

Risk in the Norwegian settlement system 1995-2000

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In recent years, there has been strong international focus on risk in the payment system and most countries have implemented measures to reduce this risk. In this article, we will discuss the main aspects of Norges Bank's and the Norwegian banking industry's efforts to reduce settlement risk in Norway's payment system. The establishment of Norges Bank's settlement system (NBO) in 1997 was a milestone in this work. A comparison of settlement risk today with risk before the establishment of NBO shows a considerable reduction, but there is scope for further reduction.

1 Introduction

Every day, large amounts of money are transferred between households, enterprises, the public sector and other economic agents. These transfers occur in connection with the purchase and sale of goods and services, different capital transactions such as loans and securities trading, as well as payments connected with returns on capital, eg interest and dividends. The parties involved in these transactions incur a degree of risk related to the counterparties' willingness and ability to fulfil their obligations. An individual who sells goods on credit risks, for example, that the buyer does not pay for the goods, and a lender risks that the borrower does not repay the loan. The focus of this article is not on this type of risk, but rather on risks incurred by banks when they transfer funds from payer to payee. Very often, such transactions also result in payments and obligations between the parties' banks, for example, in connection with the use of payment cards, giros and other instruments for transferring funds to and from customers' accounts. Several million transactions are sent through the Norwegian payment system every day. Most transactions are small, but extremely large transactions also occur. As payment intermediaries, banks may take on considerable obligations and claims in relation to other banks. A special feature of such inter-

bank exposure is that it is largely a result of customers' payments rather than the banks' own transactions. One bank's exposure to another bank can thus exceed the lines of credit that would otherwise be given. This makes risk in connection with the payment system unique.

2 Risk in the payment system and background for Norges Bank's involvement

Banks' risk connected with participation in the payment system is often divided into three categories: credit risk, liquidity risk and systemic risk.

Credit risk is the risk of losses due to the failure of another bank to meet obligations on time or at a later point in time. Credit risk arises because banks credit customers, ie individual and business customers as well as other banks, before they receive funds in settlement.

A bank that has credited a customer account will be exposed to risk until the final settlement has occurred in Norges Bank. If another bank becomes insolvent during this period, the size of the loss will depend on the legal status of transactions to and from the insolvent bank. Of course, the evaluation underlying a decision to credit the customer early will be very important to the risk

Some key concepts

NBO (Norges Bank's Settlement System): As a rule, all banks with an account in Norges Bank have access to the settlement system. NBO handles gross settlement as well as settlement based on netting between banks' accounts in Norges Bank.

NICS (Norwegian Interbank Clearing System): Banks' jointly-owned clearing and liquidity information system. Clearing: Several transactions are cleared against each other and each bank's net position is calculated.

Net settlement: Settlement of clearing in the settlement bank.

NICS retail netting: Batches of customer payments, eg giro, payment card and cheque transactions, settled twice daily in Norges Bank (ie deferred net settlement – DNS)

NICS-SWIFT¹⁾ netting: Medium-sized payments settled six times daily in Norges Bank (ie DNS)

NICS-RTGS (Real-time Gross Settlement): Real-time gross settlements where transactions over NOK 100 million and specially earmarked transactions are settled one by one in Norges Bank.

¹⁾ SWIFT stands for Society for Worldwide Interbank Financial Telecommunications

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The Norwegian settlement system

