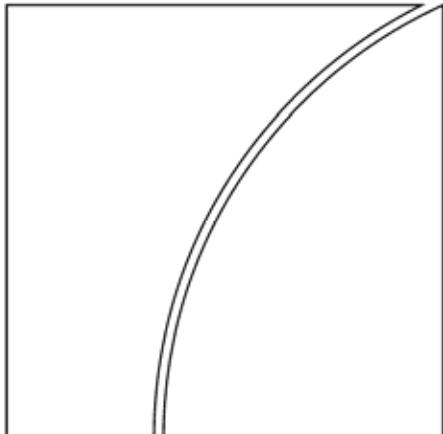


Committee on Payment and Settlement Systems



Progress in reducing foreign exchange settlement risk

Consultative report

July 2007



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Foreword

In 1996 the G10 central banks endorsed a strategy to reduce the systemic risk arising from the settlement of foreign exchange trades. The strategy was motivated by the finding that banks' foreign exchange settlement exposures to their counterparties were in many cases extremely large relative to their capital, lasted overnight or longer and were poorly understood and controlled. This report analyses the progress that has been made over the past ten years and concludes that the central bank strategy has achieved significant success, evidenced most visibly by the establishment and growth of CLS Bank, which currently settles on average more than \$3 trillion each day in FX-related payment obligations. However, at the same time, a notable share of FX transactions is settled in ways that still generate significant potential risk across the global financial system and so further action is needed. This report therefore recommends specific actions by individual institutions, industry groups and central banks to reduce and control remaining large and long-lasting exposures and to guard against a risk of reversing the important progress already made.

The report is being issued now as a consultation document and comments are invited from any interested parties. Comments should be sent to the CPSS Secretariat (cpss@bis.org) by **12 October 2007**; please mention *foreign exchange settlement risk* in the subject line of your e-mail. The comments will be published on the BIS website, www.bis.org, unless commentators have requested otherwise. A final version of the report will be published after the consultation period has ended.

The report has been prepared for the Committee on Payment and Settlement Systems by its Sub-Group on Foreign Exchange Settlement Risk. The CPSS is very grateful to the members of the sub-group and its chairman, Lawrence M Sweet, for their excellent work in preparing this report.

Timothy F Geithner, Chairman
Committee on Payment and Settlement Systems

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Part I: Assessment and recommendations

Assessment

The central bank strategy to reduce systemic risk arising from settling foreign exchange trades has achieved significant success. However, a market-wide survey has identified areas where individual institutions, industry groups and central banks need to take further action to reduce and control remaining large and long-lasting exposures and to guard against a risk of reversing progress already made. The recommended actions are set out on pages 11 to 13.

Background

In 1996 central banks endorsed a comprehensive strategy to reduce the systemic risks that arose from the arrangements then used to settle foreign exchange trades. The strategy involved three tracks: action by individual banks to control their foreign exchange settlement exposures, action by industry groups to provide risk-reducing multicurrency services for settling foreign exchange trades, and action by central banks to induce private sector progress.¹

The strategy was motivated by the finding that foreign exchange (FX) settlement exposures to counterparties were in many cases extremely large relative to a trading institution's capital and yet were also poorly understood and controlled. This unacceptable situation at the level of individual institutions, combined with the overall size of the FX market, presented significant risk to the global financial system.

Since 1996, much progress has been made on all three tracks of the strategy. Particularly noteworthy was the launch in 2002 of CLS Bank (CLS), which was the most significant response by the industry to the second track of the strategy. CLS provides a payment-versus-payment (PvP) service that virtually eliminates the principal risk associated with settling FX trades. CLS, which is a special purpose US bank supervised by the Federal Reserve, is subject to the *Core principles for systemically important payment systems*² and is under the cooperative oversight of the central banks of the fifteen currencies included in the system. Central banks decided that, ten years after the strategy was launched and almost four years since CLS started operations, it was appropriate to assess in more detail the extent to which a reduction in systemic risk has been achieved and whether or not there may be a need for further action.

To support that assessment, the Committee on Payment and Settlement Systems (CPSS) organised a survey of the size, duration, concentration and control of FX settlement exposures. This survey, which took place in the second quarter of 2006, updated and extended previous CPSS surveys carried out in 1996 and 1997. The survey was conducted by 27 central banks and involved 109 institutions (both banks and non-banks) that were selected to cover 80% of the FX market in 15 currency areas. These institutions reported average daily FX settlement obligations in April 2006 that had a total gross value of \$3.8 trillion.³

On the basis of the 2006 survey, this part of the report (Part I) provides an assessment of the extent to which the 1996 strategy has been successful and makes recommendations for further action. Part II provides more detail on the survey results underlying the assessment.

¹ See *Settlement risk in foreign exchange transactions*, CPSS, March 1996. A first progress report was issued in 1998: *Reducing foreign exchange settlement risk: a progress report*, CPSS, July 1998.

² *Core principles for systemically important payment systems*, CPSS, January 2001.

³ All value figures in this report are in USD equivalent amounts, converted at April 2006 exchange rates. Unless explicitly stated otherwise, they are also daily averages for the survey period.

Main findings of the survey

Use of different settlement methods

Of the \$3.8 trillion FX settlement obligations, 32% (ie \$1.2 trillion) were settled by traditional correspondent banking and subject to settlement risk (Table 1). This reflects a significant improvement from the time of the 1997 survey, when an estimated 85% of the obligations were settled by this method.⁴ Furthermore, this improvement occurred while the FX market exhibited strong growth: the BIS's triennial survey of the FX market shows that daily FX market turnover (which can generate settlement obligations two to three times those amounts) increased from \$1.2 trillion in April 1995 to \$1.9 trillion in April 2004.^{5, 6}

Table 1
Breakdown of total FX obligations settled by method

Settlement method	Value (USD bn eq)	% of total
CLS (PVP)	2,091	55%
Traditional correspondent banking ("gross non-PVP")	1,224	32%
Bilateral netting	304	8%
On-us ^a without settlement risk	112	3%
On-us ^a with settlement risk	53	1%
Other PVP	38	1%
Total	3,821	100%

Based on daily average value of bought currencies ("receivables") reported in the April 2006 CPSS survey. In this and subsequent tables, component figures may not exactly sum to total figures because of rounding.^a "On-us" settlement is where both legs of FX trades are settled across the books of a single institution. An explanation of all the settlement methods is contained in Part II.

The major reduction in the share of FX obligations subject to traditional settlement risk primarily reflects the increasing use of CLS. CLS was used to settle 55% (\$2.1 trillion) of the total FX settlement obligations of the surveyed institutions. Estimates based on survey data suggest that if the obligations settled by CLS had instead been settled by methods that create risk, such as traditional correspondent banking, the size of settlement exposures would have been up to three times higher than reported. Furthermore, these risk-reduction benefits were broad-based; in the market as a whole, over 550 institutions used CLS to settle trades in 15 currencies during April 2006, either directly as members of CLS or indirectly as third parties.

Bilateral netting accounted for the settlement of a further 8% of FX obligations.⁷ Other settlement methods (eg the PVP arrangement available in Hong Kong or on-us settlement) accounted for the settlement of the remaining 5% of obligations.

⁴ Comparisons between the 2006 and 1997 survey results are given if available but the more limited scope of the 1997 survey means that a comparison is often not possible.

⁵ See *Triennial central bank survey*, BIS, March 2005. The results of the April 2007 survey are not yet available.

⁶ The value of settlement obligations is a multiple of the market turnover, the size of the multiple depending on the number of currency legs that trades have. For example, a spot or forward trade has two currency legs (one for each currency) while a swap has four (two for the spot trade and two for the forward trade).

⁷ Bilateral netting was applied to 12% of total settlement obligations, reducing their value by 8 percentage points to 4% (this is the "8% settled by bilateral netting" reported in Table 1). The remaining 4 percentage points were settled by other methods such as traditional correspondent banking (and will thus be included within the figure shown for the relevant method in Table 1 – eg within the 32% for traditional correspondent banking).

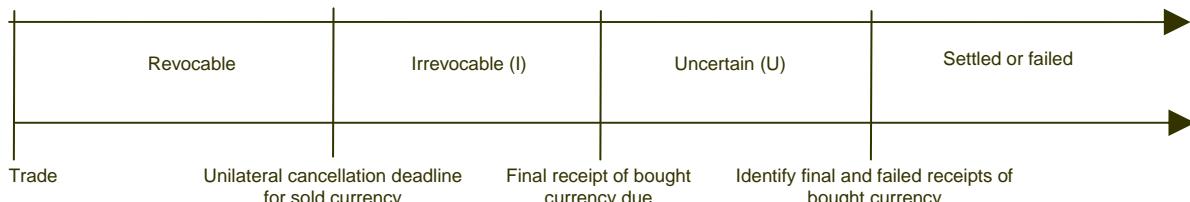
Size and duration of total exposures

Of the 45% of settlement obligations not settled by CLS, the major source of FX settlement risk is the use of traditional correspondent banking, which is considered in this section.⁸ Although major progress has been made in reducing aggregate FX settlement exposures, the size and duration of the exposures resulting from the \$1.2 trillion of obligations still settled by traditional correspondent banking remain significant. Traditional correspondent banking leads to exposures when settling FX trades because there is no direct link between the payment of the two currency legs and thus there is a risk of paying the currency sold but not receiving the currency bought. The risk can materialise for various reasons – for example, because of a technical failure by a counterparty to meet its obligations on time (the typical cause of failed trades) or, more seriously, because of a counterparty's financial difficulties (including possible default because of insolvency).

An institution's exposure begins when it can no longer unilaterally cancel its instruction to pay the currency it is selling, and ends when it receives with finality the currency it is buying. This defines the so-called irrevocable (or I) period (see Chart 1). During this irrevocable period the institution has the same exposure as if it had extended credit to its counterparty – ie it is exposed to credit and liquidity risk to the full value of the bought currency.⁹

In addition, many institutions do not routinely check whether they have received the currencies they are buying until some time after the receipts are due, creating a period of uncertainty regarding their actual exposure after the I period has ended. Since it is possible that the bought currency was *not* received when due, during this so-called uncertain (or U) period an institution might still be exposed to its counterparty for the full amount.

Chart 1
Foreign exchange settlement process: the changing status of a trade



For a given institution, the times when exposures start and finish will vary from currency to currency and thus the size of its exposures to the trades settling on a given day will vary over time. For the survey institutions, Chart 2 shows the estimated average exposure profile of an institution related to a single day's settlement obligations to all its counterparties.¹⁰ These total exposures are shown as a percentage of the total value of the institution's obligations settled by traditional correspondent banking. The solid line (I basis) shows, at each point in

⁸ "On-us settlement with risk" is not considered here because, for the market as a whole, the amounts are not significant; however, it is nevertheless important that any individual institutions for which this is a significant settlement method do control the risks appropriately. Bilateral netting is considered further below.

⁹ Note that this settlement risk is in addition to the replacement cost risk that exists from the moment the trade was originally struck. Replacement cost risk is the risk that, on or before the settlement day, the counterparty to the trade will fail to meet its obligations and the trade has to be replaced with a new one at a price that is less favourable.

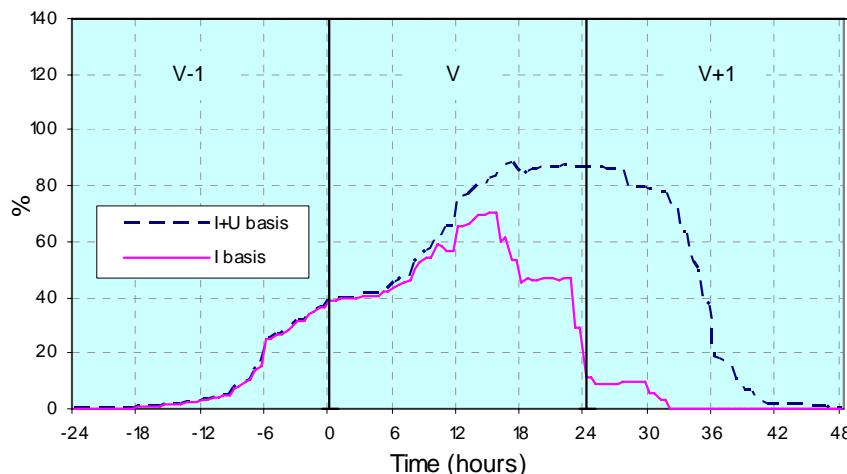
¹⁰ Two key qualifications concerning the exposure estimates given in this report should be noted. (1) The estimates are on the assumption that the underlying trades were spot or forward (or were swaps in which the first transaction was spot or forward) and thus will be *overestimates* to the extent that institutions had same day trades, where exposure durations are shorter. (2) However, because of incomplete information about the currency pair breakdown of the settlement obligations, they are likely to be *underestimates* to the extent that an institution has significant activity in certain currency pairs (this will mostly affect estimates of the *maximum* exposure of an institution). Different institutions will be affected in different ways by these two qualifications. See Annex 3 of Part II for more details.

time, the actual exposure assuming bought currencies are received when due; the dotted line (I+U basis) also includes the potential additional exposure to trades whose status is uncertain because the institution has not yet checked whether the bought currency has in fact been received.¹¹ In practice, the percentage of failed trades is low, so an estimate of an institution's actual total exposure is likely to be much closer to the I profile than the I+U profile. However, the I+U profile is particularly important when, as part of its risk management, an institution needs to make sure it does not underestimate its potential exposure to an individual counterparty. Chart 2 shows that, for the survey sample as a whole, the \$1.2 trillion of daily obligations settled by traditional correspondent banking generate exposures on a single day basis that reach an estimated maximum of \$0.9 trillion (ie 71% of \$1.2 trillion) for the I period and \$1.1 trillion (88%) for the I+U period.¹²

Chart 2

Average exposure to a single day's settlement obligations

Shown as a percentage of total obligations settled by traditional correspondent banking



It is clear from Chart 2 that the duration of FX settlement exposures remains significant – on average, significantly more than 24 hours. Although this is in part due to time zone differences, much of it reflects internal banking practices and correspondent banking arrangements. For example, the I period will begin before Day V (the settlement or "value" day) if an institution sends the payment instruction to its correspondent before Day V and the correspondent has said that it can cancel it on Day V only on a best efforts basis (ie there is no guarantee that it will be able to cancel). At the same time, the U period will continue into Day V+1 if an institution waits until then before identifying, from the information received from its correspondent, whether the bought currency has in fact been received.

Moreover, while the chart shows the average position, the longest exposure durations seen for individual institutions lasted for more than three business days for some currency pairs. FX settlement risk is therefore not just an intraday phenomenon. In fact, an estimated 39% of the exposures begin one or more days before settlement day and (on an I+U basis) an estimated 87% last at least until the next business day. Indeed, the survey showed that there has been little or no overall progress in reducing durations since the 1997 survey.

The length of the durations also means that most institutions are, at least for some of the time, exposed to the value of more than one day's settlement obligations. Chart 3 shows the

¹¹ To the extent that in practice some trades do fail, exposures will continue into the F (failed) period.

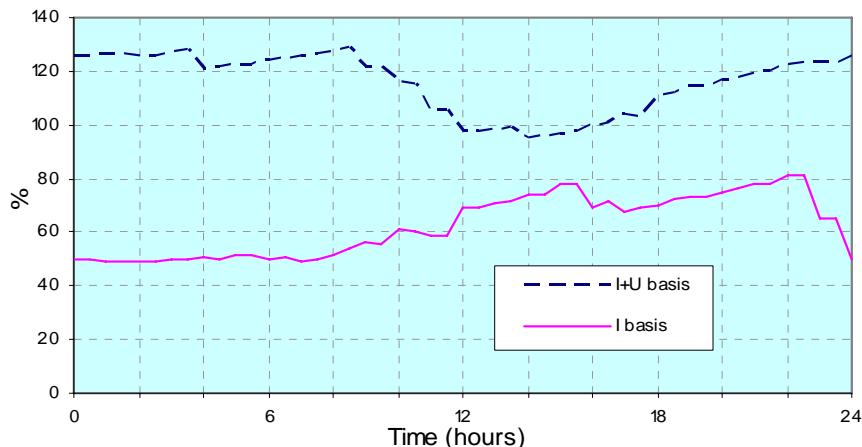
¹² Primarily because of time zone differences, which mean that the settlement of some currency pairs creates no exposure, the value of the actual maximum settlement exposure to a single day's trades is usually less than the value of the relevant settlement obligations (or potential exposure) - eg \$0.9 trillion and \$1.1 trillion are less than \$1.2 trillion. See Section 4.2 of Part II for an explanation.

average exposure to multiple days' settlement obligations. It is based directly on Chart 2 but allows for the fact that, during Day V, an institution may at times also be exposed to trades due to settle on V-1 (or even earlier) and those due to settle on V+1 (or even later).¹³ Note that, on this multiple day basis, an institution's maximum exposure on a given day can exceed the value of the trades due to settle on that day (particularly on an I+U basis). For the survey sample as a whole, the \$1.2 trillion of obligations settled by traditional correspondent banking generated exposures on a multiple day basis that reached an estimated maximum of \$1.0 trillion (ie 81% of \$1.2 trillion) for the I period and \$1.6 trillion (129%) for the I+U period.

Chart 3

Average exposure to multiple days' settlement obligations

Shown as a percentage of total obligations settled by traditional correspondent banking



Individual institutions' total FX settlement exposures were in some cases also significant when compared to the size of the institution's capital (ie rather than to the size of its total obligations settled by correspondent banking, as in the measures above).¹⁴ For instance, an institution's total multiple day settlement exposure to all its counterparties was, on average, 57% of capital on an I basis and 83% on an I+U basis. However, there was wide variation about the average, with some institutions having negligible total exposures while others had total exposures that were three to six times the size of their capital.

Largest bilateral exposures

An individual institution's largest settlement exposure to a single counterparty (ie largest bilateral exposure) was also estimated. Survey data were collected on institutions' total FX settlement obligations to their top 5 counterparties. Using plausible assumptions about the relationship between total obligations and exposures, it was possible to use these data to make an estimate for each institution of the range within which its largest bilateral exposure lay.¹⁵ Table 2 gives information about the upper and lower ends of these ranges.

¹³ Unlike Chart 2, Chart 3 shows the exposure profile for only one day. This is because the survey data were average daily values, so there is no need to show more than one day in the chart. In reality, an institution's settlement obligations are likely to vary each day and its profile will therefore vary each day.

¹⁴ Total capital (rather than some other measure such as total assets) was chosen as a proxy for the size of an institution so that the figures on aggregate total exposures given here would be comparable to those for institutions' exposure to individual counterparties, given below. Broadly speaking, total capital is Tier 1, 2 and 3 capital according to the definitions of the Basel Committee on Banking Supervision, subject to the relevant limits and deductions.

¹⁵ The method used to calculate these estimates of the largest exposure to a single counterparty is set out in detail in Part II, Annex 3.

Because the estimated ranges were quite wide, an estimate was also made of where *within* the range the largest exposure was likely to be. These "indicative" estimates of the largest bilateral exposures are also shown in Table 2. Estimation of these "indicative" points required assumptions that were more demanding than those used to calculate the ranges and therefore the scope for error is greater. However, the likelihood is that the indicative values are underestimates – ie the actual largest bilateral exposures will be greater than those estimated here.¹⁶

Table 2
Estimated largest bilateral FX settlement exposures

Range within which an institution's largest exposure to a single counterparty was estimated to lie.
Multiple day, 1 basis

Estimated largest exposure to a single counterparty as % of total capital	Daily average		Peak day	
	% of institutions (unweighted)	% of institutions (weighted)	% of institutions (unweighted)	% of institutions (weighted)
<i>Lower end of range:</i>				
Less than 5%	81%	88%	65%	72%
5 to 10%	13%	8%	19%	19%
More than 10%	6%	4%	16%	10%
<i>"Indicative" value within range:</i>				
Less than 5%	73%	81%	48%	51%
5 to 10%	14%	11%	29%	36%
More than 10%	12%	8%	23%	14%
<i>Upper end of range:</i>				
Less than 5%	35%	39%	19%	18%
5 to 10%	24%	26%	17%	21%
More than 10%	41%	35%	64%	61%

Based on 83 institutions for which sufficient data were available. The weights used were institutions' total capital.

As already noted, the survey data were daily averages for April 2006. On peak days bilateral exposures may have been higher. Table 2 therefore also gives estimates of peak day exposures, based on daily data provided by CLS.¹⁷

Table 2 shows that bilateral exposures for some institutions were likely to have been significant. For example, it shows that the largest bilateral exposure exceeds 10% of capital

¹⁶ This is also explained in Part II, Annex 3.

¹⁷ The ratio of peak day value to average day value was based on the average of CLS settlement members' positions with their large counterparties. Some individual ratios were significantly higher than this. On the other hand, it is possible that the volatility in the daily value of obligations settled by traditional correspondent banking is less than the volatility of obligations settled through CLS insofar as the former are constrained by counterparty limits (because of the exposures generated) whereas, for some institutions, the latter are not.

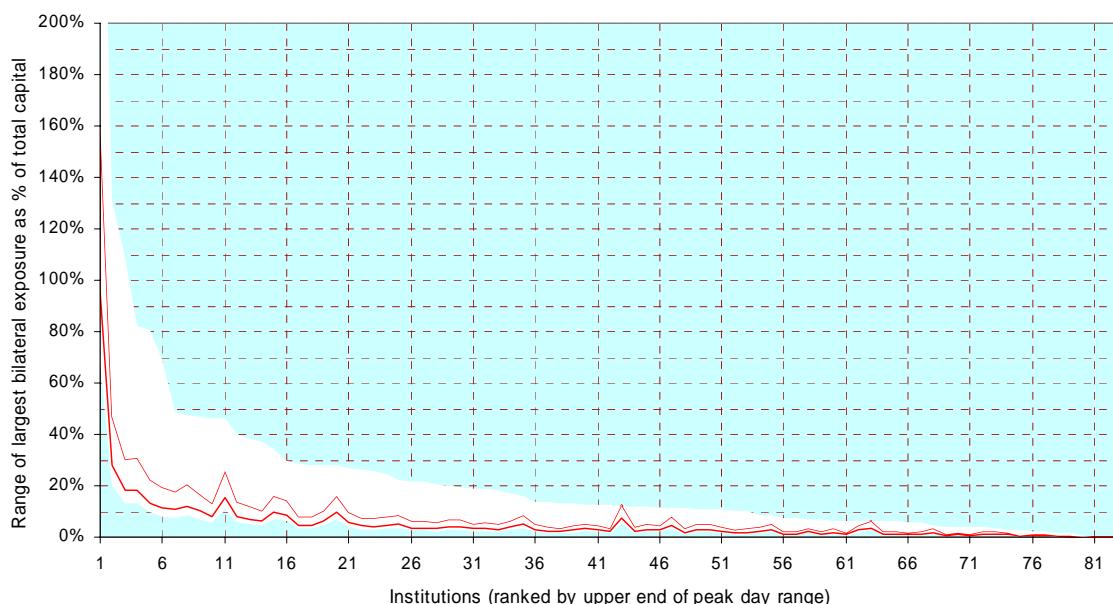
for 12% of institutions on a daily average basis and for 23% of the institutions on a peak day basis.

Chart 4 expands on Table 2 by showing for each institution the lower end of its daily average range and the upper end of its peak day range, as well as its daily average and peak day indicative values.

Chart 4

Estimated largest bilateral exposures by institution

Based on data for 83 institutions for which adequate data was available. Multiple day, 1 period exposures. The white shaded area shows the range (from the lower end of the daily average range to the upper end of the peak day range). The solid line is the average day indicative value. The dashed line is the peak day indicative value



In interpreting these bilateral exposure estimates, two important qualifications should be noted.

- First, as mentioned above, the size of the exposures that result from a given value of FX settlement obligations depends on the currency composition of the obligations. The estimates here assume that the currency composition of the settlement obligations that resulted in the largest bilateral exposure of an institution was the same as the average composition for that institution. To the extent that, in reality, the relevant obligations actually had a *different* currency composition, actual bilateral exposures could be higher or lower than the estimates.
- Second, the survey estimated the size of the largest bilateral exposures. This does not indicate the probability of the occurrence of an actual loss or what the consequences of such a loss would be. A judgment on this would depend on also having additional information such as the identity of the counterparty (and hence the degree of risk) and the institution's overall risk profile, including the other exposures it had to the same counterparty.¹⁸

¹⁸ The *Supervisory guidance for managing settlement risk in foreign exchange transactions*, issued by the Basel Committee on Banking Supervision in September 2000, says that "it is critical that banks' measurements of FX settlement exposures and associated risks are integrated into their overall risk measurement and management processes. In particular, banks have increasingly adopted consolidated risk measurement and

Control of exposures

A judgment about the implications of the bilateral exposures would also need to consider how well the institution controls the exposures. In this respect, the survey revealed that there was continued room for improvement. "Control" was judged by three broad criteria.

- On the positive side, 92% of survey institutions had established clear *senior level responsibility and authority* for managing FX settlement exposures with individual counterparties.
- In addition, 77% of institutions also had appropriate *daily management procedures* (including the use of counterparty limits) for their settlement exposures. Whether the procedures were "appropriate" or not was judged by whether they were equivalent to those for other credit extensions of similar size and duration – for example, whether \$1 million of settlement exposure to a given counterparty was treated in the same way as a \$1 million short-term credit exposure to that counterparty.

On the negative side, however, the latter figure shows that there were still a significant number of institutions (ie 23%) which, in their daily risk management procedures, did not treat FX settlement exposures in the same way as other short-term credit extensions.

