

CONTENTS

Estimating and interpreting interest rate expectations by Arne Kloster	85
The risk associated with banks' foreign borrowing by Karsten R Gerdrup, Arild J. Lund and Sindre Weme	95
Norges Bank's oversight of payment systems - licensing and supervision by May-Helle Lund and Kjetil Watne	101
Statistical annex	109

The Economic Bulletin is published quarterly by Norges Bank

Editor: *Svein Gjedrem*

Editorial Officers: *Helle Snellingen and Janet Aagenæs*

Coordinator: *Beverley Wahl*

The contents of the Economic Bulletin may be quoted or reproduced without further permission.
Due acknowledgement is requested, and copies of any offprints would be appreciated.
Signed articles do not necessarily reflect the views of Norges Bank.

Communications regarding the Economic Bulletin should be addressed to:

Norges Bank

Information Department

P.O. Box 1179 Sentrum

N-0107 Oslo, Norway

Telex: 56 71 369 nbank n

Telefax: +47 22 316 410

Telephone: +47 22 316 000

E-mail: central.bank@norges-bank.no

Internet: <http://www.norges-bank.no>

Printed at: Reclamo AS, Oslo

ISSN 0029-1676

Standard signs used in the tables:

.	Category not applicable
..	Data not available
...	Data not yet available
-	Nil
0	} Less than half the final digit shown
0.0	

Estimating and interpreting interest rate expectations

Arne Kloster, economist in the Economics Department, Norges Bank¹

Expectations about future interest rates and inflation influence economic developments. For example, market expectations of higher inflation may themselves result in higher inflation, for instance through higher pay increases. Households' choice between consumption and saving is influenced by their expectations concerning future interest rates. A high level of short-term interest rates will probably have less of a contractionary effect on economic activity if the market believes this to be a transitory phenomenon than if it is expected to persist. Inflation expectations also reflect whether market participants are confident that economic policy will result in low inflation over time. One important source of information about these expectations is the market's pricing of interest-bearing securities with different maturities. This article describes the method used by Norges Bank for estimating interest rate expectations, and discusses how these estimates may be interpreted. In addition, the importance of various premia will be considered, and some alternative approaches for estimating interest rate expectations will be discussed.

Theories about the term structure of interest rates

There are several theories as to the determinants of the relationship between interest rates with varying maturities, often referred to as the term structure of interest rates. The expectations theory is probably the explanation most widely held. This theory is based on the assumption that market participants are risk-neutral and maximise the expected return without having specific preferences as to the maturity of their loans and investments. The interest rate on a long-term investment is therefore determined entirely by expected developments in short-term rates during the same period. If this were not the case, investors could achieve an expected excess return by raising long-term loans and reinvesting the funds in revolving short-term issues (or vice versa). Market participants' pursuit of this type of excess return ensures that the interest rate on long-term securities will always be an average of expected short-term rates. If the term structure of interest rates is determined by market expectations, these expectations may be inferred from the shape of the yield curve.

The liquidity preference theory is based on the assumption that market participants are averse to risk. The price of a bond with a long residual maturity will be more sensitive to interest rate changes than the price of a bond with a shorter residual maturity. The holding-period return on a bond is thus more uncertain the longer the residual maturity. Therefore, other things being equal, risk-averse investors will prefer to invest in short-term issues. To induce market participants to invest in long-term issues, they must be compensated in the form of a higher yield than the level implied by the expectations theory. This compensation, referred to as the term premium,² will increase with the term to maturity. Like the expectations theory, the liquidity preference theory

implies that long rates are an average of expected short rates, but with the addition of a premium that depends on the term to maturity. Another complicating factor is that the term premium may not be constant over time.

The hedging pressure or preferred habitat theory assumes that market participants are highly averse to risk and that they wish to match the maturity of their investments to the maturity of their debt. Consequently, the market is split up into independent segments. Interest rates on securities of varying maturities are determined independently by supply and demand in the various market segments. According to this theory, it is meaningless to calculate market participants' interest rate expectations on the basis of the term structure of interest rates.

Implied forward rates and their interpretation

Implied forward interest rates can be calculated on the basis of observed interest rates on issues of varying maturities, ie the yield curve. Implied forward rates are interest rates between two dates in the future derived from the yield curve. If the expectations theory or the liquidity preference theory holds true, implied forward rates will reflect market expectations about interest rates, possibly adjusted for term premia. For example, the expected three-month rate three months ahead may be calculated on the basis of observations of current three-month and six-month rates. The slope of the yield curve at maturities between three and six months indicates whether the three-month rate is expected to rise or to fall. Whereas the yield curve shows the average expected interest rate in the period up to various dates, the implied forward rate expresses the expected interest rate on those dates. The reason for calculating forward rates is thus their practical interpretation rather than because they contain other information than that contained in the yield curve.

¹ I am grateful to Jon Nicolaisen, Kristin Gulbrandsen, Øistein Røisland, Tom Bernhardsen, Pål Winje, Knut Eeg and Ole-Christian Hillestad in Norges Bank for their helpful comments and suggestions.

² If the yield over time tends towards a "normal level", the term premium may be negative when the yield is high in relation to this "normal level". The price is then low and the probability of capital gains is high. The potential capital gain for a given rise in interest rates will then increase with the residual maturity.

There are a number of empirical studies of the expectations theory (for an overview see, for example, Browne and Manasse, 1990). Most studies reject the theory. This result is often attributed to the existence of a term premium which varies over time. In its pure form, the expectations theory poses the variation of long rates on a one-to-one basis with expected short-term rates rather than merely the existence of positive covariation between long-term and short-term rates. A number of studies find positive covariation, but must reject the theory even so. Rejection of the theory does not necessarily mean that the term structure of interest rates has no interest for monetary policy purposes. The variation in expected short rates may nevertheless explain a substantial part of the variation in long rates.

Interest rate expectations for the next few years will depend largely on the economic outlook and the market's perception of how the central bank sets its key rates. Expectations of growing pressures in the economy may, for example, generate expectations of higher interest rates – both nominal and real – if market participants are confident that the central bank will take steps to counter higher inflation. If such confidence is lacking, market participants may still expect higher nominal rates as a result of higher inflation expectations. Either way, this will be reflected in an upward sloping yield curve if the expectations theory holds true.

In order to be able to disentangle inflation expectations from nominal implied forward rates, it is necessary to assume that the expected nominal interest rate is approximately equal to the sum of the expected real rate and expected inflation (for further information see, for example, Frøyland, 1997). In the short term, interest rate expectations will be influenced by the cyclical outlook. However, in the long term, say ten years ahead, it seems unlikely that market participants have specific expectations about the cyclical situation. On this horizon it may seem reasonable to interpret the implied forward rate as the sum of the expected equilibrium values of the real interest rate and inflation, plus any risk and/or term premia.

Mishkin (1990) analysed the term structure of interest rates in the US using a model which assumed that the nominal interest rate is determined by the expected real rate and expected inflation, and that market participants have rational expectations about inflation developments. Based on observations of interest rates between 1964 and 1986, he found that the term structure for maturities of up to six months did not contain information about future inflation developments, but did provide information about the term structure of real interest rates. In the area from nine to twelve months, however, the nominal term structure started to provide information about future inflation, as well as, to a lesser extent, information about the term structure of real interest rates.

Schich (1999) used Mishkin's model to study the relationship between the term structure of interest rates

and expected future inflation in the US, Germany, Canada, the UK, France, Italy and Japan. Schich found a significant relationship for the first four countries. The most informative maturity segments were further out on the yield curve than in Mishkin's study. The relationship, however, varied both across countries and over time. The variation over time was primarily attributed to shifts in the monetary policy regimes. Intuitively, it seems reasonable to assume that the information content of implied forward rates is related to monetary policy and financial markets' confidence in this policy. If monetary policy is oriented towards low inflation and has a high degree of credibility, the term structure is likely to contain little information about future inflation other than that implied by the central bank's inflation target. In this case, implied forward rates may reflect expected developments in real interest rates. Changes in the monetary policy objective may lead to changes in the information content of implied forward rates, while changes in the structure of financial markets and the degree of regulation may also change the information provided by implied forward rates over time.

If the relationship between the term structure and future inflation is not stable over time, nominal implied forward rates will not be a reliable indicator of future inflation developments. Some countries have established markets for real rate bonds where the interest rate is linked to a price index. This makes it possible to assess expected inflation by comparing yields on bonds with nominal and real returns. By comparing implied forward rates based on the two types of bond, it is possible to estimate developments in inflation expectations. No market for index-linked bonds exists in Norway. However, in a world with free capital mobility, it may be assumed that the real interest rate in equilibrium must over time show approximately the same development across countries (real interest rate parity). Differences between Norwegian and foreign long-term implied forward rates may thus be interpreted as differences in expected inflation plus any risk premium. If the risk premium does not vary to any great extent, changes in long-term implied forward rate differentials far in the future may be interpreted as changes in relative inflation expectations. The long-term implied forward rate differential may then to some extent reflect market participants' (relative) confidence in economic policy.

Since Norges Bank's December 1998 *Inflation Report*, implied forward rates have provided the basis for the technical assumption concerning developments in money market rates. This assumption influences Norges Bank's projections for economic developments in the years ahead. The projections in Norges Bank's *Inflation Report* can thus be interpreted as an assessment of the realism in the market's interest rate expectations.³ The method used by Norges Bank for calculating implied forward rates is described in greater detail below.

³ See the leader in Norges Bank's June 1999 *Inflation Report* for more information.

Calculation of implied forward rates

The simplest and most obvious method for calculating implied forward rates would be to calculate them directly from the observable yield curve. There are, however, a number of caveats associated with this approach. First, the yield curve consists of a limited number of observations, so that a simple calculation will not provide a continuous implied forward rate curve. It is necessary to find a method that can "fill in the gaps" in the yield curve in order to obtain a continuous curve without breaks. In addition, bonds along the yield curve pay a coupon rate, which represents a source of error if the yields are compared directly.⁴ However, estimation of so-called zero-coupon yields makes comparison across different maturities possible. From a continuous function for the zero-coupon rates, it is relatively straightforward to calculate a continuous curve of implied forward interest rates. This curve always lies above the zero-coupon curve when the latter is rising, and below it when it is falling.

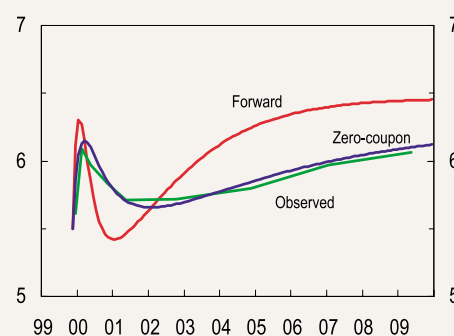
Like a number of other central banks, Norges Bank calculates implied forward rates using a parametric method developed by Nelson and Siegel (1987). This method is based on a pre-defined function. Among other things, the function is characterised by allowing for one hump or U shape along the implied forward rate curve as well as convergence towards a constant level in the long term. Svensson (1994) extended this method by adding a component in the function that allows for a second hump or U shape.⁵ Norges Bank generally uses Svensson's extended model in its calculations, although both models are probably sufficiently flexible for monetary policy purposes. In the light of the interpretation of forward rates as expected interest rates, the assumption of convergence towards a constant interest rate level in the long term seems reasonable.

Svensson's function has six parameters (see Annex). Once these have been estimated, the function provides zero-coupon rates for all future points in time. The accompanying function for the implied forward rates is given by the derivative of the zero-coupon function. The implied forward rates have very short maturities and may be viewed as instantaneous rates or overnight rates.

Norges Bank uses observations of four money market rates and five government bond yields to calculate implied forward rates and zero-coupon rates for Norway. This gives a yield curve with nine points, with maturities varying from one month to approximately ten years. Chart 1 shows the observed yield curve and the calculated zero-coupon rate curve and implied forward rate curve on 22 November 1999.

In the short term, there are relatively large fluctuations in the curves, reflecting the markets' uncertainty in November 1999 about potential problems associated with the changeover to the new millennium. This

Chart 1. Forward, zero-coupon and observed rates.
22 November 1999



uncertainty resulted in high implied forward rates around the end of the year. The chart illustrates the relationship between the zero-coupon rate and the implied forward rate. Since the zero-coupon rate is the average of the implied forward rates, the implied forward rate curve is always above the zero-coupon curve when the latter is rising, and vice versa.

In its inflation reports, Norges Bank uses implied forward rates as the technical assumption for the three-month money market rate. Since the calculated implied forward rates have maturities of less than three months, they are recalculated to a three-month moving average to facilitate comparison with three-month interest rates.

In some cases, the starting point for the estimated forward rate curve may deviate considerably from the observed level for the shortest money market rate. This makes it difficult to interpret the implied forward rates as expected short-term interest rates. In such cases, a restriction may be imposed in the estimation setting the starting point for the implied forward rate curve. The starting point may be set at the observed overnight rate. In Chart 1 above the starting point is set at Norges Bank's sight deposit rate.

The significance of risk and term premia

Various types of premia may cause implied forward rates to deviate from interest rate expectations. Examples of such premia include premia for the risk of exchange rate fluctuations, liquidity premia in markets with low turnover and term premia for long-term securities. Premia are often assumed to be positive and they may also vary over time. If this is the case, the implied forward rates will overestimate interest rate expectations by a factor that is not constant over time.

