

# Settlement risk in foreign exchange transactions

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*In this article, Ian Harrison of the Banking System Department discusses the credit risks banks can be exposed to when they settle foreign exchange transactions. The article draws on a report by the Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries, which showed that these exposures can last for longer than was commonly understood, and applies the Committee's methodology to the New Zealand foreign exchange market.*

## Executive Summary

When banks settle foreign exchange transactions they may be exposed to the risk that they could pay out on the currency that they have sold but not receive the currency that they purchased if the other party to the deal fails. This risk is commonly referred to as Herstatt risk after a small German bank, Bankhaus Herstatt, which failed in 1974.

Because of the vast size of the international foreign exchange trading business central banks have long been concerned with the implications for the stability of national and the international financial systems of the failure of one or more significant foreign exchange traders. In March 1996 the Committee on Payment and Settlement Systems (CPSS) of the central banks of the Group of Ten countries issued a report on settlement risk in foreign exchange transactions.

The CPSS report defines a bank's foreign exchange exposure as the full amount of the currency purchased, and as lasting from the time a payment instruction for the currency sold can no longer be cancelled unilaterally until the time the other currency is received with finality.

The report presents the results of a survey of the settlement practices of around 80 banks in the G-10 countries, using the above definition, which shows that foreign exchange settlement exposures are substantially larger than was commonly thought, and that, in general, the surveyed banks have not been measuring and managing these risks appropriately. Settlement exposures can last for more than three business days and the overall time will be longer again if weekends and holidays intervene. The lengthy duration of many banks' settlement exposures largely reflects the fact that their settlement procedures were designed to improve operational efficiency rather than to minimise risk.

In New Zealand foreign exchange daily settlements average around NZD17 billion which suggests that banks could have quite large settlement exposures if their practices are similar to overseas banks.

There are a number of steps that can be taken to reduce the level of a bank's foreign exchange settlement exposures, some of which are relatively easy to implement. A bank can refrain from giving unnecessarily early payment instructions and improve its correspondent banking arrangements by easing restrictive cancellation deadlines. Future developments could include greater use of legally robust bilateral netting agreements, which would reduce settlement exposures to the net positions between banks which conduct two-way business, rather than the gross amount. Other possibilities are use of multilateral netting of payments and of international payment versus payment arrangements, which attack the problem at its core by ensuring that payments will only be made if a payment is received.

Finally, where settlement exposures extend well beyond twenty-four hours, it seems apparent that banks are running interday, not just intraday, risks and there is an argument that these risks should be treated in the same way as other interday credit exposures in the calculation of prudential ratios and in the public disclosures which registered banks are required to make under the requirements of the Reserve Bank Act 1989.

## I Introduction

A settlement of a foreign exchange (FX) transaction requires the payment of one currency and the receipt of another. In the absence of a settlement arrangement that the final transfer of one currency will only proceed if the final transfer of the other currency also occurs, then a bank is exposed to the risk that it could pay out on the currency that it sold but not receive the currency it bought if the other party to the deal fails. This risk is commonly referred to as Herstatt risk after a small German bank, Bankhaus Herstatt, which failed in 1974. At the point the bank failed several of its counterparties had irrevocably paid Deutschemarks to Herstatt through the German payments system against anticipated receipts of US dollars later the same day in New York. On the announcement of Herstatt's closure (at 10.30 am New York time) Herstatt's New York correspondent bank suspended payments from its account and the counterpart banks were left exposed for the value of the Deutschemarks they had delivered.

Because of the vast size of the international foreign exchange trading business - in 1995 daily turnover averaged more than US \$1,250 billion - central banks have long been concerned with the implications of the failure of one or more significant foreign exchange traders for the stability of national and the international financial systems. In March 1996 the Committee on Payment and Settlement Systems (CPSS) of the central banks of the Group of Ten countries issued a report on settlement risk in foreign exchange transactions. The report presented the results of a survey of the settlement practices of around 80 banks in the G-10 countries which showed that FX settlement exposures are substantially larger than was commonly thought, and that, in general, the surveyed banks were not measuring and managing these risks appropriately.

The second part of this article sets out the CPSS methodology for measuring settlement risk and explains why large exposures can be generated, while the third part applies the methodology to the New Zealand situation. In the fourth section strategies for reducing FX settlement risk are explored, while the following section discusses some supervisory implications. Section VI concludes.

