BANK FOR INTERNATIONAL SETTLEMENTS

SETTLEMENT RISK IN FOREIGN EXCHANGE TRANSACTIONS

Report prepared by the Committee on Payment and Settlement Systems of the central banks of the Group of Ten countries

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FOREWORD

Financial liberalisation, expanded cross-border capital flows and major advances in trading technology have led to dramatic changes and growth in foreign exchange trading in the last twenty years. While banks have upgraded their operational capacity to settle these trades over time, current settlement practices generally expose each trading bank to the risk that it could pay over the funds it owes on a trade, but not receive the funds it is due to receive from its counterparty. Given the estimated US$ 1¼ trillion of foreign exchange trades arranged daily, the resulting large exposures raise significant concerns for individual banks and the international financial system as a whole. Although the probability of a major disruption in the foreign exchange settlement process is low, its potential consequences in a market of this size and complexity are considerable.

This report, which was prepared on behalf of the Committee on Payment and Settlement Systems by its Steering Group on Settlement Risk in Foreign Exchange Transactions, offers a practical approach to dealing with this risk. The report analyses existing arrangements for settling foreign exchange trades and makes recommendations grounded in market realities. It calls upon individual banks and industry groups alike to improve current practices and devise safe mechanisms for addressing settlement risk. For their part, central banks have identified several avenues for cooperating with the private sector and for providing inducements to push this effort forward. I believe the report makes a compelling case that the private sector can, with a relatively modest expenditure of resources, make important progress in containing settlement risk.

The Committee on Payment and Settlement Systems is indebted to Peter Allsopp for his excellent leadership in chairing the Steering Group. Mr. Allsopp, who has made many fine contributions to the work of the Committee and its predecessor over the years, is retiring from the Bank of England this year. Able assistance in editing, translating and publishing the report was provided by the BIS.

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March 1996

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[*] Until 30th November 1995.

1. EXECUTIVE SUMMARY

1.1 Introduction

The Governors of the central banks of the Group of Ten (G-10) industrial countries have endorsed a comprehensive strategy under which the private and public sectors can together seek to contain the systemic risk inherent in current arrangements for settling foreign exchange transactions. This report, prepared by the Committee on Payment and Settlement Systems (CPSS) of the central banks of the G-10 countries, describes the strategy and presents its underlying analysis.

1.1.1 Central bank concerns

The vast size of daily foreign exchange (FX) trading, combined with the global interdependencies of FX market and payments system participants, raises significant concerns regarding the risk stemming from the current arrangements for settling FX trades. These concerns include the effects on the safety and soundness of banks, the adequacy of market liquidity, market efficiency and overall financial stability.

The risk to domestic payments systems, and to the international financial system, posed by the FX settlement process came into focus at the time of the 1974 failure of Bankhaus Herstatt. More recent examples include Drexel, BCCI, the attempted Soviet coup d'état and Barings.

1.1.2 G-10 initiatives to address concerns

In response to the Herstatt episode, the G-10 central banks began by working together on supervisory issues, including FX market risk and the need for an international early warning system. In the early 1980s, they began to study the payments systems used for the settlement of domestic and cross-border transactions, with a view to ensuring that the structures and designs of those systems did not create unacceptable interbank credit exposures and did not generate liquidity risks for the financial markets or for the national or international banking systems. It was in particular apparent that large-value cross-border payments, including those made in settlement of FX transactions, account for a large, and sometimes very large, proportion of flows through domestic payments systems, and this was seen to require detailed analysis.

The work of the G-10 central banks on international payment arrangements has produced several studies, including the February 1989 *Report on Netting Schemes* (the Angell Report), the November 1990 *Report of the Committee on Interbank Netting Schemes* (the Lamfalussy Report) and the September 1993 report on *Central Bank Payment and Settlement Services with respect to Cross-Border and Multi-Currency Transactions* (the Noël Report). Through these studies the central banks identified issues that may be raised by cross-border and multi-currency netting arrangements, recommended minimum standards and an oversight regime for cross-border netting schemes, and examined possible central bank service options that might decrease risk in the settlement of FX trades.

In June 1994 the CPSS formed the Steering Group on Settlement Risk in Foreign Exchange Transactions to build upon this past work and to develop a strategy for reducing FX settlement risk. In preparing its report, the Steering Group developed a definition and methodology for measuring FX settlement exposure (*see Appendix 1*). Using this analytical framework, the Steering Group surveyed approximately 80 banks in the G-10 countries to document current market practices for, and barriers to, managing settlement risks in a prudent manner. This work yielded the following key findings:

- FX settlement exposure is not just an intraday phenomenon: current FX settlement practices create interbank exposures that can last, at a minimum, one to two business days, and it can take a further one to two business days for banks to know with certainty that they received the currency they bought.
- Given current practices, a bank's maximum FX settlement exposure could equal, or even surpass, the amount receivable for three days' worth of trades, so that at any point in time - including weekends and public holidays - the amount at risk to even a single counterparty could exceed a bank's capital.
- Individual banks could, if they so choose, significantly reduce their own exposures and systemic risk more broadly by improving their back office payments processing, correspondent banking arrangements, obligation netting capabilities and risk management controls.
- Well-designed multi-currency services such as multi-currency settlement mechanisms and bilateral and multilateral obligation netting arrangements could greatly enhance the efforts of individual banks to reduce their FX settlement exposures.
- Some major banks are concerned about the sizable FX settlement risks they face and are actively pursuing ways to improve their own settlement practices and to collectively develop risk-reducing multi-currency services.
- Nevertheless, despite their considerable capacity to reduce FX settlement risk through individual and collective action, many banks remain sceptical about devoting significant resources to such efforts.

1.2 Summary of strategy

Overall, the G-10 central banks believe that private sector institutions have the ability, through individual and collective action, to significantly reduce the systemic risks associated with FX settlements. Accordingly, the Governors of the G-10 central banks have agreed that the following three-track strategy should be implemented:

- **Action by individual banks to control their foreign exchange settlement exposures**

  Individual banks should take immediate steps to apply an appropriate credit control process to their FX settlement exposures. This recognises the considerable scope for individual banks to address the problem by improving their current practices for measuring and managing their FX settlement exposures.

- **Action by industry groups to provide risk-reducing multi-currency services**

  Industry groups are encouraged to develop well-constructed multi-currency services that would contribute to the risk reduction efforts of individual banks. This recognises the significant potential benefits of multi-currency settlement mechanisms and bilateral and multilateral obligation netting arrangements, and the G-10 central banks' view that such services would best be provided by the private sector rather than the public sector.

- **Action by central banks to induce rapid private sector progress**

  Each central bank, in cooperation, where appropriate, with the relevant supervisory authorities, will choose the most effective steps to foster satisfactory private sector action over the next two years in its domestic market. In addition, where appropriate and feasible, central banks will make or seek to achieve certain key enhancements to national payments systems and will consider other steps to facilitate private sector risk reduction efforts. This recognises the likely need for public authorities to encourage action by individual banks and industry groups, and to cooperate with these groups, to bring about timely, market-wide progress.

The G-10 central banks believe that this strategy can adequately address the systemic risk inherent in current practices for settling FX transactions. Indeed, several important industry initiatives are well under way. For instance, in 1994 the New York Foreign Exchange Committee issued a report and a set of recommendations designed to help market participants reduce their FX settlement exposures (see *Appendix 2*). That report, and the general topic of FX settlement risk, have since received considerable attention. In addition, as described in *Section 3*, several risk-reducing multi-currency services are currently available in the market. These include bilateral obligation netting arrangements provided by FXNET, S.W.I.F.T. and VALUNET, and multilateral obligation netting and settlement services provided by ECHO and, prospectively, the proposed Multinet International Bank. Furthermore, the recently formed "Group of 20" banks and other private sector organisations are exploring the feasibility of establishing other multi-currency settlement services. The G-10 central banks for their part stand ready to cooperate, where appropriate and feasible, with all industry groups seeking to develop risk-reducing multi-currency settlement services.

Although any or all of these private sector efforts could play a major role in improving the current situation, they have yet to bring about a substantial and permanent reduction in FX settlement risk throughout the market. Accordingly, the G-10 central banks will closely monitor the progress of private sector action over the next two years to determine the need for further action.

To increase market awareness and understanding of foreign exchange settlement risk, *Section 2* presents an overview of the topic and *Section 3* summarises the results of the market survey. *Section 4* describes the recommended strategy in detail and *Section 5* sets out the next steps.

2. OVERVIEW OF FOREIGN EXCHANGE SETTLEMENT RISK

2.1 Types of risk

At its core, settlement of a foreign exchange (FX) trade requires the payment of one currency and the receipt of another.[1] In the absence of a settlement arrangement that ensures that the final transfer of one currency will occur if and only if the final transfer of the other currency also occurs, one party to an FX trade could pay out the currency it sold but not receive the currency it bought. This principal risk in the settlement of foreign exchange transactions is variously called foreign exchange settlement risk or cross-currency settlement risk. It is also referred to as Herstatt risk, although this is an inappropriate term given the differing circumstances, including those described below, in which this risk has materialised.

FX settlement risk clearly has a credit risk dimension: whenever a party cannot make its payment of the currency it sold conditional upon its final receipt of the currency it bought, it faces the possibility of losing the full principal value involved in the transaction. In this situation, a party's foreign exchange settlement exposure (the size of its credit exposure to its counterparty when settling an FX trade) equals the full amount of the purchased currency. As will be described in *Section 3*, many banks currently face sizable FX settlement exposures overnight, and indeed for longer periods.

FX settlement risk also has a liquidity risk dimension: if a party did not receive the currency it purchased when due, it would need to cover and to finance this shortfall until its counterparty honoured its obligation. In fact, this liquidity risk is present even if, in this circumstance, a party could withhold its payment of the currency it sold (i.e. liquidity risk can be present even in the absence of credit risk). Thus, whether viewed from a credit or a liquidity perspective, the amount potentially at risk in settling an FX trade equals the full value of the purchased currency.

To be sure, FX trading poses many other forms of risk, including market risk (the risk of loss from an unfavourable exchange rate movement), replacement risk (the risk of having to replace, at current exchange rates, an unsettled yet profitable FX transaction with a failed counterparty) and operational risk (the risk of incurring interest charges or other penalties for misdirecting or otherwise failing to make FX settlement payments on time owing to an error or technical failure). FX market participants must recognise and manage appropriately each of these risks.[2] Nevertheless, since the associated amounts at risk represent only a fraction of the underlying value of each transaction, they are dwarfed by the size of foreign exchange settlement exposures.

2.2 Factors leading to central bank concerns

If these risks were to crystallise in a disorderly manner, they would be likely first to affect the domestic payments systems of the world's major currencies, since a significant share of their daily flows is accounted for by the settlement of foreign exchange transactions.[3] Secure and well-functioning payments systems are necessary for the attainment of central banks' monetary, macroprudential, supervisory and other policy objectives. They are also essential mechanisms in the management by individual commercial banks of their assets and liabilities, and in the settlement of

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1 For convenience, the term "currency" is used throughout this report to refer to bank balances denominated in a particular country's currency. Standard practice for settling a transaction in the interbank FX market requires the transfer of such balances.

2 For instance, the Basle Capital Accord currently covers replacement risk. In January 1996 the Accord was amended by the Basle Committee on Banking Supervision to explicitly cover market risk. This amendment is to be implemented no later than end-1997.

3 For example, systems operators estimate that FX settlements account for 50% of the daily turnover value of CHIPS and CHAPS, 80% of the daily turnover value of EAF, and 90% of the daily turnover value of SIC.

their own transactions as well as those of their customers. It is therefore appropriate that central banks should be concerned that the settlement arrangements in the foreign exchange markets should be structured so as to minimise systemic risk (the risk that the failure of one market participant to meet its required FX settlement or other obligations when due may cause significant liquidity or credit problems for other participants, and so may threaten the stability of the financial markets).

Major commercial banks also now accept that there is an international dimension to the domestic payments system of every major currency. These payments systems are interdependent, given the extent to which banks from a range of different countries are participants, directly or through a local correspondent, in each of them, and therefore have a direct interest in the efficiency and robustness of their settlement arrangements. The market, and in particular the major correspondent banks in each country, now realise that every individual commercial bank and banking sector (however defined) is vulnerable to unexpected endogenous or exogenous events, which could occur on a sufficient scale to cause one or more banks to be unable to settle their foreign exchange trading obligations on any one day.

The scale of these potential settlement problems is demonstrated by the latest survey of FX market turnover. The BIS estimates the average daily turnover of global exchange markets in spot, outright forward and foreign exchange swap contracts at US$ 1,230 billion in April 1995. Since each trade could involve two or more payments, daily settlement flows are likely to amount, in aggregate, to a multiple of this figure, although no comprehensive data are available.

Given the serious domestic and international repercussions that a significant FX settlement disruption could have in a market of this size, a bank might believe that public authorities in some countries would not close a major FX market participant during the day or permit it to default unexpectedly and cause significant losses during the settlement process. This belief might make a bank unwilling to reduce its present settlement exposures, or even increase its willingness to take on even greater settlement exposures with its counterparties. To the extent that this belief is widely held in the market, it has already produced an unacceptable level of risk in the financial system.

Moreover, the extent of this risk is in reality substantially greater than is suggested by estimates of market turnover and settlement flows. The definition of and methodology for measuring FX settlement exposure, as set out in this report, make it clear that it is not just an intraday phenomenon: in practice, FX settlement exposure typically represents overnight risk; it can last for several business days; and it will therefore be present over weekends and public holidays. Furthermore, at any point in time a bank's FX settlement exposure can greatly exceed its capital.

It is also the case that the market's belief that a major FX market participant will not be closed during the day is ill-founded. There is in fact no time, during a weekday, at which the large-value payments systems of every major currency are closed.[4] To the extent that commercial banks maintain this belief, an unnecessary and avoidable element of risk remains in the market.

Set out below are brief summaries of five case studies that demonstrate the ways in which a settlement problem can arise. They also demonstrate that despite the steps that have been taken since 1974 to improve coordination between banking supervisors and to begin to introduce settlement risk control measures in the major financial centres, the possibility of a bank failing or being closed during the business day remains, and any collapse will almost inevitably occur during the business day of one financial centre or another. While the timing of the withdrawal of a banking authorisation may in some circumstances be controllable so as to minimise shocks to the markets, there will be other cases in which a banking supervisor may have little choice as to the timing of its actions. If, for example, a banking supervisor becomes aware that a bank has sustained major losses, sufficient to seriously impair its capital base, it may need to take immediate action of some sort to protect depositors. The timing of this action may also be influenced by the need to ensure that a bank does not continue to

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[4] For instance, even during the 30-minute interval between the close of Fedwire and the opening of BOJ-NET, the SIC system and the ECU clearing system are open for next-day value.

trade while insolvent, and by the need in such circumstances to act quickly lest the fact that the institution is in difficulty becomes publicly known, precipitating a "run" on the bank. In some countries it is not legally possible to put a bank into liquidation outside the business hours of the court that must appoint the liquidator.

2.2.1 The failure of Bankhaus Herstatt (1974)

On 26th June 1974 the Bundesaufsichtsamt für das Kreditwesen withdrew the banking licence of Bankhaus Herstatt, a small bank in Cologne active in the FX market, and ordered it into liquidation during the banking day but after the close of the interbank payments system in Germany. Prior to the announcement of Herstatt's closure, several of its counterparties had, through their branches or correspondents, irrevocably paid Deutsche Mark to Herstatt on that day through the German payments system against anticipated receipts of US dollars later the same day in New York in respect of maturing spot and forward transactions.

Upon the termination of Herstatt's business at 10.30 a.m. New York time on 26th June (3.30 p.m. in Frankfurt), Herstatt's New York correspondent bank suspended outgoing US dollar payments from Herstatt's account. This action left Herstatt's counterparty banks exposed for the full value of the Deutsche Mark deliveries made (credit risk and liquidity risk). Moreover, banks which had entered into forward trades with Herstatt not yet due for settlement lost money in replacing the contracts in the market (replacement risk), and others had deposits with Herstatt (traditional counterparty credit risk).

2.2.2 Drexel Burnham Lambert (1990)

In February 1990 the Drexel Burnham Lambert (DBL) group collapsed, the initial cause being severe liquidity problems. The Bank of England had to intervene, as a facilitator, to minimise the impact of DBL's problems on the counterparties of one of its London subsidiaries, Drexel Burnham Lambert Trading (DBLT), which traded as a principal in the foreign exchange and gold markets.

As market awareness grew in February of the extent of the problems in the DBL group, DBLT's counterparties became progressively less willing to incur intraday exposures to it in the settlement of their FX deals. At the same time DBLT was unwilling to pay the amounts it owed on maturing deals, because of concerns that the counterparties might decline to pay the other currency involved and instead set off the receipts from DBLT against amounts due to them from other companies in the DBL group.

After intensive discussions with DBLT, which was required to produce evidence of its solvency, the Bank of England put in place a settlement facility, which remained open for a full week, to resolve this developing gridlock. Under this facility, DBLT's counterparties were invited to pay amounts due into accounts held in the Bank of England's name with the Bank's correspondent bank (in almost all cases the central bank) in each country concerned. Once the Bank had received confirmation that funds had been credited to these accounts it informed DBLT. DBLT then made irrevocable payments of countervalue to each counterparty directly, using funds made available for the purpose by its immediate parent company. Upon receipt of these payments the respective counterparty was asked to confirm to the Bank of England that it was prepared for the Bank to release the relevant deposit to DBLT.

Several key factors were present in the DBLT case which might not all be present in other cases of FX market gridlock. Crucially, DBLT itself was solvent, and it had a relatively small FX book, almost flat in non-dollar terms, and with relatively few forward deals. Its immediate parent in the DBL group was willing to provide the initial liquidity needed to enable DBLT to settle all amounts due. Finally, the Bank of England was in a position to act as a neutral facilitator, acceptable

to all parties, and was able to work with the management and staff of DBLT, who remained in place for the whole of that week.

2.2.3 BCCI (1991)

The appointment of a liquidator to BCCI SA on 5th July 1991 caused a principal loss to UK and Japanese foreign exchange counterparties of the failed institution.

An institution in London was due to settle on 5th July 1991 a dollar/sterling foreign exchange transaction into which it had entered two days previously with BCCI SA, London. The sterling payment was duly made in London on 5th July. BCCI had sent a message to its New York correspondent on 4th July (a public holiday in the United States) to make the corresponding US dollar payment for value on 5th July. The payment message was delayed beyond the time of the correspondent bank's initial release of payments (at 7 a.m.) by the operation of a bilateral credit limit placed on BCCI's correspondent by the recipient CHIPS member. The payment remained in the queue until shortly before 4 p.m. (New York time), when it was cancelled by BCCI's correspondent, shortly after the correspondent had received a message from BCCI's provisional liquidators in London on the subject of the action it should take with regard to payment instructions from BCCI London. In this way, BCCI's counterparty lost the principal amount of the contract.

A major Japanese bank also suffered a principal loss in respect of a dollar/yen deal due for settlement on 5th July, since yen had been paid to BCCI SA Tokyo that day, through the Foreign Exchange Yen Clearing System, and the assets of BCCI SA in New York State were frozen before settlement of the US dollar leg of the transaction took place.

The UK institution's loss illustrates a particular aspect of the difficulties which face the private sector under current circumstances in any attempt to coordinate the timing of payments; in this instance, the loss would almost certainly not have occurred but for the measures in place to reduce risk domestically within CHIPS. Moreover, the closure of BCCI by the banking supervisors illustrates that it is generally not possible to close a bank which is active in the foreign exchange market at a time when all the relevant payments systems have settled all its transactions due on a given day. In this case, the closure required the Luxembourg Court to appoint a liquidator, an action which under Luxembourg law can take place only within the normal business day of the Court.

2.2.4 The attempted Soviet coup d'état (1991)

The short-lived coup d'état in Moscow in August 1991 led to uncertainty about the status and possible actions of certain financial institutions based in, or owned by institutions in, the then Soviet Union. For a few days the uncertainty had a disruptive effect on settlement in the foreign exchange market, in which these institutions were active traders. Some of their market counterparties were unwilling, given the political climate, to expose themselves to what they saw as potentially very acute principal risk in settling their maturing FX contracts. They instead pressed for the receipt of countervalue (or a guarantee from an acceptable third party) in advance of releasing funds. As a result, some deals were not settled when due.

There were also some instances of unwillingness on the part of the Soviet-based institutions' correspondent banks to release funds even when countervalue had been received, including at least one attempt by a correspondent to withhold funds it was due to pay out to its customer on one day to cover an amount it was due to receive from the same customer the next day.

The effect of these measures was to protect the western counterparties from principal risk, but to expose the Soviet institutions to an immediate liquidity risk, at a time when money market participants were increasingly reluctant to deal with them. Fortunately, no widespread systemic problems developed, partly because some counterparties were able to come to bilateral understandings - in some cases with the help of public authorities - which enabled deals to be settled. This type of

situation could, however, in different circumstances, have had more wide-ranging and serious consequences.

