

The \$4 trillion question: what explains FX growth since the 2007 survey?¹

Daily average foreign exchange market turnover reached \$4 trillion in April 2010, 20% higher than in 2007. Growth owed largely to the increased trading activity of “other financial institutions”, which contributed 85% of the higher turnover. Within this customer category, the growth is driven by high-frequency traders, banks trading as clients of the biggest dealers, and online trading by retail investors. Electronic trading has been instrumental to this increase, particularly algorithmic trading.

JEL Classification: F31, G12, G15, C42, C82.

In April this year, 53 central banks and monetary authorities participated in the eighth Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity (“the Triennial”).² The 2010 Triennial shows a 20% increase in global foreign exchange (FX) market activity over the past three years, bringing average daily turnover to \$4.0 trillion (Graph 1, left-hand panel).³ While the growth in FX market activity since 2007 is substantial, it represents a slowdown following the unprecedented 72% rise between 2004 and 2007.⁴ However, against the backdrop of the global financial crisis of 2007–09 and the recent turmoil in European sovereign bond markets, the continued growth demonstrates the resilience of this market.

¹ The authors would like to thank Claudio Borio, Alain Chaboud, Liz Costin, Gabriele Galati, Simon Jones, Colin Lambert, Angelo Ranaldo, Elvira Sojli, Christian Upper and Mark Warns for useful comments and suggestions. Jakub Demski, Victoria Halstensen, Carlos Mallo and Jhuvesh Sobrun provided excellent research assistance. Data were generously provided by the Chicago Mercantile Exchange, and ICAP EBS. The authors are grateful to representatives from five single-bank and 12 multi-bank trading systems who agreed to be interviewed and shared proprietary data on their activities. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS or the Central Bank of Norway.

² The Triennial has been conducted every three years since 1989. For details on the methodology and changes over time, see the article by King and Mallo (this issue). For more details on developments in emerging market currencies, see Mihaljek and Packer (this issue). Detailed results of the 2010 survey are available at www.bis.org/publ/rpfx10t.htm.

³ Because euro/dollar exchange rates were very similar in April 2007 and 2010, growth calculated at constant exchange rates was also similar, at 18%.

⁴ For more details on the results of the 2007 Triennial, see Galati and Heath (2007).

The 2010 Triennial data show that 85% of the growth in FX market turnover since 2007 reflects the increased trading activity of “other financial institutions” (Table 1). This broad category includes smaller banks, mutual funds, money market funds, insurance companies, pension funds, hedge funds, currency funds and central banks, among others. For the first time, activity by other financial institutions surpassed transactions between *reporting dealers* (ie *inter-dealer* trades), reflecting a trend that has been evident over the past decade (Graph 1, centre panel).⁵

While FX turnover grew by 20% between April 2007 and 2010, trading by corporations and governments fell by 10% over this period, possibly reflecting slower economic growth (see box “Foreign exchange turnover versus international trade and financial flows”). The reduced FX activity by corporations is mirrored in the decline in international banking activity, particularly syndicated loans, and in trade finance (Chui et al (2010)).

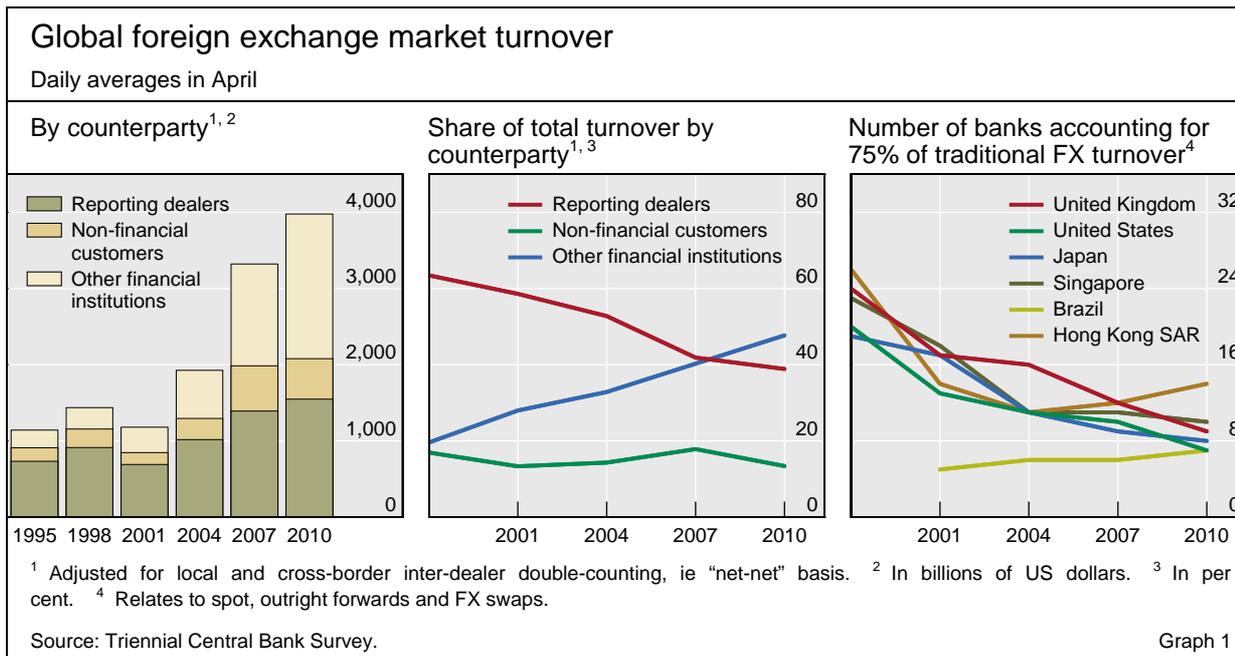
Given that most of the growth in FX market activity since 2007 is due to increased trading by other financial institutions, the \$4 trillion dollar question is: which financial institutions are behind this growth? The Triennial data do not break down trades within this category of counterparty. Discussions with market participants, data from regional FX surveys and an analysis of the currency composition and location of trading activity provide some useful clues. Taken together, they suggest the increased turnover is driven by: (i) greater activity of high-frequency traders; (ii) more trading by smaller banks that are increasingly becoming clients of the top dealers for the major currency pairs; and (iii) the emergence of retail investors (both individuals and smaller

Financial institutions drive growth ...

