Settlement Risk in the Global FX Market: How Much Remains?

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Abstract

Settlement risk is a critical concern in all financial markets and especially so in foreign exchange markets where it poses the threat of complete loss. In this paper, we offer a historical look at how risk mitigation in FX settlement has developed over time. We rely on two surveys conducted by the BIS in 1997 and 2007 and a new survey conducted by CLS Bank in April 2013. Based on our review of the evidence, we find that the market has achieved significant progress in both developing and implementing techniques that have dramatically reduced exposure to FX settlement risk. The share of FX turnover settled by means of traditional correspondent bank arrangements has declined from 85% to 32% to 13% across the three surveys. CLS Bank which offers payment-versus-payment (PVP) settlement and virtually eliminates settlement risk now settles roughly half of all FX turnover. However, because of enormous growth in FX turnover, particularly in emerging market currencies where access to risk mitigation alternatives is less prevalent, the absolute value of FX turnover exposed to settlement risk remains large. Surprisingly, one-quarter of FX turnover in currencies eligible for PVP settlement using CLS Bank still relies on bilateral settlement with some exposure to settlement risk. These findings support the need for banks, industry groups and central banks to remain vigilant and continue their efforts to incentivize PVP settlement positively, making it widely available and utilized, or finding alternative risk mitigating solutions. We offer various approaches to deal with the remaining settlement risk.

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1. Introduction and Motivation

Settlement risk is a critical concern in all financial markets and especially so in foreign exchange (FX) markets. Because there is no centralized market location and settlement of the underlying (foreign currency) requires access to the financial payments systems in two countries, FX settlement exposes counterparties to added risks, including the complete loss of principal. To take a stylized bilateral transaction, a buyer of USD may pay away JPY in Japan in the early hours of the value day without assurance that the USD leg of the trade will arrive in his New York account later that day, or at all. Settlement risk thus becomes a serious concern for individual banks. But because of the interconnectedness of banks and the huge volume of daily FX turnover, settlement risk also poses a potential systemic risk to the global payments system. The failure of one FX trade could make another bank unable, or unwilling, to settle or enter into other FX trades producing a domino effect that unsettles all financial markets.

To combat the looming threat posed by FX settlement risk, the central banks of the G-10 countries (working through the Committee on Payment and Settlement Systems (CPSS) of the Bank for International Settlements (BIS)) have long supported a three-pronged approach encouraging individual banks, industry groups, and central banks to develop and implement various means to mitigate FX settlement risk. Reports issued by the CPSS have stressed the need for senior level responsibility at banks for managing FX

settlement risk, as well as proper measurement of settlement exposures and instituting appropriate controls.[1]This in turn led banks and industry groups to develop and promote bilateral and multilateral netting systems and payment-versus-payment (PVP) systems such as CLS Bank which are now key means to mitigate FX settlement risk.[2] And central banks have worked in a variety of ways to ensure that FX settlement risk receives high-profile recognition in the supervisory process and that financial payments systems support further reduction in FX settlement risk. Given the growth in daily global FX turnover from $1.5 trillion in 1998 to over $5.3 trillion in 2013, it is important to ask how much progress has been achieved in reducing FX settlement risk.

In this paper, we offer a historical look at how risk mitigation in FX settlement has developed. Surveys conducted by the BIS in 1997 and 2007 provide two snapshots of the magnitude of FX settlement exposures and the market's reliance on different settlement methods. A new survey conducted by CLS Bank in April 2013 and related research by Levich and Packer (2015), allow us to develop a more up-to-date picture of how frequently various FX settlement methods are used and what portion of FX trading remains partially or fully exposed to settlement risk. As we will discuss, settlement arrangements can be viewed as a continuum from PVP systems that entirely mitigate exposure to settlement risk on through to gross non-PVP arrangements that leave both counterparties to a transaction completely exposed to settlement risk.

Based on our review of the evidence, over the last 20 years the good news is that the market has achieved significant progress in both developing and implementing

[1] To reflect its expanded membership and role in standard setting, in 2014 the CPSS was renamed the Committee on Payments and Market Infrastructure (CPMI)

[2] For convenience, rather than the full legal name CLS Bank International we will use CLS Bank when referring to the institution or simply CLS when referring to the system.

techniques that have dramatically reduced exposure to FX settlement risk. To illustrate how great these changes have been, the 1997 BIS survey estimated that 85% of FX obligations were settled by means of traditional correspondent banking (so-called "gross non-PVP") arrangements that are exposed entirely to settlement risk. By 2007, a follow-up BIS survey found this figure reduced to 32%. And by 2013, a CLS Bank survey estimated that only 12.6% of FX trades were settled using gross non-PVP. The flip side of these figures is that a significant portion of FX turnover is now settled using CLS or other risk-mitigating techniques such as bilateral netting.

However, the bad news embedded in these results is that because of enormous growth in FX turnover, particularly in emerging market currencies where access to risk mitigation alternatives is less prevalent, the absolute value of FX turnover exposed to settlement risk remains large. Indeed, the absolute value of FX turnover for non-CLS eligible currencies has expanded nearly ten times since the inception of CLS Bank. And a substantial number of trades continue to be settled using bilateral netting or gross non-PVP even when those transactions involve CLS-eligible currencies. We estimate that the volume of FX turnover settled using gross non-PVP and fully exposed to settlement risk could range from roughly $620 to $700 billion per day. Including some portion of the $1,350 billion per day that relies on bilateral netting (which is partially exposed to settlement risk) pushes global exposure to settlement risk still higher.

Exposures of this magnitude underscore the need for enhanced supervisory guidance for managing FX settlement risk as promulgated by the Basel Committee for Banking Supervision in 2013. Overall, our findings support the need for banks, industry

groups and central banks to remain vigilant and continue their efforts to make PVP settlement more widely available and utilized or find alternative risk mitigating solutions.

For the remainder of the paper, in section 2 we review the efficacy of alternative methods for mitigating FX settlement risk. In addition, we sketch the evidence on the use of various settlement methods in the 1990s and the magnitude of exposures that motivated new approaches to settlement risk mitigation, most importantly CLS. In section 3, we present an overview of the main features of CLS Bank and the operation of a PVP settlement system. A survey conducted by the BIS in 2007 provides various measures of FX settlement risk mitigation prior to the global financial crisis. In section 4, we outline the growth of CLS in terms of currencies, products and members eligible to use CLS Bank services. A survey conducted by CLS Bank in 2013 offers new evidence on the utilization of CLS and other settlement methods by currency, product and counterparty. We use the survey to develop estimates of FX trading that remains largely or partially exposed to settlement risk. We summarize the implications of our analysis in the final section and offer several recommendations for managing or mitigating the risks that remain. Modifying the BIS Triennial Survey to collect data on settlement methods in the future is a specific recommendation aimed at both improving the measurement of and enhancing transparency around the scale and scope of settlement risk exposure in the global markets. The results could then facilitate discussions around regulatory capital for settlement risk, including the adequacy of capital levels against observed levels of unmitigated settlement risk exposures and the need to incentivize PVP settlement positively.[3]

[3] In February 2013, the BIS provided supervisory guidance for the management of risks associated with the settlement of foreign exchange transactions, According to that guidance, building on the broader Basel

2. FX Settlement and Exposures Prior to the Founding of the CLS Bank

As noted earlier, daily global FX turnover has risen dramatically from $1.5 trillion in 1998 to over $5.3 trillion in 2013 giving FX the largest daily turnover of any financial market.[4] Despite decades of growth and dramatic changes in trading technology, the FX market can still be characterized as a globally dispersed, broker-dealer market.[5] The foreign exchange market is not a place one can visit like the New York Stock Exchange or the Chicago Mercantile Exchange. Currency trades in an interbank market through many banks and trading rooms around the world. Trading is facilitated by various electronic trading platforms (some operated by single banks as well as systems developed by Reuters and Electronic Broking Systems [EBS]) but trades facilitated via voice-brokers or simply direct calls between dealers remain a significant part of the market.[6] There are no set standard trading hours, no centralized record of transactions, and no unique closing prices as there are for listed stocks and futures contracts.

For most of its history, the nature of the foreign exchange market dictated that FX transactions were to be settled on a bilateral basis relying on traditional correspondent banking relationships. To illustrate, consider a USD/JPY trade whereby the Singapore branch of an Australian bank uses JPY to buy USD from the London office of a Swiss bank.[7] The example is designed to illustrate some of the complexity in FX trades with

framework for capital adequacy, banks should incorporate capital needs for all risks associated with FX transactions in determining the adequacy of their regulatory capital.

[4] BIS Triennial Survey (2013), Table 1.