- Furthermore, 63% of the surveyed institutions *measured* their exposures in a way that at least to some extent underestimated the amounts they had at risk. Underestimation (of both I and U periods) typically occurred because institutions failed to capture the extent of their overnight exposures. The implications of this may vary depending on the circumstances in which the underestimation occurs and the extent to which the institution mitigates its effects. For some institutions, the underestimation may only be for a few hours in infrequently traded currencies. However, in many cases underestimation was more widespread. Moreover, even measurement methods that work well in normal circumstances may not be adequate when conditions and behaviours are abnormal, such as in a financial crisis. In these circumstances they may complicate control of the exposures because the institution does not have the information to determine its true position in a timely manner.¹⁹

These various weaknesses mean that, judged overall by these three specific survey criteria, only 34% of the surveyed institutions could be said to fully control their traditional FX settlement exposures – ie only 34% met all three criteria. This finding indicates no significant improvement in this area since the 1997 survey, when 35% of institutions had fully appropriate controls.²⁰ Moreover, the institutions which did not have fully appropriate controls included some of the institutions with the largest exposures relative to capital. A comprehensive judgment about whether FX settlement exposures are being appropriately managed would need to take into account, for each institution, the wider framework within which its risk management takes place. Nevertheless, the findings here do suggest that there may be cause for concern in some cases, warranting further investigation by such institutions.

capital allocation methodologies, a trend that supervisors have strongly supported. Where such methodologies are used, appropriate measures of FX settlement risk should be included so that internal capital allocations properly reflect the risks associated with this activity."

¹⁹ The *Supervisory guidance for managing settlement risk in foreign exchange transactions* (*ibid*) says that "Estimation techniques can be appropriate - but only if they do not significantly underestimate exposures. [...] Where estimation techniques are used, management should therefore be able to demonstrate clearly how settlement exposure is measured and that, even in abnormal circumstances, the estimation techniques will not significantly underestimate the exposure."

²⁰ Note that not all the institutions in the 1997 survey participated in the (larger) 2006 survey and vice versa.

The need for further progress

The survey evidence shows that the situation of individual institutions varies considerably. There are some institutions - both large and small - that use PVP services as much as they can and that also appropriately control any exposures that result from remaining trades that they have to settle using traditional correspondent banking. However, at the other end of the range are institutions that make little or no use of PVP settlement and/or have significant exposures that are not always well controlled. Overall, therefore, it seems that although significant progress has been made, there is a need for more to be done.

Individual institutions can take further steps to reduce and to control appropriately their remaining FX settlement exposures. However, further progress in these respects depends above all on four factors: first, the scope for existing and prospective service providers to offer new risk-reducing services for settling FX trades; second, the extent to which the potential risks from using bilateral netting are robustly controlled; third, changes in the use of traditional correspondent banking; and fourth, and perhaps most importantly, the incentives for individual institutions to reduce and control appropriately their remaining exposures.

PVP settlement services

The fact that \$1.2 trillion of FX obligations are still subject to settlement risk as a result of the use of traditional correspondent banking arrangements is partly due to the fact that some FX trades cannot be settled using existing PVP settlement services. For instance, the survey showed that at least 36% (\$0.4 trillion) of the FX obligations subject to settlement risk were between CLS users, and discussions with the surveyed institutions suggest that much of this was accounted for by same day and certain next day trades, trades involving a non-CLS currency or the outside leg of "in/out" swaps.²¹ These are trades that currently cannot be settled using CLS, due to either the current timing of the CLS settlement cycle or, in the case of non-CLS currencies, ineligibility to settle in CLS. Accordingly, to reduce settlement risk on these trades it would be necessary either for changes in the CLS service to be made to enable them to settle there or for the trades to be included in some other risk-reducing settlement arrangement.

For the remaining 64% (\$0.8 trillion) of the obligations still subject to settlement risk, a proportion also cannot currently settle in CLS for the reasons just given. However, the more significant issue here is likely to be the number of FX traders who are not currently using PVP or other available settlement methods to reduce risk. To a certain extent this may be transitory. CLS has shown trend growth since it started operations; indeed, the April 2007 daily average was 23% higher than that during the survey period a year earlier. Seventy-five per cent of the surveyed institutions expect CLS to increase its overall share in industry-wide settlements over the next one to three years by at least another 10 percentage points (ie to 65% or more). Furthermore, 53% of the surveyed institutions (including 55% of current non-users of CLS) expect to settle more of their own trades through CLS, reflecting an expectation that a growing number of trading counterparties will become CLS users and/or that CLS will introduce new services for settling FX trades.

Bilateral netting

Bilateral netting is sometimes carried out to reduce the size and number of payments and thus to reduce liquidity needs and operational risk. It can also be a safe and efficient method for reducing settlement exposures, provided it is conducted under legally robust arrangements. In the survey, 70% of the institutions that used bilateral netting did so at least in part to reduce settlement risk.

²¹ For an explanation of in/out swaps see "The daily CLS process" in Annex 4.

However, bilateral netting on its own may reduce but not eliminate exposures – ie the netted positions may be positive rather than zero. If so, these netted obligations need to be settled by another method such as traditional correspondent banking. The size of the netted obligations, and thus the potential settlement exposures, depend on the value and pattern of the trades between the two counterparties. Where the size is significant, it is important that these exposures are appropriately controlled or that they are avoided by the use of PVP settlement methods.

Some institutions have indicated a growing interest in the use of bilateral netting. At the time of the survey 17% of institutions expected there to be a significant increase (of 10 percentage points or more) in the market share of bilateral netting (and 8% expected an increase in their own institution's use of netting). Subsequent discussions with some market participants suggest that potential interest may have grown since April 2006, not least because of the growth of algorithmic trading (see below).

Traditional correspondent banking

The future use of traditional correspondent banking will depend largely on institutions' decisions about using PVP and bilateral netting. However, institutions were less certain about a decrease in the market share of traditional correspondent banking than they were about an increase in the market share of PVP and bilateral netting (noted above): only 27% expected a significant decline in traditional correspondent banking's share of FX settlement. Moreover, as far as their own institution's use of traditional correspondent banking was concerned, it is not clear that there will be significant improvements in the durations of the resulting exposures: only 9% of survey institutions were planning to reduce their I period and only 17% their U period.

Incentives to improve and the risk of backsliding

In order to ensure the further reduction and improved control of remaining exposures and to guard against a risk of reversing progress already made, it is important that institutions have clear internal and external incentives. In this respect, the survey provides a mixed picture.

On the one hand, the positive aspect is that 67% of the surveyed institutions had broad internal policies that favoured the use of risk-reducing settlement methods such as CLS. A further 6% had policies that considered both risk reduction and cost. And only 9% had policies where the choice of settlement method was based on cost but not risk reduction.²² Moreover, 76% of institutions that used CLS had daily management procedures that recognised the virtual elimination of exposures when using this settlement method (eg the settlement obligations concerned were not charged against counterparty limits). This is basically in line with the widely shared expectation in the survey of the greater use of CLS in the future, as noted above.

On the other hand, less encouraging is the fact that many institutions underestimate their exposures to at least some extent and thus some may be unaware of the true scale of the risks they face. At the same time, an estimated 88% of institutions fail to account for the full range of costs associated with the different available settlement methods. In particular, there was evidence from the survey that while more transparent costs such as explicit fees may be recognised when comparing methods, less transparent cost savings such as lower cash management costs, higher straight through processing rates or other operational efficiencies were often not fully taken into account.

Accordingly, the broad risk-based policies of many institutions do not appear to be underpinned across their individual business units by a coherent set of risk-measurements, cost-benefit calculations and incentives. This raises the potential for ill-informed future

²² The remaining 18% of institutions had no broad policy on the choice of settlement method.

choices about which settlement method to use. In particular, some institutions may find that their broad internal policies that favour risk-reducing methods are challenged from time to time by individual business units that face narrower financial incentives and changing cost pressures.

At the same time, many institutions felt that there were no strong external incentives for them to make further efforts to reduce or control their remaining FX settlement exposures. Given this, it is perhaps not surprising that many institutions indicated that some form of action such as new settlement services or regulatory pressure might be needed for them to make further improvements in their management of FX settlement risk. For instance, 47% of institutions indicated that further support would be needed from industry groups, while 44% cited central banks and 52% cited supervisors or other regulators. Only 6% said they would need no external support at all.

Growth in activities such as algorithmic trading could bring particular near-term tension between risk reduction and cost cutting.²³ A significant rise in these activities may, in aggregate, generate high values of FX settlement obligations, and thus potential exposures, that need to be appropriately controlled. In particular, the trading activities may increase obligations to the non-bank financial institutions that are the major participants in these markets. At the same time, the nature of these activities means that the associated settlement obligations would generally result from high volumes of low-value individual trades; in these circumstances, settlement costs may be a significant proportion of the potential profits and so institutions would naturally seek to minimise those costs. The concern is therefore that, in a competitive market, cost cutting may take precedence over risk management and lead towards a greater use of less safe settlement methods. Developments such as this may not just limit further progress but actually raise the potential for significant backsliding – ie there is a risk that some institutions that have already taken steps to reduce and/or better control their exposures may now reverse their position.

Recommended further action

The survey evidence above suggests that the central bank strategy has achieved significant success but further action is needed to tackle remaining large and long-lasting exposures that may still present systemic risk and to address a risk of backsliding.

In the light of this, the following actions are recommended. These actions are designed – through direct action taken by individual institutions, through new services and education efforts by industry groups and through support for all these actions by central banks – to enable institutions to reduce and/or better control their exposures.

Action by individual institutions

- Control remaining exposures appropriately.
 - Where they continue to exist, large and long-lasting exposures can be reduced through the use of currently available settlement services. For instance, individual institutions could encourage their counterparties to use CLS or other PVP arrangements. They could also consider using bilateral netting to reduce exposures, in which case it would be important to ensure that such arrangements are legally sound and that the resulting bilateral exposures are appropriately controlled or are avoided by the use of PVP settlement methods.

²³ Algorithmic trading is automated trading using algorithms to decide when and what to trade. Sometimes this trading involves dividing a potential trade for a large amount into a set of smaller trades that are less likely to affect the market price, with the algorithm using real-time information about the market to decide the size and timing of the smaller trades. Some estimates suggest that about 7% of the total value of FX trading is algorithmic.

- It is also possible to shorten the duration of settlement exposures by adjusting internal payment practices and correspondent banking arrangements to eliminate unnecessarily early payment cancellation deadlines. Similar adjustments can also be made to reduce long periods of uncertainty regarding the receipt of purchased currencies.
- Irrespective of any other measures taken, all institutions should take immediate steps to avoid underestimating the risk they incur both intraday and overnight given the full size and duration of their remaining FX settlement exposures.
- They should also maintain or establish clear senior-level responsibility and authority for managing exposures with individual counterparties and appropriate daily management procedures for these exposures (such as the application of limits) which recognise that the exposures are similar to other short-term credit extensions.
- Ensure that institution-wide business policies - through appropriate risk measurement and cost-benefit calculations - are based on fully informed and appropriate choices among available settlement methods that take into account their risk-reduction effects. Ensure also that individual business units have appropriate incentives and controls to follow the institution-wide policy.

Action by industry groups

- Providers of PVP settlement services, such as CLS and other existing or prospective industry groups, should continue to develop services for settling FX trades that contribute to the risk-reducing efforts of individual institutions. Particular emphasis should be placed on possibilities for settling same day and certain next day trades, as well as trades involving additional currencies and counterparties.
- Foreign exchange committees and other industry groups should encourage further progress and heighten awareness among their members of the implications of backsliding for the risks faced by individual institutions, their counterparties and the financial industry more broadly.

Action by central banks

- Encourage continued improvement, warn against potential backsliding and heighten awareness of the need for further action.
- If the industry identifies opportunities for new FX settlement services (for example, for same day trades or additional currencies) that will offer significant benefits in reducing systemic risk, central banks will consult with the industry to establish whether changes to the large-value payment systems they operate (such as the operating hours) are necessary and desirable (eg so that, despite time zone differences, there is sufficient overlap with the operating hours of systems in other currencies to enable PVP services to be provided).
- Where relevant and appropriate, identify and take any further action needed to support potential improvements in local payments law (eg regarding finality) and the operations of large-value payment systems that would support the safe and efficient settlement of FX trades involving the central bank's currency.
- Work with banking supervisors to explore options that could ensure on an ongoing basis that banks apply appropriate risk management procedures to their FX settlement exposures, thereby addressing FX settlement exposures that remain large and guarding against the potential reintroduction of excessive exposures.
- Work with regulators of non-bank financial institutions that have existing or potentially significant FX settlement exposures to explore options similar to those of the banking supervisors.

- Continue to oversee FX settlement service providers such as CLS in order to assess their compliance with relevant international standards, particularly as they seek to introduce new services.
- Continue to monitor developments regarding the availability and use of different FX settlement methods, and the risk of backsliding, given their potential implications for global financial system stability.

Part II: Survey results

1 Introduction: background to the survey

Part II of this report sets out the findings of the survey and presents evidence supporting the assessment and recommendations contained in Part I. This section of Part II sets out the background to the survey. Section 2 gives an overview of the survey in terms of content and coverage. Each of the three main settlement methods currently used is then examined in more detail. Section 3 looks at CLS, Section 4 at traditional correspondent banking and Section 5 at bilateral netting. Finally, Section 6 considers some factors influencing the choice of settlement method.

1.1 The 1996 strategy and why it was needed

In 1996, the Governors of the central banks of the Group of Ten (G10) countries endorsed a strategy aimed at containing the systemic risks inherent in the methods used for settling foreign exchange (FX) trades. These systemic risks had nearly materialised in a few well publicised events, where individual institutions had suffered significant losses related to the settlement of their FX trades following the failure of one of their counterparties.

FX settlement risk, which arises under traditional settlement methods, stems from the lack of a direct link between the delivery of the two currencies involved in a trade. In 1996, FX trades were generally settled gross by traditional correspondent banking, in which the value of each side of the trade is transferred between the counterparties independently. With such settlement, each counterparty is exposed to the full value of the trade from the moment at which the payment order to deliver the sold currency is irrevocable to the moment at which the bought currency is received with finality. In addition to such credit risk, FX settlement risk also includes elements of liquidity, replacement and operational risks.

At the time the strategy was launched the scale of exposures arising from FX trades was such that the failure of a counterparty in the FX market could potentially have caused systemic risks to materialise. The size and duration of the exposures tended to be underestimated and risk management measures were often inadequate. Netting the obligations was the only alternative settlement method available. Netting can reduce the level of exposures, provided the netting is supported by a robust legal underpinning. However, given the size of the FX market, bilateral netting was not, at that time, considered sufficient to reduce exposures to acceptable levels.

The 1996 report on *Settlement risks in foreign exchange transactions* (the Allsopp Report) therefore laid down a three-track strategy to reduce the systemic risks associated with FX settlements (Box 1). The strategy was based on central banks' belief that private sector institutions have the ability through individual and collective action to significantly reduce these systemic risks.

1.2 Developments since 1996

Since 1996, much progress has been made on the three tracks of the strategy. Most importantly, with regard to the second track, CLS Bank (CLS), a payment-versus-payment (PvP) service settling foreign exchange trades, started operations in 2002. Under the first track, individual institutions have reduced their FX settlement exposures by using CLS. In some cases, they have also taken steps to reduce or to control them better by improving their internal settlement processes (although, as shown in Section 4 below, collectively there has been no significant improvement in this respect). Central banks have supported the strategy under the third track by various actions such as enhancing their payment systems (including longer opening hours and improved liquidity facilities to assist CLS operations), improving the legal foundations of payment and settlement arrangements, and increasing market awareness of FX settlement risks (see Annex 1 for a summary of the action taken by central banks and other authorities to support the strategy).

Ten years after the strategy was launched, and four years after CLS started operations, central banks considered that it was an appropriate time to assess the extent to which the objective of the strategy had been achieved. To this end, the Committee on Payment and Settlement Systems (CPSS) organised a survey of FX settlement which was carried out in the second quarter of 2006. This survey updates and extends previous surveys carried out in 1996 and 1997. Comparisons between the 2006 and 1997 survey results are given if available but the more limited scope of the 1997 survey means that a comparison is often not possible.

Box 1

Central bank strategy to reduce FX settlement risk (1996)

Action by individual banks to control their FX settlement exposures

Individual banks should take immediate action 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 multicurrency services

Industry groups are encouraged to develop well constructed multicurrency services that would contribute to the risk-reduction efforts of individual banks. This recognises the significant potential benefits of multicurrency settlement mechanisms and bilateral and multilateral obligation netting arrangements, and the G10 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 payment 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.

2 Overview of the survey

2.1 Content of the survey

The survey consisted of two main parts. First, there was a quantitative part covering April 2006, in which institutions were asked to provide data on the settlement methods they used. Second, there was a qualitative part involving a set of questions about such matters as how institutions controlled their FX settlement exposures; institutions answered these questions usually in a discussion with the relevant central bank, but sometimes in written form, on the basis of which the central bank completed a checklist about the institution. The survey materials sent to reporting institutions are in Annex 2.

2.2 Reporting institutions

The survey involved 109 reporting institutions from 26 countries (namely, the 26 countries of the 15 CLS currencies).²⁴ The surveyed institutions reported average daily FX settlement obligations in April 2006 that had a total gross value of \$3.8 trillion. Table 3 provides a breakdown of the reporting institutions according to the type of institution.²⁵

Table 3
Breakdown of reporting institutions by institutional type

	Number of institutions	Total value of settlement obligations (\$ trillions)	Total value of settlement obligations (%)
CLS members	48	3.3	87%
CLS third parties	41	0.4	11%
All CLS users	89	3.7	98%
Other banks	18	0.1	2%
Other non-bank financial institutions	0	0	0%
Other non-financial institutions	2	0.0	0%
All non-CLS users	20	0.1	2%
Total	109	3.8	100%

The reporting institutions from each country were chosen primarily by selecting the smallest number needed to cover 80% of the turnover of the foreign exchange market in the country or currency area.²⁶ Some additional institutions were selected to give a broader range of institutional types and sizes.

²⁴ The 15 CLS currencies are those named in Table 7. The 26 countries involved were the 12 countries of the then euro area (namely, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain) plus the countries of the other 14 currencies (Australia, Canada, Denmark, Hong Kong SAR, Japan, Korea, New Zealand, Norway, Singapore, South Africa, Sweden, Switzerland, the United Kingdom and the United States). The 27 central banks involved were those of the 26 countries plus the ECB.

²⁵ Note that the "CLS members" and "CLS third parties" categories both include some non-banks as well as banks.

²⁶ The objective of covering 80% of FX market turnover was achieved except perhaps in two cases where data from some reporting institutions were not used because of their poor quality or some invited institutions did not participate. However, even in these two cases the coverage was not substantially below 80%.

Most reporting institutions provided one set of survey data, covering either their consolidated global operations or their operations in the country in which they were incorporated. However, some institutions provided multiple sets of data, each one covering their operations in a different financial centre. Allowing for this, the 109 institutions provided 168 sets of data (ie the survey included data on 168 "entities"). Most of the results in this report are given on an institutional basis which, for an institution with multiple entities, involved aggregating the data of its different entities; any exceptions to this are noted in the text.

2.3 Counterparties

Table 4 provides an analysis of the counterparties of the reporting institutions using the same institutional categories as for the analysis of the reporting institutions themselves in Table 3. However, it was evident that activity with counterparties who were CLS users was sometimes misclassified in the survey as activity with non-CLS users. The extent of this misclassification is unknown.²⁷

Table 4
Breakdown of counterparties by institutional type

Value of total settlement obligations accounted for by counterparties of the indicated type

	\$ trillions	Percentage
CLS members	2.2	58%
CLS third parties	0.4	11%
All CLS users	2.6	69%
Other banks	0.5	13%
Other non-bank financial institutions	0.5	12%
Other non-financial institutions	0.2	5%
All non-CLS users	1.1	30%
Total	3.8	100%

2.4 Reporting institution and counterparty breakdown

Based on Tables 3 and 4 above, Tables 5a and 5b analyse the total value according to the institutional type of both the reporting institution and its counterparties. For simplicity, institutions and counterparties are divided into just two institutional types: CLS users and others (ie non-CLS users).

²⁷ Most of the misclassification is likely to have come from CLS users who, due to internal systems limitations, only allocated to the counterparty category "CLS users" those trades that actually settled through CLS; trades settled by other means (in particular, by traditional correspondent banking) were all allocated to the non-CLS counterparty categories regardless of whether the trades were with CLS users or non-users. Some misclassification also came from non-CLS users who, understandably, were not always aware whether a counterparty was a CLS user or not and thus who allocated all trades to the non-CLS counterparty categories.

Tables 5a and 5b

Analysis of the survey data by institutional type

		Reporting institutions					Reporting institutions		
Counterparties	\$ trns	Total	CLS	Other	Counterparties	%	Total	CLS	Other
	Total	3.8	3.7	0.1		Total	100%	98%	2%
	CLS	2.6	2.6	0.1		CLS	70%	69%	1%
	Other	1.1	1.1	0.0		Other	30%	29%	1%

2.5 Concentration among reporting institutions

As shown in Table 6, the \$3.8 trillion of settlement obligations were concentrated among certain reporting institutions. For example, the ten institutions with the largest total settlement obligations accounted for over half of the total value.

Table 6

Concentration of total settlement obligations among reporting institutions

	Percentage share of value of total settlement obligations in survey
Five institutions with the largest total obligations	34%
Ten institutions with the largest total obligations	53%
Remaining 99 institutions	47%
<i>By quartile:</i>	
Q1 (largest)	84%
Q2	12%
Q3	4%
Q4 (smallest)	1%

2.6 Currencies

Table 7 gives the currency breakdown of total settlement obligations in the survey and shows that the breakdown is very similar to that for the whole FX market (based on the BIS 2004 triennial survey).²⁸

²⁸ See *Triennial central bank survey*, BIS, March 2005.

Table 7
Currency breakdown of total obligations

Currency	This survey	2004 triennial survey
US dollar (USD)	45%	44%
Euro (EUR)	20%	19%
Japanese yen (JPY)	7%	10%
Pound sterling (GBP)	7%	8%
Swiss franc (CHF)	4%	3%
Australian dollar (AUD)	3%	3%
Canadian dollar (CAD)	3%	2%
Swedish krona (SEK)	2%	1%
Hong Kong dollar (HKD)	1%	1%
Norwegian krone (NOK)	1%	1%
Korean won (KRW)	0%	1%
New Zealand dollar (NZD)	1%	1%
Singapore dollar (SGD)	1%	1%
Danish krone (DKK)	1%	0%
South African rand (ZAR)	1%	0%
All other currencies	3%	3%
Total	100%	100%

2.7 Overview of settlement methods

Data were collected on six different settlement methods (these are briefly described in Box 2). The breakdown of the \$3.8 trillion of settlement obligations according to settlement method was given in Table 1 earlier and is shown again here in Chart 5.

Chart 5
Breakdown of total settlement obligations according to settlement method

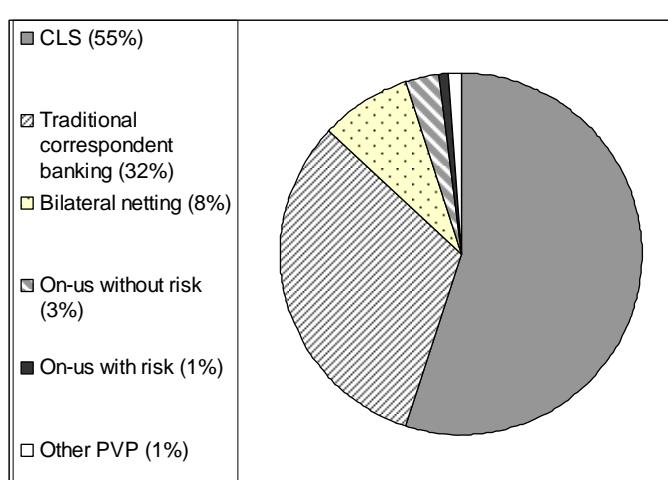


Table 8 gives the corresponding breakdown by currency for the three main settlement methods.

Table 8
Settlement methods by currency
Based on settlement obligations payable

Currency	CLS	Traditional correspondent banking	Bilateral netting (effect)	Other settlement methods
USD	55%	31%	8%	6%
EUR	58%	29%	7%	5%
JPY	62%	24%	8%	6%
GBP	54%	32%	9%	4%
CHF	58%	26%	8%	7%
AUD	58%	30%	8%	3%
CAD	38%	43%	13%	6%
SEK	66%	22%	6%	6%
HKD	47%	46%	1%	6%
NOK	70%	22%	4%	4%
KRW	30%	65%	2%	3%
NZD	59%	30%	7%	4%
SGD	52%	42%	3%	2%
DKK	74%	20%	2%	4%
ZAR	58%	33%	6%	3%
All other	-	84%	13%	3%
Total	55%	32%	8%	5%

CLS, traditional correspondent banking and bilateral netting are considered in more detail in the following three sections. Because they account for only a small proportion of the total, the other three methods are not considered further here.

Box 2

Settlement methods

CLS

When trades are settled using CLS, then, unlike in traditional correspondent banking, where the counterparties to a trade transfer the sold currencies to each other using their correspondent banks, the counterparties settle their trades on the books of a specialised FX settlement institution, CLS Bank, which ensures that the bought currency is paid out only if the sold currency is received (ie PVP). This removes virtually all principal risk. CLS is described in more detail in Section 3.

Traditional correspondent banking

Also known as gross non-PVP settlement. Under this settlement method, each counterparty to an FX trade transfers to the other counterparty the currency it is selling, typically using their correspondent banks in the currencies concerned. Because the transfer of the sold currency typically takes place independently of the transfer of the bought currency, this method exposes the counterparties to principal and liquidity risks to the full value of the trade. Traditional correspondent banking is described in more detail in Section 4.