Increase in global FX market turnover by counterparty ¹				
	Turnover in 2010 ²	Absolute change from 2007 ²	Growth since 2007 (%)	Contribution to FX market growth ³ (%)
Global FX market	3,981	657	20	100
By counterparty				
Reporting dealers	1,548	156	11	24
Other financial institutions	1,900	561	42	85
Non-financial customers	533	-60	-10	-9
By instrument				
Spot	1,490	485	48	74
Outright forwards	475	113	31	17
FX swaps	1,765	51	3	8
Currency options	207	-4	-2	-1
Currency swaps	43	11	36	2

¹ Adjusted for local and cross-border double-counting, ie “net-net” basis. ² In billions of US dollars.
³ Percentage contribution to the total increase of \$657 billion from 2007 to 2010.
Source: 2010 Triennial Central Bank Survey. Table 1

⁵ A glossary at the end explains the italicised terms that appear in this feature.



institutions) as a significant category of FX market participants.⁶ This article explores the contribution of each of these customer types to the growth of global FX turnover.

... enabled by electronic trading ...

An important structural change enabling increased FX trading by these customers is the spread of electronic execution methods. Electronic trading and electronic brokering are transforming FX markets by reducing transaction costs and increasing market liquidity. These changes, in turn, are encouraging greater participation across different customer types.

... particularly algorithmic trading ...

Continued investment in electronic execution methods has paved the way for the growth of *algorithmic trading*. In algorithmic trading, investors connect their computers directly with trading systems known as *electronic communication networks* (ECNs). Examples of ECNs in FX markets are electronic broking systems (such as EBS and Thomson Reuters Matching), *multi-bank trading systems* (such as Currenex, FXall and Hotspot FX) and *single-bank trading systems*. A computer algorithm then monitors price quotes collected from different ECNs and places orders without human intervention (Chaboud et al (2009)). *High-frequency trading* (HFT) is one algorithmic strategy that profits from incremental price movements with frequent, small trades executed in milliseconds.

... with banks trading as clients of top dealers ...

While banks engaged in FX markets below the top tier continue to be important players, the long-term trend towards greater concentration of FX activity in a few global banks continues (Graph 1, right-hand panel). The largest dealers have seen their FX business grow by investing heavily in their single-bank proprietary trading systems. The tight *bid-ask spreads* and guaranteed *market liquidity* on such platforms are making it unprofitable for smaller players to compete for customers in the major currency pairs.

⁶ Trading by all three of these groups is categorised by reporting dealers as trades with other financial institutions. Retail trades are routed through online platforms that are classified as other financial institutions by reporting dealers.

Foreign exchange turnover versus international trade and financial flows

The FX market is the largest financial market in the world, but how does turnover in this market compare with real activity? This box compares turnover in the seven countries that have the most active FX markets with the level of GDP and the volume of trade. It also benchmarks FX activity to trading volumes on major stock exchanges. The seven countries with the most active FX markets are (in decreasing order): the United Kingdom, the United States, Japan, Singapore, Switzerland, Hong Kong SAR and Australia.

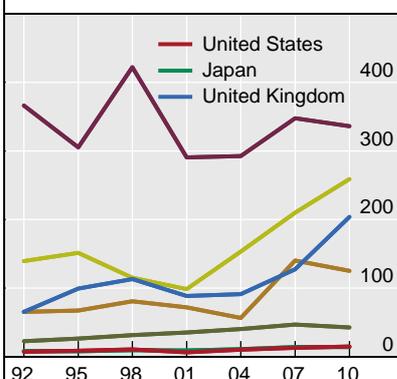
The motives for trading a currency may be divided into transactions linked to cross-border trade in goods and services, and transactions related to cross-border financial flows. The left-hand panel of Graph A shows the ratio of global FX turnover for a country, compared to the country's GDP.^① FX turnover is several times larger than the total output of the economy. The FX turnover/GDP ratio is smallest for the largest economies, the United States and Japan. In these two countries, FX turnover is more than 14 times GDP. In most cases, FX turnover has grown faster than GDP, as indicated by the upward-sloping lines.

Graph A also looks at the FX trading activity of different customer types. The centre panel compares FX turnover by other financial institutions with activity on a country's stock exchanges. "Other financial institutions" is a broad category that includes asset managers and institutional investors, who are most likely to be active in cross-border financial markets. (While it would be more appropriate to compare FX turnover with trading volumes in bond markets, where FX hedging activity is more prevalent, data on bond turnover are not available.) FX market turnover is many times larger than equity trading volumes. Again, the ratio of FX turnover to equity turnover is smallest for the United States and Japan, but still sizeable. The growth in FX turnover since 2007 is much stronger than that of equity trading for several countries, as seen in the sharp increase in the slopes.

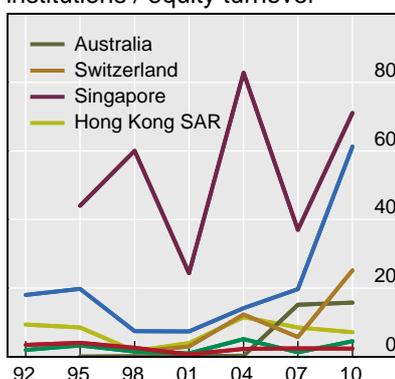
Foreign exchange market turnover and rationale for trading

In per cent

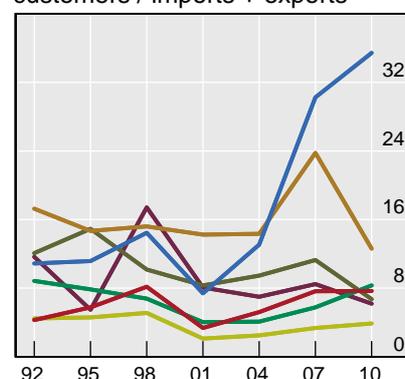
Total FX turnover / GDP¹



FX turnover by other financial institutions / equity turnover



FX turnover by non-financial customers / imports + exports



¹ Foreign exchange turnover adjusted for local inter-dealer double-counting, ie "net-gross" basis.

