

# The Continuous Linked Settlement foreign exchange settlement system (CLS)

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## Introduction

Continuous Linked Settlement (CLS) is an international payment system which was launched in September 2002 for the settlement of foreign exchange transactions. In the conventional settlement of a foreign exchange transaction the exchange of the two currencies involved in the trade is not normally synchronous. For one party to the trade there is therefore a risk that it will transfer the currency it has sold without receiving from the counterparty the currency it has bought (settlement risk). Even if a bank's risk position vis-à-vis a counterparty is short-term, it may be many times greater than its capital. With CLS, an infrastructure has been created which eliminates settlement risk by means of a payment-versus-payment (PvP)<sup>2</sup> mechanism.

CLS has 59 direct participants and more than 6,000 indirect participants (as of October 2009), and in 2008 it settled on average around 546,000 instructions to a value of around USD 4 trillion a day.<sup>3</sup> Because of the vast volume of transactions on the global foreign exchange market, with its risk-reducing settlement mechanism CLS makes a significant contribution to the stability of the global financial system. By now, around a half of all foreign exchange transactions in the world are settled via CLS.<sup>4</sup> The Swiss franc was one of the currencies settled in CLS from the very start, together with the US dollar, the pound sterling, the Japanese yen, the Canadian dollar, the Australian dollar and the euro. By now, the number of currencies settled in CLS has expanded from seven to 17. The Danish krone, the Norwegian krone, the Singapore dollar and the Swedish krona joined in September 2003, followed by the Hong Kong dollar, the Korean won, the New Zealand dollar and the South African rand in December 2004. The last two currencies up to now, the Israeli shekel and the Mexican peso, joined in May 2008.

This article is intended to give a broad interested audience a closer insight into the workings of CLS. While the first section deals with governance and oversight, the subsequent chapters describe the risks involved in foreign exchange settlement, the terms governing the admission of currencies, instruments

and participants. Then the main features of the CLS system and its liquidity and risk management are examined.<sup>5</sup>

## 1. Governance and oversight

The CLS payment system consists of two companies. One is *CLS Bank International*, a New York-based bank authorised (under the Edge Act) as an "Edge corporation", which is responsible for the management of the system and across whose accounts transactions are settled. CLS Bank is regulated by the Federal Reserve Bank of New York. The other company is *CLS Services* (organised under the law of England and Wales), which provides the operational and technical back office and IT services for CLS. Both companies are subsidiaries of *CLS UK Holdings Ltd.*, which for its part is wholly owned by *CLS Group Holdings AG*, based in Switzerland. The shareholders of CLS Group Holdings AG comprise around 70 financial service providers from various countries which together are responsible for the bulk of the world's foreign exchange trading.

Because of its importance for all the currencies involved and the possible effects on the financial markets concerned, CLS is overseen by all the central banks involved under a cooperative oversight arrangement.<sup>6</sup> The Federal Reserve Bank of New York acts as CLS's lead overseer and supervisory authority.

## 2. Risks in the settlement of foreign exchange transactions

If there is no direct account relationship between two operators on the foreign exchange market, foreign exchange transactions are traditionally settled via correspondent banks (cf. chart 1). In this case, when one party meets its obligation irrevocably, it does so without knowing whether its counterparty will settle its liability. This means that there is a risk of the counterparty delivering late (liquidity risk) or, in the worst case, not at all (credit risk). These risks are compounded if the foreign exchange market participants are in different time zones. If one party does not fulfil its obligations, depending on the size of the transaction liquidity and/or solvency problems may arise for the counterparty and thereby trigger a chain reaction (systemic risk).

1 The authors would like to thank Andy Sturm, Robert Oleschak, Philipp Häne and Patrick Lengg for their valuable comments.

2 The PvP principle can be ensured by means of synchronisation of the payments. In this process the currency that has been sold is transferred at if and only if the transfer of the currency that has been bought is guaranteed. Ch. chapter 2.