[5] King, Osler and Rime (2011) provide a detailed overview of the evolution of the foreign exchange market including its structural features and market participants.

[6] See 2013 BIS Triennial Survey, Table 26. The data show that voice execution accounts for 34.5% of spot turnover while electronic execution accounts for 63.8%. Voice accounts for a higher percentage in outright forwards, FX swaps, currency swaps, and 62.0% for FX options.

[7] The example is adapted from BIS (2008, p. 28).

two countries (Singapore and Australia) having a role in the purchase, and two other countries (Switzerland and the UK) having a role in the sale, while none of the four countries are directly involved in the payments systems for USD or JPY. To process settlement using traditional correspondent banking (i.e. bilateral settlement), at a time prior to settlement day *V* (the Value date), the Australian bank would notify its correspondent bank in Japan (J1) to transfer JPY to the Japanese correspondent bank (J2) used by the Swiss bank. Likewise, for the same value date, the Swiss bank would instruct its correspondent bank in the US (U1) to transfer USD to the US bank (U2) used by the Australian bank. The necessity of using the JPY and USD payment systems brings four new actors (J1, J2, U1, and U2) into the settlement process.

Compounding matters, bilateral trades were historically settled on a gross basis (hence the current labelling as "gross non-PVP"). Thus if Bank A purchased JPY 375 million for USD 3 million from Bank B and later sold JPY 625 million to Bank B for USD 5 million, all four amounts would flow through the payments systems. The implication is that each buyer would need to fund his purchase by having good funds available by the value date.[8] Without some form of netting (discussed later), the total amount of funds required to facilitate funding all such trades on a daily basis would become staggering.

Bilateral settlement based on traditional correspondent banking leads to exposures 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."[9] The exposure begins when an institution "can no longer unilaterally cancel its instruction to

[8] In any FX transaction, there are two legs and in effect 2 "buyers." Bank A is a buyer of JPY while Bank B is a buyer of USD.
[9] BIS (2008, p. 6)

pay the currency it is selling, and ends when it receives with finality the currency it is buying."[10] Again, using *V* as the value date for final receipt of currency due, this time interval – from *V-I* when an institution has irrevocably issued instructions to deliver the sold currency to *V+U* when uncertainty is resolved and the institution can verify either final or failed receipt of the bought currency – can extend for many hours. The BIS (2008) estimated that the average time duration of settlement exposure is significantly more than 24 hours. The duration of settlement exposure is partially the result of time zone differences, but often exacerbated by internal banking practices and correspondent banking relationships. Technical or operational failures at any of the institutions involved could result in other than on-time delivery of funds. In the worst case, should one institution become insolvent during the settlement process, the surviving institution would suffer a complete loss of principal.

This seemingly remote possibility occurred in June 1974 when Herstatt Bank received Deutsche marks at its offices in Cologne Germany, but was subsequently closed down and forced to cease operations by German banking regulators, and was thus unable to deliver US dollars to its counterparties once US banks opened for business. This aspect of settlement risk, also known as delivery risk (but naturally enough known as "Herstatt risk") resulted in a complete loss of principal for Herstatt's counterparties.

As the principal clearing bank for Herstatt in New York, Chase Manhattan Bank, N.A. was saddled with $620 million in transfers to make on behalf of Herstatt, while Herstatt had only $150 million on account at Chase.[11] Overall, New York creditors were

[10] *Ibid.*
[11] See Becker (1976, p. 1291).

far more impacted than London banks. Still, London bank losses exceeded $500 million.[12]

Beyond the financial losses which were large by then current standards, disruptions in foreign exchange trading developed that lasted for up to one month. FX trading experienced unusual settlement delays, banks were less likely to offer quotes to smaller banks, and market access, quote size, and trading limits all tended to decline.[13] Quoting memoranda from Federal Reserve Bank of New York archives, Mourlon-Droul notes that in the first few days after Herstatt, "dealers reported a drop in business of up to 90%, with the average fall off of roughly 75%."[14] On July 1, 1974, New York clearing banks instituted a policy that FX trades would be executed subject to "recall within two working days" as a means to protect themselves against settlement risk. The policy was abandoned on November 4, 1974.[15]

Soon thereafter, market participants and regulators began searching for a solution to what could only be a growing problem given the ongoing globalization of markets and financial transactions. Working through the BIS, in 1996 the CPSS issued a comprehensive report on "Settlement Risk in Foreign Exchange Transactions." The so-called Allsopp Report assessed the relative merits of delivery-versus-payment (DVP) and payment-versus-payment (PVP) settlements systems and two potential payment/receipt relationships: a guaranteed receipt system (where counterparties are guaranteed that they will receive what they are owed if they fulfil their own settlement obligation) and a guaranteed refund system (where counterparties are guaranteed that their settlement

[12] See Mourlon-Droul (2015, p. 327)
[13] Recounted in Norman (2015).
[14] Mourlon-Droul (2015, p. 313).
[15] See Norman (2015) and Schenk (2014, p.10).

payment will be cancelled or returned if their counterparty fails to pay what they owe). The Report did not seem to take a stand on which settlement system would best serve the foreign exchange market. In their words, "While any of the various settlement mechanisms described above could potentially eliminate FX settlement exposures, each has particular strengths and weaknesses that should be considered."[16]

The Report, however, came down clearly in favor of private sector rather that public sector provision of enhanced settlement services. Among the reasons given were the need for ongoing innovation, pressure to provide cost-effective arrangements and private sector methods for controlling risk. Having said this, the Report noted the important role for central banks to promote the safety and soundness of their domestic financial institutions needed to support a multi-currency settlement system. In addition, the Report expressed concern as to the speed of progress and the need for central banks to "induce rapid private sector progress." Given that the Herstatt Bank failure occurred 22 years earlier, the Report noted that "Among the impediments at the individual bank level is a belief held by some banks that the probability of an actual settlement loss is too low to justify the cost of reducing exposures."[17]

FX Settlement Arrangements and Risk Mitigation

We will review five alternative FX settlement arrangements and their impact on mitigating settlement risk. All five alternatives are in use today, although CLS Bank and

[16] The Allsopp Report (1996), p. 24.
[17] The Allsopp Report (1996), p. 27. While settlement loss on the scale of Herstatt is a rare event, other financial institution failures (e.g. Barings Bank, Drexel Burnham, REFCO, among others) have triggered concerns regarding settlement risk. Evidence on FX settlement risk is often anecdotal as there is no obligation to report such exposures and losses.

Other PVP arrangements were not available at the time of the 1997 BIS Survey on settlement arrangements (discussed in the next section).

(1) CLS describes the multicurrency cash settlement service operated by CLS Bank, which provides a mechanism for payments relating to underlying FX transactions to be made on a simultaneous basis. This ensures that the final settlement of a payment instruction in one currency occurs if, and only if, settlement of the payment instruction for the currency being exchanged is also final. By settling payment instructions on a PVP basis, CLS Bank ensures that the principal amounts involved are protected, eliminating exposure to settlement risk. An additional benefit of CLS is its multilateral net funding process, described in more detail in section 3.

(2) Other PVP describes other payment-versus-payment systems that ensure that a transfer of one currency occurs only if a transfer of the other currency also occurs. Examples of Other PVP systems are those run by Hong Kong Interbank Clearing Limited, Malaysian Electronic Clearing Corporation (RENTAS), and Philippine Dealing and Exchange Corp (PDEx). Similar to CLS, Other PVP systems are designed to eliminate settlement risk. Different than CLS, however, Other PVP systems also require funding to be made on a gross basis, which requires larger funding amounts than CLS, which benefits from multilateral netting arrangements.

(3) On-Us (or internal demand deposit account (DDA)) can be arranged in cases where both legs of a transaction are settled across the books of a single institution. For example, a USD/JPY transaction arranged by Bank A for a

corporate client or institutional investor could be settled on-us when the client expects to deliver the sold currency and receive the bought currency at accounts in Bank A. For the client, while on-us settlement avoids the risk of delivering JPY to one bank and relying on a second institution to deliver USD, the client is still exposed to settlement risk in the event that Bank A executes one leg of the transaction but fails to complete the second leg.