2.2.5 The Barings crisis (1995)

The unforeseen collapse of Baring Brothers at the end of February 1995 caused a problem in the ECU clearing. On Friday, 24th February one clearing bank had sent an ECU payment instruction addressed to Barings' correspondent for a relatively small amount for value on Monday, 27th February. After the appointment of an administrator to Barings on 26th February the sending bank sought to cancel the instruction but it found that the rules of the ECU clearing did not permit this; moreover, the receiving bank was legally unable to reverse the transaction. As it turned out, the sending bank happened to find itself in an overall net debit position in the clearing at the end of the day. Under pressure of time the bank agreed to cover that position by borrowing from a long bank, so enabling the settlement of more than ECU 50 billion in payments between the 45 banks participating in the clearing eventually to be completed on the due date.

This demonstrates the potential problems which can be caused when banks do not have a thorough understanding of the rules of the clearing systems through which they will pay or receive the currencies of their market transactions. If the sending bank had not eventually agreed to borrow in order to cover its payment, the end-of-day settlement would have been frustrated. The clearing would have had to be unwound, so that no payments between any of the 45 ECU clearing banks would have been settled on the due day, even though less than 1% of those payments had anything to do with Barings. The failure to settle could have had very serious consequences for the banks, and for their customers, in the ECU market and more widely.

2.3 Defining and measuring foreign exchange settlement exposure

To contain the systemic risk inherent in current arrangements for settling foreign exchange transactions, it is first necessary to develop a realistic understanding of the nature and scope of FX settlement exposures. On the basis of discussions with market participants, the CPSS has 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 currency purchased is received with finality.*

It is important to note that this definition is designed to address the *size* and *duration* of the credit exposure that can arise during the FX settlement process. It says nothing about the *probability* of the occurrence of an actual loss.

The definition also does not specifically address the *ability* of a bank to measure and to control its FX settlement exposure at a particular moment. To develop a practical methodology for measuring current and future FX settlement exposures in a manner consistent with the above definition, a bank would need to recognise the changing status - and, hence, the changing potential settlement exposure - of each of its trades during the settlement process. Although settling a trade involves numerous steps, from a settlement risk perspective a trade's status can be classified according to five broad categories:

Status R: *Revocable.* The bank's payment instruction for the sold currency either has not been issued or may be unilaterally cancelled without the consent of the bank's counterparty or any other intermediary. The bank faces no current settlement exposure for this trade.

Status I: *Irrevocable.* The bank's payment instruction for the sold currency can no longer be cancelled unilaterally either because it has been finally processed by the relevant

payments system or because some other factor (e.g. internal procedures, correspondent banking arrangements, local payments system rules, laws) makes cancellation dependent upon the consent of the counterparty or another intermediary; the final receipt of the bought currency is not yet due. In this case, the bought amount is clearly at risk.

Status U: *Uncertain.* The bank's payment instruction for the sold currency 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. In normal circumstances, the bank expects to have received the funds on time. However, since it is possible that the bought currency was not received when due (e.g. owing to an error or to a technical or financial failure of the counterparty or some other intermediary), the bought amount might, in fact, still be at risk.

Status F: *Fail.* The bank has established that it did not receive the bought currency from its counterparty. In this case the bought amount is overdue and remains clearly at risk.

Status S: *Settled.* The bank knows that it has received the bought currency with finality. From a settlement risk perspective the trade is considered settled and the bought amount is no longer at risk.

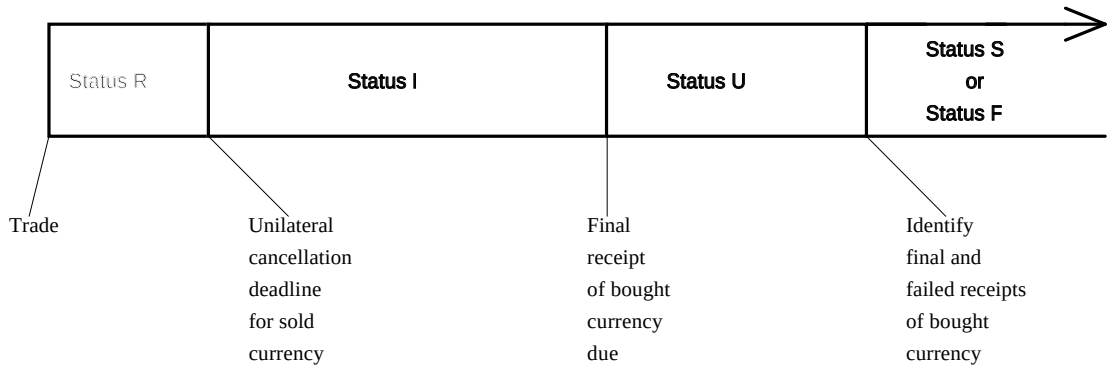
The diagram below illustrates this simplified description of the FX settlement process. To classify its trades according to the categories indicated, a bank would need to know the following three critical times for each currency it trades:

(i) its unilateral payment cancellation deadline;

(ii) when it is due to receive with finality the currency it bought; and

(iii) when it identifies final and failed receipts.

FOREIGN EXCHANGE SETTLEMENT PROCESS:
CHANGING STATUS OF A TRADE



As described in *Appendix 1*, these times depend on the characteristics of the relevant payments systems as well as on the individual bank's internal settlement practices and correspondent banking arrangements. Nevertheless, once a bank determines these times and appropriately classifies the status of each of its trades, it is a straightforward calculation to measure its FX settlement exposure even in the absence of real-time information. Banks that always identify their final and failed receipts of bought currencies as soon as they are due can determine their exposures exactly. For these banks, current exposure equals the sum of their *Status I* and *F* trades. In contrast, banks that do not immediately identify their final and failed receipts cannot pinpoint the exact size of their FX

settlement exposures. The uncertainty they face reflects their inability to know which of their *Status U* trades have or have not actually settled (i.e. they do not know the amount of bought currencies that should - but might not - have been received on time).

Faced with this uncertainty, a bank should be aware of both its minimum and maximum FX settlement exposure. For instance, a bank that only measures and controls its minimum exposure could, in adverse circumstances, experience a much larger unexpected and undesirable actual exposure. On the other hand, a bank that only monitors its maximum exposure might, if it believes that its actual exposure usually falls well short of this amount, set up excessively accommodative internal controls that would not prevent an unexpected and undesirable jump in its actual exposure.

Recognising the uncertainty that might surround its actual FX settlement exposure, a bank can use the following general guidelines to measure its minimum and maximum exposure on the basis of the current status of its unsettled trades:

Minimum exposure: **Sum of *Status I* and *F* trades.** This is the value of the trades for which a bank can no longer unilaterally "stop payment" of the sold currency but has not yet received the bought currency.

Maximum exposure: **Sum of *Status I, F* and *U* trades.** This equals a bank's minimum exposure plus the amount of bought currencies that should - but might not - have been received.

A bank can also project its FX settlement exposure using its knowledge that each of its trades will go through a predictable change in status, based on its current settlement practices. *Appendix 1* describes in detail this methodology for measuring a bank's current and future FX settlement exposure.

3. MARKET SURVEY

The CPSS surveyed approximately 80 banks in the G-10 countries to document current practices for settling FX trades (see *Appendix 3* for a list of the topics that were investigated). The findings of the survey are summarised below.

3.1 Duration of foreign exchange settlement exposures

For most of the banks surveyed and in every G-10 country, the minimum FX settlement exposure of an individual spot or forward trade (the duration of *Status I*) currently lasts for between one and two business days.[5] In addition, it can take a further one to two business days for many banks to establish whether they indeed received the currency they bought on time (the duration of *Status U*). As a result, more than three business days - plus any intervening weekends and holidays - can elapse between the beginning of some banks' settlement exposures and the time at which they know with certainty that they are no longer at risk.

Furthermore, banks can incur FX settlement risk no matter which currency they buy or sell. For instance, even when - from one bank's point of view - the bought currency settles before the sold currency, a bank might face an earlier deadline for unilaterally cancelling its payment of the sold currency. In such circumstances, it could be forced to pay out the currency it sold even when it knows that it will fail to receive the currency it bought.

As described in *Appendix 1*, the often lengthy duration of FX settlement exposure reflects the fact that current practices for handling payments and receipts were designed more for operational efficiency (e.g. faster throughput, lower costs, prevention of technical fails) than for controlling settlement exposures. For instance, many automation advances such as "straight-through processing" have offered worthwhile benefits to payments systems and individual banks by, inter alia, reducing operational risks. Once they begin, however, certain automated procedures can make it difficult, if not impossible, for a bank or its correspondent to cancel unexecuted payment instructions even before settlement day. This can increase the duration of FX settlement exposures by creating overly restrictive unilateral payment cancellation deadlines.

3.2 Size of foreign exchange settlement exposures

Given current practices, many banks face significant FX settlement exposures overnight, and therefore over weekends and holidays. The size of a bank's total FX settlement exposure depends directly on the duration of the settlement exposure of each of its trades. For instance, if a bank's minimum settlement exposure for a single FX trade lasts 48 hours, at least two days' worth of trades would always be at risk. In addition, if it takes, for example, another 24 hours to verify the final receipt of each purchased currency, a further day's worth of trades *might* still be at risk. *Appendix 1* illustrates how, under these circumstances, a bank's maximum FX settlement exposure could equal at least three days' worth of trades at any point in time, including overnight and during weekends and holidays.

No comprehensive statistics are yet available on the banks' actual levels of FX settlement exposure, partly reflecting the fact that most banks currently do not measure them properly, if at all. Nevertheless, discussions with several banks indicated that their current exposures can reach very high amounts. For instance, some banks said that they routinely settle FX trades worth well over US$ 1 billion with a single counterparty on a single day. If current practices can transform this level of activity into an actual FX settlement exposure that is two to three times this amount, bilateral FX

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[5] The duration of *Status I* when settling a forward sale of yen can actually last up to three days since members of the FEYCS can send irrevocable yen payment instructions to the system up to three days before settlement day.

settlement exposures could be large in relation to a bank's capital and could far exceed the short-term credit exposure a bank incurs in other activities with the same counterparties.

3.3 Potential impact of changing practices

The survey indicated that a bank's FX settlement practices can greatly influence the size of its exposures. One way a bank can lower its exposure is by changing the timing of its unilateral payment cancellation deadlines and of its identification of final and failed receipts. Another way is by legally binding netting of the daily settlement obligations arising out of its FX trades rather than settling each trade individually.

3.3.1 Payment cancellation and receipt identification

A bank could eliminate overly restrictive unilateral payment cancellation deadlines (to shorten the duration of *Status I*) and reduce the time it takes to identify its final and failed receipts of bought currencies (to shorten the duration of *Status U*). As described in *Appendix 1*, these improvements could require a combination of changes to its own settlement practices and, if relevant, to its correspondent banking arrangements. Some banks have also proposed that the establishment of a global practice to attach a common reference number specific to each FX trade and its related payment instructions could be quite helpful in this regard.

In October 1994 the New York Foreign Exchange Committee (NYFEC), which is a private sector group sponsored by the Federal Reserve Bank of New York, published a report on *Reducing Foreign Exchange Settlement Risk*. In its report, the NYFEC defined "best-case" FX settlement practices as those that would give a bank the following capabilities:

- To cancel its payment instructions unilaterally up until the opening time on settlement day of the local large-value transfer system (LVTS)
- To identify its final and failed receipts immediately upon finality of the local LVTS

While there may be different views as to what constitutes "best practice" in different markets,[6] the NYFEC's definition provides a useful reference point for measuring the effect of changing current settlement practices. For instance, *Appendix 1* illustrates how current "worst-case" market practices (i.e. the earliest cancellation deadlines and the latest receipt identification times reported in the market survey) can produce FX settlement exposures that are two to three times greater than those that would be generated by the NYFEC's "best-case" practices. This is particularly noteworthy since the NYFEC's "best-case" practices are already being followed by at least some market participants in different G-10 countries, providing concrete evidence that similar practices could be adopted immediately by all participants in the FX market.

3.3.2 Netting

There is also scope for at least some FX market participants to reduce the amount at risk during the settlement process through obligation netting arrangements. As defined in this report, obligation netting is the legally binding netting of amounts due in the same currency for settlement on

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6 For instance, a bank would achieve maximum protection if, as a matter of course, it or its correspondent bank executed all of its payment instructions shortly before the end of the local business day, thereby minimising the duration of *Status I*. In some markets this could be considered "best practice". In other markets, however, it could lead to an undesirable level of payment gridlock if it were adopted by all banks on a routine basis. In such cases, "best practice" might require a bank to spread its payments over the whole of the local business day.

the same day under two or more trades.[7] Under an obligation netting agreement for FX transactions, counterparties are required to settle on the due date all of the trades included in the agreement by either making or receiving a single payment in each of the relevant currencies. This reduces the amount at risk by lowering the number and size of payments that would otherwise be needed to settle the underlying transactions on a trade-by-trade basis.[8]

Appendix 1 illustrates the potential exposure-reducing benefits of obligation netting. Most importantly, any actual reduction in FX settlement exposures would depend on a bank's trading pattern. Active market-makers trading with each other out of a limited number of locations would be likely to have many offsetting trades that could be netted, whereas relatively inactive traders, or those that trade out of many different locations around the world, might have less opportunity to net their FX trades.

3.4 Market responses and initiatives

3.4.1 Individual bank level

Risk awareness. Although most banks are familiar with the concept of foreign exchange settlement risk, not all banks have a single officer who understands the entire settlement process and the risks it entails, so that meetings with some banks for the purpose of the market survey required the presence of representatives from several different departments in order to cover all aspects of the subject. Moreover, some market participants indicated that the senior executives of their banks had never been fully briefed on the FX settlement process and the associated risks. Some of the bankers interviewed saw this CPSS project as an effective way to alert senior management to the risks posed by a bank's FX settlement process and to obtain a clear mandate to improve practices.

Many bankers also suggested that it would be helpful to publicise information on the size of actual losses that banks have incurred in the past during the settlement of FX trades with problem counterparties. Such data, however, are not readily available across markets, in large part owing to banks' reluctance to make these figures publicly available. Some market groups are attempting to estimate the industry-wide cost of current FX settlement exposures and to prorate these costs to the individual bank level. While such estimates would, of necessity, be based on many assumptions and approximations, they might prove to be a useful way to highlight the potential mismatch between the risks and rewards that many banks currently face when settling their FX trades.

Risk measurement. Overall, many banks currently underestimate the duration and size of FX settlement exposure by treating it as an intraday amount no larger than a single day's expected receipts. Only a few banks treat irrevocable payment instructions issued prior to settlement day as part of their FX settlement exposure. In addition, most banks do not appear to incorporate due but unverified receipts, let alone failed receipts, in their measures of outstanding exposure with a counterparty. As a result, many banks do not recognise that they can routinely incur FX settlement exposures equivalent to several days' trades, and that these exposures can persist overnight, and therefore over weekends and holidays.

Systems for measuring FX settlement exposures vary widely. Some banks have no formal mechanism to measure their current or future settlement exposures, while others project their

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[7] Depending on the relevant legal system, obligation netting can find a legal basis in constructions such as novation, set-off or the current account mechanism.

[8] In contrast to "obligation netting", "close-out netting" requires counterparties to settle on a net basis all contracted but not yet due obligations immediately upon the occurrence of a defined event, such as the appointment of a liquidator to one of the counterparties. In the absence of such an event, however, the obligations associated with each trade must be settled individually on the due date unless the counterparties also have a supplementary obligation netting agreement. Close-out netting does not, by itself, reduce routine FX settlement exposures.

settlement exposures with direct information feeds from their trading systems. Some of the latter banks project exposures up to three days ahead, while others only look at the next day's amount.

Few banks, however, appear to draw together in a useful way all the relevant information potentially available to them that could be used to accurately measure their exposure throughout the settlement process. Hitherto, economic incentives have not been sufficiently strong for banks to assemble this existing information from their back offices and correspondent banks in a useful fashion. For instance, cash managers may become aware of a failed receipt on settlement day, but it is unclear how easily they can determine which counterparty failed to make which payment. In some cases a bank will send its correspondent an "advice to receive", which is a notice of a payment the bank expects from a third party. Some correspondents compare these advices with actual receipts and alert the beneficiaries to failed receipts. However, banks generally do not use this practice. Some correspondents charge heavily for this service; others either actively discourage their customer banks from sending such advices or ignore them if they are sent. In some cases, of course, advice from a correspondent to a cash manager of a failed receipt, or of an unexpected overdraft, will arrive too late for the manager to take any action that day - the manager may not even be able to tell, until the next business day, which anticipated receipt has failed, from which counterparty.

Most of the banks surveyed agreed on a general, theoretical level with the CPSS's methodology for defining and measuring FX settlement exposures. Only a few banks, however, expressed interest in implementing an internal measurement system that would be fully consistent with this framework. In large part, this reflects concern about the cost of such a system, particularly one that would continually update a bank's global exposures as it executes each new trade and as each unsettled trade moves through the settlement process. It also reflects different views on the level of detail that a bank would need in practice to control its FX settlement exposures. For instance, some banks believe that they would only need to measure their minimum exposure (i.e. the sum of their *Status I* and *F* trades), while others believe that they would only need to measure their maximum exposure (i.e. the sum of their *Status I*, *F* and *U* trades). Some banks believe that failed receipts (*Status F* trades) should be excluded from their day-to-day measure of FX settlement exposure, while others believe that they would need to include all unsettled trades, including those that have not yet passed a bank's unilateral cancellation deadline (*Status R* trades).

Risk controls. Some banks currently impose no limits on their FX settlement exposures, no matter how they are measured. As for those banks that do have limits, some use them as effective controls while others set them at extremely high levels or waive them altogether for their largest trading partners. In addition, some banks impose binding settlement limits, particularly on certain counterparties or in special circumstances, while others use such limits only as guidelines. In general, banks with FX settlement limits tend to set them with an eye to preventing unusual trading activity rather than containing credit and liquidity exposure. As a result, limits and actual FX settlement exposures can reach multiples of those encountered in the case of products with similar risks such as overnight placements and deposits involving the same counterparties.

Some banks are considering the introduction of new settlement limit systems. However, some believe that even if they were to properly measure and project their exposures, it would be difficult for them to introduce binding counterparty settlement limits if others in the market did not do the same thing. In addition, some banks said that even if they had an effective limit system, market pressures might make it difficult for them to cut their exposures to certain counterparties quickly in response to increased credit concerns.

Prospects for individual action. Many banks have not clearly established responsibility for managing foreign exchange settlement risk within their institutions, and so have not created the authority and incentives to control it prudently. While some bankers plan to spend the necessary time and money to improve their settlement practices, others do not and see little incentive to change their practices without a strong mandate from their senior management. This resistance appears to stem from a combination of sources, including:

- Failure to recognise that banks can routinely incur significant FX settlement exposures overnight and during weekends and holidays
- A mistaken view that an FX settlement exposure with a counterparty represents less of a risk than a loan or other formal credit extension of the same size and duration
- False comfort that major FX counterparties are "too big to fail"
- A misperception that public authorities could always avoid closing down a major FX market participant unexpectedly at a time that would cause significant losses during the settlement process
- The current complexity of settling FX transactions
- Concern that the necessary improvements will be very costly
- Fear that an uneven pace of improvements among individual market participants could lead to competitive distortions
- Other, higher priorities

3.4.2 Industry group level

Risk awareness. Much promising work has begun to take place at the industry group level. As mentioned above, the New York Foreign Exchange Committee (NYFEC) published a report in 1994 on *Reducing Foreign Exchange Settlement Risk.* This study documented for the first time the considerable impact of market practices on the size and duration of FX settlement exposure. This finding, which the CPSS subsequently confirmed through its survey of banks throughout the G-10 countries, led the NYFEC to issue a set of recommendations designed to help banks immediately reduce their FX settlement exposures (see *Appendix 2*).

At the international level, the NYFEC publicised the report through seminars in New York, London, Frankfurt and Tokyo. The Association Cambiste Internationale (ACI) has also expressed a strong interest in supporting efforts to encourage improvements in FX settlement practices. In general, the topic of FX settlement exposure has received considerable attention at many recent industry conferences, including the 1995 S.W.I.F.T. International Banking Operations Seminar (SIBOS).