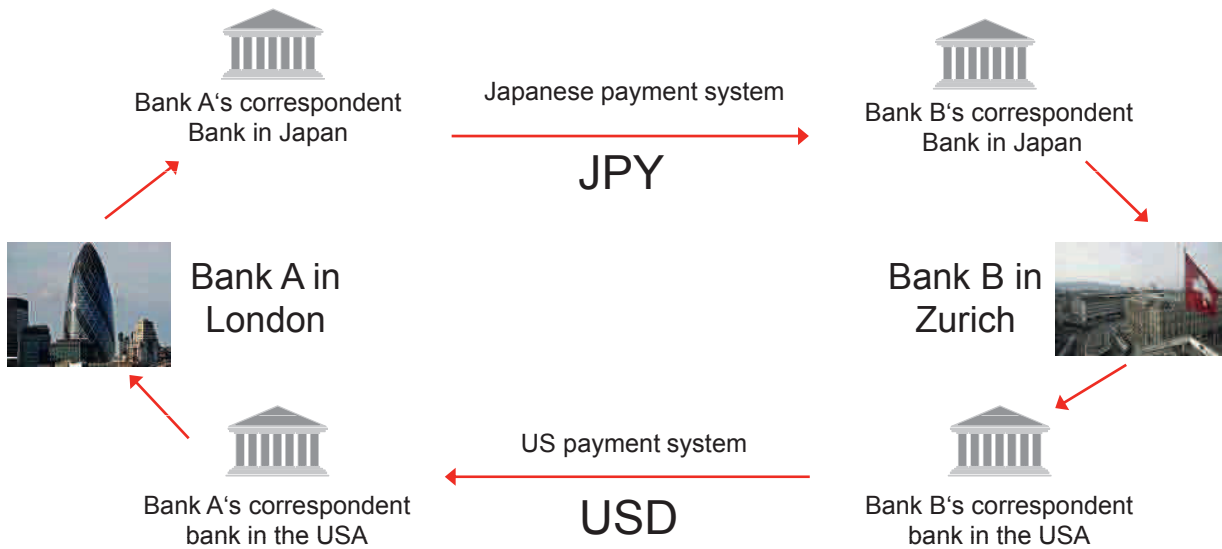
3 These are solely foreign exchange transactions. A foreign exchange transaction involves the exchange of two currencies. A foreign exchange transaction settled through CLS requires an instruction for each side of the trade. Since the individual sides of the trade are recorded for both settlement values and number of transactions, both settlement values and the number of instructions are double-counted.

4 Committee on Payment and Settlement Systems (2008): "Progress in reducing foreign exchange settlement risk", Bank for International Settlements.

5 For further information, please refer to the CLS website at [www.cls-group.com](http://www.cls-group.com).

6 The *Protocol for the Cooperative Oversight Arrangement of CLS* is downloadable from the website of the US Federal Reserve at [http://www.federalreserve.gov/paymentsystems/cls\\_protocol.htm](http://www.federalreserve.gov/paymentsystems/cls_protocol.htm).

Chart 1: Conventional settlement of a foreign exchange transaction



If two banks have no direct account relationship with each other, a USD/JPY transaction, for example, between Banks A and B is settled through their correspondent banks in their respective local large-value payment systems. A settlement risk exists, since both sides of the payment are not settled simultaneously, i.e. one bank fulfils its obligation without having received the counter-payment from the other bank at this time. If one party defaults, the whole claim may have to be written off.