(4) Bilateral Netting enables two counterparties to net their transactions for a pair of currencies on a single date and produce a single obligation to pair in each currency on that date. In the example given earlier (whereby Bank A purchases JPY 375 million for USD 3 million from Bank B and later sells JPY 625 million to Bank B for USD 5 million), a bilateral netting system would combine these two trades resulting in a net transfer of USD 2 million to Bank A to be delivered by Bank B, and JPY 250 million from Bank A to Bank B. In this example, bilateral netting results in a significant 75% reduction in the need for liquidity and the amount subject to final settlement – from USD 8 million down to USD 2 million and a similar percentage for the JPY. Note that the final settlement amounts would generally be settled using Gross non-PVP and subject to settlement risk.[18]

(5) Gross (Correspondent Banking) non-PVP was outlined earlier in this section. Under this settlement method, each counterparty to an FX transaction transfers the currency it is selling to the other, typically relying on their correspondent banks. As described, once a payment instruction is acted upon,

[18] As a variation, multilateral netting allows transactions between Banks A and B in currency pairs A/B, C/D, and so on to be combined into a single obligation between Banks A and B.

the full amount being transferred is subject to principal risk, as well as replacement cost risk and liquidity risk until the second leg of the transaction is received. In addition, Gross non-PVP maximizes the liquidity needs of the system as each counterparty must fund the position they are selling, or delivering to the other counterparty. Gross non-PVP is therefore the most risky, most liquidity intensive and least desirable means of FX settlement.

The 1997 BIS Survey

To underscore the significance of FX settlement risk and their commitment to reducing it, the BIS conducted a survey of settlement practices in 1997 and issued a progress report (BIS, 1998) the following year. The survey gathered responses from 63 banks collectively accounting for more than 50% of global FX turnover. The report covered actions undertaken by banks, industry groups and central banks.

As for banks, the report focused on the extent to which clear senior level responsibility for FX settlement risk management had been established, and whether appropriate controls and techniques for measuring risk were in place. The report also collected information on the use of bilateral and multilateral netting systems.

The 1997 BIS survey found that 77% of banks used bilateral netting, but not necessarily with all counterparties. Multilateral netting was even less common used by only 23% of banks in the survey.[19] As shown in Figure 1a, bilateral and multilateral netting was used to settle about 15% of FX turnover leaving fully 85% of turnover to be settled via traditional correspondent banking relationships meaning gross non-PVP.

[19] BIS (1998, pp. 15-6). Bilateral netting was 50% effective, taking an estimated $344 billion per day in gross flows and reducing them by $173 billion, leaving $171 billion to settle along with other gross non-PVP trades.

Applying these percentages to the next BIS Triennial survey in April 1998 (in Figure 1b), we estimate that gross non-PVP was used to settle more than $1,260 billion in daily turnover leaving about $226 billion per day to settle via bilateral or multilateral netting.[20]

The remainder of the 1998 BIS progress report highlighted efforts by industry groups to improve multilateral netting services, and efforts by central banks to raise awareness of FX settlement risk by working with national supervisory bodies and also to facilitate improvements in national payments systems.

Not long after the Allsopp Report, in June 1997 the Group of Twenty formed CLS Services Ltd. to develop and build a new, multicurrency, PVP settlement service. After 5 years of planning and development, what we now know as CLS Bank International commenced operations in 2002.

3. An Overview of CLS Bank and Progress toward Risk Mitigation Using Payment-versus-Payment Settlement

CLS Bank is an Edge Act corporation located in New York and is regulated and supervised by the US Federal Reserve. The Federal Reserve also acts as the lead overseer of CLS Bank in a cooperative oversight arrangement with the central banks whose currencies are settled by CLS Bank. CLS Bank is a wholly owned subsidiary of CLS Intermediate Holdings Ltd. which in turn in a wholly owned subsidiary of the parent company CLS Group Holdings AG based in Switzerland. As of June 2014, the parent company was owned by 76 shareholders representing many of the world's largest financial institutions from 23 countries.

[20] The survey focused on larger banks that may have been more likely to have bilateral and multilateral netting systems in place. In that case, our figures overestimate the market's overall use of netting and underestimate its reliance on gross non-PVP settlement.

CLS Bank, taking its name from a so-called Continuous Linked Settlement process, operates a payment-versus-payment (PVP) settlement service which mitigates settlement risk in the FX transactions of its settlement members and their customers (known as Third Parties). Although the details of this global operation are complex, the basics of the PVP settlement process are straightforward.[21] CLS Bank receives detailed information from both counterparties about their FX transaction and then matches the two legs of the transaction scheduled for delivery on date *V*.[22] On the settlement date, *V*, during a several hour window, CLS Bank receives currency A from one counterparty and waits for the receipt of currency B from the second counterparty. Once funding has been received for both legs of the trade, CLS settles the transaction and pays out both counterparties. Once settlement has been concluded, it is final and irrevocable. If counterparty B fails to provide the required funding, CLS suspends the failing counterparty and takes remedial actions to protect the full amount of counterparty A's principal, which avoids settlement risk (or what the Allsopp Report labelled a "guaranteed refund system"). The transaction between A and B is left to settle in some other manner.

Another critical feature is that CLS Bank operates a multicurrency system presently with 18 CLS-eligible currencies.[23] CLS multilaterally nets all positions and it is the netted amount on matched trades that CLS requests funding in relevant currencies from each settlement member on value date. In practice, the amount of cash required by

[21] The main text offers a stylized description of a CLS transaction which is not intended to capture the complexity of all possible outcomes. For instance, of transactions submitted to CLS, only those that are matched and not rescinded will be settled, subject to satisfying certain risk tests. More detail on how CLS works is available here: https://www.cls-group.com/About/CG/Pages/CorePrinciples.aspx

[22] CLS Bank generally matches payment instructions within seconds or minutes of the trade.

[23] On November 16, 2015, CLS Bank announced that the Hungarian forint became eligible for settlement through CLS, bringing the total number of CLS-eligible currencies to 18. Our analysis relies on BIS and CLS Bank surveys conducted in 2013 when there were only 17 CLS-eligible currencies.

CLS to settle all payment instructions is reduced by an average of 96%.[1] As a result, for every $1 trillion of value settled, CLS settlement members require less than $50 billion in cash to fund their transactions. This represents an enormous liquidity savings relative to gross non-PVP settlement.[24]

At its launch in 2002, CLS Bank settled transactions for 7 currencies (USD, EUR, JPY, GBP, CAD, CHF, and AUD) on behalf of 39 settlement members. In 2003, four more currencies (DKK, NOK, SEK, and SGD) were added followed by four additional currencies (HKD, KRW, NZD, ZAR) in 2004. Finally, two currencies (MXN, ILS) were added in 2008 making in total 17 CLS-eligible currencies including 9 of the top 10 currencies by volume from the 2013 BIS survey, as well as other currencies with smaller turnover. (See Figure 2)

In Figure 3, we track the global turnover in these four vintages of CLS-eligible currencies using the volume data from the nearest BIS Triennial survey. In 2001 just prior to launching CLS Bank, the original 7 CLS-eligible currencies accounted for slightly over 97% of total global FX volume. By 2004, the share for the original 7 currencies had fallen to 89.5%, but the 8 newly added currencies gave CLS-eligible currencies 94.5% coverage of total global FX volume. In 2007, the share for the 15 legacy CLS currencies fell slightly to 93.0%. But adding the MXN and ILS in 2008 raised the coverage for CLS-eligible currencies back to 93.7% where it has remained through the 2010 and 2013 Triennial surveys.

In summary, while the number of CLS-eligible currencies has grown from 7 to 17, the share of global FX turnover that those currencies account for has dropped from

[1] Cash requirements can be reduced further by using In/Out Swaps. See Box 1 for a description of In/Out Swaps.

97.1% to 93.7%. At the same time, the volume of global FX turnover has jumped dramatically, from $1.17 trillion/day in 2001 to $4.95 trillion/day in 2013.[25] Thus, the absolute value of global FX turnover *not* covered by CLS Bank has expanded more than nine-fold from $33 billion in 2001 to $310 billion in 2013.

For a variety of reasons, however, taking 93.7% as the share of global FX turnover for CLS-eligible currencies represents an upper bound for the percentage of transaction that actually could or will use CLS for settlement. First, simply adding up the share of FX turnover attributed to each of the 17 CLS-eligible currencies overstates the potential reach of CLS Bank because the data in Figure 2 includes trades with non-CLS eligible currencies which cannot be processed through CLS Bank. While turnover, for example, between the USD and Russian ruble, or between the EUR and Thai baht, and other pairs are individually small, collectively they can become non-trivial. To address this issue, Levich and Packer (2014) obtained more granular data from the 2013 BIS Triennial survey allowing them to analyze turnover for 273 currency pairs. For the 17 CLS-eligible currencies, the BIS survey included data on 100 of the 136 possible CLS-eligible currency pairs.[26] Based on these more refined data, Levich and Packer find that turnover among CLS-eligible currency pairs account for only 90.5% of global turnover, somewhat smaller than 93.7% as shown in Figure 3. Taking the revised figure leaves potentially 9.5% of global turnover *not* covered by CLS Bank, or approximately $470 billion/day.