Bilateral netting services. FXNET, S.W.I.F.T. and VALUNET currently provide bilateral obligation netting services to many banks. As of December 1995, FXNET[9] provided this service to 29 institutions operating out of 57 offices in 9 locations, including New York, London, Zurich, Tokyo and Singapore, and an additional 19 offices were in the process of joining the system. Three new locations (Geneva, Sydney and Toronto) would be introduced with the planned expansion. Accord, which is operated by S.W.I.F.T. (Society for Worldwide Interbank Financial Telecommunication), provides confirmation matching and bilateral obligation netting services. As of December 1995, 370 users employed the Accord matching services, including 27 subscribers to its netting services. VALUNET, the smallest of the service providers, is operated by International Clearing Systems (service provider for the proposed Multinet International Bank, which is discussed below). As of December 1995, VALUNET provided bilateral obligation netting services to 10 institutions operating out of 17 offices in 5 locations. In addition to these industry services, many

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9 FXNET is a limited partnership owned by the UK subsidiaries of 12 major banks. It is a decentralised system in which participants use common software provided by Quotron Foreign Exchange. FXNET and Multinet (see footnote 12) have signed a letter of intent to enter into an agreement that will allow those FXNET users which wish to do so to utilise Multinet clearing house services to multilaterally net settle FX obligations that have already been bilaterally netted.

pairs of banks have set up bilateral netting arrangements on their own, often using a standardised contract such as the *International Foreign Exchange Master Agreement* (*IFEMA*).

However, despite the potential risk-reducing benefits, the market survey indicated that not all banks use bilateral obligation netting agreements. When they do net, more often than not their netting is limited to close-out[10] provisions (mainly to take advantage of favourable capital treatment of netted positions or to improve their leverage ratios), while routine settlements continue to be conducted on a gross, trade-by-trade basis. Obligation netting is mostly confined to the largest banks and their largest counterparties.

Banks cite costs and operational capacity as barriers to the greater use of bilateral netting by novation or other methods of obligation netting. In several countries, banks also expressed concern about the lack of legal certainty of netting arrangements. Some of the discussions suggested a possible role for the European Commission or for some individual central banks in validating netting contracts. In contrast, some banks find it cost-effective to informally settle their foreign exchange trades by paying and receiving their obligations on a net basis. However, uncertainty regarding the legal soundness of such arrangements could potentially increase systemic risk.

Multilateral netting and settlement services. ECHO (Exchange Clearing House)[11] began operations in August 1995 and the proposed Multinet International Bank[12] hopes to start in 1996. Both systems are designed to transform bilaterally arranged individual FX trades into multilateral net settlement obligations and to provide risk controls that ensure the timely settlement of these obligations. In essence, these controls are designed to reduce credit and liquidity risks by assuring participants that the final settlement of each currency will take place even if a participant in the group is itself unable to settle its obligations on the due day.

ECHO began operations with 16 participant users in 8 countries netting trades in 11 currencies. ECHO hopes to expand its services to banks in more than 20 countries for trades in 25 currencies. Multinet plans initially to provide services to 8 banks in North America for their trades in US and Canadian dollars and other major currencies within the first year. Multinet also hopes to add further currencies and participants in other countries over time. It may be noted that central banks have successfully used the minimum standards and cooperative oversight principles set out in the Lamfalussy Report when reviewing these systems.

Other multi-currency settlement mechanisms. More recently, the newly formed "Group of 20"[13] has been actively exploring other possible multi-currency settlement mechanisms. Rather than directly netting the underlying FX trades, the models currently under study could be designed to support the settlement of individual trades or trades which have already been netted under other bilateral or multilateral obligation netting arrangements. Although these multi-currency settlement mechanisms would not, by themselves, provide the risk-reducing benefits of obligation netting, they could lower credit risks by assuring participants that the final transfer of one currency will occur if and only if the final transfer of the other relevant currency or currencies also occurs. Multi-currency settlement mechanisms could also, if designed accordingly, lower liquidity risks by assuring

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10 See footnote 8.

11 Exchange Clearing House Limited is a clearing house based in London for the netting of spot and forward foreign exchange obligations between its users.

12 A group of banks based in Canada and the United States propose to establish a foreign exchange clearing house to provide multilateral netting and settlement of spot and forward foreign exchange transactions. The Multinet clearing house would operate as a bank and would be owned by its member banks. The banks in the Multinet project currently net their mutual transactions on a bilateral basis (the VALUNET arrangement).

13 The Group of 20 was formed in 1994 as a common interest group of international commercial banks from Asia, Europe and North America. The purpose of the group is to identify and cause the implementation of private sector solutions that reduce the risk and increase the efficiency of the clearance and settlement of linked transactions primarily originating from foreign exchange activity.

participants that if they settle their payment obligations then they will receive their expected funds on time.

Prospects for collective action. Although some of these industry-wide initiatives are well under way, many banks remain sceptical about the business case for committing resources to efforts to reduce FX settlement exposures. As a result, many individual banks have been slow to join these efforts. Without adequate motivation for a sufficient number of FX market participants to support and use one or more of these current or prospective industry-wide multi-currency services, their short-term (let alone long-term) viability is uncertain.

4. DESCRIPTION OF STRATEGY

Building upon the results of the market survey and the past work of G-10 central banks on international payments arrangements (most notably the Angell, Lamfalussy and Noël Reports), the CPSS identified for consideration a menu of choices for addressing FX settlement risk. These choices were evaluated in the light of the seven central bank policy issues listed in the Noël Report (see the box opposite). On the basis of this analysis, the CPSS constructed, and the G-10 Governors endorsed, the following three-track strategy:

- Action by individual banks to control their FX settlement exposures
- Action by industry groups to provide risk-reducing multi-currency services
- Action by central banks to induce rapid private sector progress

This section describes the three elements of the strategy in detail and discusses their key implications from a central bank policy perspective.

4.1 Action by individual banks to control their foreign exchange settlement exposures

Individual banks should take immediate steps to apply an appropriate credit control process to their FX settlement exposures. This recognises the considerable scope for individual banks to address the problem by improving their current practices for measuring and managing their FX settlement exposures.

4.1.1 Description of recommended action

Improve practices. Individual banks could improve their settlement practices so as to gain better control over their FX settlement exposures. In particular, banks could improve their back office payments processing, correspondent banking arrangements, obligation netting capabilities and risk management controls sufficiently to permit them to:

- Measure FX settlement exposures properly
- Apply an appropriate credit control process to FX settlement exposures
- Reduce excessive FX settlement exposures for a given level of trading

Measure exposures. First, banks could adopt internal procedures that would permit them to measure their FX settlement exposures properly. For instance, a bank could develop a system that frequently updates its current and future global exposures as it executes new trades and as unsettled trades move through the settlement process. This would give it much more accurate and timely information regarding its FX settlement exposure. This capability, however, might not be immediately feasible, particularly for an international bank actively trading a wide range of currencies with a substantial number of counterparties out of many locations without the benefit of a consolidated risk management system. Nevertheless, such a bank (or, at least, each of its trading centres) could adopt procedures to update its exposure calculations periodically (e.g. once or twice a day) and to measure its minimum and maximum exposure at any moment on the basis of all available information. In either case, *Appendix 1* provides guidelines that a bank (or each of its trading centres) could use to measure its current and future exposures.

CENTRAL BANK POLICY ISSUES RAISED BY PROPOSALS FOR REDUCING FX SETTLEMENT RISK

1. The effect on **monetary policy implementation**: monetary policy implementation could be affected by the impact ... on the ability of the central bank to control the supply of and to forecast the demand for reserve balances, and by the impact on open market operations, central bank lending and other operating procedures. This might affect interest rates and exchange rates.

2. The adequacy of **private sector sources of liquidity** to support settlement in each currency: this could be influenced by the availability during settlement of deep and liquid money markets, of final transfers into settlement accounts and of collateral to support funding transactions.

3. The impact on **systemic risk**: this could depend on the effect ... on private sector motivation to design new methods to reduce settlement risks, on the ability and incentive of the public and private sectors to manage credit and liquidity risks, and on the degree of reliance on public and private sector credit and liquidity.

4. The **well-founded legal basis** of settlement arrangements and entities: this would depend in part on the legal status of settlements in each country and on the legal implications of the location and corporate form of settlement entities.

5. The likely **competitive effects** in private financial markets: this would depend on the markets to be served, on the participants and entities that would benefit from access to ... services and on likely changes to correspondent banking relationships.

6. The **cost-effectiveness** ... from the private sector perspective: this would reflect initial investment costs and the implementation timetable, the ongoing operating costs relative to the status quo and the costs of any required idle balances that might arise as a result of prefunding of debits or delayed access to credits.

7. The **acceptability ... from an individual central bank perspective**: this would reflect initial investment costs (e.g. the cost of new technology) and the implementation timetable; ongoing operating costs; required legislative and policy changes; implications for central bank supervision or oversight; implications for the role of the central bank as liquidity provider; likely shifts in the loci of financial activity; and the required degree of coordination, cooperation and sharing of confidential information.

Source: *Central Bank Payment and Settlement Services with respect to Cross-Border and Multi-Currency Transactions*, Basle, September 1993.

Manage exposures. Second, a bank could adopt internal procedures for explicitly assessing the risks and rewards of its FX settlement activities, thereby permitting it to manage its properly measured exposures on the basis of fully informed business judgements. As part of an effective management approach, a bank could choose to control its properly measured FX settlement exposures in a manner consistent with the way in which it controls its other credit exposures. For instance, many banks currently set a limit on their total credit exposure with a single counterparty based on an internal credit analysis. Such a limit would generally apply to all operations that generate credit exposure, whether a loan, a deposit, a letter of credit or any other formal extension of credit. Some banks also set separate sub-limits on different possible durations of credit exposure (e.g. remaining exposures of up to 7 days; up to 30 days; up to 90 days; etc.). Furthermore, some banks that have many offices around the world but do not have a global real-time limit monitoring system divide each limit or sub-limit among the various entities and monitor them on a decentralised basis. This control process enables a bank (or a particular office) to undertake any combination of credit-generating activities with a single counterparty and still assure senior management that the bank's overall credit exposure will remain within the level it considers appropriate.

This assurance, or any similar assurance that could be provided by other effective credit control processes, could be extended to credit exposures that arise in settling FX trades simply by including properly measured FX settlement exposures under the same set of controls. For this to work effectively, however, a bank would need to accept the proposition that - when dealing with a particular counterparty - FX settlement exposure represents the same credit risk, and the same probability of loss, for the bank as, for example, a loan of identical size and duration. Once a bank applies its standard credit controls to FX settlements, it could assure itself that these exposures would not exceed a level the bank considers appropriate.

Reduce excessive exposures. Third, even without lowering the scale of its FX trading, a bank could reduce any FX settlement exposure it deems excessive and decrease the uncertainty surrounding the size of its exposures by improving its settlement practices. For instance, by eliminating overly restrictive payment cancellation deadlines and shortening the time it takes to identify the final and failed receipt of bought currencies, a bank could lower its actual and potential FX settlement exposure for the same level of FX trading. Depending on a bank's trading pattern, the use of available bilateral or multilateral obligation netting arrangements could reduce exposures even further. If necessary, in certain cases a bank may further protect itself against excessive FX settlement exposures by, for instance, requiring collateral from its counterparties.[14]

4.1.2 Central bank policy perspective

Reduced FX settlement risk. Overall, by improving its settlement practices, a bank could gain more effective control over its FX settlement exposures in settling trades with any counterparty in any currency. This would permit a bank to protect its financial health and to reduce its reliance on potentially destabilising actions at times of market stress. Furthermore, a bank could take immediate steps to improve its practices.

Informed credit judgements. This approach to reducing risk makes use of the traditional strength of individual banks in reaching informed credit judgements and in pricing and controlling credit risk properly. Today, many banks are not aware that they can incur sizable FX settlement exposures overnight and during weekends and holidays. Once a bank fully understands and quantifies its FX settlement exposures, it could apply a rigorous risk/reward analysis to them and conclude that a reduction in exposures for given trading levels is in its economic interest. For this purpose, a bank could use an approach that is generally consistent with its approach to the control of its counterparty credit exposures in other markets, and would therefore create no new conceptual difficulties.

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[14] Since each counterparty to a trade can face FX settlement exposure, each might choose to request collateral from the other.

Reduced sources of systemic risk. An improvement in settlement practices would also help prevent a bank from either over-reacting or under-reacting to changes in the credit quality of its counterparties. For instance, overly restrictive payment cancellation deadlines and excessive delays in identifying final and failed receipts leave many banks today with three poor options when faced with a sudden increase in concern about a counterparty: continue to process their outgoing payments as usual (a possible under-reaction); attempt to monitor the flow of particular incoming receipts and outgoing payments on an ad hoc, exceptional basis (a potentially unreliable and expensive process); or halt all trading and payments (a possible over-reaction). However, with better settlement practices, a bank would be in a position to make more measured adjustments to its FX settlement exposure with a counterparty in response to its evolving financial condition. Thus, if broadly adopted by FX market participants, improved practices for managing FX settlement flows could help stabilise money markets, reduce liquidity pressures and contain the systemic risk in settling, or deciding not to settle, FX transactions at times of market stress.

Reduced uncertainty. If banks were to improve their settlement practices, they would need to eliminate current uncertainties regarding the revocability of their payment instructions and the finality of their receipts. As described in *Appendix 1*, such uncertainties can stem from correspondent banking arrangements as well as from the rules and laws governing domestic payments. Clearer arrangements, rules and laws would reduce market-wide uncertainty, another source of systemic risk at times of stress.

Impact on monetary policy. Since the envisioned action by individual banks would not require modification of the underlying payments system infrastructure, FX settlements could continue to take place relatively independently in each domestic market during normal business hours. Under such circumstances, private sector sources of liquidity should be as available as they are today to support the settlement of each traded currency. As a result, domestic monetary policy implementation should not be affected by, for instance, a significant change in the demand for central bank balances or for central bank credit and liquidity. In addition, individual central banks would retain their current degree of flexibility in deciding how to respond to liquidity problems in their home currencies.

Increased correspondent banking competition. A market-wide increase in the desire of individual banks to lower their FX settlement exposures should also encourage competition in the quality of correspondent banking services. This demand could stimulate private sector innovation more broadly to develop multi-currency services - including multi-currency settlement mechanisms and bilateral and multilateral obligation netting arrangements - that could help banks achieve even further risk reductions.

Action by non-bank financial institutions. In addition to inducing banks, and their correspondent banks, to make improvements, where appropriate and relevant it would also be necessary to reach non-bank financial institutions active in the FX markets. Unless all relevant market participants took sufficient steps to control their FX settlement exposures, an excessive level of risk might remain in the financial system; moreover, unfair competitive advantages could emerge in the near term if some market participants incurred the cost of improving their FX settlement practices while others did not.

4.2 Action by industry groups to provide risk-reducing multi-currency services

Industry groups are encouraged to develop well-constructed and soundly based multi-currency services that would contribute to the risk reduction efforts of individual banks and would reduce systemic risk more broadly. This recognises the significant potential benefits of multi-currency settlement mechanisms and bilateral and multilateral obligation netting arrangements, and the G-10 central banks' view that such services would best be provided by the private sector rather than the public sector.

4.2.1 Description of recommended action

Payment/receipt relationship. FX settlement exposure could be attacked at its source by creating one or more multi-currency settlement mechanisms that establish a direct relationship between the payment of one currency and the receipt of another. As defined in the Noël Report, a multi-currency delivery-versus-payment (DVP) mechanism would assure participants that "a final transfer in one currency occurs if and only if a final transfer of the other currency or currencies also takes place". Accordingly, a multi-currency DVP settlement mechanism (which this report calls a payment-versus-payment, or PVP, settlement mechanism) would eliminate FX settlement exposure. However, a PVP mechanism would not necessarily reduce or eliminate the liquidity or other risks that can arise when settling FX trades; indeed, some PVP mechanisms might magnify these risks. Moreover, while "PVP" may present a clear theoretical concept, it does not address some of the practical timing problems of coordinated cross-border payments and settlements. Thus, from an analytical perspective, it is helpful to pay particular attention to two important characteristics of a multi-currency settlement mechanism: the payment/receipt relationship and the timing of settlement.

Through discussions with market participants, the CPSS has identified two possible payment/receipt relationships that a multi-currency settlement system could establish. Under one approach, the system could guarantee the timely settlement of all relevant currencies. Such a system would assure participants which fulfil their settlement obligations that they will receive what they are owed even if their counterparties fail. Under another approach, a system would assure participants that if a counterparty fails to meet its settlement obligations then all of their related payments to that counterparty will be returned or cancelled. In the light of these major differences in approach, it is useful to specify these two potential payment/receipt relationships:

> **Guaranteed receipt system:** counterparties are guaranteed that if they fulfil their settlement obligations they will receive on time what they are owed ("you will receive if and only if you pay").
>
> **Guaranteed refund system:** counterparties are guaranteed that any settlement payment they make will be cancelled or returned if their counterparties fail to pay what they owe ("you will pay if and only if your counterparty pays").

Settling individual trades. Either approach could potentially eliminate FX settlement risk in the settlement of individual FX trades. For instance, a guaranteed receipt system would assure a participant that if it pays the single currency it sold, it will receive the single currency it bought even if its counterparty fails to pay what it owes. In contrast, a guaranteed refund system would assure a participant settling an individual trade that if it pays the single currency it sold but its counterparty fails to settle, then its own payment will be cancelled or returned.

Settling netted trades. In addition, either payment/receipt relationship could be designed to eliminate FX settlement risk in the settlement of FX trades under an obligation netting agreement. For instance, a guaranteed receipt system could assure a participant that if it pays each of the currencies it sold on a net basis under, for example, a bilateral obligation netting agreement, it will receive each of the currencies it bought on a net basis even if its counterparty fails to settle any of its net payment obligations. For the settlement of trades under a multilateral obligation netting agreement, the same guarantee could be offered in the case of a settlement failure by any of the participant's counterparties. In contrast, a guaranteed refund system could assure a participant that all of its payments in all of the currencies it sold on a net basis under a bilateral obligation netting agreement will be cancelled or returned if its counterparty fails to settle any of its payment obligations. For the settlement of trades under a multilateral obligation netting agreement, the system could guarantee the cancellation or return of all payments directed to all defaulting counterparties.[15]

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[15] This cancellation or return of net settlement payments, however, is likely to be inconsistent with the Lamfalussy minimum standards that require, inter alia, that multilateral netting systems be capable of ensuring the timely

Timing of settlement. Along with its potential payment/receipt relationship, the timing of a particular system's settlement can play an important role. With either payment/receipt relationship, a system could settle all relevant currencies at the same time - simultaneous settlement - or at different times - sequential settlement. With a simultaneous settlement, a system could require all participants to pay in all the funds they owe in every currency before the system pays out any funds that participants are due to receive in any currency. In contrast, in a sequential settlement, a system would pay out some currencies before it receives all other currencies.

Guaranteed receipt with simultaneous settlement. The timing of settlement can have many implications, not the least of which is its impact on the system's ability to honour the guarantee backing its payment/receipt relationship. For instance, a system that provides a guaranteed receipt with simultaneous settlement could benefit from the generally self-collateralising nature of FX settlements. If a participant in such a system were to fail to pay its obligation in one currency, the system could, if well designed, cover this shortfall by using the defaulting participant's corresponding conditional receipts in another currency to purchase or to collateralise the funds needed to pay its counterparties. Of course, exchange rate movements mean that the value of one side of an FX trade will not always equal the other, thereby limiting the self-collateralising capability of a simultaneous settlement. Accordingly, a system that provides a guaranteed receipt with simultaneous settlement would need other sources of collateral or margin to cover this potential shortfall. Such a system could also establish additional risk controls (e.g. limits, committed lines of credit, other sources of liquidity and loss-sharing arrangements) that would give participants further assurance that the system has sufficient resources to honour its settlement guarantee in a variety of situations. The system would also require the appropriate operational controls and legal basis to carry out the settlement as intended.

Guaranteed refund with simultaneous settlement. A system that provides a guaranteed refund with simultaneous settlement could benefit from its ability to verify the irrevocable (although conditional) receipt of all settlement payments before it pays out any funds to its participants. In this way, if any participant failed to meet its settlement obligation in any or all currencies, the system would be in a position to return or cancel any of the corresponding conditional payments from the counterparties to the defaulter. Such a system would also require the appropriate operational controls and legal foundation.

Guaranteed receipt with sequential settlement. If, in contrast, settlement was carried out sequentially, a system would need to find other ways to guarantee its intended payment/receipt relationship. For instance, a system that provides a guaranteed receipt with sequential settlement could establish a set of risk controls that would give it sufficient resources to honour its settlement guarantee in a variety of situations. As in the case of simultaneous settlement, these risk controls might consist of an appropriate combination of limits, committed lines of credit, collateral and loss-sharing arrangements. However, a sequential settlement system would not be "self-collateralising" to the same degree as a simultaneous settlement system since it would be obligated to disburse with finality at least some currencies before it receives others. As a result, the system might need to design different risk controls or to mobilise other, perhaps more costly, sources of collateral to support its guarantee.

Guaranteed refund with sequential settlement. A system that wishes to provide a guaranteed refund with sequential settlement would probably need to rely on some combination of prefunding or delayed disbursement to support its intended payment/receipt relationship. For instance, such a system might require participants to prepay their settlement obligations in late-settling currencies conditionally one day ahead of time. This would permit the system to verify the receipt of all expected funds and, if necessary, to cancel or return on settlement day any payment destined for a counterparty that failed to pay what it owed. However, given the potential funding costs and liquidity requirements that this prefunding process could create, it may be less economical for a system to provide a guaranteed refund with a sequential settlement process than with a simultaneous one.