Term premia may be a relevant problem when measuring interest rate expectations. If the term premium is positive, the implied forward rate curve will be more

⁴ Two bonds with the same maturity date but different coupon payments will not have the same redemption yield since they generate different cash flows and thus do not have the same value. This is often referred to as the coupon effect. Observed rates on coupon bonds must be expressed in a standardised manner before they can be used to calculate forward rates. This is accomplished by calculating zero-coupon rates. A zero-coupon bond is one that only provides payment on maturity, meaning that the redemption yield is determined by the bond price alone.

⁵ Svensson's method is also referred to as Extended Nelson & Siegel.

upward-sloping – or less downward-sloping – than interest rate expectations would imply. On the basis of data for the US, the UK, Germany and Switzerland, Dahlquist (1997) finds evidence that there are relatively small, but positive, term premia. He also finds evidence that the term premium increases with residual maturity. This indicates that there is a positive difference between the implied forward rate and the expected interest rate and that this difference increases with maturity. Dahlquist's analysis also indicates that term premia vary over time. The variation may be explained in part by the shape and location of the yield curve. Dahlquist concludes, however, that the term premium changes fairly slowly over time, allowing changes in interest rate expectations to be reflected fairly well in the changes in implied forward rates. He also finds that term premia in different countries have a fairly strong positive correlation. This may indicate that varying term premia represent less of a problem in analyses of implied forward rate differentials between countries than when the level within one country is evaluated.

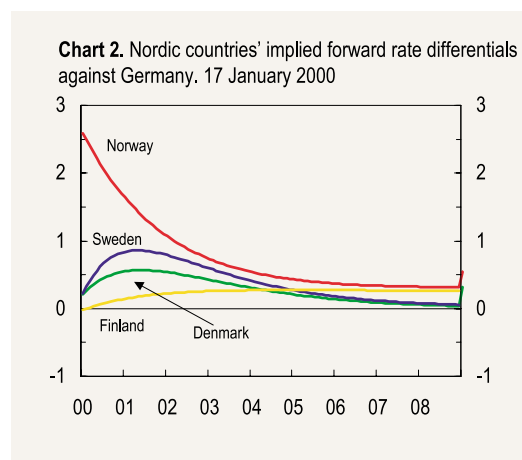
Risk premia linked to uncertainty about inflation trends may result in a premium on Norwegian interest rates in relation to foreign interest rates. For example, Norwegian long rates are generally higher than comparable German rates. This may reflect greater uncertainty about inflation trends in Norway, which, in turn, will foster uncertainty about developments in the krone exchange rate against the euro. This type of uncertainty must be compensated for by a higher yield. Liquidity factors may also be of significance: the Norwegian market is small compared with the German market, which makes it more difficult to buy or sell large blocks without affecting the market price. This also creates uncertainty that must be offset by a higher expected yield. Different degrees of credit risk will also give rise to premia. It seems unlikely, however, that credit risk is of particular significance in explaining yield differentials between Norwegian and German government bonds.

Forward rate differentials as a confidence indicator

The long-term implied forward rate differential between Norway and the euro area may be viewed as an indicator of confidence in Norway's monetary policy relative to that in the euro area. This long-term differential can be interpreted as the expected inflation differential in the long term plus a risk premium. The risk premium between Norway and Germany may reflect greater uncertainty about inflation trends in Norway than in Germany and a less liquid bond market in Norway. It is not possible to distinguish between these components in order to obtain an indication of the expected inflation differential between Norway and the euro area.⁶ However, a comparison with other countries' differentials against

Germany may be useful in this respect. Chart 2 shows the Nordic countries' implied forward rate differentials against Germany on 17 January 2000.

The chart shows that Norway's implied forward rate differential against Germany is substantially higher than that



of the other Nordic countries in the short term. This reflects the fact that Norway was at a different stage in the business cycle and had a different monetary policy stance. Developments in the implied forward rates indicated, however, that Norway's interest rate differential was expected to approach that of the other Nordic countries within the next few years. Sweden's implied forward rate differential against Germany rose fairly markedly in the short term. This may be interpreted as expectations of higher resource utilisation and higher short-term interest rates in the Swedish economy than in the euro area. In the long term, both Sweden's and Denmark's implied forward rate differentials against Germany were close to zero. This may reflect confidence in monetary policy and possibly also expectations that these countries will join EMU within the next ten years.

Finland had a small, but positive, implied forward rate differential against Germany, except in the very short term. This may seem odd considering that both Finland and Germany are members of EMU and thus have a common currency and common monetary policy. There should therefore be no risk premium arising from expected inflation differentials⁷ or exchange rate fluctuations. The differential may reflect different credit risk profiles, although the difference is probably relatively small as long as the calculations are based on government bonds. This leaves liquidity differences between the two bond markets as an important explanation for the long-term forward rate differential.

Norway's long-term implied forward rate differential versus Germany was on a par with Finland's, but higher than that in Sweden or Denmark, probably reflecting less liquid bond markets in Norway and Finland than in Sweden and Denmark. This may also be an indication

⁶ Both a higher expected inflation differential and a higher inflation risk premium reflect deteriorating confidence in monetary policy. Therefore, distinguishing between these components is not crucial as long as the long-term forward rate differential is used to assess confidence in monetary policy.

⁷ Although both Finland and Germany are members of EMU, the inflation differential at a given point in time may not always be zero. In the long term, however, it is likely that market participants expect the same inflation rate in the two countries.

that market participants considered it less likely that Norway will join EMU within the next ten years than they did in the case of Sweden and Denmark.

Such comparisons of implied forward rate differentials can prove useful when assessing changes over time in Norway's long-term implied forward rate differential versus Germany. If, for example, the differential for Norway should increase substantially without a corresponding increase in Sweden, Denmark or Finland, the increase might be interpreted as a sign of deteriorating confidence in Norway's monetary policy. On the other hand, an observation of contemporaneous increases in the other Nordic countries' differentials versus Germany would suggest that international developments, rather than Norwegian conditions, were the cause.

However, changes in the long-term implied forward rate differential must not be overly interpreted. The differentials are derived from estimates and there will always be a margin of error in the underlying estimates. In some cases, the shape of the function used may be ill adapted to the observed interest rates, and this may affect the long-term differential.

Evaluating the procedure for calculating forward rates

a) How well do implied forward rates reflect interest rate expectations?

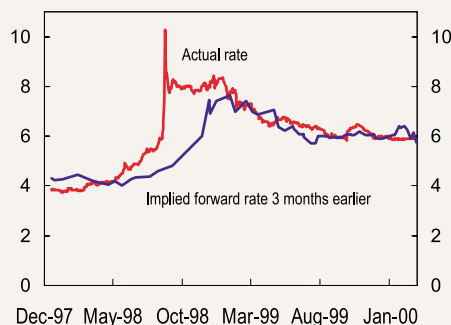
When estimating expectations, it is not possible to provide a fully adequate evaluation of the estimates. Expectations cannot be observed, they are constantly changing as new information becomes available, and they can deviate substantially from the actual outcomes ex post.

Chart 3 compares actual movements in the three-month money market rate with the implied forward rate calculated on the basis of market rates observed three months earlier. For the period considered, the implied forward rate has by and large been reasonably good at predicting the evolution of the money market rate. Not surprisingly, the steep interest rate rise in short-term interest rates in the autumn of 1998, which was associated with exchange rate market turbulence, was not predicted by the implied forward rate three months earlier. If we disregard that period, and the time it took for the implied forward rate to adjust to the shock, it appears that the implied forward rate was by and large quite close to the actual rate three months later. There are no signs of the implied forward rate being systematically higher or lower than actual developments. However, this does not provide a sufficient basis for any clear-cut conclusion as to how well implied forward rates reflect interest rate expectations.

Forward rate agreements (FRAs) provide a directly observable expression of (average) market interest rate

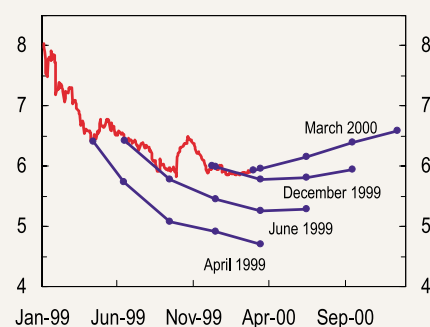
expectations. The FRA market enables agents to borrow or invest money at a given interest rate from an agreed date in the future. On the agreed date, the parties to the agreement exchange the difference between the agreed

Chart 3. "Predicted" and actual three-month money market rates. December 1997 - February 1999



interest rate and the prevailing money market rate. Hence, an FRA may be seen as a kind of wager between two parties as to the expected money market rate on the maturity date. At the same time, FRAs are a hedging instrument. The various financial institutions quote FRA rates continuously with maturities from four specific dates in the year ahead.⁸ FRAs with maturities of three, six or twelve months may be concluded as of any of these dates. Chart 4 illustrates the evolution of the three-month money market rate between January 1999 and March 2000, together with some observations of three-month FRA rates in the same period.

Chart 4. Three-month money market interest rate and FRA rates. January 1999 - March 2000



Each of these curves may be seen as expressing the anticipated movements in the three-month rate approximately one year ahead seen from the observation date. However, FRA rates are by no means a foolproof indicator of actual interest rate expectations in the market. FRAs allow market participants to hedge against interest rate fluctuations. As such, participants may be willing to pay for this insurance by borrowing at higher rates or

⁸ The contracts run from the International Money Market (IMM) dates, which are international dates for the maturity of financial contracts. These dates fall on the third Wednesday of March, June, September and December each year.

investing at lower rates than the level expected. In addition, FRA rates may be affected by premia. Factors of this nature mean that the FRA rates quoted may deviate from true interest rate expectations.⁹ Nevertheless, it is likely that FRA rates are normally fairly close to average market interest rate expectations on the relevant dates. If the deviations become too great, one of the parties would suffer considerable losses. This provides an incentive to "guess correctly".

The rates quoted in the FRA market can be compared to the implied forward rates calculated by Norges Bank. If the implied forward rates show consistent and substantial deviation from FRA rates, it may be a sign that the former do not give a very good indication of interest rate expectations. Since FRA quotations are only available one year ahead, the implied forward rate curve can only be checked in this way at the very short end. Chart 5 shows how the three-month rate expected to prevail in March 2000 evolved between March 1999 and January 2000, when measured on the basis of the FRA rate and the implied forward rates respectively. The two curves show fairly similar movements, indicating that expectations concerning the interest rate level in March 2000 were gradually raised through 1999. However, it may be noted that during the early part of the period, the implied forward rate remained markedly lower than the FRA rate. This was probably related to the shape of the yield curve. In the first half of 1999, the yield curve showed a steep negative slope for maturities up to two years. A steep negative slope of the yield curve is amplified in the implied forward rate curve. Throughout this period, very short-term forward rates remained higher than FRA rates, while the situation was the opposite for maturities up to one year ahead. We conclude that when there is a steep downward slope of the yield curve, there may be a tendency for implied forward rates to overestimate interest rate expectations in the very short term and to underestimate them in the slightly longer term. In the second half of 1999 the yield curve was somewhat flatter, and during this period there was closer accord between the implied forward rates and

FRA rates. October and November 1999 saw considerable fluctuations in implied forward rates, and they were on occasions considerably higher than FRA rates. This may be due to the interest rate volatility associated with the transition to the new millennium, which may have influenced calculations of implied forward rates to a larger extent than the directly observed FRA rates.

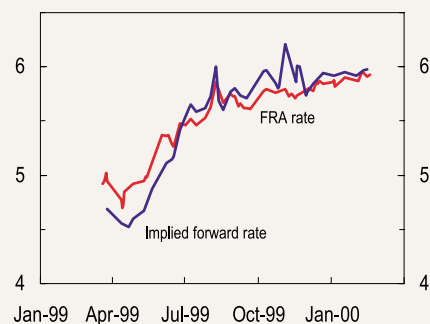
b) Implied forward rates calculated on the basis of other data

The implied forward rates discussed so far were calculated on the basis of money market rates with a maturity of one to twelve months and government bond yields with a residual maturity of ½ to 9½ years. However, the credit risk in the money market is greater than that associated with government debt instruments. As a result, money market rates are normally higher than comparable yields on government securities. If the implied forward rates are to reflect interest rate expectations correctly, the credit risk along the curve underlying the calculations should be constant. Otherwise a change in the credit risk premium along the curve may be misinterpreted as a change in the expected interest rate. If the credit risk premium falls markedly at the point of transition from money market rates to government bond yields, ie when the term to maturity exceeds one year, the implied forward rate curve may display a negative slope around this point, even if market rates are expected to remain unchanged during this period. Moreover, the credit risk premium may vary over time. The difference between interest rates on loans to private borrowers and central government tends to increase in times of financial market turbulence, which will amplify the problems described above.

There are basically two possible approaches whereby the potential distortion due to different credit risk may be eliminated. The first option is to base calculations on a yield curve consisting solely of the interest private borrowers have to pay on their loans. The alternative is to use yields on government debt issues for all maturities.