Second, both counterparties in a trade must be CLS-eligible to utilize CLS settlement services. As of June 2014, there were 64 settlement members from 23

[25] These totals include only spot, outright forward and FX swaps all of which are CLS-eligible products.
[26] With 17 currencies there are (17 x 17 – 17)/2 = 136 possible pairings. For institutional reasons related to cost and liquidity, there is not direct trading in all currency pairs.

countries and more than 11,000 third party members from about 80 countries. Third party members are heavily concentrated in the United States, the United Kingdom, and Luxembourg where institutional investors have established third party membership for many of their investment funds (each one a separate legal entity). While membership in CLS is widespread, it is not universal.

Third, settlement services using CLS Bank are available only for CLS-eligible products which include spot, outright forwards, and FX swaps. Notably, FX options and currency swaps with $391 billion in daily global turnover in 2013 are not CLS-eligible.[27] For FX options, premium income paid represents one-way payments and therefore would not settle through CLS.[28] But option exercise (for example, buying EUR at the predetermined USD strike price) initiates a spot transaction that could settle through CLS conditional on the usual criteria – both currencies and counterparties are CLS eligible.

Fourth, even when both currencies and counterparties are CLS eligible as well as the product being traded, members are under no obligation to use CLS. Failure to use CLS or another PVP system could expose the counterparties to full settlement risk.[29] Even when the counterparties elect to settle "on us" (available when both counterparties to a transaction hold accounts within the same bank) while there is no transfer of funds across institutions, settlement risk is still present owing to time zone differences and the need to rely on two separate bank entities to complete both legs of the transaction.

[27] Cross currency swaps did not settle through CLS in 2013, but as of November 2015, are now CLS eligible.

[28] Currency swaps and non-exchange traded FX options traded by US financial institutions will be subject to risk mitigation through CCP arrangements as required by the Dodd-Frank Act. Those regulations have yet to be drafted.

[29] German bank KfW Bankengruppe used bilateral means to transfer EUR 300 million to Lehman Brothers on September 15, 2008 the day Lehman filed for bankruptcy. KfW lost the entire amount as the other leg worth USD 426 million was never sent. Subsequently the German government has taken steps to recover part of this loss.

Cutting in the other direction, however, various Asia Pacific countries have developed PVP systems, or alternative risk mitigation measures to address settlement risk in their home currencies that are not presently CLS-eligible. The Philippines uses a real time gross settlement (RTGS) system with PVP for Philippine peso vs. USD trades. In 2006, Malaysia instituted the first cross-border PVP link in the region with the Hong Kong Monetary Authority (HKMA) for settling ringgit-USD trades. In 2010, Indonesia established a similar arrangement with the HKMA for settling rupiah-USD trades. The Bank of Thailand is exploring a link with the HKMA to enable settlement of baht-USD trades.[30] Notably, once an HKMA link is established, settling trades against the EUR, HKD, and CNY would become feasible. And even though India presently does not have a PVP system or a link to one in place, the Reserve Bank of India relies on a detailed system of margin, lines of credit and penalties in the event of a shortfall to reduce settlement risk in rupee-USD trades.[31]

The 2006 BIS Survey

To gauge progress on its strategy to reduce systemic risk related to the settlement of foreign exchange trades, the BIS undertook a second survey in April 2006. This survey cast a wider net relying on 27 central banks to sample 109 institutions with the intent of reflecting 80% of turnover value for the 15 CLS currencies. The sample included 89 CLS users (either settlement members or third parties) and 20 non-CLS users. The 89 CLS users, however, accounted for 98% of settlement obligations in the sample versus only

[30] "Payment Systems Report," Bank of Thailand, 2012, p. 25. The link became operational on July 28, 2014.

[31] See "Payment, clearing and settlement systems in India," known as the Red Book, Committee Payments and Market Infrastructures, BIS, 2011, p. 181. In addition, the Clearing Corporation of India Limited (CCIL) is a third party member of CLS Bank that offers settlement services in CLS-eligible currencies to participating banks (fourth parties) as a settlement aggregator. *Ibid* at page 183.

2% for the 20 non-CLS users. Highlights of survey findings are in Figures 1a and 1b and the complete survey findings and recommendations are in BIS (2008).

The BIS (2008) report concluded that substantial progress had been made in mitigating FX settlement risk, primarily through the successful launch of CLS Bank and its PVP system for settlement. Fully 55% of FX transactions in the sample were settled using CLS. The report noted that CLS "virtually eliminates the principal risk associated with settling FX trades" and that its successful launch "reflects the strong policy commitment, resources and efforts of numerous financial institutions around the world."[32] Another 12% of trades were settled using bilateral netting or on-us methods that provide some reduction of settlement risk. On the other hand, the report noted that "substantial FX settlement exposures remain." In particular, 32% of FX transactions in the sample were settled using traditional correspondent banking arrangements, or gross non-PVP. The report highlighted other dimensions of settlement exposure noting that half of the gross non-PVP transactions involved overnight risk and that some settlement exposures were large relative to the institution's capital and not well controlled. Finally, the report expressed concern over the "potential risk of backsliding" given that many firms continued to use incomplete risk measures and for cost reasons could be driven to less safe settlement methods.

While the estimated decline in the use of gross non-PVP settlement from 85% in 1997 to 32% in 2006 is significant, given that global FX turnover roughly doubled over the period, we estimate that the absolute value of daily turnover settled in 2007 using gross non-PVP remained a considerable $986 billion (Figure 1b). While this is roughly a 22% decline relative to the April 1998 estimate, because the 2006 survey relies heavily

[32] BIS (2008, p.1).

on large institutions who are CLS users, the results may understate the market's overall reliance on gross non-PVP settlement because the institutions omitted from the survey are more likely to rely on gross non-PVP settlement and less likely to use CLS.

Based on the survey findings, the BIS (2008) report recommended various actions again targeted at individual institutions, industry groups and central banks. In general, the report encouraged institutions to utilize CLS or other PVP arrangements. It also supported bilateral netting when those arrangements could be made legally sound and the resulting bilateral exposures appropriately controlled. The report also urged the expansion of PVP settlement with the most emphasis on adding certain services such as same day or next day trades, as well as making adding additional currencies and counterparties eligible for PVP settlement.

4. Growth of CLS Bank and Recent Evidence on Settlement Methods

Subsequent to the BIS (2008) report, total CLS trading volume across all eligible currency pairs and products has increased substantially. Growth has been supported in part by the addition of two currencies (MXN and ILS) in 2008, and new services (CLS Aggregation Service in January 2010) allowing smaller trades between two counterparties to be aggregated and sent to CLS for batch processing and Same-Day-Settlement for USD/CAD spot trades (introduced in September 2013).[33]

As shown in Figure 4, the average number of daily transactions hovered in the 300,000 – 400,000 range in 2007 and expanded to reach 1.25 million per day in the first

[33] It could be argued that introducing the CLS Aggregation Service did not change the volume or value of transactions, but simply repackaged the same trades into larger, more efficiently processed packages. Still, any innovation that that eases or facilitates trading is likely to expand CLS volume. Innovations such as settlement of cross currency swaps and adding the Hungarian forint as an eligible currency occurred after the April 2013 survey.

half of 2013 before declining to about 1.0 million per day in the first half of 2014.[34] In the interim, the volume of transactions experienced a slight decline associated with the global financial crisis (GFC), and also a temporary burst of volume in the first half of 2013 largely the result of a dramatic jump in JPY trading associated with the change in Japanese monetary policy.[35]

Again referring to Figure 4, the average value of transactions settled in CLS was roughly $3.5 trillion per day in 2007 and then rose to more than $4 trillion per day in mid-2008 before dropping to about $3.0 trillion per day in the first quarter of 2009. This is a far greater decline than observed in the FC market generally during the GFC. Since then, the value of transactions settled on CLS has gradually drifted upwards to a little over $5.0 trillion per day in the first half of 2014. We do not observe as pronounced a rise in the value of transactions in the first half of 2013 compared to the spike in transaction volume.

