

Liquidity and scarcity in the Norwegian government bond market

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The Norwegian government issues debt in the bond and bill market. Market prices for these instruments contain information about market expectations concerning the required real rate of return and inflation. The quality of the information depends in part on the efficiency of price formation.

This article describes the structure of the Norwegian government bond market and liquidity in the market. The article also considers the impact of supply and demand on price formation in the government bond market. Compared with other government bond markets, liquidity in the Norwegian market is considered to be relatively limited, and there are signs of a scarcity premium in price formation.

Introduction

Pricing in financial markets is anchored in the risk-free yield curve.¹ It is normally derived from the government securities market and contains information about the market's perception of future required real rate of return and inflation. A central bank can use the information to derive market expectations concerning monetary policy.

The quality of the information that can be derived from prices depends on market efficiency and on the existence of and variations in different price premia. Government debt policy is thus geared towards underpinning liquidity in the government bond market with a view to reducing the price premia. This also contributes to reducing government borrowing costs.²

This article is structured as follows: After defining liquidity in general, the structure and liquidity in the Norwegian government bond market are considered. We then attempt to estimate different measures of the liquidity premium on Norwegian government bonds compared with bonds issued by other institutions. The paper concludes with a description of the impact of the market's limited size on the pricing of government bonds.

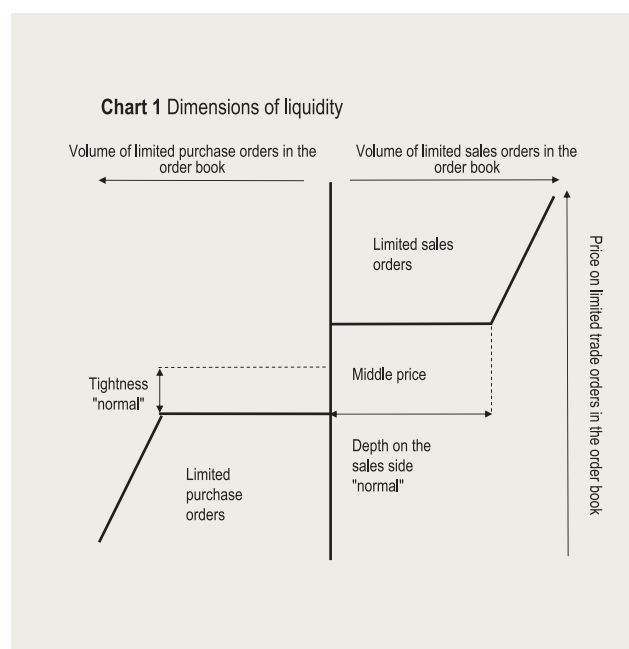
1. Liquidity in general

Liquidity is a relatively vague concept, but the following three dimensions are often attributed to liquidity in the literature:

- *Tightness* describes the spread between tradable prices and the middle rate, and is thus an expression of transaction costs in the market.
- *Depth* describes the volume that can be transacted without price impact.
- *Resiliency* describes the market's capacity to return to normal after a trade.

The definition of liquidity implies that the market can normally be characterised as liquid if market participants are able at all times to execute large trades quickly without affecting market prices to any considerable extent. Reduced tightness, greater depth and greater resiliency thus imply a more liquid market.³

Chart 1 shows the order book in an order-driven market. The order book contains limit orders that shows the volumes that can be bought (sold) immediately in the market, and at what prices. The depth on the sales side is defined as the volume that can be bought without price impact. Normal depth on the sales side in the order book is shown in the chart. Tightness is the difference between the price of the best limited purchase order (highest price) and the best limited sales order (lowest price), and is shown in the chart.



¹ The capital asset pricing model (CAPM) is an example of a model that explains, against the background of risk-free yield, the relationship between expected return and the risk associated with a given investment.

² Norges Bank functions, under agreement with the Ministry of Finance, as adviser and arranger for the State in the area of domestic debt issuance. See box for a description of government debt issuance.

³ Immediacy is another concept often used as an expression of liquidity. Immediacy, defined as the time it takes to trade a volume of a certain size within a given price interval, incorporates elements of the other features and strictly speaking cannot be regarded as a separate feature.

Resiliency contains a time element. Assume that a number of limited sales orders are executed so that the lowest sales price in the order book increases. Tightness and possibly depth are now no longer at normal levels. Resiliency then indicates the speed at which the market will normalise, i.e. the time it takes for tightness and depth to return to normal levels. Note that this does not necessarily imply that the middle price remains unchanged.

The impact of the various features of liquidity partly depends on market structure and the number of market participants, their size and behaviour. It is difficult to compare liquidity across different markets because the same measures of liquidity can provide different indications of how well the markets function. International comparisons of liquidity in government bond markets are thus not a straightforward exercise. In the description of liquidity in the Norwegian government bond market, we will nevertheless provide a brief account of our findings in relation to other government bond markets.