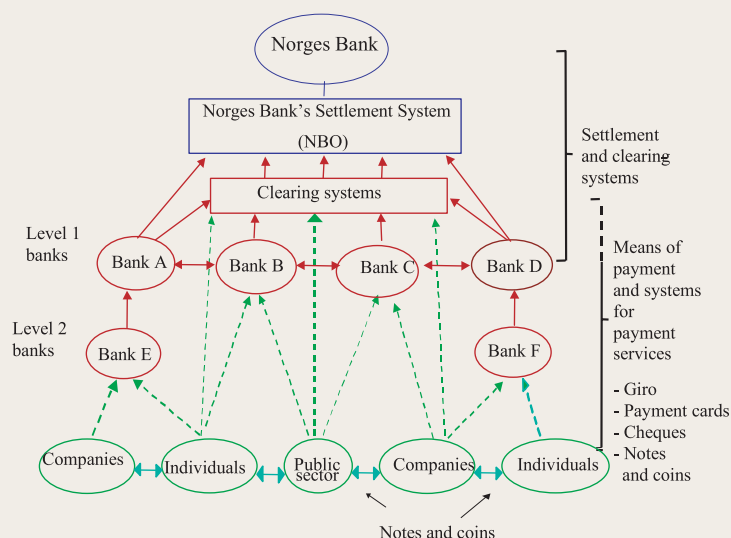
The chart below presents the Norwegian payment system. At the "bottom" of the system are banknotes and coins and a payment services system that permits the use of bank deposits and credits as a means of payment. At the "top" are systems for calculating positions and transferring funds between banks, ie clearing and settlement systems. The clearing systems include the Norwegian Interbank Clearing System (NICS), the Norwegian Central Securities Depository (VPS) and the Norwegian Futures and Options Clearing House (NOS). The settlement systems include Norges Bank's Settlement System (NBO) and settlement systems in private settlement banks. Banks may choose direct settlement in Norges Bank (level 1 banks) or indirect settlement through a private settlement bank (level 2 banks).

Large payments (over NOK 100 million) and specially earmarked transactions are sent one by one to Norges Bank for immediate settlement (gross) via the RTGS system. In principle, all banks have access to gross settlement in Norges Bank. Medium-sized transactions are cleared via NICS in the SWIFT netting system, where six settlements are made daily. Twenty-two banks participate in these settlements. Small transactions, such as giro and ATM withdrawals, are sent for

settlement via NICS retail netting. Thirty-six banks participate in this settlement. Payment orders connected with securities and derivatives transactions are sent to Norges Bank for settlement via VPS and NOS respectively. Nineteen banks participate in securities settlements, while 15 participate in derivative settlements.

The table below, which is based on statistics from May 1999 to September 2000, presents some key figures in connection with different payment settlements.

The payment system in Norway



Number and total value of transactions in different payment settlements

	NICS-RTGS	NICS-SWIFT net	NICS retail netting*
Average daily gross turnover	NOK 120 billion	NOK 20 billion	NOK 20-25 billion
Average daily turnover via accounts in Norges Bank (after netting)	NOK 120 billion	NOK 4 billion	NOK 4-5 billion
Average daily number of transactions	Approx. 300	Approx. 4 300	2-3 million
Average size of transaction	NOK 400 million	NOK 4.7 million	Approx. NOK 10,000

*There is some uncertainty about the figures for NICS retail netting

involved. However, customer accounts have often been credited automatically in connection with payment transfers and explicit credit evaluations have been lacking. A somewhat simplified measure of efficiency might be the interval between customer payment initiation and funds accessibility for the recipient. There is a conflict between efficiency and risk since early crediting makes funds more rapidly accessible for banks' customers than crediting after settlement.

Liquidity risk is tied to the costs involved in liquidity shortfall due to delays in settlement. This may be due, for example, to insufficient liquidity planning at one of the banks or the failure or breakdown of computer systems or telecommunication services.

If a bank has large exposures to other banks, settlement problems may lead to a liquidity shortfall or losses that prevent them from meeting their own obligations. In this way, a bank's liquidity and solvency problems can spread to other banks through the payment system and at worst threaten financial stability. This type of risk is called *systemic risk*, and one of Norges Bank's primary objectives is to prevent this type of risk. Therefore, the possibility of systemic risk is of central importance to Norges Bank's evaluations of risk in the Norwegian settlement system.

Routines for crediting customers

A payment from customer 1 to customer 2 via their banks will involve the following operations:

1. Bank A debits customer 1's account and sends notice of the payment through the payment system where bank B is asked to credit customer 2's account.
2. The settlement bank debits bank A's account and credits bank B's account.
3. Bank B credits customer 2's account.

Customer 1 => bank A => settlement bank => bank B=> customer 2

The order of these operations has a considerable influence on risk formation in the settlement system. If banks practice early crediting, bank B will credit customer 2 (step 3) before the bank has received payment from the settlement bank. This entails a risk for bank B, since bank A can become insolvent before settlement is made. Without early crediting, bank B will not take on an obligation to customer 2 and will not risk a loss if bank A becomes insolvent.