It is critical to note that CLS processes payment instructions representing both sides of a trade and includes both sides in its trading value calculation. Therefore to make CLS value data consistent with BIS survey turnover data, we divide the CLS settlement values by two. As a rough guide to the importance of CLS to the FX market, consider the BIS survey estimate for the global value of daily FX trading in CLS eligible products in April 2013, which was $4.954 trillion. CLS Bank reported $5.0 trillion as their average daily value settled in April 2013. Dividing the CLS figure by two, as a first

[34] The data represent matched trades rather than settled trades.
[35] The average daily volume of USDJPY transactions processed by CLS jumped from about 100,000 in the last half of 2012, to over 300,000 in the summer of 2013. Data here represent 3-month rolling averages, and input volumes, not matched trades.

approximation, CLS Bank would appear to settle around $2.5/$4.954 = 50.5% of global FX trading.[36]

It is also worth reiterating that while in April 2013, CLS members collectively entered payment instructions valued at the USD equivalent of $5.0 trillion on average each day, owing to the 96% efficiency of multilateral netting, something closer to "only" $200 billion was required in order to settle the transactions (between net buyers and net sellers) for each value date. The combination of multilateral netting with PVP settlement provides a huge liquidity funding savings for CLS members utilizing the system.

The 2013 CLS Bank Survey

A survey conducted by CLS Bank in April 2013 allows us to develop a more up-to-date picture of how frequently various FX settlement methods are used and what portion of FX trading remains partially or fully exposed to settlement risk.[37] The CLS survey requested information from 63 CLS settlement members. CLS received 44 usable responses representing an 83% participation rate based on CLS value settled in the survey month. In order to estimate total member activity, value figures were scaled up by 100/83. This scaling does not impact CLS's estimates on the breakdown of settlement methods.

A selection of survey results is shown in Figure 5a. CLS Bank members reported total daily average turnover of $4,175 billion in the CLS eligible products. That

[36] Note that our BIS turnover estimate excludes $337 billion of average daily currency option trading (representing the notional principal value of option contracts) because currency options are not CLS-eligible. However, if a currency option is exercised, that transaction may be settled as a spot transaction through CLS which inflates CLS volume by a negligible amount. Option exercise volume is not counted in the top line, BIS survey data.

[37] The results of the CLS survey (CLS, 2014) were shared with CLS settlement members. CLS has, however, previously made this and other related data available to interested academic and other researchers on a case by case basis.

represents 84% of the $4,954 billion figure reported in the BIS survey. Figure 5a shows the breakdown of the $4,175 billion total across CLS-eligible currencies ($3,886 billion) and non-CLS eligible currencies ($288 billion) as well as the breakdown against five alternative settlement methods. Respondents used CLS for settlement of $2,121 billion in trades involving CLS currencies, or 54.6% of $3,886 billion. Members obviously used CLS for settlement of 0.0% of their $288 billion in non-CLS eligible currencies. Combining these two percentages using weights from the CLS survey (3,886 for CLS currencies and 288 for non-CLS currencies) CLS calculates that 50.8% of global turnover in spot, outright forwards, and FX swaps is settled through CLS Bank.[38]

Similar calculations for the other settlements methods (bilateral netting, other PVP, on-us, and gross non-PVP) are shown in Figure 5b. Bilateral netting appears to be far more widely used for 48.3% of transactions in non-CLS eligible currencies compared to only 25.8% in CLS-eligible currencies. Gross non-PVP is employed for only 10.6% of trade volume for CLS-eligible currencies, but 38.3% for non-CLS eligible currencies. The former number may reflect trades between CLS members and non-members that would not be eligible for CLS settlement or special trades (such as same day or next day) that are not presently available at CLS for all currencies.[39]

In Figure 1b, we use the percentages estimated in the 2013 CLS survey to calculate estimates of the absolute value of daily FX turnover in April 2013 settled using alternative methods. As noted, we estimate that CLS settled 50.8% of global FX turnover in April 2013. On-us settlement that entails some small settlement risk exposure settled

[38] Alternatively, if the survey percentages were applied to the BIS survey values for CLS-eligible products, (54.6% x $4,313 = $2,355) then the fraction of CLS coverage is only 47.5% (= $2,355 / $4,954).
[39] CLS offers an Americas Same-Day settlement that allows same-day instructions in USD/CAD to be submitted to CLS. As an operational matter, some instructions involving Asia-Pacific currencies (e.g. AUD and JPY) may obtain same-day settlement owing to where the counterparties reside in the daily operational timeline.

9.2% of turnover and other PVP settlement systems designed to shield counterparties completely from settlement risk reflect an estimated 0.1% share. Bilateral netting which carries a partial exposure to settlement risk is used for 27.3% of turnover. This leaves 12.6% of turnover using gross non-PVP and fully exposed to settlement risk. Given the expanded volume of FX turnover in April 2013, the 12.6% share corresponds to slightly over $620 billion in daily turnover. Once again, there is reason to suspect that the 12.6% figure could be an underestimate as the CLS Bank survey has focused on larger market participants who have greater access to risk mitigating settlement methods such as CLS and bilateral netting systems.[40]

5. Conclusions and Implications

Up until the mid-1990s, in most instances foreign exchange trades were settled using traditional correspondent bank relationships. This gross non-PVP method exposed counterparties to the risk of delayed receipt of funds, and in the case of insolvency, potentially a complete loss of principal. Given the volume of FX turnover and the interconnectedness of banks, the risk to individual banks also posed a systemic risk to the global financial system.

In a little over one decade, CLS Bank has grown to become the "sole global multi-currency settlement system of its kind, offering both liquidity savings and settlement risk mitigation across all major currencies."[41] Roughly one-half of all FX

[40] Note that the 12.6% figure is the weighted average of 10.6% gross non-PVP for CLS eligible currencies and 38.3% for non-CLS -eligible currencies with weights based on the turnover volume as reported by CLS survey respondents. If instead we apply the gross non-PVP percentages (10.6% and 38.3%) to the BIS survey values ($4,313 and $640), then our estimate of global turnover exposed to gross non-PVP settlement rises to $702.7 billion, or 14.2% of the BIS estimate for turnover in CLS eligible products.

[41] 2012 Annual Report, Financial Stability Oversight Council, p. 157. In July 2012, the Financial Stability Oversight Council (established in the United States pursuant to the Dodd-Frank Act) designated CLS Bank

turnover is settled using CLS or other PVP systems that protect counterparties from incurring a complete loss of principal. Similarly, greater reliance on bilateral netting and on-us settlement has allowed an increasing share of turnover to be settled so that much of the ultimate settlement risk is mitigated.

The evidence assembled from surveys by the BIS and CLS Bank indicate that the estimated percentage share of turnover using gross non-PVP settlement has declined dramatically from 84.8% in 1997, to 32.0% in 2006, and to 12.6% in 2013. Over the same time span, however, the volume of FX turnover has expanded dramatically. The volume of FX turnover subject to gross non-PVP settlement has dropped (from roughly $1,260 billion in 1998, to $986 billion in 2007 and to $624 billion in 2013) but it remains a large figure. And because of sampling issues, the reliance on non-PVP settlement may be larger than these estimates suggest.

The most recent survey data suggests that the global foreign exchange market remains vulnerable to settlement risk in the sense that gross non-PVP is used to settle perhaps $620 billion or more in FX transactions daily. Whether this poses a systemic risk depends on how much any individual bank relies on non-PVP settlement and whether they have sufficient capital to withstand a risk event.

It may seem surprising, but nearly two-thirds of the $620 billion processed using gross non-PVP is for CLS-eligible currencies. The mechanical explanation is simply that CLS-eligible currencies account for roughly 90% of global turnover. So even though counterparties (CLS members in the 2013 survey) are less likely to resort to non-PVP, the

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as a systemically important financial market utility (SIFMU) based on several criteria that attest to the volume of transactions processed by CLS Bank, but also its critical role in the interconnectedness of the FX market and the costs and risks to financial stability if the ability to rely on PVP settlement for major FX transactions were jeopardized. Being classified as a SIFMU, CLS Bank is subject to enhanced regulatory oversight by the Federal Reserve.

total turnover in these currencies is nearly nine times as large.[42] More puzzling is why CLS members would route trades in CLS-eligible currencies through non-PVP settlement as opposed to through CLS. One reason could be that the counterparties required a service (such as same day or next day settlement) that was not available for a desired currency pair through CLS. Developing these services would allow more turnover to flow through CLS or an alternative PVP settlement system. Another reason could be that some of the trades reported in the survey by members had non-members as counterparties.