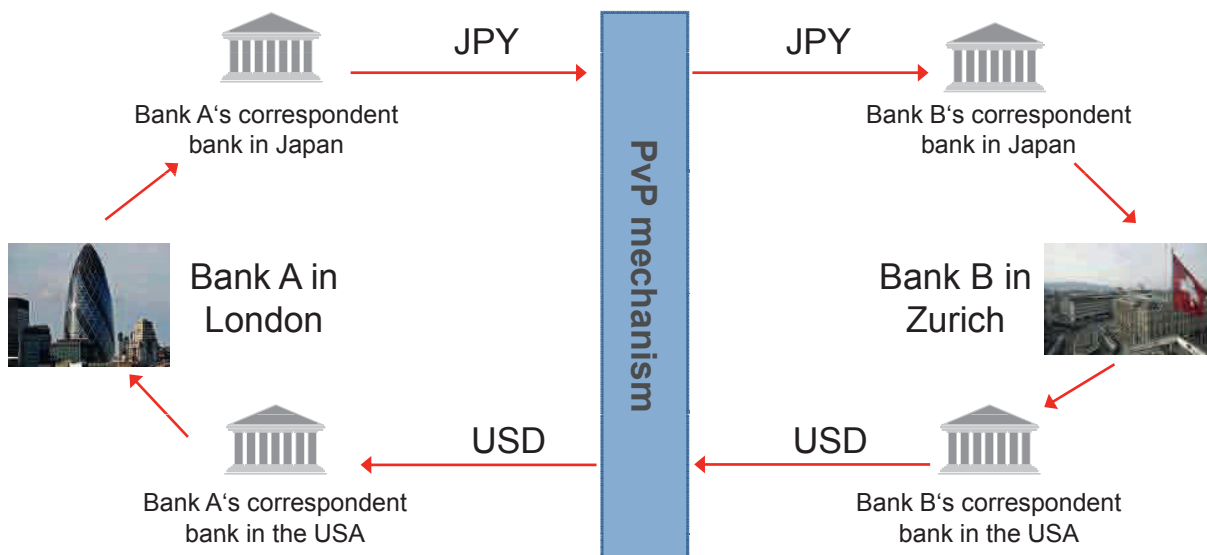
### BOX 1: Settlement risk in foreign exchange business - the collapse of Herstatt Bank

Settlement risk in foreign exchange trading is also known as “Herstatt risk”. It is named after what had been the biggest incident of its kind on the foreign exchange market to date – the 1974 collapse of Herstatt Bank, a German bank active in the foreign exchange market in Cologne. The German authorities withdrew Herstatt’s banking licence with immediate effect when they discovered concealed losses arising from unsuccessful speculative trading. Its business activities thus came to an abrupt halt. Herstatt’s

counterparties in the USA, where the trading day was just about to open, had already irrevocably delivered their deutschmark liabilities to Herstatt and now lost their US dollar claims. This led to a chain reaction on the US market. The counterparties had to find the outstanding US dollars some other way. The disruptions spread further in New York. According to estimates, the gross volume of transfers fell by 60% in the following three days. Total trading between the US dollar and the deutschmark came almost to a standstill, since the banks held back on meeting their foreign exchange trading liabilities and only delivered against confirmation of receipt of the counter payment. The markets took several days to recover.

The Herstatt case (cf. Box 1) brought foreign exchange trading settlement risk to the notice of the general public for the first time. As the foreign exchange market grew steadily in size over the years following, central banks realised the danger of potential systemic risks and called upon the banking sector to design a risk-reducing multi-currency settlement system (cf. chart 2). This led to the establishment of CLS in 2002.

Chart 2: Settlement of a foreign exchange transaction in accordance with the payment-versus-payment principle



The chart shows one possible form of the payment-versus-payment principle (PvP mechanism). The two banks involved (or their correspondent banks) transfer the payment liabilities to an intermediate institution (intermediary). Only when both currencies have arrived at the intermediary are they then passed on to the relevant banks by the intermediary. With this PvP mechanism principal risk is eliminated.

### 3. Currencies and services

A number of requirements have to be met for a currency to be settled via CLS. These requirements ensure that CLS's participants, and also CLS itself, are not exposed to any uncontrolled risks. The prerequisites/conditions include appropriate legal foundations and regulations with particular regard to the finality of payments;<sup>7</sup> requirements for the convertibility of the currencies and acceptable exchange restrictions or conditions on the transferability of currencies; operational requirements for a country's large-value payment system; a low country risk; appropriate potential of participating banks; an adequate cost/benefit ratio for the inclusion of a currency; and access to the central bank<sup>8</sup> for CLS.