3 Establishment of NBO

During the second half of the 1990s, the banking industry and Norges Bank have cooperated in a number of efforts to reduce risk in the payment system. The establishment of Norges Bank's Settlement System (NBO) in 1997 was a milestone in this work. First, we will describe settlements before the establishment of NBO. Then, we will describe the important changes that NBO has generated and how these changes have reduced risk.

Norges Bank was also the settlement bank for all major Norwegian banks before NBO was established. Banks' positions were settled once a day, at the end of the business day. This settlement included banks' positions from netting results in BBS (the Norwegian Banks' Payment and Clearing Centre) and transactions that were sent directly to Norges Bank. According to the rules, banks' positions at the end of the day should not exceed their limits for overnight loans in Norges Bank, but settlement could be completed even if a bank had a net obligation that exceeded borrowing limits (ie infringement of the rules was not controllable). Settlement could, however, be rejected if insolvency proceedings had been initiated against a bank, and in such a situation, the surviving banks would not receive payments from the insolvent bank.

In terms of risk, this solution entailed obvious drawbacks, both for the banks and for Norges Bank. Norges Bank's risk was due to the fact that lending to banks was unsecured. In addition, a settlement could be executed even though a bank exceeded the permitted loan limit.

At worst, such a bank could become insolvent and Norges Bank would only have a claim on dividends from the realisation of assets of the bankrupt estate and could incur a loss as a result of its role as settlement bank. Risk for banks participating in the settlements was tied to the possible reversal of net positions if insolvency proceedings had been initiated against a bank. With only one settlement daily, exposures could be considerable and the potential for loss or liquidity shortfalls great.

The establishment of NBO entailed a number of important changes in relation to the previous solution:

- i) requirements for cover in connection with settlements in Norges Bank
- ii) establishment of intraday liquidity information in real-time
- iii) the possibility of continuous settlement through the day

The purpose of introducing requirements for cover was to remove Norges Bank's risk in its role as settlement bank and to clarify banks' responsibility for covering their positions in the settlement. This requirement means that a settlement is only made in Norges Bank if a bank's position does not exceed the bank's available funds, ie the sum of cash balances and the bank's borrowing facility, where securities have been used as collateral. Since banks had no experience with managing liquidity through the day, this requirement was introduced gradually. In the beginning, banks were required to provide 50% collateral for loans, subsequently 67%, and finally from 8 September 1999, full collateral was required. The reduction in Norges Bank's risk may be regarded as important since any losses in connection with the settlement would represent use of government funds outside the priorities that ensue from the Government's and the Storting's fiscal decisions.

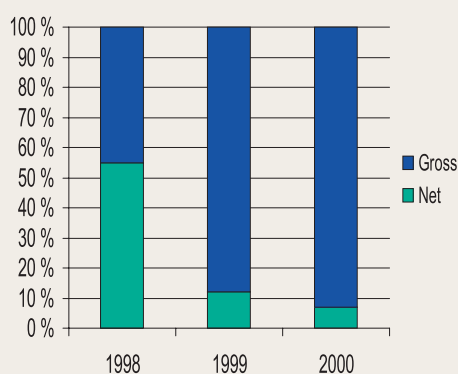
The banking industry and Norges Bank cooperated in establishing a system for real-time liquidity management. This information system made it easier for banks to monitor liquidity and their exposure to other banks through the day, and it is reasonable to assume that this has contributed to reducing banks' risk in connection with payment transactions. The introduction of continuous settlement through the day probably contributed most to risk reduction.

