

# The Global Foreign Exchange Market: Growth and Transformation

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- *The foreign exchange market is in a period of remarkable transformation that is changing who is trading, why, and how.*
- *Not only are trading volumes in the foreign exchange market expanding rapidly, the primary sources of this market growth are helping to define the profound structural transformation taking place.*
- *Deal flow in the foreign exchange market is increasingly transacted electronically, using automated computerized trading routines, and by a much wider array of market participants.*
- *These changes reflect innovative developments in electronic trading technology and institutional trading arrangements that are shifting the balance of market participation between bank and non-bank accounts, large and small market participants, and domestic and global players.*
- *As a result of this ongoing structural evolution, the foreign exchange market is arguably becoming more liquid and operationally efficient.*

**T**he foreign exchange market is known to be the largest financial market in the world, as measured by daily turnover. The most recent BIS Triennial Survey (BIS 2007) estimates that the total turnover in global foreign exchange markets is US\$3.2 trillion a day—more than 6 times larger than trading in U.S. Treasury bonds and 30 times larger than trading on the New York Stock Exchange (SIFMA 2007; NYSEData.com 2007). What may be less apparent is how quickly this market has grown over the past few years and why it is growing so quickly. By most estimates, the trading volumes in the foreign exchange market are continuing to grow rapidly. The Tower Group, for example, recently estimated that daily global trading volumes would likely reach US\$5 trillion by 2010 (*Profit & Loss Magazine* 2007). Should this happen, foreign exchange trading volumes will have more than tripled in this decade (Chart 1).

As the market expands, it is undergoing a remarkable transformation that is changing who is trading foreign exchange and how they are doing it. In turn, these changes are accelerating market growth. An increasing proportion of overall foreign exchange trading volume is being transacted on electronic trading platforms, both in the interbank market as well as between banks and clients; by large global investment dealers and non-bank market participants; and by computer-driven algorithmic trading strategies. Together, these closely related and mutually reinforcing elements are defining a new paradigm for the foreign exchange market and, indeed, for global financial markets in general.

**Chart 1**  
**Global Average Daily Trading Volume in Foreign Exchange**



This article describes how these factors are changing the structure of the foreign exchange market, from a model that prevailed as recently as the mid-1990s to a new model that is still evolving. It is important to emphasize that the foreign exchange market is still in a period of transition: while the market as a whole, and particularly its most rapidly growing sectors, may be moving towards a new trading model, different market participants are nonetheless arrayed at different points along a spectrum of change. As a result, the foreign exchange market is currently a mixture of old and new elements.

We begin describing this evolving mixture by examining the factors behind the strong growth in the foreign exchange market: changing technology, the opening of access to the market to a broader range of participants, and the automation of trading functions. This is followed by a review of how these factors have impacted market liquidity and operational efficiency.

## Innovations in Electronic Dealing Technology

Through the mid-1990s, the foreign exchange market was primarily reliant on phone-based technology. A client needing to deal in foreign exchange would phone a bank with whom it had a line of credit and ask for a two-sided price, i.e., a bid and offer on the specified amount of foreign exchange to be transacted.<sup>1</sup> Banks

1. The protocol was usually to ask for a two-sided price, rather than to indicate whether the transaction would be a purchase or sale, so that the dealer would not “shade” the price against the client.

would quote prices for their clients on demand, serving as market-makers. The market-maker bank would have typically transferred, or laid-off, the risk created by the deal in the interbank market by phoning other banks with which it had established a dealing relationship and conducting an offsetting transaction. (These interbank dealing relationships were mutual obligations between banks to quote each other two-sided prices on demand for wholesale amounts of foreign exchange—typically US\$5 million or larger.) This phone-based network of direct relationships between banks was the principal component of the interbank market, the central source of liquidity in the foreign exchange market.<sup>2</sup> Frequently, banks’ participation in these interbank dealing relationships was motivated solely by price discovery. Because the wholesale price apparent to a dealer consisted only of the two-sided quotes provided on demand by other banks (and even then, only for the duration of the phone call) and because they were faced with a constantly changing foreign exchange rate, banks were forced to make frequent calls to each other throughout the business day to learn the current wholesale price. Banks would typically “pay away the spread” (the difference between bid and offer quotes) on price-discovery transactions as a necessary cost of doing business.