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completion of daily settlements in the event of an inability to settle by the participant with the largest single net debit position.

Payment versus payment. It is worth noting that the CPSS did not find it analytically helpful to use the label "PVP" to differentiate between the four identified settlement mechanisms: guaranteed receipt with simultaneous settlement; guaranteed refund with simultaneous settlement; guaranteed receipt with sequential settlement; and guaranteed refund with sequential settlement. In fact, any of the four systems could arguably be called a PVP mechanism that assures participants that a final transfer in one currency will occur if and only if a final transfer of another currency or currencies also takes place. For instance, in a guaranteed refund system (whether settlement takes place simultaneously or sequentially), each participant's transfer is conditioned upon a related transfer by one or more of its trading counterparties. In contrast, in a guaranteed receipt system (whether settlement takes place simultaneously or sequentially), the transfer to each participant is conditioned upon a related transfer by it to the "system". Whether a particular approach should be labelled "PVP", however, is an insignificant issue compared with its overall effectiveness in eliminating FX settlement exposure and the other risks that can arise when settling FX trades. In practice, this effectiveness will depend critically on the strength and nature of the guarantee supporting the intended payment/receipt relationship of the settlement mechanism.

4.2.2 Central bank policy perspective

While any of the various settlement mechanisms described above could potentially eliminate FX settlement exposures, each has particular strengths and weaknesses that should be considered. For instance, some arrangements might, if they are not well designed, increase certain risks while reducing others. Set out below are some of the major factors that should be considered at the design stage to ensure that a potential multi-currency settlement mechanism would achieve an appropriate balance.

Reduced FX settlement risk. Any sound multi-currency settlement mechanism - whether a guaranteed receipt or a guaranteed refund system, or a system that settled simultaneously or sequentially - could go directly to the heart of the problem and completely eliminate FX settlement exposures when settling individual trades.[16] By removing the potential for settlement losses and the associated liquidity pressures, such arrangements would remove a major source of systemic risk that can arise in the settlement of FX trades.

The risk-reducing benefits of any multi-currency settlement mechanism could be magnified when combined with bilateral or multilateral obligation netting of the underlying FX trades. Legally valid obligation netting (whether arranged bilaterally between pairs of individual banks or multilaterally with the aid of an industry utility) would reduce the number and size of settlement flows and, hence, could reduce the intraday liquidity needs for settling these trades through a multi-currency settlement mechanism. Depending on the circumstances, however, problems in either the netting arrangement or the settlement mechanism could potentially impair the other. Accordingly, any guarantee underlying a payment/receipt relationship and the safety of any accompanying netting scheme must both be sufficiently strong to ensure that the combined arrangement does not create greater problems than it solves.

Reduced sources of systemic risk. Strong guaranteed receipt systems could have benefits beyond the potential elimination of FX settlement risk. With sufficient resources behind their guarantees, such systems would encourage banks to honour their settlement obligations even in the face of sudden concerns about their counterparties. Accordingly, they could be stabilising factors for money markets, especially at times of market stress. While no system's guarantee will prove fail-safe in every conceivable situation, the Lamfalussy framework could be used to assess the adequacy of the risk controls that stand behind a system's assurance of settlement.

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[16] In some cases protection against principal risk might be based, in part, on loss-sharing agreements among a system's participants. Such agreements would represent another form of FX settlement exposure that would need to be recognised and managed appropriately.

Possible new sources of systemic risk. Despite its risk-reducing potential, a multi-currency settlement mechanism might also create a new source of systemic risk: a disruption in the settlement of one currency could disrupt the settlement of all other linked currencies. This concern could be acute in guaranteed refund systems. If, for instance, a system returned or cancelled conditional payments in the event of a default, the remaining system participants could face substantial, unexpected liquidity and replacement risks.[17] These problems could be exacerbated if system participants were depending on their expected FX settlement receipts to extinguish their payment obligations under transactions in the FX, securities or other markets to counterparties within and outside the arrangement. Depending on the system's particular structure, the number of participants and the magnitude and pattern of the FX trades being settled, a failure to settle certain trades in a single currency might lead to major liquidity pressures in an unpredictable number of financial markets.

The possibility of not receiving the currencies they purchased on time could lead participants in guaranteed refund systems to hold back their payments at times of market stress, thereby increasing the total number of failed settlements. Even though the system could eliminate its participants' concerns regarding their FX settlement exposures, they would still face liquidity risks if their trades failed to settle. In such circumstances, participants might rationally choose to avoid delivering through the settlement system valuable resources (i.e. funds that they would use to settle their FX obligations) that might ultimately be returned to them if, instead, they could use these funds outside the system to avoid potential liquidity shortfalls. An individual bank would be likely to base its decision on the direct costs it might face (e.g. late-payment penalties, currency swap rates, late-day funding rates) without full consideration of the potential systemic impact of not paying its FX settlement obligations on time.

Possible liquidity pressures. Possible liquidity pressures could increase if, under any multi-currency mechanism, FX settlements were to shift to a less liquid time for the market. For instance, some potential simultaneous settlement systems might require final payment in central bank balances at different times than today. Such a settlement would be susceptible to liquidity problems if it occurred at a time when the market for immediately deliverable central bank balances in any one of the currencies being settled was not sufficiently deep and liquid. This, in turn, could lead to an unacceptable reliance on central bank credit and liquidity facilities, at least until the local market adapted to the new settlement pattern.

In addition, moving from a sequential settlement to a simultaneous one could shift risk and increase certain participant costs. For instance, settling a currency earlier or later would require a bank either to cover its settlement obligations sooner or to fund its anticipated settlement receipts for longer. Unless banks had available idle balances during the relevant time periods, these transactions (whether explicit or implicit) would shift exposures from FX counterparties to other entities (possibly including, if permitted, central banks) and could impose additional funding costs on the participants. Although these funding costs would not be considered a direct cost of participating in the system, depending on the circumstances they might nonetheless represent a significant ongoing indirect cost to a bank when using a simultaneous settlement system.

Although interbank settlements generally involve transfers of balances at central banks, settlement could also involve transfers of balances at another financial intermediary such as an existing or specially created private bank. For instance, participants in such an arrangement could establish accounts denominated in different currencies at a private bank and settle their mutual obligations by debiting and crediting these accounts. If liquidity at settlement time were limited to the system participants' existing balances at a private bank, several problems could arise. For instance, in some possible versions of these systems, participants might be forced to act as reciprocal providers of liquidity to one another, potentially creating undesirable liquidity interdependencies, a concentration

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[17] The impact of such an event could, depending on its scale, be similar to the simultaneous forced unwind of a net settlement system in each of the currencies handled by the mechanism.

of liquidity risk and large and unforeseeable credit exposures. Other versions of these systems could be designed to address these problems.

Impact on monetary policy. The establishment of a multi-currency settlement mechanism would be likely to have a measurable impact on the flows of payments through the national large-value payments systems of the currencies concerned and might also raise potentially significant monetary policy concerns for some central banks. This impact might depend, at least in part, on whether settlement would involve transfers of balances in accounts at central banks or at another financial intermediary such as a private bank. In particular, in countries where the settlement of FX transactions represents a large share of domestic payments, effective use of some arrangements involving a private bank might require a large and lengthy daily transfer of central bank balances to the bank's account. This could seriously limit the remaining amount of privately held central bank balances that could be used to support other domestic payments. Depending on the timing, size, distribution and predictability of settlements, this could have a major impact on domestic money markets and on the volatility of demand for central bank balances and credit and liquidity facilities. Accordingly, the developers of a multi-currency settlement mechanism, and the central banks of issue, will need to ensure that the mechanism would not create problems for the availability of intraday liquidity in the payments systems concerned, or reduce their ability to handle, in a timely and efficient manner, the remaining non-FX-related payment traffic in the respective currencies.

International interdependencies. By making the settlement of each currency directly dependent on the settlement of every other currency, multi-currency settlement mechanisms might both increase the risk of undesirable global payments gridlock and constrain the ability of central banks of issue to respond in a relatively independent manner to all home-currency settlement problems. These concerns would be greatest in a system providing a guaranteed refund with simultaneous settlement since the failure of one currency to settle could immediately trigger a series of unexpected settlement failures in all other currencies. Today, the possible failure of any home-currency system to settle on time would most likely be linked to a liquidity problem in that currency of one or more of the system's participants, even though a participant's problems could originate elsewhere. If deemed desirable, in such circumstances the central bank of issue might be in a position to mitigate these problems directly. In contrast, the operation of a multi-currency settlement mechanism would institutionalise currently informal interdependencies. Under such circumstances, if a possible home-currency settlement failure was related to a liquidity problem in another country and currency, the resolution of the underlying liquidity problem and, hence, of the potential home-currency settlement failure might depend more directly on the liquidity of money markets in other currencies and on the actions of other central banks.

Included currencies. To combine the benefits of a multi-currency settlement system with the benefits of obligation netting, a multi-currency settlement system would need to create a direct relationship between transfers in all of the currencies included in the netting agreement. In this light, a settlement mechanism that, for example, only linked transfers in two currencies (i.e. the basic PVP arrangement as seen by the market) would be incompatible with the use of broad obligation netting arrangements covering trades in many currencies. For instance, under an obligation netting arrangement covering trades in all of the major currencies, a bank might, from time to time, be either a net receiver or a net payer in any particular pair of currencies. In such circumstances, creating a relationship between the transfers of only that pair of currencies would offer little or no protection against FX settlement risk. Accordingly, a bank might choose either not to use the dual-currency settlement system, or to exclude its trades in the two currencies from the broader netting arrangement and settle them individually over the dual-currency system.

Access to services. It is unlikely that all FX market participants will have direct access to every settlement system. In addition, not all traded currencies are likely to be included in every arrangement. As a result, it may be impossible to settle all trades with all counterparties through a single settlement mechanism. This might leave a significant level of FX settlement exposure outside the system. It might also create competitive distortions among the different included and excluded currencies and FX market participants. To address these concerns, complementary action by

individual banks to improve their practices for settling trades in all currencies with all counterparties may be needed.

Private sector versus public sector provision of services. The G-10 central banks share the view that multi-currency services would best be provided by the private sector rather than the public sector.[18] One factor behind this view is that no inherent barriers to the private sector provision of such services have been discovered. Indeed, as discussed in *Section 3*, some risk-reducing private sector services are already available and others are under development or study. These existing and prospective multi-currency services include settlement mechanisms with guaranteed receipts, guaranteed refunds, simultaneous settlement, sequential settlement and different combinations of these features. Some services offer netting of obligations at the transaction stage, netting of obligations at the settlement stage, the inclusion of forward transactions in the system, and the use of a special clearing house bank or other private financial intermediary to facilitate netting or settlement. Overall, market demand for these services should increase as individual banks see the need to control their FX settlement exposures.

Another factor is that market-place competition in providing multi-currency services would bring important benefits. For instance, a privately operated multi-currency settlement system could draw on successful private sector methods for controlling risk. Private sector groups in some countries currently operate a variety of systems for transferring funds and securities with the aid of risk controls such as bilateral credit limits, multilateral credit limits and explicit liquidity-sharing and loss-allocation rules. This private sector approach to clarifying risks and giving participants the tools and incentives to control them should be a valuable addition to the operations of a multi-currency settlement system. Beyond this, the test of the market-place could promote competition and ongoing innovation and would make use of continual market pressure to provide cost-effective arrangements. This could be particularly useful in shaping an efficient array of complementary and competing services; indeed, it is not yet clear whether a market-wide reduction in risk would best be achieved with a small or a large number of service providers. Market participants themselves can make appropriate choices once the costs of alternative services are properly identified and allocated, and if consistent regulatory requirements are met in full by every service provider.

While G-10 central banks believe that multi-currency services would best be provided by the private sector, they also recognise that the successful creation of multi-currency settlement mechanisms would require cooperation between market participants and central banks, since all these parties need to be concerned with the safety and soundness, as well as the economic viability, of any multi-currency settlement system.

4.3 Action by central banks to induce rapid private sector progress

The G-10 central banks believe that private sector institutions can adequately address the systemic risk inherent in current practices for settling FX transactions. Indeed, some major banks are already concerned about the sizable FX settlement risks they face and are actively pursuing ways to improve their own settlement practices and to collectively develop risk-reducing multi-currency services. Nevertheless, despite their considerable capacity to reduce FX settlement risk through individual and collective action, many of these efforts are at an early stage of development, and timely progress across the market cannot be guaranteed. Among the impediments at the individual bank level is a belief held by some banks that the probability of an actual settlement loss is too low to justify the cost of reducing exposures. At the industry level, doubts may persist as to the optimal form and economic viability of risk-reducing multi-currency services.

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[18] The Noël Report presents a detailed analysis of possible options for central bank payment and settlement services to support cross-border and multi-currency settlements.

Recognising the potential barriers to success, each central bank, in cooperation, where appropriate, with the relevant supervisory authorities, will choose the most effective steps to stimulate satisfactory private sector action over the next two years in its domestic market. In addition, where appropriate and feasible, central banks will make or seek to achieve certain key enhancements to national payments systems and will consider other steps to facilitate private sector risk reduction efforts. This reflects the likely need for public authorities to encourage action by individual banks and industry groups, and to cooperate with these groups, to bring about timely, market-wide progress.

4.3.1 Description of recommended action

Facilitate private sector action. Central banks will seek to facilitate progress by increasing private sector understanding of what banks can do individually and collectively to reduce FX settlement exposure. For instance, this report is being published in order to explain the nature of FX settlement exposure and to offer suggestions that individual banks and industry groups could adopt to address the associated risks. In particular, this report is designed to:

- Increase market awareness and understanding of FX settlement risk
- Offer a clear definition of and guidelines for measuring FX settlement exposures
- Describe how banks can control their FX settlement exposures by improving their individual settlement procedures and practices, as well as existing market-wide systems and arrangements (including practices and arrangements at correspondent banks)

Central banks also plan to work cooperatively with industry groups seeking to develop well-constructed multi-currency services (e.g. multi-currency settlement mechanisms and bilateral or multilateral multi-currency obligation netting arrangements) that would be widely available and would help banks control their FX settlement exposures on a routine basis. Where appropriate and feasible, central banks will cooperate with industry groups in one or more of the following ways:

- Attend industry working groups as observers
- Work with industry groups to extend the operating hours of domestic payments systems
- Work with industry groups to clarify and, where possible, to resolve legal issues and cross-border collateral issues
- Consider granting access to settlement accounts to sound multi-currency settlement mechanisms or to their members
- Consider granting access, on appropriate terms, to central bank credit and liquidity facilities to sound multi-currency settlement mechanisms or to their members

In several areas, such as the extension of payments system operating hours, these efforts are well under way. In addition, the Lamfalussy framework of minimum standards and principles for cooperative oversight has been, and continues to be, a useful starting-point for discussions between central banks and industry groups. In this connection, central banks will review the way in which the Lamfalussy framework might apply to multi-currency settlement mechanisms that are not clearly designed as netting schemes.

Finally, central banks plan to facilitate private sector action by making or seeking the following key enhancements to national payments systems:

- Clarification of the times at which payment instructions become irrevocable and receipts become final in the settlement of FX transactions via home-currency payments systems or book-entry transfers on the accounts of correspondent banks
- Provision, where not now available in at least one large-value payments system, of an intraday final transfer capability or its equivalent
- Removal of obstacles (e.g. early cut-off times for third-party transfers) that inhibit payments system direct members from acting upon late-day customer payment instructions for same-day value
- Strengthening, as necessary, of the risk management arrangements of privately operated systems used to settle FX transactions

These enhancements could make it easier for individual banks to overcome at least some of the obstacles they might face when trying to measure and control their FX settlement exposures. Furthermore, to the extent that multi-currency settlement mechanisms would need to transfer funds over domestic payments systems, these enhancements might also make it easier for them to provide safe and effective risk controls. Indeed, many of the suggested key enhancements to national payments systems are already under way within the G-10 and EU community in response to domestic or regional policy objectives. Two notable examples are the development of domestic real-time gross settlement payments systems (or their equivalent) and the application of the Lamfalussy minimum standards to domestic netting schemes.

Domestic strategies. In addition to these measures, each central bank, in cooperation, where appropriate, with the relevant supervisory authorities, will choose the most effective overall strategy to stimulate satisfactory private sector action over the next two years in its domestic market. To different degrees in different countries, central banks may act as monetary authority, credit and liquidity provider, supervisor, regulator, payment and settlement service provider, payments system overseer and/or overseer of the financial system. In the light of these divergent roles, as well as other local circumstances, individual central banks may select different strategies to stimulate domestic action. Nevertheless, such strategies will be likely to include one or more of the following elements:

- Publicising this report and its recommendation that banks take immediate steps to apply an appropriate credit control process to their FX settlement exposures
- Using moral suasion to encourage banks to adopt this recommendation
- Seeking to reinforce this recommendation with supervisory measures
- Promoting this recommendation among relevant non-bank financial institutions

Individual central banks might publicise this report in their domestic markets with the intention of focusing, in particular, the attention of the senior management of banks on FX settlement exposure. This effort could encourage banks to consider, at top management level, the report's analysis of the nature of the problem and its possible solutions.

Some individual central banks might also use moral suasion to persuade domestic banks to follow the report's recommendation that banks take immediate steps to apply an appropriate credit control process to their FX settlement exposures. Depending on local market circumstances, central banks might choose to use moral suasion either directly or through industry groups (i.e. through peer pressure, codes of conduct, etc.).

Central banks or other public authorities might, after proper consultation, also choose to use supervisory measures to persuade individual banks to control their FX settlement exposures. If appropriate and feasible, one or more of the following measures could be taken:

- Supervisory guidelines for measuring FX settlement exposures in a manner consistent with the proposed methodology
- Regular confidential reporting of properly measured FX settlement exposures
- Regular public disclosure of properly measured FX settlement exposures
- Supervisory guidelines regarding the prudential management and control of properly measured FX settlement exposures
- Verification of compliance with the selected measures through bank examination and audit reports

If necessary, one or more of the following stronger supervisory measures might also be considered:

- The enforcement, by statute where available, of the use by individual banks of mechanisms to control their properly measured FX settlement exposures. This could include the setting of formal limits on those exposures
- Consideration, by agreement with banking regulators (G-10 and EU), of FX settlement risk in the set of risks subject to capital adequacy requirements
- The enforcement or imposition (by agreement with the relevant supervisors) of comparable measures applying to non-bank regulated financial institutions active in the FX market

4.3.2 Central bank policy perspective

Private sector inducements. It is recognised that, at present, some trading banks might conclude that there is no business case for their taking further steps to control their FX settlement exposures. Accordingly, the private sector needs, and should be given, encouragement and support to improve settlement practices in individual institutions and on a market-wide basis.

Inducements for individual banks. At the level of individual banks, inducements to action would best be pursued through the home central bank or, depending on national circumstances, through the appropriate supervisory authorities; the most effective combination of publicity, moral suasion and supervisory measures will be chosen to induce domestic banks and, where relevant and appropriate, non-bank financial institutions to improve their settlement practices within the next two years.

Many individual central banks might use publicity or moral suasion as part of a comprehensive strategy to reduce FX settlement risk. Indeed, in some markets either of these efforts might be sufficient to stimulate significant action by individual banks to improve their settlement practices. In some countries, however, publicity alone might not be sufficient to prompt private sector action. And, while banks in some countries might respond quickly if publicity was accompanied by central bank moral suasion, this might not be true in all markets. At the same time, policy or statutes might prevent some central banks from using moral suasion to call for improved practices by individual banks.

In some countries, central banks might find supervisory measures to be an effective market-wide strategy for bringing about desired improvements at the individual bank level. And, either through their direct supervisory role or through their relationship with other domestic authorities, some central banks might be able to initiate certain supervisory measures rather quickly. However, while supervisory measures might be useful in some markets, in others they might not be appropriate or feasible. Reaching international agreement on the amendment of existing regulations or the creation of new ones could be particularly time-consuming.

Some central banks might promote risk-reducing measures among relevant non-bank financial institutions so as to contain the systemic risk in FX settlement practices found outside the domestic banking sector. Some central banks might be able to influence these institutions directly with publicity and moral suasion, if not supervisory measures; other central banks would need to work through other public authorities.

Inducements for industry groups. At the industry group level, central banks plan to cooperate, where appropriate and feasible, with those existing and prospective private sector groups that would like to provide risk-reducing multi-currency services. Central banks are ready to work with the developers of such services to ensure that they satisfactorily address risk management and other key issues and meet, or, as necessary, surpass, applicable minimum standards or criteria. In this connection, the central banks concerned can oversee such service developments using an approach consistent with the Lamfalussy framework. When cooperating with industry groups, however, central banks must retain their ability to make their own judgements about the safety and soundness of specific services and practices.