## II Definition and measurement of settlement risk

The CPSS adopted the following definition of foreign exchange settlement exposure:

*A bank's actual exposure - the amount at risk - when settling a foreign exchange trade equals the full amount of*

*the currency purchased and lasts from the time a payment instruction for the currency sold can no longer be cancelled unilaterally until the time the other currency is received with finality.*

To measure its FX settlement exposure according to this definition a bank needs to recognise the changing status of its trades during the settlement process. At any point in time a trade can be classified according to five broad categories.

- **Revocable.** A payment instruction either has not been issued or may be unilaterally cancelled by the bank. There is no settlement exposure for this trade.
- **Irrevocable.** The payment instruction cannot be cancelled unilaterally either because it has already been processed by the relevant payments system or because some other factor (eg internal procedures, correspondent banking arrangements, local payment system rules, relevant laws) make cancellation dependent upon the consent of the counterparty or another intermediary. The final receipt of the bought currency is not yet due, hence the amount bought is at risk.
- **Uncertain.** The payment instruction can no longer be cancelled unilaterally. Receipt of the bought currency is due but the bank does not yet know whether it has received these funds with finality. The bought amount might be at risk.
- **Failed.** It is established that the bought funds have not been received from the counterparty. The funds are clearly at risk.
- **Settled.** The bank knows that the bought currency has been received with finality. The bought amount is no longer at risk.

The CPSS study recommended that banks measure two sets of exposures. The *minimum* exposure would be the sum of the irrevocable and failed trades. The maximum exposure would be the sum of the minimum exposure plus the uncertain trades.

The survey of the 80 banks in the G-10 countries found that for most banks the *minimum* FX exposures for spot and forward trades lasts for between one and two business days. In addition, it can take a further one or two days for some banks to establish that they did receive the bought currency. In total, settlement exposures can last for more than three business days and the overall time will be longer again if weekends and holidays intervene.

These results give a different perspective on the size of FX settlement exposures than was commonly thought. It

**Table 1**  
**New Zealand foreign exchange turnover April 1997 (NZD billion)**

	NZD/USD	NZD/other currencies	USD/other currencies
Spot	31	4	25
Forwards	3	2	2
Swaps	<u>108</u>	<u>2</u>	<u>33</u>
Total	142	8	60

has always been understood that a bank would be exposed to FX settlement risk when it was paying away a currency which settled in an earlier time zone than the currency it is due to receive. If, for example, a bank was paying Deutschmarks and receiving US dollars, it would have been aware that it would have had a settlement risk of about eight hours but would have thought that it had no exposure for the reverse transaction.

The lengthy duration of many banks' settlement exposures largely reflects the fact that their settlement procedures were designed to improve operational efficiency rather than to minimise settlement exposures. In particular, many banks will send payment instructions to their correspondent banks well before the value day. Banks will often do this to reduce processing costs and to avoid penalties and administrative disruptions due to technical problems. On its part the correspondent bank may start processing payment orders as soon as they are received and it may be difficult to cancel a payment by manually overriding an automated payment system. Payments could therefore become irrevocable in practice well before the payment day.

A key factor which determines the length of an exposure will be the ability of the paying bank to cancel unexecuted instructions. If the contract clearly states that the correspondent bank is obliged to cancel payments up to a certain time, and that bank has the capacity to do so, then the dealing bank's settlement risk will commence from that time. If, on the other hand, the contract implies that cancellations will be carried out on a best endeavours basis then the bank could be exposed from the time it sends the payment instructions. In many cases banks may not be aware of the precise nature of their correspondent bank's obligations because they have always received good service in having their payments cancelled in the ordinary course of business. In a crisis situation, however, where a large number of banks are seeking to cancel payments and the correspondent bank is also seeking to control its own risks, there will be no certainty that cancellation requests will be acted on.

### **III Foreign exchange settlement risk in New Zealand**

Table one presents a summary of turnover in the New Zealand foreign exchange market for April 1997. The table shows that the market is large and complex with total daily turnover averaging nearly NZD10 billion a day. Of this about 67 percent relates to NZD/USD trades, about 5 percent to NZD and other currency trades, and 28 percent to USD and other currency trades. By type of business, under 30 percent relates to spot transactions, 3 percent to forwards and nearly 70 percent to FX swaps.

To get a sense of how the CPSS methodology could apply in the New Zealand market it is useful to work through a couple of examples of NZD/USD trades, which generate the bulk of the FX market turnover. These examples are not intended to represent the average practice in New Zealand; rather they are intended to show how particular procedures can generate exposure periods.