During the past decade, these interbank dealing arrangements began to shift to electronic protocols. Reuters Dealing and EBS (Electronic Broking Services) both introduced electronic interbank trading platforms in the early 1990s.<sup>3</sup> Although uptake of electronic broking was relatively slow at first, by the late 1990s these platforms came to dominate interbank trading flows.<sup>4</sup> By most estimates, their combined market share now accounts for about 90 per cent of interbank trading in most major currency pairs; voice broking accounts for

2. Alternatively, banks could use voice brokers (so called because they used “squawk boxes” that gave a live audio feed on available prices to their client banks) as intermediaries in deals with other banks. Voice brokers would search for dealing interest among their client banks for transactions at a given price or amount, collecting a proportional fee every time a deal was completed. They acted solely as agents, and the prices they quoted were valid only in the size and for the amount of time determined by the banks acting as principals.

3. The EBS platform was introduced in September 1993, and Reuters Dealing 2000-2 in 1992. The 2000-2 version has live streaming prices, but an earlier version using electronic messaging for trading had been in place since the 1980s. In 2007, EBS was bought by ICAP, a large interbank fixed-income broker and was renamed ICAP EBS.

4. These two interbank platforms dominate trade in different currency pairs rather than competing directly against each other. EBS, the largest, carries most of the interbank trading volume in the euro, yen, and Swiss franc; Reuters Dealing dominates trade in the pound sterling and the Canadian, Australian, and New Zealand dollars, as well as in several emerging-market currencies.

most of the rest, while direct dealing among major banks has all but disappeared.

The price-discovery process on Reuters Dealing and EBS differs from the phone-based model of direct dealing in several key aspects. First, banks participating on these platforms are not obliged to provide two-sided price quotes to other banks on demand. A bank can post a one-sided price (either a bid or an offer) and only when it chooses to. Second, the minimum deal size allowed on these portals is much smaller than the standard wholesale amounts used in the traditional direct-dealing relationships between banks. This allows any dealer with a smaller amount to transact to enter the market without the obligation of making or accepting delivery of unwanted, larger amounts. Third, and perhaps most importantly, these electronic portals provide a live price stream that aggregates all bids and offers posted on the system. This interbank price is visible at all times to all participating dealers.

The same technology that enabled electronic price delivery in the interbank market was relatively easily extended to bank-to-client (B2C) relationships as well. Single-bank portals are bank-owned trading platforms that establish an electronic communications link between the dealer and its end-user clients, supplying that dealer's price quotes and trade details electronically. Multi-bank portals are third-party platforms that connect an end-user client with price quotes from several banks simultaneously. (Examples of multi-bank portals include FX Connect and FXall; average daily trading volumes on these two platforms are shown in Chart 4, below.) The technology for both single and multi-bank portals now makes live, dealable, streaming price quotes (similar to those available on electronic interbank platforms) available to end-user accounts.

## **A Changing Mix of Market Participants**

Technological innovation dramatically reduced trading costs and has created new opportunities, as well as new challenges, for a broad range of market participants. This has occurred in several principal ways.

First, the ability to transact in relatively small amounts on fully transparent prices on these global electronic dealing platforms has led to fundamental changes in the operation of the interbank market. Since banks no longer need to engage in costly price-discovery transactions and mutual dealing relationships with other dealers, the foreign exchange market has been opened

up to much broader global participation among banks in the provision of liquidity. The electronic aggregation of a multitude of worldwide orders and transparency in pricing has also led to sharp compression in the typical interbank bid/offer spread.