In addition to foreign exchange transactions (foreign exchange spot and forward transactions, foreign exchange option exercises, foreign exchange swap transactions), a few years ago CLS began settling additional financial instruments. Since late 2007 CLS has been settling payments arising from trading in credit default swaps (CDS) and non-deliverable forwards (NDFs). The settlement of option premiums will be rolled out shortly. While NDF payments are paid directly into CLS

by the participants, CDS payment orders are submitted by DTCC Deriv/SERV Trade Information Warehouse. DTCC Deriv/SERV is a platform that provides post-trade services, including the multilateral netting of mutual claims and liabilities. The net amounts are then settled in CLS. Compared to CLS's core business, transaction volumes in these products are small. Unlike conventional foreign exchange transactions, settlement of these transactions triggers only a unilateral payment. In these cases CLS settles like a conventional payment system, with the difference that payments are possible in various currencies.

### 4. Participation conditions and participants

Participation in CLS can be either direct (*settlement member*) or indirect (*third party*).<sup>9</sup> At present there are just under 60 settlement members with a direct CLS connection. The direct members have an account with CLS, which consists of several currency-specific sub accounts. Settlement members are responsible for the timely submission of the instructions (payment messages)<sup>10</sup> and pay-ins entered into the system and

<sup>7</sup> Finality denotes the irrevocability and unconditionality of the settlement of a transaction in a payment or securities settlement system.

<sup>8</sup> This entails an account with the central bank and access to the local large-value payment system that settles in central bank money.

<sup>9</sup> In addition, it is also possible to participate as a *user member*. This facility was created for participants who are not prepared to meet CLS's strict payment requirements but who do, nevertheless, have a considerable volume of business and do not want to submit their trade data via a settlement member for confidentiality reasons. User members submit their instructions direct to CLS. The category of user member is, however, scarcely used. At present there are only two of them. In addition, CLS also offers special membership for central banks.

<sup>10</sup> Foreign exchange transaction details are submitted to the CLS system by means of a SWIFTNet InterAct message. In CLS usage these messages are known as *instructions*.

also for the indirect members connected to them, the third parties. For this reason, settlement members are of great importance for the proper functioning of CLS and therefore have to meet various minimum requirements: share ownership of CLS Group Holdings, adequate supervision, stringent technical, operational, and financial standards, appropriate resources, minimum short and long-term credit ratings, access to liquidity facilities, compliance with anti-money laundering directives, etc. Although the requirements make no specific demands about a participant's size, direct membership is generally worthwhile only for larger institutions.

*Third Parties* participate in CLS indirectly via a settlement member. Since there are no contractual relationships with CLS, Third Parties are not subject to any requirements from CLS. Third Parties generally submit both their instructions and their payments via a settlement member, although only a third or so of all settlement members offer services for third parties. At present, more than 6,000 financial institutions participate in CLS as third parties.

## 5. Main features of the CLS system

In principle, foreign exchange transactions are – apart from the exchange rate risk – self-collateralising transactions: a liability in one currency is always covered by a claim in another currency. However, the self-collateralisation functions only if both parties can also be guaranteed to meet their liabilities. In simplified terms, in a foreign exchange transaction CLS is interposed between two trading parties in order to coordinate the mutual liabilities created by a foreign exchange transaction. CLS ensures that the flows of funds are transferred simultaneously between the parties involved by means of the PvP mechanism so as to eliminate settlement risk for the two parties. The CLS system is so complex because fund transfers must be as secure as possible while at the same time keeping liquidity requirements to a minimum. How CLS satisfies these requirements in detail is explained in the following sections.

### **Separation of settlement and funding**

In principle, PvP settlement of a foreign exchange transaction via CLS could be carried out extremely easily: the two parties to the trade pay the currency they have sold into CLS; CLS settles the two sides

of the foreign exchange transaction simultaneously and pays out the currency to participants they have bought. Since with this extremely secure mechanism the flow of funds of each transaction settled also has to be transferred individually, the participants would have to provide large amounts of expensive liquidity. If one takes into account not only the fact that a party carries out a large number of foreign exchange transactions a day in which it acts sometimes as the buyer and sometimes as the seller of the same currency but also the considerable volumes traded on the foreign exchange market, the advantages of a liquidity-saving mechanism are obvious.