Bringing additional members into the CLS community would add to the pool of eligible counterparties. Whether a company or financial institution decides to seek membership presumably depends on a comparison of the expected benefits of PVP settlement versus the costs of joining and utilizing CLS. It is useful to distinguish between costs borne by an institution to become "CLS-ready" and fees assessed by CLS for utilizing the system. A prospective member incurs initial fixed costs in terms of modifying their own trading and back-office accounting systems. In addition, prospective members may need to factor in various ongoing costs such as additional staff because the CLS settlement cycle runs on Central European Time, with some critical elements of settlement set for non-standard local business hours. Member must meet certain credit criteria to retain CLS membership. And because Basel III capital requirements do not include a specific charge for exposure to FX settlement risk, banks do not lower their capital costs by becoming CLS members and utilizing the service. Taking these factors together, a prospective member might view these costs as high relative to their

[42] The CLS Survey (2014, pp. 22-4) contains estimates of the percentage of value settled using gross non-PVP for CLS-eligible currency pairs. For major currency pairs, EUR/USD (12%), USD/JPY (8%), and GBP/USD (9%) survey respondents used non-PVP for about 10% of settlement activity. However, for certain CLS-eligible currency pairs – EUR/CAD (27%), EUR/DKK (23%), and USD/KRW (27%) – reliance on gross non-PVP was far higher.

assessment of a seemingly remote repeat of a Herstatt risk event.[43] A variation of this argument could be that although an institution is a CLS member, it may not uniformly require the use of PVP settlement in all of its FX operations worldwide.[44]

The remaining one-third of turnover not now routed through PVP settlement involves currencies that are not CLS-eligible.[45] Bringing additional currencies into the CLS community can be a lengthy and complex process, but one that has a known set of criteria. Of critical importance, the country's legal system must support the enforceability of netting agreements and allow for finality of settlement and finality of funding as determined by a foreign institution, as CLS Bank would appear to any prospective new currency. In addition, the country must have an operational RTGS system for messaging and timed payments, currency convertibility, and meet sovereign credit rating requirements. Countries considering CLS membership make their own cost-benefit analysis based on the benefits of reduced exposure to FX settlement risk and enhanced stability of the local financial sector compared to the costs borne by both the country and individual financial institutions.[46]

One concern about prospective CLS membership is the prospect, contrary to the "Field of Dreams" script, that if the country builds the apparatus needed for CLS

[43] The marginal costs charged by CLS for using CLS settlement are not material for most institutions. In their Interim Financial Report for the six months ending June 30, 2013, CLS reported revenues of £86.8 million. With more than 1.25 million matched trades per day, revenue to CLS Bank is less than $1.00 per trade.

[44] The CLS survey found that Reporting Dealers route 80% of their eligible activity through CLS, compared to only 28% for non-financial customers. Reliance on gross non-PVP was highest among non-financial customers (19.0% of their activity) versus 7.3% and 12.1% for reporting dealers and other financial institutions, respectively.

[45] In the CLS Survey, CLS members rely on gross non-PVP for settlement for a far higher percentage of non-CLS eligible currency pairs, such as USD/CNY (60%), USD/THB (64%) and EUR/CNY (43%) to name only a few.

[46] In "Report on Payment Systems,"(2013, pp. 44-6) the Hungarian central bank presented estimates of the FX settlement risk exposure in the Hungarian banking sector that could be mitigated through CLS eligibility.

membership, local institutions may not be willing to pay the upfront costs needed for membership and the right to utilize a PVP system. The BIS has been sensitive to this issue and concerned about the risk of "backsliding" whereby individual institutions or industry groups feel that they have already done enough and that further efforts to mitigate FX settlement risk are not needed. The BIS (2008) specifically asked the 109 banks in their sample if external support was needed to realize further improvements in the management of FX settlement risk. Roughly one-half of the respondents, representing about 70% of the sample on a turnover-weighted basis, replied that some type of support – action from central banks, industry groups, or supervisory or regulatory bodies – would be needed to make further improvements.

In February 2013, the Basel Committee on Banking Supervision (BCBS) of the BIS published the expanded and enhanced supervisory guidance for managing risks associated with the settlement of foreign exchange transactions.[47] The BCBS noted that since the publication of the original document in 2000, the FX market had made significant strides in reducing FX settlement risks. However, because of factors including rapid growth in FX trading activities, banks still needed to mitigate substantial FX settlement-related risks. The guidance includes an explicit recommendation that a bank should "…reduce its principal risk as much as practicable by settling FX transactions through the use of financial market infrastructures that provide PVP arrangements. Where PVP settlement is not practicable, the bank should properly identify, measure, control and reduce the size and duration of its remaining principal risk." The BCBS guidance did not commit to a specific target date for jurisdictional implementation, but recent glimmers of

[47] This replaced the original document of the same name that had been published by BCBS in 2000.

renewed regulatory focus and interest indicate the guidance may finally be having some impact. A recent Bloomberg news article reports that the Japanese Financial Services Agency will survey banks asking whether they use PVP settlement systems and to explain if they do not.[48]

With only three surveys on settlement methods since 1996, it is clear that better information on settlement practices is needed to understand the size and incidence of exposure to settlement risk. One concrete step in that direction would be to expand the next BIS Triennial Survey to collect responses from reporting dealers on settlement methods. The responses would provide a more comprehensive view of the market's exposure to settlement risk, including a better profile of settlement risk exposure across instruments, currency pairs and counterparties. While various national regulatory agencies have issued their own guidance and advisory statements that reinforce the BCBS (2013) report, the simple addition of a survey question on settlement methods would alert reporting dealers that their choices are being monitored. Monitoring activity is often a precursor to regulating activity, and may in and of itself incentivize market participants to mitigate settlement risk given there is no disincentive. As noted earlier, there is no direct risk capital charge for exposure to settlement risk, nor is there any direct capital relief offered for mitigating settlement risk.[49] Overall, regulators should consider the appropriate methods and tools by which market participants could be positively

[48] See Taniguchi and Allan (2016).

[49] While there is no specific regulatory capital requirement for settlement risk, recent guidance from regulators specifies the need for risk capital for foreign exchange transactions. See, for example, Federal Reserve Board (2013): "Capital for foreign exchange transactions: When analyzing capital needs, a bank should consider all foreign exchange settlement-related risks, including principal risk and replacement cost risk. A bank should ensure that sufficient capital is held against these potential exposures, as appropriate."

incentivized to actively mitigate their exposures to settlement risk by adopting safer PVP settlement methods where available and practicable.[50]

While the share of FX turnover settled without benefit of risk mitigation has declined, the absolute value of turnover exposed to settlement risk remains sizable. Continuing attention by central banks and financial market regulators to FX settlement risk remains important to ensure that the foreign exchange market operates with adequate safeguards in place.

[50] The Federal Reserve Board (2013) guidance builds on the BIS (2013) guidance on settlement risk in FX transactions that suggests that capital needs for all risks associated with FX transactions should be considered when determining the adequacy of banks' regulatory capital and these capital needs should complement existing capital frameworks. This implies that banks should incorporate the nature, size, complexity and risk profile of their FX transactions when assessing capital held against these risks, which are similar to principles enumerated in the processes of assessing internal capital adequacy (e.g., ICAAP) for banks. The BIS guidance also suggests that banks should incentivize settlement risk mitigation internally, including the example of lowering their internal risk charge for PvP settlement relative to traditional settlement on a gross basis through correspondent banking.

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Box 1: In/Out Swaps

The CLS settlement process utilizes a multilateral netting process that leaves members with obligations to "pay in" certain CLS eligible currencies while awaiting receipt of other CLS eligible currencies. The amounts to be paid in represent obligations that require liquidity, or force the member to borrow funds in the open market, either of which entail a cost. These obligations can be large, especially at the time of day (early morning in Europe) when CLS completes settlement. To address this liquidity issue, CLS operates a liquidity management program that allows members to reduce their CLS "pay ins" by engaging in same-day FX swaps with other members that have offsetting positions.

The majority of CLS's members have opted to participate in a liquidity management program that CLS offers, the In/Out Swap Program. Participation in In/Out Swaps is entirely at the discretion of each CLS member, and is not a requirement for participating in CLS's PVP settlement service.

Suppose, to take an example, that Member 1 has an obligation to pay in USD 2600 and receive GBP 2000, while Member 2 has a similar but opposite obligation. Namely, Member 2 has an obligation to pay in GBP 1000 and receive USD 1300. If both Members 1 and 2 have sufficient credit limits with one another, they could agree to an "In/Out Swap" whereby

- Member 1 buys 1,300 USD, selling 1,000 GBP with Member 2 (the In leg)
- Member 1 buys 1,000 GBP, selling 1,300 USD with Member 2 (the Out leg)

Note that the In and Out legs combined cancel out with no impact on either members' overall FX positions. However, the "In" leg, settled within CLS, provides a benefit by reducing both members' liquidity and funding needs. The offset is that the "Out" leg settles outside CLS and hence reintroduces settlement risk when settled later in the day.