2. Market structure in the secondary market for Norwegian government bonds

Participants

Participants in the Norwegian government bond market can be divided into three main categories: the State and Norges Bank, which are respectively the borrower and arranger of issues, banks and brokerage firms as intermediaries, and investors as end-users of government bonds. Norges Bank is also responsible for market-making in the government securities market and Norges Bank has entered into a primary dealer agreement with a number of brokerage firms concerning pricing in the government bond market.

A heterogeneous market, where investors have different perceptions as to the value of bonds, different trading needs and different interests in different segments of the maturity spectrum, will normally feature a larger trading volume and a higher degree of liquidity than a homogeneous market. In a homogeneous market, primary-dealers will be exposed to “one-way trading”, which will either increase or reduce their bond holdings and be associated with an unacceptably high risk. This may reduce liquidity.

As a result of consolidation in the financial sector in Norway, the number of banks and brokerage firms that are active as intermediaries in the government bond market declined through the 1990s. Government bond intermediation primarily occurs via the primary dealers today. The concentration on the investor side is also relatively high, with life insurance companies, pension

Table 1. Distribution of government bond holdings, January 2003

Sector	Holdings of volume of government bonds outstanding
Foreign sectors	41.6%
Private pension funds, incl. life insurance companies	34.6%
Government and social security sector	5.5%
Non-life insurance companies	2.5%
Securities funds	2.3%
Private limited companies	2.3%
Commercial banks, incl. Postbanken	1.0%
Municipalities	1.4%
Others	8.9%
Total	100.0%

Source: Norwegian Central Securities Depository

funds and foreign sectors as the dominant participants. These groups combined accounted for 76 per cent of outstanding government bond holdings at end-2002 (see Table 1).

The trading process

Secondary market trading in Norwegian government bonds takes place in two different venues. The largest share of trading occurs in the telephone market, where stock exchange members trade with each other and with investors. Trades that are agreed in the telephone market are to be reported forthwith to the Oslo Stock Exchange, but it is possible to defer the publication of the trade, which makes it easier for primary dealers to reduce their own risk in the market. As a result, they can better underpin market liquidity.

The Oslo Stock Exchange’s AM sub-market⁴ is an order-driven market where stock exchange members’ orders are collected in an order book for each bond that is traded. Buy and sell orders are matched according to the applicable rules. Primary dealers are required to quote prices in this market, with defined limits as to the maximum allowed difference between bid-ask prices (bid-ask spread) and a minimum requirement as to volume (see appendix). The requirements relating to primary dealer pricing in the AM sub-market ensures a minimum degree of liquidity under all market conditions and for all groups of investors. In addition to the trading-oriented function, pricing in the AM sub-market serves as a reference for investors trading in the telephone market.

⁴ Oslo Stock Exchange’s ordinary sub-market with automatic order matching.

Government debt issuance

The government issues debt in the domestic market at the same time as a portion of the budget surplus is allocated to the Government Petroleum Fund. This is done among other things, cf. Proposition no. 1 to the Storting, Annex 14 (2002-2003), for the following reasons:

- Consideration for the balance in the money market
- Consideration for the government's cash holdings
- The intrinsic value of government loans

Government debt issuance also gives the government easier and cheaper access to the capital markets and may be viewed as a kind of insurance in the event of a net financing need.

Debt issuance strategy

The strategy for domestic debt issuance reflects a desire to deliver a correct, risk-free yield curve up to 10-year maturity. In recent years, borrowing in the bond market has been based on a pattern whereby a new 11-year bond is introduced roughly every other year. Issuance has mainly reflected the desire to rapidly increase the volume in the newest (and longest) loan. Table 3 shows the five outstanding benchmark bonds.

Predictability of issuing activity is important for market participants. Therefore, the government does not issue debt for short-term commercial reasons.

Traditionally, government bonds have been increased to about NOK 20-30 billion. After reopening the bonds, the outstanding volume of the two

Norwegian benchmark bonds, per 1 April 2003.

Bond	Nominal - interest rate	Maturity	Outstanding volume, in billions of NOK
NST 465	5.75%	30.11.04	38.75
NST 467	6.75%	15.01.07	35.90
NST 468	5.50%	15.05.09	23.60
NST 469	6.00%	16.05.11	22.00
NST 470	6.50%	15.05.13	17.00
Total			121.25

largest bonds is currently close to NOK 40 billion.

Method of issue

In December, Norges Bank usually publishes a circular containing the auction calendar for government bonds and Treasury bills for the next year. The calendar does not contain information about the issues or volumes to be auctioned. In the bond market, this information is published one week prior to the auction. Pre-announced auctions may be supplemented by ad-hoc auctions when justified by special circumstances. In recent years, there have been five to six auctions of government bonds each year. Issue volume has varied from NOK 2 billion to NOK 6 billion.

