

# Settlement risk in foreign exchange transactions

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Each day huge amounts of money are transferred between financial institutions around the world as settlement for foreign exchange (FX) transactions. Owing to time zones and technological limitations, parties to settlement transactions normally assume full and unsecured risk with regard to counterparty exposure. A bank's risk exposure for each transaction often lasts for as long as 48 hours, sometimes entailing credit risk against certain counterparties which exceeds the bank's equity. The central banks of the G-10 countries have for many years worked to induce participants to take steps to contain this risk. Banking crises and political unrest can spread through FX settlement risk, which may inflict considerable losses on Norwegian banks and jeopardise financial stability. Norges Bank has recently conducted a survey of FX settlement risk in Norwegian banks, modelled on analyses for the G-10 countries. The survey showed that the bulk of the volume is under acceptable control, but that there is still considerable room for improvement.

## 1. Introduction

Over the past 20 years, liberalisation and internationalisation of capital markets, combined with advances in FX trading technology, have led to considerably stronger growth in FX trading than implied by the growth in international trade in goods. According to an international survey carried out by the Bank for International Settlements (BIS) in April 1998, daily FX trading had reached an estimated USD 1500 billion.<sup>1)</sup>

This article starts by explaining how FX settlement risk arises and discusses special features of this risk. It goes on to discuss how banks and public authorities can help reduce exposures and risk. In keeping with international practice and recommendations, in spring 2000 Norges Bank carried out a survey of FX settlement risk in Norwegian banks. This article describes the survey and provides a preliminary assessment of the main findings.

## 2. Foreign exchange transactions and settlement

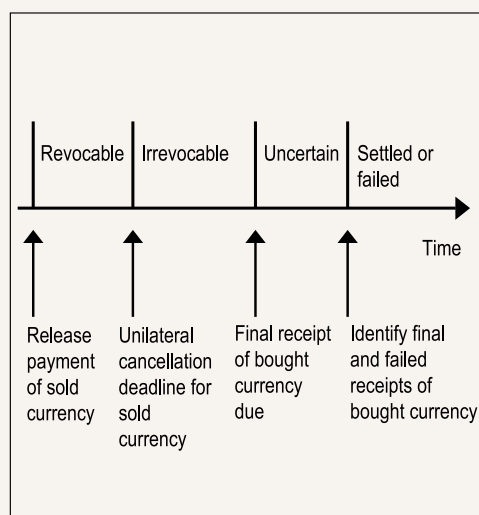
Only a small proportion of FX transactions are effected in order to provide greater access to the currency purchased as an asset or a means of transaction. Transactions of this kind are for instance often associated with international trade or investment. The majority of transactions are motivated by perceptions of changes in exchange rates, that is to say taking positions for financial motives. Private market participants have estimated that this applies to well over 90% of the market. However, whatever the purpose of the transaction, it is normal market practice to deliver the sum in its entirety in one currency in return for an equivalent value in the other currency.

Settlement of FX transactions involves two payments being effected in two independent national payment systems on a given date. The risk for each party is that the counterparty may not fulfil its obligation in the bought

currency, either permanently or temporarily. In the worst case scenario, the bank will be unable to revoke payment in the sold currency. If the counterparty is insolvent (is placed under public administration), so that the payment problem is not only temporary, the bank's legal claim on the estate in liquidation will be on a par with that of any other creditors. The fact that the counterparty is normally a foreign bank increases the uncertainty and the legal risk in situations like this. Legal protection for special FX agreements is described in section 3.

Settlement for FX transactions can be classified according to different stages based on the risk status of the settlement for the parties. This classification forms the basis for the definition of FX settlement exposure durations provided by the BIS (1996):

Chart 1. The changing status of a trade



The chart shows that the actual credit exposure for FX settlements does not start until the bank's payment instruction for the sold currency cannot be cancelled

<sup>1)</sup> BIS (1999). This figure includes spot, outright forward and swap contracts. The figures only include one side of each transaction. The Norwegian figures in the survey are discussed in Jacobsen (1998).

unilaterally (cancellation deadline). It also shows that a bank maintains full credit exposure also in the period after receiving the currency purchased when it is due, since the bank does not yet know whether it has received these funds with finality. The bought amount must therefore be treated as credit exposure until the point at which the bank's internal control functions identify the settlement as successful and final (receipt-identification time). The use of correspondent banks for executing settlement tends to increase the duration of exposures. The same is true of transactions where the two currencies belong to different time zones, since the operating hours of the two payment systems are not the same.