How does the program work?[51]

Every morning before settlement, CLS analyzes participating members' currency positions to identify bilateral positions that could be traded down through an In/Out Swap trade in order to reduce participating members' funding obligations. The payment instruction relating to the first leg (the "In" leg) of an In/Out Swap transaction is submitted to the CLS settlement service by the two relevant members and will be settled PVP along with all the other transactions settled in CLS. The second leg (the "Out" leg) of the swap transaction is settled later that same day, outside CLS. Consequently, settlement risk exists with respect to this "Out" leg.

Participating members define, and retain full control of, credit limits related to In/Out Swap activity. These limits are set on a case-by-case basis for each individual other participating member, and can be adjusted intraday by each participating member. Setting an individual limit to zero eliminates the possibility of CLS generating an In/Out Swap trade with that specific counterparty. Additionally, participating members determine a maximum aggregate amount of In/Out Swaps that they are willing to enter into regardless of the counterparties involved. This overall limit can also be adjusted on any given day by each participating member, and can be set to zero to avoid all In/Out Swaps on a specific day or days.

From an overall CLS perspective, the size of In/Out Swaps is very modest relative to the total flow of activity. In recent years, CLS has settled close to $5 trillion daily in currency transactions. Multilateral netting typically results in 96 percent netting efficiency, implying total "pay ins" in aggregate of $200 billion equivalent across all CLS currencies. However, even this much smaller amount can be a large obligation, especially when it occurs in a concentrated period when market liquidity is not deep. In/Out Swaps help to reduce these aggregate "pay ins." In recent years, the daily volume of In/Out Swaps has totaled roughly $145 billion equivalent, implying aggregate "pay ins" of roughly $55 billion equivalent, leaving the remaining $145 billion equivalent to settle

[51] This section provides a stylized description of the In/Out Swap Program, for more detail, please see CLS's PFMI Disclosure Framework, available here: https://www.cls-group.com/About/CG/Pages/CorePrinciples.aspx. Annex D contains a numerical example.

bilaterally and subject to settlement risk.[52] Thus, CLS members can reduce their funding costs for FX settlement via CLS, but only by accepting the risks of bilateral settlement on the Out legs of their In/Out Swaps.

[52] Note that given these figures, members still require $200 billion daily to settle their FX trades. However, utilizing In/Out Swaps allows members to spread their funding needs across the trading day – with these figures $55 billion in the early morning in Europe, and then $145 billion at other times of the day. This underscores the value of liquidity management and how closely liquidity can be managed throughout the day.

Figure 1a. FX Settlement Methods over Time, percentage share

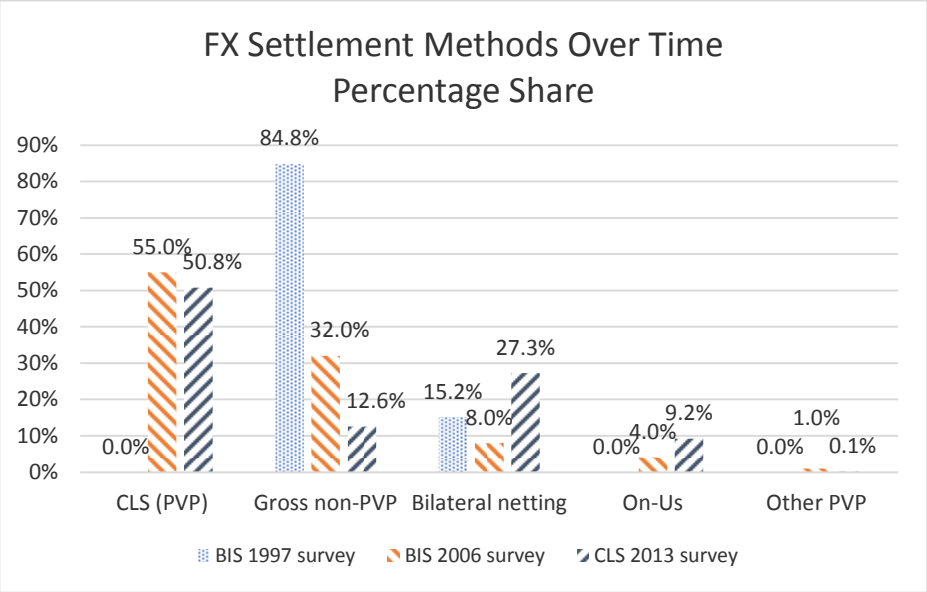
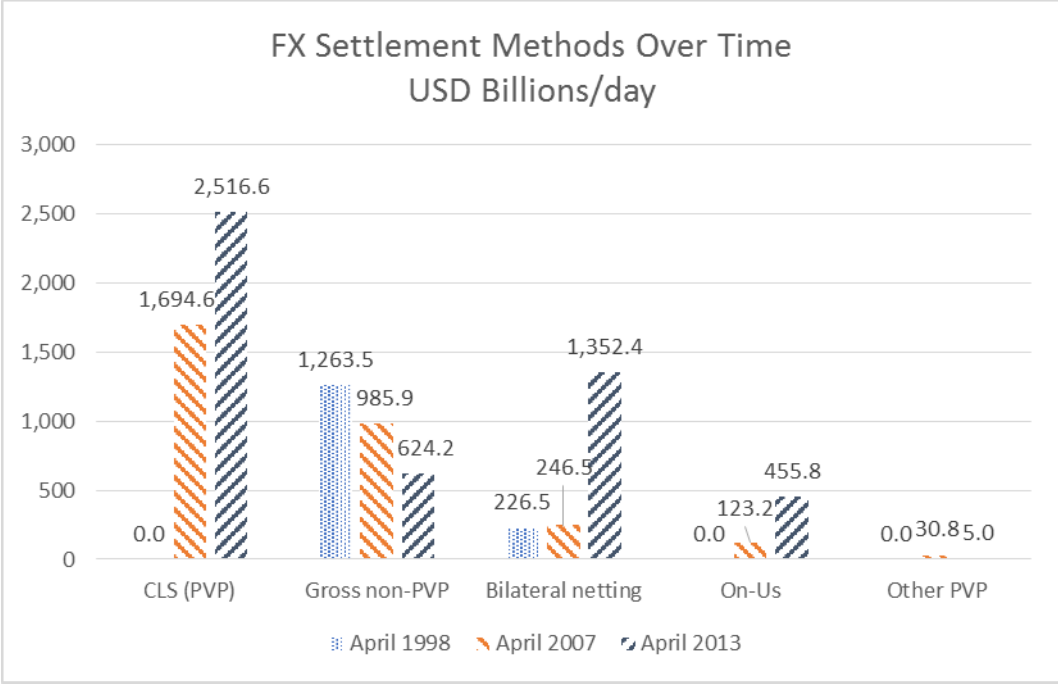


Figure 1b. FX Settlement Methods over Time, USD Billions/day



Note: Estimates in Figure 1b are based on percentage composition of settlement methods in 1997, 2006 and 2013 (fig. 1a) applied to BIS estimates of FX trading volume in 1998, 2007, and 2013 respectively for CLS eligible products only.

Figure 2

CLS-eligible currencies as of September 2014 and turnover as of April 2013

	Currency	Turnover(%)[1]	Rank in BIS Triennial Central Bank Survey 2013
1	US dollar	87.0	1
2	Euro	33.4	2
3	Japanese yen	23.0	3
4	Pound sterling	11.8	4
5	Australian dollar	8.6	5
6	Swiss franc	5.2	6
7	Canadian dollar	4.6	7
8	Mexican peso	2.5	8
9	New Zealand dollar	2.0	10
10	Swedish krona	1.8	11
11	Hong Kong dollar	1.4	13
12	Norwegian krone	1.4	14
13	Singapore dollar	1.4	15
14	Korean won	1.2	17
15	South African rand	1.1	18
16	Danish krone	0.8	21
17	Israeli new shekel	0.2	29
	Total	187.4	

[1] Percentage share of average daily turnover in April 2013.

Because every foreign exchange trade involves two currencies, the total turnover for all currencies equals 200%. These data imply that the 17 CLS-eligible currencies account for 187.4/2 = 93.7% of all global FX turnover.

Source: BIS Triennial Central Bank Survey (2013).