Norges Bank is responsible for the sale of Treasury bills and government bonds in the market. The sales are executed via the Oslo Stock Exchange's trading system, Saxess. Tenders may be offered by members of the stock exchange or directly by telefax to Norges Bank. The issue is awarded at the highest price that will ensure sale of the total volume, if this price is acceptable.

3. Liquidity in the Norwegian government bond market

In the following, we evaluate liquidity in the government bond market using different indicators of market tightness and depth. The evaluation is based on prices data from the order books in the AM sub-market and order volume data.

Tightness

Market tightness is normally defined as the difference between bid and offer prices in the market, the spread.⁵ In the government bond market, there are two spreads that are of relevance, the spread in the AM sub-market and the spread in the telephone market.

The spread in the AM sub-market is directly available

to all stock exchange members and in principle also to investors via the possibility of routing⁶ trades directly into a trading system. The Oslo Stock exchange registers all orders that are entered in this market. This makes it possible to estimate the spread exactly.

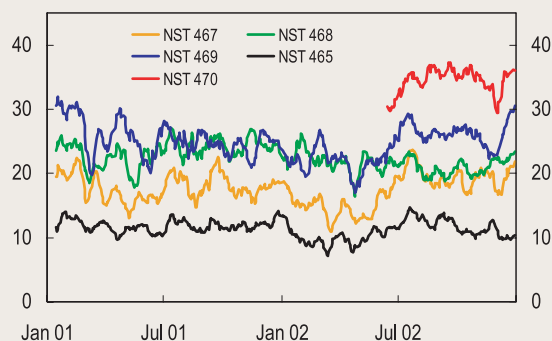
Chart 2 shows the price spreads quoted in the period 2001-2002. The price spread is wider for bonds with longer residual maturities. This is because the price risk is normally higher for bonds with longer residual maturities owing to higher price variations⁷, and this has implications for the obligations primary dealers will commit to. The lower the liquidity for a bond series the higher the risk because the costs of adjusting bond holdings after a trade increase if liquidity is poor. This may be the reason for the considerable spread in the longest bond (NST 470), which is still being increased. The primary

⁵ According to the definition of tightness, the spread corresponds to two measures of tightness.

⁶ Routing means that investors that have an agreement with a stock exchange member can put in an order on the stock exchange via the Internet.

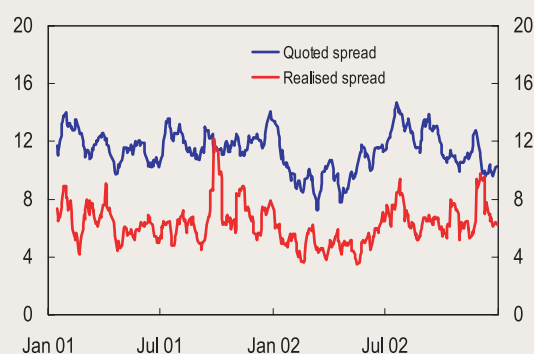
⁷ Measured in interest rate basis points, the spread for the various bonds with different maturities is approximately the same.

Chart 2 Quoted price spread in basis points. 10-day moving average of daily time-weighted spread in the AM sub-market.



Sources: Oslo Stock Exchange and Norges Bank

Chart 3 Quoted (time-weighted) and realised (trading volume weighted) basis point spread in prices for NST 465. 10-day moving average



Sources: Oslo Stock Exchange and Norges Bank

dealers' access to borrowing bonds in Norges Bank reduces such costs, and underpins liquidity in the market.

The average quoted spread reflects the requirements concerning primary dealer spreads in the agreement with Norges Bank. The quoted spreads increased somewhat when the volume requirements for shorter bonds stated in the primary dealer agreement were tightened on 27 May 2002.⁸

The spread in the telephone market is of relevance because the bulk of trading takes place in this market. There are no data for pricing in the telephone market, but all transactions are immediately reported to the Oslo Stock Exchange. The trades executed make it possible to estimate the spread.

The spreads realised in all transactions in both markets in government bond NST 465, with maturity on 30 November 2004, calculated here as two times the distance from the price in the trades executed at the simultaneous middle price in the AM sub-market⁹, are used as a measure of the effective spread in the total market for this bond. Chart 3 shows quoted and realised spreads for government bond NST 465. The realised spread is 5 price basis points lower than the spread quoted in the AM sub-market. The realised spread is generally expected to be lower than the quoted spread because the trader can decide the timing and generally prefers trading when the spread is small.

The spreads indicate that the liquidity in the total government bond market can be regarded as better than that observed in the AM sub-market.

In the latter part of 2002, the spread in the Norwegian government bond market was about 12, 20 and 25 price

basis points, respectively, for the maturities 2, 5 and 10 years, using prices through the trading day in the AM sub-market. In comparison, the average spreads in the Danish government bond market were respectively about 6, 8 and 10 price points for the 2, 5 and 10-year segments.¹⁰ The corresponding spreads for Finnish government bonds were 4, 6 and 8 price points.¹¹ Different measures for both volume and price and differences in market structure make it difficult to make a direct price comparison. Nevertheless, the figures indicate that liquidity in the Norwegian market is poorer than in the two other markets.