In addition to the credit risk dimension, FX settlement risk has a liquidity risk dimension. The parties incur the risk of higher costs resulting from bought currency not being received at the time expected. This risk exists even if the affected bank is able to hold back payment of the sold currency. The risk is linked particularly to the extra costs of using alternative sources of liquidity in the currency in question, often at short notice.

Experience shows that the likelihood of a real loss on the credit element of FX settlements must be regarded as low, requiring the closure of a bank to occur extremely unexpectedly in the market without time for the bank's counterparties (or their correspondent banks) to revoke their payments. Even so, this situation has been known to happen, notably with the failure of Bankhaus Herstatt in June 1974, which led to considerable losses for the bank's counterparties in USD/DEM transactions.

Losses in the form of liquidity-related extra costs may be incurred far more frequently, since factors such as market nervousness or technical failure may be a sufficient trigger. One example of uncertainty of this kind was during Iraq's invasion of Kuwait in August 1990. Many of the Kuwaiti banks' counterparties in the FX market at that time were affected when correspondent banks held back payment for several days. A large share of these payment transactions are based on credit lines, and the correspondent banks were unwilling to take up increased positions in relation to the Kuwaiti banks until they were certain that these banks would continue operations.

### 3. Reducing risk

In many countries, banks are subject to capital requirements for their currency portfolios, for example under international regulations. In certain countries, including Norway, there are also direct limits on the size of banks' foreign currency positions. The general market and liquidity risk associated with FX trades, related to exchange rate fluctuations, is therefore a relatively well controlled part of banks' commercial operations. The risk associated with the actual settlement of the contracts is not yet subject to similar control by the public authorities. At the same time, the banks' own manage-

ment of this risk has historically been considered inadequate, although marked improvements have taken place in recent years.

Effective risk management in individual banks means taking steps to shorten the period of irrevocability and the period of uncertainty as shown in Chart 1. The following measures should be regarded as particularly important:

- Establishing binding cancellation deadlines for correspondent banks through explicitly formulated contracts.
- Ensuring that correspondent banks report crediting of payments as soon as possible after the value date.
- Defining clear exposure limits, personal liability and realistic methods for measuring risk exposures. FX settlement risk should be managed in the same way as other credit risk in the bank's operations, and this should be linked to the bank's general risk management procedures.
- Avoiding overnight delays in the bank's systems before reconciliation and verification take place.

The infrastructure for FX settlements could be improved nationally and internationally through statutory regulations or IT systems. This normally requires co-operation between the financial industry and central banks and other public authorities. At the national level, measures of this kind would reduce the risk associated with settlement of trades in the domestic currency through the national interbank systems. Cross-border cooperation in this area could give rise to new trading and communication systems, common risk management standards and coordinated government measures to avoid distortion of competition.

The development of sound national settlement systems would facilitate swifter communication flows, and could reduce the time lag between correspondent banks' cancellation deadlines and final settlement in the payment system. Enhancing the efficiency of the settlement systems could also increase the competitive pressure on the correspondent banks, so that they moved their cancellation deadlines closer to the time of settlement.

The objective of the new Norwegian Act relating to Payment Systems, which came into force on 14 April 2000, is to ensure that interbank systems are organised in such a way as to safeguard the consideration of financial stability, with particular emphasis on reducing the risks associated with liquidity or solvency difficulties of a participant in such a system.<sup>2)</sup> The Act gives the authorities greater leeway for imposing requirements on Norwegian interbank settlement systems. This also has consequences for international participants' risk when settling FX transactions in NOK, particularly as it reduces the legal risk of participation in Norwegian payment settlement. The new Act implements the EEA Directive on Settlement Finality in Payment and Securities Settlement Systems as well as following up international

<sup>2)</sup> See the article by Lund and Watne in *Economic Bulletin* 3/2000, p. 101

recommendations presented by the BIS. Norges Bank has also made a contribution towards more secure settlement by improving Norges Bank's settlement system (NBO), notably through the introduction of real time gross settlement and limits in netting systems.<sup>3)</sup>

By concluding agreements on netting FX transactions, the banks could substantially reduce settlement amounts. However, it is essential that these agreements are legally enforceable in the event of insolvency, or else they would not entail a real reduction of credit risk. The authorities can therefore promote global risk reduction by encoding legal protection for netting in national legislation. The banks, for their part, should make active use of the opportunities for netting. Under section 10-2 of the Securities Trading Act of December 1997, the content of netting agreements may also be brought to bear on Norwegian contractual parties, in line with Norges Bank's recommendations.

