.2	499.4	
10008	float.	2001/08 swap from DKK with floating rate	53.7	399.2	
10009	float.	2001/08 swap from DKK with floating rate	67.1	499.2	
10010	float.	2001/06 swap from DKK with floating rate	53.7	399.5	
Total EUR			6,550.8	48,710.0	
FRF loans					
514	float.	1992/02 swap from fixed rate	250.0	283.4	
-	9.43	1992/02 swap to floating rate	-250.0	-283.4	
713	float.	1996/06	500.0	566.8	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
EUR - continued					
FRF loans – continued					
-	float.	1996/06 swap to DEM with floating rate	-500.0	-566.8	
Total FRF			0.0	0.0	
GRD loans					
873	7.5	1998/03	8,410.5	183.5	
-	7.5	1998/03 swap to DEM with floating rate	-10,000.0	-218.2	
896	6	1999/02	10,000.0	218.2	
-	6	1999/02 swap to EUR with fixed rate	-10,000.0	-218.2	
933	7.5	2000/03 swap from EUR with floating rate (Swap concerning buy-back (GRD 1,589.5 million) of loan no. 873)	1,589.5	34.7	
Total GRD			0.0	0.0	
LUF loans					
619	0	1995/03	5,000.0	921.7	
Total LUF			5,000.0	921.7	
NLG loans					
211	9.5	1984/04	18.8	63.3	(5)
Total NLG			18.8	63.3	
EUR total			11,263.7	83,753.1	
GBP loans					
120	13	1980/05	25.5	310.6	
906	5.875	1999/04	200.0	2,437.1	
-	5.875	1999/04 swap to EUR with floating rate	-150.0	-1,827.9	
-	5.875	2000/04 swap to EUR with floating rate	-50.0	-609.3	
941	float.	2000/09 EIB loan, Danish Higher Education Framework A	40.8	497.2	
-	float.	2000/03 swap to EUR with floating rate	-40.8	-497.2	
943	float.	2000/09 EIB loan, Danish Motorways III B	6.2	74.9	
-	float.	2000/03 swap to EUR with floating rate	-6.2	-74.9	
948	13	2001/05 swap to EUR with floating rate	-25.5	-310.6	
Total GBP			0.0	0.0	
JPY loans					
794	float.	1997/07	1,000.0	64.1	
-	float.	1997/07 swap to DEM with floating rate	-1,000.0	-64.1	
835	2.63	1997/07	5,000.0	320.4	
-	2.63	1997/07 swap to DEM with floating rate	-5,000.0	-320.4	
838	0	1997/07 JPY(redemption)/AUD(interest)	3,000.0	192.3	
-	0	1997/07 swap to DEM with floating rate	-3,000.0	-192.3	
850	float.	1997/07	2,000.0	128.2	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
JPY loans – continued					
-	float.	1997/07 swap to DEM with floating rate	-2,000.0	-128.2	
853	float.	1997/07	500.0	32.0	
-	float.	1997/07 swap to DEM with floating rate	-500.0	-32.0	
855	2.02	1997/07 EIB loan, Danish Road By-passes B	3,400.0	217.9	
-	2.02	1997/07 swap to DEM with floating rate	-3,400.0	-217.9	
924	5	2000/03 JPY(interest on 10,000 million)/ USD (redemption)	0.0	0.0	
-	5	2000/03 swap to EUR with floating rate	-0.0	-0.0	
932	0.24	2000/02	5,000.0	320.4	
-	0.24	2000/02 swap to EUR with floating rate	-5,000.0	-320.4	
Total JPY			0.0	0.0	
NOK loans					
881	6.25	1998/07	330.0	307.7	
-	6.25	1998/07 swap to DEM with floating rate	-330.0	-307.7	
907	5.75	1999/05	500.0	466.2	
-	5.75	1999/05 swap to EUR with floating rate	-500.0	-466.2	
Total NOK			0.0	0.0	
SEK loans					
888	5	1998/07	500.0	399.5	
-	5	1998/07 swap to DEM with floating rate	-500.0	-399.5	
890	5.12	1998/07	500.0	399.5	
-	5.12	1998/07 swap to DEM with floating rate	-500.0	-399.5	
891	5.065	1998/06	400.0	319.6	
-	5.065	1998/06 swap to DEM with floating rate	-400.0	-319.6	
912	5.375	1999/03	1,500.0	1,198.4	
-	5.375	1999/03 swap to EUR with floating rate	-1,500.0	-1,198.4	
Total SEK			0.0	0.0	
USD loans					
772	6.065	1996/06 swap to DEM with floating rate	-20.0	-168.2	
793	0	1997/02	300.0	2,522.9	
-	0	1997/02 swap to DEM with floating rate	-300.0	-2,522.9	
841	6.625	1997/03	500.0	4,204.8	
-	6.625	1997/03 swap to DEM with floating rate	-500.0	-4,204.8	
849	6.25	1997/04	500.0	4,204.8	
-	6.25	1997/04 swap to DEM with floating rate	-500.0	-4,204.8	
862	4	1997/07	30.0	252.3	
-	4	1997/07 swap to DEM with floating rate	-30.0	-252.3	
870	5.75	1998/05	500.0	4,204.8	
-	5.75	1998/05 swap to DEM with floating rate	-500.0	-4,204.8	
887	3.875	1999/02	150.0	1,261.4	
-	3.875	1999/02 swap to EUR with fixed rate	-100.0	-841.0	
-	3.875	1999/02 swap to EUR with fixed rate	-50.0	-420.5	
895	6.065	1999/06 swap from EUR with floating rate (Swap concerning buy-back (USD 20 million) of loan no. 772)	20.0	168.2	