In order to reduce participants' liquidity requirements, the settlement of instructions has therefore been separated from the resultant payment flows. This enables the instructions to be settled individually on a gross basis (gross settlement), while at the same time the resultant payment obligations are netted. As a consequence, only the balances of the netted claims and liabilities, i.e. participants' respective net positions, are transferred via the system (net funding). Participants' liquidity requirements can be significantly reduced in this way. Because of the multilateral netting procedure used, the payment flows actually transferred between participants only amount to around 2% of the gross amounts actually settled.

### **The settlement process**

For each participant CLS keeps an account which consists of several sub-accounts, one for each currency included in CLS. A foreign exchange transaction is settled between the two parties by debiting the sub-account for the currency that has been sold and at the same time crediting the sub-account for the currency that has been bought. As a result of these simultaneous account movements, the settlement risk is eliminated. Foreign exchange transactions that are to be settled via CLS must generally be sent to CLS by midnight before the value date in question. CLS then matches and stores them in a database. From 07:00 Central European Time (CET)<sup>11</sup> the instructions are settled sequentially by irrevocably debiting the sub-account for the currency that has been sold and at the same time irrevocably crediting the sub-account for the currency that has been bought (gross settlement). As a result, during the course of the settlement process the settlement members accumulate a net short position in the currencies in which they (and their customers)

<sup>11</sup> In the summer months all timings are based on Central European Summer Time (CEST).

are overall net sellers and a net long position in the currencies in which they are overall net buyers. Foreign exchange transactions are settled on the CLS accounts on a gross basis.

### The funding process

In principle, the cash flows due could be transferred via an international commercial bank to which all settlement members and CLS are connected. If this bank were to fail, however, this would endanger not only the payment system itself but also the solvency of the participants, since they have to hold considerable assets with the bank in order to meet their payments as they fall due. In addition, this solution would also make it difficult to obtain short-term liquidity via central banks and, ultimately, participants are not minded to let an international commercial bank – and thus a potential competitor – have their trade data. In order to overcome these serious shortcomings, CLS has been granted direct access to the central banks of the currencies involved and to the large-value payment systems settling in central bank money. Foreign exchange transaction pay-ins and pay-outs pass through the accounts which CLS and the participants hold with the central banks. Therefore, the opening times of the large-value payment systems have been coordinated in such a way that there is a common time-window for all the currencies settled so that the funds on the central bank accounts can be moved between the payee and the payer in the PvP system.

In order to start the settlement process without exposing CLS to a credit risk, participants must first transfer part of their net short positions in the respective currencies to CLS. Because of the netting procedure, settlement members have to pay in to CLS only their net short positions in the individual currencies. This corresponds to the cumulative net short position arising from the foreign exchange transactions of the day in question sent to CLS for settlement. If a participant has a net long position in a currency, it does not need to make any pay-ins in this currency at all on this value date but receives corresponding pay-outs from CLS. So while instructions are settled on a gross basis, funding<sup>12</sup> is on a net basis.

Since settlement members have direct access to *all* large-value payment systems used for the eligible currencies in only a very few cases, for funding purposes they use what are known as *nostro agents*. These do not necessarily have to be participants in CLS. A nostro agent only needs access to the relevant large-

value payment system so that it can meet the payment liabilities on behalf of the settlement member. Although responsibility for the submission of instructions and payments still lies with the settlement member, nostro agents play an important role in the smooth functioning of CLS.