Netting reduces the sums to be settled between the parties. One alternative is to combine the timing of the settlements in the two currencies, ensuring Payment versus Payment (PvP), which in principle eliminates credit risk. Under a PvP system, a final transfer of one currency occurs if and only if a final transfer of the other currency takes place. The fundamental impediment to implementing this under the current arrangements is that in principle settlement of the two currencies occurs as two independent transactions in the payment systems of two countries. PvP for FX settlements therefore requires advanced technology and coordination of national payment systems. The company CLS Services, owned by a number of banks internationally, is working on setting up a PvP system called Continuous Linked Settlement (CLS), where the intention is to include trading in NOK in the long term. Norges Bank has actively supported this work.

There is also a market initiative underway to create a new kind of FX instrument known as a contract for difference (CFD). This initiative is based on the premise that a large portion of FX transactions do not require delivery of the underlying currencies. These transactions are related to speculation or hedging transactions, and only market losses or gains are of importance to the parties. A contract could therefore be established whereby only losses or gains are settled on the settlement date. The challenge lies in establishing a stable system with reference exchange rates against which losses and gains are calculated. In addition, the participants must be permitted under domestic legislation to conclude such contracts. Pending the introduction of CLS, the CFD project has lost some momentum, but it is possible that the idea could be an important supplement to CLS in the longer term.

Cooperation between national authorities is also important in reducing risk globally. In summer 1998 Norges Bank became a member of a sub-group of the G-10 Committee on Payment and Settlement Systems (CPSS)<sup>4)</sup> which works on issues related to FX settlement

risk. The top priority for the group at present is following up the development of CLS. This task involves close contact with the market participants behind the initiative, with the objective of developing a system design which ensures optimal risk reduction globally combined with low operational and legal risk. In more general terms, the group follows up the recommendations set out in the G-10 reports by working for increased awareness of the risk and taking whatever action is deemed necessary. The group has for instance published a manual for other central banks that are seeking to initiate risk-containment measures in their countries. The group has also played a central role in preparing the Basle Committee's guidelines for the authorities' supervision of FX settlement risk.

#### 4. Foreign exchange settlement risk in Norway

In spring 2000 Norges Bank carried out a survey of FX settlement risk in Norway. The survey was modelled on similar surveys carried out in the G-10 countries and Australia. The objective was to obtain a better overview of risk, to induce banks to review their internal procedures for dealing with FX settlement risk, and to form a basis for Norges Bank's future work on payment settlement in general and FX settlement in particular. The survey also enabled the Bank to replace uncertain estimates with actual figures for settlement flows. Previously, these figures were estimated on the basis of statistics on FX turnover.

In addition to the major Norwegian banks, all foreign banks represented in Norway were invited to take part in the survey. However, some of the foreign banks have centralised FX settlement processes at their head offices, and therefore declined the invitation. In such cases, the full financial and legal liability for FX settlement risk lies outside Norway, and most of these banks' FX settlement risk is covered by G-10 surveys. A total of eight banks participated, five Norwegian banks and three branches of foreign banks. This represents almost the total market for FX trading in Norway.

The survey consisted of a qualitative section and a quantitative section. In the qualitative section, the participants were requested to describe various aspects of their procedures for managing FX settlement risk. Particular emphasis was placed on the banks explaining how FX settlement risk is managed in relation to other short-term credit risk, and how the risk is measured. The quantitative section was based on the assumption that FX settlement risk is determined by a time dimension and a volume dimension. Particular emphasis was therefore placed on identifying the banks' volumes and critical stages of FX settlement (see Chart 1). The figures reflect the banks' activities in weeks 13 and 14. The following sections contain a description of the results and some preliminary assessments.

<sup>3)</sup> For a discussion of NBO and risk in the Norwegian payment system, see Norges Bank's report on *Financial Stability 1/2000*, section 4.

<sup>4)</sup> CPSS Sub-Group on Foreign Exchange Settlement Risk. The secretariat is located at the Bank for International Settlements (BIS) in Basle, Switzerland.

## Quantitative survey

### (a) Time

Table 1 shows how long the banks are fully exposed in the settlement for certain relevant currency pairs, based on the definition of exposure duration in Chart 1. For each pair of currencies, the longest and shortest reported exposure durations are stated, together with a weighted average based on settlement volumes. For purposes of comparison, the corresponding average exposures in the G-10 survey are stated, using trading in Deutsche Mark as an indication of corresponding figures for EUR. Trades in NOK were not included in the G-10 survey.