4 Continuous settlement has reduced credit risk

From the outset, NBO involved a transition to frequent net settlement of payments in SWIFT format and the possibility of manual settlement of individual transactions through the day. Manual handling of gross transactions meant that it could take time for a transaction to be settled after it was sent to Norges Bank. In March 1999, however

Real-time Gross Settlement (RTGS) was established in NBO. This meant that banks could send gross transactions to Norges Bank and they would be settled automatically and immediately upon receipt, assuming the banks had cover for the transactions. At the same time, an upper value limit of NOK 100 million was introduced for transactions in NICS-SWIFT netting. This means that all SWIFT transactions over NOK 100 million are automatically channelled to gross settlement. Since payments sent in SWIFT format account for the majority of turnover in the Norwegian payment system, the transaction limit meant that most transactions now go to gross settlement (see Chart 1).

Chart 1 Turnover in NBO. Share of transactions sent to net and gross settlement through accounts in Norges Bank



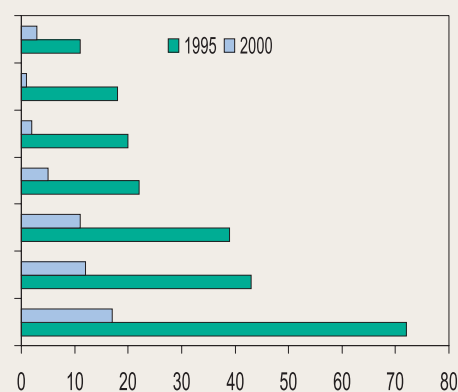
Source: Norges Bank

This development has had a positive effect on risk connected with large transactions. Before NBO was established, such payments were either included in the intermediate account or they were sent directly to Norges Bank where there was one final settlement daily. This meant that banks' exposure to each other developed through the day and that this exposure lasted for a relatively long period. Introduction of frequent net settlements and real-time gross settlements has reduced both the size and duration of banks' exposure to one another. RTGS also contributes to more effective risk management since banks may decide when transactions are sent to settlement. They can influence their exposure to other participants in the payment system by eg holding back payments to banks where exposure is already high. It should be added, however, that the reduction in exposure has been counterbalanced by the fact that banks have coordinated the exchange of individual transactions out of consideration for liquidity risk and liquidity needs. This means that turnover in NBO is not evenly spread throughout the day but that about half of the daily turnover in SWIFT netting is included in one of the settlements and most of the RTGS transactions are sent at a previously agreed time.

The lack of comparable data makes it difficult to quantify exactly how much risk reduction has been achieved. Chart 2, however, shows developments in exposure in connection with SWIFT netting for a group of banks in 1995 and 2000. The figures are based on the largest exposures in the respective nettings from a period of 16 days in 1995 and 10 days in 2000.

The reduction in the largest exposures from 1995 to 2000 varies from less than 40% to 90%, while the average is 50%. The banks' capital situation has changed during the period, however, and the average reduction in exposure is as much as 80%, measured in relation to core capital. If we look at the spread of exposure for a 10-day period in 2000, we find that in more than 95% of the cases the exposure is less than 5% of the recipient bank's core capital. See the box on calculating exposure for more details on the assumptions underlying these calculations. Based on these observations, we can conclude that credit risk in connection with SWIFT transactions has been reduced considerably and that credit risk seems to be at an acceptable level in connection with netting in normal situations. The reduction in positions is primarily due to the transition to gross settlement but may also be the result of more frequent net settlements. It is important to realise, however, that exposure may be much greater during periods of high activity in different markets and that there are no instruments which directly limit exposure for individual banks and the banking industry as a whole.

Chart 2 Estimate of largest credit exposure for each of seven Norwegian banks¹⁾ as a percentage of core capital



¹⁾ Based on the largest bilateral gross netting position adjusted for estimated early crediting. Positions measured on the basis of the intermediate account during 16 days in 1995 and on the basis of SWIFT netting during 10 days in 2000.

Source: Norges Bank

Calculation of banks' exposure in the payment system

On the basis of average daily turnover in different parts of NBO and rough estimates of the incidence of early crediting in individual netting, we can make an estimate of aggregate credit exposure in NBO:

	Early crediting	Average daily turnover	Credit exposure
NICS retail netting	100%	NOK 25bn	NOK 25bn
NICS-SWIFT netting	50%	NOK 20bn	NOK 10bn
NICS-RTGS	20%	NOK 120bn	NOK 24bn
Total			NOK 59bn

A rough estimate like the above says nothing about the potential loss that can occur in the payment system. If the total loss in the payment system is to be equal to the total exposure, all banks must go bankrupt simultaneously.

