

Foreign Exchange Markets: Structure and Systemic Risks

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Foreign exchange trading involves such large cross-border settlements that a failure by one party to deliver the currency needed for a single settlement could disrupt the global financial system. Fortunately, there are ways to reduce settlement risk.

THE FOREIGN exchange market is, by most accounts, the oldest, largest, and most extensive financial market in the world. In its most recent triennial survey of foreign exchange markets, the Bank for International Settlements (BIS) estimated that average daily turnover in the global foreign exchange market was \$1,190 billion in April 1995. In comparison, average daily turnover during the same period in the next largest financial market—US government securities—was \$175 billion (excluding repurchase and reverse repurchase agreements); in the world's ten largest stock markets together, it was a mere \$42 billion.

Despite its vast liquidity and geographic breadth—or perhaps, in part, because of them—the foreign exchange market has the capacity to bring modern global financial markets to their knees. Recognizing that the

large and numerous cross-border settlements that accompany foreign exchange trading pose a systemic risk, the public and private sectors have proposed various mechanisms for managing this risk.

The state of the market

Although participants in the foreign exchange market are increasingly scattered around the globe, most transactions still take place in London, New York, and Tokyo. London dominates the foreign exchange markets, with 30 percent of all transactions; New York's share is 16 percent. Tokyo's share, now 10 percent, has been whittled away by the markets of Singapore and Hong Kong, which are fast gaining prominence. Singapore has become the world's fourth largest foreign exchange market, and Hong Kong has overtaken Switzerland to become the fifth largest. Even though 56 percent of the world's foreign exchange transactions are executed in the three largest financial centers, between one-half and three-fourths of daily turnover is cross-border during the centers' business hours, suggesting that one side of many transactions occurs outside of their business hours.

Market concentration. Nearly two-thirds of daily foreign exchange transactions take place between bank dealers. About 16 percent of transactions involve nonfinancial customers, an increasingly diverse group. Originally, this group consisted primarily of customers executing transactions related to trade; it now includes international investors, specula-

tors, and other new players. The remaining 20 percent of transactions involve financial institutions other than bank dealers, mostly securities firms active in the international debt and equity markets that have entered the foreign exchange market as intermediaries, providing one-stop shopping for their customers.

Despite the growing diversity of customers, market concentration has increased since 1992, as the proportion of trading carried out by the top banks continues to rise. This trend is most evident in the smaller markets, which are being abandoned by foreign banks seeking to consolidate their business in the major centers, but it is also being seen in the major centers. Between 1992 and 1995, the market share of the top ten dealers in Tokyo rose from 44 percent to 51 percent, in New York from 41 percent to 47 percent, and in London from 43 percent to 44 percent. The top 20 banks accounted for 70 percent of daily foreign exchange transactions in New York in 1995, up from 60 percent in 1992, and 68 percent in London, up from 63 percent in 1992. The picture of the foreign exchange market that emerges from the 1995 survey resembles the flight map of a growing airline, in which the hubs are getting bigger and the spokes more numerous—and market participants are increasingly interconnected.

Liquidity. The foreign exchange market is highly liquid—transactions tend to be large and are executed frequently. A typical dealing institution writes between 3,000 and 4,000 trading tickets for foreign

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exchange transactions during an average 24-hour day, and about 50 percent more than that on a busy day. Quoted prices can change 20 times a minute for major currencies, with the dollar-deutsche mark rate changing up to 18,000 times during a single day. During periods of extreme stress, a single dealer may execute a trade every two to four minutes. Single transactions worth between \$200 million and \$500 million are not uncommon in the foreign exchange market and, at most times, do not affect prices.

While often overshadowed by the spot market, there is a growing and vibrant derivatives market based on foreign exchange. Over-the-counter (OTC) derivative contracts involving foreign exchange accounted for 37 percent of the estimated \$47.5 trillion in outstanding notional principal of derivatives contracts at the end of March 1995, as reported by the first BIS survey of derivatives. Since notional principal provides information only about the outstanding face value of the contracts being held and not about their economic value, the BIS estimates their gross market value as well. Foreign exchange contracts account for 64 percent of the gross market value of \$2.2 trillion, which itself represents roughly 5 percent of reported notional principal.

