

FOREIGN EXCHANGE MARKET DYNAMICS, PARTICIPANTS & TRANSACTION METHODS

A graphical translation of “Foreign Exchange Market Structure, Players and Evolution”, by Michael R. King, Carol Osler and Dagfinn Rime, last revised on August 14, 2011

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PURPOSE OF THIS PRESENTATION

This presentation is created to present a backdrop of the foreign exchange market, inclusive of its size, growth, participants and the manner in which they interact.

Much of the information in this presentation is sourced from “Foreign Exchange Market Structure, Players and Evolution”, a research paper written by Michael R. King, Carol Osler and Dagfinn Rime, last revised on August 14, 2011. This presentation was created in January of 2012. King, Osler and Rime’s paper aimed to provide a written description of the foreign exchange market, as well as potential evidence of how its structure has changed over the past two decades. This presentation is essentially a graphic translation of this paper, with language presented *verbatim* in many instances. From its abstract:

“Electronic trading has transformed foreign exchange markets over the past decade, and the pace of innovation only accelerates. This formerly opaque market is now fairly transparent and transaction costs are only a fraction of their former level. Entirely new agents have joined the fray, including retail and high-frequency traders, while foreign exchange trading volumes have tripled. Market concentration among dealers has risen reflecting the heavy investments in technology. Undeterred, some new non-bank market participants have begun to make markets, challenging the traditional foreign exchange dealers on their own turf. This paper outlines the players in this market and the structure of their interactions. It also presents new evidence on how that structure has changed over the past two decades. Throughout, it highlights issues relevant to exchange rate modeling.”

MARKET SIZE & DEPTH

- Average daily turnover: \$3.98 Trillion as of April, 2010
- In 1992, average daily turnover was only \$857 Billion
- 48% growth in turnover of spot transactions since April 2007, which represents 37% of foreign exchange market turnover
- Turnover of other foreign exchange instruments grew only 7% since 2007, with average daily turnover of approximately \$2.5 trillion.
- Turnover of outright forwards and swaps grew strongly since 2007, while swaps remained relatively flat.
- Much of the recent growth is attributed to “other financial institutions”, which includes non-reporting banks, hedge funds, pension funds, mutual funds, insurance companies and central banks, among others.

MARKET SIZE & DEPTH (cont.)

Table 1
Global foreign exchange market turnover by instrument¹

Average daily turnover in April, in billions of US dollars

| Instrument | 1998 | 2001 | 2004 | 2007 | 2010 |
|--|--------------|--------------|--------------|--------------|--------------|
| Foreign exchange instruments | 1,527 | 1,239 | 1,934 | 3,324 | 3,981 |
| Spot transactions ² | 568 | 386 | 631 | 1,005 | 1,490 |
| Outright forwards ² | 128 | 130 | 209 | 362 | 475 |
| Foreign exchange swaps ² | 734 | 656 | 954 | 1,714 | 1,765 |
| Currency swaps | 10 | 7 | 21 | 31 | 43 |
| Options and other products ³ | 87 | 60 | 119 | 212 | 207 |
| <i>Memo:</i> | | | | | |
| Turnover at April 2010 exchange rates ⁴ | 1,705 | 1,505 | 2,040 | 3,370 | 3,981 |
| Exchange-traded derivatives ⁵ | 11 | 12 | 26 | 80 | 166 |

¹ Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). ² Previously classified as part of the so-called "Traditional FX market". ³ The category "other FX products" covers highly leveraged transactions and/or trades whose notional amount is variable and where a decomposition into individual plain vanilla components was impractical or impossible.

⁴ Non-US dollar legs of foreign currency transactions were converted into original currency amounts at average exchange rates for April of each survey year and then reconverted into US dollar amounts at average April 2010 exchange rates. ⁵ Sources: FOW TRADEdata; Futures Industry Association; various futures and options exchanges. Reported monthly data were converted into daily averages of 20.5 days in 1998, 19.5 days in 2001, 20.5 in 2004, 20 in 2007 and 20 in 2010.

BY LOCATION

The United Kingdom's geographic location allows it to overlap both Asian and U.S. sessions, thus remains the dominant player in terms of turnover.

It captures over one-third of global trading, compared to the U.S. (one-fifth) and the Asia (comprised of Tokyo, Hong Kong, Singapore, and Sydney: one-fourth).