A yield curve consisting entirely of private interest rates can be constructed using the fixed interest rate offered on interest rate swaps instead of government bond yields. The European Central Bank, for instance, uses these long-term private interest rates when estimating implied forward rates. Using private interest rates for all maturities makes it more natural to interpret the implied forward rates as expected money market rates. Another advantage of using this kind of data is that the number of observations along the yield curve increases, making for more accurate estimates. On the other hand, the credit risk premium component of interest rates on loans to private borrowers is probably substantial. This credit risk premium is liable to increase in line with the maturity: if there is a non-zero probability that the

Chart 5. Implied forward rate and FRA rate for March 2000. March 1999 - February 2000



⁹ In order to avoid the possibility of arbitrage, FRA rates and implied forward rates in the money market must be subject to the same effects of any risk and term premia.

borrower will go bankrupt, the likelihood of this occurring during the term of the loan will be greater the longer the term to maturity. A rising credit risk premium will contribute to an upward bias in the estimates of expected interest rates obtained from implied forward rates, and the error will increase in line with the time horizon. No attempt was made to correct for this type of disturbance in the following discussion.

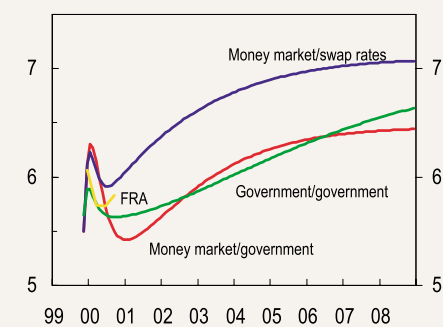
A yield curve consisting of yields on Treasury bills at the short end and government bonds further out will also have the same credit risk over the entire curve. The credit risk premium on these government debt issues is probably equal to, or very close to, zero. This implies that the problem associated with credit risk which increases with the loan's maturity is unlikely to be of any relevance. The use of government bond yields for all maturities may suggest that the implied forward rates should be interpreted as expected movements in Norges Bank's key rates, rather than money market rates. The Swedish central bank bases its implied forward rate calculations on government bond yields, and interprets the resulting rates as expected movements in its key rate (repo rate).

At any given time there are four or five outstanding Treasury bills in the Norwegian market, generating roughly the same number of observations as those used by Norges Bank in its calculations based on money market rates. Liquidity in the secondary market for Treasury bills has improved in recent years, and has probably reached a level at which these yields could viably be used as the basis for calculations. An additional advantage of using yields on Treasury bills rather than money market rates is that the prices quoted in the Treasury bill market are binding, whereas interest rates observable in the money market are indicative. This implies that observed yields on Treasury bills should provide a better picture of actual market rates. On the other hand, it is more difficult to find comparable figures for other countries on the basis of yields on Treasury bills than on the basis of money market rates. As Norges Bank uses forward rates to a large extent for international comparisons, the use of money market rates at the short end may still be preferable.

Chart 6 compares three different implied forward rate curves for 22 November 1999. The red curve is based on money market rates and government bond yields, and corresponds to that used by Norges Bank in its inflation reports. The blue curve is based on money market rates and the fixed interest rate component of interest rate swaps with maturities of up to ten years. The green curve is based on Treasury bill and government bond yields. The yellow curve shows three-month FRA rates.

All three curves rise in the very short term and fall after the end of 1999. This probably reflects that markets expected high short-term interest rates around the end of the year owing to uncertainties relating to potential problems associated with the changeover to the new

Chart 6. Implied forward rates based on various inputs. 22 November 1999



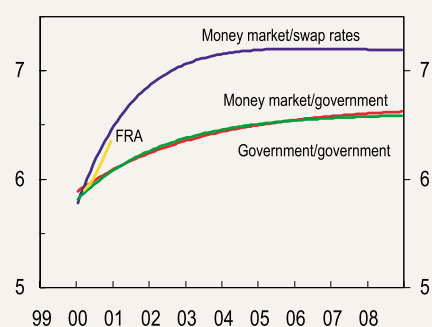
millennium (Y2K). The chart shows, however, that yields on government paper were less affected by these fears, as the green curve is flatter than the others in the short term. This probably indicates that the credit risk in the money market rose significantly as a result of Y2K concerns, while the effect on Treasury bills was relatively small. As might be expected, the blue curve, showing implied forward rates based solely on private interest rates, is higher than the others, probably reflecting higher credit risk premia.

In the short term the red curve falls much more steeply than the blue curve, despite the fact that these two curves are based on identical interest rate observations for maturities up to one year. This may indicate that the red curve falls more steeply than implied by interest rate expectations owing to the change in credit risk in the transition from money market rates to government bond yields.

At no point along the curve do the implied forward rates calculated on the basis of private interest rates drop below 5.9 per cent. This may appear somewhat high given that the three-month money market rate at that point was just over 6 per cent, and that FRA rates and market participants' interest rate forecasts indicated expectations of lower rates within a one-year horizon. This may signal that the implied forward rates based solely on private interest rates overestimated interest rate expectations.

Considering that the green and red curves in the chart are based on exactly the same observations for maturities of over one year, the difference between the end points of the two curves is quite considerable. The explanation for this is probably related to the method used. The red curve seems better in the sense that it converges towards a constant long-term level at an earlier stage than the green curve. This may be the case because the shape of the function used in the estimations (see Annex) was better suited to observations of the combination of money market rates and government bond yields than to observations of government bond yields alone. However, this only applies to the observations on that

Chart 7. Implied forward rates based on various inputs.
17 January 2000



particular day, and is not a general feature of this method (see Chart 7).

In the long term, the blue curve, based on private interest rates only, shows a considerably higher level than the other two curves. For December 2008, the difference between the implied forward rates based only on private interest rates and the ones based on a combination of money market rates and government bonds yields is 0.7 percentage point. A similar calculation based on German data produced a difference of 0.2 percentage point in the long term, giving a difference in implied forward rates between Norway and Germany when calculated on the basis of private interest rates almost twice as large as when calculated on a combination of private interest rates and government bond yields. This may be attributable to a more liquid interest rate swap market in Germany than in Norway, or to lower credit risk premia on long-term loans to private borrowers in Germany than in Norway. However, the possibility of the substantial difference in credit spread being due to factors of a purely temporary nature cannot be ruled out.

Chart 7 shows the same implied forward rate calculations, carried out on 17 January 2000. In these calculations the difference between the implied forward rates calculated on the basis of money market rates and government bond yields and the ones calculated solely on the basis of yields on government debt issues is far smaller. This may indicate that the problem of varying credit risk was particularly prominent in late 1999, in a period marked by great uncertainty associated with Y2K. As was also seen in Chart 6, the forward rates calculated on the basis of private interest rates only are much higher than the two other curves, and they probably overestimate interest rate expectations in the long term. However, Chart 7 also shows that FRA rates at this point were much closer to private forward rates than the two other curves. One possible interpretation is that the private forward rates reflected interest rate expectations more accurately in the short term than the two other forward rate curves. Alternatively, it may be that FRA rates and private forward rates are affected by the

same premia, and that both overestimated interest rate expectations.

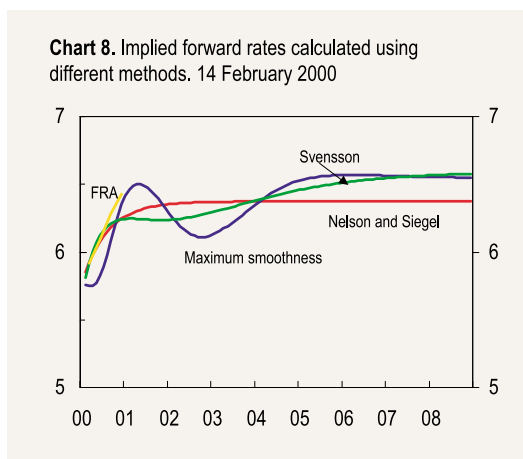
Alternative method for calculating implied forward rates

Nelson and Siegel (or Svensson) is just one of many methods developed for calculating zero-coupon rates and implied forward rates. For an overview of other methods, see for instance Deacon and Derry (1994). One method preferred by a number of market participants in Norway is the maximum smoothness method. This method is based on adapting a curve which consists of sub-functions for the various time intervals, rather than estimating a single curve as in Nelson and Siegel or Svensson. The maximum smoothness method ensures that the zero-coupon rates calculated are consistent with observed market prices for interest-bearing securities. This means that the zero-coupon rates calculated must be such that using these to discount the various bonds' cash flows results in prices (present values) which are equal to the observed market prices. At the same time, the zero-coupon curve must be as smooth as possible. For a more detailed description of this method, see for instance Bjerksund and Stensland (1996).

Using Nelson and Siegel or Svensson, the zero-coupon rates calculated will not normally be fully consistent with observed market prices. These methods are therefore less suitable for assessing market pricing of the individual securities along the yield curve. On the other hand, Nelson and Siegel or Svensson generate forward rate curves which are by and large smoother and with fewer humps than the maximum smoothness method. For monetary policy purposes, fully accurate pricing of individual securities is not required to the same extent – some precision may be exchanged for a smoother forward rate curve which captures the main features of the term structure and is easier to interpret.

The maximum smoothness method nevertheless represents a valuable supplement to Nelson and Siegel or Svensson when assessing the term structure of interest rates. Chart 8 shows forward rate curves for 14 February 2000 calculated using the three different methods. The calculations are all based on the same observations of money market rates and government bond yields. The chart illustrates how the maximum smoothness method provides information about the extent to which humps or U shapes in the term structure are "evened out" by the other two methods. Such humps may result from special supply/demand conditions in the market. For the purpose of monetary policy analysis it may be appropriate to ignore these humps and U shapes, refraining from interpreting them as interest rate expectations. On the other hand, they may be an indication of actual interest rate expectations, in which case it would be appropriate to take them into consideration. In general it is not

possible to separate these cases, and assessment must therefore be based on closer examination of market conditions.



Irrespective of whether any humps in the term structure of interest rates are attributable to particular market conditions or reflect interest rate expectations, it is important to be aware of their presence. The reason for this is that even though Nelson and Siegel or Svensson to a great extent "even out" humps of this type, the calculations can be distorted by them. Chart 8 shows that the long-term forward rate is approximately 0.2 percentage point lower in the Nelson and Siegel-based calculation than in the calculations based on Svensson and those based on the maximum smoothness method. This is probably because the Nelson and Siegel curve levels off after around two years. The entire flat portion of the curve seems to be "dragged down" by the fall which the maximum smoothness curve shows in the area between 2001 and 2003. In this respect, Nelson and Siegel may be said to produce a term structure which is too smooth, and which probably shows a long-term implied forward rate that is too low. In the absence of calculations based on other methods, this would be difficult to see. The chart also shows that Svensson's method is sufficiently flexible to avoid this problem.

It would not appear reasonable simply to interpret the fall in implied forward rates between 2001 and 2003 as expectations of falling short-term rates during this period. An alternative interpretation could be that the fall is a result of varying credit risk, since the calculations are based on a combination of money market rates and government bond yields. However, a comparable calculation based exclusively on government securities showed an implied forward rate curve with a similar shape. As such, it appears probable that the fall in forward rates is ascribable to particular supply/demand conditions linked to one or more of the bonds in the maturity segment in question. In certain countries, tax rules are linked to the size of the bond's coupon payment. Other things being equal, these tax rules make low coupon rates more

favourable than high coupon rates. This can result in higher prices, and hence lower yields on bonds with a low coupon rate. The government bond maturing in 2004 has a relatively low coupon rate, and this could account in part for the shape of the implied forward rate curve.

Summary and conclusions

On the assumption that the expectations theory holds true, implied forward rates reflect market expectations concerning movements in short-term interest rates. However, most empirical studies in the literature reject the expectations theory, at least in its pure form. A widely held explanation is that positive term premia exist which increase in line with the term to maturity, and which vary over time. These premia result in a variable deviation between the implied forward rate and the expected interest rate. Despite widespread rejection of the expectations theory, evidence suggests that a considerable portion of the variation in long-term rates is attributable to expectations of developments in short-term interest rates. However, the existence of premia means that implied forward rates should be interpreted with a degree of caution, particularly with regard to the level of expected interest rates. The presence of term premia is probably less of a problem when assessing changes in implied forward rates between different points in time, or when analysing differences in implied forward rates between countries. However, it seems clear that there is potential for improving estimates of interest rate expectations by adjusting them for various types of premium. Further work is, however, necessary in this field.

Simple comparisons of implied forward rates for the near term and actual movements in interest rates do not produce clear indications that the implied forward rates calculated by Norges Bank systematically overpredict or underpredict developments in interest rates, nor is there any sign of systematic deviation in relation to FRA rates. Substantial deviation can occur, however, at certain times. Consequently, when assessing interest rate expectations, implied forward rate calculations should be supplemented by observations of FRA rates and other available information.

Implied forward rates calculated on the basis of money market rates and government bond yields will have varying credit risk for short and long maturities. Such changes in credit risk across different maturities are in danger of being misinterpreted as changes in the expected interest rate level. This problem appears to be of importance in periods of uncertainty in the markets, exemplified by the period prior to the changeover to the new millennium, whereas in more normal periods the difference in credit risk would appear to be of less significance. There is nonetheless a case for basing

implied forward rate calculations exclusively on interest rates/yields with the same credit risk profile, ie to use either yields on government debt issues or interest rates on private loans, rather than a combination of the two. Calculations based solely on private interest rates would appear to generate implied forward rates which vary a good deal over time, with an accompanying tendency to overestimate interest rate expectations in the long term. One important explanation of this phenomenon is probably credit risk premia which vary across the maturity spectrum and over time. There is less of a problem associated with implied forward rates calculated on the basis of government securities alone. However, finding comparable international figures for Treasury bill yields proves more difficult than for money market rates. The use of implied forward rate calculations for international comparisons, coupled with the seemingly moderate significance of varying credit risk, tends to favour continued use of the current method. A switch to forward rates based exclusively on yields on government debt issues would necessitate a closer study of government securities markets in those countries commonly included in our comparisons.