Bilateral netting

Another long-standing method is bilateral netting, whereby the FX trades between two counterparties due on a certain date are netted and the net amounts then settled by another method (such as traditional correspondent banking). Provided the netting is legally valid, this reduces risk to the extent that the net amounts are smaller than the original gross amounts. Bilateral netting is considered in more detail in Section 5.

On-us settlement; with and without exposure to settlement risk

On-us settlement is where both legs of FX trades are settled across the books of a single institution. It can arise in various ways. One way is where a bank trades with one of its own customers, and that customer has an account with the bank in both the relevant currencies. A similar situation arises in reverse where a bank trades with its correspondent bank.

On-us settlement *with settlement risk* is where execution or authorisation of the relevant entry in the on-us account denominated in the currency being sold is *not conditional* upon the execution or authorisation of the corresponding entry in the on-us account denominated in the currency being bought - for example when final credit for the currency being sold is given without assurance that there will be covering balances or preauthorised credit lines that will cover the corresponding debit for the currency being bought.

On-us settlement *without settlement risk* occurs where execution or authorisation of the relevant entry in the on-us account denominated in the currency being sold is *conditional* upon the execution or authorisation of the corresponding entry in the on-us account denominated in the currency being bought - for example where either the accounting entries for settling obligations in both currencies are made simultaneously or there is certainty that they will be made within preauthorised credit lines.

Other PVP or equivalent settlement methods

In addition to CLS, another form of PVP, namely direct links between payment systems in the currencies being traded, exists in Hong Kong for trades involving EUR, HKD and USD (Hong Kong has local RTGS systems in each of these currencies).

This heading also includes the settlement obligations of trades that settle on the books of a single correspondent bank (ie where both counterparties have accounts at that bank in the relevant currencies) provided that bank explicitly offers a PVP service.

This category also includes any method that provides one counterparty equivalent protection against the loss of principal even if it does not provide the other counterparty with this protection. For example, this includes:

- (a) settlement obligations where the other counterparty has to prefund, to post collateral or to provide other guarantees equal to the full value of the currency being bought;
- (b) settlement obligations where one counterparty sends the payment instruction for the currency being sold only after it has definitely received the currency being bought.

3 Settlement using CLS

CLS was used to settle 55% (\$2.1 trillion) of the value of settlement obligations in the survey. Scaled up to the market as a whole, it is estimated that CLS's share was up to 54%.²⁹ As noted earlier, CLS was used by 89 out of the 109 institutions in the survey.

3.1 Effect of CLS

CLS works by, in effect, acting as a trusted third party between the two counterparties to an FX trade.³⁰ Each CLS member has a multicurrency account with CLS Bank and a trade is settled on the accounts of the two relevant members by simultaneously debiting the accounts by the amount of the currency being sold and crediting them by the amount of the currency being bought (ie PVP). Settlement of a trade takes place if, and only if, both parties to the trade meet all of CLS's risk controls, including retaining an overall positive balance on their accounts. Allowing for all its trades that are due to settle that day, a CLS member will have either a multilateral net short or long position in each currency. Those members with net short positions in a currency make payments to CLS Bank which CLS Bank uses to make payments to members with net long positions.

If for any reason a member fails to meet its obligations to pay (a "pay-in failure"), then principal risk to the counterparty is avoided because CLS can return to that counterparty the value of the currency it is selling. Moreover, to reduce liquidity risk in these circumstances, CLS has standing liquidity facilities with large banks so that it can, in effect, convert the currency the counterparty is selling into the one it is trying to buy despite the original member's pay-in failure; the value "returned" to the counterparty will thus generally be in the currency it was buying.³¹ The way CLS works and its risk management procedures are discussed in more detail in Annex 4.

To put the effect of CLS in context, calculations using survey data suggest that if the obligations settled by CLS had instead been settled via other available methods, settlement exposures would have been on average almost two to three times higher than reported. For example, if the \$2.1 trillion had been settled instead by traditional correspondent banking, the amount settled by that method would have increased from \$1.2 trillion to \$3.3 trillion. Alternatively, the \$2.1 trillion could have been settled by bilateral netting. Assuming that netting would have reduced the gross obligations by 50% (see Annex 3), this would have left just over \$1.0 trillion of net obligations to be settled by traditional correspondent banking, increasing the latter from \$1.2 trillion to \$2.3 trillion.³²

²⁹ This is slightly lower than the survey result of 55% because the survey contained a relatively large number of bigger institutions which are more likely to be CLS users. See Annex 3.

³⁰ CLS acts as the settlement institution but does not act as a central counterparty for FX trades. The trades remain the obligations of the counterparties themselves. At the same time, although this report, for simplicity, refers to CLS "settling FX trades", CLS actually settles not the trades themselves but the payment instructions arising from the trades.

³¹ However, although CLS can virtually eliminate principal risk, the same is not true for liquidity risk. This is primarily because, although CLS settles individual trades on a gross basis, the amounts to be paid in are calculated on a multilateral net basis assuming all trades will settle. A pay-in failure by a CLS member may cause some trades to fail to settle, and thus cause the net amounts others have to pay in to be recalculated at short notice. Thus, for example, a member might initially expect to be long in a currency, assuming all its trades settled, and thus expect not to have to pay anything to CLS. However, if the pay-in failure caused some trades to remain unsettled and thus be removed from the net pay-in calculation, it might instead become short in the currency and thus need to pay funds to CLS at short notice.

³² This analysis of the effect of CLS needs to be slightly qualified because, by removing risk, CLS may have enabled institutions to trade more within existing counterparty limits; thus, if CLS had not existed, some of the market growth, and thus some of the potential exposures that CLS has removed, might not have existed.

3.2 Growth and potential growth in CLS

Growth since 2002

CLS has shown trend growth since the start of the service in 2002 (Charts 6a and 6b). This growth is the result of the increasing value and volume of trades settled by CLS members plus the increasing activity of third-party users (ie customers of members).

CLS now settles trades in 15 currencies (as shown in Table 7 earlier), an increase from the original seven currencies. The number of members (56 at the time of the survey) has not changed substantially over the period: exits as a result of mergers between existing members have been largely offset by new members joining as a result of additional currencies being included in the service. The number of third-party users increased to over 700 by the time of the survey, with the figure currently standing at around 1300. Of the 700 third party users in April 2006, 244 were banks, 18 were non-bank financial institutions, 19 were corporates and most of the rest were funds.

Chart 6a

Growth of CLS since 2002: value

USD billions (15-day moving average); vertical line indicates survey period

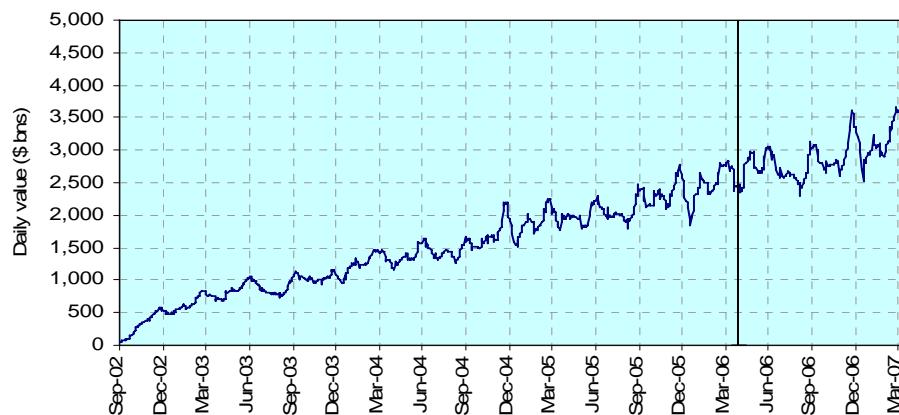
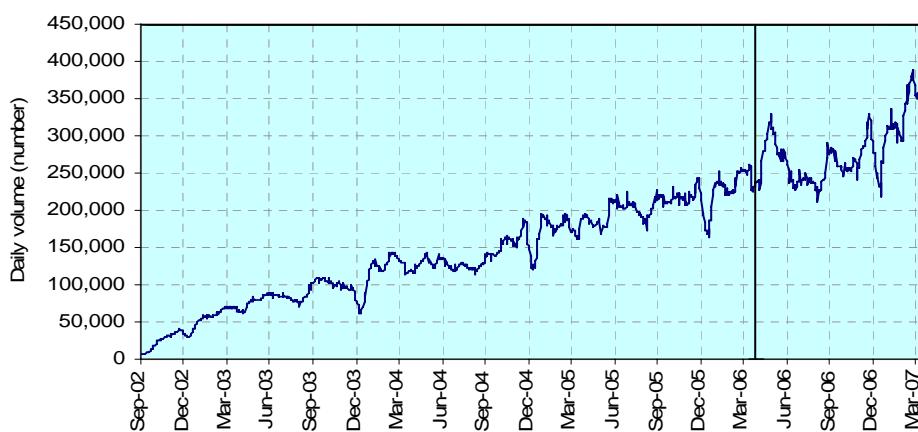


Chart 6b

Growth of CLS since 2002: volume

Number of sides³³ (15-day moving average); vertical line indicates survey period



³³ Sides are equivalent to legs (see footnote 6).

Further growth from existing CLS users

Significant further growth in CLS's share of settlement activity between *existing* CLS users would probably be possible only if CLS were to provide new services to enable additional FX trades to settle through CLS. This is because the interviews with reporting institutions indicated that, in most cases, all trades between CLS users that could be settled in CLS are settled in CLS. That is, CLS users make use of non-CLS settlement methods, and especially traditional correspondent banking, only when an FX trade is in a non-CLS currency or when it is a type of trade where it is currently not possible or desirable to use CLS (this includes most same day and certain next day trades, including the out leg of so-called inside/outside (I/O) swaps).³⁴

The survey data are consistent with this finding, although a lack of good estimates of the size of the market in same day trades makes it difficult to be certain. As noted earlier (Table 5), of the total \$3.8 trillion settlement obligations in the survey, at least \$2.6 trillion (69%) were between CLS users. However, only \$2.1 trillion of this was settled through CLS. The residual \$0.5 trillion was settled using other methods (in fact, almost all using traditional correspondent banking). Of this residual \$0.5 trillion, \$0.1 trillion could not be settled through CLS because it involved a currency not settled by CLS, while up to \$0.1 trillion was accounted for by the out leg of I/O swaps.³⁵ If all CLS-eligible trades between CLS users are indeed settling in CLS, this implies that the value of settlement obligations relating to same day trades must account for the remaining \$0.3 trillion of total activity between CLS users.³⁶

Future growth from those currently not using CLS

Future CLS growth could also come from current non-users. As Table 5 earlier showed, 31% of the value of settlement obligations in the survey involved a non-CLS user and thus could not currently be settled in CLS. However, the bulk of this (30 percentage points) involved trades between a non-CLS user and a CLS user; only a small amount (1 percentage point) was *between* non-CLS users. This means that significant increased usage of CLS could come about as a result of unilateral decisions by current non-users to use the CLS service - ie more easily than if a joint decision were needed by both counterparties to a trade.

Expectations about future CLS growth

Seventy-five per cent of the surveyed institutions expect CLS to increase its overall share in industry-wide settlements over the next one to three years by at least another 10 percentage points (ie to 65% or more). Furthermore, 53% of the surveyed institutions (including 52% of current CLS users and 55% of current non-users) expect to settle more of their own trades through CLS. For current CLS users this reflects some combination of the growing number of trading counterparties they expect will become CLS users and new services for settling FX trades that CLS may introduce. For current non-users it reflects an expectation that they will start to use CLS in future.

³⁴ Most same day trades cannot be settled through CLS because trades have to be submitted to CLS by 06:30 CET on settlement day. Moreover, in some markets, such as the United Kingdom, it is agreed best practice that same day trades apart from I/O swaps will not normally be entered after midnight at the beginning of settlement day. These times are too early for most same day trades for many institutions (eg those located in European or Continental American time zones). I/O swaps are described in Annex 4.

³⁵ Some of the \$0.1 trillion of I/O swaps would have been carried out by CLS members not in the survey.

³⁶ However, given the misreporting of some activity with CLS users as being with non-CLS users mentioned in Section 2.3 earlier, the actual figure is likely to have to be higher than this.

4 Settlement using traditional correspondent banking

Judged by value, traditional correspondent banking was the next most important method of settlement after CLS, accounting for 32% (\$1.2 trillion) of the total settlement obligations in the survey. This method was used to some extent by all but two of the institutions in the survey, although in some cases only for very small amounts relative to their total FX activity.³⁷

As noted earlier, the use of traditional correspondent banking as a settlement method usually exposes the counterparties to a trade to principal and liquidity risks to the full value of the trade; each counterparty is exposed to the risk that it pays away the sold currency to the other counterparty but fails to receive the bought currency. Box 3 gives more information on how exposures arise from traditional correspondent banking.

This section of the report looks first at the *duration* of exposures. It then considers how the value of an institution's settlement obligations in different currency pairs combines with its exposure durations for those currency pairs to affect the size of its exposures. On the basis of this, it considers, both for the survey institutions as a whole and for individual institutions, various measures of the size of their aggregate exposures (ie across all counterparties). As an indicator of the scale of the *risk* to which institutions may be exposed, it then considers the potential size of institutions' largest exposures to a single counterparty. Finally, it considers how institutions *control* their settlement exposures.

As noted earlier, the estimates of the size and duration of exposures in the report are on the assumption that the underlying trades were spot or forward (or were swaps in which the first transaction was spot or forward) and thus will be overestimates to the extent that institutions had same day trades, where durations are shorter.

4.1 Duration of exposures

As explained earlier, an institution's settlement exposure to a trade starts at the time when it can no longer unilaterally cancel its instruction to pay the currency being sold – ie the so-called "unilateral cancellation deadline", when it becomes irrevocably committed to making the payment. The exposure ends when it receives, with finality, the currency it is buying – typically this time is when its correspondent credits its account with the funds. This exposure duration is known as the irrevocable (I) period.

Although an institution's actual exposure in a currency ends when it receives with finality the currency it is buying, many institutions do not routinely check until some time after the final receipt is due whether the funds have been successfully received from the counterparties concerned (ie they do not reconcile their receipts). This creates a further uncertain (U) period of exposure. Since it is possible that the bought currency was *not* received, during this so-called uncertain period an institution might still be exposed to its counterparty for the full amount of the purchase.

Exposure durations vary from institution to institution and, within an institution, from currency to currency. In general, however, it is not unusual for them to last for more than 24 hours, particularly, but not exclusively, when considering the I+U period.³⁸

- For most institutions and for at least some currencies, the I period for trades due to settle on Day V will actually start on Day V-1 or even earlier. There can be various reasons for this, such as correspondent bank practices (eg if a correspondent

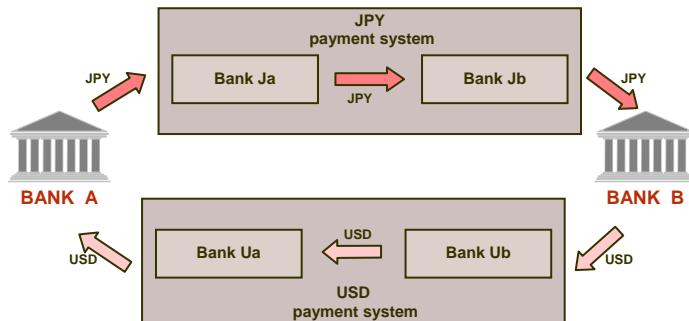
³⁷ The two institutions which did not use traditional correspondent banking to settle FX trades were both relatively small CLS third parties trading in just a few currencies. One of the institutions dealt only with a small number of counterparties and was able to settle all its trades with these counterparties using CLS. The other had a larger number of counterparties and, where it was unable to use CLS, it used on-us settlement instead.

³⁸ Moreover, even when they last less than 24 hours, in many cases they last overnight (eg from 20:00 on V-1 to 18:00 on V) rather than just during Day V. This is considered in more detail later in this section.

requires a significant notification period to cancel a payment instruction) or time zone differences (eg for an institution in North America selling an Asia-Pacific currency).

Box 3

An example of how traditional correspondent banking is used to settle FX trades



In this example, Bank A has a spot trade with Bank B where it is selling yen for US dollars. The trade is executed on Day V-2 for settlement on Day V.

To settle its side of the trade, Bank A sends an instruction to its correspondent in Japan (Bank Ja), asking the latter to send the yen to Bank B's correspondent there (Bank Jb) on Day V. Bank Ja executes this instruction sometime during Day V by debiting the account that Bank A holds with it and sending the yen to Bank Jb via the relevant payment system. After Bank Jb has received the funds, it credits them to Bank B's account and informs Bank B that they have arrived.

In parallel, Bank B settles its side of the trade by a similar process in which it instructs its correspondent in the United States (Bank Ub) to send US dollars to Bank A's correspondent there.

Looking at the trade from Bank A's point of view, its exposure to settlement risk starts when it can no longer be certain that it can cancel its instruction to pay Bank B. This "cancellation deadline" depends on a number of factors. In the absence of a specific agreement otherwise, Bank Ja may submit the instruction to the yen payment system at any time. Also, once the payment system is open, the instruction could settle at any time after it has been submitted. In these circumstances, the latest the cancellation deadline could be is the opening time of the yen payment system. In addition, Bank Ja may need some time before this to process a request by Bank A to cancel a specific payment instruction. The effective cancellation deadline may therefore be very early on V or even on V-1 in Japanese local time, which, if Bank A is located in (say) Europe, will be even earlier in Bank A's local time because of time zone differences. In some circumstances, Bank A may send the payment instruction to Bank Ja after the cancellation deadline has already passed, in which case this "send" time becomes the effective cancellation deadline.

Bank A's exposure ends when Bank Ua credits its account with the dollars received from Bank Ub. Bank Ua may not receive the funds until just before the close of the relevant payment system and it may be some time after that that the funds are credited to Bank A's account. This could be relatively late on Day V in US local time, and even later on Day V or even on Day V+1 in the local time of Bank A. Bank A's actual exposure to this trade (the so-called period of irrevocability, or I period) could therefore last more than 24 hours. Moreover, it may be some further time before Bank Ua sends Bank A information about account transactions on Day V and Bank A checks that information to see whether the funds did arrive from Bank B. Thus even after the actual exposure has ended, there is a further period of uncertainty (or U period) about the status of the trade.

Bank B also faces I and U periods of exposure. These will differ from those of Bank A to the extent that (a) Banks B, Ub and Jb have different settlement processes compared to those of Banks A, Ja and Ua, and (b) the relevant US and Japanese payment systems have different opening hours. Time zone differences are also important. In this trade, time zones work against Bank A because it is selling a currency in an early time zone and buying one in a late time zone extending the duration of its exposure. Conversely, the time zone difference works in Bank B's favour. However, it is important to note that the problem does not arise solely because of time zone differences.

- In most cases the I period will end on Day V. However, even if the counterparty meets its obligations, sometimes the I period may extend into Day V+1. This could be because, although the correspondent bank received the funds on Day V, it took some time for it to credit them to the reporting institution's account. Or it could be because of time zone differences (eg an institution in the Asia-Pacific region buying a North American currency).
- Even if the I period ends on Day V, it is common for the U period to last until V+1 since many institutions do not check whether or not they have received the funds until the morning of V+1.³⁹

Durations by currency pair

Table 9 gives the average durations across all reporting institutions for selected currency pairs. The table shows that average durations are significant. For example, when selling euros and buying US dollars, the average irrevocable period was 22 hours, and the average uncertain period 8 hours.

Moreover, these durations are significantly higher than the "reference" durations, which are a measure of what the market as a whole might achieve in current circumstances (Box 4). Thus for the EUR/USD pair the average duration of 31 hours (including both irrevocable and uncertain periods) compared to a reference duration of 17 hours.

Box 4

Reference durations

The actual durations of the reporting institutions were compared with "reference" durations which were in most cases based on the opening and closing times of the domestic payment systems used to settle FX trades. The reference duration for a currency generally begins at the time when the payment system for the currency opens for business on the day an FX trade is to be settled, since institutions selling currencies could in principle have cancelled their payment instructions at any time up to this point. Similarly, the reference duration ends shortly after the payment system closes, since institutions could in principle identify failed receipts immediately after this time.

In effect, these reference times provided one measure of what the market as a whole could have achieved in current circumstances. Note that, at least from the point of view of an *individual* institution, it is possible to have exposure durations that are less than the reference durations. For example, an institution might have an arrangement with its correspondent that instructions to make payments would not be entered into the payment system until the afternoon of the settlement day, in which case the cancellation deadline might be midday (ie later than the reference duration based on the opening time of the system). However, no analysis has been done of whether it would be desirable for the market as a whole to adopt such behaviour. The potential danger is that it could lead to a concentration of FX-related payments at certain times during the day, which might cause liquidity problems in certain payment systems. In the absence of that analysis, the reference durations can be thought of as a conservative measure of what might be achieved. Similarly, individual institutions may obtain information on payments received in certain systems throughout the day and thus often be able to achieve a receipt identification time earlier than the close of such systems. But it is not until a payment system has closed that an institution can be sure that a payment has *not* been received.

The average duration of almost all currency pairs is unchanged or has lengthened since the 1997 survey. In some cases this may be because of extensions in the operating hours of the payment systems concerned since 1997 (as, in general, an institution cannot be certain it has *not* received a currency until the closing time of the payment system concerned).

³⁹ Note also that if a trade has failed, then the exposure related to that trade will continue into the F (failed) period – ie until the funds are received.

Table 9

Average duration of exposures for selected currency pairs

Averages are weighted by institutions' total obligations settled by traditional correspondent banking. The durations are based on survey data for the times applicable for settling spot, forward and swap trades and thus will not be applicable for same day trades. Data are in hours (except for currency pair market shares)

Currency pair		USD sold					USD bought				
USD against	Currency pair as % of market ¹	I	U	I+U	I+U ref	I+U change from 1997	I	U	I+U	I+U ref	I+U change from 1997
AUD	5%	5	23	26	8	nav	32	8	40	23	nav
CAD	4%	16	11	26	21	-4	18	8	28	12	0
CHF	4%	7	19	26	12	1	27	8	36	31	4
DKK	nav	8	19	26	13	nav	28	8	36	17	nav
EUR	28%	9	13	22	14	7 ²	22	8	31	17	0 ²
GBP	14%	9	15	24	14	5	24	8	33	17	2
HKD	nav	5	22	27	9	nav	33	8	41	21	nav
JPY	17%	5	20	25	9	13	33	8	40	22	3
KRW	nav	12	15	29	7	nav	38	8	47	22	nav
NOK	nav	8	19	26	14	nav	27	8	35	18	nav
NZD	nav	15	11	27	20	nav	33	8	41	25	nav
SEK	nav	9	19	26	14	7	28	8	36	17	3
SGD	nav	6	21	26	10	nav	33	8	41	21	nav
ZAR	nav	8	18	25	13	nav	29	8	37	16	nav
Currency pair		EUR sold					EUR bought				
EUR against	Currency pair as % of market ¹	I	U	I+U	I+U ref	I+U change from 1997 ²	I	U	I+U	I+U ref	I+U change from 1997 ²
CHF	1%	11	19	30	8	-1	18	13	31	24	9
GBP	2%	13	15	28	10	3	15	13	29	10	8
JPY	3%	9	20	28	5	10	24	13	37	15	10

nav = not available. ¹ Source: BIS triennial survey (ibid). ² 1997 figures are for ECU.

Table 10 gives the maximum and minimum durations for the three most important currency pairs. It shows that there is significant variation in institutions' actual exposure durations. Exposures can last for three days for some currency pairs for some institutions. However, in other cases the exposures can be shorter than the reference durations. (As noted in Box 4, the reference durations are one measure of what the market as a whole could have achieved in current circumstances; individual institutions can have shorter exposure durations.)

Table 10

Maximum and minimum duration of exposures for selected currency pairs

Durations of the institutions with the longest or shortest duration in the currency pair concerned. Note that, for example, the institution with the longest I period may be different from the institution with the longest U period or the longest I+U period, so the I and U periods do not sum to the I+U period. Data in hours (except for currency pair market shares)

Currency pair		USD sold					USD bought				
USD against	Currency pair as % of market ¹	I	U	I+U	I+U ref		I	U	I+U	I+U ref	
Maximum											
EUR	28%	40	34	53	14		45	21	52	17	
GBP	14%	40	61	76	14		45	21	53	17	
JPY	17%	35	39	53	9		71	21	79	22	
Minimum											
EUR	28%	0	R	1	14		6	R	14	17	
GBP	14%	0	R	0	14		7	R	5	17	
JPY	17%	0	R	0	9		8	R	18	22	

R = institution monitors receipts in real time, so U period is zero. ¹ Source: BIS triennial survey (ibid).

Average durations by institution

Each institution's average duration across all currency pairs was also estimated (Table 11). Table 11 shows that the average duration for the average institution was 17 hours for the irrevocable period, with the uncertain period adding a further 9 hours. For the irrevocable period, 19 of the 99 institutions had an average duration that was longer than 24 hours; adding in the uncertain period increased the number to 54.

Table 11
Average exposure duration by institution

Durations in hours	Average (all)	Average (top 5)	Average (top 10)	Average duration > 24 hours ¹	Average duration < 12 hours ¹
I+U	26	46	43	54 institutions	3 institutions
I	17	34	31	19 institutions	30 institutions

The table is based on the 99 institutions for which complete data were available. Averages are unweighted. "Top 5/10" are judged according to the measure in the relevant row. The average exposure duration is also a measure of the "width" of its single day exposure profile (see Section 4.2 below). ¹ Number of institutions.