Sources: IMF *IFS*; World Federation of Exchanges; BIS.

Graph A

Finally, the right-hand panel of Graph A shows the ratio of FX activity by non-financial customers to gross trade flows. Gross trade flows are defined as the sum of imports and exports of goods and services. FX turnover is much higher than underlying trade flows, although the ratios are an order of magnitude smaller than in the other two panels. A closer look at growth since 2007 shows the decrease in activity by non-financial customers is matched by a drop in trade volumes, at least for the United States and the United Kingdom.

Overall, looking at developments since 1992, it is clear that FX turnover has increased more than underlying economic activity, whether measured by GDP, equity turnover or gross trade flows.

^① All comparisons are based on monthly figures, where daily average FX turnover is multiplied by 20 trading days, and measures of economic activity are yearly figures divided by 12.

Increasingly, many smaller banks are becoming clients of the top dealers for these currencies, while continuing to make markets for customers in local currencies. This hybrid role allows smaller banks with client relationships to profit from their local expertise and comparative advantage in the provision of credit, while freeing them from the heavy investment required to compete in spot market-making for the major currency pairs.

... and individual investors trading online

Finally, greater FX trading activity by small retail investors has made a significant contribution to growth in spot FX, and this growth in activity was made possible by the spread of electronic execution methods.

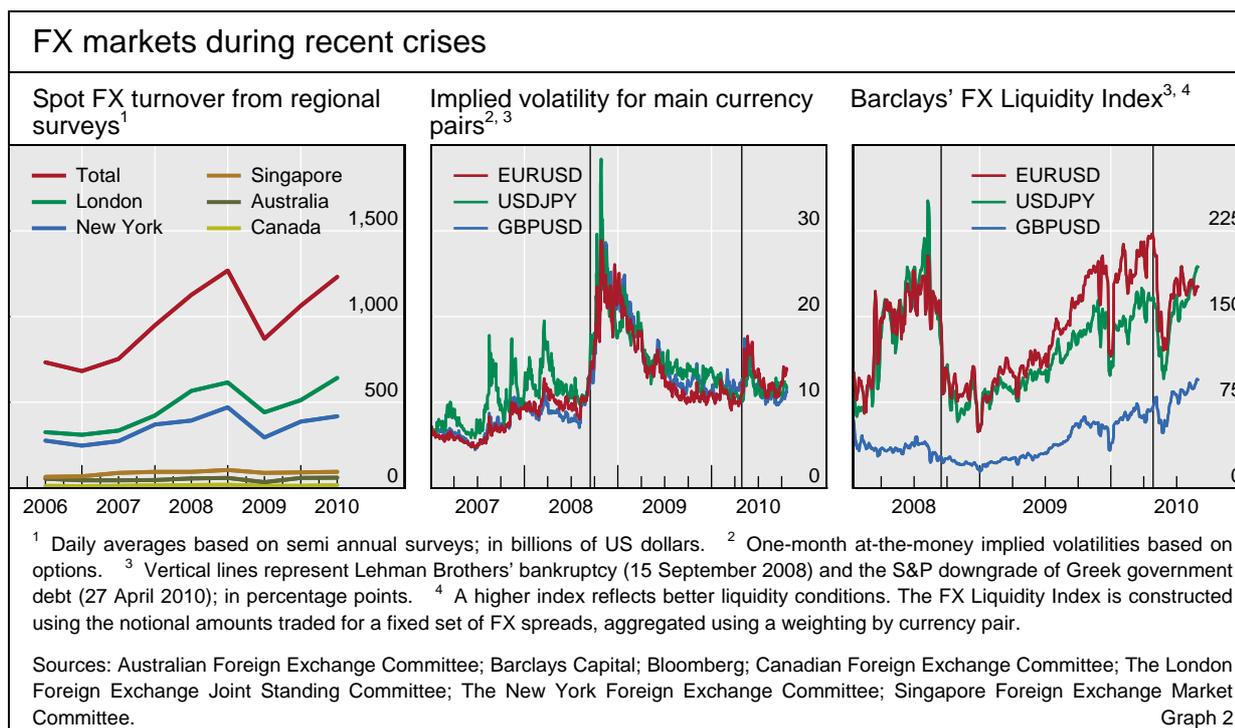
The 2007–09 financial crisis and its impact on FX markets

Global FX activity peaked in October 2008 ...

While the \$4 trillion figure reported in the 2010 Triennial sets a new record high for daily average FX turnover, this level may already have been reached 18 months ago during the 2007–09 global financial crisis. Data from regional foreign exchange committees and multi-bank ECNs show a peak in FX activity in October 2008 following the bankruptcy of Lehman Brothers (Graph 2, left-hand panel). Thereafter, activity in FX markets declined sharply, before recovering from October 2009 onwards.

... as investors used FX to hedge

Following Lehman's bankruptcy, many financial markets experienced large disruptions with a sharp increase in volatility (Graph 2, centre panel). With limited market liquidity in various asset classes, many investors reportedly turned to spot FX markets to hedge risk exposures ("proxy hedging"). For example, downside risk in US equities was reportedly hedged by buying Japanese yen, in European equities by selling the euro, and in emerging market equities using emerging market currencies. These strategies may have had limited success, but at least they were available – albeit at an increased cost, as bid-ask spreads for the major currencies widened during the height of



the crisis by a factor of 4 to 5 times (Melvin and Taylor (2009)) A proprietary liquidity index constructed by Barclays shows that market liquidity for spot trading in major currency pairs dropped sharply around this event, as well as following the downgrade of Greek government debt on 27 April 2010 (Graph 2, right-hand panel).