When working with industry groups to bring about the identified key enhancements to national payments systems, central banks would need to guard against possible side-effects. For instance, removing obstacles to late-day domestic payments could be an important step in enhancing the efficiency of the FX settlement process, but in some markets this could have an adverse impact on the liquidity of individual banks, of correspondent banks, or of the money market as a whole if all payers sought to execute their payments as late in the day as possible. In such countries, central banks might need to accompany this change with an indication that "best practice" in their domestic markets should ensure the smooth flow of payments throughout the business day.

Monitoring progress. The G-10 central banks believe that the private sector can adequately address the systemic risk inherent in current practices for settling FX transactions. Some major banks, recognising the large size of their FX settlement exposures, are already taking steps to improve their procedures for settling FX trades, and industry groups are working to develop risk-reducing multi-currency services. However, there is no guarantee that the identified inducements will prove sufficient to stimulate rapid private sector action in every domestic market. Accordingly, the G-10 central banks, through the CPSS, will closely monitor progress over the next two years and assess the need for further action.

5. NEXT STEPS

Individual banks. Individual banks should take immediate steps to apply an appropriate credit control process to their FX settlement exposures. In many cases, this will require banks to improve their back office payments processing, correspondent banking arrangements, obligation netting capabilities and risk management controls so that they can properly measure and control their exposures and, where deemed necessary, reduce excessive exposures.

Industry groups. Reflecting the view that multi-currency services would best be provided by the private sector, the G-10 central banks encourage existing and prospective industry groups to develop and offer services that would contribute to the risk-reducing efforts of individual banks.

Central banks. Each G-10 central bank, in cooperation, where appropriate, with the relevant supervisory authorities, will choose the most effective steps to stimulate satisfactory private sector action over the next two years in its domestic market. This decision process should proceed at the national level over the next several months. Individual central banks will also make or seek to achieve certain key enhancements to national payments systems.

Collectively, the G-10 central banks will, through the CPSS, initiate several additional steps to support this strategy. For instance, the CPSS will cooperate with industry groups that seek to offer risk-reducing multi-currency services. In addition, the CPSS will begin to identify and to consider pursuing the resolution of legal or other relevant issues that may arise in the implementation of the strategy.

The CPSS will also closely monitor market-wide private sector progress towards reducing and managing risk over the next two years in order to determine the need for any additional central bank action. The CPSS plans to develop and follow several qualitative benchmarks, such as the number of market participants that properly measure their FX settlement exposures, that apply an appropriate credit control process to FX settlement exposures, that implement bilateral or multilateral obligation netting arrangements with their largest counterparties, and that use or participate in the development of sound private sector multi-currency settlement systems. The CPSS will also investigate the possibility of collecting market-wide statistics on actual FX settlement exposures to quantify the impact of these qualitative developments.

APPENDIX 1

Defining and measuring foreign exchange settlement exposure

Definition of foreign exchange settlement exposure

1. On the basis of discussions with market participants, the CPSS has 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 currency purchased is received with finality.*

2. It is important to note that this definition is designed to address the *size* and *duration* of the credit exposure that can arise during the settlement process. It says nothing about the *probability* of the occurrence of an actual loss. The definition also does not specifically address the *ability* of a bank to measure and to control its FX settlement exposure at a particular moment. To develop a practical methodology for measuring current and future FX settlement exposures in a manner consistent with the above definition, a bank would need to recognise the changing status - and, hence, the changing potential settlement exposure - of each of its trades during the settlement process.

FX settlement process

3. Although settling a trade involves numerous steps, from a settlement risk perspective a trade's status - from the time it is executed until the time it is settled - can be classified according to five broad categories:

Status R: *Revocable.* The bank's payment instruction for the sold currency either has not been issued or may be unilaterally cancelled without the consent of the bank's counterparty or any other intermediary. The bank faces no current settlement exposure for this trade.

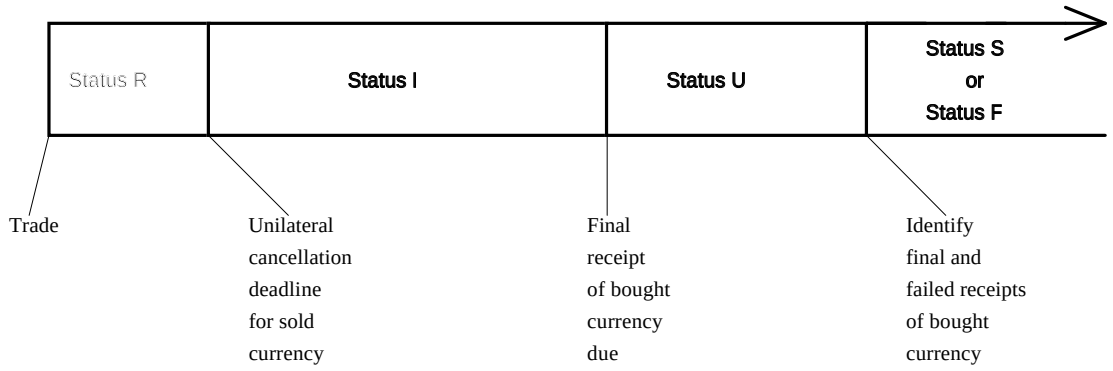
Status I: *Irrevocable.* The bank's payment instruction for the sold currency can no longer be cancelled unilaterally either because it has been finally processed by the relevant payments system or because some other factor (e.g. internal procedures, correspondent banking arrangements, local payments system rules, laws) makes cancellation dependent upon the consent of the counterparty or another intermediary; the final receipt of the bought currency is not yet due. In this case, the bought amount is clearly at risk.

Status U: *Uncertain.* The bank's payment instruction for the sold currency 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. In normal circumstances, the bank expects to have received the funds on time. However, since it is possible that the bought currency was not received when due (e.g. owing to an error or to a technical or financial failure of the counterparty or some other intermediary), the bought amount might, in fact, still be at risk.

Status F: *Fail.* The bank has established that it did not receive the bought currency from its counterparty. In this case the bought amount is overdue and remains clearly at risk.

Status S: *Settled.* The bank knows that it has received the bought currency with finality. From a settlement risk perspective the trade is considered settled and the bought amount is no longer at risk.

Foreign exchange settlement process:
changing status of a trade



4. The above diagram illustrates this simplified description of the FX settlement process. To classify its trades according to the categories indicated, a bank would need to know the following three critical times for each currency it trades:

(i) its unilateral payment cancellation deadline;

(ii) when it is due to receive with finality the currency it bought; and

(iii) when it identifies final and failed receipts.

5. As described below, these times depend on the characteristics of the relevant payments systems as well as on the individual bank's internal settlement practices and correspondent banking arrangements. As part of its market survey, the CPSS collected these times for approximately 80 bank offices in the G-10 countries.

Measuring FX settlement exposures

6. Once a bank appropriately classifies the status of each of its trades, it is a straightforward calculation to measure its FX settlement exposure even in the absence of real-time information. In fact, banks that always identify their final and failed receipts of bought currencies as soon as they are due can determine their exposures exactly. For these banks, current exposure equals the sum of their *Status I* and *F* trades.

7. In contrast, banks that do not immediately identify their final and failed receipts cannot pinpoint the exact size of their FX settlement exposures. The uncertainty they face reflects their inability to know which of their *Status U* trades have or have not actually settled (i.e. they do not know the amount of bought currencies that should - but might not - have been received on time).

8. Faced with this uncertainty, a bank should be aware of both its minimum and maximum FX settlement exposure. For instance, a bank that only measures and controls its minimum exposure could, in adverse circumstances, experience a much larger unexpected and undesirable actual exposure. On the other hand, a bank that only monitors its maximum exposure might, if it believes

that its actual exposure usually falls well short of this amount, set up excessively accommodative internal controls that would not prevent an unexpected and undesirable jump in its actual exposure.

9. Recognising the uncertainty that might surround its actual FX settlement exposure, a bank can use the following general guidelines to measure its minimum and maximum exposure on the basis of the current status of its unsettled trades:

Minimum exposure: **Sum of *Status I* and *F* trades.** This is the value of the trades for which a bank can no longer unilaterally "stop payment" of the sold currency but has not yet received the bought currency.

Maximum exposure: **Sum of *Status I, F* and *U* trades.** This equals a bank's minimum exposure plus the amount of bought currencies that should - but might not - have been received.

10. A bank can also project its FX settlement exposure using its knowledge that each of its trades will go through a predictable change in status, based on its current settlement practices. For example, if a bank sells yen and buys dollars, the trade will have *Status R* from the time it is executed until the time the bank's yen payment can no longer be cancelled unilaterally. The trade will then have *Status I* until the time that the final dollar receipt is due. Once the final receipt of dollars is due, the trade will have *Status U* until the bank knows whether or not the purchased dollars were, in fact, received. Then, depending on the answer, the trade will be classified either as *Status S* (if the final receipt of dollars is verified) or as *Status F* (if the bank learns that it failed to receive the dollars from its counterparty). A bank can use this predictable change in status - as well as the possibility that it will not receive some or all of the currencies it bought on time - to project the future minimum and maximum exposures associated with the trades it has executed.

11. The *potential minimum exposure* that a bank will face at a point in the future will equal the value of the trades with *Status F* at the time of the projection[1] plus the trades that will have *Status I* at that future point. This is the amount for which the bank will be at risk if all of its currently due but uncertain receipts (*Status U* trades) have, in fact, been received and no additional fails occur in the future.

12. The *potential maximum exposure* that a bank will face at a point in the future will equal its projected minimum exposure, plus the fails it may identify over the projection period, plus the amount of irrevocably bought currencies that should - but might not - have been received by that time (i.e. the trades that are projected to have *Status U*). This is the total amount for which the bank might possibly be at risk at that point in the future.

13. On the basis of the bank's current settlement practices, it is a straightforward calculation to measure both its potential minimum exposure and its *Status U* trades at each point in the future. Its future identified fails, however, can take on a range of values from 0 to 100% of the expected receipts that will be reviewed during the projection interval. This adds an element of uncertainty even for a bank that always identifies its final and failed receipts of bought currencies as soon as they are due.

14. If, at one extreme, it turns out that a bank has no outstanding identified fails at some point in the future, its potential maximum exposure at that time (i.e. its *Maximum exposure if identified fails = 0%*) will simply equal its projected minimum exposure plus its projected *Status U* trades. At the other extreme, a bank might learn that none of the expected receipts it reviewed over the projection interval came in on time. In this case, its potential maximum exposure at the end of that interval (i.e. its *Maximum exposure if identified fails = 100%*) will equal the value of these fails plus the sum of its projected minimum exposure and its projected *Status U* trades.

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[1] This projection methodology treats identified fails as outstanding exposures to a counterparty until they are settled. This permits a bank to measure and control these exposures as part of its settlement risk management process. Alternatively, a bank could exclude *Status F* trades from its projections if it developed another way to measure and control the associated exposures.

Current duration of FX settlement exposures

15. For most of the banks surveyed and in every G-10 country, the minimum FX settlement exposure of an individual spot or forward trade (the duration of *Status I*) currently lasts for between one and two business days. In addition, it can take a further one to two business days for many banks to establish whether they indeed received the currency they bought on time (the duration of *Status U*). As a result, more than three business days - plus any intervening weekends and holidays - can elapse between the beginning of some banks' settlement exposures and the time at which they know with certainty that they are no longer at risk.

16. Furthermore, banks can incur FX settlement risk no matter which currency they buy or sell. For instance, even when - from one bank's point of view - the bought currency settles before the sold currency, a bank might face an earlier deadline for unilaterally cancelling its payment of the sold currency. In such circumstances, it could be forced to pay out the currency it sold even when it knows that it will fail to receive the currency it bought.

Payment of sold currency

17. While payments can, theoretically, be made on value day up until the close of the local payments system (and sometimes even later through special arrangements), banks usually initiate the payment process well before that time. For a spot deal, the process typically begins on trade day, and in some cases immediately upon execution of the trade, when the back office starts verifying the details of the payment obligation with the back office of its counterparty, which is called the "confirmation procedure": which currency was sold, what amount, and when and where the counterparty should be paid. After the back office has established these details, the bank will issue a payment instruction to its correspondent bank.[2] Most banks send payment instructions to their correspondent banks one to two days before value day. Banks cite improved efficiency, lower processing costs and the desire to avoid penalties for technical fails or other operational risks among the reasons for sending early payment instructions.

18. The ability to cancel payment instructions can depend on many factors. In many countries payments can be amended, cancelled or returned late on settlement day as long as the payer or its correspondent bank obtains the consent of the beneficiary, its correspondent bank or some other intermediary in the payment process. While such consent might easily be obtained in routine circumstances (e.g. to correct payment errors), it might not be granted at times of financial stress. Thus, from a settlement risk perspective, a bank would need to be aware of its explicit or implicit deadline for unilaterally cancelling its payment instructions. After such a deadline, the various intermediaries involved in executing a payment instruction might be able to cancel it on a "best efforts" basis; however, there is no guarantee that such efforts would be made or, if they were made, that they would be successful.

19. Some banks report that they can unilaterally cancel payment instructions for certain currencies on value day, and in some cases late on value day. Banks that report very late cancellation deadlines in a particular currency appear to act as their own paying agent in that currency or to use affiliated or unaffiliated correspondents that typically send payment instructions to the local payments system late in the processing day.

20. The majority of banks, however, report explicit or implicit cancellation deadlines of one to two days before value day (many correspondent banks indicate their willingness to try to cancel payment instructions after such deadlines, but they do not guarantee results). These restrictive

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[2] A bank may use the services of one or more affiliated or unaffiliated correspondent banks to make and receive payments or it may act as its own "correspondent" bank. Furthermore, banks tend to use different correspondents when making or receiving payments in different currencies, reflecting the advantages of using correspondents that can provide local currency liquidity or that have direct access to the local payments system.

deadlines reflect various combinations of the banks' and their correspondents' rules, practices and technological capabilities for processing payments.

21. For instance, in some cases these earlier deadlines reflect the fact that correspondent banks can send payment instructions to the local payments system one or more days before value day (e.g. in Japan, up to three days; in France, the Netherlands and Switzerland, one day). And, depending on local rules, laws and circumstances, these payment instructions may be processed or become irrevocable at that time.

22. Automatic straight-through processing conducted by a correspondent bank one to two days before value day may also make it very difficult, if not impossible, to cancel unexecuted payment instructions. In some cases correspondent banks can intervene manually to override their automated procedures and prevent processed but pending payment instructions from being sent to the local payments system. If, however, they are not able (or are not required) to do so, payment instructions become de facto irrevocable once they have been received by the correspondent - even if the correspondent does not actually send them to the local payments system until some later time.

23. If payment instructions become de facto irrevocable once they have been received by a bank's correspondent, then from the bank's perspective the unilateral cancellation deadline is the time when it commits itself to sending its payment instruction to its correspondent. Some banks have internal procedures that would permit them to hold back unissued payment instructions up until the time they are actually sent. The internal procedures of other banks, however, may be so automated (or cumbersome) that after some earlier point in the process it becomes virtually impossible for them to prevent a particular payment instruction from being issued. For such a bank, its unilateral payment cancellation deadline may be a time well before it actually issues its payment instruction.

24. The deadline for unilaterally cancelling payment instructions will also depend on how the payment is made (e.g. through a real-time gross settlement system, through a net settlement system or by a book-entry transfer[3] on the accounts of a correspondent bank). The deadline can also be affected by the laws, rules and practices governing the relevant method of payment (operating hours, deadlines for sending and receiving messages, queuing arrangements, posting times, finality, etc.). In some currencies, correspondents may have one or more options for executing payment instructions, as well as the discretion to choose among those options. This may add a further element of uncertainty since each option may embody different cancellation rules.

Receipt of bought currency

25. On the receipt side, settlement exposure does not end until the bank receives final (i.e. irrevocable and unconditional) funds. In many cases, however, the timing of finality can vary. For example, the timing of finality can differ depending on whether a payment is received through a real-time gross settlement system, through a net settlement system or by book-entry transfer. Just as this choice affects the time at which a payment instruction becomes irrevocable, it also affects the time at which a receipt becomes final. Since beneficiaries typically do not choose the method of receiving payment, they face some uncertainty as to the timing of the receipt of final funds.

26. Even where the method of payment is known, a combination of local laws, rules and market practice may affect the timing of finality during value day. For instance, correspondent banks typically have at least some discretion as to when they must credit their beneficiaries with received funds. In addition, correspondents often have discretion as to when they must notify their beneficiaries about such credits. At the same time, in many G-10 countries the act of crediting or notifying the beneficiary of received funds plays an important role in determining the legal finality of those funds.

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[3] A payment can be settled by book-entry transfer when both the originator and the beneficiary (or their correspondent banks) have an account with the same correspondent bank for the currency in question. The correspondent may have a choice as to the exact time, on the value date, at which it performs that transfer.

Thus, depending on the circumstances, funds may be received with finality at any time from the early morning hours until the close of business on value day (or, in some cases, the next day).

27. It is worth noting that funds may not become final from the point of view of the beneficiary until several hours - or even days - after the underlying payment instruction can no longer be cancelled unilaterally by the payer. This is most evident in those circumstances in which payment instructions become de facto irrevocable even before they are sent to the local payments system, let alone to the correspondent bank. This situation may also arise when payments are made over net settlement systems. For instance, in most G-10 net settlement systems payers cannot revoke their payment instructions once they have been accepted, yet such payments cannot be considered final by the beneficiary until settlement: until that time the system operator may cancel them in certain circumstances (e.g. in the event of a settlement problem).

28. In addition to understanding when a final payment *may* be received, in managing settlement risk it is necessary to monitor whether, in fact, a final payment *has been* received. A bank's process for identifying final and failed receipts may involve one or more of the following steps: the bank's account being credited by its correspondent; the correspondent notifying the bank that its account has been credited; and the bank receiving and processing this information and comparing it against its expected receipts (i.e. the bank's reconciliation process). And, as stated above, the correspondent's act of crediting or notifying its customer may itself play a role in determining the finality of the funds. In addition to its routine reconciliation process, a bank may also be alerted to a failure (or at least a potential failure) to receive expected funds from its counterparty through other means, such as cash management reports of unusually low or overdrawn balances at its correspondent bank, or even through public news sources.

29. Some banks can always identify the final and failed receipt of bought currencies as soon as they are due. Most banks, however, do not identify their daily receipts and fails until one or two days after value day. In some cases a late receipt identification process reflects the fact that correspondents do not send timely information; in the majority of cases, however, banks simply delay processing the information they receive for perceived cost and efficiency reasons. In a few situations, banks consider their trades to be settled *before* their receipts are final (e.g. in the case of Canadian dollar receipts); in such circumstances banks will underestimate their settlement exposure if they ignore the possibility that such receipts could be revoked or unwound, leaving them at risk to their counterparties.

Current size of FX settlement exposures

30. The size of a bank's total FX settlement exposure depends directly on the duration of the settlement exposure of each of its trades. For instance, if a bank's minimum settlement exposure for a single FX trade lasts 48 hours, at least two days' worth of trades would always be at risk. In addition, if it takes, say, another 24 hours to verify the final receipt of each purchased currency, a further day's worth of trades *might* still be at risk. Under these circumstances, a bank's maximum FX settlement exposure would always equal at least three days' worth of trades. Furthermore, this exposure level could exist at any point in time, including overnight and during weekends and holidays.

31. To illustrate the potential impact of the payments system infrastructure and market practices on the size of a bank's FX settlement exposure, it is useful to consider the following hypothetical spot trades between a bank and a single counterparty involving Japanese yen (JPY), Deutsche Mark (DEM) and US dollars (USD):

Hypothetical portfolio

Currency sold	Currency bought	Amount bought (in USD millions)
USD	JPY	15
DEM	JPY	10
USD	DEM	20
JPY	DEM	15
DEM	USD	20
JPY	USD	20
		100

32. Let it be assumed that these same trades were conducted every day for four consecutive business days - Tuesday, Wednesday, Thursday and Friday - and that exchange rates were stable over the period. Since these are spot transactions, Tuesday's trades will settle on the following Thursday; Wednesday's trades will settle on Friday; Thursday's trades will settle on Monday; and Friday's trades will settle on Tuesday.

33. What would be the status of each of these trades on Friday at 11 a.m. New York time, on the assumption that Friday's trading has been completed by that time? Table 1a answers this question from the perspective of a hypothetical "worst-case" North American bank as defined by the market survey.[4]

34. ***Tuesday's trades.*** All of Tuesday's trades - the trades that should have settled on Thursday - have *Status U*. This reflects the finding that a "worst-case" North American bank does not identify its final and failed receipts until the afternoon on the day following settlement. Thus Thursday's receipts of Tuesday's purchases will not be verified until Friday afternoon.

35. ***Wednesday's trades*.** Payment instructions for the currencies sold on Wednesday for value Friday became irrevocable either on Wednesday (for JPY and DEM) or on Thursday (for USD). Those trades that involved the purchase of JPY or DEM have *Status U* since those currencies should already have been received by 11 a.m. New York time; those trades that involved the purchase of USD have *Status I* since the USD receipts are not due until later in the day.