4.2 Relationship between settlement obligations and exposures

Exposure to a single day's trades

By combining data on the currency breakdown of an institution's obligations settled by traditional correspondent banking with data on the duration of its exposures in particular currency pairs, it is possible to create a "profile" of each survey institution's exposure to settlement risk resulting from a single day's trades.

An institution's exposure starts at the time of the earliest currency cancellation deadline and increases as time passes and more currency cancellation deadlines are reached, eventually reaching its maximum value. After this time its exposure will decline as the receipt times for different currencies are reached (when calculating the I period) or as the reconciliation times are reached (when calculating the I+U period), eventually reaching zero.

An institution's *potential* maximum aggregate exposure to a single day's trades is the total value of the obligations that it settles by traditional correspondent banking. However, the *actual* maximum will not necessarily reach this level. This is partly because a few currency pairs may result in no exposure (because the institution receives the bought currency before it pays away the sold currency). For example, this could occur for an institution buying an Asia-Pacific currency (ie in an early time zone) and selling a North American one (ie in a late time zone). It is also partly because the end of the exposure period for some currency pairs (eg a trade between two Asia-Pacific currencies) occurs before the beginning of the exposure period for other currency pairs (eg between two North American currencies); in these cases, there is no "overlap" period and so the institution is never exposed to all currency pairs at the same time.

Exposure to multiple days' trades

For most institutions, exposure durations for at least some currency pairs are such that exposure to trades settling on Day V actually starts before Day V and/or ends after Day V. This can arise for at least two reasons. It may arise because an institution has relatively long exposure durations. But because of time zone differences, it may also arise even when an institution has relatively short exposure durations. For example, the 14- to 16-hour time zone difference between Australasia and North America means that an institution may be exposed to AUD/NZD trades settling on day V+1 before its exposure to USD/CAD trades settling on Day V has ended.

Because of this, for at least some period each day most institutions are exposed to multiple days' trades – eg on Day V they may also be exposed to some extent to trades settling on Day V-1 (and possibly earlier) and/or Day V+1 (and possibly later). By superimposing the single day exposure profile for each relevant day, a multiple day profile can also be created for each institution.⁴⁰

Note that the combination of the effects noted may be that an institution's maximum exposure on Day V may be above or below the value of its FX obligations settled by traditional correspondent banking that are due to settle on Day V, depending on which of the effects discussed above are dominant.

⁴⁰ Note that the survey data were daily averages for April 2006. The single day profile created for each institution was thus the profile for an average day in April (ie the profile for Days V, V-1, V+1, etc was the same) and the multiple day profile was created by superimposing these identical average day profiles.

4.3 Exposure profile for all institutions in the survey

Charts 7 and 8 give the exposure profiles summed across all institutions in the survey.

Exposure profile in institutions' local times

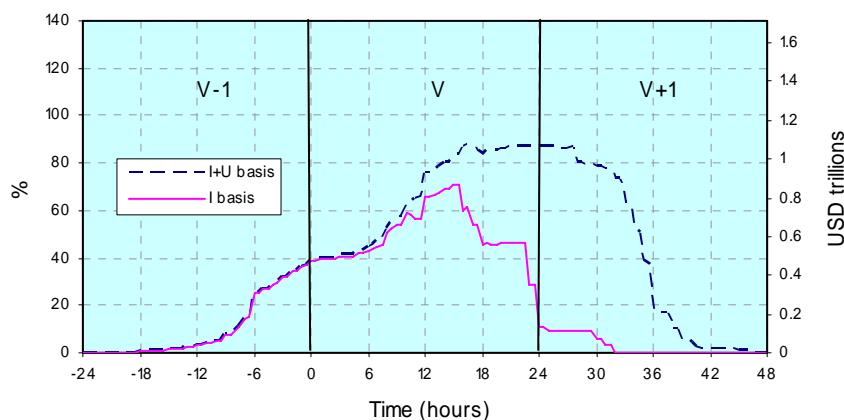
For Charts 7a and 7b (which repeat Charts 2 and 3 in Part I), each institution's individual profile was left expressed in its local time zone when summing the profiles of individual institutions (eg midnight on Day V for an institution in the Asia-Pacific region is regarded as being the same time as midnight on Day V for an institution in North America). The shape of the profile can thus be thought of as the shape of the "average" institution in the survey. This method of calculating the profile for all survey institutions also shows that, on a single day basis, the \$1.2 trillion of settlement obligations result in exposures that peak at \$0.9 trillion (I period) and \$1.1 trillion (I+U period).⁴¹ On a multiple day basis, the corresponding peaks are \$1.0 trillion (I period) and \$1.6 trillion (I+U period). Note also that on a multiple day basis the exposures never fall below \$0.6 trillion and \$1.2 trillion respectively.

Charts 7a and 7b

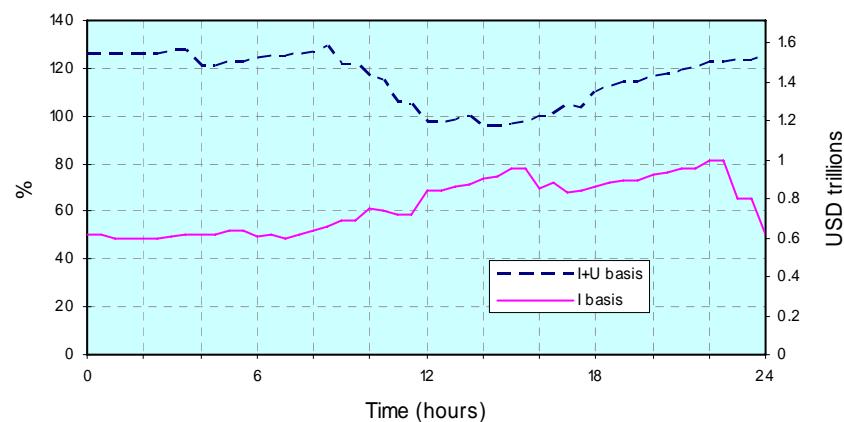
Exposure profiles for the whole survey sample (in local times)

Shown as percentage of obligations settled by traditional correspondent banking and as USD amounts

Single day basis



Multiple day basis



⁴¹ Note that, for the reasons explained in Section 4.2, the maximum exposure on a single day basis is less than the total value of the underlying obligations.

Exposure profile in standardised time (GMT/UTC)

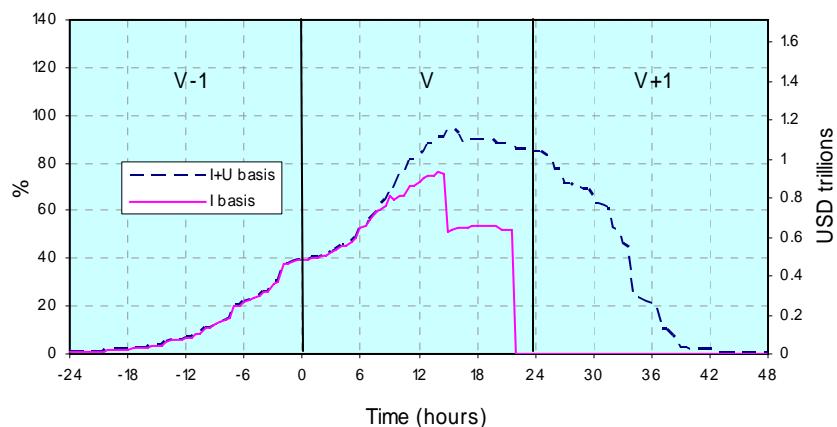
Because of time zone differences, the peak exposures that lie behind Charts 7a and 7b would often occur at different times for different institutions even if they had identical exposure profiles. Charts 8a and 8b show the effect of this. For these charts, each institution's individual profile was first recalibrated from its local time to GMT/UTC before summing the individual profiles. The charts thus give estimates of the actual aggregate exposure of all the institutions at any given point in time. They show that, on a multiple day basis, exposures never fall below \$0.5 trillion (I period) and \$1.3 trillion (I+U period) and reach maximums of \$1.1 trillion and \$1.5 trillion respectively.

Charts 8a and 8b

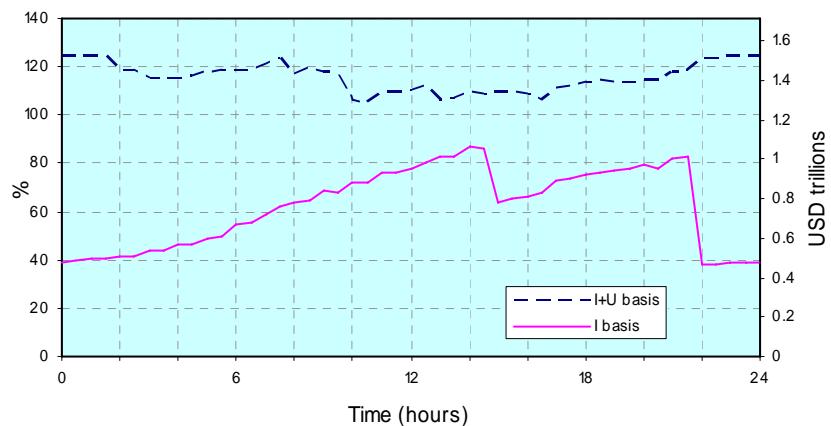
Exposure profiles for the whole survey sample (in standardised time)

Shown as percentage of obligations settled by traditional correspondent banking and as USD amounts

Single day basis



Multiple day basis



4.4 Aggregate exposures for individual institutions

So far this section has considered the exposure profiles for the survey institutions as a whole. A direct comparison between individual institutions' profiles is not easy but it is possible to compare certain features of the profiles such as the maximum and minimum values. For these purposes, it is useful to scale the exposure of an institution by some indicator of the size of the institution. There are various possible scaling factors (eg its total assets). The calculations below use the institution's total capital, not least because it enables a comparison with the analysis of exposures to single counterparties in Section 4.5.⁴²

⁴² See footnote 14 for a definition of total capital.

Table 12 gives some summary statistics on institutions' *maximum* aggregate exposures. On average, institutions' actual maximum exposure was 57% of capital (multiple day, I basis) but allowing for the period of uncertainty this increased to 83% (multiple day, I+U basis).

Table 12
Aggregate exposure as a percentage of total capital

Maximum	Average (all)	Average (top 5)	Average (top 10)	Number of institutions > 100%	Number of institutions > 50%
<i>Multiple day</i>					
I+U	83%	501%	357%	20	39
I	57%	317%	226%	13	30
<i>Single day</i>					
I+U	54%	295%	212%	13	29
I	47%	230%	176%	10	26
Minimum	Average (all)	Average (top 5)	Average (top 10)	Number of institutions minimum = 0	Number of institutions minimum < 1%
<i>Multiple day</i>					
I+U	35%	227%	165%	3	10
I	18%	147%	98%	6	24
Midnight	Average (all)	Average (top 5)	Average (top 10)	Number of institutions midnight = 0	Number of institutions midnight < 1%
<i>Multiple day (start and end of day)¹</i>					
I+U	70%	450%	314%	1	4
I	30%	203%	140%	2	13
<i>Single day (start of day)</i>					
I+U and I ²	23%	187%	124%	9	23
<i>Single day (end of day)</i>					
I+U	47%	276%	202%	1	5
I	8%	57%	43%	28	50

The table is based on the 88 institutions for which complete data were available. Averages are unweighted. "Top 5/10" are judged according to the measure in the relevant row. ¹ For the survey data, the multiple day exposure will be the same at the beginning and end of the day (see footnote 13 in Part I). ² On a single day basis, the start-of-day results are the same for the I+U and I periods because the U period does not begin until some point during settlement day.

The profiles can also be used to identify each institution's *minimum* aggregate exposure to multiple days' trades.⁴³ The results are also given in Table 12. On average, the minimum exposures are 18% of capital (I) or 35% (I+U) – ie more than a quarter of the maximum level.

⁴³ It is not relevant to consider the minimum aggregate exposure to a *single* day's trades as this is always zero.

Moreover for only a minority of institutions does the minimum approach zero. This shows clearly that, for most institutions, FX settlement exposures are present at all times – they are not just an intraday phenomenon.

Another way of showing that FX settlement exposures are not just intraday is to look at the level of exposures at *midnight* at the beginning and/or end of the settlement day (ie exposures that began on V-1 and/or continued into V+1). For the purposes of these calculations, "midnight" was selected according to the local time of the institution.⁴⁴ Table 12 confirms that most institutions have significant overnight exposures.

4.5 Largest bilateral exposures

Data were collected in the survey on each institution's settlement activity with its largest counterparties (see Annex 2, Spreadsheet 2). "Largest" was judged by the institution's total settlement obligations with the counterparty – ie obligations irrespective of the settlement method used and thus irrespective of whether they resulted in settlement exposures or not. However, it was possible to use these data to calculate, for an average day during the survey period, the range within which an institution's largest "bilateral" exposure lies – ie its largest single-counterparty exposure.

The method used to calculate the range is set out in Annex 3. The key assumption needed for the calculation is only that there is some relatively low positive correlation between counterparties with whom the institution has large total settlement obligations and those with whom it has large exposures.

Because the estimated ranges were quite wide, an estimate was also made of where *within* the range the largest exposure was likely to be. These estimates used additional data provided by CLS about obligations settled in CLS during the survey period. Specifically, the data showed the value of settlement members' daily average obligations to *each* of their five largest counterparties. This was used to calculate the ratio between the size of the obligations to the single largest counterparty and the size of those to the remaining four largest counterparties. This ratio, based on obligations settled in CLS, was then applied to the survey data on obligations settled by traditional correspondent banking in order to calculate an "indicative" estimate of the size of the largest bilateral exposure. The method is explained fully in Annex 3. It should be noted that these "indicative" estimates required more demanding assumptions than those used to calculate the ranges and therefore the scope for error is greater. However, the likelihood is that the indicative values are underestimates – ie the actual largest bilateral exposures will be greater than those estimated here.

As with all the survey results, these are daily averages over the survey period; on individual days the exposures may have been smaller or larger. There is no direct evidence about the daily volatility of values settled by traditional correspondent banking (either in total or between pairs of institutions). However, the data from CLS mentioned above showed for each bilateral position the peak day value of obligations, as well as the daily average. This was used to estimate the ratio between peak and average days, and this ratio was applied to the estimates of the daily average range and indicative value to obtain peak day estimates. Note that the ratio was based on the *average* of CLS settlement members' positions with their large counterparties and some individual ratios were significantly higher than this. However, it is possible that the volatility in the daily value of obligations settled by traditional correspondent banking is less than the volatility of obligations settled through CLS insofar as the former are constrained by counterparty limits (because of the exposures generated) whereas, for some institutions, the latter are not.

⁴⁴ Note that on a single day basis the exposure at the beginning and end of the day can, and usually will, differ. In reality, the same is also true on a multiple day basis, because every day is different. However, the survey only has the average daily position for the period (ie every day is the same) and so on a multiple day basis the exposure level at the beginning and end of the day must be the same (eg see Charts 7 and 8 above).

Moreover, when interpreting the results on bilateral exposures, two other points should be borne in mind. First, as noted earlier, when settling by traditional correspondent banking, the relationship between the value of an institution's settlement *obligations* to a counterparty and the resulting *exposures* depends on the currency composition of the obligations. The survey data contained a currency breakdown only for aggregate obligations across all counterparties. To the extent that the currency obligations vis-à-vis the counterparty with the largest bilateral exposure were different from the average, again the actual exposures could be smaller or larger than those shown. Second, the purpose of these estimates is to assess the size of exposures to a single counterparty. No attempt is made to estimate the *probability* of the occurrence of an actual loss.

The results are shown in Table 13 (which is the same as Table 2). The estimates in the table have been calculated on a multiple day, I period basis that is appropriate when comparing institutions' FX settlement exposures with the exposures they have as a result of other credit extensions of similar size and duration (eg overnight interbank loans). However, an institution also needs to know its bilateral FX settlement exposures on an I+U period basis if it is to be sure that it is not underestimating its potential exposures to its counterparties.⁴⁵

Table 13
Estimated largest bilateral FX settlement exposures

Range within which an institution's largest exposure to a single counterparty was estimated to lie.
Multiple day, I basis

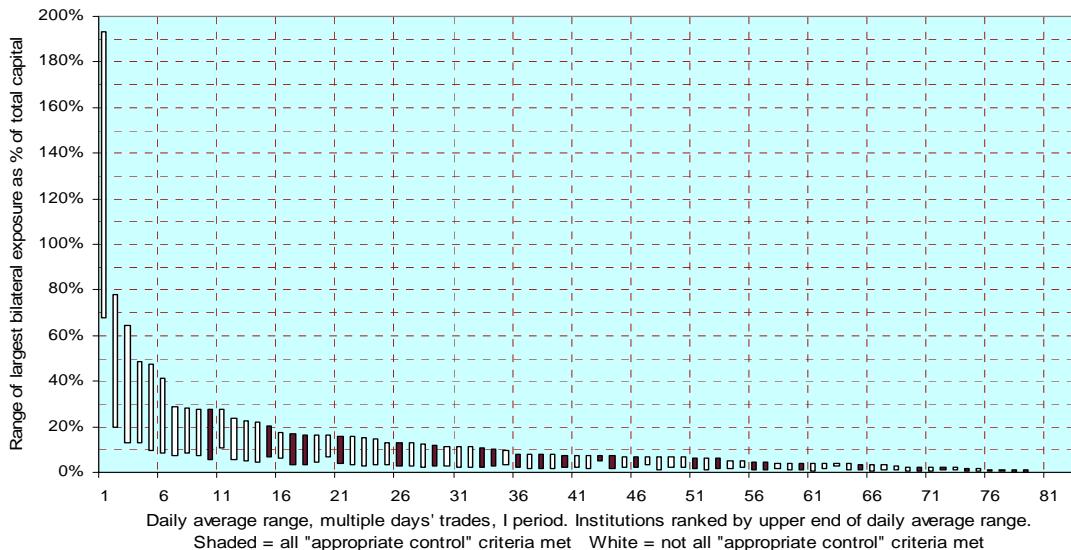
Estimated largest exposure to a single counterparty as % of total capital	Daily average		Peak day	
	% of institutions (unweighted)	% of institutions (weighted)	% of institutions (unweighted)	% of institutions (weighted)
<i>Lower end of range:</i>				
Less than 5%	81%	88%	65%	72%
5 to 10%	13%	8%	19%	19%
More than 10%	6%	4%	16%	10%
<i>"Indicative" value within range:</i>				
Less than 5%	73%	81%	48%	51%
5 to 10%	14%	11%	29%	36%
More than 10%	12%	8%	23%	14%
<i>Upper end of range:</i>				
Less than 5%	35%	39%	19%	18%
5 to 10%	24%	26%	17%	21%
More than 10%	41%	35%	64%	61%

Based on 83 institutions for which sufficient data were available. Weights: institutions' total capital.

⁴⁵ As noted in the *Supervisory guidance for managing settlement risk in foreign exchange transactions* (*ibid*), "A bank's measurement of its exposure also needs to take account of the process of reconciling incoming payments with expected receipts. [...] When measuring its exposure, a prudent bank will therefore assume that during this uncertain period the funds have not been received."

The average day range for each institution is also shown in Chart 9, which, in addition, indicates whether, according to the criteria discussed in the next subsection, the institution was judged to be appropriately controlling its exposures or not. Overall, there was no evidence that those with larger exposures were controlling them better.

Chart 9
Largest bilateral exposure (daily average range)



4.6 Control of exposures

In the qualitative part of the survey, each institution was asked to provide information on how it controls its FX exposures. On the basis of this, a judgment was made about whether the institution's control was "appropriate". The aspects of control considered, and the criteria used to judge whether they were appropriate, were as follows.⁴⁶

- *Senior management responsibility and authority.* The criterion here was whether the institution had established clear, senior-level responsibility and authority for managing its FX settlement issues with individual counterparties.
- *Management of exposures.* Two related aspects of management were considered. First, whether the institution subjected FX settlement exposures to the same or equivalent counterparty credit management process and controls (such as counterparty limits) that it applied to other similar exposures. Second, whether, in doing this, it applied the same weight to FX settlement exposures as it did to other similar exposures to the same counterparty (eg whether \$1 of FX settlement exposure was treated the same way as \$1 of short-term credit). Note that, in assessing the management of exposures, there was no attempt to make an *absolute* judgment about its adequacy, since that would be a supervisory or regulatory judgment outside the scope of the survey. Rather, the criterion was whether the institution managed its FX exposures in *the same way as or an equivalent way to* other similar exposures such as deposits, placements or other formal short-term credit extensions of similar size and duration. This is in line with the *Supervisory guidance for managing settlement risk in foreign exchange transactions*, Basel Committee on Banking Supervision, September 2000.
- *Measurement of exposures.* The criterion here was whether the institution used a measurement method that *avoided underestimating* the size and duration of its FX

⁴⁶ A comprehensive judgment about the management of FX settlement exposures would need to take into account, for each institution, the wider framework within which its risk management takes place.

settlement exposures. Measurement of both the I and U periods was considered. (For more on measurement methods, see Box 5.)⁴⁷

Box 5

Measurement of exposures

Only 8% of institutions (accounting for 1% of the value settled by traditional correspondent banking) measured their exposures accurately. Accurate measurement requires an institution to identify explicitly both the unilateral payment cancellation deadlines and the reconciliation process times involved in each type of currency transaction. An exact measure of FX exposures has to recognise that the duration of exposures varies by currency pair and that an institution's exposures are likely to change during the day. Exact measurement has the advantage of avoiding overestimation as well as underestimation. Overestimation has disadvantages: it may lead to inefficient use of counterparty credit limits or to excessive expansion of credit limits to offset the overestimate. However, underestimation is clearly a more serious problem.

However, most institutions do not measure their exposures exactly. Instead various estimation methods are used. Of these the most common is the calendar day method, where institutions measure their daily settlement exposures as the total receipts coming due on settlement day. The calendar day method was used by 52% of institutions (accounting for 70% of obligations settled by traditional correspondent banking). Other approximation methods used included measuring exposures as lasting two calendar days (eg V-1 and V) or other fixed periods (eg 36 hours from 12:00 V-1 until 24:00 on V). Whether or not these approximation methods avoid underestimating exposures depends, of course, on what an institution's actual exposure durations are. A method that is appropriate for one institution may be inappropriate for another. Annex 4 of *Reducing foreign exchange settlement risk: a progress report* (*ibid*) has some examples of approximation methods.

Table 14 summarises the survey results on the control of exposures, including a comparison (where available) with the situation in the 1997 survey. In addition to each of the three specific measures listed above, the table also shows the percentage of institutions whose overall control was judged appropriate – ie who met all three measures. The table shows that, at 35% and 34% respectively, this figure changed little between 1997 and 2006.

Table 14

Control of exposures

	1997¹	2006¹	2006 weighted²
Senior-level responsibility and authority	96%	92%	99%
Appropriate management	73% ³	77%	66%
Process and controls	nav	92%	93%
Weights	nav	80%	72%
Appropriate measurement	39%	37%	21%
I period	43%	54%	41%
U period	39%	43%	22%
Overall control	35%	34%	13%

nav = not available. ¹ Unweighted. ² Weights used were the value of institutions' total settlement obligations except for the measurement of exposures, where they were the value of the obligations settled by traditional correspondent banking. ³ The questions on management were phrased differently in the 1997 and 2006 surveys so the results may not be completely comparable.

⁴⁷ Appropriate measurement should also take into account any failed trades, although whether institutions did this was not separately assessed in the survey.

5 Use of bilateral netting⁴⁸

Of the total settlement obligations in the survey, 12% (\$0.4 trillion) were bilaterally netted. This was a significantly smaller share than in 1997, when 29% were bilaterally netted, (although, because the market was smaller in 1997, the absolute amount involved in 1997, at \$0.3 trillion, was not so different from 2006).

In the current survey, bilateral netting reduced the gross obligations to which it was applied by 69% - ie from \$0.4 trillion to \$0.1 trillion. Put another way, netting reduced total gross obligations in the survey by 8% (12% x 69%, or \$0.3 trillion). This 8% can be regarded as the effect of netting, or the extent to which the \$3.8 trillion of total settlement obligations in the survey were "settled" by bilateral netting.

At 69%, the "power of netting" (ie the extent to which netting reduces the value of gross obligations) was significantly stronger than in the 1997 survey, when it was 50%. To some extent this may be explained by changes in the types of institutions using bilateral netting. Table 15 shows how the use and impact of netting varied by counterparty type in the 2006 survey. It shows that most of the bilateral netting (73%) took place with non-CLS users, particularly non-bank financial institutions. Many of these counterparties deliberately trade so that their positions net out on the value date. Moreover, some institutions do not give large FX settlement limits to some of these counterparties (such as hedge funds) because of the perceived risk and so they are required to square up their positions for a particular value date to ensure that final settled amounts are small. The power of netting for these types of counterparties is therefore high: for non-bank financial institutions it is 78%. This is in contrast to 1997, when bilateral netting was in more general use, including among many of the larger institutions which are now CLS members, and where trading strategies and counterparty limits did not result in high powers of netting. Indeed, Table 15 shows that the power of netting with CLS members is still the same – ie 50%.

Netting can be used for various purposes. Sometimes it is used to reduce the size and number of payments and thus to reduce liquidity needs and operational risk. However, to the extent that it is used to reduce counterparty credit risk by reducing the size of FX settlement exposures, it is necessary that the netting is legally robust so that, in the event of the insolvency of the counterparty for example, an institution's obligations to that counterparty are indeed the lower netted amounts rather than the higher gross amounts. It is also important that the bilateral exposures from the netted amounts are appropriately controlled or are avoided by the use of PVP settlement methods. Not least because of the complexity of assessing the legal validity of netting, no attempt was made in the survey to assess whether these conditions were met. However, the survey did measure the extent to which institutions were using bilateral netting with the *intention* of reducing risk. For those institutions that provided the information (which accounted for 78% of the netting in the survey), between a third and a half of the netting was for the purpose of risk reduction.