Table 5
Geographical distribution of global foreign exchange market turnover¹

Daily averages in April, in billions of US dollars and percentages

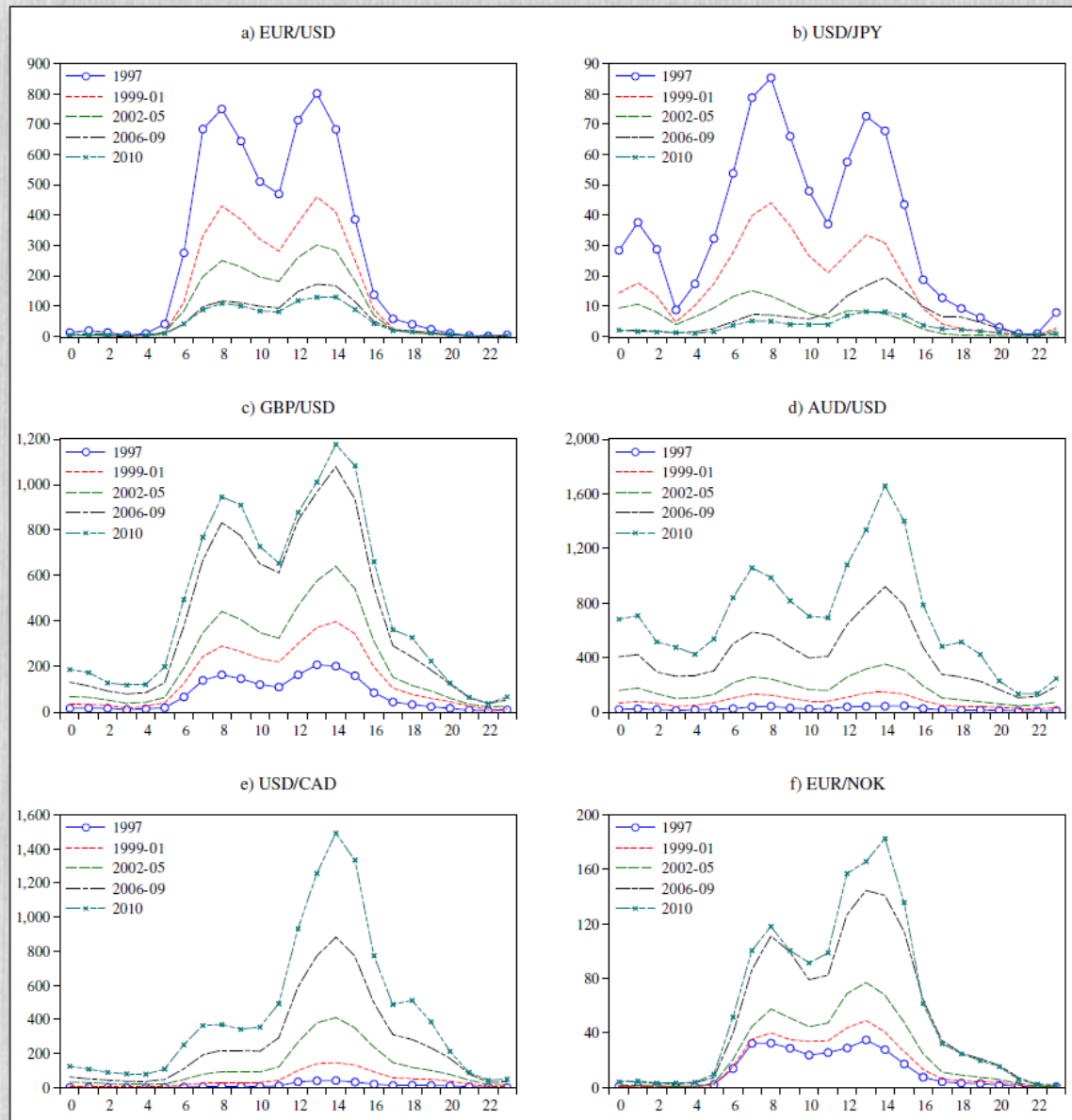
| Country | 1995 | | 1998 | | 2001 | | 2004 | | 2007 | | 2010 | |
|---------------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| | Amount | % | Amount | % | Amount | % | Amount | % | Amount | % | Amount | % |
| Argentina | ... | ... | 2.2 | 0.1 | ... | ... | 0.7 | 0.0 | 1.1 | 0.0 | 1.6 | 0.0 |
| Australia | 40.5 | 2.5 | 48.3 | 2.3 | 54.0 | 3.2 | 107.1 | 4.1 | 176.3 | 4.1 | 192.1 | 3.8 |
| Austria | 13.5 | 0.8 | 11.8 | 0.6 | 8.4 | 0.5 | 14.6 | 0.6 | 18.8 | 0.4 | 19.5 | 0.4 |
| Bahrain | 3.2 | 0.2 | 2.6 | 0.1 | 3.0 | 0.2 | 2.7 | 0.1 | 3.2 | 0.1 | 4.5 | 0.1 |
| Belgium | 28.5 | 1.7 | 27.3 | 1.3 | 10.4 | 0.6 | 20.8 | 0.8 | 50.1 | 1.2 | 32.5 | 0.6 |
| Brazil ² | ... | ... | 5.1 | 0.2 | 5.5 | 0.3 | 3.8 | 0.1 | 5.8 | 0.1 | 14.2 | 0.3 |
| Bulgaria | ... | ... | ... | ... | ... | ... | ... | ... | 0.5 | 0.0 | 0.9 | 0.0 |
| Canada | 30.7 | 1.9 | 37.9 | 1.8 | 44.2 | 2.6 | 59.3 | 2.3 | 64.0 | 1.5 | 61.9 | 1.2 |
| Chile | ... | ... | 1.3 | 0.1 | 2.3 | 0.1 | 2.5 | 0.1 | 4.0 | 0.1 | 5.5 | 0.1 |
| China ³ | ... | ... | 0.2 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 9.3 | 0.2 | 19.8 | 0.4 |
| Chinese Taipei | ... | ... | 4.9 | 0.2 | 4.8 | 0.3 | 9.5 | 0.4 | 15.5 | 0.4 | 18.0 | 0.4 |
| Colombia | ... | ... | ... | ... | 0.4 | 0.0 | 0.8 | 0.0 | 1.9 | 0.0 | 2.8 | 0.1 |
| Czech Republic | ... | ... | 5.1 | 0.2 | 2.1 | 0.1 | 2.4 | 0.1 | 5.0 | 0.1 | 5.1 | 0.1 |
| Denmark | 31.8 | 1.9 | 28.0 | 1.3 | 23.8 | 1.4 | 42.1 | 1.6 | 88.2 | 2.1 | 120.5 | 2.4 |