Figure 3

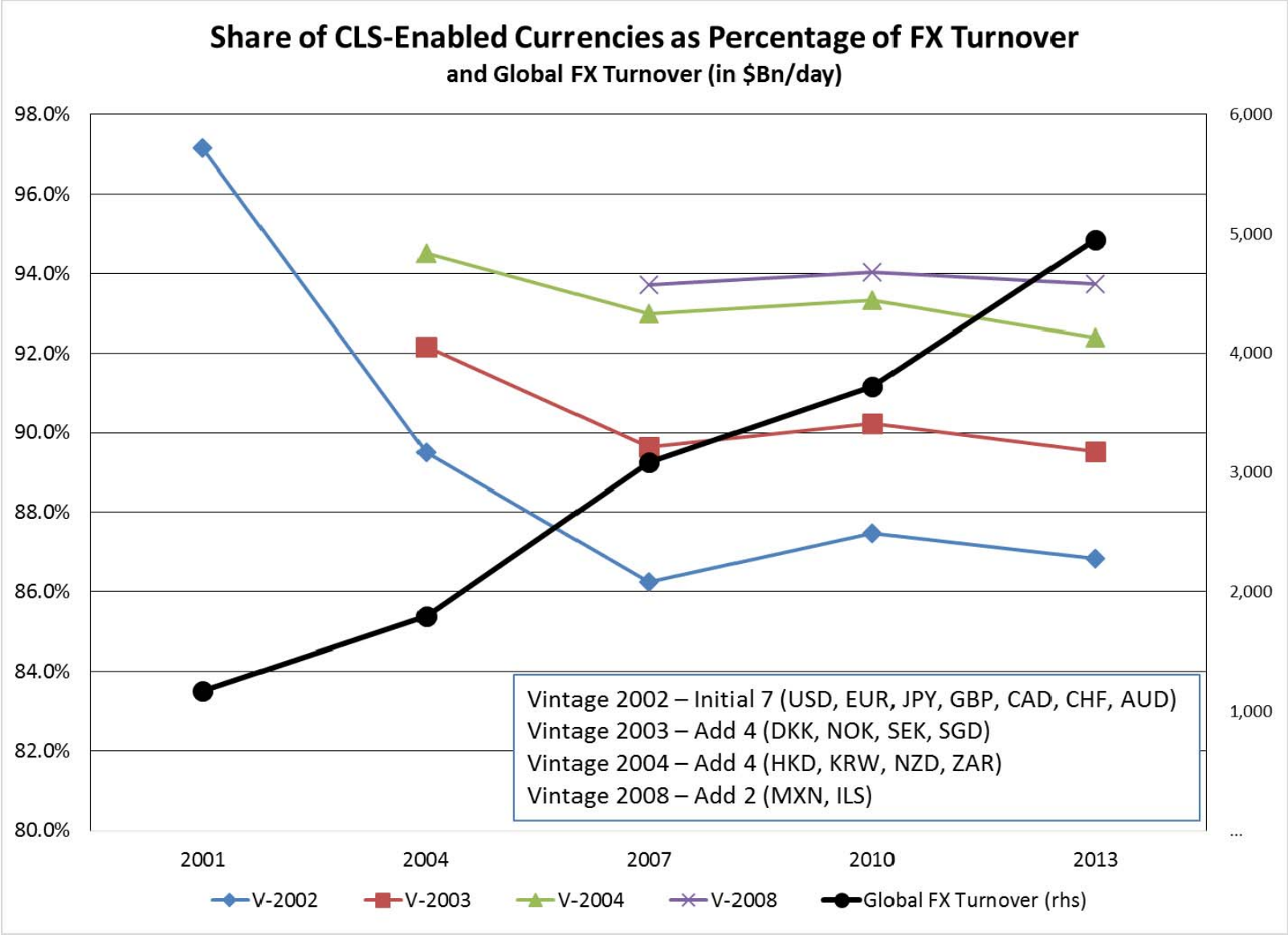
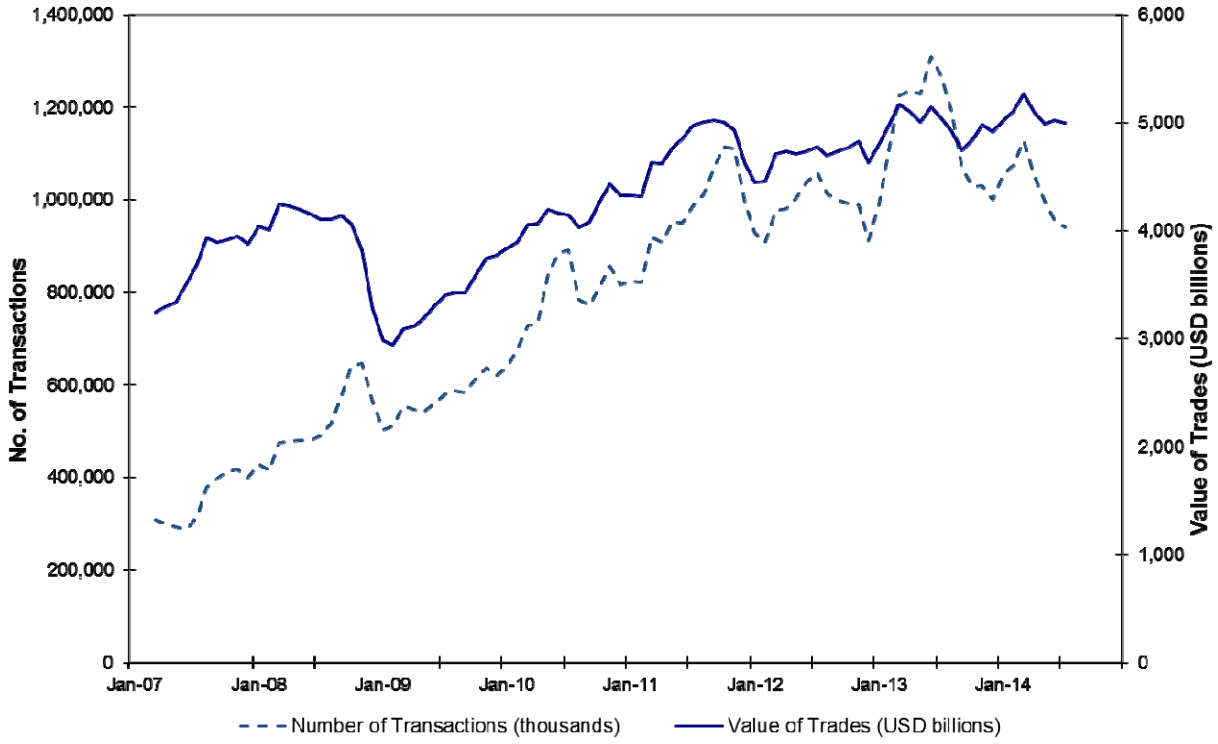

Share of CLS-Enabled Currencies as Percentage of FX Turnover
and Global FX Turnover (in $Bn/day)
98.0%
96.0%
94.0%
92.0%
90.0%
88.0%
86.0%
84.0%
82.0%
80.0%
6,000
5,000
4,000
3,000
2,000
1,000
...
2001
2004
2007
2010
2013
Vintage 2002 – Initial 7 (USD, EUR, JPY, GBP, CAD, CHF, AUD)
Vintage 2003 – Add 4 (DKK, NOK, SEK, SGD)
Vintage 2004 – Add 4 (HKD, KRW, NZD, ZAR)
Vintage 2008 – Add 2 (MXN, ILS)
V-2002
V-2003
V-2004
V-2008
Global FX Turnover (rhs)

Figure 4

CLS volume of transactions and value of trades

Three-month moving average of daily data



Note: Data reflect matched trades that were entered into on date *t* rather than settled trades that were entered into at some earlier time for settlement on date *t*.

Sources: CLS Bank; authors' calculations.

Figure 5a: April 2013 Overall Daily Values by Settlement Method ($ billions)

	Total FX Market	CLS Eligible Currencies	Non-CLS Eligible Currencies
BIS Survey Values	5,345	4,654	691
BIS Survey Values for CLS Eligible Products	4,954	4,313	640
CLS Survey Values for CLS Members	4,175	3,886	288
CLS	*2,121*	*2,121*	*-*
Other PVP	*4*	*0*	*3*
On-Us	*386*	*351*	*35*
Bilateral Netting	*1,141*	*1,002*	*139*
Gross Non-PVP	*523*	*413*	*110*

Figure 5b: April 2013 Overall Percentages by Settlement Method

	Total FX Market	CLS Eligible Currencies	Non-CLS Eligible Currencies
CLS	50.8%	54.6%	0.0%
Other PVP	0.1%	0.0%	1.2%
On-Us	9.2%	9.0%	12.2%
Bilateral Netting	27.3%	25.8%	48.3%
Gross Non-PVP	12.6%	10.6%	38.3%
Total	100.0%	100.0%	100.0%

Note: CLS-eligible products include spot, outright forward, and FX swap transactions. The notional value of FX options and currency swaps are included in the BIS survey values. Exercised FX options are excluded from BIS survey data but those that are settled through CLS are included as spot trades. CLS eligible currencies are the 17 currencies listed in Figure 2 as of 2014.