The rise in FX volatility and increased risk aversion of investors led to a rapid unwind of currency *carry trade* positions, with funding currencies appreciating sharply and many investors experiencing large losses. The Japanese yen, for example, appreciated by 7.7% against the Australian dollar on 16 August 2008. While the unwinding of carry trades may have been important over 2008 and 2009, market participants report that this was not a significant factor explaining FX turnover during April 2010.

Despite the widespread financial market disruptions, most parts of the FX markets continued to function relatively smoothly, although FX swaps were severely disrupted. The robustness of FX markets in the face of these disruptions owes much to the role of CLS Bank, which uses a combination of payment versus payment in central bank funds and multilateral payment netting to eliminate *settlement risk* (Galati (2002), Lindley (2008)). In the aftermath of the global financial crisis, CLS Bank has seen an influx of new members, particularly investment and pension funds.⁷

FX markets proved robust due to CLS Bank

The global financial crisis has changed the focus in FX markets and attracted the attention of regulators. Clients are concerned about minimising transaction costs while demonstrating best execution. Managing *counterparty credit risk*, while always important in FX markets, has taken on increased importance. Activity in instruments that generate counterparty credit risk exposures, such as FX swaps, has not rebounded due to continuing constraints on dealers' balance sheets and restrictions on the availability of credit. Customers are reportedly relying more on bank credit lines and central bank facilities instead of the FX swap market. Regulators have increased capital requirements for retail FX *brokers* and reduced the leverage available to individuals. Finally, regulators are focused on reducing systemic risk and increasing the robustness of electronic infrastructure by increasing the use of *central counterparties*.⁸

Counterparty credit risk is more important

Electronic execution methods are transforming the FX market

The greater activity of all three of the above-mentioned customer types – high-frequency traders, banks as clients and retail investors – is closely related to the growth of electronic execution methods in FX markets. Greenwich Associates estimates that more than 50% of total foreign exchange trading

⁷ Based on the Triennial data for April 2010, CLS Bank settled 43% of spot transactions and 39% of combined spot, outright forwards and FX swaps (compared to 42% and 34% in April 2007, respectively).

⁸ In the United States, the 2010 Dodd-Frank Act will make central clearing of OTC derivatives mandatory for many investors. In Europe, trading of OTC derivatives is being addressed in the review of the Markets in Financial Instruments Directive (MiFID). For more on central counterparties in OTC markets, see Cecchetti et al (2009).

volume is now being executed electronically (Graph 3, left-hand panel). Electronic execution methods can be divided into three categories: electronic brokers, multi-bank trading systems and single-bank trading systems.

Electronic brokers arrived in 1992 ...

Electronic brokers were introduced in the inter-dealer FX market as early as in 1992. For customers, however, the main channel for trading continued to be direct contact with dealers by telephone. In the rather opaque and fragmented FX market of the 1990s, barriers to entry were high and competition was limited. Customers typically paid large spreads on their FX trades.

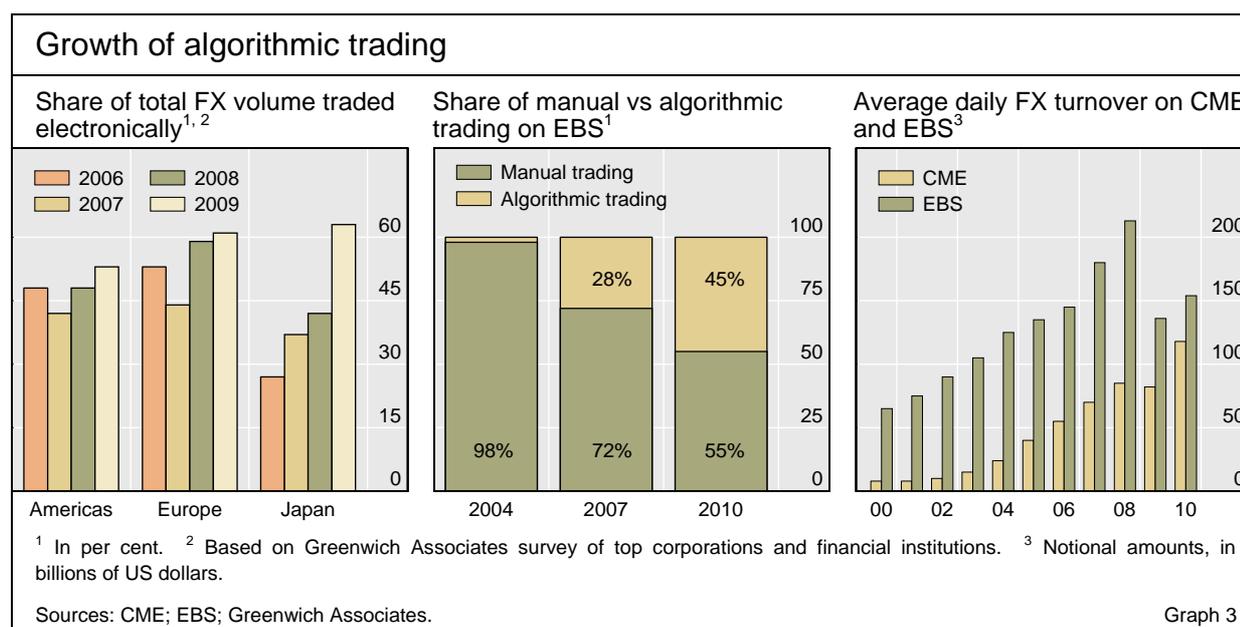
... followed by multi-bank ECNs in the late 1990s ...

The first multi-bank trading system was Currenex, which was launched in 1999. By providing customers with competing quotes from different FX dealers on a single page, Currenex increased transparency, reduced transaction costs and attracted a growing customer base. State Street's FXConnect, which had been launched in 1996 as a single-bank trading system servicing only State Street's clients, opened up in 2000 and became a multi-bank ECN.

In response to the increased competition, top FX dealers launched proprietary single-bank trading systems for their clients, such as Barclays' BARX in 2001, Deutsche Bank's Autobahn in 2002 and Citigroup's Velocity in 2006. According to data provided to the BIS, daily average trading volumes on the top single-bank trading systems have increased by up to 200% over the past three years.