Depth

The depth of the government bond market (the volume that can be transacted in the market without price impact) is evaluated on the basis of the volume that can be traded immediately in the AM sub-market and on total turnover. These are indirect indicators of depth, which do not provide direct information as to the volume that can be traded without price impact, or information as to price sensitivity to order flows. However, both indicators give an impression of the trade flow that the market "normally" accommodates.

Norges Bank monitors pricing in the AM sub-market to ensure that it is in line with the requirements in the primary dealer agreement. In this connection, the total volume available in the AM sub-market is registered. The volumes available in the order books in the AM sub-market reflect to a large extent the number of primary dealers and the agreement's pricing requirements

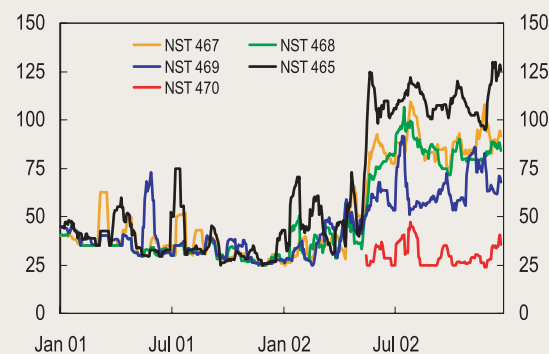
⁸ This occurred at the same as the transition to the trading system SAXESS on the Oslo Stock Exchange and the introduction of the right to delay the publication of trades until the end of the trading period.

⁹ It is assumed that the middle price in the telephone market and the AM sub-market is the same and that the spread in the telephone market is symmetrical around the middle price.

¹⁰ Average spreads at the end of the trading period, October 2002

¹¹ In the electronic MTS trading system

Chart 4 Volume of purchase orders in the order book in the AM sub-market, in millions of NOK. 10-day moving average of daily observations at 2 pm 1400.



Sources: Oslo Stock Exchange and Norges Bank

(see Chart 4).¹² The increase in the order book in mid-2002 reflects the increase in the volume requirements¹³ applying to the primary dealers, while the gradual reduction in the lower volume limit through 2001 is attributable to the reduction in the number of primary dealers from 7 to 5.

Higher volume requirements for primary dealers have improved liquidity, as measured by depth. This has enabled stock exchange members to transact larger volume at all times. The increase in volume requirements was also introduced with a view to achieving a more accurate price picture in the AM sub-market, which has since been achieved as confirmed by various market participants.¹⁴

Turnover in the government bond market is often used as a measure of liquidity. Turnover can also provide a

picture of market depth because it depends on market participants' evaluation of transaction costs. All other things being equal, turnover will increase when transactions costs are reduced.

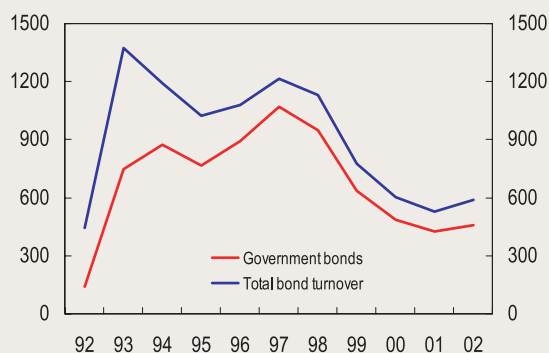
Turnover in the Norwegian government bond market has declined considerably since 1998 (see Chart 5), despite virtually no change in the volume of government bonds outstanding. The same picture applies to the rest of Europe. Consolidation in the financial sector, which has also resulted in a fall in the number of primary dealers, may be one of the main explanatory factors behind the decline. In addition, major international investors, that were previously active in the Norwegian bond market, have reduced their presence.

The turnover rate¹⁵ in the Norwegian government bond market is low in an international context. In 2002, the average annual turnover rate for the five bond issues outstanding was 3.5 per year (see Table 2). Government bond NST 469 functioned in 2002 as a benchmark bond in the internationally important 10-year segment. This contributed to relatively high turnover in the bond. By comparison, the turnover rate for Danish benchmark bonds¹⁶ in the 2, 5 and 10-year segments was about 10, 6 and 14, respectively, per year.¹⁷

Liquidity premium

Normally, investors will require compensation for investing in a fairly illiquid instrument. A comparison of the pricing of two bonds that feature approximately the same coupon, residual maturity and credit risk provides an indication of how the market evaluates the liquidity in government bonds compared with other bonds. As a rule, the most liquid bond will be traded at a higher

Chart 5 Annual turnover of bonds and government bonds on the Oslo Stock Exchange. In billions of NOK



Source: Oslo Stock Exchange

Table 2 Annual turnover rate for Norwegian government bonds, 2002

	Turnover rate (turnover/ volume outstanding)	Volume outstanding Annual average, in NOK billions
NST 465	4.1	29.5
NST 467	2.9	29.0
NST 468	2.9	23.2
NST 469	4.0	21.6
NST 470	2.4	9.0
Total	3.5	109.0

* NST 470 was launched in May 2002. The figures show the annual turnover rate.
Source: Oslo Stock Exchange, Norges Bank

¹² Volume on the sales side of the market does not systematically deviate from the purchase side.