36. ***Thursday's trades*.** Payment instructions for Thursday's sales of JPY and DEM for settlement on Monday became irrevocable late on Thursday, and so are classified as *Status I*. Payment instructions for Thursday's sales of USD, however, can be cancelled unilaterally until late on Friday and so are still classified as *Status R*.

37. ***Friday's trades*.** The bank has not yet issued any irrevocable payment instructions for Friday's currency sales, and so all of these trades have *Status R*.

38. ***Fails.*** For the sake of simplicity, the bank is assumed to have no outstanding identified fails with this counterparty as of 11 a.m. on Friday (i.e. no trades have *Status F* at that time).

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[4] For the purposes of this analysis, a "worst-case" North American bank is defined as a bank that faces the earliest unilateral payment cancellation deadlines and the latest receipt identification times reported by a North American bank in the Steering Group's survey. According to the survey of current market practices, the earliest unilateral cancellation deadline for DEM payment instructions is 4 p.m. two days before value day (New York time). The earliest unilateral cancellation deadline for JPY payment instructions is 5 p.m. two days before value day, and the earliest unilateral cancellation deadline for USD payment instructions is 5 p.m. on the day before value day. At the other end of the settlement process, the latest time at which a North American bank identifies its final and failed USD receipts is 3 p.m. on the day after they are due; the latest time for identifying final and failed JPY and DEM receipts is 5 p.m. on the day after they are due.

39. On the basis of the status of these transactions, Table 1a calculates the FX settlement exposure of the hypothetical US$ 100 million in daily trades from the perspective of a "worst-case" North American bank as of Friday, 11 a.m. (Tables 1b and 1c provide similar calculations from the perspective of a "worst-case" Asian and European bank at the same moment in time.) The bank's **minimum exposure** at that time would equal US$ 105 million, consisting of irrevocable purchases of USD due later on Friday (value US$ 40 million) plus irrevocable instructions to pay JPY and DEM on Monday (value US$ 65 million).

40. The bank's **maximum exposure** would equal US$ 265 million, or more than two and a half times its daily trading. Its maximum exposure would consist of its minimum exposure (value US$ 105 million) plus the amount of funds that should - but might not - have been received on Thursday (all purchases, value US$ 100 million) and Friday (JPY and DEM purchases, value US$ 60 million).[5]

41. Figure 1a projects - as of Friday, 11 a.m. New York time - a "worst-case" North American bank's potential minimum exposure in settling the hypothetical US$ 100 million daily portfolio. At a minimum, its current US$ 105 million exposure will peak at least temporarily at US$ 205 million, or more than double its daily trading. This peak will be reached during Friday afternoon as the bank's USD payment instructions for Monday (value US$ 35 million) and its JPY and DEM payment instructions for Tuesday (value US$ 65 million) become irrevocable. Its minimum exposure will then fall to US$ 165 million as it receives the USD due later on Friday.

42. Minimum exposure will remain at US$ 165 million throughout most of the weekend. Early on Monday morning the minimum exposure is expected to fall as the bank receives the currencies it has irrevocably purchased for delivery on Monday and Tuesday. The only other high in its minimum exposure is projected to occur on Monday afternoon, the time at which its USD payment instructions for Tuesday become irrevocable.

43. Figure 1a also shows the two extreme scenarios for the bank's projected maximum exposure. The first scenario, labelled *Maximum exposure if identified fails = 0%*, equals the bank's projected minimum exposure plus its projected *Status U* trades. This is the bank's forecast of the maximum amount for which it will consider itself at risk at each point in the future on the assumption that it will not identify any new failed receipts over the projection interval. As indicated in the chart, this amount will rise with the issuance of irrevocable payment instructions and fall with the projected successful verification of final receipts.

44. For instance, from Friday evening until late on Monday morning the bank's *Maximum exposure if identified fails = 0%* is projected to equal US$ 265 million: during this time the bank will not know whether it received the amounts due on Friday (value US$ 100 million); it will be awaiting either the receipt or verification of the receipt of irrevocably purchased funds due on Monday (value US$ 100 million); and it will have issued JPY and DEM payment instructions for Tuesday (value US$ 65 million) which can no longer be cancelled unilaterally. Furthermore, since the bank in this example does not identify its final and failed receipts until late on the day following settlement, the earliest time at which it will be in a position to assure itself that it no longer has any potential FX settlement exposure from these hypothetical trades will be late on Wednesday (i.e. after it verifies Tuesday's receipts).

45. Figure 1a also shows the second extreme scenario for the bank's projected maximum exposure in settling the hypothetical portfolio. This projected path, labelled *Maximum exposure if identified fails = 100%*, could potentially rise to US$ 400 million. This level would be reached if

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[5] Table 1a shows that a "worst-case" bank also has *Status R* trades totalling US$ 135 million as of Friday, 11 a.m. These trades consist of Thursday's sales of USD for settlement on Monday (value US$ 35 million) and all of Friday's trades for settlement on Tuesday (value US$ 100 million). *Status R* trades are excluded from the suggested measures of a bank's current settlement exposure because payment instructions for the sold currencies can still be cancelled unilaterally, if necessary. However, it is important for a bank to measure and monitor its *Status R* trades because they will become at risk (*Status I*) once the implicit or explicit unilateral cancellation deadline is passed.

(i) the bank learns that it did not, in fact, receive payment on any trade with *Status U* as of Friday, 11 a.m. (value US$ 160 million); (ii) the bank does not receive payment on any trade with *Status I* at that time (value US$ 105 million); and (iii) despite these fails the bank follows its routine scheduling procedures and issues irrevocable payment instructions for trades that currently have *Status R* (value US$ 135 million). In essence, this scenario shows how quickly all of the currently US$ 400 million in unsettled trades - including those that still have *Status R* - could potentially build up into actual exposures. Figures 1b and 1c show similar projections for a "worst-case" Asian and European bank.

Potential impact of improving practices

46. The survey indicated that a bank's FX settlement practices can greatly influence the size of its exposures. One way a bank can lower its exposure is by changing the timing of its unilateral payment cancellation deadlines and of its identification of final and failed receipts. Another way is by legally binding netting of the settlement obligations arising out of its FX trades rather than settling each trade individually.

Payment cancellation and receipt identification

47. A bank could eliminate overly restrictive unilateral payment cancellation deadlines (to shorten the duration of *Status I*) and reduce the time it takes to identify its final and failed receipts of bought currencies (to shorten the duration of *Status U*). As indicated above, these improvements could require a combination of changes to its own settlement practices and, if relevant, to its correspondent banking arrangements. In October 1994 the New York Foreign Exchange Committee (NYFEC), which is a private sector group sponsored by the Federal Reserve Bank of New York, published a report on *Reducing Foreign Exchange Settlement Risk.* In its report, the NYFEC defined "best-case" FX settlement practices as those that would give a bank the following capabilities:

- To cancel its payment instructions unilaterally up until the opening time on settlement day of the local large-value transfer system (LVTS)
- To identify its final and failed receipts immediately upon finality of the local LVTS

48. While there may be different views as to what constitutes "best practice" in different markets,[6] the NYFEC's definition provides a useful reference point for measuring the effect of changing current settlement practices. In addition, the NYFEC's "best-case" practices are already being followed by at least some market participants, providing concrete evidence that similar practices could be adopted immediately by all participants in the FX market.

49. Table 2a and Figure 2a help to illustrate the potential impact of improving settlement practices. They take as a starting-point the hypothetical portfolio underlying Table 1a and Figure 1a, but instead show the trade status and projected FX settlement exposures from the perspective of a "best-case" bank as defined by the NYFEC. According to the NYFEC's definition, such a bank can cancel its payment instructions up until the opening time of the local LVTS. As a result, as Table 2a shows, it would have only US$ 40 million worth of *Status I* trades as of 11 a.m. on Friday, compared with US$ 105 million for the "worst-case" bank (in contrast to the "worst-case" bank, a bank following the NYFEC's "best-case" practices could still unilaterally cancel the US$ 65 million of JPY and DEM it is scheduled to pay on Monday). Looked at from another point of view, a "worst-case"

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6 For instance, a bank would achieve maximum protection if, as a matter of course, it or its correspondent bank executed all of its payment instructions shortly before the end of the local business day, thereby minimising the duration of *Status I*. In some markets this could be considered "best practice". In other markets, however, it could lead to an undesirable level of payment gridlock if it were adopted by all banks on a routine basis. In such cases, "best practice" might require a bank to spread its payments over the whole of the local business day.

bank's minimum exposure would exceed two and a half times the exposure of a bank following the NYFEC's "best-case" practices in settling the same hypothetical set of FX trades.

50. Since, according to the NYFEC's definition, a "best-case" bank identifies its final and failed receipts as soon as they are due, in normal circumstances it would not expect to have any *Status U* trades - once final receipt is due, such a bank could immediately classify its trade as either *Status S* or *Status F* with certainty. Thus, at 11 a.m. on Friday, an NYFEC "best-case" bank will know whether all of the receipts due on Thursday (value US$ 100 million) and all the JPY and DEM receipts due on Friday (value US$ 60 million) were, in fact, received. Table 2a indicates that if all such receipts were verified as paid with finality (i.e. the trades have *Status S*), the maximum exposure of an NYFEC "best-case" bank would equal only US$ 40 million - the same as its minimum exposure.[7] Furthermore, if it verified the final receipt of the US$ 40 million in USD due on Friday, an NYFEC "best-case" bank could be certain that it had *no* settlement exposure to its counterparty over most of the weekend, whereas a "worst-case" bank would calculate its maximum exposure at US$ 265 million throughout the weekend. Tables 2b and 2c and Figures 2b and 2c show similar calculations and projections and, hence, potential exposure-reducing benefits from the perspective of Asian and European banks.

Netting

51. Banks could also legally net the settlement obligations arising out of their FX trades rather than settling them on a trade-by-trade basis. Legally binding obligation netting could directly reduce the amount at risk by lowering the number and size of payments that would otherwise be needed to settle the underlying transactions.

52. Table 3 and Figure 3 show a "worst-case" North American bank's settlement profile if it were to settle the hypothetical set of trades on a bilaterally netted basis. A comparison of Tables 1a and 3 shows that, as calculated on Friday at 11 a.m., the bank's minimum exposure would drop from US$ 105 million on a gross settlement basis to US$ 15 million on a net settlement basis. Similarly, its maximum exposure would fall from US$ 265 million to US$ 30 million. A comparison of Figures 1a and 3 shows that netting would also bring similar reductions in the "worst-case" bank's projected settlement exposures, especially over the weekend.

53. Table 4 and Figure 4 show the net settlement profile of a bank following the NYFEC's "best-case" settlement practices. A comparison with Table 2a and Figure 2a indicates that even an NYFEC "best-case" bank could lower its exposure significantly by switching the settlement of its FX trades from a gross basis to a net basis. For instance, its maximum exposure, as calculated on Friday at 11 a.m., would equal only US$ 5 million (compared with US$ 40 million on a gross basis) and would not exceed this level until Sunday evening.

54. Of course, any actual reduction in FX settlement exposures would depend on a bank's trading pattern. Active market-makers trading with each other out of a limited number of locations would be likely to have many offsetting trades that could be netted. On the other hand, relatively inactive traders or those that trade out of many different locations around the world might have less opportunity to net their FX trades.

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[7] If, however, none of these due currencies were received, they would all be classified as *Status F* (value US$ 160 million) and, when combined with trades having *Status I* (value US$ 40 million), would raise the "best-case" bank's exposure to US$ 200 million.

Table 1a

"Worst-case" North American bank
FX settlement exposure as of Friday, 11 a.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15	U	15	U	15	R	15	R	
DEM	JPY	10	U	10	U	10	I	10	R	
USD	DEM	20	U	20	U	20	R	20	R	
JPY	DEM	15	U	15	U	15	I	15	R	
DEM	USD	20	U	20	I	20	I	20	R	
JPY	USD	20	U	20	I	20	I	20	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		65		0		= **105**
Status U		100		60		0		0		= **160**
Status R		0		0		35		100		= **135**
							MINIMUM EXPOSURE			= **105**
							MAXIMUM EXPOSURE			= **265**

Figure 1a

Projections as of Friday, 11 a.m. local time, in millions of US dollars

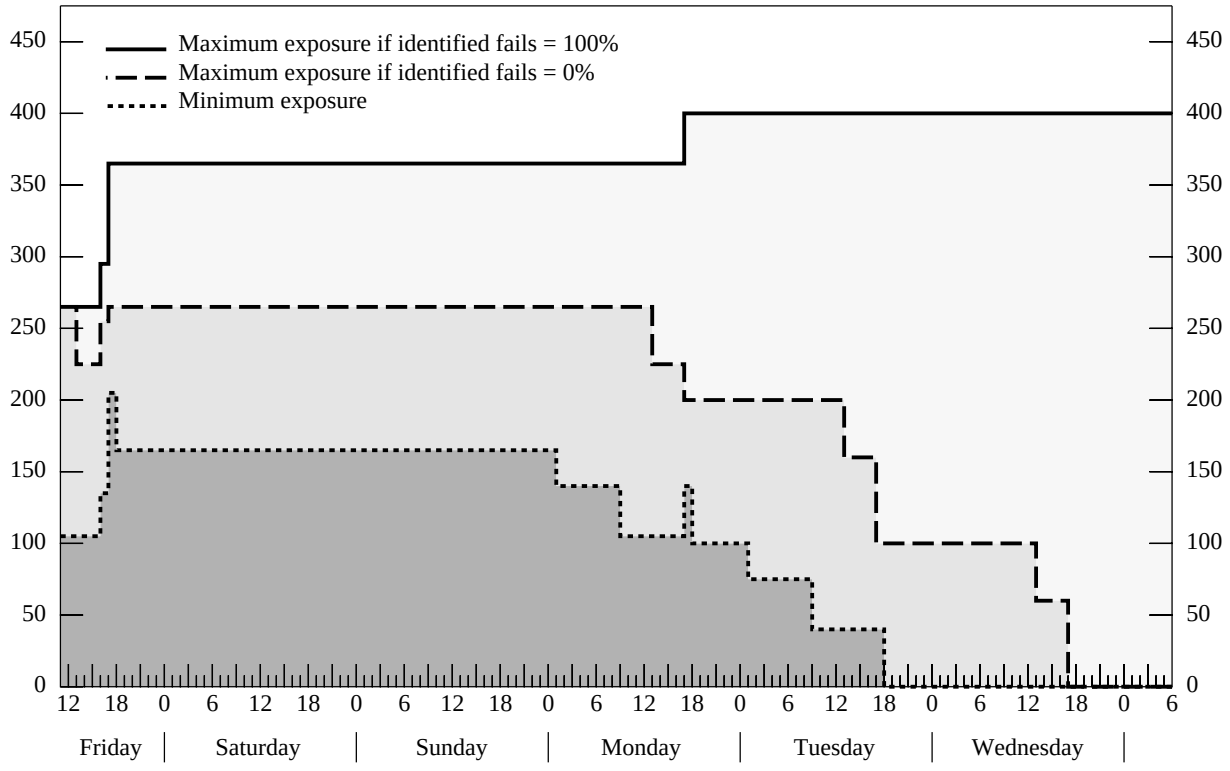


Table 1b

"Worst-case" Asian bank
FX settlement exposure as of Saturday, 1 a.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15	U	15	U	15	I	15	R	
DEM	JPY	10	U	10	U	10	I	10	R	
USD	DEM	20	U	20	U	20	I	20	R	
JPY	DEM	15	U	15	U	15	I	15	R	
DEM	USD	20	U	20	I	20	I	20	R	
JPY	USD	20	U	20	I	20	I	20	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		100		0		= **140**
Status U		100		60		0		0		= **160**
Status R		0		0		0		100		= **100**
							MINIMUM EXPOSURE			= **140**
							MAXIMUM EXPOSURE			= **300**

Figure 1b

Projections as of Saturday, 1 a.m. local time, in millions of US dollars

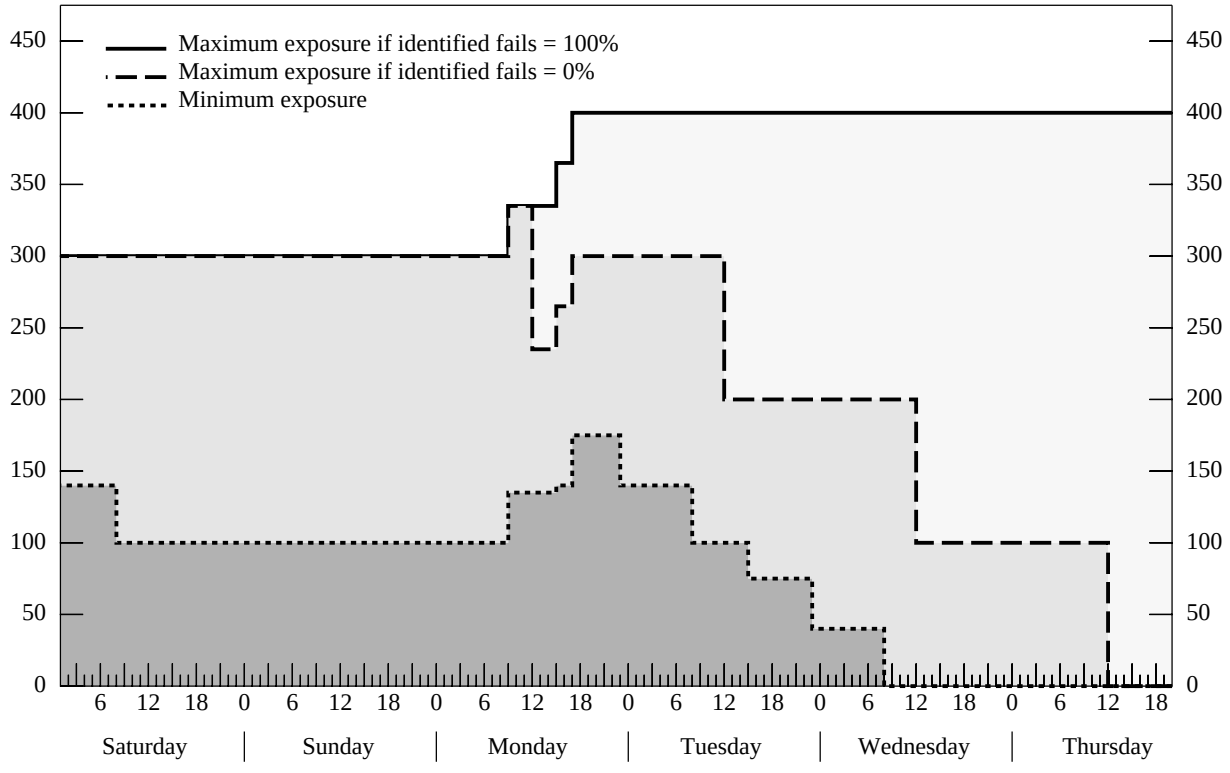


Table 1c

"Worst-case" European bank
FX settlement exposure as of Friday, 5 p.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15	U	15	U	15	I	15	R	
DEM	JPY	10	U	10	U	10	I	10	R	
USD	DEM	20	U	20	U	20	I	20	R	
JPY	DEM	15	U	15	U	15	I	15	I	
DEM	USD	20	U	20	I	20	I	20	R	
JPY	USD	20	U	20	I	20	I	20	I	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		100		35		= **175**
Status U		100		60		0		0		= **160**
Status R		0		0		0		65		= **65**
							MINIMUM EXPOSURE		=	**175**
							MAXIMUM EXPOSURE		=	**335**