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Second, heightened competition between dealers and the much greater degree of price transparency has led to interbank spread tightening being passed along to end-user accounts in the B2C market. As dealing costs for end-user clients have declined, new accounts entered the foreign exchange market, and existing market participants were able to profitably transact more. Increased trading by end-user clients was further facilitated by the cost efficiencies of using B2C dealing portals. The use of electronic foreign exchange trading by buy-side accounts has been growing steadily: it is estimated that in 2006, for the first time, more than half of all foreign exchange transactions by end-user clients were executed electronically (Greenwich Associates 2007).

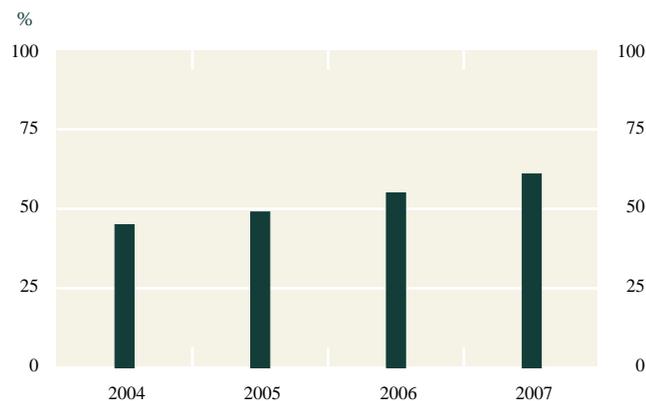
Third, many of the market-making banks that previously dominated the market have been forced to re-examine their business model as dealing spreads in both the interbank and B2C markets compress. The result has been a changing mix of large and smaller banks in the interbank market. Technology is expensive. In addition to considerable start-up costs, it requires continuous upgrades. Given the tighter bid/offer spreads in both the interbank and B2C markets, most successful dealing banks have therefore implemented a low-margin, high-volume business model that amortizes these higher technology costs through continually building trading volumes. This gives a competitive advantage to those banks with the size and large global distribution networks needed to sustain ongoing technological innovation and to provide competitive, profitable price quotes. The result has been consolidation in the foreign exchange market, with the largest banks accounting for a growing percentage of the overall global trading volume. For example, in the May 2007 *Euromoney* foreign exchange poll, five

banks accounted for over 60 per cent of client trading activity.<sup>5</sup> (See Chart 2.) In the 2006 poll, the top five had a 54 per cent market share; a decade ago, the top five accounted for less than one-third of market volume.

Fourth, as a result of deal flow in the global foreign exchange market consolidating among the largest global banks, the role of second-tier dealers has been evolving. For smaller banks, the level of technological commitment needed to remain competitive in such a low-margin environment or to operate in all currency pairs and all time zones is no longer feasible. It often makes more economic sense for them to outsource this function to large global institutions.

For some second-tier dealers, this outsourcing has taken the form of “white-labelling” (or white-boarding), whereby the smaller bank will act as an intermediary between an end-user client buying foreign exchange and another larger bank that supplies it. Essentially, the smaller bank becomes a liquidity retailer, maintaining its single-bank B2C portal for servicing client orders but using a larger bank to provide the wholesale liquidity.<sup>6</sup> The smaller bank is thus able to specialize in managing the client’s credit risk. The larger bank provides the liquidity and manages the market risk

**Chart 2**  
**Combined Market Share of the Five Largest Banks in the Foreign Exchange Market**



Source: *Euromoney Magazine* (2007)

5. The top five banks by global market share were Deutsche Bank, UBS, Citibank, RBS, and Barclays Capital.

6. White-labelling describes an *electronic* transmission mechanism between the liquidity-supplying bank and the end user. However, many banks engage in *de facto* white-labelling by manually quoting clients a price taken directly off an interbank system (such as EBS or Reuters Dealing), simply adding a spread and passing along the liquidity supplied by other banks.

generated by the client’s order. This institutional division of labour and specialization in areas of comparative advantage supports better pricing for the end-user client.