...with the biggest impact in financial centres

Structural changes in execution methods are moving fastest in the largest financial centres. Table 2 shows the execution methods across all FX instruments as reported in the 2010 Triennial. According to the survey methodology, each country allocates all OTC FX transactions to one of these categories.⁹ The table compares the top three financial centres (the United Kingdom, the United States and Japan) with the next seven most active



⁹ For more details on the categories of execution methods, see King and Mallo (this issue).

Execution methods for global FX market turnover ¹						
In per cent						
	Inter-dealer direct ²	Voice broker	Electronic broker	Customer direct ³	Multi-bank trading system	Total
All FX instruments						
UK, US and Japan	15	16	19	39	12	100
Next 7 countries ⁴	24	19	17	31	10	100
Remaining 43 countries	29	11	24	25	10	100
Spot only						
UK, US and Japan	12	8	27	36	16	100
Next 7 countries ⁴	20	11	20	39	11	100
Remaining 43 countries	27	8	27	28	10	100
FX swaps only						
UK, US and Japan	18	28	15	32	7	100
Next 7 countries ⁴	26	23	17	25	9	100
Remaining 43 countries	33	15	22	18	12	100

¹ When comparing national results, FX turnover is on a "net-gross" basis (ie only adjusting for local inter-dealer double-counting). ² Trades directly between reporting dealers executed either electronically or by telephone. ³ All direct trades between a customer and a dealer executed either by telephone or on a single-bank trading system. ⁴ In descending order of global FX activity: Switzerland, Singapore, Hong Kong SAR, Australia, France, Denmark and Germany.

Source: 2010 Triennial Central Bank Survey. Table 2

countries in the 2010 Triennial.¹⁰ These top 10 countries account for close to 90% of global FX turnover, with volumes dropping off sharply thereafter. Table 2 also shows the execution methods for the remaining 43 countries in the survey.

In the top three financial centres, customer direct trading – whether executed electronically on a single-bank portal or by telephone – is the most important category.¹¹ The growth since 2007 is primarily due to the increased importance of single-bank trading systems. The share of customer direct trading (39%) has grown at the expense of inter-dealer direct trading (15%), as seen in the comparison across the different country groups. Notice that the relative shares of voice broking and electronic broking are similar for the top 10 financial centres, but electronic broking is much more important than voice for the remaining 43 countries.

A comparison of the execution method for spot trades and FX swaps highlights the areas where electronic methods are gaining ground. Electronic broking and multi-bank trading systems are more important for spot trading, where counterparty credit and settlement risks are limited. Instruments that embody counterparty credit risk, such as FX swaps, are harder to trade electronically. Individual transactions in FX swaps tend to be large and

Electronic execution has driven spot FX

¹⁰ The next seven most active countries in the 2010 Triennial, in descending order of FX activity, are: Switzerland, Singapore, Hong Kong SAR, Australia, France, Denmark and Germany.

¹¹ While "customer direct" and "single-bank trading systems" are separate execution categories in the Triennial, both categories may include electronic trades. Some reporting dealers appear to have allocated their electronic trades to the former category while others used the latter.

negotiated on a bilateral basis. A FX swap generates a credit exposure to the counterparty, particularly on longer-dated instruments. Given the greater risk, banks want to be able to check their credit limits with counterparties on a more real-time basis. As a result, in all country groupings, a greater share of FX swaps is therefore transacted via inter-dealer direct and voice brokers.

Competition led dealers to launch own platforms ...

The growth of single-bank trading systems has brought several important changes to the FX market. The biggest FX dealers, such as Barclays, Deutsche Bank and UBS, have gained market share, reaping the benefits of their IT investment, while contributing to the overall growth of global FX markets. In a number of major currency pairs, many smaller banks are reportedly becoming clients of the top FX dealers. In this hybrid role, smaller banks may trade the major currencies either via electronic brokers (such as EBS or Thomson Reuters Matching) or via a top dealer's single-bank trading system, while focusing on making markets in their local currency. These structural changes have increased turnover by other financial institutions and decreased the relative share of inter-dealer activity.

... and has lowered transaction costs

The cost-effectiveness of electronic trading and the increased competition have led to lower transaction costs for customers, in turn supporting turnover. Table 3 shows the increase in customer direct trading of spot FX, whether executed by telephone or on single-bank trading systems. Across all countries, this activity grew by 67% over the past three years, outpacing the overall 50% growth in spot. When ranked based on the biggest absolute increases, customer trading of spot in the United Kingdom more than doubled, while turnover for the United States, Australia, Denmark and Japan also increased substantially. Emerging markets are also contributing, notably Hong Kong SAR, Singapore, Brazil and India.

Customer direct trading of spot FX globally ¹				
	2010 ²	2007 ²	Change from 2007 to 2010 ²	Growth from 2007 to 2010 ³
United Kingdom	214.8	94.3	120.4	128
United States	168.3	116.9	51.5	44
Japan	43.6	33.8	9.8	29
Australia	32.2	8.0	24.2	303
Denmark	17.4	2.5	14.9	597
Singapore	16.3	14.1	2.2	15
Hong Kong SAR	10.1	5.4	4.7	86
Canada	4.6	2.5	2.1	86
India	4.1	2.7	1.4	51
Brazil	2.9	1.2	1.7	147
All countries	571.1	341.9	225.3	67

¹ All direct trades between a customer and a dealer executed either by telephone or on a single-bank trading system. ² In billions of US dollars. ³ In per cent.

Source: 2010 Triennial Central Bank Survey. Table 3

As client flows through electronic platforms have increased, banks are matching more trades against each other on their books electronically, thereby capturing the bid-ask spread. While the top dealers report that in April 2007 less than 25% of trades were internalised in this way, by April 2010 they were matching 80% or more of customer trades internally. These trades settle on the bank's books and are not seen by the marketplace, although they are reported in the Triennial. The market only sees the hedging activity of the remaining 20%, which reportedly takes place in the electronic broking markets via trading from financial centres, in particular London.¹²

Banks match client trades electronically

Increased competition from electronic platforms, combined with improved trade processing and settlement systems, have lowered transaction costs. Lower costs, in turn, make more trading strategies profitable, inducing more speculative activity and encouraging the entry of new participants in global FX markets. At one end of the scale, macro hedge funds and other leveraged investors find it more attractive to trade. At the other end, the smaller trade sizes of retail investors can now be accommodated. These trends are driving FX growth.