¹³ The volume requirement in pricing was changed from NOK 5 million per primary dealer in all bonds to differentiated volume, with larger volumes for bonds with shorter residual maturities.

¹⁴ Data on pricing in the AM sub-market show that the middle price in the order book for NST 469 was changed 20 per cent more frequently after the transition to the SAXESS trading system and higher volume requirements in the primary dealer agreement.

¹⁵ Turnover rate is estimated as turnover in relation to nominal volume outstanding.

¹⁶ A benchmark bond is a trendsetting bond whose price is generally perceived as an expression of market trends.

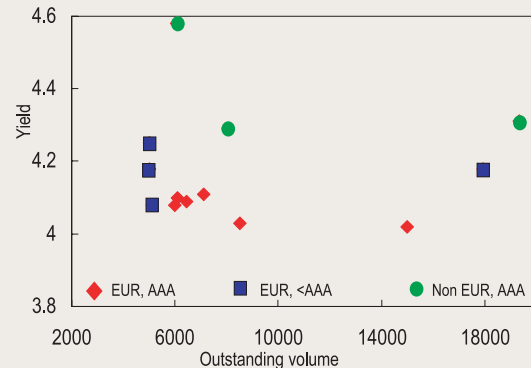
¹⁷ Based on turnover in October 2002

Chart 6 Yield on government bond NST 467 and a (synthetic) bond with the same maturity issued by Norges Kommunalbank



Sources: Reuters, Oslo Stock Exchange and Norges Bank

Chart 7 Yield and outstanding volume for EU countries' government bonds in the 10-year segment. 1 April 2003



Source: Reuters

price, i.e. a lower yield. This price difference is often referred to as the liquidity premium.

Chart 6 presents such a comparison of government bond NST 467, with maturity on 15 May 2007, and a (synthetic) government-guaranteed bond with equal maturity issued by Norges Kommunalbank (private municipal bank).¹⁸ The volume outstanding in the municipal bank bond amounted to about NOK 2.5 billion through 2002, while the volume outstanding in the government bond was between NOK 29 and 31 billion.

The municipal bank bond has a government guarantee, but has been traded at an average 21 interest rate basis points above the government bond through 2002. The main reason for this is that the municipal bank bond is less liquid.

In the market for government bonds issued by EU countries, similar factors explain yield spreads between government bonds issued by various countries, but with the same creditworthiness (see Blanco (2001)). Chart 7 shows the yields on different EU countries' benchmark government bonds in the 10-year segment and the volume outstanding¹⁹. For AAA/Aaa-rated²⁰ EUR-denominated government bonds, there is a negative relationship between yield and volume outstanding. In light of this relationship, one could expect that a comparable bond with a volume outstanding of EUR 2000 million would have a liquidity premium that is at least 10 interest rate basis points higher than the yield on the German government bond, which has the lowest yield in the chart.

The yield spread between different countries' government bonds, denominated in different currencies, consists of several components. In addition to differences in

the liquidity premium, the differential primarily reflects differences in expected inflation and exchange rate developments, and different premia that are normally attributable to differences in credit risk for the bonds.

The yield spread between Norwegian and German government bonds can be roughly decomposed into these components. Since Norwegian and German government bonds are both Aaa-rated, the credit risk component has little impact on the yield differential in practice.

The impact of differences in expected inflation and exchange rate developments and exchange rate risk can be determined by using interest rate swaps.²¹ The swap rate reflects expectations concerning short rates in the period to the swap's maturity. The difference between swap rates in different currencies can be looked upon as a rough expression of the market's evaluation of the components that stem from inflation and exchange rate differences.²²

The difference between Norwegian and German (euro) 10-year swap rates and 10-year government bond yields in the latter half of 2002 indicates that elements related to liquidity and any other factors combined accounted for minus 2 points. Since Chart 7 indicates that the liquidity premium on an Aaa-rated bond with a volume outstanding equivalent to EUR 2000 million is at least 10 points higher than for the German government bond, one could have expected a positive residual factor.

The method used may thus indicate that there was a scarcity premium in the pricing of the Norwegian 10-year government bond in the latter half of 2002, and that this contributed to reducing the yield.

¹⁸ The municipal bank bond consists of KOMB63, 8.15%, 95/05 and KOMB73, 5.5%, 98/08.