## 6. CLS operational timeline

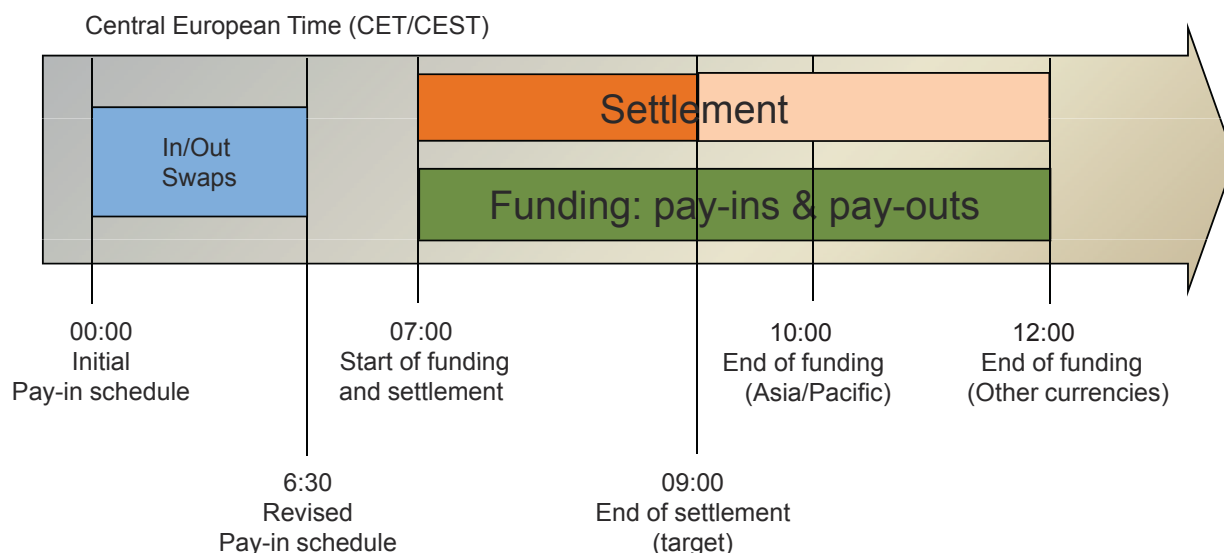
In order to settle a foreign exchange transaction via CLS both parties must submit their instructions by no later than 00:00 CET via a SWIFT message.<sup>13</sup> As soon as they have been received, the instructions of both participants are validated, authenticated and matched (*trade matching*).

12 The term *funding* comprises both pay-ins and pay-outs.

13 Participants can unilaterally rescind instructions up to midnight CET.



Chart 3: CLS operational timeline



Once the submission deadline of 00:00 CET has expired, CLS sends the settlement members an initial pay-in schedule with the due pay-in times, based on participants' net short positions (cf. chart 3). System participants may thus estimate their liquidity requirement in the individual currencies for the upcoming settlement cycle. Between 00:00 CET and 06:30 CET further instructions may be entered into the system, mainly in the form of what are known as in/out swaps, in order to reduce liquidity requirements (cf. further below).<sup>14</sup> From 06:30 CET CLS calculates the final net short positions of all participants in the respective currencies and draws up the revised pay-in schedule. The settlement and funding cycle then commences. While settlement usually lasts from 07:00 CET to 09:00 CET, the funding process runs alongside it between 07:00 CET and 12:00 CET. An exception are the Asia/Pacific currencies, which because of the time difference are connected to CLS only during the three hours from 07:00 CET to 10:00 CET. In those currencies in which the participants have a net short position the amount due under the revised pay-in schedule is normally divided into five tranches (pay-ins) which have to be paid hourly between 07:00 CET and 12:00 CET.<sup>15</sup> But it is also possible to pay the whole amount due in one single Pay-in before 08:00 CET. Not only does the division into different tranches make it possible for participants to stagger their liquidity requirements, it also prevents an excessive amount of liquidity in an individual currency accumulating on the accounts of CLS.

CLS pay-outs on net long positions also take place step by step between 07:00 CET and 12:00 CET.<sup>16</sup> pay-outs are calculated according to a complex algorithm which, among other things, prioritises currencies and settlement members with high account balances. If all instructions can be settled, then at the end of a settlement day all pay-ins will have been paid out again to the payees and CLS will have a zero balance on its central bank accounts.<sup>17</sup>

## 7. Liquidity management

Compared to conventional foreign exchange settlement via correspondent banks, CLS, imposes increased, time-critical liquidity requirements on the participants with its pay-in obligations. In order to prevent a temporary liquidity shortage of one participant from spreading further via CLS to other participants, the Swiss National Bank has introduced the interest-free *intraday liquidity* facility. This enables participants in the Swiss repo market to draw on Swiss franc sight deposits with the SNB against the lodging of collateral.<sup>18</sup> The liquidity used must be repaid by no later than the end of the settlement day of the Swiss RTGS system Swiss Interbank Clearing<sup>19</sup> (i.e. by no later than 16:15 CET).