**Table 1.** Number of hours' exposure in transactions in selected pairs of currencies. Weighted average of the banks.

Purchase/sale (currency)	Longest exposure	Average exposure	Shortest exposure	G-10 survey (1998) <sup>a</sup>	Difference between time zones <sup>b</sup>
USD/JPY	46	37:30	16	37	14
USD/EUR	66	27	17	34 (DEM)	6
EUR/USD	43	11	3:30	23 (DEM)	-6
USD/NOK	44	21:20	13:15	N.a.	6
EUR/NOK	44	15:40	6	N.a.	0
EUR/SEK	43	18	4	31 (DEM)	0
EUR/JPY	46	29:20	19	35 (DEM)	8
SEK/NOK	44	23:20	8:20	N.a.	0

a: Corresponding exposure durations in 1998 G-10 survey.

b: Difference between time zones of sold and bought currencies.

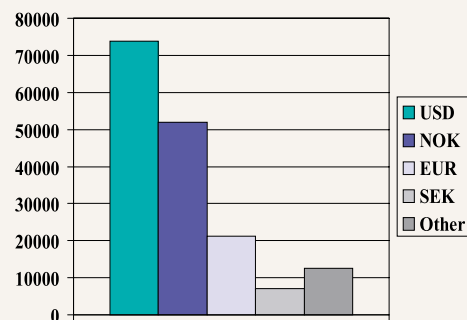
As expected, transactions which span different time zones are associated with particularly long exposures, especially when a currency is bought in exchange for a currency further east. In such cases, exposures can last for as long as 48 hours. Exposures can be even longer when public holidays are taken into account. The Norwegian input data for the BIS foreign exchange and derivatives survey (1999) show that the currency pair traded most frequently in Norwegian banks is USD/NOK, followed by USD/EUR (or DEM). This impression is borne out by the turnover figures<sup>5)</sup> submitted for our survey (Chart 2).

The substantial volumes of trades involving USD make a significant contribution to the total risk. In many cases, payment in EUR will be irrevocable for a full 24 hours prior to settlement in USD. In addition, the Norwegian banks do not know whether the settlement is final until it is reconciled and identified on the subsequent working day. Norwegian banks trade in USD with counterparties all over the world, and unforeseen solvency problems may affect some of these counterparties while Norwegian banks have credit exposures corresponding up to two days' trading.

Attention should also be drawn to the relatively long exposures in transactions between two European currencies,

although the differences between banks are considerable. Now that many banks have made their links to payment systems in EUR more efficient, the main problem would appear to be on the control side, ie the period of uncertainty. This being the case, it would seem to be necessary for the banks to concentrate on putting in place procedures for same-day confirmation and reconciliation of movements in EUR accounts.

**Chart 2.** Daily foreign exchange settlement turnover. In NOK millions.



Source: Norges Bank.

The settlement procedures for the various pairs of currencies generate highly varying exposure throughout the day. Looking at one exposure shown by the survey shows that when purchasing USD against NOK, on day D there is an almost complete build-down of positions deriving from the settlement on D-1 (the period of uncertainty comes to an end), before the positions for settlement on day D start building up from approximately 12 noon. As mentioned, among the most commonly traded currency pairs, purchases of USD against EUR account for a substantial part of the total industry risk. This is because, unlike for sales of NOK, the banks have to make payments in EUR appreciably earlier, sometimes even the day before. This means that there is a prolonged period every day during which total market exposures are equivalent to almost two days' trading.

The comparison between the Norwegian results and the results of the G-10 report in Table 1 indicates sound practices in Norwegian banks, but it should be noted that the international banking industry has probably seen substantial improvement since 1998, not least in more efficient payment settlements in EUR.

### (b) Volume

The survey shows that the banks make very little use of netting as a means of reducing settlement risk. The 1998 G-10 survey documented that participants' bilateral netting accounted for 29% of settlement volumes, and that after netting this was reduced to 15% of the total. Similarly, the Norges Bank survey showed that only just over 4% of Norwegian banks' transactions are netted.<sup>6)</sup> This may

<sup>5)</sup> Total daily receipts and payments in each currency during the period. The data do not specify the individual pairs of currencies.

<sup>6)</sup> Netting of FX contracts should not be confused with various forms of netting of multiple payments in a single currency (for instance as in the Norwegian system NICS). The latter relates solely to participants in a country's payment system (which is often different from the parties to a trade) and is not directly related to obligations in the original FX contract.

be because the relatively small volumes in Norwegian banks make netting a less cost-effective tool for risk reduction than for larger banks abroad. When assessing the usefulness of netting agreements, it is important to remember that netting is not merely suitable for reducing liquidity risk and liquidity costs in general, but also serves to reduce counterparty credit risk.