#### **A spot purchase of US dollars**

When a New Zealand bank purchases spot US dollars, by convention the transaction will be settled two days after the deal is concluded. If the deal is concluded on, say, the 15th of the month the bank will pay New Zealand dollars to the counterparty on the 17th (the value day, V) in New Zealand while the counterparty will arrange to pay the US dollars into the New Zealand bank's New York account on the same date.

On the New Zealand dollar leg of the trade most transactions will be settled through KITS (Kiwi Interbank Transfer System) and will become irrevocable at the point the payment instruction is entered into this system on value day. This is generally likely to occur early on the value day as most deals would have been processed one or two days before. If the payment instruction entered KITS at 9am on the value day, then the bank would have an exposure until the US dollars were paid into its New York ac-

count. If the US dollar payment was settled in New York through CHIPS (Clearing House Interbank Payments System) then the payment may not be made until this system closed for business at about 5pm New York time. If the difference between New York time and New Zealand time were 16 hours then this would be 9am of the day following the value day (V+1) in New Zealand. The bank would have a minimum exposure for the eight hours between 9am and 5pm plus the 16 hours time difference, for a total of 25 hours.

Once the payment is made in New York it will take additional time for the New Zealand bank to be advised and then for the reconciliation process to be completed. If this were done by 2pm on V+1 then the maximum exposure period would be 30 hours. Thus if the bank normally purchased \$250 million of USD each day then its minimum exposure would be around \$250 million, but for part of the day, from 9am until 2pm its maximum exposure would be twice as high.

The exposure period can be cut by making the New Zealand dollar payment late in the value day. Depending on the payment system the bank is using, it may be possible to make payments as late as 8pm on the value day, which would cut the minimum exposure to 13 hours, but this could not be done on a routine basis.

### **A spot sale of US dollars**

In this example the New Zealand bank has to send a payment instruction to its New York correspondent bank to pay US dollars to the counterparty on the value date. To illustrate a worst-case example it is assumed that the payment instruction is irrevocable when it is sent and that the instruction is sent late on the trade day (V-2). If the instruction is sent at 5pm on V-2 and the New Zealand dollars are expected to be received at 5pm on the value day, then the minimum exposure will last for 48 hours. If the receipt of the New Zealand dollars is confirmed around 12pm on V+1 then the maximum exposure will be 67 hours.

This example points to the importance of the time at which payments instructions are typically sent in determining the length of a single exposure and hence the amount of credit risk the bank will be accepting. If the bank normally sent its payment instruction out the day after the trade (V-1) with the average instruction being sent at, say, 2pm then the period of the minimum exposure would be cut to 27 hours. This could probably be done without reducing operational efficiency and without materially increasing operational risks relating to failed trades. Clearly the later the payment instruction is sent the lower the settlement risk and, depending on the correspondent bank's cut-off time for receiving payment instructions, it

might be possible to cut it out altogether. If the cut-off time were, say, 8am New York time, then the bank would have until 12pm on the settlement day in New Zealand to send the instruction. By that time the bank could have confirmed that it had received the New Zealand dollars from the counterparty.

### **Forward foreign exchange contracts**

A forward exchange contract involves the sale and purchase of currencies at an agreed price at some point in the future. The settlement procedures and risks are the same as for spot transactions.

### **US dollar/third currency trades**

US dollar/third currency business will generally generate more risk than trades involving the New Zealand dollar when payment instructions are sent early. The reason is that all trades involve sending foreign currency payment instructions, which as was explained above can result in quite lengthy exposure periods if the instructions are sent early. With New Zealand dollar/foreign currency business, however, half the trades will involve the payment of New Zealand dollars, which, because they are not irrevocable until settlement day, result in shorter exposure periods. The average length of the exposure will therefore be longer for US dollar/third currency business.

### **Foreign exchange swap transactions**

To understand the settlement risk implications of transactions in the foreign exchange swaps market it is useful to have a understanding of the instrument and why so much of the total FX turnover is generated by this market. A foreign exchange swap is a combination of a spot foreign exchange contract and the opposite forward foreign exchange contract. For example, a contract may involve selling New Zealand dollars and purchasing US dollars spot and purchasing New Zealand dollars and selling US dollars forward. Both the spot and forward legs of the swap transaction have to be settled, which means that the volume of settlements generated by foreign exchange swaps is twice the volume of the turnover figures. On the assumption that the average length of the settlement exposure for swap transactions is the same as for outright forward and spot transactions then the swap market will be generating over 80 percent of foreign exchange settlement risk.