CENTRAL-GOVERNMENT FOREIGN DEBT AS OF 31 DECEMBER 2001[1] Table 6

Loan no.	Rate of interest, per cent p.a.	Title	Outstanding amount, million of currency	Outstanding amount DKK million (1)	Note
USD loans – continued					
909	6.375	1999/03	250.0	2,102.4	
-	6.375	1999/03 swap to EUR with floating rate	-250.0	-2,102.4	
913	6.625	1999/05	530.0	4,457.0	
-	6.625	1999/05 swap to EUR with floating rate	-500.0	-4,204.8	
-	6.625	2000/05 swap to EUR with floating rate	-30.0	-252.3	
917	6.375	1999/02	500.0	4,204.8	
-	6.375	1999/02 swap to EUR with floating rate	-400.0	-3,363.8	
-	6.375	2000/02 swap to EUR with floating rate	-100.0	-841.0	
920	7	2000/03	300.0	2,522.9	
-	7	2000/03 swap to EUR with floating rate	-300.0	-2,522.9	
924	0	2000/03 USD(redemption)/JPY(interest)	94.6	795.2	
-	0	2000/03 swap to EUR with floating rate	-94.6	-795.2	
930	0	2000/02	125.5	1,055.5	
-	0	2000/02 swap to EUR with floating rate	-125.5	-1,055.5	
939	7	2000/03	250.0	2,102.4	
-	7	2000/03 swap to EUR with floating rate	-250.0	-2,102.4	
945	6.875	2000/02	300.0	2,522.9	
-	6.875	2000/02 swap to EUR with floating rate	-300.0	-2,522.9	
949	5	2001/04	500.0	4,204.8	
-	5	2001/04 swap to EUR with floating rate	-500.0	-4,204.8	
950	0	2001/04	15.0	126.1	
-	0	2001/04 swap to EUR with floating rate	-15.0	-126.1	
951	0	2001/04	15.0	126.1	
-	0	2001/04 swap to EUR with floating rate	-15.0	-126.1	
952	5.125	2001/06	1,000.0	8,409.5	
-	5.125	2001/06 swap to EUR with floating rate	-1,000.0	-8,409.5	
Total USD			0.0	0.0	
ZAR loans					
944	11.375	2000/03	50.0	34.6	
-	11.375	2000/03 swap to EUR with floating rate	-50.0	-34.6	
Total ZAR			0.0	0.0	
Central-government foreign debt, total				83,794.7	

(1) The outstanding amount as of 31 December 2001 is calculated on the basis of the following exchange rates as of 31 December 2001, expressed as the exchange rate per 100 units: AUD = 429.56, BEF = 18.433, CAD = 528.67, CHF = 501.63, CZK = 23.405, DEM = 380.18, EUR = 743.57, FRF = 113.36, GBP = 1,218.57, GRD = 2.182, JPY = 6.4084, LUF = 18.433, NLG = 337.42, NOK = 93.24, SEK = 79.89, USD = 840.95, ZAR = 69.21.

(2) Swap (in BEF) of LUF loan.

(3) Multi-currency loan. The creditor can choose which currency to make payments in, however at a fixed rate of exchange. At present DKK is the most advantageous currency for the creditor. Redeemable by the Kingdom of Denmark at 3 months' notice.