The fall in the importance of bilateral netting since 1997 is largely due to the availability now of CLS.⁴⁹ For the future, survey participants had mixed opinions.

- Of those that expressed a view, 17% of institutions expected bilateral netting's *share of the market* to grow by more than 10% over the coming one to three years, while 8% expected the share to fall by more than 10% over the same period.
- As far as their *own institution's use of netting* was concerned, 8% (accounting for 10% of total settlement obligations) expected a significant increase in their own institution's

⁴⁸ Included within the figures for bilateral netting are trades that are rolled over.

⁴⁹ Some of the standardised bilateral netting services available in 1997, such as FXNET, have since stopped operating. In 1997 it was also possible to do multilateral netting through a service called ECHO, which was taken over by CLS with the intention of offering a multilateral service alongside the CLS PVP service. However, the value of multilateral netting was small (in 1997 it was used to settle 1% of the total settlement obligations) and ECHO ceased operations in 1999.

use over the period, although subsequent discussions with selected market participants suggest that potential interest may have grown since April 2006.

Table 15
Bilateral netting by counterparty type

Counterparty type	Distribution of netting among counterparty types ¹	Share of netting ²	Power of netting ³	Effect of netting ⁴
CLS members	20%	4%	50%	2%
CLS third parties	6%	6%	67%	4%
All CLS users	25%	4%	54%	2%
Other banks	16%	14%	67%	9%
Other non-bank financial institutions	47%	46%	78%	35%
Other non-financial institutions	10%	24%	72%	17%
All non-CLS users	73%	28%	75%	21%
Total	100%	11%	69%	8%

¹Of total gross obligations subject to bilateral netting (\$0.4 trillion), percentage accounted for by each counterparty type. ²Percentage of total gross obligations with that counterparty type that were subject to bilateral netting. ³Extent to which netted obligations were smaller than gross obligations, in per cent.

⁴Reduction in total gross obligations as a result of netting (ie "share of netting" x "power of netting"), in per cent.

6 Factors influencing the choice of settlement method

This section contains some information from the survey about factors which may influence the settlement methods that institutions use.

Table 16 summarises reporting institutions' expectations about the changes they expect to make in their own use of settlement methods.

Table 16
Expected changes in institutions' own settlement methods

Institutions which plan significant changes to their settlement practices over the next 1 to 3 years

	Number of institutions	% of institutions (unweighted)	% of institutions (weighted)
Increased use of CLS	57	53%	49%
Increased use of bilateral netting	9	8%	10%
Improved unilateral cancellation times	10	9%	20%
Improved receipt identification times	18	17%	35%

Based on Checklist question V (see Annex 2). Weights are institutions' share of total settlement obligations.
Data for 108 institutions.

Institutions' decisions about settlement methods may depend partly on the extent to which they are aware of the relative cost of different methods. In the qualitative part of the survey, institutions were therefore asked to describe how they measured the costs associated with settling foreign exchange trades. They were also asked to what extent these measures took into account differences between settlement methods in specific costs such as back-office processing, funding or transaction processing costs. The results are in Table 17, which shows that, for example, 43% of the institutions did not measure the overall cost of settling FX trades while only 12% measured the cost in a way that took full account of the differences between settlement methods.

Table 17
Measurement of settlement costs

	Number of institutions	% of institutions (unweighted)	% of institutions (weighted)
Does not measure cost	47	43%	17%
Measures total cost only	22	20%	31%
<i>Measures total cost and distinguishes between settlement methods with respect to:</i>			
Transaction charges only	11	10%	11%
Transaction charges plus some other costs	9	8%	12%
All costs except transaction charges	3	3%	10%
All costs	13	12%	20%
No information	4	4%	0%
Total	109	100%	100%

Based on Checklist questions N and O (see Annex 2). Weights are institutions' share of total settlement obligations. Data for 109 institutions.

Institutions were also asked to describe the policies or guidelines they had on the settlement method to be used under specific circumstances and, in particular, state whether differences in exposures and/or costs influenced the decisions (including any “front office” requirements or incentives that were used to encourage settlement methods with lower risk and/or lower cost). The results are in Table 18, which shows that 82% of the institutions had policies about the settlement method to be used, of which 82% reflected the exposures associated with the different methods and 11% the costs.

Table 18
Policies and incentives

	Number of institutions	% of institutions (unweighted)	% of institutions (weighted)
Institutions that have policies or guidelines on which settlement method should be used in specific circumstances	89	82%	91%
<i>Of those that have policies:</i>			
Policies that reflect differences in exposures associated with different methods	73	82%	89%
Policies that reflect differences in costs associated with different methods	10	11%	7%
Mandatory policies	42	47%	54%
Voluntary policies	33	37%	34%
Policies that are partly mandatory	14	16%	11%
<i>Institutions that have requirements or incentives for those initiating trades to select lower-risk settlement methods:</i>			
Higher counterparty limits	17	16%	39%
Lower charges against counterparty limits ⁵⁰	26	24%	32%
Lower fees/risk premia to counterparties	4	4%	7%
Higher compensation for traders	2	2%	0%

Based on Checklist questions P, Q and R (see Annex 2). Weights are institutions' share of total settlement obligations. Data for 108 institutions.

Finally, the survey considered the extent to which institutions felt they needed external support from industry groups, central banks or regulators in order to realise improvements to the way they manage FX settlement risk. These results are in Table 19.

⁵⁰ However, the number of institutions that place lower charges against counterparty limits for lower-risk settlement methods may be higher than indicated here. For example, in response to Checklist question G, 77% of institutions which used CLS (and thus 62% of all institutions) said that their measure of exposures recognised the elimination of principal risk when settling via CLS.

Table 19

Need for external support for change

Institutions which said they would need external support to realise further improvements in the management of FX settlement risk

	Number of institutions	% of institutions (unweighted)	% of institutions (weighted)
Action by industry groups	51	47%	70%
Action by central banks	47	44%	67%
Action by supervisors or regulators	56	52%	76%
<i>Memo:</i>			
<i>No external support needed</i>	7	6%	3%

Based on Checklist question X (see Annex 2). Weights are institutions' share of total settlement obligations.
Data for 108 institutions.

Annex 1: Summary of action taken by central banks and other authorities

This annex summarises the action taken by central banks since 1998 to support the strategy (ie since the publication of *Reducing foreign exchange risk: a progress report*).⁵¹

Publicity, education and communication

Central banks have continued to use speeches, meetings with banks or groups of banks, ad hoc papers or articles or features in regular bulletins (such as the oversight reports that several central banks now publish) in order to publicise foreign exchange settlement risk with a view to increasing the industry's awareness of the issue. In addition, in 2001 the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP) published a survey of FX settlement risk as part of a more general regional initiative to raise the market's awareness of FX settlement risk.⁵²

CLS and other industry groups

CLS, which is a special purpose US bank supervised by the Federal Reserve, is subject to the *Core principles for systemically important payment systems* and is under the cooperative oversight of the central banks of the fifteen currencies included in the system. More generally, the CPSS also continues to keep in regular contact with CLS (currently through its Sub-Group on Foreign Exchange Settlement Risk); the Committee has also issued a standing invitation to any other international industry groups that might be formed. Individual central banks or groups of central banks are in close contact with their domestic CLS settlement members. For example, the "Euro CLS group", which includes Eurosystem central banks, settlement members and euro nostro agents, meets biannually.

Supervisory measures

In September 2000 the Basel Committee on Banking Supervision (BCBS) published its *Supervisory guidance for managing settlement risk in foreign exchange transactions*. The purpose of the guidance, which was produced in close consultation with the CPSS, is to provide banking supervisors with information about FX settlement risk and its management that they should take into account when assessing a bank's policies and procedures (see Box 6 for more details). However, although supervisors in some countries have introduced consideration of FX settlement risk into their domestic supervisory process, through various means such as points of attention during examinations or guidelines which include stipulations on FX settlement risk management, in general the guidelines have not yet been widely incorporated into the body of regulations that banks are required to observe.

More recently, the BCBS has published another policy of direct relevance to FX settlement risk, namely the capital treatment for unsettled and failed trades that forms part of the implementation of the Basel II Framework. This is also covered in Box 6.

Improvements to payment services

Improvements made among other reasons to accommodate the needs of industry groups such as CLS concern changes to payment systems, enhancements to the provision of intraday liquidity and the strengthening of the national legal foundations of settlement in domestic payment systems and in CLS.

⁵¹ *Reducing foreign exchange risk: a progress report*, BIS, 1998.

⁵² *Foreign Exchange Settlement Risk in the East-Asia Pacific Region*, December 2001. The EMEAP consists of the central banks of Australia, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand.

Box 6

Initiatives by the Basel Committee on Banking Supervision

This box provides information on two initiatives by the Basel Committee on Banking Supervision (BCBS) that are of particular relevance for FX settlement risk.

Supervisory guidance for managing settlement risk in foreign exchange transactions

This guidance, published in September 2000, notes that all banks should be expected to have a good understanding of FX settlement risk and to have formulated clear and firm plans for how to manage it. It suggests that banks with significant FX settlement exposures should give strong consideration to using risk-reducing arrangements such as CLS, either by participating in them directly or by taking advantage of third-party services. In evaluating whether to do this, banks should carefully assess the costs associated with the exposures, including both expected losses and the cost of economic capital associated with unexpected losses. It notes that while the decision to make use of risk-reducing arrangements should ultimately be based on the balance of all costs and benefits, it is particularly important that banks do not underestimate the benefits of risk reduction by assuming that sudden bank failures are impossible.

Supervisors should require that banks engaging in FX trading have appropriate methods of managing FX settlement exposures consistent with the guidance. Supervisors should expect all banks to measure FX settlement risk, set binding limits for all counterparties, and closely monitor limit excesses and unusual settlement activity. Supervisors should expect a bank to use methods commensurate with the range and scope of its activities and assess such methods as part of their ongoing supervisory activities. Supervisors should consult with the internal auditor to determine the adequacy of the risk assessment methodology used by the institution. In cases where supervisors determine that a bank's FX settlement risk management is not adequate or effective for that bank's specific risk profile, they should take appropriate action. Supervisors should place special emphasis on encouraging and monitoring reductions in the deadlines for irrevocable payments before payment date and in the time required to reconcile settlements. In addition, supervisors should focus on whether a bank has fully and carefully evaluated the potential risk reductions that could be gained through participation in initiatives to reduce FX settlement risk, including netting and other risk-reducing arrangements.

Capital treatment for failed trades and non-DVP transactions

Annex 3 of the Basel II Framework, published in June 2006, sets out the capital treatment for unsettled and failed trades.⁵³ It notes that banks should continue to implement and improve systems for monitoring the credit risk exposures arising from unsettled trades so that they have management information that facilitates timely action. For non-DVP trades (including foreign exchange trades settled by a non-PVP method), a capital charge will be applied to trades that fail to settle. More specifically, if a bank that has paid the sold currency has not received the bought currency by the end of the settlement day, it will treat its exposure as a loan and apply the relevant capital charge according to the normal Basel II rules. If the payment still has not been received five business days after settlement day, the bank will deduct from capital the full amount of the value transferred plus replacement cost, if any.⁵⁴

All central banks of issue have opened accounts for CLS, in many cases via remote access. Existing RTGS and non-RTGS systems were enhanced in order to facilitate CLS operations by, for example, extending operating hours (eg Canada, Japan, United States). Some central banks modified their payment systems to include high priority for CLS pay-ins or changed the timing of payments related to the settlement of ancillary systems. Some others opened

⁵³ *International convergence of capital measurement and capital standards*, BCBS, June 2006.

⁵⁴ Note that there is no capital charge for spot trades that settle normally on settlement day. Also, for spot trades that settle via a DVP/PVP method, there is no capital charge unless the trade remains unsettled for five business days after the settlement day, in which case both counterparties (if they are banks) must calculate a capital charge based on the positive current exposure of the trade.

special CLS sub-accounts for settlement members so that they could reserve liquidity for their CLS pay-ins. Two central banks (Korea, Singapore) actively supported domestic initiatives that created a common infrastructure to link to CLS. One central bank (United States) adapted its proprietary messaging system so as to be compatible with some types of MT 103 SWIFT messages and thus support the provision of cross-border multicurrency settlement services. Furthermore, some central banks developed special contingency measures for CLS payments in case of a disruption to the domestic large-value payment system (eg Belgium, Canada, France, Germany). The Eurosystem published the *Recommendations for CLS payments in euro* (February 2001), which include recommendations for settlement members and nostro agents for payments made in euros through the TARGET system.

Central bank intraday credit provision has been enhanced in some cases in part to facilitate liquidity management in CLS, including the role of liquidity providers. This was done by introducing intraday credit (Switzerland), widening the range of securities accepted as collateral (Canada, United States) or eligible for intraday repurchase (Australia), introducing a cross-border scheme (Scandinavian cash pool) and building a central scheduling functionality for liquidity management purposes (United Kingdom). Furthermore, some systems have included features that lower banks' overall liquidity needs for payment purposes, for example by introducing liquidity-saving features (Germany, Hong Kong).

The legal foundations of settlement were strengthened, sometimes also because of requirements related to the inclusion of certain currencies in CLS. They have been strengthened by legislation ensuring the finality and irrevocability of settlement in designated systems (for example, the EU settlement finality directive which was adopted in 1998 and has now been implemented in all EU countries). They have also been strengthened in the case of CLS by ensuring that netting is legally robust (eg Australia).⁵⁵

In addition to changes triggered entirely or in part by CLS, other changes made to payment systems indirectly benefit CLS operations. This is true for the overall improvement in the resilience of payment systems and of the financial system more generally, due to enhanced business continuity planning. The oversight of payment systems conducted by central banks also contributes to improving their resilience.

Other PVP arrangements

There have also been significant developments concerning other PVP arrangements. In particular, in Hong Kong links have been created between the RTGS systems in Hong Kong dollars, US dollars and euros to enable PVP of FX trades in these currencies. In addition, the central banks of Hong Kong and Malaysia introduced a cross-border PVP link between Hong Kong's USD RTGS system and Malaysia's ringgit RTGS system in November 2006. See Box 7.

⁵⁵ This was necessary in some jurisdictions to ensure the "unity of account" principle whereby if a CLS settlement member becomes insolvent, CLS is entitled to treat the member's account as a single account so that, in effect, the long positions in some currencies can be netted against the short positions in others and the combined long and short positions regarded as a single net balance. See Annex 4 for a description of CLS.

Box 7

PVP arrangements in Hong Kong

To improve settlement efficiency and eliminate the FX settlement risk, a linkage between the HKD and USD RTGS systems in Hong Kong was established in September 2000 to enable PVP settlement for USD/HKD FX trades. Based on the experience of this link, the HKD and USD RTGS systems were linked to the euro RTGS system in Hong Kong in April 2003 to enable PVP settlement for USD/EUR and EUR/HKD FX trades as well. In addition, the central banks of Hong Kong and Malaysia set up a cross-border PVP link between Hong Kong's USD RTGS system and Malaysia's ringgit RTGS system in November 2006. Financial institutions can make use of these PVP links to settle the above FX currency pairs and both legs of the FX trades will be settled simultaneously, eliminating the principal element of FX settlement risk from the trades concerned.

The two parties to a PVP transaction can submit their payments to the RTGS systems at any time when the system is in operation, using a general code to flag that the payments are for PVP settlement. Each payment will be held in the RTGS system's queue until a matching programme has been able to match them. To do this, it uses information such as the settlement date, currencies involved, ordering institution and beneficiary institution. The transacting parties may also include a specific PVP code in the payments to uniquely identify the payment pair. Once payments are matched and funds are available for settlement, the matcher will trigger the two RTGS systems involved to settle the relevant payments simultaneously. Any unmatched payments at the end of the day are cancelled.

In 2006, the HKD RTGS system settled an average of HKD 12 billion a day on a PVP basis, accounting for 2% of the total turnover of the system. In the same period, an average of USD 2 billion a day was settled in the USD RTGS system on a PVP basis, accounting for 33% of the turnover. The EUR RTGS system settled an average of EUR 400 million a day, accounting for 38% of the turnover.

Annex 2: Survey materials.
Spreadsheets 1 to 3, the questionnaire, the checklist and instructions note.

SPREADSHEET 1: VALUE OF FOREIGN EXCHANGE RELATED SETTLEMENT OBLIGATIONS BY CURRENCY												1 February 2006							
Name of reporting entity:				City/country of trading centre or "consolidated":															
<p>Value of average daily FX-related obligations (spot, forward and swap) settled during April 2006. US dollar millions.</p> <p>Please fill in all the blue-shaded cells. If needed, use NA for "not available". Use 0 for zero or insignificant activity or for not relevant.</p> <p>Exclude non-deliverable forwards, contracts for difference, premiums paid for currency options. Include roll-over trades (if settled outright or by bilateral netting) and I/O swaps.</p> <p>Exclude trades with related parties and trades you are settling on behalf of others.</p>																			
	Total notional gross value of FX related obligations settled by reporting entity during period		of which, value of obligations settled under bilateral netting arrangements				Adjusted gross value of FX related obligations		of which, adjusted gross value of obligations settled via:										
									'On-us' accounts				CLS		Other PVP or equivalent settlement methods		Gross non-PVP settlement methods		
Currency	Notional gross payable	Notional gross receivable	Notional gross payable	Notional gross receivable	Actual net payable	Actual net receivable	Payable	Receivable	Payable	Receivable	Payable	Receivable	Payable	Receivable	Payable	Receivable			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)=(1)-(3)+(5)	(8)=(2)-(4)+(6)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
TOTAL																			
AUD																			
CAD																			
CHF																			
DKK																			
EUR																			
GBP																			
HKD																			
JPY																			
KRW																			
NOK																			
NZD																			
SEK																			
SGD																			
USD																			
ZAR																			
All other																			
<i>Memorandum item: total FX trading (average daily value) for April 2006:</i>																			
For further information, please see the separate document <i>Instructions for completing the spreadsheets</i> and/or the comments electronically annotated to relevant cells.																			

SPREADSHEET 2: VALUE OF FOREIGN EXCHANGE RELATED SETTLEMENT OBLIGATIONS BY COUNTERPARTY					1 February 2006				
Name of reporting entity:		City/country of trading centre or "consolidated":							
<p>Value of average daily receivables corresponding to FX-related obligations (spot, forward and swap) settled during April 2006. US dollar millions.</p> <p>Please fill in all the blue-shaded cells. If needed, use NA for "not available". Use 0 for zero or insignificant activity or for not relevant.</p> <p>Exclude non-deliverable forwards, contracts for difference, premiums paid for currency options . Include roll-over trades (if settled outright or by bilateral netting) and I/O swaps.</p> <p>Exclude trades with related parties and trades you are settling on behalf of others.</p> <p>The definition of a counterparty that you use when completing this attachment should be based on the way you manage your exposures.</p> <p>References to top 5 and top 10 refer to counterparties within the specified categories ranked by total notional gross value of FX-related obligations settled during April 2006.</p>									
Currency	Total notional gross value of receivables corresponding to FX related obligations	of which, value of receivables for obligations settled under bilateral netting arrangements	Adjusted gross value of FX related receivables	of which, adjusted gross value of receivables for obligations settled via:					
				"On-us" accounts		CLS	Other PVP or equivalent settlement methods	Gross non-PVP settlement methods	
				Without exposure to settlement risk	With exposure to settlement risk				
(1)	(2)	(3)	(4)=(1)-(2)+(3)	(5)	(6)	(7)	(8)	(9)	
TOTAL RECEIVABLES									
of which, receivables from top 5									
of which, receivables from top 10									
OF WHICH, BY COUNTERPARTY:									
CLS users:									
Settlement/user members									
of which, receivables from top 5									
of which, receivables from top 10									
Third parties									
of which, receivables from top 5									
of which, receivables from top 10									
Others:									
Banks									
of which, receivables from top 5									
of which, receivables from top 10									
Non-bank financial institutions									
of which, receivables from top 5									
of which, receivables from top 10									
Non-financial institutions									
of which, receivables from top 5									
of which, receivables from top 10									
<p>For further information, please see the separate document <i>Instructions for completing the spreadsheets</i> and/or the comments electronically annotated to relevant cells.</p>									

SPREADSHEET 3: TIMELINE OF FOREIGN EXCHANGE TRADE SETTLEMENT PROCESS

1 February 2006

Name of reporting entity: City/country of trading centre or "consolidated": **Please provide information ONLY for transactions that are settled via gross non-PVP settlement methods.**

Please fill in all the blue-shaded cells. If necessary, use NR for "not relevant" (eg because of zero or insignificant activity in the currency) and NA for "not available".

For the cells in all columns except the "time" columns please use the drop-down list which will appear when you click on the cell.

For the "time" columns, please provide answers in the local time of the indicated trading centre (not the local time of the currency) using format specified (eg 20:30 for time, V+1 for day).

Currency	Self-settle?	Send payment instruction		Unilateral payment cancellation deadline			Final receipts due			Identify final and failed receipts	
		Time	Day	Time	Day	Documented?	Time	Day	Documented?	Time	Day
	(1)	(2a)	(2b)	(3a)	(3b)	(3c)	(4a)	(4b)	(4c)	(5a)	(5b)
AUD											
CAD											
CHF											
DKK											
EUR											
GBP											
HKD											
JPY											
KRW											
NOK											
NZD											
SEK											
SGD											
USD											
ZAR											

For further information, please see the separate document *Instructions for completing the spreadsheets* and/or the comments electronically annotated to relevant cells.

INSTRUCTIONS FOR COMPLETING THE SPREADSHEETS

This note gives instructions on how to complete the spreadsheets in the Excel workbook. [Spreadsheets 1 to 3 earlier]

General information

Survey period

The survey period is the calendar month of April 2006.

Summary of spreadsheets

There are three spreadsheets:

- Spreadsheet 1 asks for information on settlement values according to the settlement method used (breakdown by currency).
- Spreadsheet 2 asks for similar information to Spreadsheet 1 but broken down instead by the type of counterparty.
- Spreadsheet 3 asks for information about the timetable for settling trades on a gross, non-PVP basis (breakdown by currency). (See below for definitions of different settlement methods.)

Consolidated or disaggregated data?

If possible, please provide disaggregated data – ie a separate set of spreadsheets (ie each of Spreadsheets 1, 2 and 3) for each of the specific trading centres/countries requested. (Some participating institutions have been asked to provide data not just for the trading centre/country where your head office is located but also for other trading centres/countries. Where this was the case, it was indicated in the letter you were sent requesting your participation in the survey.)

Consolidated data for your whole institution globally is also acceptable *if* the settlement of all the trades included in the data is handled in the same way by one central office.

- However, if settlement is managed locally (eg by local trading centres) rather than centrally, consolidated data causes complications. For example, the number of trading days in April (needed to calculate the daily averages in Spreadsheets 1 and 2) and the relevant timelines (needed for Spreadsheet 3) may vary between centres. (These complications and how to deal with them are explained further below.) There may also be problems in answering the qualitative questions in the separate document *Discussion questions*, which has also been sent to you. So in these circumstances, please do *not* use consolidated data or, if you feel you have to, please discuss the issue with us first (see contact details above).

You will see that spreadsheet 1 asks you to indicate which trading centre the spreadsheet is for or to put "consolidated", as applicable. This information (and the name of your institution) is then automatically displayed on Spreadsheets 2 and 3.

Spreadsheet 1

This spreadsheet asks for information on settlement values according to the settlement method used (breakdown by currency).

Please fill in all the blue-shaded cells. If needed, use NA for "not available". In this spreadsheet, use 0 for zero or insignificant activity or for "not relevant".

1.1 Settlement obligations

The survey covers foreign exchange spot, outright forward and swap deals.

- Exclude settlement obligations that *necessarily* take the form of single currency cash settlement and thus where FX settlement risk does not arise (eg non-deliverable forwards, contracts for difference, or premiums paid for currency options).
- Include the settlement obligations of roll-over trades when both currencies of such trades are settled outright or under bilateral netting arrangements with the counterparty.
- Include the settlement obligations of any in/out (I/O) swaps if you are a CLS user. I/O swaps include PETRA, SEMAPHORE and TUCS trades.

All the figures should exclude settlement obligations for trades with **related parties** (ie branches, subsidiaries or affiliated firms).

Also exclude the settlement obligations of trades that you are settling on behalf of others (ie trades where you are not a counterparty to the trade – for example, if you are a CLS settlement member, exclude trades that you settle in CLS on behalf of third party users).

1.2 Values

Please provide *average daily values* for the month. In calculating these, use the number of working days in April for the trading centre concerned.

- However, if you are providing consolidated data and the number of working days varies between the trading centres covered by that data, please use a weighted average of the number of trading days (the number of trading days in each centre weighted by the value of settlement obligations managed by that centre).

Values should be expressed, in millions, as USD equivalent amounts.

- If possible, calculate these amounts using exchange rates prevailing on the settlement date of the trade (either average rates over that day or a rate at a point during the day). If this is not possible, average exchange rates for April or even end-April rates may be used.
- If you want to show fractions of a million, please use the format according to your computer's regional setting (eg for USD 1,500,000, put 1.5 if you have an American setting, but put 1,5 if you have a German setting).

1.3 Explanation of the columns

Columns 3 to 6: bilateral netting

Please include in columns 3 and 4 the notional *gross value* of those FX settlement obligations that are bilaterally netted and then settled by paying the netted amount to the counterparty. Include in columns 5 and 6 the actual *net values* paid and received.