The in/out swap is an instrument for reducing participants' time-critical liquidity requirements. Depending on a participant's trading activity, both its net short positions and its net long positions may be

<sup>14</sup> in/out swaps may be cancelled only with the mutual agreement of both parties.

<sup>15</sup> For each tranche settlement members have one hour to make the payment. Pay-ins for Asia/Pacific currencies are made in three tranches between 07:00 CET and 10:00 CET.

<sup>16</sup> Between 07:00 CET and 10:00 CET for Asia/Pacific currencies.

<sup>17</sup> Since CLS commenced operations in 2002 all validated instructions have been settled successfully.

<sup>18</sup> For details cf. *Instruction sheet on the intraday facility* at [www.snb.ch](http://www.snb.ch)

<sup>19</sup> Cf. also Mägerle, Jürg and Robert Oleschak, 2009: "The Swiss Interbank Clearing payment system" at [www.snb.ch](http://www.snb.ch).

considerable. The in/out swap offers two participants an opportunity to exchange (swap) large mutually offsetting balances.<sup>20</sup> By way of an example, a participant with a high net short position in US dollars and net long position in Swiss francs agrees to conclude a currency swap with another participant whose balances in the two currencies are just the reverse. One side of the swap is settled via CLS (the *in leg*), while the other side is settled on the same value date outside CLS via the traditional correspondent banking mechanism (the *out leg*).<sup>21</sup> As a result of this swap, the negative (and positive) balances are reduced for both parties and so are the time-critical pay-ins to CLS in the next settlement cycle.<sup>22</sup> The disadvantage of in/out swaps is that the out leg is settled through conventional correspondent banking arrangements and, thus, the participants are exposed to the full settlement risk.

## 8. Risk management

In principle, a foreign exchange transaction settled on a PvP basis is a self-collateralising transaction. In addition, various risk management measures insure CLS against any possible losses and thus possible illiquidity or insolvency. For that reason, in the event of a participant defaulting, CLS normally has sufficient funds to compensate the counterparties affected by the default. There is still a possibility, though, that these credit balances will just not be available in the currencies that the counterparties are expecting. In order to obtain the corresponding currencies, within 20 minutes CLS can use what are known as *liquidity providers*<sup>23</sup> to exchange the balances it does hold by means of a swap against the currencies it needs. To this end, liquidity providers hold collateral in order to obtain short-term liquidity from central bank facilities. The liquidity providers are compensated by CLS for opportunity costs incurred.

Although in the settlement of foreign exchange transactions CLS acts only as an agent and not as a counterparty, various risk management measures have been implemented in order to ensure that settlement is completed possibly in all circumstances, thereby keeping any repercussions of a potential default by a participant for the remaining participants as small as possible.<sup>24</sup> Every instruction must therefore go through various tests before it is accepted for settlement by CLS. If the test requirements are not met, an instruction is not settled but remains in a queue. The following conditions must be met for an instruction to be settled:

1. Positive overall account balance on the participant's sub-accounts with CLS (*net positive overall value*): At all times the sum of the settlement member's long positions and short positions converted in US dollars (the "Account Balance"), adjusted by applicable haircuts (the "Adjusted Account Balance"), must not be negative. This condition is the most important measure for ensuring that CLS is at no time exposed to a credit risk.
2. Short position limits in any one currency (*short position limit; SPL*): Restrict the amount of a short position that a settlement member may have in that currency. Any short position in respect of each currency must not exceed the short position limit. The SPL is identical for each participant and is chosen in such a way that the liquidity facilities committed by the liquidity providers are not exceeded even if the biggest liquidity provider fails. CLS can reduce the SPL or even set it at zero at any time.
3. Aggregate short positions (*aggregate short position limit, ASPL*): This limit is specific to each participant and restricts the amount of a participant's total short positions. The limit is calculated continuously in US dollar terms including a safety margin (*haircut*). For the calculation of the participant-specific amount, a number of different factors are taken into account, such as the amount of the participant's core capital (Tier 1 Capital), its capital and liquidity ratios, its internal short and long-term ratings and the country currency risk rating. CLS can reduce a participant's ASPL or even set it at zero at any time.