While white-labelling allows liquidity outsourcing in the B2C market, a similar institutional dealing arrangement—prime brokerage—allows outsourcing of liquidity provision in the interbank market. Many smaller dealers do not have access to a broad range of reciprocal credit lines and thus to the most competitive interbank price quotes. Prime brokerage arrangements allow such dealers to access the interbank market by using the credit relationships of a top-tier bank. The larger bank acts as an intermediary, connecting the smaller dealers with competitive interbank market pricing and managing their credit risk, but not assuming any price risk itself. (As with white-labelling, the intermediary in prime brokerage simply passes through the pricing and price risk to the client.) Prime brokered dealing typically provides the smaller bank with better pricing than it could obtain on its own; the prime broker, in turn, earns a fee for this service.

Fifth, prime brokerage has recently created new trading opportunities for market participants outside the banking sector. Although prime brokerage originated as a specialized relationship between dealers in the interbank market, in the past couple of years these dealing relationships have been extended to a large and growing class of market participants largely outside the banking sector, the professional trading community (PTC). Hedge funds, in particular, have grown enormously in the past decade, both in numbers and in the amount of capital under management, to form the core of the PTC. The PTC also includes commodity-trading advisers that manage exchange-trade futures accounts, as well as currency-overlay managers that actively manage foreign exchange exposures in investment portfolios. Significantly, the PTC also includes the proprietary trading desks at major banks and investment dealers.

The PTC has proven extraordinarily efficient at locating pricing inefficiencies and quickly trading them away. Trading strategies typically involve rapid trading in and out of positions, with profits highly dependent on cost-efficient execution, which in turn is supported by the cost and efficiency advantages of electronic dealing platforms and prime brokerage arrangements. Despite initial resistance by some banks to opening up interbank dealing platforms to non-bank participants, both EBS and Reuters report very strong PTC demand for prime brokerage dealing relationships. As a result,

non-bank trading accounts are increasingly gaining access to the interbank market through prime brokerage channels.

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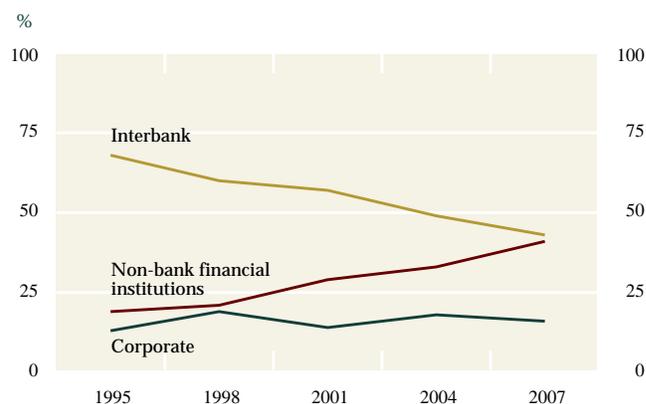
Sixth, the efficiency of electronic price delivery has also allowed a specialized subsector of the B2C market, the retail aggregator platform, to develop. These electronic dealing portals cater to the smallest accounts, including households as well as small corporations, asset managers, trading firms, and institutions. Technology has so lowered the price of dealing in foreign exchange that some firms have found a profitable niche providing electronic services for foreign exchange dealing in retail amounts, typically defined as less than US\$1 million (some retail platforms will open trading accounts for amounts as small as US\$250). Retail aggregators capture the efficiencies in electronic price delivery and pass along very competitive pricing to retail accounts. As the costs of foreign exchange trading have dropped, retail participation in the market has surged. Some surveys suggest that retail accounts globally traded as much as US\$60 billion a day in 2006; this number is projected to increase to well over US\$100 billion a day by 2009 (Aite Group 2007).

As a result of these various factors, the range of foreign exchange market participants has been broadening. This can be seen in Chart 3, which indicates that the proportion of overall trading volume accounted for by non-bank financial institutions, such as the PTC, institutional money managers, and retail aggregators, has been increasing, while the proportion accounted for by interbank trading has been declining. The proportion of activity accounted for by corporate accounts has been relatively stable.