The following example illustrates how one kind of trading strategy using the FX swaps market will generate a high volume of business. Suppose that the one year interest rate in New Zealand were 7.5 percent and the one year rate in the US were 5.5 percent. If a bank thought that the New Zealand dollar were going to appreciate, or decline

by less than two percent per annum, then it could benefit by borrowing in US dollars and investing in New Zealand dollars. Rather than borrow the funds and place them on deposit, the bank could enter into the following arrangement which would give it an identical position. It would enter into a spot transaction to purchase New Zealand dollars and sell US dollars. At the same time it would enter into a swap transaction whose spot leg involved selling New Zealand dollars and receiving US dollars on the same value day as the outright spot transaction, and whose forward leg involved purchasing New Zealand dollars and selling US dollars at a date in the future, at a rate which was determined when the contract was entered into.

If the bank were not sure how long a New Zealand dollar position would continue to be favourable, it would enter into a short-term swap and roll the position forward for as long as its view on the New Zealand dollar remained positive. Thus a position of, say, NZD50 million would generate turnover of NZD250 million if it were held for five trading days. Short-term swap transactions are not unusual, with trades with terms of seven days or less accounting for over 80 percent of the total volume.

There are several reasons why the swaps market is used to conduct these transactions. First, because there are no explicit interest receipts there may be a tax advantage for offshore investors who would otherwise be subject to a New Zealand tax or levy on their interest earnings. Secondly, it is the largest and most liquid market in which to borrow or place New Zealand dollars. Large parcels can be traded without affecting market prices and transaction costs are low. Thirdly, swaps can reduce credit risk. If a bank enters into a six month swap then it has settlement risk at the beginning and end of the contract. For the rest of the period it is subject only to the market risk of replacing the contract if the counterparty fails rather than being exposed for the full principal sum if it had lent the funds.

However, it is possible that certain strategies in the swaps market can actually increase a bank's credit risk. A bank which entered into a series of one day swaps and which had relatively lengthy settlement exposures could generate a total exposure that was a multiple of the size of the underlying position. Its minimum exposure could easily be four times the size of this position.

## IV Managing F/X settlement risk

The CPSS report recommended that individual banks should take steps to apply an appropriate credit control process to their FX settlement exposures. This would involve the following steps. First, banks should develop systems that would enable them to measure their FX exposures properly and provide accurate and timely information on their exposures. Secondly, banks should manage these exposures by making informed business judgments about the risks and rewards of their FX trading activities. Banks could look to control their FX settlement exposures in a manner which is consistent with the way they control their other exposures to counterparties. Thirdly, banks should look to reduce the level of exposures generated by a given amount of trading.

There are a number of steps that can be taken to reduce the level of a bank's FX settlement exposures.

*Limit unnecessarily early payment instructions.* It is clear from the above examples that banks can reduce the size of their FX settlement exposures by changing their settlement procedures. For example, banks which send irrevocable foreign payment instructions on the deal day could substantially reduce the length of their average exposure by withholding those instructions until the next day.

*Improve correspondent banking arrangements.* Substantial improvements can also be made by easing unduly restrictive cancellation deadlines. In 1994 the New York Foreign Exchange Committee, which is a private sector group sponsored by the Federal Reserve Bank of New York, published a report which defined "best-case" FX settlement practice as the capability to cancel payment instructions unilaterally up until the opening time on settlement day of the local large-value transfer system. The CPSS study found that best-case practice could reduce the level of exposure by up to two thirds of that generated by worst-case practices. The benefits of this capability in the New Zealand case are most clear with trades that involve the sale of US dollars. Because of the time lag between New Zealand and New York, the capability to cancel a payment instruction right up until the opening of CHIPS could enable FX settlement risk to be eliminated.

*Bilateral netting.* Where banks conduct a relatively high proportion of their business with a small number of counterparties, FX settlement risk can be reduced by the legally-binding netting of amounts due in the same currencies for settlement on the same day. Netting by novation involves the replacement of the underlying contracts by a new contract which specifies the net amount to be settled. Netting reduces the amount at risk by reducing the number and amount of settlements that would otherwise be generated by the underlying transactions if they

were settled individually. While netting by novation is legally robust, it can be expensive or technically difficult to manage and is not widely used. "Close-out netting", which requires counterparties to settle all contracted (but not yet due) obligations on the occurrence of a defined event of default, is simpler to use operationally but may not be legally robust. The Reserve Bank has recommended that legislation should be introduced to make all forms of netting legally robust in New Zealand, but this would not necessarily provide a robust netting regime for FX settlements unless the netting contract were recognised in all of the legal jurisdictions that may be relevant in the event of the failure of one of the parties.