Figure 1c

Projections as of Friday, 5 p.m. local time, in millions of US dollars

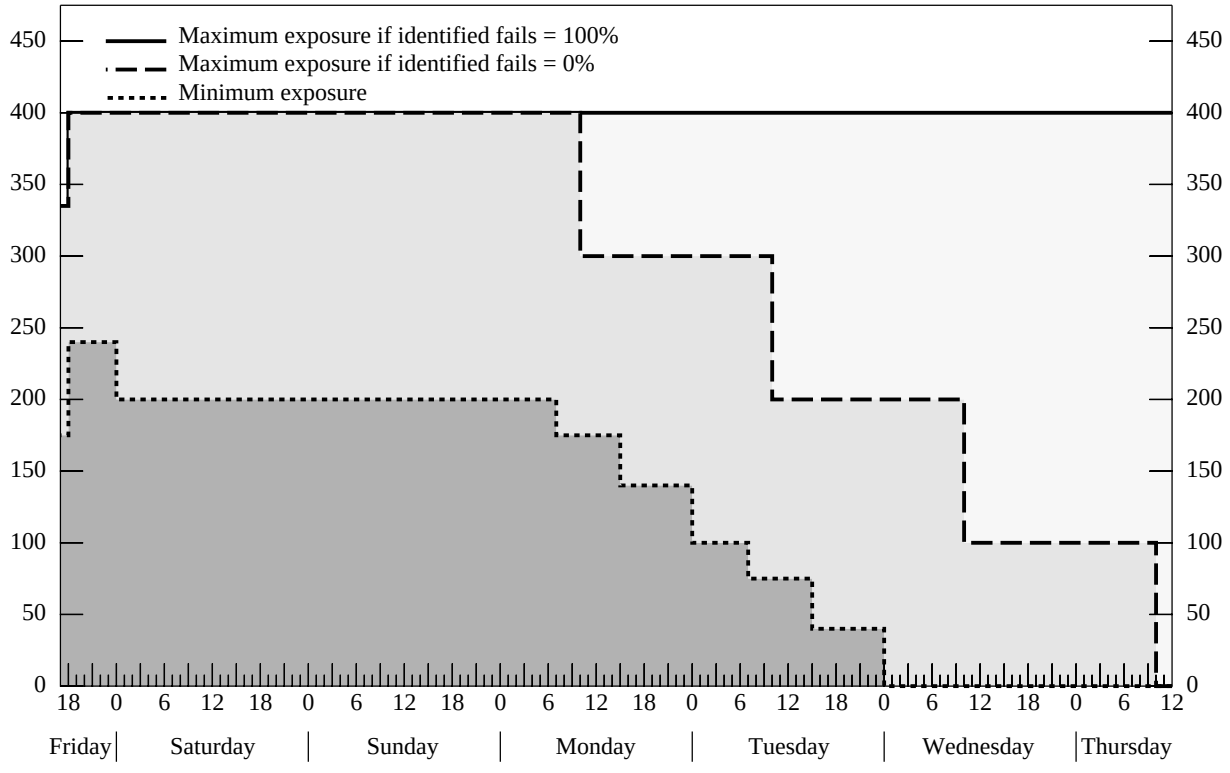


Table 2a

"Best-case" North American bank
FX settlement exposure as of Friday, 11 a.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15		15	S	15	R	15	R	
DEM	JPY	10		10	S	10	R	10	R	
USD	DEM	20		20	S	20	R	20	R	
JPY	DEM	15		15	S	15	R	15	R	
DEM	USD	20		20	I	20	R	20	R	
JPY	USD	20		20	I	20	R	20	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		0		0		= **40**
Status U		0		0		0		0		= **0**
Status R		0		0		100		100		= **200**
							MINIMUM EXPOSURE			= **40**
							MAXIMUM EXPOSURE			= **40**

Figure 2a

Projections as of Friday, 11 a.m. local time, in millions of US dollars

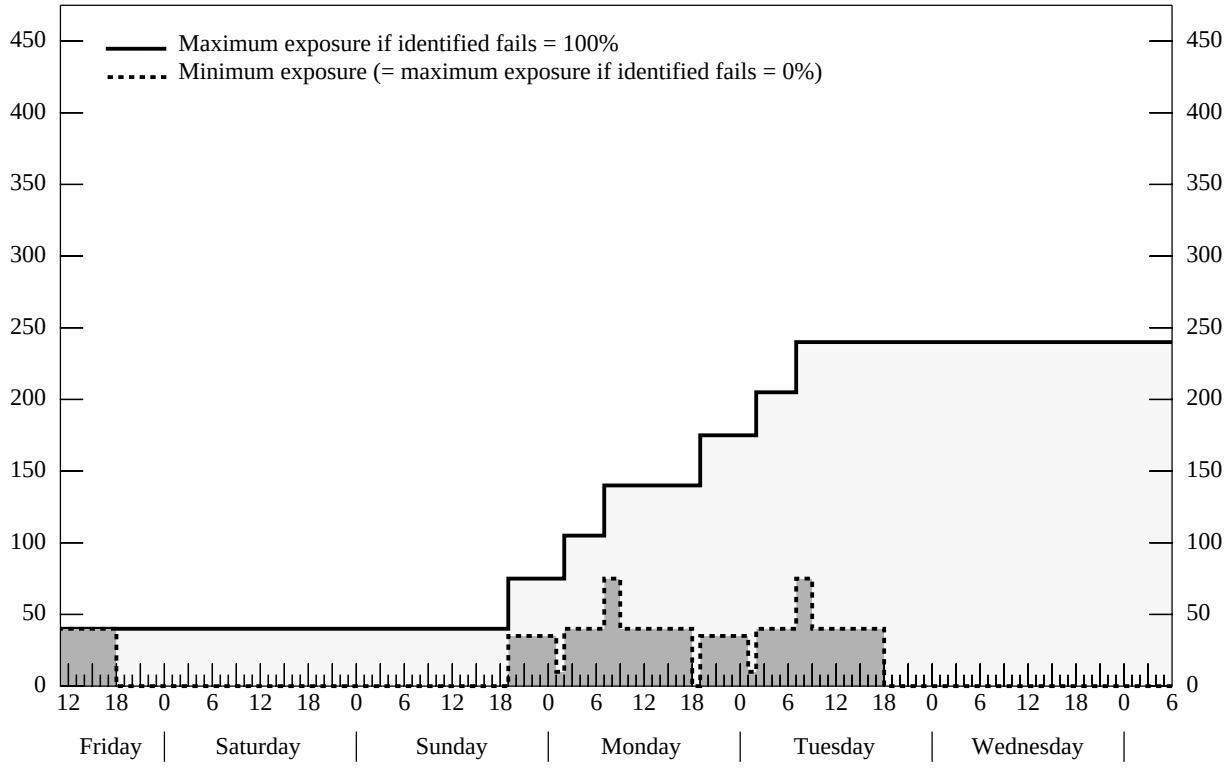


Table 2b

"Best-case" Asian bank
FX settlement exposure as of Saturday, 1 a.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15	S	15	S	15	R	15	R	
DEM	JPY	10	S	10	S	10	R	10	R	
USD	DEM	20	S	20	S	20	R	20	R	
JPY	DEM	15	S	15	S	15	R	15	R	
DEM	USD	20	S	20	I	20	R	20	R	
JPY	USD	20	S	20	I	20	R	20	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		0		0		= **40**
Status U		0		0		0		0		= **0**
Status R		0		0		100		100		= **200**
							MINIMUM EXPOSURE			= **40**
							MAXIMUM EXPOSURE			= **40**

Figure 2b

Projections as of Saturday, 1 a.m. local time, in millions of US dollars

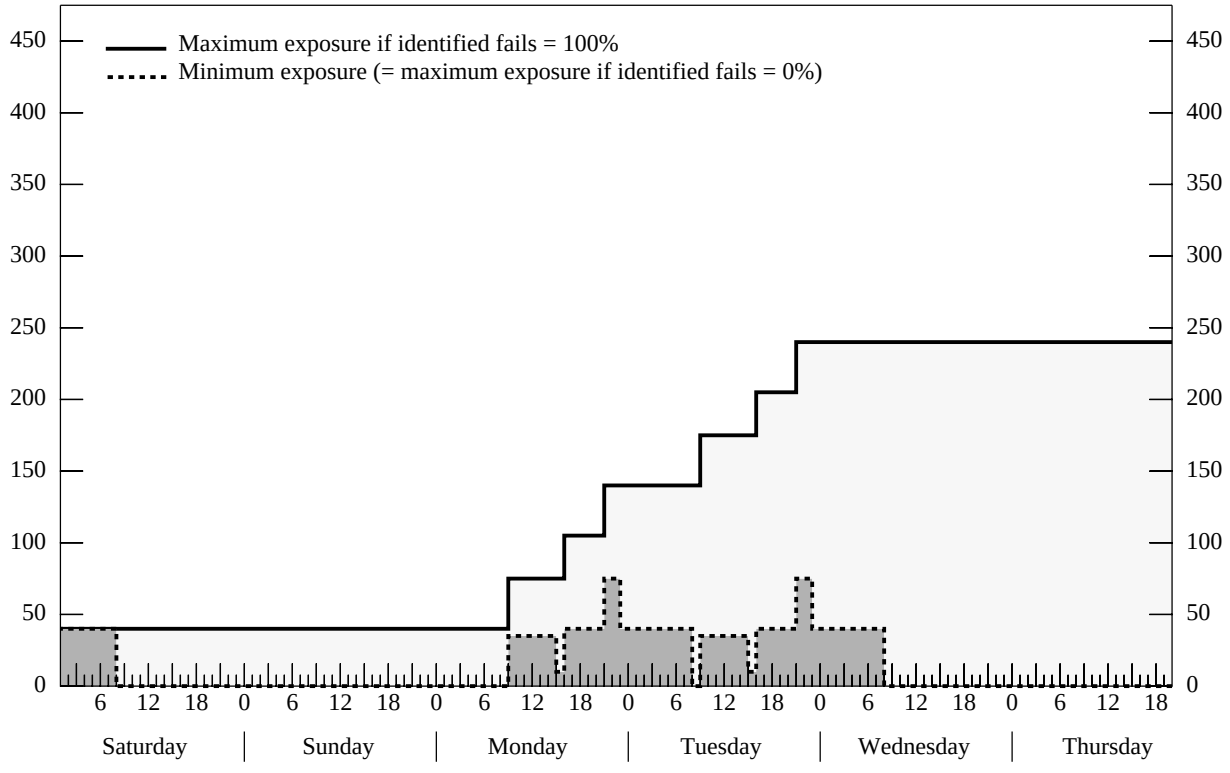


Table 2c

"Best-case" European bank
FX settlement exposure as of Friday, 5 p.m. local time (4 p.m. GMT)

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	15	S	15	S	15	R	15	R	
DEM	JPY	10	S	10	S	10	R	10	R	
USD	DEM	20	S	20	S	20	R	20	R	
JPY	DEM	15	S	15	S	15	R	15	R	
DEM	USD	20	S	20	I	20	R	20	R	
JPY	USD	20	S	20	I	20	R	20	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		40		0		0		= **40**
Status U		0		0		0		0		= **0**
Status R		0		0		100		100		= **200**
							MINIMUM EXPOSURE			= **40**
							MAXIMUM EXPOSURE			= **40**

Figure 2c

Projections as of Friday, 5 p.m. local time, in millions of US dollars

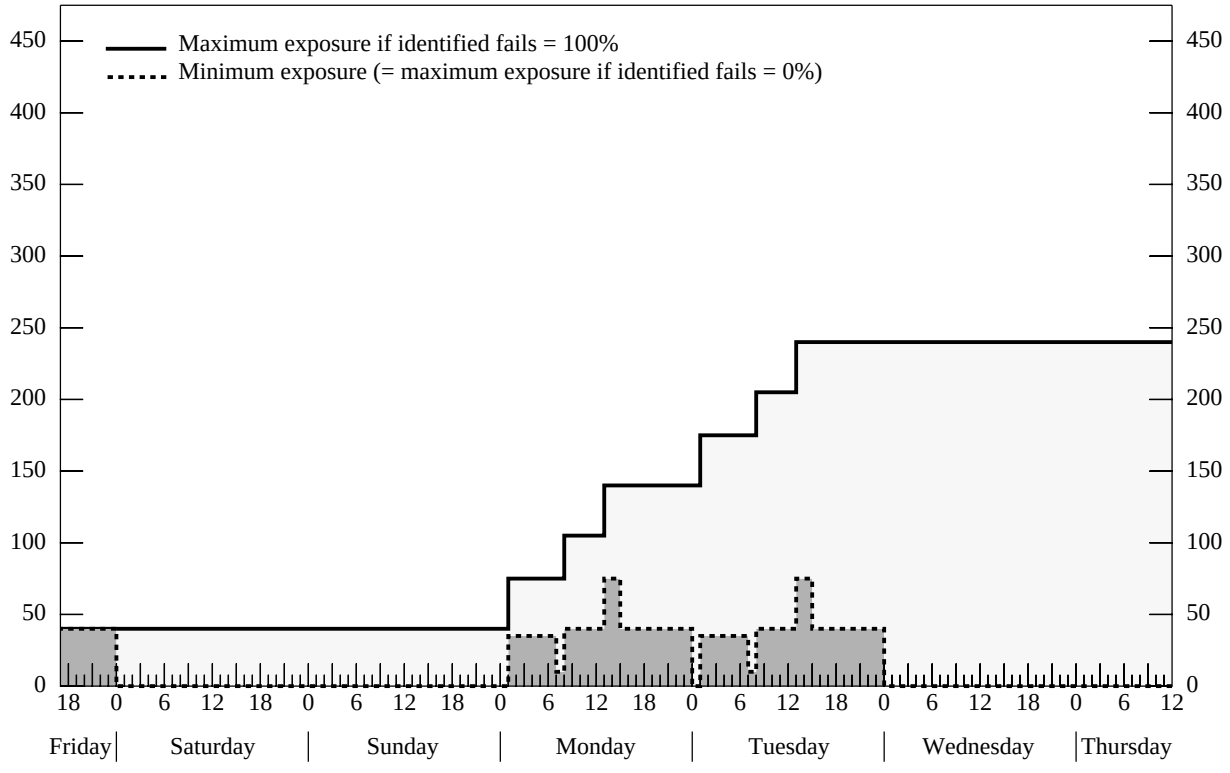


Table 3

"Worst-case" North American bank
FX settlement exposure as of Friday, 11 a.m. local time (4 p.m. GMT)
with netting

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	0	U	0	U	0	R	0	R	
DEM	JPY	0	U	0	U	0	I	0	R	
USD	DEM	0	U	0	U	0	R	0	R	
JPY	DEM	5	U	5	U	5	I	5	R	
DEM	USD	0	U	0	I	0	I	0	R	
JPY	USD	5	U	5	I	5	I	5	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		5		10		0		= **15**
Status U		10		5		0		0		= **15**
Status R		0		0		0		10		= **10**
							MINIMUM EXPOSURE			= **15**
							MAXIMUM EXPOSURE			= **30**

Figure 3

Projections as of Friday, 11 a.m. local time, in millions of US dollars

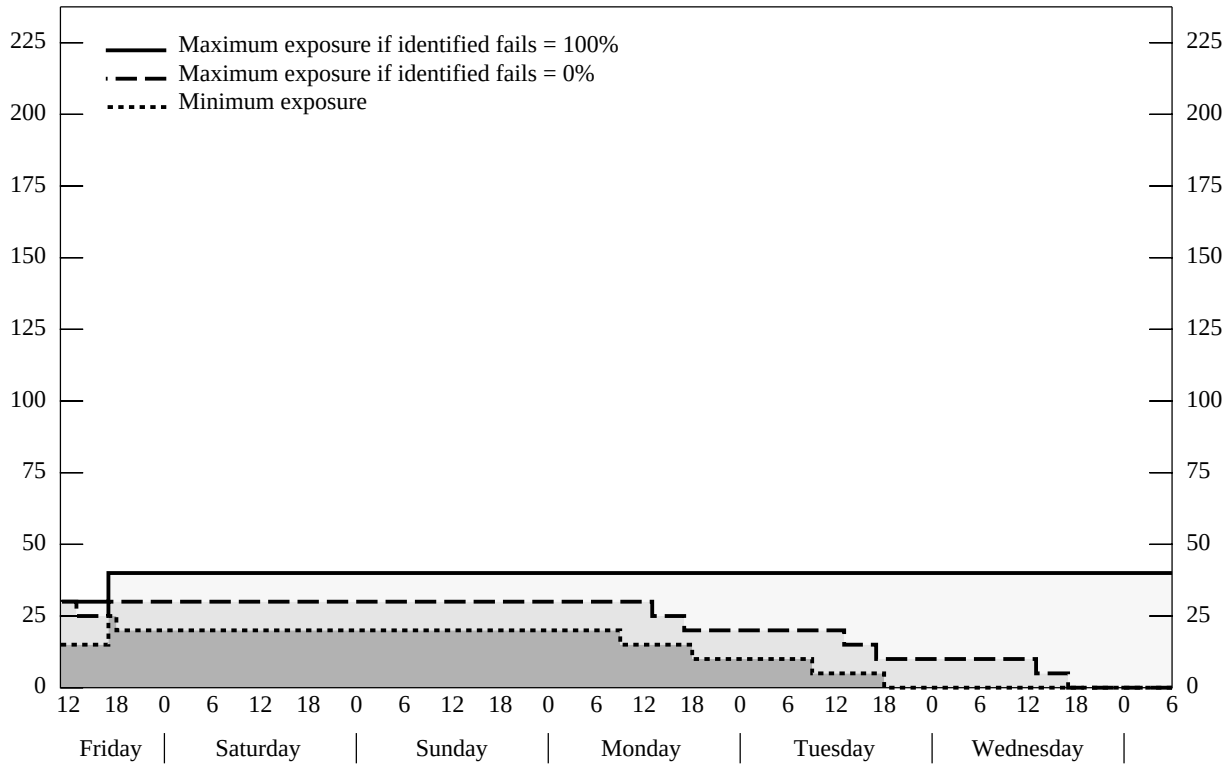


Table 4

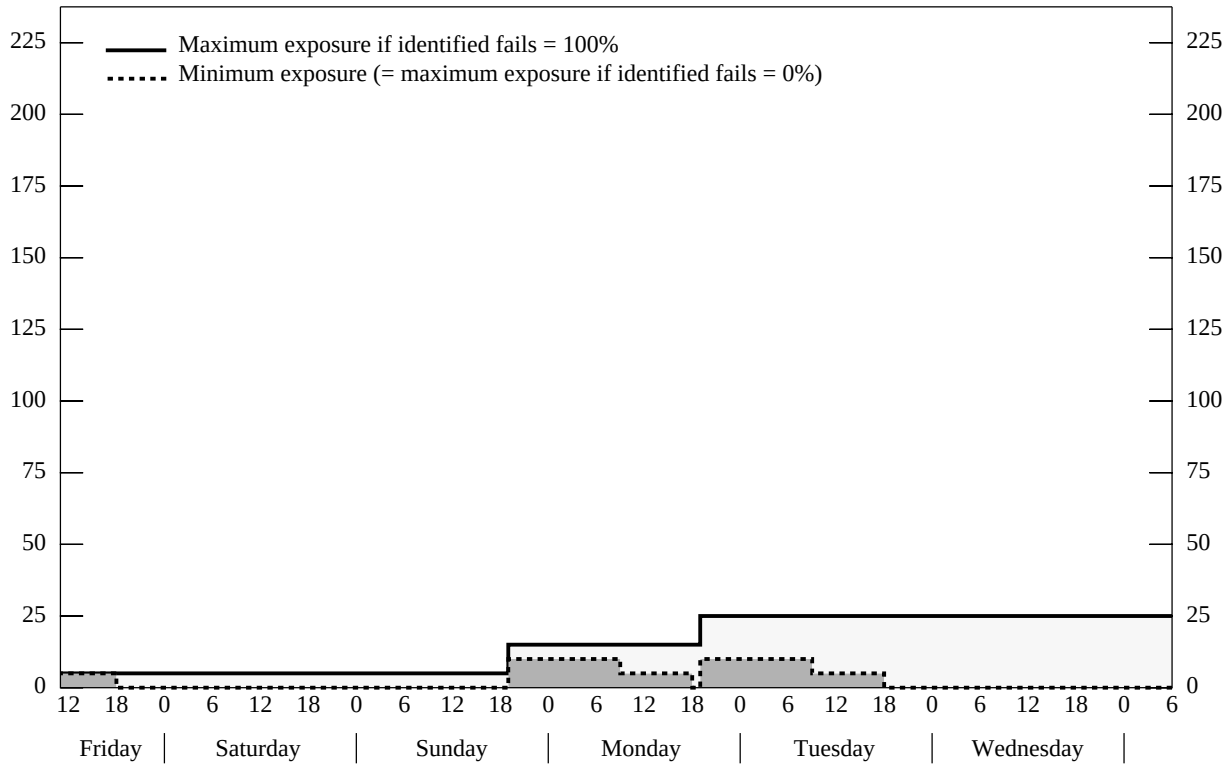
"Best-case" North American bank
FX settlement exposure as of Friday, 11 a.m. local time (4 p.m. GMT)
with netting

Amount bought, in millions of US dollars

Transaction		**By transaction**								
Currency sold	Currency bought	Due Thursday	Status	Due Friday	Status	Due Monday	Status	Due Tuesday	Status	
USD	JPY	0	S	0	S	0	R	0	R	
DEM	JPY	0	S	0	S	0	R	0	R	
USD	DEM	0	S	0	S	0	R	0	R	
JPY	DEM	5	S	5	S	5	R	5	R	
DEM	USD	0	S	0	I	0	R	0	R	
JPY	USD	5	S	5	I	5	R	5	R	
Trade status		**By trade status**								**TOTAL**
Status F		0		0		0		0		= **0**
Status I		0		5		0		0		= **5**
Status U		0		0		0		0		= **0**
Status R		0		0		10		10		= **20**
							MINIMUM EXPOSURE			= **5**
							MAXIMUM EXPOSURE			= **5**

Figure 4

Projections as of Friday, 11 a.m. local time, in millions of US dollars



APPENDIX 2

The New York Foreign Exchange Committee's *Summary of Recommendations for Private Sector Best Practices*

Recommendation No. 1: ***Understand the settlement process***

Senior management should promote a complete understanding of the settlement process at all decision-making levels.