Of total OTC derivative contracts, 6 percent were foreign exchange options contracts. While this is still a relatively small percentage, there is keen interest in foreign exchange options products. The hedging strategies of many "exotic" and "plain vanilla" options require the continuous buying and selling of the underlying currencies to maintain risk-free hedges. Thus, they are often written on the most liquid foreign currencies, increasing the volumes traded in the spot market.

Settlement risks

Transactions in the foreign exchange market take place at all hours of the day and night and, more often than not, involve institutions in different national jurisdictions. It is this last feature—the cross-border, cross-time-zone nature of the transactions—that poses the greatest challenge for the efficient settlement of the nearly \$2.4 trillion two-way payments or the estimated 250,000 to 300,000 exchanges of currency every day. Large settlements pose at least two types of risk.

Herstatt risk. The first has been called Herstatt risk, after Bankhaus Herstatt, which failed to deliver US dollars to counterparties after it was ordered into liquidation by the German authorities in 1974.

Banks are exposed to large amounts of cross-border settlement risk because irrevocable settlement of the separate legs of a foreign exchange transaction may be made at different times. For example, delivery of yen to a New York bank's Japanese correspondent bank in Tokyo occurs during Tokyo business hours, while the corresponding delivery of dollars by a New York bank to a Japanese counterparty's US correspondent bank in New York occurs during New York business hours. Since the two national payment systems are never open at the same time, there is the risk that after the first counterparty has delivered one side of the transaction, the other counterparty may go bankrupt and fail to deliver the offsetting currency.

More than 20 years after the collapse of Herstatt, there is still no widely accepted method of quantifying settlement risk. The Foreign Exchange Committee, a private sector group sponsored by the Federal Reserve Bank of New York, was the first to survey foreign exchange dealers and provide a methodology for examining settlement risk, as well as a set of recommended best practices, in its report, "Reducing Foreign Exchange Settlement Risk." More recently, in March 1996, the Committee on Payment and Settlement Systems of the Group of Ten (the ten industrial countries with the largest economies) released the Allsopp Report, which, building on the earlier methodology, analyzes existing arrangements and sets out a strategy for reducing settlement risk.

The Allsopp Report found that foreign exchange settlement is not just an intraday phenomenon and that payment lags can initially last at least one to two business days; another one to two business days may then elapse before a bank is assured that it has received the requisite payments. The amount at risk at a bank could exceed three days' worth of trades, so that the exposure to even a single counterparty could exceed a bank's capital. While the risk is only beginning to be recognized and quantified, recent foreign exchange payment defaults, including those of the Bank of Credit and Commerce International (BCCI) and Barings Plc, demonstrate that the risk cannot be ignored.

The liquidity risk. The second risk has to do with the possibility a counterparty will default because of an operational or systems problem that leaves it with insufficient liquidity to make payment. In most cases, operational failures can be resolved within 24 to 48 hours, and overnight funding can be obtained to cover a failed

delivery of currency. It is not uncommon, however, to have more than \$2 billion outstanding between banks overnight. A large operational failure could surpass the ability of even some of the best-capitalized institutions to access money markets, especially when notice of the failure is received during off-hours in the institution's domestic market or when the undelivered currency is not one in which the exposed institution customarily borrows. This is an especially important issue in emerging markets, where the physical infrastructure for payment and settlement may not be adequate to accommodate transactions that are increasing in size and number.

Impact on financial markets. A counterparty that defaults because of either an insolvency or a liquidity problem could trigger a systemic problem. The most commonly articulated scenario is one in which the failure of one large bank causes a second bank to fail, in turn causing a third bank to fail, and so on—a "domino effect." Another situation might arise in which a small number of institutions independently fail to deliver, causing other institutions to fail or to encounter liquidity problems.