Annex

This annex contains a brief technical description of Svensson's model for calculating implied forward rates. This description is based on Söderlind and Svensson (1996). Let $f(m)$ be the instantaneous forward rate at a future date m . In Svensson's model the forward rate function is:

$$f(m;b) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \frac{m}{\tau_1} \exp\left(-\frac{m}{\tau_1}\right) + \beta_3 \frac{m}{\tau_2} \exp\left(-\frac{m}{\tau_2}\right)$$

where $\beta = (\beta_0, \beta_1, \beta_2, \tau_1, \beta_3, \tau_2)$ is the vector of parameters to be estimated. Once the parameters have been estimated, the function gives the instantaneous implied forward rate at all future points in time m . The parameters β_0 , τ_1 and τ_2 must be positive. Svensson's function is a sum of four components. The first component is a constant, β_0 . This is the horizontal asymptote of the function, and may be interpreted as the constant level the implied forward rates approach in the long term (when m is high). This must consequently be positive. The second component, $\beta_1 \exp(-m/\tau_1)$, is monotonically decreasing (or increasing, if β_1 is negative) towards zero when the term to maturity (m) is increasing. When the term to maturity approaches zero, the forward rate approaches the constant $(\beta_0 + \beta_1)$, which must be non-negative to ensure that the instantaneous interest rate at this point (the starting point of the curve) is non-negative. The third component generates a hump on the curve (or a U shape, if β_2 is negative) as a function of the term to maturity. The fourth component is also a hump or a U shape. The function thus allows for two local humps or

U shapes. The shape of the function in Nelson and Siegel's model is almost identical to Svensson's, except that it does not include the fourth component. This means that the Nelson and Siegel function can only have one hump or U shape.

References

- Bjerksund, Petter and Gunnar Stensland (1996): "Utleddning av rentens terminstruktur ved "maksimum glatthets"-prinsippet". *BETA* 1/96.
- Browne, Frank and Paolo Manasse (1990): "The Information Content of the Term Structure of Interest Rates: Theory and Evidence". *OECD Economic Studies*, No. 14.
- Dahlquist, Magnus (1997): "An Assessment of Conditional Term Premia". Unpublished memorandum (www.hhs.se/personal/dahlquist)
- Deacon, Mark and Andrew Derry (1994): "Estimating market interest rate and inflation expectations from the prices of UK government bonds". *Bank of England Quarterly Bulletin*, Vol. 34 Number 3.
- Frøyland, Espen (1997): "Beregning og tolkning av terminrenter". *Penger og Kreditt* No. 1. Norges Bank.
- Mishkin, Frederic S. (1990): "What does the term structure tell us about future inflation?" *Journal of Monetary Economics*. Vol. 25 No. 1.
- Nelson, Charles R. and Andrew F. Siegel (1987): "Parsimonious Modelling of Yield Curves". *Journal of Business*, Vol. 60.
- Schich, Sebastian T. (1999): "What the Yield Curves Say About Inflation: Does it Change Over Time?" *OECD Economic Department Working Papers* No. 227
- Svensson, Lars E. O. (1994): "Estimating and Interpreting Forward Rates: Sweden 1992-1994." *Working Paper* 94/114 International Monetary Fund.
- Svensson, Lars E.O. and Paul Söderlind (1997): "New Techniques to Extracting Market Expectations from Financial Instruments". *Journal of Monetary Economics* 40(2).

The risk associated with banks' foreign borrowing

Karsten R. Gerdrup, economist in the Financial Analysis and Market Structure Department, Arild J. Lund, director, and Sindre Weme, head of division, both in the Securities Market and International Finance Department

Since 1995 banks' foreign borrowing has increased sharply, matching the growth recorded in the mid-1980s. Measured in relation to banks' total loans, foreign funding is smaller now than at that time. As was the case in the mid-1980s, the increase in foreign borrowing came in response to strong demand for domestic NOK loans. In principle, the exchange rate risk associated with borrowing is eliminated inasmuch as banks use the foreign currency loans to buy NOK spot and sell the same volume of NOK forward in the foreign exchange market. Foreign borrowing, however, involves higher liquidity risk than funding from other sources. Liquidity risk increases both because foreign borrowers may react collectively towards Norwegian banks to a greater extent than ordinary Norwegian depositors and because of the possibility of liquidity problems in the forward market where the currency is temporarily exchanged for NOK. The increased magnitude of bond issues since 1997 has contributed to extending the maturity of foreign debt, thereby curbing the increase in liquidity risk.¹

1 Introduction

This article attempts to shed light on developments in banks' foreign borrowing and analyse the associated risk. The risk is primarily related to the possibility that foreign lenders may abruptly reassess their perception of future developments in a country's economy and collectively reduce their exposure to a country's borrowers. An example of this was most recently seen in connection with the Asian crisis. We also saw how ready access to foreign loans contributed to the build-up of imbalances that later triggered a reversal of foreign funding.

It is difficult to evaluate the possibility of forward market failure. There are several types of operators with varying needs in this market and the harmful effects of herd behaviour from a limited group of operators will thus be reduced. It must be assumed, however, that a macroeconomic shock where foreign lenders collectively reassess their Norwegian borrowers will also influence the forward market to some extent.

Banks' foreign funding is of particular interest to Norges Bank as lender of last resort (LLR). When foreign funding dries up, this represents a type of crisis which, at least in principle, will emerge as a pure liquidity crisis without accompanying solvency problems.

Part 2 of this article describes developments in foreign borrowing. Part 3 discusses the possibility that the foreign sector as a funding source will dry up and the risk of liquidity problems in the forward market, while part 4 presents a summary.

2 Description of foreign funding

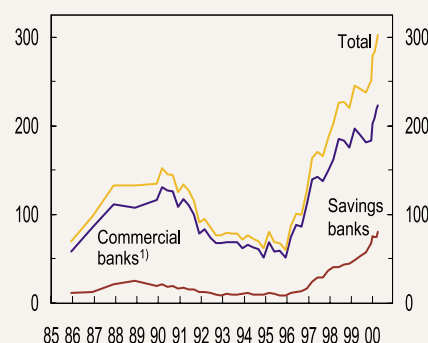
Banks' foreign debt

Banks' gross and net foreign debt rose substantially between 1995 and April 2000 (see Charts 1-3). The increase in foreign borrowing must be seen in the light of a combination of sharp lending growth and far lower growth in customer deposits (see Chart 4). Sharp lending growth towards the end of the 1990s was the result of a

vigorous cyclical upturn and historically low interest rates up to the first half of 1998. Developments after the first half of 1998 were marked by a steep decline in prices in securities markets, higher interest rates and uncertainty concerning future economic developments. For a while this contributed to slower growth in lending to the general public and higher growth in customer deposits.

The competition for savings from other investment

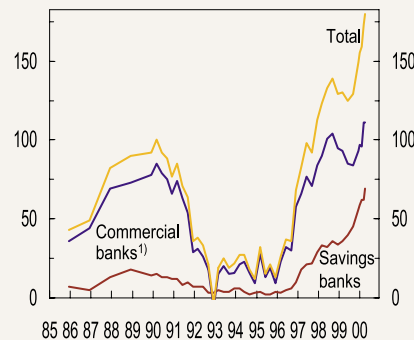
Chart 1 Banks' gross foreign debt, total and for commercial and savings banks separately. In billions of NOK



¹⁾ Incl. Postbanken from 31 December 1992

Source: Norges Bank

Chart 2 Banks' net foreign debt, total and for commercial and savings banks separately. In billions of NOK



¹⁾ Incl. Postbanken from 31 December 1992

Source: Norges Bank

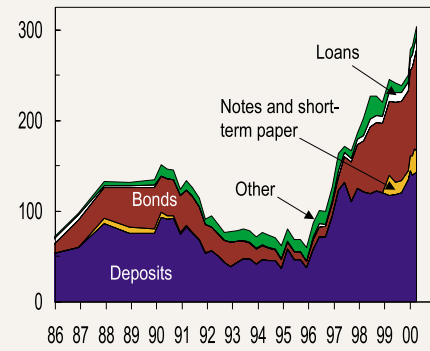
¹ Banks' liquidity risk, including the risk associated with foreign borrowing, is also discussed in the report Financial Stability 1/2000, published in May (www.norges-bank.no/english)

alternatives, such as securities funds and insurance products with a savings component, increased in this period, making it more difficult for banks to finance strong lending growth on the basis of customer deposits. Money and capital markets in Norway and other countries have been alternative funding sources. One possible reason that banks have largely chosen foreign funding may be that domestic money and capital markets have not been considered sufficiently liquid to cover this funding requirement and higher credit ratings internationally have resulted in favourable foreign funding.²

Short-term loans account for a large share of foreign borrowing, with foreign banks placing deposits in Norwegian banks (see Chart 5). Since the second half of 1997, banks have to an increasing extent relied on bonds denominated in foreign currency for long-term financing. This may be related to Standard and Poor's upgrading of Christiania Bank on 21 July 1997. Den norske Bank was given its first rating by Standard and Poor's the same day. However, both banks were upgraded by Moody's as early as 1995.

It may also be natural to view developments in banks' foreign debt in connection with other components of the capital account of the balance of payments (see Table 1). In the period 1995-1999, capital outflows were larger than the current account surplus, primarily as a result of allocations to the Government Petroleum Fund. The central government sector also recorded an outflow in

Chart 5 Banks' gross foreign debt by financial instrument. In billions of NOK



Source: Norges Bank

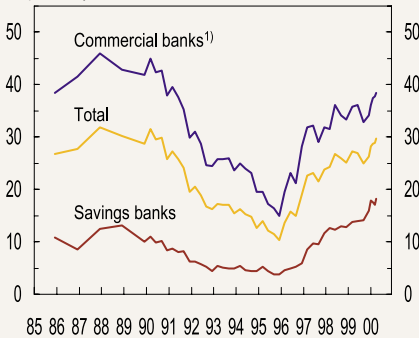
connection with the repayment of government foreign debt. Despite large current account surpluses in the period, capital inflows to private sectors were therefore required.

The capital outflow from Norges Bank and the central government sector probably contributed to slightly higher interest rates in Norway than would otherwise have been the case. It is unlikely, however, that this has motivated banks to borrow abroad. Because banks exchange foreign currency for NOK and hedge the amount through forward exchange transactions (see below), they always pay the prevailing krone interest rate on loans raised abroad.

It is difficult to link capital inflows to banks with changes in capital inflows to other sectors. As seen in Table 1, the sectoral breakdown of capital movements is highly uncertain, and the item "Undistributed capital transactions and errors and omissions" is correspondingly high.

One natural question is whether this funding is favourable for banks because foreign lenders assume that the authorities will cover losses if borrowers experience problems. In practice, the authorities are

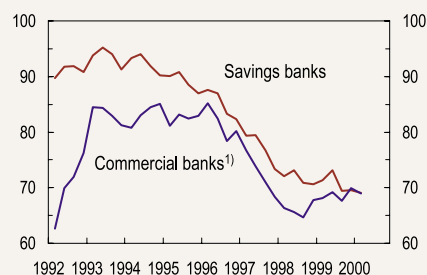
Chart 3 Banks' foreign debt as a percentage of total lending. Total and for commercial and savings banks separately



¹⁾ Incl. Postbanken from 31 December 1992

Source: Norges Bank

Chart 4. Banks' customer deposits as a percentage of lending to non-financial institutions



¹⁾ Incl. Postbanken from 31 December 1992

Source: Norges Bank

Table 1 Banks' foreign financing and Norway's external account. In billions of NOK

	1996	1997	1998	1999	Accumulated 1996-99
Current account balance	72.5	56.1	-16.3	43.5	155.8
Capital outflows	72.5	56.1	-16.3	43.5	155.8
From Norges Bank	79.9	57.5	-6.0	67.5	198.9
From 'Other sectors'	-7.4	-1.5	-10.2	-24.0	-43.1
Commercial and savings banks	-53.2	-40.3	-13.3	-18.5	-125.3
Insurance	5.6	18.3	8.4	34.1	66.4
Other financial institutions	-6.7	-11.3	-2.5	0.3	-20.2
Central government	13.5	11.4	16.6	-7.2	34.2
Local government	1.4	0.8	0.2	0.2	2.6
Ocean transport	-4.6	-2.5	0.5	-3.4	-10
Petroleum activities	-5.9	-5.5	-46.4	-1.2	-59.2
Other private and state enterprises	5.2	15.1	-5.0	-21.7	-6.4
Undistributed capital transactions and errors and omissions	37.3	11.3	31.0	-7.9	71.7

Sources: Statistics Norway and Norges Bank

²The committee studying the competitiveness of the Norwegian financial industry (NOU 2000:9) points out that giving banks the opportunity to securitise part of their loan portfolio and to issue asset-backed bonds may improve liquidity in the Norwegian bond market.

often willing to "make funds available" quickly if foreign funding is in jeopardy.³ This has been necessary in countries with fixed exchange rate regimes. On the basis of this assumed implicit guarantee, foreign lenders may have stipulated a lower interest rate than common risk assessments would imply.⁴

Exchanging foreign currency for NOK and hedging in the forward market

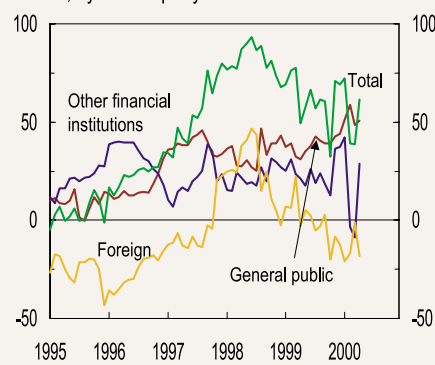
In order to avoid increased currency exposure as a result of loans raised in foreign currency, banks engage in forward exchange transactions in which they exchange the foreign currency for NOK "today" and, at the same time, agree to buy the currency back at a future date at a predetermined rate (forward contract).