*Multilateral netting and settlement services.* A comprehensive and sound multi-currency settlement system that ensured that a bank would not pay away funds unless it had received them would be effective in eliminating most FX settlement risk between participating banks. At present there is one multilateral netting and settlement system in operation. ECHO (Exchange Clearing House), which began operation in 1995, is designed to transform bilaterally arranged individual FX trades into a set of multilateral net settlement obligations between members, and provides a set of risk controls that ensure that final settlement in each currency will take place even if one member is unable to meet its obligations on the due day. One problem with a multilateral netting service is that it needs to achieve a critical mass before it will significantly reduce FX settlement risk. A bank will not significantly reduce its risk if most of its counterparties are not members and this may make membership less attractive, at least in the short run, which in turn makes it more difficult to achieve the necessary membership coverage.

*Payment versus payment ( PVP ) systems.* Many countries, including New Zealand, have either introduced, or are planning to introduce, real time settlement systems which will eliminate intraday credit exposures by providing a payment versus payment service for domestic transactions. If the domestic systems could be linked then it is conceptually possible for settlement risk on foreign exchange transactions to be eliminated. Whether a comprehensive international PVP service will eventually become a reality is a matter of conjecture at this point.

## V Supervisory implications

The magnitude of the possible credit exposures through FX settlements raises some interesting supervisory questions. The main thrust of the New Zealand supervisory regime is based around the disclosure of financial and prudential information and compliance with minimum capital ratios and a maximum ratio for connected lending. All of the disclosures and ratio requirements are based

on a bank's balance sheet at the end of the business day. Intraday risks, including FX settlement risks, are not captured by this framework.

There are two components of settlement risk exposure which raise different issues from a supervisory perspective. Where settlement exposures extend well beyond twenty-four hours, it seems apparent that banks are running interday, and not just intraday, risks; and to be consistent with the existing framework there is a strong argument that these risks should be treated in the same way as other interday exposures. Under the New Zealand accounting framework these exposures probably already fall within the definition of a credit risk and should therefore be reflected in banks' balance sheets, but this is not current accounting practice. The issue from a supervisory perspective is whether accounting practice should change to capture interday FX settlement risk.

Under current accounting conventions the intraday component of the exposure cannot be captured within a bank's formal financial accounts, but there is still an issue of whether it should be separately captured for disclosure purposes and for the calculation of prudential ratios. Conceptually there is an argument that it should be. A risk is a risk whether it is incurred for part of the day or overnight. The case for excluding intraday exposures is largely based on practical problems in measuring them rather than on a view that they do not matter. The question of whether banks should be required to disclose information essentially comes down to a judgement as to whether the additional information is worth the cost of providing it. If the intraday risk is large - and daily FX settlements turnover of NZD17 billion (counting both legs of FX swaps transactions) suggests that it would be - then this strengthens the case for requiring some form of disclosure of the risk.

These considerations are based very much on current practice. Up until now the kinds of settlement risks outlined in this paper have been, at least to some extent, unavoidable. However, improvements to both national payments systems and to international settlement arrangements are starting to offer a number of possible methods for controlling FX settlement risks which will be both efficient and effective. As these methods gain more widespread use, it can be expected that the very large risks which exist at present will be substantially reduced.

## VI Conclusion

Since the failure of the Herstatt bank it has been widely understood that banks can be exposed to credit risk in the settlement of foreign exchange transactions, but this risk has been seen largely as an intraday phenomenon. The CPSS report showed that this is not necessarily the case:

appropriately measured exposures can extend for up to three days and there can be an exposure even when the bought currency settles in an earlier time zone than the sold currency. Depending on their settlement practices and correspondent bank relationships, New Zealand banks can have credit exposures for quite lengthy periods, but it is possible to reduce these quite significantly by altering the times at which payment instructions become irrevocable. Even if the average duration of a settlement exposure were relatively short the sheer volume of transactions would still mean that the aggregate amount of exposure remained large, raising the issues of how those exposures can be controlled more effectively, and how they should be treated within the New Zealand supervisory regime.