To be able to describe total FX settlement risk in Norway it is necessary to make a number of assumptions with regard to exposure duration. For the market as a whole, the variations in settlement procedures for different pairs of currencies probably offset each other. For instance, the build-down of positions in the middle of the day when purchasing USD against NOK will by and large be offset by settlements more prone to risk, such as purchases of USD against EUR. As an approximation for quantifying risk it is therefore not unrealistic to assume that exposure is relatively steady throughout the day (on the assumption of steady market activity).

On the basis of knowledge of the settlement cycle and market weighting for the various pairs of currencies, the average exposure throughout the day can be estimated as approximately 1.5 times the daily payment obligations. The banks in the survey report daily payment obligations in connection with FX transactions of around NOK 84 billion. This means that the Norwegian banks which took part in the survey continuously have FX settlement exposures of NOK 130-140 billion, corresponding to roughly 3.3 times their Tier 1 capital. These positions also remain open during weekends and public holidays, and are for the most positions against foreign banks.

For purposes of comparison it is worth noting that the pure credit risk in the Norwegian settlement system arising from banks crediting their customers in payment settlement before they themselves have received money from the counterparty bank may be estimated at roughly NOK 50 billion per day.<sup>7)</sup> Moreover, these exposures are of considerably shorter duration and are naturally only against participants in the Norwegian interbank system.

Even though the exposures for the market as a whole are spread fairly evenly throughout the day, there are wide fluctuations in the various banks for each pair of currencies. The survey shows that purchases of USD against currencies other than NOK (especially Asian currencies) lead to pronounced exposure peaks in the middle of the day. This should be reflected in the banks' risk management, particularly in periods of greater than normal activity of trading in certain currencies. In this connection it is also important to note that if the concentration of counterparties in a given period is high, this will reduce the diversification of the risk.

### *Qualitative survey*

The survey of the banks' FX trading procedures show wide variation in how banks manage FX settlement risk.

Some of the banks appear to have an inadequate link between FX settlement risk and other credit risk. Nor do some of the banks operate with a definition or understanding of this risk which fully reflects the specific problems associated with this type of risk. However, the larger banks in particular appear to have working practices in this area on a par with sound international practice. In addition, the majority of the banks have established clear divisions of responsibility within the organisation, and in most cases the settlement risk is checked against stipulated limits.

Several of the banks appear to underestimate the duration of the risk in relation to the exposure durations revealed by the survey. FX settlement risk is seldom estimated on the basis of explicit analyses of the duration of the settlement cycle. Those banks which attempt to take this into consideration commonly base the estimates on two days' exposure. This is probably an adequate method on average, although during periodic fluctuations in trading patterns, for instance in periods of extraordinarily high trading of Japanese yen, the risk may nevertheless be underestimated. It is therefore distinctly advantageous for the methods used to be directly linked to the level of trading activity.

As recommended in the G-10 surveys, there need to be clear lines of responsibility for FX settlement risk, and this risk management should be closely linked to other credit risk. A preliminary assessment would seem to be that particularly the smaller banks may have inadequate procedures, and should therefore focus on ensuring that FX settlement risk is made more transparent in internal risk management. The possibility that a number of banks in Norway do not fully appreciate the problem of FX settlement risk must be taken seriously. At the same time, there is little indication that banks of a comparable size in other countries by and large have considerably better procedures. However, for Norges Bank the objective of financial stability is of overriding importance, and the absolute quality of risk management is therefore more important than relative quality in terms of banks in other countries.

## 5. Further work

Norges Bank's work in the field of FX settlement risk is oriented primarily towards promoting improved risk management in Norwegian banks. The survey suggests that exposures in connection with FX settlement far exceed exposures associated with participation in other domestic payment and securities settlements. Norges Bank has for some time been committed to reducing the risk relating to these settlements, and it is therefore natural that FX settlement risk be accorded greater attention in the future. The survey will be followed up with the aim of promoting financial stability in this area too, and of

<sup>7)</sup> On the assumption that 10% of SWIFT gross settlement, 40% of SWIFT/NICS net settlement and the entire NICS retail settlement refer to "early crediting" of customers. Amendments to the rules as of 26 June 2000 will result in the virtual elimination of early crediting in connection with retail settlement. See Norges Bank's report on *Financial Stability 1/2000* for an explanation of these terms.

maintaining Norwegian market practice at a high international standard.

Improving the infrastructure of the Norwegian payment system will reduce the risk for both Norwegian and foreign banks associated with FX settlements involving NOK. If the infrastructure is considered to be ineffective over time, this could have consequences for the level of activity in the NOK market, as was confirmed from several quarters within the industry during the debate on the netting provisions in the Securities Trading Act in spring 1997. As part of the work to reduce the risk associated with FX trading in NOK, Norges Bank will continue its efforts for NOK to be included in the FX settlement system, CLS.

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