¹⁹ Differences in residual maturities and coupon rates give a duration between 7 and 8 years.

²⁰ S&P 500/Moody's

²¹ The parties in an interest rate swap agree to swap interest payments on a defined principal over a fixed period. Normally, a fixed (swap) rate is exchanged against a variable (money market) rate. The swap rate is set so that the present value of in-going and out-going payments is equal. Swap rates are also to some extent influenced by supply and demand conditions.

²² The participants in the swap market in Norway and Europe are fairly similar so that credit risk is not taken into account in the comparison. It is also assumed implicitly that the liquidity premium for the Norwegian and European swap rate is approximately the same.

4. The significance of a shortage of Norwegian government bonds

Fluctuating supply and demand pressures may be expressed in prices to a degree that does not reflect the market's assessment of fundamental factors. When outstanding volume is low, such pressures may take hold in the market and prices may be affected more permanently by the trading flow. This price component is often called a shortage premium. Such price components may fluctuate widely if demand is relatively large and represents a particularly homogeneous group. This tendency can at times be observed in the Norwegian government bond market.²³ Variations in the shortage premium undermine the value of the information that may be derived from the government yield curve.

Cooper and Scholtes (2001) analyse the importance for pricing of reduced supply (in the primary market) of US and British government bonds. Coopers and Scholtes state that incorrect pricing depends on two factors: i) there is a group of investors with price-inelastic demand for government bonds and ii) the supply of government bonds is low enough that this investor group becomes the marginal and hence dominant investors that dictate the bond price. Their article suggests that price inelasticity of demand is a result of regulations that require or parameters that motivate investors to buy government bonds in spite of a yield rate that is "too" low.

A number of conditions in the Norwegian bond market imply that supply and demand conditions may have a particularly large impact on price formation:

- Outstanding volume in the government bond market is limited and has declined in the last few years relative to the demand side of the market.
- The possibility of classifying government bonds as fixed assets reduces in practice the remaining supply in the secondary market.
- Prevailing regulations provide life insurance companies and pension funds with some incentive to invest in safe government bonds. This may apply in particular in periods when negative returns on the companies' investment portfolios deplete the buffer capital and reduce the companies' ability to invest in instruments with higher expected returns and risk.
- Integration in the European (government) bond market may have increased Norwegian government bonds' value in the international market as an instrument of diversification. At times, this may increase the demand from abroad for Norwegian government bonds.
- Norwegian government bonds, which are used as collateral for loans in Norges Bank, give the least haircut in the value of the loan.

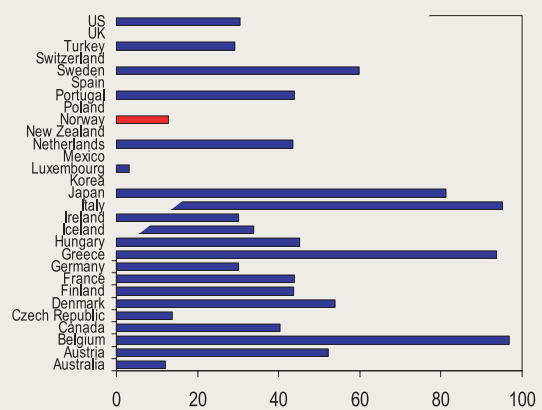
Norwegian government debt in a European perspective

As of 1 January 2003, outstanding government debt in the note and bond markets was NOK 51.5 billion and NOK 124.6 billion respectively.¹ In an international perspective, Norwegian government debt is small, calculated both in absolute value and relative to GNP, cf. chart. Outstanding volume in the individual Norwegian government bonds is therefore relatively low by international standards.

Integration in the European government bond market in recent years has led to increased competition among issues from the various EU countries. Greater substitutability between different countries' issues in euro has contributed to this. Liquidity has become a decisive competitive parameter, and this has contributed to increasing the focus on benchmark loans with large outstanding volume. The segments being given priority are 2, 5 and 10-year bonds, and the outstanding volume is often more than 5 billion, which is the minimum requirement for listing on the European electronic marketplace EuroMTS.

Differences in the size of the bond issues, the market structure and the existence of substitutable instruments means that government bond liquidity is often better in the EU countries' than in Norway and that scarcity has less impact on prices.

Chart Securitised government debt as a percentage of GDP in the OECD countries. 2000



Source: OECD

¹ Debt issues include NOK 3.4 billion in repayment loans which were issued during the period 1968 to 1986.

The possibility of achieving cheap financing by entering into a buy-back agreement (repo²⁵) at a low yield on government bonds with scarcity in the market may help

²³ Scarce supply also makes the market vulnerable to the behaviour of individual market participants, and at times allows individual market participants to achieve enough market power to have a pronounced influence on prices.

²⁴ Elasticity expresses how sensitive demand or supply is to price changes. Inelastic demand (supply) means that demand (supply) is not sensitive to price changes.