Columns 7 and 8: amounts to be settled

Columns 7 and 8 include the actual amounts to be settled (ie adjusted for the effect of bilateral netting where relevant). Thus:

- Column 7 = Column 1 – Column 3 + Column 5
- Column 8 = Column 2 – Column 4 + Column 6

Columns 9 to 18: different settlement methods

Columns 9 to 18 then indicate which settlement methods are used to settle the amounts in columns 7 and 8. Thus:

- Column 7 = Column 9 + Column 11 + Column 13 + Column 15 + Column 17
- Column 8 = Column 10 + Column 12 + Column 14 + Column 16 + Column 18

The possible settlement methods are as follows:

Columns 9 to 12. On-us accounts

Please include the settlement obligations of those FX trades where both currencies are settled across your books (for example, when you trade with one of your customers who maintains accounts with you in both the relevant currencies) or where both currencies are settled across the books of your counterparty (for example, when you trade with a counterparty with whom you maintain accounts in both the relevant currencies).

Columns 9 and 10. "On-us" accounts without exposure to settlement risk

Please include the settlement obligations of those trades where execution or authorisation of the relevant entry in the "on-us" account denominated in the currency you are selling is *conditional* upon the execution or authorisation of the corresponding entry in the "on-us" account denominated in the currency you are buying. For example where the accounting entries for settling obligations in both currencies are either made simultaneously or there is certainty that they will be made within preauthorised credit lines.

Columns 11 and 12. "On-us" accounts with exposure to settlement risk

Please include the settlement obligations of those trades where execution or authorisation of the relevant entry in the "on-us" account denominated in the currency you are selling is *NOT conditional* upon the execution or authorisation of the corresponding entry in the "on-us" account denominated in the currency you are buying. For example when final credit for the currency you are selling is given without assurance that there will be covering balances or preauthorised credit lines that will cover the corresponding debit for the currency you are buying.

Columns 13 and 14. CLS

Please include the obligations that you settle through the CLS Bank (as a settlement member, user member or a third party).

- Please report the notional gross value of FX-related obligations settled via CLS (ie the gross values of payables and receivables, *not* the value of the associated pay-ins and pay-outs).
- Only include the settlement obligations of transactions that you are a counterparty to (eg if you are a settlement or user member, you should *not* include amounts settled on behalf of third parties in your function as a third party service provider).

- I/O swaps:
 - Please include in these columns the notional gross value of payables and receivables associated with the *in-leg* of all in-out swaps, including PETRA, SEMAPHORE and TUCS trades.
 - The related notional gross value of payables and receivables associated with the *out-leg* should NOT be included here. Instead it should be included in the column corresponding to the settlement method used.

Columns 15 and 16. Other PVP or equivalent settlement methods

Please include the settlement obligations of transactions that are settled using any other mechanism that provides payment-versus-payment (PVP) – for example, Hong Kong's PVP arrangement for EUR, HKD and USD trades. Included under this heading are the settlement obligations of trades that settle on the books of a single correspondent bank (ie where both you and your counterparty have accounts at that bank in the relevant currencies) provided that bank explicitly offers a PVP service.

Please also include under this heading any settlement method that provides you with equivalent protection against the loss of principal – even if it does not provide your counterparty with this protection. (If the counterparty, who is not protected, is also participating in this survey, it should include the same trades under "gross non-PVP".) For example, this includes:

- settlement obligations where the counterparty has to pre-fund, to post collateral or to provide other guarantees equal to the full value of the currency you are buying;
- settlement obligations where you send the payment instruction for the currency you are selling only after you have definitely received the currency you are buying. For example, if (a) the counterparty has an account with you in the currency you are buying, and you debit that account before sending the payment instruction for the currency you are selling; or (b) you are located in an eastern time zone (eg Japan), the currency you are selling is in a western time zone (eg US dollars), and you require receipt of the currency you bought before sending the payment instruction for the currency you are selling.

Columns 17 and 18. Gross non-PVP settlement methods

Please include those settlement obligations where your payment of the currency you are selling is not conditional upon your receipt of the currency you are buying.

Please exclude obligations settled via on-us accounts with exposure to settlement risk, which should be reported under columns 11 and 12 (see above).

1.4 Value traded

This survey is primarily concerned with how trades *settle*. However, at the bottom of Spreadsheet 1 you are also asked for the daily average value *traded* during April 2006 as a memorandum item.

This figure does not need to be specially calculated for this survey. Provide it only if April 2006 data is readily available – for example because it is being calculated and reported by your institution as part of a routine (eg monthly, semi-annual or annual) survey on FX trading (eg those taking place in Australia, Canada, Japan, UK and the USA) or if you calculate it using a comparable methodology for internal/management purposes.

Whether you are completing the spreadsheets for one or more specific trading centres/countries or on a consolidated basis, the figure you provide here should be on the same basis.

Spreadsheet 2

Spreadsheet 2 asks for similar information to Spreadsheet 1 – ie settlement values according to the settlement method used - but broken down instead by the type of counterparty.

You need provide information only on notional gross **receivables** (ie not payables).

Please fill in all the blue-shaded cells. If needed, use NA for "not available". In this spreadsheet, use 0 for zero or insignificant activity or for "not relevant".

2.1 Settlement obligations

See Spreadsheet 1.

2.2 Values

See Spreadsheet 1.

2.3 Explanation of the columns

See Spreadsheet 1 (although Spreadsheet 2 only has columns relating to receivables)

2.4 Counterparties

The definition of a "counterparty" that you use when completing this spreadsheet should be based on the way you manage your exposures. For example, if you treat two offices of the same bank as being different for risk management purposes (eg they have different trading limits) then you should treat them here as being two different counterparties. But if you treat them as a single entity with a single limit, they should be considered as a single counterparty.

References to "top 5" and "top 10" counterparties refer to counterparties within the specified categories ranked by total notional gross value of all FX-related settlement obligations during April 2006.

Counterparties are divided into five categories:

1. *CLS members.* This includes both settlement members and user members. There is list of members at <http://www.cls-services.com/whoswho/members.cfm>.
2. *CLS third parties.* A list of some CLS third parties can usually be found at <http://www.cls-services.com/news/>. However, the list excludes investment funds and a few others that wish to remain anonymous. Only include a counterparty as a CLS third party if it appears on the list and/or you have settled some deals with that counterparty using CLS in the recent past.
3. *Non-CLS banks.* Any bank that is neither a CLS member nor a CLS third party user. "Bank" means any bank, credit institution or depository institution according to the relevant local definition.
4. *Non-CLS, non-bank financial institutions.* This category covers any financial institution not included under categories 1 to 3 above (eg non-bank financial institutions such as mutual funds, pension funds, hedge funds, currency funds, money market funds, building societies, leasing companies, insurance companies, other financial subsidiaries of corporate firms, and central banks – in all cases provided these institutions are *not* CLS users).
5. *Non-CLS, non-financial institutions.* Any counterparty that is not included under categories 1 to 4 above.

Please note that the category applies to the counterparty regardless of the settlement method used. For example, all settlement obligations concerning a CLS member should be

in the CLS user row of the spreadsheet (ie under category 1), even for trades where CLS is not used because the trade is in a currency ineligible for CLS.

Please note also that, for a given column, the sum of the figures in rows 21, 24, 28, 31 and 34 should equal the total receivables figure in row 16.

Spreadsheet 3

This spreadsheet asks for information about the timetable for settling trades (breakdown by currency). Please provide information ONLY for transactions that are settled via gross non-PVP settlement methods.

Please provide the information for any point during April 2006 that is representative of your routine settlement practices.

Please fill in all the blue-shaded cells. In this spreadsheet, if needed, use NR for "not relevant" (eg because of zero or insignificant activity in the currency) and NA for "not available".

....

3.1 Which times?

If you are providing disaggregated data, the times should be in the local time of the trading centre concerned (*not* the local time of the currency).

If you are providing consolidated data and the settlement of all the trades included in the data is handled by one central office, then the times should be in the local time of that office.

If you are providing consolidated data and the centres included have different timelines, you will need (for each of the four "time points" asked for, for each of the currencies) to use the "worst case" time that applies (expressed in the local time of your head office to ensure the times are comparable). For "send payment instruction" and "unilateral payment cancellation deadline", the worst case time will be the earliest time that applies; for "final receipts due" and "identify final and failed receipts" it will be the latest time.

3.2 Formats

For each time, please indicate the hour and minute using the 24 hour clock (eg 15:30), not the am/pm format. Please use 00:00 for midnight and 12:00 for midday. Please express the time using four digits and with a colon separating hours and minutes eg 07:00 (not 7:00 or 07.00).

For each day, please use V to indicate value day (ie the scheduled settlement day), V-1 (or V-2 etc) to indicate one (or two etc) business day(s) before value day, and V+1 (or V+2 etc) to indicate one (or two etc) business day(s) after value day. You can choose the day from the drop-down list. (Please note that, if you need them, NA and NR are at the bottom of the drop-down list.)

Please put the time and day in the relevant cells. For example, 8.30 pm on the day after settlement day should be entered as 20:30 in the time cell and shown as V+1 in the day cell.

3.3 Self-settlement

If you self-settle in a particular currency, please put "yes" in Column 1 against that currency. Otherwise put "no". "Self-settle" means that you use a branch, subsidiary or other affiliate of your own institution to settle that currency, not a correspondent bank.

3.4 Timeline definitions

Spreadsheet 3 asks for four specific times for each currency.

Send payment instruction

At what time do you routinely issue your payment instructions for value on day V?

Unilateral payment cancellation deadline

In routine cases (ie ignoring best effort arrangements or any other possible form of special handling), what is your routine deadline for unilaterally cancelling (or delaying or amending) with certainty your payment instructions for value on day V? In other words, what is the earliest time after which such cancellation is not certain because it may depend on the consent or best efforts of your correspondent bank, the beneficiary, the beneficiary's correspondent bank, or some other intermediary?

If your back office or correspondent has more than one way to execute your payment instructions in a particular currency (eg via a large-value transfer system or via book-entry transfer) and the cancellation deadlines differ according to the method used, please list the earliest time.

Final receipts due

Assuming your counterparty (via its correspondent bank etc) has successfully made the payment on time given the terms of the trade, by what time will the funds be credited to your account? In other words, what is the latest time your correspondent in the currency concerned will credit your account with finality?

Note that where a payment could be received by your correspondent at any time during the payment system day, this time would normally be no sooner than the close of the payment system.

If funds can be paid to you in more than one way (eg via a large-value funds transfer system or via book-entry transfer), please list the latest time a final payment can reach you via any of the relevant options and still be considered on time.

Identify final and failed receipts

At what time do you usually identify final and failed payments to you for value on day "V"?

In the case of the "unilateral payment cancellation deadline" and the "final receipts due", the spreadsheet asks if the times are **documented**. Please reply "yes" if the indicated time and day is based on a legally enforceable agreement or arrangement. Otherwise reply "no".

DISCUSSION QUESTIONS

Central banks will be using this document to initiate a qualitative discussion regarding your institution's management of foreign exchange settlement risk as part of the survey. It would be helpful if, at the meeting, those present are able to provide answers applicable to **each** of the centres/countries for which you are providing statistical data.

Senior management oversight

1. Please describe the current duties, responsibilities and reporting structure of the person(s) charged with managing on a day-to-day basis your institution's foreign exchange settlement exposures with individual counterparties.
2. Please describe the types of management information reporting related to foreign exchange settlement provided to senior level management on a routine and ad hoc basis.

Managing exposure

3. Please describe your institution's general framework and policies for managing and controlling foreign exchange settlement exposures.
 - Please discuss the extent to which FX settlement exposures are managed and controlled like deposits, placements, and other formal short-term credit extensions of similar size and duration.
 - How and to what extent does your institution aggregate its FX settlement exposure with its measures of other short-term credit extensions to the same counterparty?
4. Please describe your institution's (or, where relevant, your individual trading centre's) current process for managing counterparty credit exposures associated with FX settlements.

Please specify, in managing counterparty credit exposures:

- Does your institution apply limits to the counterparty credit exposures associated with FX settlements?
 - How and to what extent does your institution apply counterparty trading limits in a way that takes into account the particular method used to settle each trade?
 - Are limits applied globally or on a decentralised basis among your institution's trading centres?
 - Are limits mandatory (ie do you allow them to be exceeded)? If limits are not mandatory, please explain.
 - If exposures in excess of counterparty credit limits do occur, how are they handled?
 - To the extent that your institution participates in CLS-related in-out swaps (PETRA, SEMAPHORE and TUCS trades), how are exposures related to the out-leg of these transactions managed? In managing those exposures, how does your institution balance the reintroduced credit exposures and the liquidity reduction effects of these trades?
5. How and to what extent does your institution avoid exposure to settlement risk during "on-us" account settlement (eg through simultaneous entries in the two relevant currency accounts; credit checks; controls to ensure credit limits are not breached in the accounts denominated in the relevant currencies; withholding availability of funds)?

Measuring exposure

6. Please describe your institution's general framework and policies for measuring its foreign exchange settlement exposures.
7. Please describe your institution's (or, where relevant, your individual trading centre's) current methodology for measuring and projecting its FX settlement exposures for

counterparty credit risk management purposes across settlement methods (ie via bilateral netting; "on-us" accounts without exposure to settlement risk; "on-us" accounts with exposure to settlement risk; CLS; other PVP or equivalent arrangements; and gross non-PVP settlements)⁵⁶.

- How and to what extent do these settlement exposure measures take into account the different size and duration of exposures across each of the settlement methods?
- Do these exposure measures recognise the elimination of the risk of loss of principal when settling via (a) CLS (b) "on-us" accounts without exposure to settlement risk and (c) other PVP or equivalent settlement methods?
- Please discuss how the measures avoid underestimating the potential size and duration of exposures resulting from settlement via (a) gross non-PVP methods and (b) "on-us" accounts with exposure to settlement risk.
- For obligations settled gross without PVP, please specify the extent to which the methodology takes into account:
 - The period of "irrevocability" when settling a trade (ie the time between your institution's unilateral cancellation deadline of the sold currency and the time by which the final receipt of the bought currency is due); and
 - The period of "uncertainty" when settling a trade (ie the time it takes your institution to identify the final or failed receipt of the bought currency after it is due).
- For obligations that are netted before settlement:
 - Are the institution's bilateral netting arrangements (a) solely for the purpose of reducing operational risk and liquidity needs (ie "position" or "payment" netting with no reduction in gross counterparty credit risk) or (b) solely/also for the purpose of reducing counterparty credit risk (eg netting by novation)?
 - Are the periods of "irrevocability" and "uncertainty" for net settled payments and receipts materially different (ie involve different unilateral cancellation and receipt

⁵⁶ The possible settlement methods are defined as follows:

Bilateral netting: These trades are netted and then settled by paying the netted amount to the counterparty.

"On-us" account settlement: Trades where both currencies are settled across your books or where both currencies are settled across the books of your counterparty (for example, when you trade with one of your customers who maintains accounts with you in both the relevant currencies).

"On-us" accounts without exposure to settlement risk: Where execution or authorisation of the relevant entry in the "on-us" account denominated in the currency sold is *conditional* upon the execution or authorisation of the corresponding entry in the "on-us" account denominated in the currency bought. For example where the accounting entries for settling obligations in both currencies are either made simultaneously or there is certainty that they will be made within preauthorised credit lines.

"On-us" accounts with exposure to settlement risk: Where execution or authorisation of the relevant entry in the "on-us" account denominated in the currency sold is *NOT conditional* upon the execution or authorisation of the corresponding entry in the "on-us" account denominated in the currency bought. For example when final credit for the currency sold is given without assurance that there will be covering balances or preauthorised credit lines that will cover the corresponding debit for the currency bought.

CLS: Transactions that are settled through the CLS Bank (as a settlement member, user member or a third party) including the in-leg of I/O swaps (PETRA, SEMAPHORE and TUCS trades).

Other PVP or equivalent arrangements: Any other settlement mechanism that provides PVP (eg Hong Kong's PVP arrangement for EUR-HKD and USD-HKD trades) or equivalent protection against the loss of principal (eg trades that require the counterparty to prefund, post collateral or provide other guarantees equal to the full value of the receivable).

Gross non-PVP settlements: Where your payment of the currency sold is not conditional upon your receipt of the currency bought (eg through the exchange of currencies via traditional correspondent banking arrangements).

See the *Instructions for completing the spreadsheets* for a fuller description of the various settlement methods.

identification times) from those settled gross without PVP? If yes, please describe the extent of this variation.

- Are these exposure measurement methodologies consistently applied across all counterparties that use the same settlement method? Please elaborate on any exceptions.
8. Please describe and/or provide copies of management information reports routinely used to give information about the size and duration of foreign exchange settlement exposures.

Measuring costs

9. Please describe whether and how your institution measures the costs associated with settling foreign exchange trades.
- How and to what extent do these cost measures take into account the associated back-office processing, payment/funding/cash-management, transaction processing, and/or any other relevant costs?
 - How and to what extent do these measures take into account any differences in the overall cost of settling foreign exchange trades according to the associated settlement method (ie via bilateral netting; “on-us” accounts without exposure to settlement risk; “on-us” accounts with exposure to settlement risk; CLS; other PVP or equivalent arrangements; and gross non-PVP settlements)?

Strategy

10. Please describe how and to what extent differences in exposures and/or costs influence the choice of settlement method used in particular circumstances.
- Please discuss any policies or guidelines your institution may have on the settlement method to be used under specific circumstances.
 - If such policies or guidelines exist, are they mandatory? If not, please explain.

11. Please describe how and to what extent your institution takes into account at the time of a trade the relative risk and/or cost of the associated settlement method.

Please elaborate on:

- What, if any, specific “front office” mandatory requirements and/or incentives (eg higher counterparty limits, lower charges against counterparty limits, lower fees and/or risk premium charges to counterparties, higher incentive compensation for traders, other) are used to encourage trades that use settlement methods with lower risk and/or lower cost?
- Who and/or what other factors influence the selection of a particular trade’s settlement method (eg trader preference, non-mandatory institutional policies or guidelines, counterparty preference, limits imposed by nostros, limits imposed by settlement members, operational efficiency, trading volumes at the centre concerned, other)?

12. Does your institution’s choice of a settlement method vary by the type of foreign exchange instrument involved in the transaction?

- Please discuss whether the structural differences among the FX instruments (spot, forwards, and swaps) create any reason to select a particular type of settlement method.

13. Please discuss your perspective on the evolution of settlement practices in the foreign exchange market as a whole over the next one to three years.

- Do you expect significant growth or contraction (ie by 10 percentage points or more) or stability in the relative share (by value) of the various foreign exchange settlement methods (ie via bilateral netting; “on-us” accounts without exposure to settlement risk; “on-us” accounts with exposure to settlement risk; CLS; other PVP or equivalent arrangements; and gross non-PVP settlements)?
 - Please describe what you think is the underlying rationale for these projected changes, as well as the major risks, uncertainties and/or concerns you may have regarding these projections.
14. Please describe any significant planned changes in settlement practices at your institution in the next several years (eg regarding the use of various foreign exchange settlement methods, changes to the unilateral cancellation/receipt-identification times, other).
15. Please discuss the initiatives your institution is taking or could consider in order to improve the management of FX settlement risk.
- Please identify the areas within your institution whose support would be needed to realise these improvements:
 - Executive management
 - Senior credit officer(s)
 - Senior back-office management
 - Senior cash management
 - Front office / trading room
 - Other?
 - What external support would be needed to realise these improvements?
 - Action by industry groups?
 - Action by central banks?
 - Action by supervisors/regulators?
 - Other?

Checklist (Document G)

18 May 2006

To be completed electronically by interviewing central bank. Use the drop-down lists where provided; the options NR (for not relevant) and NV (for the institution has no view on the issue) are only provided for certain cells. Where there is no drop-down list you can enter free text, but please be as concise as possible.

Country of central bank:

Anonymised name of reporting entity (Bank A, Bank B etc):

Type of Institution

Sample category (ie "80% sample" or "other")

Country of trading centre (if applicable - otherwise put "all" if the institution has provided multiple quantitative spreadsheets but this checklist applies to all of them or "consolidated" if the institution has provided consolidated data covering more than one country):

Senior management oversight (Interview questions 1 and 2)

- A Has the institution established clear, senior level responsibility and authority for managing its FX settlement exposures with individual counterparties?

Managing exposure (Interview questions 3 to 5)

- B In aggregating credit exposures across products/business lines, does the institution apply the same weight to FX settlement exposures as it does to other similar exposures to the same counterparty (eg is \$1 of FX settlement exposure treated the same way as \$1 of short-term credit)?

- C Does the institution subject FX settlement exposures to the same or equivalent counterparty credit management and controls (eg limits, management process) it applies to other similar exposures?

- D If counterparty credit limits are applied to FX settlement exposures:

- D1 Does the institution apply these limits in a way that takes into account the particular method used to settle each trade?

- D2 Is there a global limit (for each counterparty) that applies across all the institution's trading centres?

- D3 As far as D2 is concerned, is the way the limits are applied to FX exposures the same as the way that they are applied to other similar exposures?

- D4 Are they mandatory (ex ante or ex post)?

- D5 As far as D4 is concerned, is the way the limits are applied to FX exposures the same as the way that they are applied to other similar exposures?

- E To the extent that the institution participates in CLS-related in-out swaps (including PETRA, SEMAPHORE and TUCS trades), does it appropriately manage the exposures related to the out-leg if these transactions (eg does it ensure that limits are not exceeded)?

- F For obligations categorised as settled via "on-us" accounts without exposure to settlement risk, does the institution ensure that final execution or authorisation of the relevant entry in the "on-us" account denominated in the currency sold will not occur without final execution or authorisation of the corresponding entry in the "on-us" account denominated in the currency bought?

Note: If answer is "no" please ensure that institution's data reporting is accurate, they should not include any trades in "on-us without settlement risk" category since they do not have proper credit controls to eliminate settlement risk.

Measuring exposure (Interview questions 6 to 8)

- G Does the institution have a measurement methodology of FX counterparty credit exposure that recognises the elimination of exposures when using the following settlement methods:

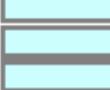
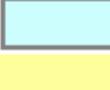
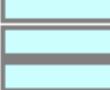
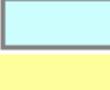
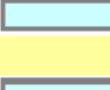
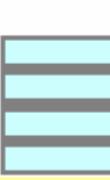
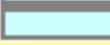
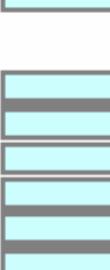
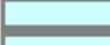
- G1 CLS?

- G2 "on-us" accounts without exposure to settlement risk?

- G3 other PVP or equivalent arrangements?

- H Does the institution have a measurement methodology that appropriately measures (ie avoids underestimating) the size and duration of its FX settlement exposure when using "on-us" accounts with exposure to settlement risk?

- I Does the institution have a measurement methodology that appropriately measures (ie avoids underestimating) the size and duration of the FX exposures arising from trades settled gross without PVP?

I1 Does the Institution appropriately capture the period of "Irrevocability" in its measurement methodology of counterparty credit exposure for settlement of these obligations?	
I2 Does the Institution appropriately capture the period of "uncertainty" in its measurement methodology of counterparty credit exposure for settlement of these obligations?	
J For obligations that are bilaterally netted before settlement, are some or all of these arrangements intended to reduce overall counterparty credit risk (for example, through netting by novation) rather than just to reduce settlement flows (for example, through payment or position netting)? If yes, select appropriate share of such netting arrangements (as a percent of the gross notional value of trades settled under bilateral netting arrangements):	     
J1 over 75%	
J2 between 50% and 75%	
J3 less than 50%	
J4 don't know	
K For obligations that bilaterally netted before settlement, are the Institution's periods of "Irrevocability" and "uncertainty" for net settled payments and receipts materially different from those for gross non-PVP settlements?	
L Does the Institution appropriately capture in management information reporting the size and duration of the exposure it faces across settlement methods?	
Controlling exposure	
M Based on discussions and answers to questions on senior management oversight, managing exposures, and measuring exposures, does the Institution appropriately control its settlement exposures?	
<i>Note: Please provide any comments that may be relevant for the above answer.</i>	
Measuring costs (Interview question 9)	
N Does the Institution measure the overall cost of settling FX transactions?	
O If yes, does the Institution capture differences across settlement methods in any of the following factors when measuring the costs of settling its foreign exchange transactions:	
O1 back-office processing costs?	
O2 payment/funding/cash-management arrangements?	
O3 transaction processing fees?	
O4 other? (please specify)	
Strategy (Interview questions 10 to 15)	
P Does the Institution have any policies or guidelines on which settlement method should be used in specific circumstances?	
P1 Do these policies or guidelines reflect differences in the settlement exposures associated with the different settlement methods?	
P2 Do these policies or guidelines reflect differences in the overall costs associated with the different settlement methods?	
Q Are the Institution's policies or guidelines on the settlement method to be used in specific circumstances:	
Q1 mandatory?	
Q2 voluntary?	
Q3 mandatory only for some settlement methods or in some circumstances?	
R Does the Institution have any of the following incentives for those initiating transactions to select lower risk settlement methods when available:	
R1 higher counterparty limits?	
R2 lower charges against counterparty limits?	
R3 lower fees and/or risk premium charges to counterparties?	
R4 higher incentive compensation for traders?	
R5 other? (please specify)	
S Does the Institution's choice of settlement method vary by the type of foreign exchange instrument involved in the trade?	