Individual bank's exposures as they are presented in Chart 2 are calculated on the basis of banks' gross receipts from one counterparty in the netting concerned and use the same rough estimates for the scope of early crediting. Netting can be reversed and sent to gross settlement if a bank participating in netting is unable to meet its obligations. In such a case, the potential loss for the recipient bank will be the prepaid customer payment's share of transactions from the bankrupt bank. It may be argued that this is an unrealistic estimate of the loss, since it assumes that there will not be any payments from the estate. The extreme cases are of interest, however, when assessing risk in the payment system. If, for example, a bank has a gross exposure to another bank in the amount of NOK 100 million in NICS-SWIFT netting, our calculations indicate that the credit exposure would be comparable to NOK 50 million. We look at this in relation to the bank's core capital, which is an indication of the bank's ability to withstand possible losses.

With the introduction of RTGS, the composition of transactions entered into the deferred net settlement is completely different now than it was in 1995. Using 20% and 50% as estimates for early crediting's share of turnover in each of the two nettings gives us a total of 24% for such payments. This figure is used as an estimate of the scope of early crediting in 1995 in Chart 2.

5 Transition to crediting after settlement gives further reduction in credit risk

Credit risk arises in the settlement system because banks credit their customer accounts before settlement in the settlement bank. In June 2000, the banking industry discontinued early crediting of customer accounts for

transactions that account for the bulk of value in NICS retail netting. This change reduces daily credit exposure by NOK 20-25 billion. The disadvantage of the transition to crediting after settlement is that customer access to incoming payments is delayed. This is counterbalanced, however, by the introduction of an extra daily settlement of retail transactions.

We have demonstrated that in general, exposure connected with SWIFT netting is small for individual banks and the duration of exposure in RTGS is short. Exposure varies from day to day, however, and may be considerably higher on days with considerable activity in the financial markets. The potential for risk reduction has not been fully utilised until banks discontinue the practice of early crediting of customer accounts for these transactions as well. Ongoing efforts in the banking industry's organisations indicate that banks will discontinue this practice in the first quarter of 2002 and thereby further reduce credit risk connected with SWIFT netting and NICS-RTGS settlement. This will not prevent banks from crediting customers before settlement, but the share of transactions that are credited before settlement will probably decline and early crediting will be based on a more explicit credit evaluation. A decline in efficiency due to a transition to crediting after settlement will also be limited since SWIFT payments will either go to gross settlement or be incorporated in frequent net settlements.

It is natural, however, to point out that there are also other solutions for promoting an effective and safe payment system. Important elements of such a solution may be collective guarantees, loss distribution agreements and exposure limits. If one of the participants lacks cover for his position in the netting, collective guarantees may be used to ensure execution of the settlement. Loss distribution agreements may contribute to a fair distribution of such loss, and exposure limits may limit the size of the loss that a single bank can impose on the banking industry as a whole (multilateral exposure limits) and/or individual banks (bilateral exposure limits). Despite exposure limits, such a solution will lead to loss for the other participants if a bank becomes insolvent. The size of the loss will depend on the legal status of the netting. If the netting result is protected by law, the potential loss from netting may be reduced to the multilateral net position in the netting for the industry as a whole. Lacking such legal protection of the netting, the estate may choose to complete only those transactions in the netting that are advantageous to the insolvent bank (cherry picking). The banking industry as a whole will then risk a loss that is comparable to the sum of all payments from the insolvent bank. For example, if insolvency proceedings has been initiated against one of the larger Norwegian banks, the potential loss in a NICS netting without legal protection for the netting agreement may typically be ten times larger than if legal protection was in place. When Norway's Act relating to Payment Systems etc came into force 14

April 2000, it allowed for legal protection of netting agreements. It is possible that in time, the banking industry will also adopt solutions based on collective guarantees, loss distribution and early crediting.