²⁵ A repo (repurchase agreement) is a buy-back agreement for a security, where the date and price is set. Because a repo involves the purchase of a security at one price and sale at another, there is an implied yield on the liquidity which changes hands during the life of the repo. In the repo market, repos are traded on the basis of this yield.

to increase the willingness to pay above and beyond the fundamental value.²⁶

The following illustrates the significance of scarcity in pricing of a Norwegian government bond. Developments in the price of government bond NST 465 in the autumn of 2002 indicate that scarcity was a real and significant factor in price formation. Chart 8 shows developments in the yield spread between government bond NST 465 and an interest rate swap with an equal residual maturity, i.e. the swap spread. Normally, the swap spread consists primarily of a credit risk component. As a rough approximation, it is assumed that the swap rate has been correctly priced on the basis of expectations concerning real interest rates and inflation and the addition of relevant premia. This is the basis of comparison in Chart 8. The swap market may be affected to some degree by supply and demand pressures, but probably to a lesser degree than the bond market, which has real supply limitations. In addition, underlying figures indicate that turnover is considerably larger in the swap market than in the bond market. This underpins efficiency in this market.

If pricing in the government bond market is not affected by supply and demand pressures, the swap spread, by means of a constant credit risk premium, will normally be relatively stable over time. The stability in the German swap spread indicates that variations in the credit risk premium in the Norwegian swap rate²⁷ in the last half of 2002 have not been large.

Chart 8 shows that the swap spread in Norway widened markedly in the fourth quarter of 2002. Until that time, the spread had shown a tendency to narrow to a level that was roughly 15 points above the German swap spread.

Life insurance companies, pension funds and foreign sectors are not considered to be very price sensitive with regard to supply and demand in this period. After a pro-

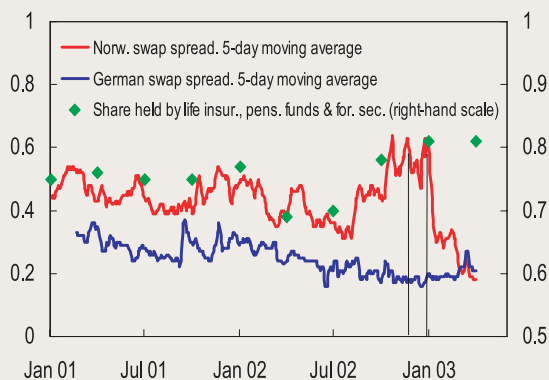
nounced fall in stock markets in the two preceding quarters, it may be assumed that life insurance companies' and pension funds' willingness to pay for government bonds was relatively high. The fall in the equities markets combined with high interest rates in the krone market made it favourable for foreign sectors to invest in Norwegian government bonds. In addition, the Norwegian krone was considered to be a safe haven during a period marked by uncertainty in the Middle East, high oil prices and an international recession.

According to VPS statistics, these groups' holdings of NST 465 increased from 69 per cent to 81 per cent of the total outstanding volume from the beginning of the second quarter to year-end. The increase was primarily the result of acquisitions by foreign sectors. Chart 8 also shows the proportion of NST 465 owned by insurance companies, pension funds and foreign sectors. The chart shows that the swap spread, as an expression of the scarcity premium, tends to widen when the proportion of NST 465 owned by the above mentioned groups increases.

The shape of the yield curve towards the end of November 2002, cf. Chart 9, also underpins the hypothesis that demand has influenced pricing. This applies in particular to the 2-year segment of the curve. The size of the swap spread for longer maturities indicates that there was no general widening of the swap spread, which could for example result from an increase in the credit risk premium.

Other factors also support the hypothesis that supply has influenced the widening of the swap spread. After the announcement of the issue of NST 465 by auction on 25 November 2002 and on 6 January 2003, cf. Chart 8, the swap spread narrowed considerably. The latter auction did not result in any substantial change in the proportion of outstanding volume owned by insurance companies, pension funds and foreign sectors. However, due to the increase in total volume, the volume in the market available for sale has increased. The volume appears to be adequate so that price is not significantly affected by the shortage premium.

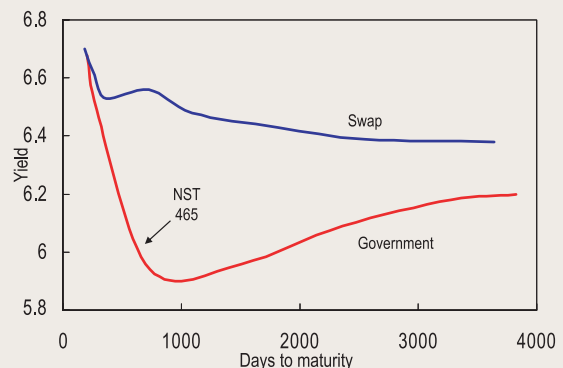
Chart 8 Norwegian and German swap spreads with the same maturities as NST 465, and the share of outstanding volume owned by life insurance companies, pension funds and the foreign sector¹⁾



¹⁾Announcement of auction dates 25 November and 6 January are indicated by the vertical lines

Sources: Reuters, the Norwegian Central Securities Depository and Norges Bank

Chart 9 Swap and government yield curve. 25 November 2002



Source: Reuters

²⁶ In a theoretical study, Duffie (1996) shows that this may be factored into the price of such papers, while Jordan and Jordan (1997) find empirical evidence for the phenomenon in the US.