Norges Bank receives statements of banks' counterparties in the forward market from registered foreign exchange banks (commercial and savings banks). On the basis of these statements, foreign exchange banks' total net currency positions in the forward market are calculated. Chart 6 shows changes in banks' net foreign currency positions in the forward market from January 1995. The chart shows that up to the summer of 1998 banks' net forward foreign currency holdings increased. This was followed by a pronounced reduction and then a further increase from autumn 1999. The chart shows that the corollary to changes in the total foreign currency position is largely a change in the position vis-à-vis foreign counterparties. The corollary to the increase from the autumn of 1999, however, is primarily a change in the position vis-à-vis other Norwegian financial institutions and the general public.

Chart 7 shows that there is a clear relationship between the increase in banks' foreign debt from 1995 to 1998 and growth in their net position in the forward market. This seems to confirm that the forward market in this period was largely driven by banks' need to convert foreign currency funding into NOK loans.

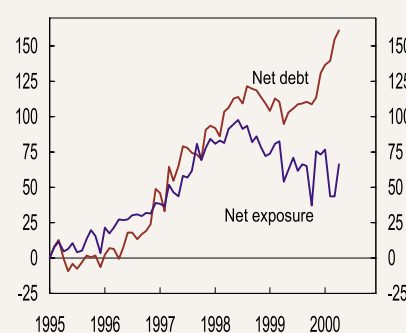
In general, however, there are a number of other operators and motives that influence the forward market, and this reduces the covariation between banks' foreign loans and their position in the forward market. There may also be variations in the level of speculative activity, for example in relation to expectations concerning the future krone exchange rate. Variations in foreign currency loans may also occur, ie part of the currency exposure on the funding side is netted against customers who want foreign currency loans. Daily turnover in the forward exchange market is also very high in relation to the level of banks' foreign funding. These factors imply that caution should be exercised when using changes in the forward market as an indication of developments in banks' foreign funding.

Chart 6 Banks' net currency exposure in the forward market, by counterparty sector. In billions of NOK



Source: Norges Bank

Chart 7 Banks' net currency exposure in the forward market, and banks' net foreign debt. Change from January 1995. In billions of NOK



Source: Norges Bank

3 What are the risks?

There are three different risks associated with banks' foreign funding:

- Liquidity risk, because foreign funding is more volatile than domestic funding with the same maturity.⁵
- Risk of liquidity problems arising in the forward market, making it difficult for banks to convert foreign currency deposits and loans into krone loans.
- Currency risk, because banks may be left with an open currency position if the loan and forward transaction are not simultaneous.

Banks' currency risk in connection with foreign funding is limited. This is partly because their currency positions are regulated in their own currency risk guidelines, and partly because of currency exposure regulations, which impose restrictions on both open positions in individual currencies and overall foreign currency exposure.⁶ The next two paragraphs provide a more detailed account of liquidity risk associated with foreign funding and the risk of liquidity problems arising in the forward market.

³ This occurred in Norway in 1986 and in connection with the banking crisis in the early 1990s. There are many examples of this internationally, most recently in connection with the Asian crisis in 1997-1998. The IMF's ever more extensive rescue operations may also have contributed to this moral hazard. On the other hand, Norway may point to the example of the state-owned company Kongsberg Våpenfabrikk where foreign investors lost money in the mid-1980s.

⁴ Bernard and Bisignano discuss this in the Bank for International Settlement's (BIS) Working Paper no. 86 (March 2000) "Information, Liquidity and Risk in the International Interbank Market: Implicit Guarantees and Private Credit Market Failure" in which they state that implicit guarantees in the international interbank market may have contributed to capital flows to emerging market economies where information asymmetry has made it difficult to assess counterparty risk.

⁵ Liquidity risk can be defined as the risk of a financial institution being unable to meet its commitments when they fall due without incurring substantial additional costs in the form of higher refinancing costs or a sharp fall in the price of assets that have to be realised.

⁶ The Foreign Exchange Regulations contain a provision to the effect that net positions of up to 15 per cent of a financial institution's capital may be taken in each currency. Total foreign exchange exposure must be restricted to 30 per cent of the institution's capital.

Norwegian banks' gross foreign debt is not higher than that of other countries' banks

Even after the sharp increase in foreign funding, Norwegian banks' gross debt is not particularly high compared with other countries' banks (see table below). At the same time, Norwegian Countries banks' gross assets are very low, leaving their level of net debt to foreign banks at a high level. Of the OECD countries included in the table, only Irish banks' net foreign debt as a percentage of total assets was higher than Norway's. In other words, Norwegian banks' exposure in the international interbank market is substantial. However, the net figure for short-term debt in the form of deposits in or loans from foreign banks is not particularly high owing to increased funding in the bond market since 1997. All in all, Norwegian banks' exposure is smaller than prior to the banking crisis.

Like Norwegian banks, Finnish and Swedish banks' net debt to foreign banks was high in the period prior to the

banking crisis. In the 1990s these banks carried out an extensive restructuring of their business. In addition to reducing gross debt, Swedish and Finnish banks have also increased their gross assets. In 1998 Swedish banks' net foreign debt was more or less on a par with that of Norwegian banks, while Finnish banks' net debt was still at a very low level. Danish banks have been in a net creditor position vis-à-vis foreign banks since 1992.

A feature that distinguishes Norwegian banks from Danish, Finnish and Swedish banks is that Norwegian banks have consistently recorded a very low level of gross claims on foreign banks, reflecting Norwegian banks' heavy reliance on the international interbank market as a source of funding. An important explanation may be that Norwegian banks' international operations are very limited, with few foreign subsidiaries and branches. Banks with foreign subsidiaries and branches normally have substantial positions between the parent bank and its branches/subsidiaries that are reflected in these statistics.

Gross claims and liabilities vis-à-vis banks in other countries. Percentage of total assets. 10 Countries by size of net debt.

	Claims				Liabilities				Net claims			
	1985	1990	1995	1998	1985	1990	1995	1998	1985	1990	1995	1998
Ireland			17.8	23.6			25.6	37.9			-7.8	-14.4
Norway	4.0	3.1	2.1	2.8	19.4	18.8	5.2	16.2	-15.5	-15.8	-3.2	-13.4
Sweden	9.7	8.9	11.8	13.2	23.3	38.8	21.4	26.2	-13.6	-29.9	-9.7	-13.0
UK	95.1	81.5	76.2	59.1	107.0	88.1	89.8	68.6	-11.9	-6.6	-13.6	-9.5
France	11.8	12.9	11.2	15.0	15.0	15.3	15.8		-3.2	-2.4	-4.5	
US	11.3	14.5	11.1	13.0	10.9	17.0	18.1	17.4	0.3	-2.5	-7.0	-4.4
Germany	6.9	12.1	9.0	9.1	5.2	6.7	8.7	12.0	1.7	5.4	0.3	-2.9
Finland	7.8	3.4	9.0	12.3	16.9	19.8	13.4	13.1	-9.0	-16.5	-4.3	-0.8
Denmark	13.1	18.5	20.4	25.5	12.1	21.4	13.3	24.6	1.1	-2.9	7.0	0.9
Japan	7.0	13.9	13.0	15.8	8.9	17.1	10.6	13.3	-1.9	-3.2	2.4	2.5
Luxembourg	36.2	46.8	42.6	41.6	53.2	40.7	34.4	33.5	-17.1	6.1	8.2	8.1
Switzerland	12.8	42.6	32.9	42.2	10.4	11.9	11.4	18.6	2.4	30.7	21.5	23.7

Sources: The BIS, International Banking and Financial Market Developments and the OECD, Bank Profitability, Financial Statements of Banks

Risk of loss of foreign funding

An important difference between ordinary short-term deposits from the general public, or other financing in NOK, and short-term foreign loans or deposits is that foreigners are more likely than Norwegian depositors and lenders to engage in herd behaviour. One can imagine events in Norway that might cause foreign financial institutions to collectively reduce their total exposure to Norwegian counterparties. In such a scenario, it makes little difference whether short-term foreign funding takes the form of loans from foreign banks or foreign currency deposits from abroad in Norwegian banks.

Such a reaction from foreign lenders may not necessarily be triggered by Norwegian conditions. Major international portfolio managers may have response rules, entailing an automatic reduction in their exposure in all countries of a particular category if certain events occur. For example, exchange rate problems in Latin America might prompt a reduction in exposure to all small open economies that are not part of a large currency bloc. In such a situation, Norway may also be affected. A similar mechanical contagion effect might be triggered for example by a requirement for higher margin payments in one or more markets, entailing the realisation of

positions in other markets. Both these factors probably played a part in autumn 1998 in connection with Russia's moratorium on payments and the crisis of the Long Term Capital Management hedge fund. Paradoxically enough, the growing contribution from institutional investors and investors with sophisticated risk management systems may have made such mechanisms more important than they have been in the past. In such cases, nevertheless, liquidity problems are not likely to be as great as if the underlying unrest were due to factors specific to Norway.

Norway's petroleum activities may be one such factor. A dramatic fall in the oil price might trigger a loss of confidence in Norwegian financial institutions.

As a general rule, problems in banks, for example high credit risk, will cause a loss of confidence. We saw this in connection with the Norwegian banking crisis. The episode illustrates the tendency for various types of risk to be interdependent. A typical scenario is that weaker profitability and financial strength as a result of high loan losses reduce banks' credit ratings to the extent that they cannot obtain (re)financing without significant extra costs.

While the internationalisation of the banking industry has increased the risk of contagion from abroad, it may

also have reduced the possibility of systemic problems, in that the banking system has become more diversified, both geographically and by industry. For example, the foreign banks that have established operations in Norway will be less vulnerable to a Norwegian economic downturn or other specifically Norwegian crisis than banks with all their activities in Norway. An improved information supply in recent years may also have reduced the risk of "unjustified" herd behaviour by foreign operators. Short-term foreign funding will irrespective be a more fragile structure than bank deposits from the general public.

The risk of liquidity problems in the forward market

If it is not possible to exchange funds for NOK and hedge against currency risk in the forward market, foreign currency loans will not be a relevant source of financing for NOK loans. There is therefore a liquidity risk associated with the forward market.

Much of the activity in the forward exchange market is a result of underlying needs, such as banks' need to hedge foreign currency financing. According to the banks themselves, a bank that has been promised a foreign currency loan will immediately initiate a hedging transaction.

In addition to the underlying needs, there will be substantial activity of a speculative nature in the forward market. The major Norwegian banks and some foreign banks quote two-way prices for NOK in the forward market. This means that part of the business of these financial institutions is to offer forward transactions to customers, whether they wish to buy or to sell NOK. Depending on the prices set, banks may shift their net exposure in the desired direction, or dispose of undesired exposure against another bank that quotes prices in the forward market. The banking community maintains that the forward exchange market for NOK is so large and liquid that it is not difficult to find counterparties.

The risk of the forward market drying up is directly related to the identity of the banks' counterparties. Who wanted to increase their spot purchases of foreign currency and their forward purchases of NOK in the period from 1995 to mid-1998? The only source that provides an indication is the breakdown into non-residents and some Norwegian sectors shown in Chart 6. The figures suggest that it was primarily non-residents who were counterparties in the forward contracts entered into in order to hedge their currency exposure in connection with banks' increased foreign funding in the period 1995-1998. However, the corollary to the increase from autumn 1999 is a change in the position vis-à-vis other Norwegian financial institutions and the general public.

Turnover figures can provide an indication of whether there is a substantial risk of a loss of counterparties in this market. Every third year, the Bank for International Settlements conducts an international survey on activity

in foreign exchange markets. Norges Bank is responsible for the survey of the Norwegian foreign exchange market.⁷

In April 1998, turnover in the forward exchange market was USD 111 363 million, or USD 5 861 million per banking day (see Table 2). Since April 1995, turnover has increased by almost 58 per cent. By comparison, Norwegian banks' total currency-based funding came to USD 25 909 million in April 1998.⁸

Table 2 Turnover in the Norwegian forward market by counterparty in April 1995 and April 1998. In millions of USD and as percentages

Counterparties	Turnover			
	April 1995		April 1998	
Residents	21 230	30.1%	24 999	22.4%
of which financial institutions	10 357	48.8%	13 193	52.8%
of which non-financial enterprises	10 873	51.2%	11 806	47.2%
Non-residents	49 290	69.9%	86 364	77.6%
of which financial institutions	45 243	91.8%	85 667	99.2%
of which non-financial enterprises	4 047	8.2%	697	0.8%
Total	70 520	100.0%	111 363*	100.0%

*Of the total amount in 1998, NOK 86.4 billion related to NOK transactions

Sources: Norges Bank, BIS surveys of spring 1998 and 1995

The large turnover figures indicate that the market is liquid. The increase since 1995 shows that liquidity increased during the three-year period, but it is difficult to analyse whether the increase is due to increased use of hedging strategies or to speculative transactions. However, banks increased their foreign funding substantially during the period, which should provide part of the explanation for the upswing in the forward market. Almost 90 per cent of forward trading takes place between banks and other financial institutions. The breakdown of the turnover by counterparty shows that the non-resident sector is clearly the most important. Non-residents were counterparties in almost 78 per cent of transactions entered into by Norwegian foreign exchange banks in April 1998. In Norway, other financial institutions and non-financial enterprises are almost equally important as counterparties for banks.