These scenarios are more likely to occur when institutions are highly interdependent. Using actual gross settlement numbers from a day in 1994 when the yen appreciated against the dollar by 5 percent, Multinet, a multilateral foreign exchange netting facility under development, showed that the failure of the participant with the largest position within its system could have caused a number of other participants to fail.

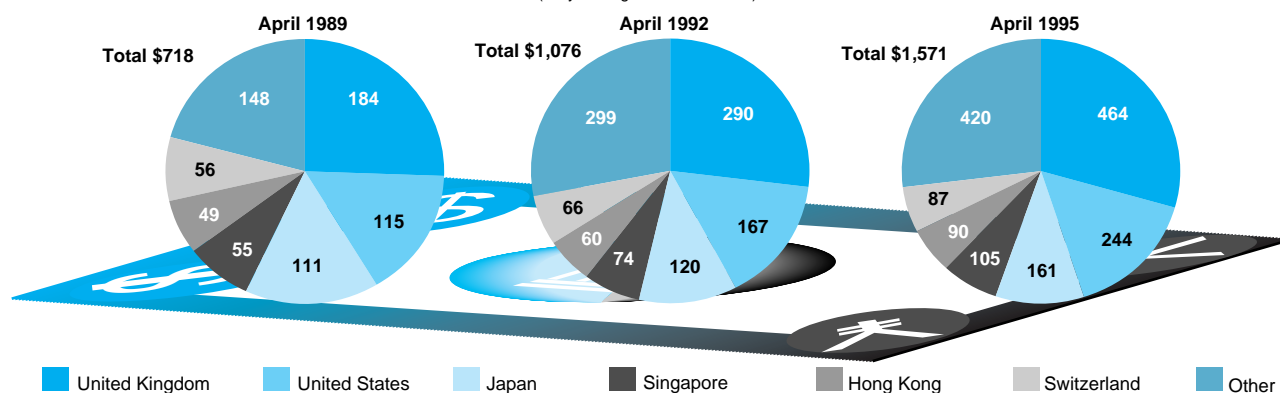
Solutions

Proposals for managing settlement risk are based on two approaches: (1) eliminating the delay between the two legs of a transaction and (2) reducing the number and size of payments requiring settlement.

Simultaneity. The first approach is based on the belief that settlement risk could be eliminated, or at least substantially reduced, if payments in the corresponding currencies were delivered and guaranteed simultaneously, thereby averting the possibility of default between the time one payment is made and the other is received. This approach requires important changes in arrangements for international payments. First, gaps in the operating hours of the major wholesale domestic payment systems would need to be closed. Second, some type of linked payment systems or verification of payments is required to guarantee intraday "finality of payment"—that is, the

The major financial centers account for a growing share of foreign exchange transactions

(daily average in billion dollars)



Source: Bank for International Settlements, 1996, *Central Bank Survey of Foreign Exchange and Derivatives Market Activity, 1995* (Basle).

Note: Data are adjusted for local double counting except for 1992. Category "Other" is composed of 20 countries: Australia, Austria, Bahrain, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, and Sweden.

irrevocability of the payments and the ability of the counterparties to use their payments as soon as they are received.

The elimination of gaps in operating hours is fairly straightforward. While there is still much work to be done before every country has a payment system capable of processing and settling large-value transactions in real time (a "real-time gross settlement," or RTGS, system), improvement for the major currencies is expected in 1997 when the United States' RTGS system, Fedwire, will open at 12:30 a.m. local time. This will create an overlap between payment systems in the United States and Japan and increase the overlap between the US and German payment systems. More improvements should occur in 1999, when the Trans-European Automated Real-Time Gross Settlement Express Transfer (TARGET) system in Europe will link the existing and new RTGS systems of member countries in the European Union.