²⁷ This is partly due to the fact that many of the same market participants are operating in the interest rate swap market in both Norway and Europe.

Turnover of NST 465 in the repomarket also indicates that there has been a considerable shortage of the bond in the period up to the end of 2002. Repo turnover increased substantially through 2001 and 2002 and pushed the repo rate down. In the second half of 2002, the repo rate²⁸ for transactions in which Norges Bank did not take part was an average of 20 basis points below the sight deposit rate, while the difference in November 2002 was 50 basis points. The possibility of obtaining cheap financing by lending government bonds when there is a shortage in the market may therefore have discouraged other investor groups from offering their bond holdings for sale despite a high price.

In the period from the beginning of 2001 to the fourth quarter of 2002, the average difference between the Norwegian and German swap spreads was 17 basis points. In the fourth quarter of 2002, the difference was 36 basis points, which may indicate an increase in the shortage premium of roughly 20 basis points in this period.

Due in part to the shortage of Norwegian government bonds, other market participants, for example in the foreign sector, may consider it to be favourable to issue bonds with long maturities in Norwegian krone. The number of issues from highly rated issuers in the Eurokrone market²⁹ was considerable. Demand for such issues from Norwegian life insurance companies probably contributed to this. The shortage in the government bond market will be reduced to the extent that this type of issue serves as a substitute for Norwegian government bonds for some investors. Therefore, such issues may indirectly contribute to reducing “incorrect pricing” of Norwegian government bonds and in this way contribute to a more informative government yield curve.

5. Conclusion

Prices in the government bond market normally reflect fundamentals. In some periods, limited supply may be observed to have had a substantial impact on prices, thus reducing the information content in the prices. Developments in the price of NST 465 in the autumn of 2002 are an example of this.

A low outstanding volume, and subsequent low liquidity, exposes the Norwegian government bond market to both temporary and permanent supply and demand

components in the formation of prices. This raises the question of whether price in the government bond market provides a correct picture of market expectations concerning future real interest rates and inflation. The price of NST 465 in the autumn of 2002 represents a rare and extreme case of the shortage premium in pricing. At the same time, the ability of other instruments to serve as substitutes for government bonds in Norway is limited. This indicates that it may be appropriate to underpin the efficiency of the government bond market.

Flexibility in the management of government debt may help to prevent components that do not contain information about fundamental factors from being factored in to the price. The increase of NST 465 in December 2002 and January 2003 are examples of this.

Literature

- BIS (1999): *Market Liquidity: Research Findings and Selected Policy Implications*, Basel. CGFS study group.
- BIS study group on fixed income markets (2001): “The changing shape of fixed income markets”, *BIS Paper* no. 5 October 2001
- Blanco, Roberto (2001): “The euro-area government securities markets. Recent developments and implications for market functioning.” Banco de España – Servicio de Estudios *Documanto de Trabajo* no. 0120.
- Cooper, Neil og Scholtes, Cedric (2001): “Government bond market evaluations in an era of dwindling supply”. *BIS Paper* no. 5, October 2001.
- Danmarks Nationalbank (2003): *Statens låntagning og gæld 2002*. (Government lending and debt).
- Finnish State Treasury Internet homepage: www.valtiokonttori.fi
- Fleming, Michael J. (2001): “Measuring Treasury Market Liquidity”. Federal Reserve Bank of New York, *Staff Reports*, July 2001, no. 133.
- Jordan, Bradford D. and Jordan, Susan D. (1997): “Special Repo Rates: An Empirical Analysis”. *The Journal of Finance*, vol. LII, No 5. December 1997.
- OECD (2001): *Trends and recent structural changes in OECD public debt markets*. Note of the Task Force of the Working Party of Public Debt Management. Proposition no. 1 to the Storting, Annex 14 (2002-2003).

Annex. Price according to the primary dealer agreement:

Residual maturity	2001 – 27 May 2002		After 27 May 2002	
	Price spread, maximum no. of basis points	Volume, in millions of NOK	Price spread, maximum no. of basis points	Volume, in millions of NOK
< 2 years	15	5	15	20
2 - 4 years	20	5	20	20
4 - 7 years	30	5	30	15
7 - 10 years	40	5	40	10
10 - 15 years	50	5	50	5

²⁸ Based on daily volume-weighted average repo rate

²⁹ Eurokrone bonds are bonds in NOK issued outside of Norway.