Increase in FX market turnover driven by algorithmic trading

The growth in electronic execution methods in FX markets has enabled algorithmic trading. Algorithmic trading is an umbrella term that captures any automated trades where a computer algorithm determines the order submission strategy.¹³ For example, FX dealers use algorithms to automatically hedge risk in their inventories or to clear positions in an efficient manner. Customers are increasingly using execution management systems that break up trades and seek the best market liquidity to reduce market impact. Hedge funds and proprietary trading desks use algorithms to engage in macro bets, statistical arbitrage or other forms of technical trading. All these activities are contributing to the increase in FX turnover.

Algorithmic trading covers many strategies

A key turning point for algorithmic trading in FX markets came in 2004 when the electronic broker EBS launched the service "EBS Spot Ai", where Ai stands for automated interface. By providing a computer interface to banks, EBS enabled algorithmic trading in spot FX markets using the real-time prices quoted on EBS. In 2005, this service was extended to the major customers of banks, allowing hedge funds and other traders to gain access to inter-dealer markets – the deepest and most liquid part of the FX market – via their *prime brokerage* accounts with the biggest FX dealers.¹⁴

It took off in inter-dealer FX markets from 2004 ...

¹² Lyons (1997) coined the term "hot-potato trading" to describe the repeated passing of inventory imbalances between dealers. Hot-potato trading is offered as one explanation for the high inter-dealer turnover in FX markets.

¹³ Manual traders may use keypads and electronic monitors to follow markets but the decision to trade is made by a human, with the trade executed either electronically or by telephone.

¹⁴ A bank's prime brokerage customers trade in the bank's name using the bank's existing credit lines with other dealers. Counterparties may not know the identity of the client, only the name of the prime brokerage bank that is their counterparty on a trade. For more details, see www.ny.frb.org/fxc/2005/fxc051219a.pdf.

... and has driven growth on multi-bank platforms

Algorithmic trading has boosted growth on multi-bank platforms. For example, on EBS algorithmic spot trading has been rising steadily from 2% in 2004 to 45% in 2010 (Graph 3, centre panel). Algorithmic trading was also behind the growth of activity in exchange-traded currency futures and options on the Chicago Mercantile Exchange (CME). The CME first provided an electronic interface for algorithmic traders in late 2002, leading to sharp increase in turnover from 2003 onwards. Over the past three years, the CME's average daily turnover in FX products has more than doubled to \$110 billion per day (versus \$154 billion for EBS) (Graph 3, right-hand panel).

High-frequency trading is one type of algo trading ...

High-frequency trading (HFT) is one type of algorithmic trading that has received considerable media attention.¹⁵ While HFT emerged over a decade ago in equity markets, it became an important source of FX growth from 2004. HFT takes place in the deepest and most liquid parts of the FX market. As the number of high-frequency traders increased, the traditional profit-making opportunities from HFT diminished. As a result, the top HFT firms (such as Getco, Jump Trading and RGM Advisors) have evolved from engaging purely in price arbitrage on multi-bank ECNs to becoming liquidity providers as well.

... and accounts for an estimated 25% of spot FX

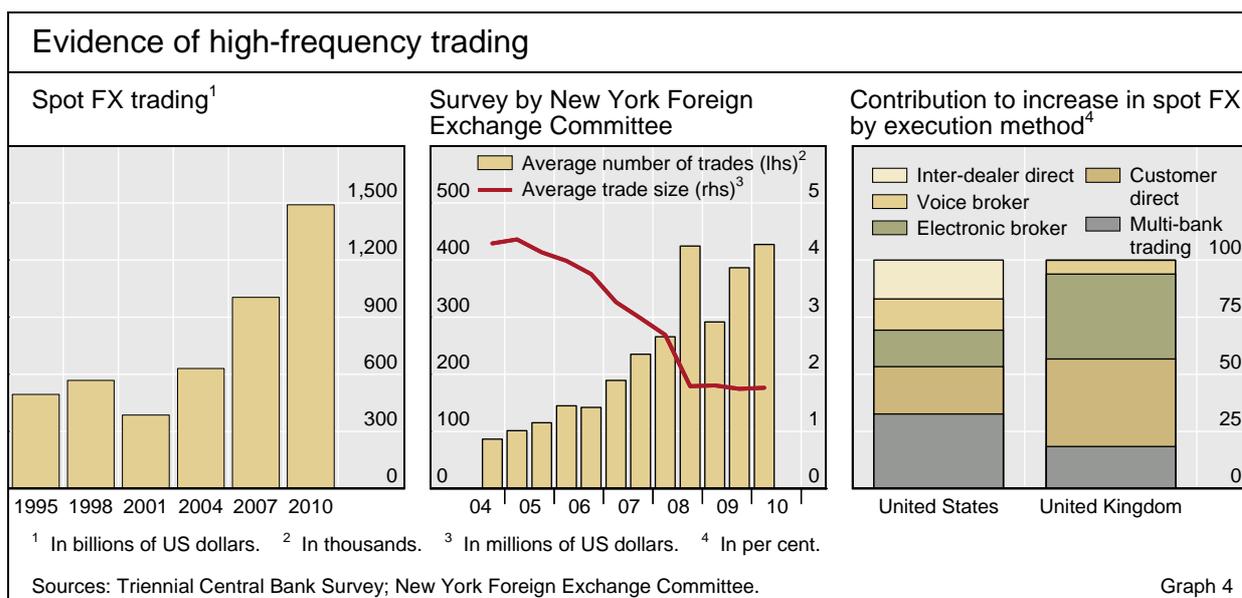
Market estimates suggest HFT accounts for around 25% of spot FX activity. While many commentators suggest much of the growth in spot turnover is due to HFT, the contribution of HFT to the increased FX turnover between 2007 and 2010 is not known with precision (Hughes (2010), Lambert (2010)). Neither the Triennial data on counterparty types nor the data on execution methods identify HFT. This estimate therefore cannot be verified.