(4) Including XEU loans issued before 1 January 1999.

(5) Redeemable according to the principle of annuities. Semi-annual or annual payments, beginning after a grace period of at least one year.

SERVICE ON CENTRAL-GOVERNMENT DOMESTIC DEBT[1], END-2001 Table 7

DKK billion	Interest	Redemptions	Total
2002	35.7	74.3	110.1
2003	31.9	98.0	130.0
2004	25.2	68.1	93.3
2005	20.4	57.7	78.1
2006	17.5	63.2	80.7
2007	12.4	51.6	63.9
2008	8.7	-1.6	7.1
2009	8.7	66.8	75.5
2010	4.7	0.1	4.8
2011	5.1	58.5	63.6
2012	1.8	0.0	1.8
2013	1.8	0.0	1.8
2014	1.8	0.0	1.8
2015	1.8	0.0	1.8
2016	1.8	0.0	1.8
2017	1.8	0.0	1.8
2018	1.8	0.0	1.8
2019	1.8	0.0	1.8
2020	1.8	0.0	1.8
2021	1.8	0.0	1.8
2022	1.8	0.0	1.8
2023	1.8	0.0	1.8
2024	1.8	25.0	26.8
Total	193.2	561.8	754.9

[1] Excluding Treasury bills. Including net interest payments on domestic interest-rate swaps. Currency swaps from kroner to euro are included in the redemptions. In the expiry year of the swap the central government receives kroner, which reduces the need for issuing domestic government securities. Domestic perpetuals are included in the redemptions in 2024.

SERVICE ON CENTRAL-GOVERNMENT FOREIGN DEBT[1], END-2001 Table 8

DKK billion	Interest	Redemptions	Total
2002	3.7	22.4	26.1
2003	2.5	17.1	19.6
2004	1.7	16.0	17.8
2005	1.0	7.9	9.0
2006	0.8	12.0	12.7
2007	0.3	2.5	2.9
2008	0.2	5.1	5.4
2009	0.0	0.6	0.6
2010	-0.0	0.0	-0.0
2011[2]	-0.0	0.0	-0.0
Total	10.2	83.8	94.0

[1] Including net interest payments on swaps.
[2] Perpetual loans are added to redemptions in 2011.

KINGDOM OF DENMARK'S RATING IN DOMESTIC CURRENCY — Table 9a

	Moody's	Standard & Poor's
1981, Mar		AAA
1986, Jul	Aa	
1986, Aug	Aa1	
1986, Nov	Aaa	
Current rating	Aaa	AAA

Note: Moody's Investors Service and Standard & Poor's use the following ratings:
Moody's: Aaa, Aa, A, Baa, Ba, B, Caa, Ca and C.
For the categories Aa to Caa are used 1, 2 or 3 to indicate a status slightly better or worse within the category.
Standard & Poor's: AAA, AA, A, BBB, BB, B, CCC, CC, C and D.
For the categories AA to CCC are used + or - to indicate a status slightly better or worse within the category.

KINGDOM OF DENMARK'S RATING IN FOREIGN CURRENCY — Table 9b

	Moody's	Standard & Poor's
1981, Mar		AAA
1983, Jan		AA+
1985, Apr	Aa	
1986, Aug	Aa1	
1987, Mar		AA
1991, Oct		AA+
1999, Aug	Aaa	
2001, Feb		AAA
Current rating	Aaa	AAA

Note: See the note in Table 9a for ranking of the rating categories.

RATING OF SELECTED COUNTRIES' CENTRAL-GOVERNMENT DEBT Table 10

	Moody's		Standard & Poor's	
	Domestic	Foreign	Domestic	Foreign
Australia	Aaa	Aa2	AAA	AA+
Belgium	Aa1	Aa1	AA+	AA+
Denmark	Aaa	Aaa	AAA	AAA
Finland	Aaa	Aaa	AA+	AA+
France	Aaa	Aaa	AAA	AAA
Greece	A2	A2	A	A
Netherlands	Aaa	Aaa	AAA	AAA
Ireland	Aaa	Aaa	AAA	AAA
Italy	Aa3	Aa3	AA	AA
Japan	Aa3	Aa1	AA	AA
New Zealand	Aaa	Aa2	AAA	AA+
Norway	Aaa	Aaa	AAA	AAA
Portugal	Aa2	Aa2	AA	AA
Spain	Aaa	Aaa	AA+	AA+
UK	Aaa	Aaa	AAA	AAA
Sweden	Aaa	Aa1	AAA	AA+
South Africa	A2	Baa2	A-	BBB-
Czech Republic	A1	Baa1	AA-	A-
Germany	Aaa	Aaa	AAA	AAA
USA	Aaa	Aaa	AAA	AAA
Austria	Aaa	Aaa	AAA	AAA

Note: As published in January 2002. Se the note in Table 9a for ranking of the rating categories.
Source: Moody's Investors Service and Standard & Poor's.