## Increasingly automated trading functions

Through the mid-1990s, most trading functions were done manually. This implied that dealers' market-making and proprietary trading activities were, in general, not systematically implemented. Traders had wide latitude when quoting prices to clients and other

**Chart 3**  
**Spot Foreign Exchange Flow by Organizational Type**



Source: BIS and Reuters

banks, using their best judgment to manage the various risks generated by the market-making process and to assume proprietary risk positions. As a result, there was often little distinction between market making and proprietary trading, since market making involved warehousing imbalances (and thus price risks) in the client order flow, as well as trading in and out of the market in a continuous price-discovery process. Moreover, to manage the bank's position in the currency, traders were typically expected to have an opinion on the market and to express that bias when quoting prices to clients. Thus, a close relationship existed between agency trading functions (executing client orders) and principal functions (proprietary trading and the management of price risk). At many banks, one trader performed both functions.

With the technological innovations of the past decade, many trading functions once performed exclusively by traders are now increasingly performed by specialized computer programs. What distinguishes recent developments in this area is the use of application programming interface (API), the protocols that connect trading algorithms directly with the live price feeds on electronic trading platforms. With API, a trader can program the computer-based trading model to receive data from the market, process this information according to predetermined rules, and then generate buy and sell orders that are transmitted directly and immediately to the market without human intermediation.<sup>7</sup> The development of API has transformed all aspects of the trading process; specialized

7. Of course, human intermediation is required to reprogram the trading model for changing market circumstances or to override the algorithm's orders, if required.

computer programs now initiate trades, manage trade execution and order flow, and use complex algorithms to handle dealers' market-making functions.

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API and algorithmic trading have had a marked impact on trading volume. The immediacy of computerized trading programs can produce a staggering number of trades, particularly for active-trading PTC accounts. Hedge funds already control a very large and rapidly growing pool of capital (estimated to be almost US\$2.5 trillion in 2007 (Hedge Fund Intelligence 2007), and, like other PTC accounts, typically apply leverage to amplify their trading capacity. This extremely large pool of capital can then be rapidly traded through the market.

The combination of PTC penetration into the interbank market and computer-based trading has led to a surge in the proportion of algorithmically sourced foreign exchange volume. It is estimated that, since its introduction, algorithmic trading has achieved an approximate market share of 30 per cent on interbank platforms. Some analysts predict that algorithmic trading will eventually account for up to 70 per cent or more of foreign exchange volume, similar to what has occurred in equity markets (West 2007). The widespread availability of retail electronic trading portals and inexpensive computer power has enabled even smaller speculative accounts (such as day traders) to participate in the foreign exchange market.

## **A New, Hybrid Market**

These three interrelated factors—electronic dealing platforms, a changing mix of market participants, and algorithmic trading—are rapidly changing the cost structure of the foreign exchange market. Reflecting this, foreign exchange is in a period of transition as global competition forces market participants to focus on areas where they have a clear comparative advantage. This is leading to a more distinct separation of principal and agency trading functions in the new paradigm foreign exchange market.

On one hand, a growing proportion of global market liquidity is supplied by large global dealers acting as *principals*, accepting and managing market risk for profit. Their client lists generate a significant order flow (especially through their PTC accounts), but these dealers will nonetheless warehouse temporary imbalances in the market and use client order flow to manage proprietary trading positions. In many respects, these top-tier dealers duplicate the market-making functions of local banks under the previous market structure, with one significant difference: their market-making activity is increasingly algorithmic in order to cope with the high speed and volume of modern foreign exchange markets. These market-making algorithms will often analyze client order flow and use the information gathered to guide the dealer's risk positioning, defining a form of automated, flow-based proprietary trading.