In order to shed further light on the liquidity risk associated with banks' foreign debt, it may also be useful to look more closely at turnover in the forward market broken down by maturity. Table 3 shows the turnover in the forward market in April 1995 and April 1998 broken down by maturity. One important feature of turnover in 1998 was the large proportion of short maturities (7 days or less). However, it is also worth noting that the turnover for maturities of over a year amounted to USD 1640 million in April 1998, which represented 14 per cent of banks' foreign bond debt.

In addition to banks, insurance companies, among others, have underlying needs in the forward market. Insurance companies that receive premia in NOK, but

⁷Nineteen Norwegian banks were covered in the BIS survey of spring 1998. These banks are assumed to cover more than 95 per cent of activity in the Norwegian foreign exchange market. A total of 43 countries participated in the international survey.

⁸The amount in USD is based on the average exchange rate for April 1998 (NOK 7.5262/USD).

want to invest in securities denominated in other currencies, may wish to hedge an exchange rate forward. They will then purchase currency forward against NOK. An insurance company may also wish to hedge its investments in foreign currency, particularly investments in bonds. They must then sell foreign currency forward against NOK.

Table 3 Turnover in the Norwegian forward exchange market by maturity in April 1995 and April 1998. In millions of USD

Maturity	1995		1998	
7 days or less	35 036	49.7%	84 672	76.0%
Over 7 days and				
up to 1 year	33 728	47.8%	25 051	22.5%
Over 1 year	1 756	2.5%	1 640	1.5%
Total	70 520	100%	111 363*	100%

*Of the total amount in 1998, NOK 86.4 billion related to NOK transactions

Sources: Norges Bank, BIS surveys of spring 1995 and 1998

Enterprises also have a regular need for hedging. Meeting this need may entail both purchasing foreign currency forward to hedge the price in NOK of deliveries from abroad, and selling foreign currency forward to hedge the NOK price of goods that are sold against payment in foreign currency.

Experience with liquidity problems in the forward market

Strong lending growth also created an increasing demand for foreign funding in the 1980s. By financing an increasing portion of activities with foreign currency deposits, and at the same time buying foreign currency forward, banks obtained NOK funding. In the 1980s there was still zero exposure regulation, which meant that banks' net foreign currency exposure, ie the aggregate of forward and spot positions with offsets in NOK, was supposed to equal zero.⁹ In order to be able to finance domestic lending growth through foreign loans, banks were thus heavily dependent on currency traders wanting to sell foreign currency against forward purchases of NOK. Since forward contracts oblige parties to buy and sell foreign currency at rates that are agreed before the transaction takes place, the market is vulnerable to uncertainty about future exchange rates.

Toward the end of 1985 and in early 1986, it became increasingly difficult for Norwegian banks to buy foreign currency forward against NOK. There were problems in rolling over contracts because of mounting devaluation expectations, partly owing to the sharp drop in oil prices.

With no possibility of currency hedging, banks would have to reduce their foreign currency borrowing. They would be unable to compensate for a loss of foreign funding in the domestic money and capital markets without a substantial increase in interest rates. To prevent a sharp increase in interest rates – which was considered to be inconsistent with general economic policy guidelines – Norges Bank therefore chose to replace foreign funding

with the Bank's own lending to banks. In April and May 1986, banks' borrowings from Norges Bank increased from just under NOK 10 billion to NOK 70 billion. In addition, Norges Bank supplied liquidity through repurchase agreements.

In the 1980s the forward market was influenced by a number of factors. One of these was confidence in the fixed exchange rate policy. If this confidence failed, confidence that money market investments via the forward market were profitable would also fail. This would in turn trigger a shift out of foreign currency positions to avoid substantial losses. In 1985 and 1986, developments in the Norwegian economy generally and in the oil price in particular had an impact of this nature. It is uncertain whether even a substantial raising of Norwegian interest rates, at any rate at such a late stage, could have prevented a reversal of currency flows via the forward market.

A number of fundamentals have changed since the mid-1980s, which should have reduced the possibility of disturbances in the forward market. First, exchange controls have been substantially reduced, and the EEA agreement makes it highly unlikely that extensive controls will be reintroduced. The reintroduction of exchange controls, or expectations of their reintroduction, could clearly have a highly negative effect on the forward market. Second, Norway now has a floating krone exchange rate, while in the mid-1980s we had a fixed exchange rate (band) against a basket of foreign currencies. Such a band, with expectations of movements in the exchange rate both within and outside the band, could impede the functioning of the forward market.

4 Summary

Banks' foreign debt has increased sharply since 1995. Measured in relation to their overall activities, for example total lending, banks' foreign debt is still slightly lower than it was in the mid-1980s. Since a large proportion of the loans are short-term, there is liquidity risk associated with banks' foreign funding. In recent years, more bond debt has been raised in foreign currency, so that the maturity of banks' foreign debt has increased.

Liquidity risk associated with foreign funding has proved to be substantial. Most recently in connection with the Asian crisis, we saw examples of herd behaviour among foreign lenders which created major, acute problems for borrower countries.

A more smoothly functioning Norwegian capital market will probably make it less attractive for banks to seek foreign funding.

It must be assumed that the probability of foreign funding drying up as a result of problems in the forward market has decreased. This market is substantially more liquid than it was earlier, and the absence of exchange controls and transition to a floating exchange rate should have reduced the possibility of the market drying up.

⁹The requirement that a net foreign exchange position of zero be maintained was abandoned in 1990 and replaced by foreign currency position regulation.

¹⁰Data on banks' claims and liabilities vis-à-vis banks in other countries are based on BIS statistics and total assets on OECD statistics. This may lead to a degree of error, since the selection of banks used in the statistics of the BIS and the OECD, respectively, may differ. BIS statistics are stated in USD. Total assets are converted from national currencies into USD. Data on total assets for 1998 are projected from 1996 on the basis of average growth in total assets over the past five years.

Norges Bank's oversight of payment systems – authorisation and supervision

May Helle Lund, senior legal adviser in the Legal Department, and Kjetil Watne, senior economist in the Financial Infrastructure and Payment Systems Department

Throughout the 1990s a number of international recommendations on risk reduction in payment systems have been drawn up. The most recent recommendations were issued by the Bank for International Settlements (BIS) in the report "Core Principles for Systemically Important Payment Systems" from the Committee on Payment and Settlement Systems (CPSS), consisting of representatives of the G-10 countries. The principles are supplemented by recommendations on the responsibilities of central banks in this area. The new Norwegian Act of December 1999 relating to Payment Systems is in accordance with these recommendations. The Act introduces authorisation and supervision of payment systems, assigning responsibility for interbank systems to Norges Bank. The Act also establishes requirements concerning the organisation of payment systems and risk management, and it incorporates the EEA Settlement Finality Directive in Norwegian law. This article describes Norges Bank's oversight responsibility for payment systems on the basis of the Act relating to Payment Systems.

1. International recommendations on risk reduction

For several years there has been a broad international focus on payment system risk, and a number of international recommendations on risk-reduction measures have been put forward. One central recommendation is that participation in payment systems should have a well-founded legal basis. It was partly on the basis of this recommendation that the EU began work on the Directive on Settlement Finality in Payment and Securities Settlement Systems (Settlement Finality Directive). The most important recommendations and the main content of the Settlement Finality Directive are described in brief in the following section, providing a background for a more detailed exposé of recent developments in the Norwegian payment system.

1.1 The BIS and the EU

In 1990, the BIS issued the "Report of the Committee on Interbank Netting Schemes of the Central Banks of the Group of Ten Countries". This report, known as the Lamfalussy Report, made recommendations concerning requirements for multi-currency, cross-border private netting systems in order to reduce risk. These recommendations were followed up by the Committee of Governors of the Central Banks in the European Union, which recommended that they should also apply to national payment systems. The Lamfalussy Report set the pattern for central banks' work on risk-reduction measures in national payment systems, and laid the basis for subsequent recommendations in the area.

In addition, the European Monetary Institute (EMI), the precursor of the European Central Bank, drew up a report in 1994 on minimum standards for the functioning of domestic payment systems, with the aim of achieving greater harmonisation of national payment systems in the EU. The report recommends, among other things, that systems should be based on transparent and

objective criteria for participation and that the operating hours of systems should be harmonised. The EMI also recommended that national gross settlement systems be established.

1.2 Core Principles for Systemically Important Payment Systems

Partly as a result of the problems in the wake of the Asian crisis in the late 1990s, the BIS produced a report entitled "Core Principles for Systemically Important Payment Systems". The report sets out ten principles that should be applied to systemically important payment systems (see separate box), including how the principles should be interpreted and implemented. As at July 2000 the report was available in a consultative report edition. The final version is expected to be published by the beginning of 2001.

The report was drawn up by a task force consisting of payment system experts from 23 central banks, as well as the IMF and the World Bank, and therefore reflects a broad international consensus on the requirements for important payment systems. The report is written in such a way that it can be used by countries at different stages of development, including emerging markets. However, this does not imply that the report is of less relevance for countries with highly developed payment systems, such as Norway. The purpose of the report is to help strengthen the international financial infrastructure, as safe and efficient payment systems are important for ensuring financial stability.

The BIS Core Principles are largely based on the recommendations of the 1990 Lamfalussy Report. The original six Lamfalussy recommendations have, however, been augmented by four new principles, namely numbers 4, 6, 8 and 10 in the box below. In addition, the most recent BIS report contains four recommendations on how central banks, in line with their oversight responsibility, should apply these principles. Moreover, the report applies to all systemically important payment

systems, including national systems, whereas the recommendations in the Lamfalussy Report were originally confined to multi-currency, cross-border private netting systems. The most recent report also places greater emphasis on the need to balance the considerations of efficiency and risk reduction in payment systems. The report emphasises that the systems must meet stringent risk control requirements, while it is also important to limit costs, as this is necessary in order to be able to offer efficient payment services.

On the whole, the Core Principles are more flexible than the Lamfalussy recommendations, particularly with regard to accepting various approaches to reducing and managing risk. This must be viewed in the light of the experience gained in developing "hybrid systems", such as netting systems with several settlements through the day, which have reduced risk and require lower liquidity than gross settlement systems.

1.3. Settlement Finality Directive

The Settlement Finality Directive contributes to safeguarding the legal basis for payment and securities settlement systems. The objective of the directive is to reduce the legal risk associated with participation in these systems, to promote financial stability and to strengthen the internal market within the European Economic Area (EEA), not least through provisions on settlement finality and choice of jurisdiction. The directive is also intended to facilitate implementation of the European Central Bank's monetary policy.

The directive relates to both domestic and cross-border payment and securities settlement systems, but is confined to systems established within the EEA which have been notified to the European Commission or the EFTA Surveillance Authority, ESA. Member states are required to "satisfy themselves as to the adequacy of the rules of the system prior to notification". The directive does not specify how comprehensive this approval must be, but it provides for the introduction of fully developed authorisation and supervision arrangements. The most important provisions of the directive have been implemented in Chapter 4 of the new Norwegian Act relating to Payment Systems on legal protection and security (section 2.5).

In 1998, the Nordic Council of Ministers appointed a Nordic task force to maximise harmonisation of the implementation of the directive in Nordic law. All the Nordic countries have now implemented the directive in their national legislation.

2. The Norwegian Payment Systems Act – why do payment systems need regulation?

2.1 Risks in payment systems

When a customer uses a bank card to pay for goods in a shop, and the shop has an account at a different bank from the customer, this generates in reality at least three

funds transfers. First, the customer's bank debits the customer's account for the sum in question. Second, the shop's bank credits the shop's account with the same amount. Third, the same amount is transferred from the customer's bank to the shop's bank.

The number of card payments and other types of payment effected by banks on behalf of their customers in the Norwegian payment system can reach several million transactions per day. Participants in the payment systems may incur considerable risk in connection with the obligations which arise from these transactions should anything unforeseen occur. However, it is not card payments which give rise to the greatest risk in the payment system. The greatest exposure arises as a result of interbank trading in securities and foreign exchange and money market transactions. Most claims are settled via transfers between the banks' accounts at a settlement bank, referred to as interbank settlement. In order to handle smaller transfers more efficiently, banks have established procedures for calculating each bank's total net claim or net obligation vis-à-vis other banks, instead of settling each transaction individually. This process is known as netting. Payments where the time factor is crucial and transfers of large amounts are processed separately in the Real Time Gross Settlement (RTGS) system. Norges Bank is the ultimate settlement bank both for the RTGS system and for settlement of netted positions in the central retail netting system. These systems thus comply with BIS Core Principle no. 6 stating that assets used for settlement should preferably be a claim on a central bank. Some private banks also undertake settlement of retail transactions for smaller banks. The chart in the box provides a graphic illustration of transactions between participants in payment systems.