- T Does the Institution project significant growth in the market as a whole (ie by 10 percentage points or more) over the next one to three years in the relative share (by value) of any of the following foreign exchange settlement methods:
- T1 bilateral netting?
 - T2 "on-us" accounts with exposure to settlement risk?
 - T3 "on-us" accounts without exposure to settlement risk?
 - T4 CLS?
 - T5 other PVP or equivalent arrangements?
 - T6 gross, non-PVP settlements?
- U Does the Institution project significant contraction in the market as a whole (ie by 10 percentage points or more) over the next one to three years in the relative share (by value) of any of the following foreign exchange settlement methods:
- U1 bilateral netting?
 - U2 "on-us" accounts with exposure to settlement risk?
 - U3 "on-us" accounts without exposure to settlement risk?
 - U4 CLS?
 - U5 other PVP or equivalent arrangements?
 - U6 gross, non-PVP settlements?
- V At the moment, does the Institution have plans to make significant changes in its settlement practices over the next one to three years:
- V1 Increase the use of bilateral netting?
 - V2 Increase the use of CLS?
 - V3 Increase the use of other PVP or equivalent arrangements?
 - V4 Improve unilateral cancellation times?
 - V5 Improve receipt-identification times?
 - V6 other? (please specify)
- W Which areas' support within the institution would be needed to realise further improvements in the management of FX settlement risk (regardless of whether such support is likely to be forthcoming or not):
- W1 executive management
 - W1.1 If yes, please briefly specify form of support.
 - W2 senior credit officer(s)
 - W2.1 If yes, please briefly specify the form of support.
 - W3 senior back-office management
 - W3.1 If yes, please briefly specify form of support.
 - W4 senior cash management
 - W4.1 If yes, please briefly specify form of support.
 - W5 front office/trading room
 - W5.1 If yes, please briefly specify form of support.
 - W6 other? (please specify)
- X What external support would be needed to realise further improvements in the management of FX settlement risk (regardless of whether such support is likely to be forthcoming or not)?
- X1 action by industry groups?
 - X1.1 If yes, please briefly specify form of support.
 - X2 action by central banks?
 - X2.1 If yes, please briefly specify form of support.
 - X3 action by supervisors/regulators?
 - X3.1 If yes, please briefly specify form of support.
 - X4 other? (please specify)

Annex 3: Methodology

Most of the survey results were calculated directly by aggregating or averaging the survey data obtained in Spreadsheets 1 to 3 and in the Checklist (see Annex 2). However, some results require further explanation, which is given in this annex.

CLS market share

This section explains the CLS market share calculation in the introduction to Section 3.

In the survey, CLS accounted for \$2,091 billion (55%) of the total settlement obligations of \$3,821 billion. However, we know from CLS's own data that, in the market as a whole (ie including institutions not in the survey), the daily average settlement value in CLS in April 2006 was \$2,600 billion. Assuming that the survey objective of covering 80% of the market was achieved, total settlement obligations in the market were \$4,776 billion (ie 1.25 times 3,821). The CLS share was thus 54% (ie 2,600/4,776). However, as noted in footnote 26, the survey may have covered slightly less than 80% of the market, and thus the estimate is that CLS's market share was "up to 54%".

Exposure durations

This section explains the exposure duration results for currency pairs that were reported in Tables 9 and 10 in Part II. (For Table 11, see below.)

As noted in the main text, when settling an FX trade by traditional correspondent banking, an institution's exposure begins when it can no longer *unilaterally cancel* its instruction to pay the currency it is selling and it ends when it *receives with finality* the currency it is buying (this defines the I period). The U period starts when the I period ends and continues until the institution has *identified* whether or not it has received the currencies it is buying.

- For the survey estimates, data on the *unilateral cancellation deadline* for each currency being sold by an institution was usually taken from column (3) of Spreadsheet 3. However, where the institution routinely sent its payment instruction after this time, the latter time was in most cases used instead (taken from column (2)).⁵⁷ For example, an institution's euro correspondent may have told it that it can unilaterally cancel a euro payment instruction until 18:00 on the day before settlement day (ie 18:00 V-1). But if the institution only sends its payment instruction to its correspondent at 08:00 on Day V, the latter time was taken as being the adjusted unilateral cancellation deadline.⁵⁸ The resulting times (ie whether from column (2) or column (3)) are referred to as the "adjusted unilateral cancellation deadlines".
- The time when the currency being bought was *received with finality* was assumed to be the closing time of the relevant payment system in the currency concerned. These times are given in Table 20.
- The time when an institution identified whether or not the currency being bought had been received was taken from column (5) of Spreadsheet 3.

The *reference durations* were, as discussed in Box 4 earlier, based on the opening and closing times of the relevant payment systems (the opening times are also given in Table 20). For example, when selling EUR and buying USD, the reference duration would (in

⁵⁷ However, this was *not* done in the case of a few institutions where, on the basis of the information they provided in the survey about their internal procedures, it was judged not to be appropriate.

⁵⁸ Note that this assumes that if an institution decides to cancel its instruction to pay a certain counterparty it can immediately take the necessary action to prevent that instruction from being sent to the correspondent bank – ie the payment can be cancelled right up to the send time. In practice, an institution may need time to identify the payment instruction in its internal systems and cancel it.

the local times of the currencies concerned) be from 07:00 CET to 18:00 EST, which, adjusting for the six-hour time zone difference, is a duration of 17 hours (the time zone information relevant for April 2006 is also given in Table 20).

Table 20
Payment system hours and time zones

For currencies, payment system hours in local time of currency. For reporting locations, time zones relative to UTC/GMT in April 2006

Currency	Opening time (earliest time FX-related payment for value on V could settle)	Closing time (latest time FX-related payment for value on V could settle)	Location	Time zone
AUD	09:15	18:30	Australia	+10
CAD	06:00	18:00	Canada	-4
CHF	17:00 V-1	15:00	Switzerland	+2
DKK	07:00	15:30	Denmark	+2
EUR	07:00 CET	17:00 CET	-	+2
	-	-	Ireland, Portugal	+1
	-	-	Finland, Greece	+3
	-	-	All other (CET)	+2
GBP	06:00	16:00	United Kingdom	+1
HKD	09:00	17:30	Hong Kong SAR	+8
JPY	09:00	19:00	Japan	+9
KRW	09:30	17:00	Korea	+9
NOK	05:40	16:30	Norway	+2
NZD	09:00	08:30 V+1	New Zealand	+12
SEK	07:00	17:00	Sweden	+2
SGD	09:00	19:00	Singapore	+8
USD	21:00 V-1 EST	18:00 EST	-	-4
	-	-	USA (East Coast)	-4
	-	-	USA (West Coast)	-7
ZAR	08:00	16:00	South Africa	+2

Exposure profiles

This section explains the results shown in Charts 2, 3, 7 and 8 and also in Table 11.

An institution's exposure profile to the trades settling on a single day (V) was based on the timing data in Spreadsheet 3 and the currency breakdown of obligations settled by traditional correspondent banking in Spreadsheet 1 ("gross non-PVP settlement" in columns (18) and (19)).

Consistent with the exposure duration calculations described above, an institution's exposure was assumed to increase by the amount payable in a currency (column (18)) when the adjusted unilateral cancellation deadline for that currency was reached. The exposure was assumed to decrease by the amount receivable in a currency when the payment system

closing time for that currency was reached (for the I period) or when the relevant identification time was reached (for the I+U period). Box 8 gives an example that corresponds to the I period profile for a single day's trades in the institution's local time (ie as in Charts 2 and 7a). The example also shows how, because of a lack of data on currency pairs in the survey, the method may underestimate the exposure for part of the period.

The exposure profile for an institution's multiple day trades was created by superimposing the relevant single day profiles. Box 8 also gives an example of this. Note that in the example – and in reality – the single day profile for each day's trades is different, reflecting differences in the pattern of trading, whereas in the survey we had to assume that each day was the same (ie the daily average for the survey period).

Finally, the average durations for institutions, shown in Table 11, were calculated by measuring the area under an institution's single day profile (ie the integral of the profile) and dividing this by the height (ie the maximum exposure). In effect, this is a measure of the width of the profile, and hence the duration of the exposure.

Box 8

Example of exposure profile calculation

Single day profile

This box gives, first, an example of the single day profile for the I period for an institution that has trades in just three currency pairs. The value of the trades in each currency pair due to settle on Day V by traditional correspondent banking is as follows:

Currency pair	Value of trades (USD equivalent)
Sell NZD, buy AUD	200
Sell USD, buy AUD	100
Sell EUR, buy USD	150

Note, however, that Spreadsheet 1 has a breakdown by currency but not by currency pair. The above data would thus appear in Spreadsheet 1 as follows:

Currency	Amount payable	Amount receivable
NZD	200	0
AUD	0	300
EUR	150	0
USD	100	150

The institution is assumed to be located in London (ie in the British Summer Time time zone) and to have adjusted unilateral cancellation deadlines (expressed in BST) as follows for the three currencies being sold:

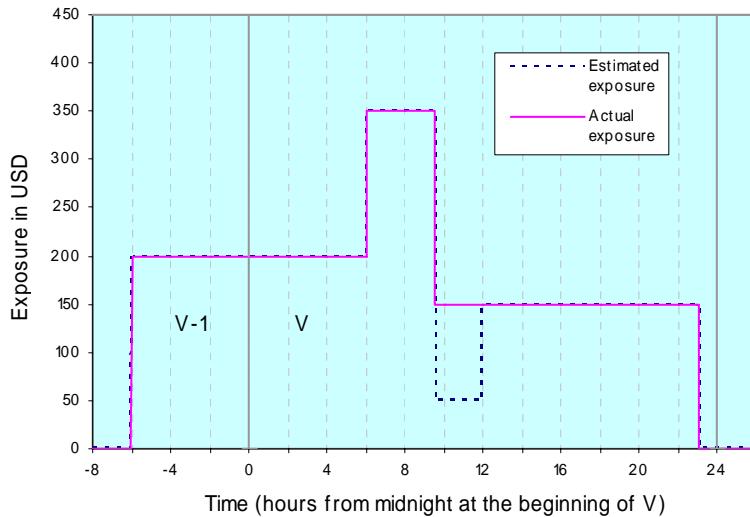
Currency sold	Exposure starts
NZD	18:00 V-1
EUR	06:00 V
USD	12:00 V

The relevant final receipts due times for the two currencies are as follows (taken from Table 20 and converting the relevant payment system closing time into BST):

Currency bought	Payment system close (local time of currency)	Exposure ends (BST)
AUD	18:30 V	09:30 V
USD	18:00 V	23:00 V

The dashed line in the chart below shows the estimated exposure profile. Under the estimation method used, the institution has no exposure to Day V trades until 18:00 V-1, when its exposure goes up to 200 (the amount of the NZD being sold). The exposure increases by 150 to 350 at 06:00 (because of the EUR being sold). Then at 09:30 V it decreases by 300 to 50 (because of the AUD being bought, assuming the currency was indeed received). However, at 12:00 it goes back up to 150 (because of the USD being sold). Finally, at 23:00 the exposure falls back to zero because of the USD being bought, again assuming the currency was received).

Box 8 (continued)



However, this method of estimating the exposure profile leads to possible underestimation. The cause of the underestimation is that some currency pairs generate no exposure. In this example there is no exposure (at least on an I period basis) where USD are being sold against AUD (trades with a value of USD 100). This is because the unilateral cancellation time for the USD, at 12:00 V, is *after* the AUD have been received, at 10:30 V - ie the institution does not irrevocably commit itself to paying the USD until after it has received the AUD. Therefore at 10:30 V the exposure profile should only decrease to 150, rather than to 50 – ie it should only go down by the amount of the trades where NZD (rather than USD) are being sold against AUD (these trades *do* generate exposures).

The actual exposure profile is shown in the chart above by the solid line. However, because the survey data only had values for currencies, rather than currency pairs, it would be impossible to know that, of the AUD 300 being bought, 200 was against NZD (and should be included because it generated an exposure) and 100 was against USD (and should be excluded because there was no exposure).

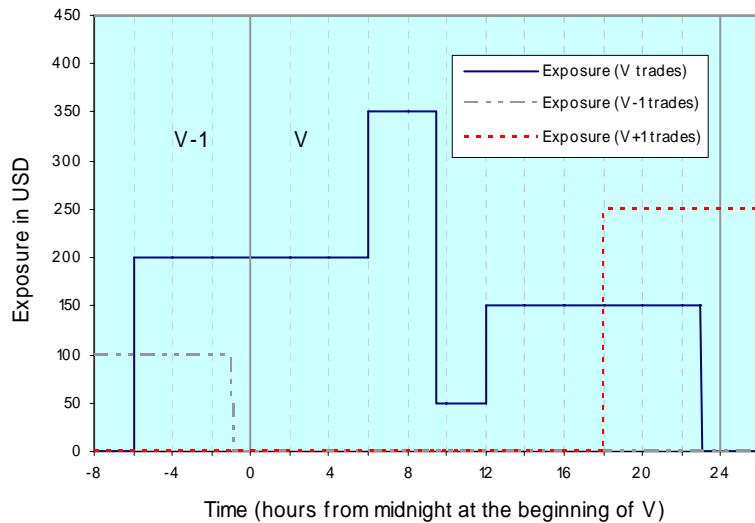
In general, the only trades with no exposures will be those where an Asia-Pacific currency is being bought and a North American one sold – since only in these cases are the time zone differences great enough to have the necessary effect.

Multiple day profile

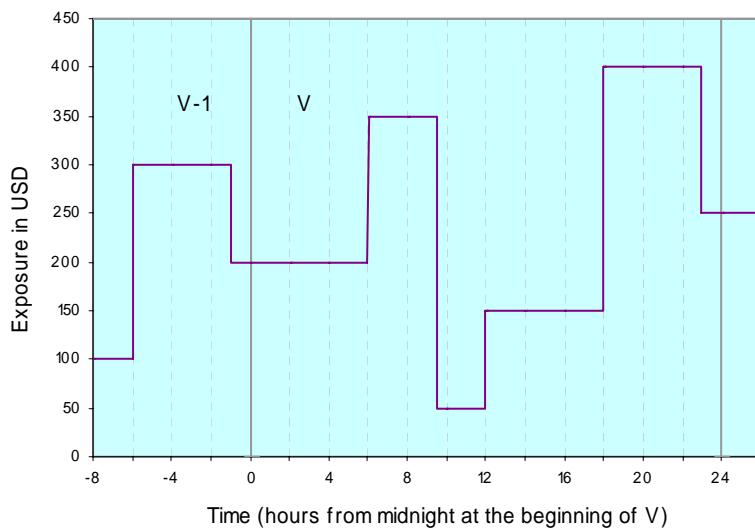
The multiple day profile is created by superimposing the single day profiles for the relevant days. The single day profile for a given day depends both on which currency pairs were traded (which determines the times at which exposures change) and on the value of trades in each currency pair (which determines the size of the change at each of the relevant times). The profile for each day *could* therefore look very different. In practice, it seems likely that most institutions trade a similar set of currency pairs each day, so the basic shape of the profile is likely to have a certain similarity each day. However, the scale of the profile could vary significantly as the value of the trades varies. (This is in contrast to the survey data which were the daily average for the survey period, so each day was in effect the same.)

The chart below repeats the estimated single day profile for Day V and also shows assumed profiles for Days V-1 and V+1 (which assume that the same three currency pairs were traded each day although the amounts vary).

Box 8 (continued)



The next chart shows the resulting multiple day profile, which is created by simply summing the exposures where they overlap.



Note that, at USD 400, the multiple day maximum exposure for V is higher than the single day maximum for V (USD 350) and also occurs at a different time of day (in the evening rather than in the morning, as the institution begins to commit irrevocably to V+1 payables in some currencies).

The above shows the profile for an individual institution. The profile for all the survey institutions can be created in two different ways:

- The first is just to sum the profiles for all the institutions, leaving each one measured in the institution's local time. This is the method used for Charts 2, 3, 7a and 7b (and also for the profiles used for the results in Table 12). It can be seen as producing a kind of "average" profile for the survey institutions relative to their local time zone.
- The alternative is to first adjust the profile so that it is expressed in a standardised time - typically UTC/GMT. In the example above, this would mean shifting the profile one hour to the left (since BST is one hour ahead of UTC/GMT). Then the profiles can be summed. This is the method used for Charts 8a and 8b and can be seen as a kind of "aggregate" for the survey institutions, indicating the total exposure in the market worldwide at a given time.

Note also that the charts in the main text show the exposure in both USD equivalent and as a percentage of the total daily obligations settled by traditional correspondent banking.

Largest bilateral exposures

This section explains how the results in Tables 2 and 13 and in Charts 4 and 9 were calculated.

Data on an institution's largest *exposure* to a single counterparty (ie its largest bilateral exposure) were not collected in the survey. However, each institution did provide data on counterparties to whom it had the largest *total settlement obligations* (ie judged by column (1) of Spreadsheet 2). Specifically, institutions provided data about their aggregate positions with their top 5 and top 10 counterparties, overall (ie regardless of type of institution) and also in each of the five categories of institutional types (ie CLS members, CLS third parties, other banks, other non-bank financial institutions and other non-financial institutions) – ie 12 groups of counterparties (top 5 and 10 for each of six institutional categories). For each group they gave the value of the total settlement obligations and a breakdown by settlement method.

Using these data to estimate an institution's largest bilateral exposure was complicated by two main factors.

- First, the data on large counterparties were aggregated data for *groups* of 5 or 10 counterparties rather than data on the *single* largest counterparty.
- Second, exposures are generated by obligations settled by *traditional correspondent banking* (ie gross non-PVP data in column (9)) but the "largest" counterparties were judged by *total obligations* (column (1)). The largest bilateral exposure was therefore not necessarily to the "largest" counterparty or, indeed, to any of the 50 "largest" counterparties contained in the twelve groups.^{59, 60}

Because of these complications, the main estimates made of an institution's largest bilateral exposure consisted of a *range* within which the actual exposure was likely to lie. For this purpose the key assumption needed was only the plausible one that the counterparty with the largest exposure was large enough judged by total obligations to be included somewhere in one of the twelve groups of 50 large counterparties, although we did not know in *which* specific group. However, the resulting ranges were in some cases quite large, so an "*indicative*" value (point estimate) was also calculated, which required more demanding assumptions to be made. For both the range and the indicative value, we calculated estimates for both the daily average for the survey period and the peak day.

In the rest of this section, the method used to calculate these estimates is explained. An example is given in Box 9 and the method is summarised in Box 10.

For all these calculations, note that the data in columns (1) and (9) of Spreadsheet 2 for the twelve groups were first reorganised to be "mutually exclusive" – ie the "top 10" groups were converted into "top 6 to 10" groups by subtracting each top 5 group from its corresponding top 10 group.

⁵⁹ Note that the twelve groups of top 5 and top 10 counterparties included 50 (rather than 60) counterparties because two of the groups were the "overall" groups (ie regardless of counterparty type) and would thus include counterparties already included in one of the ten specific "counterparty type" groups.

⁶⁰ For example, it could be that an institution's "overall" top 10 counterparties (judged by total settlement obligations) consisted of six "CLS members" and four "other banks". Moreover, most obligations with these counterparties could be settled using CLS and/or bilateral netting rather than by traditional correspondent banking, meaning that it had relatively small exposures to its overall top 5 and top 10. Instead, the counterparty to whom it had the largest exposure could be an "other bank" that was its sixth largest counterparty of that type. Thus, judged by total obligations, this counterparty would be too small to appear in the "overall" top 5 or top 10 groups or even in the top 5 "other banks" group; it would only appear in the top 10 "other banks". (Indeed, more generally, it could be the case that the counterparty to whom an institution had the largest exposure was in none of the twelve top 5 or top 10 groups.)

Box 9

Example of largest bilateral exposure estimates

This example, for a single institution, is based on a version of Spreadsheet 2 in which columns (2) to (8) have been combined and in which the top 5 and top 10 groups have been reorganised into top 5 and top 6 to 10, as explained in the main text. Note that for the totals for each counterparty type (and overall) - shown in normal font - the rows and columns must add up. For the top 5 and top 6 to 10 – shown in bold font - for a given row the columns must add up, but in a given column the rows do not have to add up. For simplicity, this institution is assumed to have settlement obligations only to CLS users and other banks. Obligations are in USD millions.

Counterparty type	Total settlement obligations – column (1)	Obligations settled by all methods except traditional correspondent banking – columns (2) to (8)	Obligations settled by traditional correspondent banking – column (9)
Overall (ie total) Total	2,000	1150	850
of which: Top 5	1,000	550	450
Top 6 to 10	700	150	550
CLS members Total	1,000	600	400
of which: Top 5	700	350	350
Top 6 to 10	500	400	100
CLS third parties Total	500	200	300
of which: Top 5	400	150	250
Top 6 to 10	100	50	50
Other banks Total	500	350	150
of which: Top 5	200	200	0
Top 6 to 10	100	0	100
Other NBFIs Total	0	0	0
of which: Top 5	0	0	0
Top 6 to 10	0	0	0
Other NFIs Total	0	0	0
of which: Top 5	0	0	0
Top 6 to 10	0	0	0

For the lower end of the range, the largest group in column (9) is identified (ie \$550mn) and divided by 5 (ie \$110mn). The multiple day adjustment factor for this institution is assumed to be 1.2. The lower end of the daily average range is therefore estimated to be \$132mn.

The indicative value is estimated to be 140% of the lower end of the range – ie \$185mn.

For the upper end of the range, the largest group in column (9) excluding the overall groups is identified (ie \$350mn). This is a top 5 group, so the column 1 constraint for this group is \$300mn (see footnote 62). The upper end of the daily average range is the lower of the column (9) group and the column (1) constraint (ie \$300mn) times the adjustment factor (ie 1.2). The upper end of the range is therefore estimated to be \$360mn.

The peak day values are estimated to be 168% of these daily average values – ie \$222mn, \$311mn and \$605mn for the lower end of the range, indicative value and upper end respectively.

Note that in the charts and tables, the results for an individual institution are scaled by its total capital.

Lower end of the range

For the lower end of the range we needed to calculate how small the largest bilateral exposure could possibly be while nevertheless remaining the largest. We therefore identified the largest group of counterparties in column (9) and divided it by five – ie assuming that the institution had equal exposures to each of the five counterparties in that group. This is because, in a group of five, the largest individual can never be less than one fifth of the total – if it were, it would automatically cease to be the largest in that group. Thus there must be one counterparty that has an exposure that is at least one fifth of the largest group in column (9).

The column (9) data provide estimates of an institution's maximum *single day* exposures. Adjustment factors were applied to the lower end estimates to convert them into multiple day estimates. An adjustment factor was calculated for each institution by comparing, for the I period, the maximum of its multiple day exposure profile to the maximum of its single day exposure profile.

Upper end of the range

For the upper end of the range, we again identified the largest group of five counterparties in column (9) and assumed that the largest bilateral exposure accounted for all of this amount (ie the group consisted of this counterparty and four counterparties to whom the institution had zero exposures).

However, in this case, when identifying the largest group we ignored the two "overall" groups. This is because if a counterparty appears in one of these groups it must also appear in the group that corresponds to its specific institutional type. For example, if the largest counterparty overall was a CLS member then it would appear not only in the "overall" top 5 but also in the "CLS members" top 5. So if the largest group in column (9) was an overall group then it would be impossible for the largest bilateral exposure to account for all that amount – since the counterparty also has to appear in another group, it is the value of the latter group that is the largest it could be.

In calculating the upper end of the range, the data in column (1) were also used. This is because the exposure to a counterparty in the column (9) data cannot be greater than the total obligations to that counterparty in the column (1) data – ie the column 1 data provide a constraint on the estimates made from the column (9) data. The relevant constraint depends on whether the largest column (9) group is a top 5 or top 6 to 10 group.

- If the largest column (9) group is a *top 5 group* then the upper end of the range is whichever is the smallest of (a) that column (9) group and (b) $C_5 - 0.8C_{10}$ in column (1).⁶¹ This is because the counterparty with the largest bilateral exposure is one of the top 5 counterparties of that institutional type when judged by total obligations and $C_5 - 0.8C_{10}$ is the largest the top 1 in that group can be.

To understand this constraint, note that in column (1) the counterparties are correctly ranked – ie the top 5 does indeed contain the five largest counterparties ranked by total obligations and the top 6 to 10 likewise contains the next five largest. So clearly the top 1 must be greater or equal to the other four in the top 5. Also, all the top 5 must be greater or equal to the top 6 to 10.

By the same logic used to calculate the lower end of the range, the smallest that each of top 6 to 10 can be is one fifth of the total for that group – ie $0.2C_{10}$. Correspondingly, the smallest the top 2 to 5 can each be is the same. Therefore the smallest the top 2 to 5

⁶¹ See Box 10 for an explanation of the notation (ie C_5 and C_{10}).

collectively can be is four times this – ie $0.8 C_{10}$ – and thus the largest the top 1 can be is $C_5 - 0.8C_{10}$.⁶²

- However, if instead the largest column (9) group is a top 6 to 10 group then the upper end of the range is whichever is the smallest of (a) that column (9) group, (b) C_{10} and (c) $0.2C_5$. To understand this, consider first the C_{10} group. The largest counterparty in that group could account for the whole value of the group (ie if the value of the obligations to the other four counterparties was so small as to effectively be zero). However, we also know that each of the top 6 to 10 must be smaller than or equal to each of the top 1 to 5 and that the smallest that each of the top 1 to 5 could be is $0.2C_5$. So the largest counterparty in the relevant column (1) group can be no larger than the smaller of C_{10} and $0.2 C_5$.

Finally, as for the lower end of the range, each institution's adjustment factor was applied to convert the upper end of the range from a single day to a multiple day estimate.

Indicative value

The lower end estimate assumes that all the settlement obligations in the selected group of five counterparties are spread evenly among the five; the upper end estimate assumes they are concentrated in a single counterparty. We also estimated where within the range the actual value might lie, this time assuming the concentration among the group of five was the same as that in a different segment of the market (ie CLS) where separate, more detailed data were available.