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On the other hand, the new paradigm market structure also contains significant *agency* elements, since many dealers also execute the orders of other market participants, but without assuming market risk themselves. There are two sources of agency operations that between them appear to account for a growing proportion of foreign exchange trading volume. First, an increasing proportion of the overall deal flow passing through the larger banks represents non-bank PTC accounts using prime brokered market access. Second, smaller (often domestic) banks that lack a comparative advantage in liquidity provision are increasingly outsourcing this function to larger banks via white-labelling or prime brokerage arrangements. Both prime brokerage and white-labelling are flow-based, low-margin commodity-like business models that succeed by keeping operating costs down, transactions volumes high, and exposure to market risk low.

As these agency functions grow in relative importance, the new paradigm foreign exchange market is adopting some characteristics of an "exchange" model. This

model already exists for several other asset classes— notably equities and commodities—where standardized financial products are traded on formal public exchanges by exchange members (e.g., the New York Stock Exchange). An exchange-based market model is no longer defined by the existence of a trading floor (many stock and commodity exchanges are moving towards electronic trading platforms). Rather, an exchange model has certain defining characteristics, including:

1. End-user accounts trade with each other through dealers (exchange members) who act only as their agents. Dealers do not act as principals by accepting or warehousing price risk, but provide only market access, credit-risk management, and other fee-based ancillary trading services.
2. This client-to-client (C2C) market is totally anonymous because end-user accounts trade through agents; there is no need for end-user accounts to know the identity of their ultimate counterparty as long as their agents (credit-risk managers) provide surety of settlement.<sup>8</sup>
3. With total trading anonymity and surety of settlement, all end users face the same price on the exchange without discrimination.

As the foreign exchange market evolves, some of the exchange-like characteristics are being integrated into its structure in several ways.

First, the relative importance of agency activities at many dealers is increasing as their business model expands to include fee-based market access, order execution and settlement, and credit-risk management for active trading accounts and other clients.

Second, although large dealers provide market-making functions, these market-making principal activities are increasingly provided by PTC accounts, both bank and non-bank. Dealers' proprietary trading desks have been likened to in-house hedge funds and clients of the dealers' agency-based order execution services. Prime brokerage allows non-bank PTC accounts to place orders in the interbank market like any other participant. In some aspects, the trading activities of the PTC—both bank and non-bank—replicate the functions of locals on the floors of commodity exchanges, or of specialists on some equity exchanges:

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8. Exchange members manage the credit risk of their clients.

absorbing temporary imbalances in the order flow and speculating on future price movements. In this manner, the ultimate source of liquidity in the market is more often a PTC account than a bank.

Third, prime brokerage arrangements provide anonymous trading for end-user PTC accounts, guarantee foreign exchange delivery to their clients, and give PTC accounts access to the same pricing as large global dealers. Surety of settlement is further reinforced because prime broker banks generally clear transactions among themselves through the CLS Bank.<sup>9</sup>

Fourth, not only have PTC accounts been increasing their access to the main interbank trading platforms, more recently, several electronic portals that cater to prime brokered PTC order flow have sprung up. Known as electronic communications networks (ECNs), some of these larger portals have been attracting trading volumes that are beginning to rival those of the main interbank platforms and multi-bank portals. (An example of an ECN is Hotspot FXi; its average daily trading volume is shown in Chart 4, below.<sup>10</sup>)

Moreover, while trading volumes on these exchange-like ECNs have been building, an explicit exchange model has already developed in foreign exchange: the currency futures market at the Chicago Mercantile Exchange (CME). Recent (December 2006) estimates put average daily turnover volume for currency futures on the CME at US\$80 billion. This rivals daily turnover on the main interbank portals and exceeds that on the major ECNs and multi-bank dealing portals. Moreover, volume growth on the CME is surging, since PTC accounts find the central clearing house exchange model well suited to their preferred trading strategies.<sup>11</sup> The CME's electronic trading platform also provides the high-speed API access and deep, liquid markets