Recommendation No. 2: ***Understand settlement exposure***

Credit and risk managers should understand the impact of their internal procedures on settlement exposure and develop accurate methods of quantifying the extent of their risk.

Recommendation No. 3: ***Review and upgrade correspondent services***

The bank relations department should review its correspondent bank relationships to ensure that the services provided give the firm maximum control over its nostro account. Emphasis should be placed on obtaining the latest possible cutoff times for cancellation and amendment of payment instructions and the earliest confirmation of final receipt.

Recommendation No. 4: ***Complete reconciliation as early as possible***

Creating the system support necessary to process intra-day notification of receipts and to begin the reconciliation process before the end of the day is an investment that will significantly reduce the amount of time that the total settlement receivable due from each counterparty is considered at risk.

Recommendation No. 5: ***Monitor non-receipts and establish and practice clear follow-up procedures***

Senior management should establish procedures to evaluate non-receipts of payments and to alert all concerned parties to potential problem situations.

Recommendation No. 6: ***Establish netting arrangements***

Payment netting arrangements should be established with market participants to reduce settlement risk.

Recommendation No. 7: ***Establish operational capability to net payments***

Management should develop the operational capability to net payments.

Recommendation No. 8: ***Make credit risk managers responsible for monitoring and controlling settlement exposure***

Credit risk managers stationed on the trading floor should have primary responsibility for the monitoring and control of foreign exchange counterparty exposure.

Recommendation No. 9: ***Set prudent settlement exposure limits***

The credit department, functioning autonomously from the trading and sales areas, should set settlement exposure limits for all counterparties regardless of size.

Recommendation No. 10: ***Update exposures on-line and aggregate globally across all dealing centers***

When a firm has dealing centers located in different time zones, counterparty exposure should be monitored in real time and aggregated globally across the firm's own dealing centers and the various trading locations of the counterparty.

Recommendation No. 11: ***Enforce adherence to settlement limits***

The credit department should ensure that traders have up-to-date information on counterparty limits and exposure before they execute a trade.

Recommendation No. 12: ***Mandate ownership of credit risk***

Senior management policy should clearly indicate which area takes responsibility for losses stemming from counterparty failure.

Recommendation No. 13: ***Prepare for crisis situations***

Firms should anticipate crises and prepare internally.

Recommendation No. 14: ***Utilize all correspondent capabilities***

The quality of services provided by a firm's correspondents should be proved well in advance of a crisis.

Recommendation No. 15: ***Involve senior management***

Senior management should be apprised of a crisis situation at the outset and directly involved in controlling it.

Recommendation No. 16: ***Establish industry working groups***

At the industry level, working committees should be formed to study the dynamics of crisis situations.

Source: *Reducing Foreign Exchange Settlement Risk*, The New York Foreign Exchange Committee, October 1994.

APPENDIX 3

The CPSS market survey

As part of its analysis, the CPSS surveyed banks in each of the G-10 countries in order to document current practices for settling foreign exchange trades. The survey, which involved written questions and answers and face-to-face discussions, was conducted in several stages during 1994 and 1995. Approximately 80 bank offices were initially asked to list their current payment cancellation deadlines and their receipt identification times for each of the G-10 currencies. Several banks in each country were then selected to answer more detailed qualitative questions about their practices for managing FX settlement exposures. In the last stage of the survey the CPSS informally sought comments on its definition and measurement methodology with the aid of a discussion paper that was distributed to selected banks. This appendix contains the list of topics that were investigated.

A QUALITATIVE AND QUANTITATIVE SURVEY OF COMMERCIAL BANKING PRACTICE

Objectives

1. Through structured discussions with the banks in every G-10 country, to develop their awareness of the nature and scale of the risks they run in the settlement of their own, and their customers', cross-currency transactions; and to identify best practices in this business, including where necessary and practicable changes in local or international procedures. The survey therefore covers not only problems encountered by any bank in its own national currency and payment system, but also problems it encounters in paying or receiving settlement obligations through the relevant payment systems of other countries.

2. To use the results of this survey to identify options for services which central banks could if necessary offer, individually or collectively, to build on and to complement the market's best practices.

3. To consider how to encourage and persuade the market to support and make use of these best practices and service options.

4. In this exercise, settlement risk arises where a bank is exposed for the full notional amount of each foreign exchange transaction during the end-to-end process of settling that transaction.

Topics to be covered in the structured discussions

1. Establish the extent in every G-10 centre of the banks' awareness and understanding of the general issue of FX settlement risk, and of how it applies to them.

2. Identify the relevant currencies for the local banks, and the scale of the cross-currency settlement risks they run (recognising that a quantitative survey may not be practicable for more than a few banks).

3. Obtain an overview of the local banks' process for settling foreign exchange trades (from trade execution to settlement reconciliation), and of the timing (practices and constraints) relevant to key elements of this process.

4. Determine how local banks generally measure and control foreign exchange settlement risk.

5. Determine the extent to which netting is used for foreign exchange trades. Note whether contracts are netted but trades are settled on a gross basis; or contracts are not netted but settlement payments are informally made on a netted basis.

6. Identify any key factors that can increase or decrease settlement risk (e.g. internal practices; correspondent banking arrangements; netting; rules, practices and structures in the national payment system).

7. Establish what steps local banks *can*, if they are ready and willing, take to address FX settlement risk:

- as banks trading FX for their own account;
- as correspondent banks for the national currency in the local payment system;
- as banks using the services of correspondent banks in other countries' payment systems.

8. Do any of the possible steps identified in 7 require all the banks, or all the major banks, in that centre to act unanimously in taking and implementing decisions (for example in changing market rules on the cut-off times for making third-party payments)? Or can individual banks take adequate steps on their own to control their own or their customers' risks?

9. Do any of these steps require the involvement of system or service suppliers such as, for example, S.W.I.F.T., or an independent clearing house?

10. In what respects do any of these steps require action to be taken by the local central bank, or by other central banks?

11. Are there any obstacles in the provisions of national, state or other laws to any of the steps in 7?

12. Would any of the steps in 7 require changes in:

- direct membership of the national payment system;
- the spread of correspondent banking business;
- the role of the central bank in the payment system;
- the relationship between individual banks and their customers?

13. What steps, if any, have the local banks *actually* decided to take, of those identified in 7?

14. Who would be regarded as the key individuals in the local market, in seeking to encourage and persuade that market to implement the identified best practices?

QUESTIONS REGARDING INSTITUTIONAL PROFILES OF TRADING AND RISK MANAGEMENT PRACTICES*

Banks participating in the FX market for their own account

1. Describe how a trade is executed and trade information is processed from the point of execution through to the reconciliation of the settlement, including the information flows, processing methods and technologies used in such functional areas as trade execution, trade clearance, settlement and risk management (e.g. centralised or decentralised processing, timing of data flows, cut-off times, information availability).

2. Describe your procedures for making and receiving payments in the major currencies in which you trade. Please indicate when payment instructions are issued; the time beyond which they cannot be cancelled without the consent of the receiving bank or beneficiary; and when you reconcile your receipts to identify failed payments. To what extent are these times affected by your internal procedures and by your correspondent banking arrangements?

3. How are settlement exposures in respect of foreign exchange transactions measured within the bank? Are exposures measured on a consolidated basis for all trading locations of both the bank and the counterparty? What are the intraday and interday information flows and timeframes associated with measuring such exposures?

4. To what extent are bilateral netting arrangements used by the bank? How are such arrangements structured (processes, legal agreements, etc.)? How are they monitored? Is "contract netting" ever used without "settlement-payment netting"? Is "settlement-payment netting" ever used without "contract netting"?

5. How are actual gross and net settlement exposures monitored (e.g. ex post, real-time, periodically)?

6. Are limits applied to these settlement exposures? If so, are limits applied on a global consolidated basis? Are the settlement limits on each counterparty a subset of, or a supplement to, the trading and credit limits set on that counterparty?

7. What internal controls, system controls, or procedures exist in the bank to prevent actual settlement exposures from exceeding established limits? Is there a mechanism for authorising increases in settlement limits on an exceptional basis?

8. What mechanism or procedure is used to monitor the daily progress of settlements in each of the major currencies in which you trade? How quickly can such a procedure identify settlement problems, either with a particular counterparty or more generally? If a settlement problem is identified, to whom in the organisation is such information conveyed and how is it utilised?

9. Describe any emergency settlement procedures or "exception processing" arrangements for foreign exchange transactions. What contingencies are such procedures intended to cover? In what situations would such procedures be used? Describe any relevant examples from recent experience.

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* Some of the questions will need to be modified if they are to be answered by a financial institution other than a bank.

Additional questions, for banks acting as correspondents in the national currency for the settlement of FX transactions

10. Describe the procedures for receiving FX or international payment settlement instructions from customer financial institutions and for processing such instructions. What are the information flows associated with processing these customers' payment orders?

11. What are the timeframes, including cut-off times, for the receipt and processing of settlement instructions from these customers? What is the basis for these deadlines (e.g. operational constraints, local payments system rules)? How are these times communicated to your customers?

12. What are the deadlines for cancelling or revoking these customers' payment orders without obtaining the consent of the receiving bank or beneficiary? Until what time might payment orders be cancelled on a "best-efforts" basis? What is the basis for these deadlines? How are these times communicated to your customers?

13. Describe the procedures for receiving funds on behalf of these customers. What are the timeframes for notifying customers of their daily receipts? Are they notified on a flow basis per receipt? Do they receive a single summary of all receipts? At what point are receipts considered final? Are customers notified when receipts become final? What is the basis for the timing of all of these information flows?

14. Describe the procedures for making a transfer in your books from the account of one customer to the account of another. What deadlines apply to instructions to make such a transfer? At what time during the day is the transfer made, and at what point is it considered final?

15. Do customers have the ability to obtain intraday information regarding the status of their payments and receipts?

16. To what extent are bilateral netting arrangements used by the bank for its customers' FX settlement instructions? How are such arrangements structured (processes, legal agreements, etc.)? How are they monitored by the bank?

17. Does the bank in any circumstances make outgoing payments for its customers in one currency on the basis of pre-advices of incoming payments to that bank in another currency? How is this potential settlement exposure monitored and controlled?

18. Describe the procedures that the bank uses for limiting its settlement exposures arising from customer FX transactions. Are settlement limits applied to individual currency positions or to multi-currency positions? Are they allocated to individual locations or on a global, consolidated basis?

19. Are these settlement limits applied ex post, real-time or periodically? Are the limits often binding, resulting in payments processing queues? Is there a mechanism for authorising increases in these limits on an exceptional basis?

20. What mechanism or procedure is used to monitor the daily progress of settlement of your customers' payments? How quickly can such a procedure identify settlement problems, either for a particular customer or more generally? If a settlement problem is identified, to whom in the bank's organisation is such information conveyed and how is it utilised?

21. Have any risk reduction measures in your national large-value payment system had any impact on the bank's ability to meet its customers' instructions?

22. Describe any emergency settlement procedures or "exception processing" arrangements for settlement of customers' FX transactions. What contingencies are such procedures intended to cover? In what situations would such procedures be used? Describe any relevant examples from recent experience.

QUESTIONS CONTAINED IN THE JUNE 1995 DISCUSSION PAPER ON DEFINING AND MEASURING FOREIGN EXCHANGE SETTLEMENT EXPOSURE*

1. Does paragraph 1 provide a reasonable and useful definition of FX settlement exposure for risk management purposes? What changes would you suggest?

2. Please give your overall reaction to the suggested guidelines for measuring and projecting FX settlement exposures. Do they seem reasonable and useful? Are they consistent with the definition? Would it be better to include more or less detail?

3. Do you find the trade status categories described in paragraph 3 to be clear and useful? Would you suggest any changes?

4. Does your bank's settlement-risk manager currently know for each currency in which the bank trades (i) the unilateral payment cancellation deadline; (ii) when final receipts are due; and (iii) when the bank identifies final and failed receipts? If not, how difficult would it be for the settlement-risk manager to determine these times?

5. Do you agree, as described in paragraph 6, that the current FX settlement exposure of a bank that confirms its final receipts as soon as they are due equals the sum of its *Status I* and *F* trades? If not, which trades should be included or excluded? Please specify any alternative calculation using the hypothetical portfolio, tables and charts.

6. For a bank that does not confirm its final - and failed - receipts as soon as they are due, is it reasonable and useful to measure its current minimum and maximum exposures as defined in paragraph 9? If not, which trades should be included or excluded? Please specify any alternative calculation.

7. Is it reasonable and useful for banks to measure and monitor their *Status R* trades? If not, why not?

8. Does paragraph 11 provide a reasonable and useful methodology for projecting a bank's minimum FX settlement exposure? If not, which trades should be included or excluded? Please specify any alternative calculation.

9. Does paragraph 14 provide a reasonable and useful methodology for projecting the potential range of a bank's maximum FX settlement exposure? If not, which trades should be included or excluded? Please specify any alternative calculation.

10. Do you agree with the exposure calculations contained in paragraphs 41-42, 44-45 and 49-50, especially regarding the projections for "weekend" exposure? If not, what alternative calculations would you suggest?

11. Do you agree with the calculations used to quantify the exposure-reducing benefits of switching from "worst-case" to "best-case" practices and of settling on a net rather than gross basis (paragraphs 47-52)?

12. If your bank currently uses a different methodology to measure and project its settlement exposures, how difficult (in terms of time, money, etc.) would it be for your bank - if it chooses to do so - to adopt the methodology suggested in this note?

---

* Paragraph references relate to Appendix 1.

FIRM NAME _____

CONTACT NAME _____

CONTACT PHONE NUMBER _____

NORTH AMERICAN PAYERS/RECEIVERS

Please provide answers in New York time (GMT-5)

Currency	Send payment instructions[1]	Cancel payment instructions[2]	Identify failed receipts[3]
Japan: Yen			
Belgium: Franc			
France: Franc			
Germany: Mark			
Italy: Lira			
Netherlands: Guilder			
Sweden: Krona			
Switzerland: Franc			
UK: Pound sterling			
Canada: Dollar			
US: Dollar			

1 At what time do you routinely issue payment instructions for value on day "V" (example: 10 p.m. on V-2)?

2 What is your deadline for cancelling or amending these payment instructions *without* the consent of the receiving bank or beneficiary (example: 5 p.m. on V-1)?

3 At what time do you usually identify failed payments to you (example: 9 a.m. on V+1)?

FIRM NAME _____

CONTACT NAME _____

CONTACT PHONE NUMBER _____

ASIAN PAYERS/RECEIVERS

Please provide answers in Tokyo time (GMT+9)

Currency	Send payment instructions[1]	Cancel payment instructions[2]	Identify failed receipts[3]
Japan: Yen			
Belgium: Franc			
France: Franc			
Germany: Mark			
Italy: Lira			
Netherlands: Guilder			
Sweden: Krona			
Switzerland: Franc			
UK: Pound sterling			
Canada: Dollar			
US: Dollar			

1 At what time do you routinely issue payment instructions for value on day "V" (example: 10 p.m. on V-2)?

2 What is your deadline for cancelling or amending these payment instructions *without* the consent of the receiving bank or beneficiary (example: 5 p.m. on V-1)?

3 At what time do you usually identify failed payments to you (example: 9 a.m. on V+1)?

FIRM NAME _____

CONTACT NAME _____

CONTACT PHONE NUMBER _____

EUROPEAN PAYERS/RECEIVERS

Please provide answers in London time (GMT)

Currency	Send payment instructions[1]	Cancel payment instructions[2]	Identify failed receipts[3]
Japan: Yen			
Belgium: Franc			
France: Franc			
Germany: Mark			
Italy: Lira			
Netherlands: Guilder			
Sweden: Krona			
Switzerland: Franc			
UK: Pound sterling			
Canada: Dollar			
US: Dollar			

1 At what time do you routinely issue payment instructions for value on day "V" (example: 10 p.m. on V-2)?

2 What is your deadline for cancelling or amending these payment instructions without the consent of the receiving bank or beneficiary (example: 5 p.m. on V-1)?

3 At what time do you usually identify failed payments to you (example: 9 a.m. on V+1)?

APPENDIX 4

Glossary

Close-out netting: an arrangement to settle all contracted but not yet due liabilities to and claims on an institution by one single payment, immediately upon the occurrence of one of a list of defined events, such as the appointment of a liquidator to that institution (see netting by novation and obligation netting).

Credit risk/exposure: the risk that a counterparty will not settle an obligation for full value, either when due or at any time thereafter. In exchange-for-value systems, the risk is generally defined to include replacement risk and principal risk.

Cross-currency settlement risk: see foreign exchange settlement risk.

Delivery versus payment (DVP): a mechanism in an exchange-for-value settlement system that ensures that the final transfer of one asset occurs if and only if the final transfer of (an)other asset(s) occurs. Assets could include monetary assets (such as foreign exchange), securities or other financial instruments (see payment versus payment).

Final (finality): irrevocable and unconditional.

Final settlement: settlement which is irrevocable and unconditional (see settlement).

Foreign exchange settlement exposure: the amount at risk when a foreign exchange transaction is settled. This equals the full amount of the currency purchased and lasts from the time that a payment instruction for the currency sold can no longer be cancelled unilaterally until the time the currency purchased is received with finality (see credit risk/exposure and foreign exchange settlement risk).

Foreign exchange settlement risk: the risk that one party to a foreign exchange transaction will pay the currency it sold but not receive the currency it bought. This is also called cross-currency settlement risk or principal risk; it is also referred to as Herstatt risk, although this is an inappropriate term given the differing circumstances in which this risk has materialised.

Guaranteed receipt system: an arrangement whereby counterparties are guaranteed that if they fulfil their settlement obligations they will receive (according to some predetermined schedule) what they are owed. This guarantee could be supported by risk controls such as limits, collateral, liquidity facilities and loss-sharing arrangements (see payment versus payment and guaranteed refund system).

Guaranteed refund system: an arrangement whereby counterparties are guaranteed that any settlement payment they make will be cancelled or returned if their counterparties fail to pay what they owe (see payment versus payment and guaranteed receipt system).

Herstatt risk: see foreign exchange settlement risk.

Liquidity risk: the risk that a counterparty (or participant in a settlement system) will not settle an obligation for full value when due. Liquidity risk does not imply that a counterparty or participant is insolvent since it may be able to settle the required debit obligations at some time thereafter.

Market risk: the risk that an institution or other trader will experience a loss on a trade owing to an unfavourable exchange rate movement (see replacement risk).

Netting: an agreed offsetting of positions or obligations by trading partners or participants. The netting reduces a large number of individual positions or obligations to a smaller number of positions or obligations. Netting may take several forms which have varying degrees of legal enforceability in the event of default of one of the parties (see also close-out netting, netting by novation and obligation netting).

Netting by novation (novation): satisfaction and discharge of existing contractual obligations by means of their replacement by new obligations (whose effect, for example, is to replace gross with net payment obligations). The parties to the new obligations may be the same as to the existing obligations or, in the context of some clearing house arrangements, there may additionally be substitution of parties (see close-out netting, netting and obligation netting).

Obligation netting: the legally binding netting of amounts due in the same currency for settlement on the same day under two or more trades. Under an obligation netting agreement for foreign exchange transactions, counterparties are required to settle on the due date all of the trades included under the agreement by either making or receiving a single payment in each of the relevant currencies. Depending on the relevant legal system, obligation netting can find a legal basis in constructions such as novation, set-off or the current account mechanism (see close-out netting, netting and netting by novation).

Operational risk: the risk of incurring interest charges or other penalties for misdirecting or otherwise failing to make settlement payments on time owing to an error or technical failure.

Payment versus payment (PVP): a mechanism in a foreign exchange settlement system that ensures that a final transfer of one currency occurs if and only if a final transfer of the other currency or currencies takes place.

Principal risk: see foreign exchange settlement risk.

Replacement risk/replacement cost risk: the risk that a counterparty to an outstanding transaction for completion at a future date will fail to perform on the settlement date. This failure may leave the solvent party with an unhedged or open market position or deny the solvent party unrealised gains on the position. The resulting exposure is the cost of replacing, at current market prices, the original transaction (see credit risk/exposure and market risk).

Sequential settlement: the settlement of payment obligations in different currencies at different times. A sequential settlement system would pay out some currencies to one or more participants before all relevant participants pay in all of the currencies they owe (see final settlement, payment versus payment, settlement and simultaneous settlement).

Settlement: an act that discharges obligations in respect of funds or securities transfers between two or more parties.

Settlement system: a system in which settlement takes place.

Simultaneous settlement: the settlement of payment obligations in different currencies at the same time. A simultaneous settlement system would not pay out any currencies to any participant before all relevant participants pay in all of the currencies they owe (see final settlement, payment versus payment, sequential settlement and settlement).

Systemic risk: the risk that the failure of one participant in a transfer system, or in financial markets generally, to meet its required obligations when due will cause other participants or financial institutions to be unable to meet their obligations (including settlement obligations in a transfer system) when due. Such a failure may cause significant liquidity or credit problems and, as a result, might threaten the stability of financial markets.