This "indicative value" estimate used additional, anonymised data provided by CLS which showed, for each settlement member during the survey period, the daily average value of its CLS-settled obligations to each of its five largest counterparties ("largest" being judged in this case by the value of CLS-settled obligations). These data were used to calculate the value of a member's CLS obligations to its *single* largest counterparty as a percentage of the value of its CLS obligations to the *average of the five* largest counterparties – ie a measure of the size of the largest counterparty relative to the group of five counterparties. Across all settlement members, this percentage was 140%.⁶³

For the indicative value of the largest bilateral exposure, this percentage was applied to the lower end of each institution's range. (Note that, as explained above, the lower end was calculated by assuming the institution had equal exposures to each of the five counterparties in the largest column (9) group - ie the indicative value calculation is equivalent to comparing the largest CLS counterparty to the average of the five largest CLS counterparties.)

However, note that, to be valid, the indicative value calculation requires significantly tougher assumptions than that needed to calculate the range. As noted above, for the range calculation the only assumption needed was that the institution's counterparty to which it had the largest bilateral exposure was large enough when judged by total obligations to be included in one of the institution's top 5 or top 10 groups. The indicative value calculation also requires relative counterparty sizes judged by CLS obligations to be a good indicator of relative sizes of obligations settled by traditional correspondent banking. Moreover, in the CLS data the five counterparties were the top 5, properly ranked, putting a constraint on the

⁶² As an example, assume that the C_5 and C_{10} have values of 700 and 500 respectively. The smallest that the top 2 to 10 can each be is 100 and so the top 1 can be no larger than 300 – ie the top 10 have values of 300, 100, 100, 100, 100, 100, 100, 100 and 100 respectively. To test this, assume instead that the top 1 was bigger than the minimum calculated – ie $300 + X$ instead of 300. To keep the collective value of the top 5 at 700, this would mean that the top 2 to 5 could be no larger than $700 - (300 + X)$ collectively and therefore no larger than $100 - 0.25X$ each. Therefore, to preserve the ranking, the top 6 to 10 could also be no more than $100 - 0.25X$ each, but this would give a collective value of only $500 - 1.25X$, rather than the 500 observed, ie the result is possible only if X is zero.

⁶³ Because the data were anonymised it was not possible to calculate a different percentage for each institution.

relative size of the largest to the other four. In contrast, the data in column (9) are more random. For example, it is possible that the largest group of five identified (ie the largest $G_{i,j}$) could contain the counterparty with the largest exposure and the four counterparties with the lowest exposures. In other words, for bilateral exposures the ratio of the largest to the average of the group of five is likely to be larger than the 140% estimated from the CLS data. This means that the indicative values are likely to be underestimates of the largest bilateral exposure.

Box 10

Summary of method

Notation

In the description below, the column 9 groups are denoted by $G_{i,j}$ where

- $i = 5$ or 10 , indicating a "top 5" or "top 6 to 10" group respectively, and
- $j = 1$ to 6 , indicating the six counterparty types (ie 1 = "overall", 2 = "CLS members", 3 = "CLS third parties", etc).

$\text{Max}G_{i,j}$ indicates the largest $G_{i,j}$ for the values of i and j specified.

C_5 and C_{10} indicate the top 5 and top 6 to 10 groups (respectively) in column 1 that correspond to (ie have the same j as) the $\text{Max}G_{i,j}$.

f is the adjustment factor for the institution that converts a single day estimate into a multiple day estimate.

For example:

$G_{10, 4}$ indicates the value of obligations settled by traditional correspondent banking (the gross non-PVP figure in column (9) of Spreadsheet 2) for the top 6 to 10 group of "other banks".

$\text{Max}G_{i,j}$ (for $i = 5$ and $j = 2$ to 6) indicates the largest top 5 group in column 9 excluding the "overall" groups.

If the $\text{Max}G_{i,j}$ was where $j = 2$ (ie CLS members) then C_5 and C_{10} would be the top 5 and top 6 to 10 groups for CLS members in column (1).

Calculation method

Using the above notation, the lower end of the range is:

$$f^*0.2 * \text{Max}G_{i,j} \text{ (for all } i \text{ and } j\text{)}$$

The upper end of the range is calculated as follows:

Identify the $\text{Max}G_{i,j}$ (for all i and for $j = 2$ to 6)

If the maximum identified is where $i = 5$, then the upper end of the range is the minimum of (a) and (b) where:

$$(a) = f^* \text{Max}G_{i,j} \text{ (for all } i \text{ and for } j = 2 \text{ to } 6\text{)}$$

$$(b) = f^*(C_5 - 0.8C_{10})$$

Alternatively, if it is where $i = 10$, then the upper end of the range is the minimum of (a), (b) and (c) where:

$$(a) = f^* \text{Max}G_{i,j} \text{ (for all } i \text{ and for } j = 2 \text{ to } 6\text{)}$$

$$(b) = f^* C_{10}$$

$$(c) = f^* 0.2 C_5$$

The indicative value was calculated as 140% of the lower end of the range.

The above calculations are for the daily average estimates during the survey period. For the peak day values, these estimates were multiplied by 168%.

Peak days

All the bilateral exposure estimates discussed so far have been based on the *daily average* values for the survey period. The CLS data mentioned above also included the value of each settlement member's peak day obligations settled using CLS. These data were used to estimate the peak day value as a percentage of the daily average value. This percentage (168%) was then used to scale up the daily average bilateral exposure estimates into peak day estimates.

However, it is possible that the volatility in the daily value of obligations settled by CLS is greater than the volatility of obligations settled by traditional correspondent banking insofar as the latter might be more constrained by counterparty limits (because of the exposures generated).

Institutions versus entities

As noted in Section 2.2 of the main text, most reporting institutions provided one set of survey data, covering either their consolidated global operations or their operations in the country in which they were incorporated. The explanation above applies to such institutions. However, some institutions provided multiple sets of data, each set covering their operation in a different financial centre – ie the institution provided Spreadsheet 2 data about its counterparties for each location. In these cases the same method was used except that the largest G_{ij} was identified by looking across the counterparty groups for all the locations and identifying the largest.

Implicitly this assumes that each location dealt with different counterparties. For example, an institution might have provided data for its operations in London and New York and for the purposes of calculating the upper end of the range the largest G_{ij} was one of the counterparty groups for the New York operation. This value was used to make the largest bilateral exposure estimates. However, it is quite possible that the London operation also had an exposure to the same counterparty, in which that exposure should, if the data were available, be added to New York's exposure to estimate the largest bilateral exposure. However, from the survey data it was impossible to do that. This is therefore likely to be a source of underestimation of the largest exposure.

Total capital

All the largest bilateral exposure estimates were scaled by an institution's total capital, using data provided by Bankscope, where available. Broadly speaking, total capital is Tier 1, 2 and 3 capital according to the definitions of the Basel Committee on Banking Supervision, subject to the relevant limits and deductions.

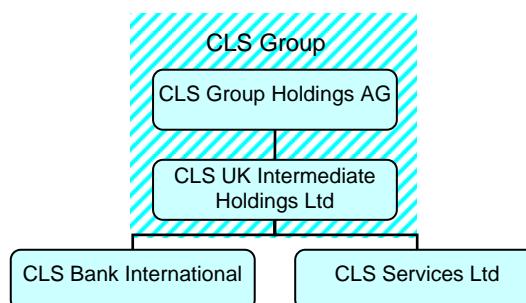
Annex 4: Description of the main features of the CLS service

This annex describes the CLS service, focusing on its risk management features.

Corporate structure, legal basis and regulation

Daily CLS operations are carried out by two companies: settlement takes place on the books of CLS Bank International (CLSB), which is an Edge Act corporation chartered by the Federal Reserve and based in New York, but CLSB contracts out most processing to CLS Services, a company based in London. Both CLSB and CLS Services are wholly owned by a United Kingdom holding company, which in turn is wholly owned by CLS Group Holdings, a holding company in Switzerland which currently has 71 financial institutions as shareholders (see Chart 10). The Board of CLS Group is responsible for the group's strategic decisions.

Chart 10
CLS group structure



CLSB membership agreements are governed by New York law, while the system's rules and procedures are governed by English law, an arrangement designed to give CLSB the benefits of special insolvency protection under both United States and European Union law.

CLSB is supervised by the Federal Reserve. The CLS service is also overseen by the 15 central banks whose currencies are settled in CLS. This oversight is based on the cooperative oversight framework set out in the CPSS's report on *Central bank oversight of payment and settlement systems*.⁶⁴ As supervisor of CLSB, the Federal Reserve acts as lead overseer, consulting with the other central banks.

Participation

Financial institutions can make use of CLS in three ways. "Settlement members" are direct participants, submitting trades to CLSB on behalf of themselves and their customers, and having responsibility for the funding of the amounts needed to settle the trades. "User members" can also submit trades directly to CLSB, but the funding is the responsibility of a settlement member selected by the user member. Finally, "third parties" (including entities that are not financial institutions) have no direct relationship with CLSB - they select a settlement or user member to submit trades on their behalf. In this annex the focus is on settlement members because, with their responsibility for funding, they are the most important users from the point of view of risk management. However, in cases where settlement members themselves are not direct participants in the payment system of a CLS currency, they need to use "nostro agents" (correspondent banks) to make and receive payments on their behalf and the role played by these nostros can also be important, particularly in respect of operational risk.

⁶⁴ *Central bank oversight of payment and settlement systems*, BIS, May 2005. The principles for international cooperative oversight set out in that report are an updated version of those in the 1990 Lamfalussy Report (*Report of the Committee on Interbank Netting Schemes of the central banks of the Group of Ten countries*).

The daily CLS process

CLS currently settles 15 currencies (see Section 2.2). Each CLS settlement member has a single multicurrency account at CLSB. Settlement members normally start each day with zero balances on their account.

Trades to be settled by CLS must normally be submitted by the members to CLSB before midnight (Central European Time) at the beginning of the settlement day. From 07:00 CET onwards on settlement day, trades will settle one by one on the members' accounts at CLSB by simultaneously debiting the account by the amount of the currency being sold and crediting the account by the amount of the currency being bought.⁶⁵ A trade will settle provided it passes the risk management tests described below. Settlement members will thus accumulate negative balances in currencies where overall they and their customers are sellers and positive balances in those where overall they are buyers. Settlement of all trades submitted is normally completed by 09:00 CET.

CLS draws a key distinction between this gross settlement of trades across CLSB's books and the funding by members of their accounts, which is on the basis of the multilateral net short positions they are expected to have. (These are the net positions assuming all trades submitted to CLSB do indeed settle.) Members with a net short position in a currency can choose either to make a single payment to CLSB for the full amount by 08:00 CET or, subject to a minimum pay-in schedule calculated by CLSB, make the payment in instalments of their own choosing until 10:00 CET for Asia-Pacific currencies and until 12:00 CET for currencies in other time zones. Payments are made to accounts which CLSB holds at the central banks of the currencies concerned.

CLSB makes pay-outs to members with expected net long positions in stages throughout the process, subject to the risk management constraints discussed below (and, in particular, the requirement that a member's account always has an overall positive balance across all currencies). Pay-outs are made according to an algorithm which, among other things, accords priority to members and currencies with the highest balances and to currencies with the earliest payment system closing times. In normal circumstances, settlement members have zero balances in their CLSB accounts at the end of each day and CLSB has no funds in its central bank accounts.

Pay-ins and pay-outs are made by using RTGS systems or their equivalent to transfer funds to and from CLSB's central bank accounts. In most currencies CLSB is a direct participant in the system but in one (namely the Canadian dollar) it accesses the system as a customer of the central bank. Where it is a direct participant in non-US payment systems, CLSB's participation is on the basis of "remote access" – ie without having a branch or subsidiary in the country concerned (CLSB has no branches or subsidiaries).

As noted above, pay-ins and pay-outs are on the basis of a member's short or long position in each currency. To help reduce these positions, most CLS members use so-called in/out (I/O) swaps. These consist of two equal and opposite FX trades that are agreed as an intraday swap. One leg, which is settled in CLS, involves a member reducing its CLS positions by buying a currency in which it is short against a currency in which it is long; the other leg, which settles outside CLS (typically by traditional correspondent banking), reverses this position. This reduces the member's CLS pay-ins and pay-outs while leaving its overall FX position for the day unchanged. To the extent that the member originally had a position to settle outside CLS (eg from trades with non-CLS users) that offset its position in CLS, the I/O swap will reduce its funding needs there too. And compared to the tight CLS schedule, it may also have more flexibility about when to settle the outside leg. However, the outside leg does not, of course, benefit from the risk-reducing benefits of CLS.

⁶⁵ As noted in footnote 30 earlier, although this report, for simplicity, refers to CLS settling FX trades, CLS actually settles not the trades themselves but the payment instructions arising from the trades.

CLS identifies potential I/O swaps on the basis of the initial pay-in schedule drawn up shortly after the midnight deadline for submitting trades but it is up to the members to decide whether to carry out the swaps. The combination of the multilateral netting effect of the pay-in/pay-out calculation and the I/O swap process reduces pay-ins and pay-outs to less than 2% of the gross value.

Time zone differences mean that the core CLS operating hours (07:00 to 12:00 CET) are at the very end of, or after, the working day for the Asia-Pacific currencies (eg from 17:00 to 22:00 in Sydney for part of the year) and very early in the morning in North America (eg 01:00 to 06:00 in New York for most of the year).

Protection against principal risk

How protection is provided

In the context of foreign exchange settlement, principal risk is the risk of losing the full value of a trade as a result of a counterparty's failure to settle – ie paying away the currency being sold but failing to receive the currency being bought. Protection against principal risk in the settlement process is provided by simultaneous settlement of both sides of a trade in the books of CLSB and by a rule that members always have an overall balance on their CLSB accounts that is zero or positive. This positive account balance rule is designed to ensure that, if a member defaults, CLSB will not be owed money by that member and, thus, that it will have sufficient funds to pay survivors.

A member's overall balance is calculated by converting its balances in the individual currencies into their US dollar equivalents and then summing them. The exchange rates used are those that are current at the time of the calculation. However, as noted below, in doing this calculation, CLS applies haircuts to the individual currency balances; this has the conservative effect of reducing the US dollar equivalent of positive balances in other currencies and increasing that of negative balances. Thus the positive account balance requirement means that a member is allowed to have a negative balance in some currencies but only to the extent that it has a positive balance in other currencies that is of more than equal value at current exchange rates.

Exchange rate movements since the time a trade was struck mean that, at settlement time, the value of the currency being sold is unlikely to equal the value of the currency being bought: one counterparty will have made a profit, the other a loss. The overall value on a member's account will thus be affected not only by the funds that it has paid in to CLSB but also by the profit or loss on the trades which have settled and by the haircut.

Before settlement starts, the trades submitted for settlement that day by all the members are put into a queue in random order. As the system works its way through the queue of trades waiting to be settled, any that would cause the overall account balance to turn negative (or that would break the limits noted below) are left in the queue and tested again later. The system recycles its way through the queue as many times as necessary until all trades are settled, which, provided members pay in sufficient funds, is by 09:00 CET.

As noted above, when calculating the overall balance, CLSB applies haircuts to the individual currency balances. This protects it against the possibility that adverse exchange rate movements which occur after settlement but before the completion of funding cause what was initially a positive account balance to turn negative.

The likelihood of a positive overall balance turning negative because of exchange rate movements is affected by the size of the individual currency balances on the account (the bigger the negative balance in a currency, the more likely it is that an adverse exchange rate movement in that currency could cause a negative overall account balance). CLSB therefore sets limits on the negative balances members are allowed to have in each currency (these limits also provide important protection against liquidity risk - see below). These short position limits (SPLs) are currency-specific but not member-specific - that is, for a given currency each member faces the same limit.

In addition, CLSB applies aggregate short position limits (ASPLs) to the sum of a member's negative balances across all currencies in its account, ignoring any currencies where the member has a positive balance. These ASPLs are member-specific, based on the short-term credit rating and capital of each member. For brevity, references to SPLs in the rest of this annex do not explicitly mention the fact that ASPLs may be an additional constraint.

Possibility of residual loss

At this point it is worth noting that an element of loss could still occur if a member fails to make a pay-in and exchange rates move during the short CLS processing period by an amount that exceeds the protection provided by the haircuts and position limits. In this case, the aggregate value of the currencies CLSB holds could become less than the value it owes and so, if the member continues to fail to pay in, CLSB will have to share this residual loss among the remaining members. CLSB has a loss-sharing agreement in place to cover this eventuality.

Unsettled trades

To maximise the potential risk-reducing benefits of the CLS service, CLSB does not restrict the number or value of trades submitted by members for settlement. Provided members pay in sufficient funds, CLSB will be able to settle all the trades submitted.

However, if there is a pay-in failure by a settlement member it is possible that some trades will fail to settle because there may be insufficient value to settle those trades without causing the member's overall account balance to turn negative or an individual currency balance to exceed its SPL. Nevertheless, even if some trades have to be returned unsettled to the members, these unsettled trades are also protected against principal risk (unless the counterparties subsequently decide to settle the trade outside CLSB): if a surviving member has already paid in funds to settle the trade, the positive account balance rule means that CLSB will be able to return equivalent value (again assuming there has not been an exceptional exchange rate movement as described above).

Protection against liquidity risk

How protection is provided

In the context of foreign exchange settlement, liquidity risk is the risk of having unexpected positions in currencies as a result of a counterparty's failure to settle as expected. Because of the positive account balance rule, CLSB should, barring the special circumstances described above, have enough funds to pay the CLS counterparties of a member that fails to pay in. However, it will not necessarily have those funds in the currencies the members expect to receive. To mitigate this liquidity risk, CLSB has committed liquidity facilities with major banks. For each currency, CLSB tries to have at least three liquidity providers although in some specific circumstances CLS has accepted two. (Liquidity providers in general need to be major banks active in the currencies concerned and in most cases are themselves CLS members.) In the event of a pay-in failure, CLSB will use swaps or outright purchases under these facilities to complete its pay-out obligations to the non-failing members in the required currencies.

By limiting the negative balances members are allowed in individual currencies, the short position limits described earlier will limit CLSB's need to draw on the facilities when there is a member failure. To the extent that CLSB's liquidity facilities cover the liquidity shortfall caused by the pay-in failure, CLS should reduce liquidity risk compared to that arising from traditional settlement of foreign exchange trades.

Pay-outs in third currencies

However, in certain circumstances such as multiple pay-in failures, the liquidity facilities may be insufficient to enable CLSB to meet its pay-out obligations in the required currencies. The CLS liquidity risk management procedures are designed to cope with the simultaneous

failure of both a settlement member and a liquidity provider (since many large banks are both settlement members and liquidity providers, the failure of just one such bank could result in such a simultaneous failure). But in the event that two or more settlement members fail and/or two or more liquidity providers fail, the available liquidity facilities may be insufficient to cover all CLSB's pay-out obligations. In these circumstances, liquidity risk remains on settled trades since CLSB may not be able to pay the surviving members the currencies they were buying.

Indeed, in these circumstances, because of its so-called "continuous recycling" of liquidity, CLSB also may not be able to repay surviving members the same currencies that they were selling and had paid into CLSB. Continuous recycling, whereby CLSB pays out funds due to members as fast as it can, is designed to minimise the amount of liquidity held in CLSB during the settlement process. CLSB does not wait to pay out until both counterparties to a trade have paid in. Rather, on trades that have settled, CLSB will pay out to a member as soon as it has an available balance in that currency and provided the payment will leave that member with enough overall value so that any remaining trades can settle without being blocked by the positive account balance rule. This recycling is a core element of CLS design, minimising the impact of the system on liquidity in domestic markets. But it means that CLSB cannot predict in advance what currencies it will pay out in the event of a multiple pay-in failure.

So although the positive account balance rule means that CLSB should have enough value to pay the counterparties of a member that fails to pay in, system design and finite liquidity facilities mean that it will not always have that value in the right currencies to ensure that, on a settled trade, surviving members always receive the currency they were buying or that they are refunded the currency they were selling. Instead CLSB may sometimes have to pay out using a third currency – that is, a currency which is neither the one being bought nor the one being sold by a member. Thus although CLS is able to significantly reduce liquidity risk on settled trades, it is not able to eliminate it.

Unsettled trades

Liquidity risk also remains on any trades that do not settle in CLSB because of a member's failure to pay in and which are thus returned unsettled to the members. Surviving members with unsettled trades will be unexpectedly short (or less long) in the currencies they were buying and correspondingly long (or less short) in the currencies they were selling.

Where a surviving member becomes unexpectedly short in a currency, the liquidity risk will materialise at least in part as an unexpected change to its pay-in schedule. As noted above, the pay-in schedule is calculated assuming all trades submitted will settle. If in fact some trades fail to settle, the net pay-ins for the affected members will be revised by CLSB during the settlement process. For example, a member that originally had a net long position in a currency might find that it had a net short position in the currency after unsettled trades with a failed member were deleted from the calculation and thus unexpectedly had a pay-in requirement to CLS where previously it had no requirement.

Members' liquidity positions resulting from unsettled trades are also affected by the possibility of third currency pay-outs. Insofar as surviving members are unexpectedly long (or less short) in a currency and are due either increased pay-outs from CLSB or refunds of money already paid in, then, in the event of a multiple failure as described above, the combination of finite liquidity facilities and continuous recycling again means that these funds may also be paid out by CLSB in a third currency.

Other risks

CLS is not designed to reduce pre-settlement risk - the risk that, between the time a trade is struck and the settlement date, one party to the trade defaults, leaving the counterparty to replace the trade at rates that might be less favourable. Moreover, as noted earlier, to maximise the potential benefits of principal and liquidity risk reduction, CLSB does not restrict

the number or value of trades submitted to it for settlement and successful settlement is dependent on members paying in sufficient funds.

Institutions which use CLS as third parties also continue to have liquidity and credit risk exposures to the CLS member that they use. Just as with any other customer-bank relationship, such exposures arise to the extent that the third party holds positive balances on its account at the CLS member (eg to fund its pay-ins or as a result of receiving its pay-outs).

Criteria for settlement membership and currency eligibility

Because, as explained above, users of CLS will face some residual risks, the criteria for settlement membership include an applicant's financial standing: normally, a member must have a credit rating of at least BB-/Ba3. There is no minimum capital requirement, except that the applicant must meet its regulator's own requirements (and capital size will be used along with other criteria such as the credit rating to determine each member's ASPL).

Settlement members also have to meet a number of other criteria. These include being a financial institution (such as a bank, trust company, investment firm, broker/dealer or, potentially, another type of financial institution), while operational criteria have been set to minimise the risk of pay-in failure due to operational difficulties. Settlement members also have to be CLS shareholders and thus pay the necessary capital subscription.

To be eligible for settlement in CLS, currencies also have to meet a number of criteria including a minimum rating of BB-/Ba3, the availability of a sufficient number of liquidity providers, satisfaction that the currency's relevant payment system meets CLSB's operational requirements, determination that any restrictions or conditions on the transferability of the currency are acceptable, determination that any of the currency's convertibility, liquidity or volatility issues are acceptable, the quality of the rule of law, and a satisfactory legal opinion addressing the finality of payments made to and from CLS in the currency.

Guaranteed receipt/guaranteed refund

The Allsopp Report identified two possible types of payment/receipt relationships for FX settlement: guaranteed receipt (a counterparty that fulfils its settlement obligations will receive on time what it is owed) and guaranteed refund (a counterparty is guaranteed that any settlement payment it makes will be cancelled or returned if its counterparties fail to pay what it is owed). Given the risk management features described above, the CLSB design can be described as a balance between these two types.

For settled trades there is a "guaranteed receipt", although the strength of the "guarantee" is limited by the size of the available liquidity facilities, as discussed above. Any positions left when the liquidity facilities are exhausted are subject to a "guaranteed refund" with the significant qualification that the refund is likely to be in a third currency (rather than the currency originally paid in) and, thus, if there are extreme exchange rate movements, there may even be a residual loss.

Unsettled trades are subject to a "guaranteed refund" - that is, if a member has paid in too much in a currency (because the pay-in schedule was based on the assumption that all the trades submitted would settle, whereas actually some failed to settle), CLSB will refund the excess. The same qualification as above still applies concerning third currencies and extreme exchange rate movements.

Annex 5: Members of the Sub-Group on Foreign Exchange Settlement Risk

This report was produced for the CPSS by its Sub-Group on Foreign Exchange Settlement Risk, whose members are listed below.

Chairman	Lawrence M Sweet Federal Reserve Bank of New York
Reserve Bank of Australia	Nicholas Roberts
National Bank of Belgium	Benoît Bourtembourg
Bank of Canada	Alexandra Lai (until December 2005) Neville Arjani (since March 2006) Carol Ann Northcott
National Bank of Denmark	Lone Natorp (until May 2006) Tina Skotte Sørensen (since May 2006)
European Central Bank	Helmut Wacket (until October 2006) Markus Mayers (since October 2006)
Bank of France	Thomas Ros (until October 2006) Gabrielle Chabassol (since October 2006)
Deutsche Bundesbank	René Thoma
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Bank of Korea	Kyle Kim
Netherlands Bank	Simon Kappelhof
Reserve Bank of New Zealand	Andrew Rodgers
Central Bank of Norway	Bjorn Bakke Casper Christophersen
Monetary Authority of Singapore	Terry Goh Peng Hwee Jeryl Poh Kim Huat
South African Reserve Bank	Tim Masela Johann Bence (since October 2006)
Sveriges Riksbank	Maria Bergsten (until December 2005) Malin Omberg (until October 2006) Emma Bäcke (since October 2006)
Swiss National Bank	Juerg Maegerle
Bank of England	David Sawyer (until October 2006) Victoria Cleland (since October 2006) Julian Oliver (since October 2006)
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