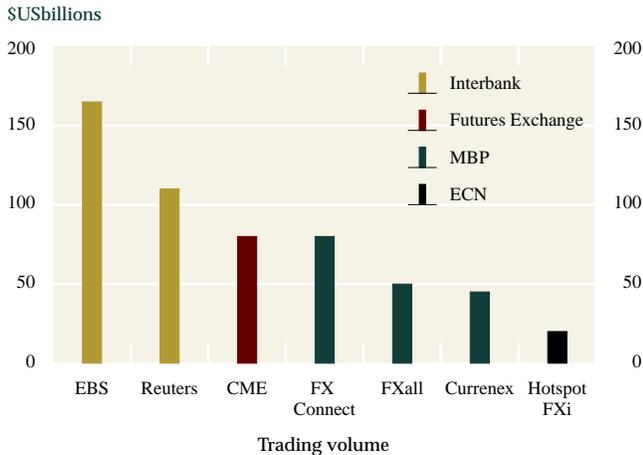
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9. The CLS Bank is a clearing organization sponsored by the worlds' major central banks through which investment dealers can settle their trades. Surety of settlement is ensured through delivery-versus-payment protocols: banks must deliver their side of the trade to the CLS Bank before they will receive their counterparty's funds. More recently, and for a variety of cost and technical reasons, some banks have been exploring the possibility of netting trades between themselves outside of the CLS Bank.

10. Chart 4 also shows the average daily trading volume for Currenex, an electronic platform that combines modules from multi-bank portals and ECNs. FXall has recently introduced an ECN called Accelor, which operates separately from its multi-bank portal.

11. At the CME and other futures exchanges, all trades are settled through a central clearing house that provides total anonymity, surety of settlement, and non-discriminatory pricing for all counterparties.

Chart 4  
Daily Trading Volume (end 2006)



Source: *FX Week*, 14 May 2007

that algorithmic trading routines depend on. As a result, the average daily trading volumes on the CME may be growing more rapidly and gaining on the traditional interbank trading platform.

While trading in currency futures contracts is not *spot* foreign exchange, it provides an efficient means of managing currency risk. Although this suits many PTC accounts, spot foreign exchange settlement is important to a broader array of market participants. Accordingly, to expand the exchange model, the CME recently entered into a joint venture with Reuters, named FXMarketSpace. This electronic trading platform duplicates the exchange-market features of a futures exchange, but in the spot foreign exchange market. Moreover, FXMarketSpace is open to all end-user accounts: the PTC, banks, institutional money managers, and corporations. This essentially creates a universal C2C trading space where dealers (exchange members) provide only market access and other agency-based ancillary trading services.

FXMarketSpace began trading early in 2007, and it is still too early to assess its overall impact on the spot foreign exchange market. But regardless of whether FXMarketSpace or ECN-based exchanges prevail—or even new trading platforms and protocols yet to be developed—the traditional paradigm of a geographically confined, relationship-based, bank-intermediated over-the-counter (OTC) market is being increasingly superseded by new participants, new business models, and new trading relationships that embody important elements of a global, C2C, exchange-style market.

## Increased Liquidity in the New Market

Foreign exchange trading volumes have soared as the barriers to market access and the price of dealing in foreign exchange have declined. Not only are existing market participants trading more, but new participants are rapidly entering the market. The “democratization” of the foreign exchange market has resulted in the involvement of a much broader array of trading accounts. Indeed, much of the recent growth has come from PTC algorithmic traders, retail aggregators, corporate accounts, and institutional money managers who are increasingly treating foreign exchange as a separate, tradable asset class.

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In addition to boosting trading volumes, this broader range of market participants has increased the diversity of opinion expressed in the market. Many of these new accounts trade in huge volumes but will split orders into a myriad of smaller deals spread throughout the trading day (growth in the number of trade tickets has exceeded growth in trading volume). By most measures, the larger trading volumes, increasing ticket numbers, and broader range of market participants have improved the liquidity of most currency pairs. For example, bid/offer spreads have been dramatically compressed; market flow is more evenly distributed across the trading day; order books are deeper (there are more resting orders at every price point); markets are more resilient to shocks; and both historical and implied volatility have recently been trending towards low levels.