6 Continuous settlement and liquidity risk in the payment system

The introduction of NBO meant that banks were required to have cover for all their positions in the settlements. This increased both the need for liquidity management and resulted in a potentially higher liquidity risk. Increased liquidity risk can be a particular problem in connection with gross settlement because transactions in a gross settlement are not netted until they are sent to settlement. If liquidity problems arise in connection with gross settlement, we say that there is a gridlock. The banks will then have a queue of gross transactions that are not settled because one or more banks lack cover. So far, however, there have not been extensive queues in connection with gross settlement in NBO. Such problems have been avoided for three important reasons. First, Norges Bank offers unlimited intraday loans against collateral to banks participating in the settlement. Second, banks have coordinated the exchange of gross transactions. This has helped prevent banks from creating liquidity problems for other banks by holding back their own transactions until the end of the day. Finally, NBO has a built-in an "anti-gridlock function" that automatically offsets banks' positions in the queues against each other. If there is cover for the net position of a number of transactions that are in the queue, these transactions will be batched together for settlement. Although there has not yet been serious liquidity problems in connection with gross settlement, it should be underlined that gross settlement makes great demands on banks' liquidity management and completion of settlements is vulnerable to individual bank's transactions.

Before NBO was established, banks did not risk rejection of a settlement due to liquidity problems at another bank. Therefore, banks' liquidity risk was only linked to Norges Bank's rejection of a settlement due to the initiation of insolvency proceedings against a bank. In isolation, this may indicate that banks' liquidity risk has increased due to the establishment of NBO. On the other hand, we must also consider that there was only one settlement daily before NBO was established. A consequence of this was that banks built up positions against each other through the entire day and had larger gross positions against each other at the time of final settlement than they have today. Banks could therefore incur a larger liquidity shortfall as a result of a rejected settlement than today.

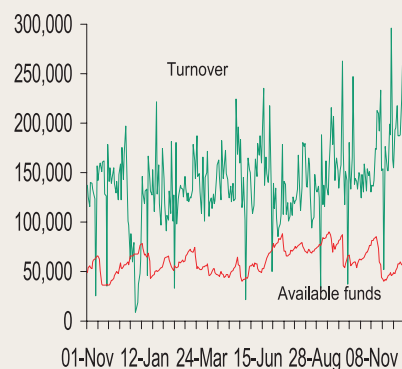
We can ask whether liquidity risk is at an acceptable level today. A survey of positions between a number of banks over a two-week period in May and August 2000 indicates that the answer is positive with regard to both

SWIFT and retail netting. The spread of positions shows that 96% and 98% of the SWIFT positions were within 5% and 10% respectively of available liquidity, measured as the available funds in NBO at the beginning of the day. Comparable figures for retail netting are 99% and 99.6%. No bank had liquidity exposures in SWIFT and retail netting during the period that exceeded 50% or 30% of the bank's available funds in NBO. It is essential to exercise caution in making this conclusion, however, since the survey only captures the banks' typical positions during a normal period. It says nothing about the liquidity situation during periods of market unrest, when eg redistribution of liquidity in the interbank market functions less effectively than on a normal day.

During the last few years, measures that have contributed to reducing liquidity risk have been implemented. In the autumn of 1999, the possibility of using securities as collateral in Norges Bank was expanded to include several types of securities, and in the summer of 2000, the requirement to earmark liquidity to cover anticipated positions was altered to reduce banks' liquidity needs in connection with retail settlement. Another factor is that since foreign exchange interventions currently play a limited role in monetary policy management, it is unlikely that krone purchases in the foreign exchange market will result in a considerable decline in banks' liquidity in NBO.

Chart 3 shows day-to-day developments in turnover in accounts in Norges Bank and banks' liquidity measured as available funds in NBO at the beginning of the day. Turnover figures vary greatly, with an average of around NOK 140 billion, whereas the average available amount has been around NOK 60 billion. The efficiency in using available liquidity may be measured by the relationship between turnover in accounts in Norges Bank and available liquidity. In the period between November 1999 and end December 2000, the ratio has varied between 1 and 4,

Chart 3 Turnover and available funds in NBO¹⁾. November 1999 - December 2000 (NOKm)



¹⁾ Turnover in NBO, ie after clearing. Available funds consist of the sum of cash balances and banks' borrowing facility at the beginning of the day.