Glossary

This glossary presents explanations of a number of terms and concepts related to Danish institutional arrangements that are often used in Danish Government Borrowing and Debt. Terms in *italics* are included elsewhere in the glossary.

Copenhagen Inter Bank Offered Rate (Cibor)
The rate of interest at which a bank in the Copenhagen interbank market is willing to lend Danish kroner without collateral to another creditworthy bank. Cibor is fixed for loans of maturities of up to 12 months. Cibor is the reference interest rate for a large number of financial contracts.

Foreign-exchange reserve
The foreign-exchange reserve is Danmarks Nationalbank's holdings of net foreign assets.

Government debt
The government debt comprises the assets and liabilities of the central government which are managed by Government Debt Management at Danmarks Nationalbank. The government debt is compiled as the total domestic and foreign debt of the central government less the assets of the Social Pension Fund (SPF) and the balance of the central government's account with Danmarks Nationalbank.

Gross financing requirement
The gross financing requirement is compiled as expenditures by the central government less receipts to the central government, with addition of redemptions on the domestic and foreign debt and the net bond purchases of the Social Pension Fund (SPF). See also *Gross domestic financing requirement* and *Gross domestic borrowing requirement.*

Gross domestic borrowing requirement
The part of the *gross domestic financing requirement* that is covered by issuing domestic government securities.

Gross domestic financing requirement
Compiled as the *gross financing requirement* less redemptions of the foreign government debt.

Minimum coupon rate

The permitted minimum coupon rate for bonds that exempts the capital gains of investors who are liable to pay income tax in Denmark from taxation, cf. the Capital Gains Act (Legislative Order No. 901 of 11 October 2001 with subsequent amendments).

Ordinary fixing of the minimum coupon rate takes place for the six-month periods January-June and July-December. The minimum coupon rate is fixed on the basis of a reference yield calculated on a daily basis by the Copenhagen Stock Exchange. The reference yield is calculated to two decimal places as a simple average of the yields to maturity for open, fixed-yield krone bonds (apart from *callable bonds* quoted above par, and index-linked bonds) for the last 20 trading days prior to 15 December and 15 June. The minimum coupon rate is 7/8 of the average yield thus compiled, rounded down to the nearest whole number of percentage points.

The minimum coupon rate can be changed extraordinarily should the reference yield on 10 consecutive trading days be more than 2 percentage points higher, or 1 percentage point lower, than the average which is the basis for the current minimum coupon rate. The new minimum coupon rate is 7/8 of the average of the reference yield for these 10 trading days, rounded down to the nearest whole number of percentage points.

The ordinary minimum coupon rate was 4 per cent in the 1st and 2nd halves of 2001. With effect from 23 November 2001 the minimum coupon rate was lowered extraordinarily to 3 per cent. The minimum coupon rate for the 1st half of 2002 is 4 per cent.

Monetary-policy counterparties

Danish banks and mortgage-credit institutes, and a number of branches of foreign credit institutions, are the monetary-policy counterparties in Denmark. The monetary-policy counterparties have access to the monetary-policy instruments: deposits with Danmarks Nationalbank on a day-to-day basis, purchase of certificates of deposit and loans against securities as collateral.

Net financing requirement

The net financing requirement is compiled as expenditures by the central government less receipts to the central government. Corresponds to the net cash balance with sign opposite.

Saxess

Electronic trading system for bonds and shares used on e.g. the Copenhagen Stock Exchange.

Social Pension Fund (SPF)
The Social Pension Fund (SPF) was established by law in 1970 whereby a special national retirement pension contribution was introduced. The proceeds were allocated to SPF and invested in bonds. With effect from 1982 the Act was amended, and the payments to SPF ceased. SPF was continued as an asset of the central government.

Tap sale
Issues in the same series on a current basis. In Denmark the issue of Treasury notes and government bonds, as well as mortgage-credit bonds, is normally by tap sale.

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