The second change involves larger public policy issues and is more problematic. It is typically assumed that only a central bank can guarantee finality of payment in its own currency; the achievement of simultaneous finality would thus require the coordination of foreign exchange-related payments among central banks. Although it is technically feasible to create cross-border links within the RTGS systems run by the central banks so that, for example, verification that a yen payment has been received in Tokyo is made before the corresponding dollar payment is released in New York, there are difficult practical and political issues that need to be resolved. For example, one potential side effect of linking national RTGS systems is that a disruption at one site would affect other sites. This would be an especially difficult situation if

the ability to access off-hour money markets were inhibited or the money markets were not deep enough to provide adequate liquidity for the duration of the disruption. Multiple central banks running such linked RTGS systems may be required to supply central bank credit and liquidity facilities until the site where the dislocation occurred is able to adapt. Questions regarding which banks would supply the credit, to whom, and for how long, and how excess funds would be "mopped up" after the event would all have to be addressed. There would be a need for increased international coordination of macroprudential, supervisory, and lender-of-last-resort policies.

The central banks of the Group of Ten countries have thus far been reluctant to link their domestic payment systems and instead have pressed the private sector for solutions to settlement problems. One way to reduce settlement risk would be by altering or augmenting bank risk-management techniques. For example, credit risk control processes could be adapted to identify and control the foreign exchange settlement exposures of counterparties. Improved back office payment processing, correspondent banking arrangements, and bilateral netting capabilities may also reduce settlement risks. Altering the timing of payments and identifying final or failed receipts as soon as possible could also help banks shorten the duration of settlement risks. These solutions require no public sector involvement and could substantially reduce settlement exposures.

A more aggressive private sector approach being examined by 20 internationally active banks known as the Group of Twenty is to set up a "global clearing bank"—a private sector institution that would act as the link between national payment sys-

tems, verifying payments so that simultaneity could be achieved. While a global clearing bank appears to be, in principle, the most direct method for managing Herstatt risk, there are remaining challenges.

First, the clearing bank's ability to guarantee finality of payment in each country is uncertain. Finality would require that the legal status of settlements be similar in all participating countries, which, in turn, requires that the participants address such issues as the clearing bank's location, corporate form, and relation to national settlement facilities. Second, the operation of a global clearing bank might have an impact on liquidity in short-term money markets and, thus, on management of liquidity by the central banks, and, perhaps, on monetary policy objectives. If a global clearing bank required its members to pay large sums of money into their accounts to cover large settlements, it might drain liquidity from domestic money markets. The loss of liquidity might offset the ability of a central bank to control short-term interest rates and provision of intraday liquidity to domestic money markets. Furthermore, until the RTGS systems involved in the settlement of the major currencies are operating 24 hours a day, the clearing bank's procedures may require funds to be available to support settlement during the short periods of overlapping hours between the various national RTGS systems. It is unclear whether sufficient liquidity would develop during these periods to support the settlement of cross-border transactions. Finally, a single system purporting to settle the majority of global foreign exchange payments would be vulnerable to technological failures; several redundant systems would probably be required to minimize this risk.

Reducing settlements. In theory, a

well-constructed global clearing bank could eliminate foreign currency settlement risk. However, the problems of harmonizing national laws and developing procedures for adequate liquidity provision, although not insurmountable, are difficult and time consuming. Because the development of such a bank is still in its early stages, private sector bilateral and multilateral netting arrangements are receiving increased attention. These arrangements are based on the second approach to managing settlement risk—that of dramatically lowering the size and number of payments.

Formal *bilateral netting systems*, available since 1990, periodically aggregate the amounts owed between counterparties and calculate one payment per currency for each pair of counterparties—there are no automatic payment facilities and the systems do not assume foreign exchange exposures. (Informal bilateral arrangements may be privately negotiated between counterparties at any time.) Bilateral netting can reduce amounts at risk by an estimated 50 percent, on average.

Multilateral netting systems net the amounts owed among a group of counterparties through a clearinghouse arrangement, resulting in one payment each day in a given currency to or from the clearinghouse by each counterparty. While Multinet is still under development, another system, the Exchange Clearing House (ECHO), became available in August 1995. Multilateral netting can reduce settlement risk by 73 percent for a group of about 20 participants, and by as much as 95 percent for a bigger group.