Source: Norges Bank

Chart 4 Ratio turnover/available funds in NBO¹⁾
November 1999 - December 2000



¹⁾ 10-day moving average

Source: Norges Bank

with an average of 2.3. This is illustrated by Chart 4. How this compares with figures from other countries is difficult to say. This is due in part to the fact that efficiency in using liquidity must also be seen in relation to conditions that are unrelated to the organisation of the payment settlements. An important factor in this connection is the Bank Act's liquidity requirements which stipulate a minimum level for bank's holdings of notes and coins, deposits in Norges Bank, Treasury bills and government or government-guaranteed bonds/certificates.²⁾ Bonds and certificates may only be used to meet

security requirements at Norges Bank. Thus, a bank will not have extra costs connected with providing collateral security in Norges Bank if the bank must otherwise hold these securities to meet liquidity requirements. Another factor is that the collateral in Norges Bank will be used both in connection with payment settlements and as security for Norges Bank's overnight loans. Therefore, we cannot automatically compare the efficiency in NBO with the efficiency in settlement systems where securities are only used as collateral for payment settlements. In addition, there are relatively many small banks with settlements in NBO. Such banks contribute little to liquidity distribution and can thus be the cause of less effective utilisation of the liquidity in NBO than would otherwise have been the case. Finally, the present Act relating to the Norwegian Central Securities Depository does not allow for security to be covered by legal protection upon registration. When the changes in the new bill regarding the Norwegian Central Securities Depository (cf NOU 2000:10) are implemented, securities used as collateral will be protected by law upon registration, and then banks will be able to adjust the level of security through the day. This means that it will be easier for banks to adjust the level of security to the needs in NBO and this can thus lead to a more effective utilisation of liquidity in the system.

7 Conclusion

Through their roles in the payment system, banks are exposed to both credit risk and liquidity risk. We have tried to shed light on developments in risk conditions the last few years.

There are many indications that credit risk has been reduced considerably. Continuous settlement has reduced both the size and duration of banks' exposure to each other. Crediting after settlement has removed most of the credit risk connected with ordinary customer payment transactions. In the long term, it also appears that banks will increasingly go over to crediting after settlement for large customer payments as well (payments sent in the SWIFT format) and this will further reduce the remaining credit risk.

It is difficult to come to any clear conclusions with regard to liquidity risk. Continuous settlement has reduced banks' positions against each other and thus the consequences of a rejected settlement on liquidity. On the other hand, banks are now required to have available funds in Norges Bank before settlement is made. This means that, in contrast to earlier, a settlement may be rejected because a bank lacks cover for its position in the settlement. In isolation, this has increased banks' liquidity risk. However, queues have been limited and there has been little use of extraordinary borrowing facilities. There may be a number of explanations for this. First, banks have become more competent at man-

Important measures for reducing risk in the Norwegian payment system

1997 Establishment of NBO. This involved:

- i) a transition from settlement at the end of the day to the possibility of continuous settlement through the day (manual settlement of gross transactions through the day and frequent net settlements based on the result of SWIFT netting in NICS)
- ii) establishment of real-time liquidity information
- iii) a collateral requirement for loans extended in connection with settlement
- iv) balance check in Norges Bank

1999 Establishment of real-time gross settlement (NICS-RTGS) and introduction of an upper value limit for each transaction in NICS-SWIFT netting.

2000 The Act relating to Payment Systems etc gives Norges Bank responsibility for licensing interbank systems and allows for legal protection of netting and settlement agreements.
Transition from early crediting to crediting after settlement in retail netting removed banks' credit risk in this net settlement.

²⁾ See Section 22 of the Commercial Banks Act and Section 27 of the Savings Banks Act.

aging liquidity through the day. Second, the banking industry as a whole has had ample liquidity during the period since NBO was established. On the whole, banks' overnight balances are positive and their access to loans against collateral in Norges Banks is good. Another factor is that since foreign exchange interventions play a limited role in monetary policy management, it is unlikely that krone purchases in the foreign exchange market will result in a considerable decline in banks' liquidity in NBO.

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