One way to evaluate the importance of HFT to FX market growth is to identify the instruments, currency pairs and execution methods where this activity is more likely to show up in the Triennial data. Increased HFT activity should be associated with: (i) increased trading by the relevant category of customers; (ii) increased spot turnover due to the ease of electronic trading and the lowest transaction costs; (iii) increased activity in the main currency pairs, where turnover is the highest; (iv) increased trading in the United States and United Kingdom, where high-frequency traders are located; (v) a growth in trades executed via EBS, Reuters and other multi-bank ECNs; and (vi) HFT should also be associated with a reduction in average trade size.

Triennial data are consistent with more HFT ...

Trends in the 2010 Triennial data are consistent with growth in HFT. The increase in turnover is driven by "Other financial institutions", the category that includes HFT. In terms of instruments, most of the increase takes place in spot trading, which grew by 50% to \$1.5 trillion per day in April 2010 (Graph 4, left-hand panel). The biggest absolute increase over the past three years has taken place in the US dollar and euro (Table 4). Three quarters of increased spot trading is located in the United Kingdom and the United States (Table 4). Data collected by the New York Foreign Exchange Committee also show that average trade size has declined, consistent with an increase in HFT (Graph 4, centre panel).

¹⁵ While the 6 May 2010 "flash crash" in US equity markets was initially blamed on HFT, the report by the US Securities and Exchange Commission relieves HFT of any responsibility, pointing instead to the order execution algorithm of a US mutual fund.



The Triennial data on execution method provide evidence consistent with HFT as an important source of FX growth. Due to the importance of execution speed, high-frequency traders need to be located as close as physically possible to the multi-bank platform's central matching engine. Given that the leading multi-bank trading systems such as FXall, Currenex, or Hotspot FX have their operations in the United States, the increase in activity on these platforms should rise faster than other execution methods if it is driven by HFT. Consistent with this hypothesis, one third of the increase in spot trading in the United States takes place on multi-bank ECNs (Graph 4, right-hand panel). In the United Kingdom, however, electronic broking systems (such as EBS and Thomson Reuters Matching) account for a greater share of the increase in spot trading than multi-bank ECNs. Reuters confirms that the majority of their HFT

... as seen in instruments, execution methods, and location

Increase in global FX market turnover by currency and location				
	Turnover in 2010 ¹	Absolute change from 2007 ¹	Growth since 2007 (%)	Contribution to FX market growth ² (%)
By currency (net-net basis)				
US dollar	1,689	266	8	41
Euro	778	162	5	25
Japanese yen	378	91	3	14
All currencies	3,981	657	20	100
By location (net-gross basis)				
United Kingdom	1,854	370	9	48
United States	904	159	4	21
Japan	312	62	1	8
All countries	5,056	776	18	100

¹ In billions of US dollars. ² Percentage contribution to the total increase of \$657 billion from 2007 to 2010.

Source: 2010 Triennial Central Bank Survey. Table 4

clients transact via servers in London to be closer to Reuters' central matching engine.¹⁶

Growing importance of retail as an investor class

Retail investors are trading up to \$150 billion per day ...

More than any other customer segment, electronic trading has opened up the foreign exchange market to retail investors – a trend highlighted already in the discussion of the 2007 Triennial survey (Galati and Heath (2007)). Trading by households and small non-bank institutions has grown enormously, with market participants reporting that it now accounts for an estimated 8–10% of spot FX turnover globally (\$125–150 billion per day). Japanese retail investors are the most active, with market estimates suggesting this segment represents 30% or more of spot Japanese yen trading (ie more than \$20 billion per day).

... through online retail aggregators ...

Retail FX trading takes place over the internet via a new type of financial institution, the *retail aggregator*.¹⁷ A retail aggregator is a financial firm that acts as a FX intermediary, aggregating bid-offer quotes from the top FX dealing banks and facilitating trades by retail investors. Some retail aggregators act purely as FX brokers, matching retail trades with quotes from banks. Other retail aggregators combine a broker model with a dealer model; they may act as the counterparty for some retail trades while passing others directly to the banks. Based on the quantity of business transacted by their customer base, retail aggregators secure a commitment from the biggest FX banks to provide them with tight bid-ask quotes.¹⁸ Competing quotes are streamed live to customers via the retail aggregator's online platform, typically with a small markup of one pip or less for the major currency pairs.¹⁹ Retail customers primarily trade spot in the major currencies, although the number of emerging market currencies offered is growing.

... using high leverage ...

Retail investors are attracted to FX by the long trading hours, the deep market liquidity, the low transaction costs and the ability to generate leverage. Retail customers create leverage by trading via a *margin account* with the retail aggregator. The initial cash deposit is used to secure the larger notional value of their positions, with the margin requirement varying across jurisdictions. When a trade is executed, the retail aggregator settles it against the margin in the customer's account.

... attracting the attention of regulators

The rapid growth of retail FX trading has led to increased regulation. Regulators have introduced registration of online FX dealers, raised their

¹⁶ With matching engines in all three time zones, high-frequency traders on EBS operate out of a number of centres, although the United States and United Kingdom are preferred.

¹⁷ Examples of retail aggregators are: US-headquartered FXCM, FX Dealer Direct, Gain Capital and OANDA; European-based Saxo Bank and IG Markets; and Japanese-based Gaitame.com.

¹⁸ As competition has intensified, retail aggregators have begun posting prices out to five decimal points for the most actively traded currency pairs.