In order to avoid gridlock in the settlement and funding process, and in order to limit the negative effects of instructions that are not settled, CLS has also set for each currency a maximum upper limit per instruction (*splitting threshold*). If this threshold is exceeded, an instruction is automatically split into two or more.

Although a foreign exchange transaction settled on a PvP basis is a self-collateralising transaction, there is still an exchange rate risk for CLS. In order to protect it against exchange rate fluctuations, participants are charged a haircut (safety margin) on their long positions. Accordingly, the participant must always over-compensate for its short positions. The haircut specific to each currency is based on the historic volatility of the currency, including a mark-up. In the event of a participant failing to meet its pay-in obligations, the

20 The conclusion of in/out swaps is facilitated by means of a central automated process which brings the two potential counterparties together. Once the provisional pay-in schedule has been produced at midnight, the possible in/out swaps are worked out by CLS and the relevant information is forwarded to the settlement members. Participation in in/out swaps is voluntary. Once the in/out swap agreements have been concluded, a revised pay-in schedule is produced, which the participants receive at 06.30 CET, half an hour before commencement of the settlement and payment process.

21 The out leg cannot be settled in CLS in the same settlement cycle as the in leg, since the swap transaction would otherwise be offset and the swap would be ineffective.

22 The in/out swap is an instrument for deferring liquidity requirements for a short while (in leg). One reason for this is that in some time zones the money markets are not yet open or have already closed at the start of funding. The exchange of currencies envisaged in the actual foreign exchange transaction and the associated liquidity procurement do not, therefore, take place outside CLS until sometime later (out leg).

23 Liquidity providers must be able to supply CLS with the currency in question in case of need. Normally there are three participants per currency. Exceptions are granted only with the consent of CLS.

24 At the same time, the potential credit risk for CLS is thereby reduced.



haircut will protect CLS against any loss if the exchange rate of the failed participant's long positions moves unfavourably, resulting in a potential overall negative account balance for the respective participant.

If, in the event of a participant failing, the exchange rate volatility were so high that its long positions including haircuts and mark-ups would still be insufficient to cover its short positions, the resultant losses would be split between the remaining participants (*loss-sharing agreement*). The loss-sharing agreement is the ultimate measure to cover any losses for CLS.

## 9. Assessment

The strong growth in turnover on the foreign exchange market, combined with the risky settlement via correspondent banks, gave rise to systemic stability concerns. The launch of the CLS foreign exchange settlement system has contributed to mitigating these risks. CLS has been able to eliminate the principal risk inherent in the settlement of foreign exchange transactions via correspondent banks by means of the PvP mechanism. Since CLS commenced operations in 2002, the scope of its business and the number of participants has increased steadily. Currently, 17 currencies are settled.

Despite the advantages that CLS has brought for the foreign exchange market, for various reasons some foreign exchange transactions are still settled outside CLS. For example, some currencies do not yet meet the regulatory requirements of CLS, or the cost of accepting a new currency exceeds the expected benefit of inclusion. Various foreign exchange market participants still prefer the conventional settlement channels owing, for example, to insufficient business volume. Moreover, it is not yet possible to settle all foreign exchange market operations (e.g. the out legs of in/out swaps) via CLS. Against this background, CLS's current market share of around 50% of all international foreign exchange transactions may be seen as a success.

During the financial crisis of 2007–2009 the advantages of CLS became evident. For instance, CLS proved itself to be a robust infrastructure that weathered the failure of Lehman Brothers unscathed. CLS also continued to function smoothly in the face of a sharply increased volume of transactions caused by the financial turmoil. All in all, the financial crisis has made market participants conscious of counterparty risk again and emphasised the need for and benefits of PvP settlement in foreign exchange trading.

### **Published by**

Swiss National Bank  
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CH-3003 Berne  
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### **Publication Date**

November 2009

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