Despite these measurable improvements, some have expressed concern over the growing PTC role in providing foreign exchange market liquidity because these accounts typically use highly leveraged, aggressive trading strategies. This may lead some speculative accounts to overcrowd similar positions, to over-extrapolate existing price trends, or to inappropriately over-leverage price and credit risk. Such behaviour

has the potential to make the foreign exchange market less resilient or liquid under stressed conditions.

Although the foreign exchange market has not recently been tested by a period of severe stress, the increased price volatility observed in many global financial markets through the summer and autumn of 2007 was not accompanied by a marked deterioration in foreign exchange market liquidity. To the contrary, anecdotal evidence suggests that market participation by algorithmic PTC accounts, as well as overall foreign exchange trading volumes, increased remarkably during this period. By many accounts, liquidity remained deep in most foreign exchange markets even during the most volatile trading days of this extraordinary period.<sup>12</sup>

Whether broader PTC participation and the use of high-frequency trading algorithms have helped to moderate extreme price movements, or whether they may occasionally lead to price distortions and illiquidity in times of extreme market stress, remains an open question in foreign exchange and in many other markets. On balance, however, recent trading activity suggests that broadening the foreign exchange market has led to deeper liquidity, tighter pricing, more advanced trading technology, and more flexible, accommodative credit arrangements underlying market access (e.g., through prime brokerage). Moreover, foreign exchange markets have arguably become more operationally efficient as the automation of trading has dramatically lowered transactions costs. Allocative efficiency has also improved as technological innovation and new institutional trading arrangements have allowed trading risks to be unbundled, priced separately, and transferred to those more willing to bear them. This allows each market participant to manage those risks in which it has a comparative advantage.

As a result, the ongoing evolution in foreign exchange markets has benefited almost all market participants, not just the large investment dealers or the PTC.

## Conclusion

The foreign exchange market is in a period of transition. Electronic trading platforms, algorithmic trading strategies, and a changing mix of market participants are driving market growth and accounting for an increasingly large share of global trading volume. In the process, the market structure that characterized foreign

exchange through the mid-1990s is increasingly being displaced by a new structure that is different in several fundamental ways.

The lines of demarcation between buy-side and sell-side accounts; price-takers and price-makers; wholesale and retail trading platforms; and market players, banks, and the PTC are becoming increasingly blurred. So, too, are the distinction between exchange-traded and OTC transactions and those between bank-intermediated markets and disintermediated capital markets. In place of a primarily domestic market largely dominated by local banks, foreign exchange is moving towards an electronically linked international marketplace dominated by large global banks and non-bank trading funds, where all participants can access broadly similar pricing on a range of competing electronic platforms, and where a growing professional trading community increasingly supplies more of the liquidity and manages more of the price risks. Many banks are increasingly being disintermediated in the foreign exchange market and having to adjust their business models accordingly, making difficult choices as to where their core competencies lie: in an agency role providing fee-based ancillary trading services, or as risk-managing principals.

The distinctions between various financial markets have also been blurring as this new market model becomes increasingly multi-asset class in nature. Many PTC accounts have been moving into new asset classes, looking for new sources of return. The PTC's trading strategies have been generalizing to trade across different asset classes simultaneously, exploiting cross-price movements on multiple financial products. Real money institutional investors also have reasons to trade multiple asset classes simultaneously (for example, to buy foreign assets and hedge them at the same time, or to actively manage currency-overlay programs for their multi-asset-class portfolios).

The organizational structure of many banks is also evolving to reflect this new model. Departmental divisions are breaking down individual product silos in order to allow clients a more fully integrated multi-asset-class approach to transacting business. The skill set demanded of traders and dealers is changing as well: individuals well versed in high-value-added, multi-asset-class trading solutions are displacing single-product specialists who essentially provide foreign exchange price quotes on demand.

Similarly, electronic trading platforms are evolving to reflect the multi-asset-class approach increasingly

12. There were some reports of illiquidity in forward currency markets during this period, reflecting credit and technical concerns, but liquidity in spot foreign exchange markets remained firm.