The daily turnover in the Norwegian payment system may reach several hundred billion Norwegian kroner. The bulk of this relates to transactions between banks in which no customers are directly involved. The positions taken by the banks in the payment system will often result in significant exposures. Financial legislation sets limits on the volume of loans banks may lend to individual customers, but these limits do not apply to payment system exposures. Since interbank exposures are not always subject to an explicit credit rating, and since the exposure arises in the course of a short period of time, the risk associated with participation in the payment system is unique. The ability to manage risk depends partly on the legal framework, the division of responsibility among the participants and the organisation of netting and interbank settlements.

The participants in the payment system in Norway have a long tradition of cooperating in areas such as agreements, technical standards and infrastructure for clearing and settlement. This cooperation has laid the basis for the coordination of banking services, allowing payment orders to be transferred efficiently from a customer in one bank to a customer in another bank. A great deal has been achieved through this self-regulation, but it has not always proved sufficient to safeguard fully the general public's interests in

Core principles for systemically important payment systems

1. The system should have a well-founded legal basis under all relevant jurisdictions.
2. The system's rules and procedures should enable participants to have a clear understanding of the system's impact on each of the financial risks they incur through participation in it.
3. The system should have clearly defined procedures for the management of credit risks and liquidity risks, which specify the respective responsibilities of the system operator and the participants and which provide appropriate incentives to manage and contain those risks.
4. *The system should provide prompt final settlement on the day of value, preferably during the day and at a minimum at the end of the day.
5. *A system in which multilateral netting takes place should, at a minimum, be capable of ensuring the timely completion of daily settlements in the event of an inability to settle by the participant with the largest single settlement obligation.
6. Assets used for settlement should preferably be a claim on the central bank; where other assets are used, they should carry little or no credit risk and little or no liquidity risk.
7. The system should ensure a high degree of security and operational reliability and have contingency arrangements for timely completion of daily processing.
8. The system should provide a means of making payments which is practical for its users and efficient for the economy.
9. The system should have objective and publicly disclosed criteria for participation, which permit fair and open access.
10. The system's governance arrangements should be effective, accountable and transparent.

* Systems should seek to exceed the minima included in these two principles.

Responsibilities of the central bank in applying the core principles

- A. The central bank should define clearly its payment system objectives and should disclose publicly its role and major policies with respect to systemically important payment systems.
- B. The central bank should ensure that the systems it operates comply with the core principles.
- C. The central bank should oversee compliance with the core principles by systems it does not operate and it should have the ability to carry out this oversight.
- D. The central bank, in promoting payment system safety and efficiency through the core principles, should cooperate with other central banks and with any other relevant domestic or foreign authorities.

connection with the payment system.

Central banks are concerned with risks in the financial sector, and Norges Bank has in recent years focused in particular on reducing risk in the payment system, not least through the development of the central bank's own settlement system. The Payment Systems Act gives Norges Bank responsibility for authorisation, thereby providing the Bank with a new instrument for assuring the quality and supervision of the systems external to the Bank's own settlement system. Approval from Norges Bank will therefore also imply a kind of quality stamp for an interbank system.

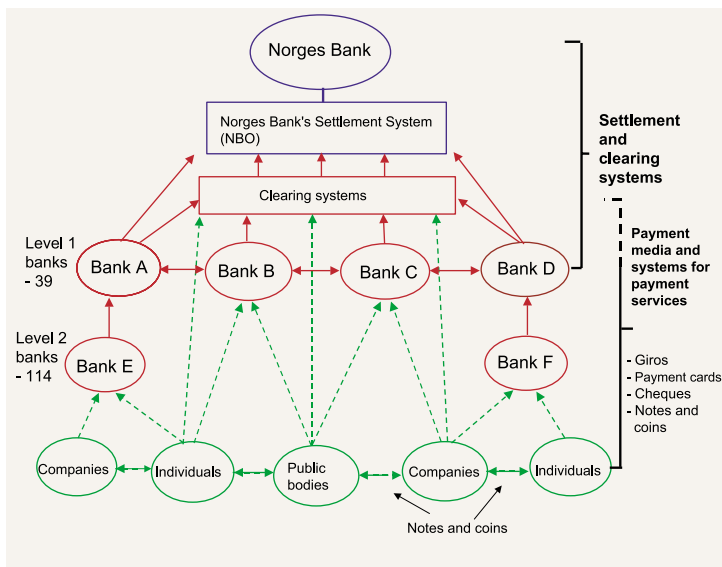
Level 1 banks settle accounts through the central bank, while level 2 banks settle in commercial or savings banks. Approximately 100 savings banks use Union Bank of Norway, and 12 to 15 savings banks use Sparebank1 Midt-Norge as their settlement bank for payment transfers.

Returning to the example of using a bank card for payment as mentioned at the beginning of this section, we can imagine a scenario where the customer (an individual) is a customer of Bank B, while the shop (a company) is a customer of Bank C. In this case both Bank B and Bank C carry out settlement at level 1 in Norges Bank. The green arrow from the private individual to Bank B illustrates how the customer's transfer order (card payment) passes through Bank B to the settlement system. There the payment is included together with many other transfer orders for calculating all the participating banks' net positions in relation to the other participants. These positions are settled in the settlement system by means of a transfer of funds between the banks' accounts at the settlement bank. This means that in the settlement system Bank C is credited with the card payment, while Bank B is debited for the same amount. Through the settlement system, notification is also sent to Bank B's customer account database that the customer's account is to be debited for the amount in question. In addition, notification is sent to Bank C's customer account database that the shop's account is to be credited with the same amount.

2.2 Key points in the Payment Systems Act

Act no. 95 of 17 December 1999 relating to Payment Systems entered into force on 14 April 2000.¹ The Act distinguishes between payment systems in interbank systems and systems for payment services. Interbank systems are defined as systems based on common rules for clearing, settlement or transfer of funds between credit institutions. Netting is the conversion into one net claim or one net obligation of claims and obligations resulting from transfer orders issued by two or more participants. The Act introduces a general rule requiring authorisation for establishing and operating such systems, and supervision of authorised systems. In line with the current division of responsibility between the

¹ The English translation of the Act is to be found on Norges Bank's web site at www.norges-bank.no. The Act is based on the Banking Law Commission's third report, NOU 1996:24 relating to payment systems etc., which in turn is based on a number of international recommendations. The EEA directive "Council Directive 98/26/EC" concerning settlement finality in payment systems and securities settlement systems is incorporated in Chapter 4 of the Act.



today, but not all of them are of importance to financial stability. Norges Bank may according to the Act grant exemptions to the authorisation requirement for systems whose operations are limited to the extent that they are assumed to have no significant effect on financial stability. Nor are such systems subject to supervision under the provisions of the Act (see section 2.3 below.)

The Act requires each interbank system to have an operator that is responsible for its establishment and operation. In order to satisfy this requirement, some existing interbank systems must be reorganised so that full responsibility for operations rests with one entity. For instance, it is necessary to specify a separate legal entity that can serve as operator for the central clearing carried out by the Norwegian Banks' Payment and Clearing Centre Ltd (BBS). The provisions of the Act with regard to the responsible operator are described in section 2.4 below.

In a regulation of 13 April 2000 issued by the Ministry of Finance on the entry into force and transitional provisions of the Payment Systems Act, it was decided that interbank systems already in operation on the date the Act entered into force must apply for authorisation by the end of 2000. However, such systems may continue operations pending the outcome of applications for authorisation. No new system may be established or operated until authorisation has been granted.

The Act is intended to complement rather than replace banks' self-regulation in this area. It is stressed that the

authorities in this area, Norges Bank has been given responsibility for the authorisation and supervision of interbank systems.

The Banking, Insurance and Securities Commission has been given responsibility for systems for payment services. Systems for payment services are systems based on standardised arrangements for the transfer of funds from or between customer accounts in banks and financial undertakings when the transfers involve the use of payment cards, numeric codes or any other form of independent user identification issued to an unrestricted range of customers. Those who operate or wish to establish systems of this kind must now send notification of this to the Banking, Insurance and Securities Commission, which may issue further specified rules on the standardisation of agreements, conditions and technical aspects for systems for payment services. Since the definition of the systems that are subject to the notification requirement is confined to transfers involving the use of payment cards, numeric codes or any other form of independent user identification, the Act does not encompass, for example, cheques, paper-based giro systems or electronic giro systems that are not based on independent user identification. Cheques are the only form of payment instrument regulated in a separate Act that was adopted as early as 1936.

The primary purpose of regulating the interbank systems is to ensure that interbank systems are organised in such a way as to safeguard the consideration of financial stability. In addition, emphasis may be placed on the importance of these systems for the efficiency of the payment system. Particular emphasis is placed on reducing the risks associated with liquidity or solvency difficulties experienced by participants in such a system. In other words, the Act is designed to help reduce systemic risk in payment systems. In this connection, Norges Bank considers it important that the system is organised in such a way as to ensure timely completion of the daily settlement, even in the event of an inability to settle by the participant with the largest settlement obligation, as recommended in Core Principle no. 5. There are about 8-10 interbank systems in Norway

Risks associated with participation in the payment system

Banks can be exposed to considerable risk when participating in the payment system. This risk can be divided into credit risk, liquidity risk, legal risk, operational risk and systemic risk.

- Credit risk depends, among other things, on to what extent banks credit customers' accounts before the banks themselves have received settlement. If a customer instructs his bank to transfer an amount to a customer in another bank, and the latter bank credits its customer before it has received settlement from the first bank, it will be exposed to credit risk which it cannot control.
- Liquidity risk is the risk that a participant will not receive anticipated funds as a result, for example, of delays in the execution of the settlement.
- Legal risk includes the risk associated with the legal status of transactions from or to a bank which is placed under public administration, and the national legislation to be applied to systems with participants from more than one country.
- Operational risk is the risk of failure or breakdowns in IT systems or communication between IT systems.
- Systemic risk is the risk that the inability of one of the participants in the payment system to meet its obligations, or a disruption in the system itself, could result in the inability of other system participants to meet their obligations.

systems remain the responsibility of the authorised operator, and that authorisation does not imply, for example, that the authorities guarantee the properties of the system's operations.

Together with the implementation of the Settlement Finality Directive in Norwegian legislation, the provisions of the Act concerning the establishment of agreements between participants in and the operator of the payment system will contribute to satisfying Core Principle no. 1 regarding a well-founded legal basis. Through its processing of applications for authorisation from the systems, Norges Bank will be able to confirm whether the systems comply with the other core principles.

2.3 Deciding which systems require authorisation

When determining whether a system should be exempted from the authorisation requirement, special emphasis will be placed on the importance of the system to the stability of the financial system. More specifically, this means determining whether the system is organised in such a way that any problems a participant might have in meeting its obligations could result in problems for other participants in meeting their obligations. In this context, systemic risk as a result of liquidity and insolvency difficulties is a central factor. This delimitation can be compared to the BIS report's delimitation of systemically important payment systems. However, when determining those systems that are to be subject to the authorisation and supervision requirement, Norges Bank will also take account of the importance of the system to the efficiency of and confidence in the payment system as a whole, and the system's need for legal protection of netting agreements.² The emphasis on the system's importance for efficiency as a determining criterion must be viewed in connection with Core Principle no. 8, which states that the system should provide a means of making payment which is practical and efficient for the economy. The final decision as to whether a system should be subject to or exempt from the authorisation requirement will be based on an overall and concrete assessment, in which emphasis is placed on whether the system has the properties described below.

The potential harm as a result of problems will in principle increase with the turnover in the systems and the value of transactions processed. A high turnover and large transaction values are therefore factors indicating a need for authorisation. If in addition there is significant credit and liquidity risk associated with the system, it should be subject to authorisation and supervision. Systems with a limited risk level will also normally be subject to the authorisation requirement if the risk level in an extreme situation could have serious consequences for financial stability. Such a situation might arise if the system's routines or organisation collapsed. Moreover, if a system with many participants fails, this may rapidly have major negative economic consequences, even if

turnover is relatively limited. Such systems may be of considerable importance to the efficiency of and confidence in payment systems, a factor which implies that they should be subject to authorisation and supervision.

Systems with limited turnover and a relatively small number of participants will also be subject to authorisation if they are linked to other important systems in such a way that the risk associated with the small system is transmitted to these larger and more important systems. This might occur as a result of the rules regarding when participants take on obligations in relation to one another.

It is usual to distinguish between interbank systems that clear and settle interbank transactions, on the one hand, and retail payment systems, on the other. The vast majority of payment transactions are retail payments, which are made when the general public uses cheques, payment cards or various paper-, telephone- or PC-based giro transactions. Payments of this kind are normally for relatively limited amounts. Even though they process a larger number of transfers, retail payment systems have a lower turnover than interbank systems, which mainly deal with foreign exchange, securities or money market transactions between banks.

The risk associated with interbank transactions is nevertheless not necessarily as large as the size of the transactions or the exposure of the participants might suggest. This is because banks are aware of the counterparties to the transactions and can monitor credit risk. However, the time factor will often be crucial in such payments, as is the case for settlement of transactions in securities and foreign exchange trading. The contagion effects associated with system difficulties may therefore spread very quickly through these markets. This means that systems that handle interbank transactions where the time factor is crucial should not be exempted from the authorisation requirement.