One of the primary difficulties faced by multilateral netting systems has been making netted contracts legally enforceable. Compared with other types of clearinghouses, a foreign exchange netting system cannot operate effectively without resolving the legal status of contracts in many different jurisdictions. The clearinghouse itself needs to be able to guarantee that the contracts it enters into are legally binding, and institutions from different legal jurisdictions need to guarantee their ability to net and enter into contracts with the clearinghouse. In addition, in situations of insolvency, the counterparties and clearinghouse need to assure themselves of access to collateral that may be held outside any of their legal jurisdictions.

To attract members and satisfy regulators, netting systems need to ensure that the clearinghouse does not take on settlement exposures that cannot be covered in the unlikely event of a failed payment or

the bankruptcy of a user. As a general rule, netting systems are required to meet the Lamfalussy minimum standards established by the Group of Ten's central banks, which require that the multilateral netting system "be capable of ensuring timely completion of daily settlements in the event of an inability to settle by the participant with the largest single net debit position." To meet this requirement, the multilateral netting system relies on a combination of real-time exposure limits, the collection of collateral or margin, and precise operating procedures for limiting the duration of settlement risks and for dealing with a defaulting member.

To avoid transferring a failure to its other members, a multilateral netting system needs to be able to acquire funding if payments are withheld and to continue payments to other members. Multilateral netting systems have broached the funding issue either by holding collateral or by assuring themselves of outside sources of liquidity—for example, lines of credit and foreign exchange swap facilities, mostly with member banks. However, it is unclear whether the systems can rely on lines of credit with member banks, because these may also be affected by a liquidity problem during a period of stress. Ultimately, then, central banks would serve as the backstop in a liquidity crisis, just as they do without private multilateral netting systems.

It is worth emphasizing that netting systems are not stand-alone methods for eliminating settlement risk. After payments are netted, banks must still use a payment system that guarantees finality of payments. Thus, once the netting has been accomplished, the system's operating procedures are critical in determining the amount of time between the settlement of the two legs of the transactions. Both netting systems have the ability to collect payments from participants a few hours before releasing their payments to the recipient participants for currencies in which it is feasible to access large-value RTGS systems simultaneously, shortening the exposure period. But, unless there is simultaneous finality of received payments, there remains some degree of Herstatt risk.

Two multilateral netting systems may not be sustainable. The degree of risk reduction is a function of the number of linked counterparties and is therefore greatest when all the largest participants join the same system. It may not be cost-effective for a single bank to become a member unless the other banks with which it does business join the same netting system.

Furthermore, a bank may wait to see what its counterparties do, delaying realization of the system's full potential for risk reduction until enough banks join one netting system to make it cost-effective for the others.

With the recent Group of Twenty initiative to develop a global clearing bank, the bilateral and multilateral netting systems face further challenges. While the two approaches to lowering Herstatt risk could be viewed as complementary, both require scarce funds from banks' foreign exchange trading businesses. Further, as competing approaches to the reduction of Herstatt risk present themselves, banks may wait until one system emerges a clear winner before attempting to reduce their own settlement exposures. But both the bilateral and the multilateral netting system and a global clearing bank are economically viable only for the transfer of large payments. Hence, competition among the groups developing methods to lower Herstatt risk may reduce the effectiveness of any one system and slow the adoption of strategies to reduce Herstatt risk.

Conclusion

The foreign exchange market has registered healthy increases in turnover and continues to be the most liquid of markets. However, the size and number of transactions, and the increased concentration of transactions in a handful of international banks place the foreign exchange market at the nexus of the global network of interbank payments. Any disruption in the settlement of foreign exchange transactions could have serious consequences for global trade and finance and for the international banking system. One of the main difficulties in settling foreign exchange payments is that it is not always possible to make final payments simultaneously. This creates a window in which one of the counterparties could fail to deliver, with possible repercussions for the international banking system. Both the private and the public sectors are aware of this difficulty and are pursuing several initiatives that will enable them to reduce and better manage foreign exchange settlement exposures. However, these initiatives are not yet comprehensive or coordinated. Their success will require vigilance and persistence on the part of central banks.

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