¹⁹ For the EURUSD pair, one pip equals 0.0001. On 30 April 2010 the price to buy one EUR ("the offer") was \$1.3316 and the price to sell ("the bid") was \$1.3315. The bid-ask spread of one pip is equivalent to \$1 on EUR 10,000 (\$13,316 – \$13,315).

capital requirements and introduced other measures to protect consumers such as requiring the segmentation of customer funds. The US Commodity Futures Trading Commission recently reduced the cap on retail leverage from 100:1 to 50:1 for major currencies (and 20:1 for other currencies). Japan's Financial Services Authority also reduced leverage to 50:1, with plans to reach 25:1 by 2011. Greater regulation has led to consolidation in this industry, with the number of retail aggregators in the United States declining from 47 in 2007 to 11 today and in Japan from over 500 in 2005 to around 70 today. In the United Kingdom and continental Europe, however, there are currently no limits on leverage and limited regulation, creating the potential for regulatory arbitrage.

Conclusion

Electronic trading is transforming FX markets and encouraging greater trading by the category of "Other financial institutions". This broad category includes smaller banks, mutual funds, money market funds, insurance companies, pension funds, hedge funds, currency funds and central banks, among others. Higher trading by other financial institutions is responsible for 85% of the increase in daily average turnover between 2007 and 2010. Within this category, the main contribution appears to come from high-frequency traders, banks trading as clients of the biggest FX dealers and retail investors trading online.

The investment by all FX participants in electronic execution methods has increased competition, lowered transaction costs and encouraged the entry of new participants in global FX markets. These structural changes have also fuelled the rapid growth of algorithmic trading, particularly high-frequency trading in spot markets for the major currency pairs. FX instruments where counterparty credit concerns remain important, such as FX swaps, are proving more difficult to automate and have grown more slowly. While electronic execution methods have initially boosted growth in the main financial centres, this trend is also likely to lift turnover in other countries in the coming years. At the same time, the relative importance of inter-dealer trading may continue to decline as banks match more customer trades internally.

References

- Cecchetti, S, J Gyntelberg and M Hollanders (2009): “Central counterparties for over-the-counter derivatives”, *BIS Quarterly Review*, September, pp 45–58.
- Chaboud, A, B Chiquoine, E Hjalmarsson and C Vega (2009): “Rise of the machines: algorithmic trading in the foreign exchange market”, The Federal Reserve Board *International Finance Discussion Papers*, 2009–980.
- Chui, M, D Domanski, P Kugler and J Shek (2010): “The collapse of international bank finance during the crisis: evidence from syndicated loan markets”, *BIS Quarterly Review*, September, pp 39–49.
- Galati, G (2002): “Settlement risk in foreign exchange markets and CLS Bank”, *BIS Quarterly Review*, December, pp 55–65.
- Galati, G and A Heath (2007): “What drives the growth in FX activity? Interpreting the 2007 triennial survey”, *BIS Quarterly Review*, December, pp 63–72.
- Hughes, J (2010): “Innovation drives trading surge”, *Financial Times Special Report – Foreign Exchange*, 28 September 2010.
- King, M and C Mallo (2010): “A user’s guide to the Triennial Central Bank Survey of foreign exchange market activity”, *BIS Quarterly Review*, December, pp 71–83.
- Lambert, C (2010): “Special report – the \$4 trillion market”, *Profit & Loss*, October 2010, pp 17–32.
- Lindley, R (2008): “Reducing foreign exchange settlement risk”, *BIS Quarterly Review*, September, pp 53–65.
- Lyons, R (1997): “A simultaneous trade model of the foreign exchange hot potato”, *Journal of International Economics*, no 42, pp 275–98.
- Melvin, M and M Taylor (2009): “The crisis in the foreign exchange market”, *Journal of International Money and Finance*, no 28, pp 1317–30.
- Mihaljek, D and F Packer (2010): “Derivatives in emerging markets: what can we learn from the 2010 Triennial Survey?”, *BIS Quarterly Review*, December, pp 43–58.

Glossary

Algorithmic trading: Automated transactions where a computer algorithm decides the order-submission strategy. See also: **High-frequency trading**.

Bid-ask spread: Difference between the price for buying (ask) and the sell price (bid), which measures the transaction costs for executing a trade; often used as an indicator of market liquidity.

Broker: A financial intermediary who matches counterparties to a transaction without being a party to the trade. The broker can operate electronically (electronic broker) or by telephone (voice broker).

Carry trade: A trading strategy where low-yielding currencies are sold to finance the purchase of higher-yielding currencies.

Central counterparty (CCP): An independent legal entity that interposes itself between the buyer and the seller of a security, and requires a margin deposit from both sides.

Counterparty credit risk: The risk that a counterparty will not settle an obligation in full value, either when due or at any time thereafter.

Dealer (or market-maker): A financial institution whose primary business is entering into transactions on both sides of markets and seeking profits by taking risks in these markets.

Electronic communication network (ECN): Generic term for a type of computer system that facilitates electronic trading, typically in over-the-counter markets. Orders are typically entered into the ECN via the internet or through a private electronic network.

High-frequency trading (HFT): An algorithmic trading strategy that profits from incremental price movements with frequent, small trades executed in milliseconds for investment horizons of typically less than one day. See also: **Algorithmic trading**.

Interdealer market: The market where FX dealers trade with each other, either bilaterally or through brokers. Also called the "interbank market", due to the dominance of banks as FX dealers.

Margin account: An account that allows customers to buy securities with money borrowed from a financial intermediary. The customer's cash deposit in the account is called the margin.

Market liquidity: A characteristic of the market where transactions have a limited impact on prices ("price impact") and can be completed quickly ("immediacy").

Multi-bank trading system: An electronic trading system that aggregates and distributes quotes from multiple FX dealers.

Prime brokerage: A service offered by banks that allows a client to source funding and market liquidity from a variety of executing dealers while maintaining a credit relationship, placing collateral and settling with a single entity.

Reporting dealer: A bank that is active in FX markets, both for its own account and to meet customer demand, and participates in the Triennial survey.

Retail aggregator: A term used for online broker-dealers who aggregate quotes from the top FX dealers and provide them to retail customers (individuals and smaller institutions).

Settlement risk: The risk that one of the counterparties to a transaction does not deliver payment.

Single-bank trading system: A proprietary electronic trading system operated by an FX dealer for the exclusive use of its customers.