Banks may be subject to passive exposure in retail payments systems, for example if corporate customers initiate payment orders for large amounts in the retail systems, and the banks credit their customers before the interbank settlement. Such transactions may result in relatively large exposures, and a high potential risk for the beneficiary's bank, if the system is not organised in an appropriate and sound manner. Furthermore, these systems are of considerable importance to the efficiency of and the confidence in payment systems. The failure of systems that handle card transactions, which are very widespread today, may lead to loss of the public's confidence in the payment system as a whole. All in all, retail payment systems may therefore be of such importance to society that they might be required to authorise and supervise the clearing and settlement arrangements associated with the systems, even if the retail systems themselves are not regarded as systemically important.

On the other hand, there will be less need for authorisation and supervision of interbank systems with only a small number of participants, limited turnover or limited links to other interbank systems. If the exposure of

² Cf description of legal protection and security for netting and settlement agreements in section 2.5.

participants in these systems is small in relation to their capital, this may also provide grounds for exempting them from the authorisation requirement.

2.4 *The role of operator*

So far it has not been sufficiently clear in practice who has had the main responsibility for some of the Norwegian interbank systems. The Act's requirement that the systems appoint one operator will clarify the matter of responsibility. The operator is given responsibility for organising and operating the interbank system in accordance with the requirements laid down in the Act and the conditions for authorisation. It is the operator who will be the licensee and the institution to be addressed as to any requirements for adapting the system to comply with the Act. Other participants in the system must also comply with the Act, and loyally assist the operator in running the system in a sound manner. The requirements stipulated in the Act concerning the operator will fulfil Core Principle no. 10 on the system's governance arrangements.

The Payment Systems Act was formulated bearing in mind that interbank systems are constantly evolving. It is presupposed that the operator will play a key role in the operation of the systems, without this implying that the operator must take the initiative or decide on every change. The ultimate responsibility for ensuring that developments are not in contravention of the Act or the system's authorisation conditions nevertheless rests with the operator. In line with this, the operator is obligated to notify Norges Bank of any significant changes before they are implemented. Changes may be implemented, unless otherwise decided by Norges Bank, within two months of notification being received. The operator shall also suspend a participant in the system that acts in such a way that its continued participation may jeopardise financial stability. Before the decision to suspend a participant is taken, the case shall be submitted, to the extent possible, to Norges Bank.

In contrast to some other countries' implementation of the Settlement Finality Directive, the Payment Systems Act does not stipulate requirements regarding the enterprise form. The operator may be organised as a bank, another company, a non-stock institution or an association. Nor does the Act prevent several legal persons from functioning jointly as operator for a system. However, any such cooperation must take place through one legal entity, so that the authorities only have one responsible entity to deal with. The Act also allows one operator to operate several interbank systems.

Irrespective of the enterprise form, the operating body shall have a manager and a board of directors. As with institutional legislation, the Payment Systems Act requires that the manager and board members shall satisfy the necessary requirements for good conduct and experience, in accordance with the requirements for credit institutions in Council Directive 77/780/EC.

The Act requires that the agreement between participants shall specify the operator of the system. The rights and obligations of the operator and participants must also be agreed in detail. This applies, for example, to conditions for the suspension of a participant (including the operator's handling of suspension cases), the operator's responsibility to inform participants of decisions taken by the authorities, and the duty of confidentiality in connection with confidential information.

2.5 *Legal protection and security*

The Settlement Finality Directive provides approved payment and securities systems with protection against legal risk associated with the insolvency of a participant. As previously noted, the provisions of the Directive are mainly incorporated in the provisions in Chapter 4 of the Act relating to legal protection and security for clearing and settlement agreements.

The provisions in this chapter allow the systems to establish legal protection for their clearing and/or settlement agreements. Such legal protection means that the opening of insolvency proceedings cannot prevent the system from settling transactions from an insolvent bank, provided that the transactions were entered into the system prior to the decision to place the bank under public administration. The liquidator may not, for example, choose to accept incoming transactions and at the same time reject transactions that are to be charged to the insolvent bank. The general right of a liquidator, pursuant to insolvency legislation, to choose freely which agreements it will honour and fulfil has thus been eliminated. Legal protection pursuant to the Payment Systems Act also extends the participants' right to execute netting in the event of insolvency, as opposed to what follows from general insolvency legislation rules. This is because the Payment Systems Act permits multilateral netting and net settlement in insolvency situations, in contrast to the Creditors Security Act, which only allows bilateral netting.

If legal protection is established, the system can thus carry out netting and settlement even if a participant is insolvent. In order to have legal protection, the agreements must stipulate the time when transactions are entered into the system and the time when the right to revoke the order no longer applies. The Securities Trading Act also contains rules concerning legal protection for agreements on bilateral netting of financial instruments. These are general provisions that are not linked to participation in an approved interbank system.

However, agreements on legal protection are not always sufficient for executing a settlement with an insolvent participant, and the solvent participants may therefore still be exposed to credit risk. This risk could be reduced or eliminated by establishing guarantees that cover the obligations of the insolvent bank. Such guarantee arrangements may, for example, consist of a pool of securities furnished to the settlement bank. Since guarantee

arrangements can help to reduce settlement risk in a settlement system, the Savings Bank Act now allows savings banks, like commercial banks, to furnish the settlement bank with a guarantee. As the institution responsible for authorisation, Norges Bank may also instruct interbank systems to establish guarantee arrangements. The Payment Systems Act (like the Settlement Finality Directive) also provides protection against claims from the liquidator for invalidating collateral security for old debts. This means that the liquidator cannot prevent the system from realising this collateral security in order to meet the insolvent participant's obligations in the settlement.

The Act also contains important rules as to which country's legislation is applicable to securities that only exist in electronic form (dematerialised securities). These rules regarding choice of jurisdiction are relevant for cross-border pledging of collateral security, where, for example, collateral security provided to a Norwegian system is recorded in a register established in another EEA country.

Protection against legal risk associated with the insolvency of a participant is first achieved when Norges Bank notifies the systems to the EFTA Surveillance Authority. Notification will be sent when the interbank system has been authorised. Such a system is consistent with the Settlement Finality Directive, which requires national authorities to satisfy themselves as to the adequacy of the rules of the system before sending notification.

2.6 Other conditions for authorisation

The authorisation and supervision arrangement laid down in the Act shall ensure that interbank systems have a predictable regulatory framework. Central system requirements are laid down directly in the Act, such as the requirement that there be one operator. The openness requirement in the participation criteria is also explicitly laid down in the Act. This requirement may be compared to Core Principle no. 9 concerning objective and publicly disclosed criteria for participation. The Act further requires that the rights and obligations of participants be stipulated in agreements. The most central agreements are the systems' netting and settlement agreements, which are to be formulated in accordance with the requirements of the Act. As the institution responsible for authorisation, Norges Bank can stipulate other requirements regarding the systems, including capital and security requirements applicable to the operator, settlement bank or central counterparty. These requirements will have to be based on a concrete assessment of the risk factors associated with the individual system.

It is particularly important that the system be organised in such a way that it does not result in liquidity or solvency difficulties for participants. As a minimum, Norges Bank will require that participants are aware of the actual and potential risk in the system, and that the

system has procedures for providing information about such risk. Moreover, applications must present the results of a study of the risk level in the system as well as procedures for managing the risk. When applications for authorisation are considered, it will be required that the systems satisfy Core Principles nos 2 and 3. The systems must also provide information on contingency plans to ensure the timely completion of the daily settlement even if the ordinary system fails. This provision implements Core Principle no. 7 on contingency arrangements.

2.7 Norges Bank's supervisory responsibilities

Pursuant to the Payment Systems Act, Norges Bank is responsible for supervising systems that receive authorisation, and may instruct the operator to make any changes deemed necessary. The Act thus empowers Norges Bank to carry out the oversight recommended by the BIS report in point C of "Responsibilities of the central bank in applying the Core Principles". This oversight can to some extent be said to be institution-based, but will be limited to those activities of the operator that are directly linked to the interbank system. There is also a distinction between Norges Bank's system-based oversight, and the institution-based oversight for which the Norwegian Banking, Insurance and Securities Commission is responsible. System-based oversight can be looked upon as putting the central bank's traditional responsibility for monitoring payment systems into practice. Norges Bank's oversight of the systems must not encroach on the Commission's general institution-based supervision of the same institutions.

The aim of the system-based oversight shall be to ensure that the systems are operated in accordance with the purpose of the Act and the conditions for authorisation. Oversight will therefore be focused on ensuring compliance with the authorisation requirements with respect to sound procedures for managing risk in connection with clearing and settlement. Oversight will also be maintained to ensure that significant changes in operations and organisation do not influence the risk situation in a manner that is in contravention of the Act. Norges Bank may call a halt to planned changes in the system, or instruct the operator to make adjustments if the Act or the authorisation so indicates.

Applications for authorisation must, as mentioned, contain data from a study of the risk level of the system. The specific content of these studies will vary from system to system, but will normally consist of data on average daily gross turnover and maximum multilateral and bilateral positions. It may also be relevant to relate positions to the participants' capital. As a condition for authorisation, systems will be required to report key data at regular intervals. Norges Bank may also at any time require from the operator such information as is deemed necessary for determining whether the system is being operated in compliance with the Act and conditions for authorisation.

3. Summary

There is a long tradition of giving central banks responsibility for oversight of payment systems, but very few of them are empowered to instruct systems to make changes. As a result, central banks have mainly exercised their authority in this area through their role as ultimate settlement bank. This has also been the case for Norges Bank which, pursuant to the existing Norges Bank Act, "shall contribute to promoting an efficient payment system in Norway and vis-à-vis other countries". Some central banks also exert some influence on systems through part ownership and representation on the governing bodies of the systems.

Over the past ten years, there has been increased focus on the importance of payment systems to financial stability and to the economy in general. It has been found that a weak organisation of the systems may expose participants to undesired liquidity and credit risk. There has also been considerable legal risk, partly because the legislation of most countries has not provided the systems with the necessary protection in insolvency situations.

When the BIS issued the Lamfalussy Report in 1990, it became a cornerstone in the work on reducing risk in payment systems. The recommendations in the report were adopted as standards for many central banks and private systems. It also laid the basis for more detailed statutory regulation of the systems as, for example, in Canada. In its report on "Core Principles for Systemically Important Payment Systems", the BIS has further developed the recommendations from 1990, and the report stresses the central banks' responsibility for overseeing the systems. Moreover, the EU began its work on the Settlement Finality Directive partly as a result of the Lamfalussy Report, which revealed a need to establish a better legal basis for the systems. The Directive may be said to have increased national statutory regulation of payments systems in the EEA. In order to obtain the protection offered by the Directive, the system must be subject to some form of national approval. The Directive nevertheless does not require EEA States to establish a fully developed authorisation and supervisory arrangement like the one the Payment Systems Act is now introducing in Norway.

All in all, the purpose and orientation of the Payment Systems Act is closely in line with international recommendations in this area. With the introduction of an authorisation and supervisory authority for payment systems, Norges Bank is one of the first national central banks to have explicit responsibility for these systems. The central banks of Australia, Canada and Italy, as well as the ECB already have similar, explicit legal bases. This explicit statutory regulation makes the responsibilities and instruments of central banks clearer than, for example, part ownership of the systems. The BIS report on "Core Principles for Systemically Important Payment Systems" has prompted a number of central banks to consider how

they can best ensure that their systems are brought into line with the recommendations in the report, and whether central banks have an adequate legal basis for assuming decision-making powers. The result of the report in the longer term may well be that the authorities in a number of countries are given more explicit responsibility and the legal basis for intervening in the systems.

An overview was provided above of the risk factors associated with participation in a payment system. The BIS Core Principles provide guidelines on how these risk factors should be dealt with. The authorisation and oversight authority gives Norges Bank explicit authority to instruct operators to reduce risk and thereby bring their systems into line with these principles.

Norges Bank plans to finalise its conclusions as to whether the Norwegian payment systems meet with the requirements of the Act, and whether the systems comply with the BIS' Core Principles, by mid-2001.

References

Country-specific:

Australia: Reserve Bank of Australia (1998): "Payment Systems (Regulation) Act, Payment Systems and Netting Act"

Canada: Bank of Canada (1997): "Guideline Related to Bank of Canada Oversight Activities under the Payment Clearing and Settlement Act"

General:

BIS (1990): "Report of the Committee on Interbank Netting Schemes of the Central Banks of the Group of Ten Countries"

BIS (1999): "Core Principles for Systemically Important Payment Systems – Part 1: The Core Principles"

BIS (2000): "Core Principles for Systemically Important Payment Systems - Part 2: Implementing the Core Principles"

Commission of the European Union: Council Directive 98/26/EC of 19 May 1998 on Settlement Finality

EMI (1992): "Issues of Common Concern to EC Central Banks in the Field of Payment Systems"

EMI (1993): "Minimum Common Features for Domestic Payment Systems"

Norway:

NOU 1996: "24 Payment Systems etc." (Green Paper from the Banking Law Commission)

Norwegian Act no. 95 of 17 December 1999 relating to Payment Systems, etc.

Ot prp nr 96 (1998-99) Om lov om betalingsssystemer m.v., Innst O nr 13 (1999-2000) Innstilling fra finanskomiteen om lov om betalingsssystemer m.v. (Odelsting proposition 96 (1998-99) Concerning an Act on payment systems etc., Recommendation no. 13 of 1999-2000 to the Odelsting from the Standing Committee on Finance on an Act on Payment Systems etc.)