| Estonia | ... | ... | ... | ... | ... | ... | 0.2 | 0.0 | 1.3 | 0.0 | 1.1 | 0.0 |
| Finland | 5.4 | 0.3 | 4.4 | 0.2 | 1.6 | 0.1 | 1.8 | 0.1 | 8.3 | 0.2 | 31.3 | 0.6 |
| France | 61.5 | 3.8 | 77.2 | 3.7 | 49.6 | 2.9 | 66.5 | 2.6 | 126.8 | 3.0 | 151.6 | 3.0 |
| Germany | 79.2 | 4.8 | 99.6 | 4.7 | 91.5 | 5.4 | 120.4 | 4.6 | 101.4 | 2.4 | 108.6 | 2.1 |
| Greece | 3.3 | 0.2 | 7.2 | 0.3 | 4.8 | 0.3 | 4.3 | 0.2 | 5.0 | 0.1 | 5.2 | 0.1 |
| Hong Kong SAR | 90.9 | 5.6 | 79.9 | 3.8 | 68.4 | 4.0 | 106.0 | 4.1 | 181.0 | 4.2 | 237.6 | 4.7 |
| Hungary | ... | ... | 1.4 | 0.1 | 0.6 | 0.0 | 2.8 | 0.1 | 6.9 | 0.2 | 4.2 | 0.1 |
| India | ... | ... | 2.4 | 0.1 | 3.4 | 0.2 | 6.9 | 0.3 | 38.4 | 0.9 | 27.4 | 0.5 |
| Indonesia | ... | ... | 1.8 | 0.1 | 3.9 | 0.2 | 2.3 | 0.1 | 3.0 | 0.1 | 3.4 | 0.1 |
| Ireland | 4.9 | 0.3 | 10.7 | 0.5 | 8.7 | 0.5 | 7.5 | 0.3 | 11.4 | 0.3 | 14.6 | 0.3 |
| Israel | ... | ... | ... | ... | 1.5 | 0.1 | 5.0 | 0.2 | 8.4 | 0.2 | 10.0 | 0.2 |
| Italy | 24.2 | 1.5 | 28.6 | 1.4 | 17.6 | 1.0 | 23.5 | 0.9 | 37.6 | 0.9 | 28.6 | 0.6 |
| Japan | 167.7 | 10.3 | 146.3 | 7.0 | 152.7 | 9.0 | 207.4 | 8.0 | 250.2 | 5.8 | 312.3 | 6.2 |
| Korea | ... | ... | 3.6 | 0.2 | 9.8 | 0.6 | 20.5 | 0.8 | 35.2 | 0.8 | 43.8 | 0.9 |
| Latvia | ... | ... | ... | ... | ... | ... | 2.0 | 0.1 | 2.6 | 0.1 | 2.2 | 0.0 |
| Lithuania | ... | ... | ... | ... | ... | ... | 1.0 | 0.0 | 1.0 | 0.0 | 1.2 | 0.0 |
| Luxembourg | 19.2 | 1.2 | 22.7 | 1.1 | 13.1 | 0.8 | 14.6 | 0.6 | 43.9 | 1.0 | 33.4 | 0.7 |
| Malaysia | ... | ... | 1.1 | 0.1 | 1.4 | 0.1 | 1.7 | 0.1 | 3.5 | 0.1 | 7.3 | 0.1 |
| Mexico | ... | ... | 8.7 | 0.4 | 8.6 | 0.5 | 15.3 | 0.6 | 15.3 | 0.4 | 17.0 | 0.3 |
| Netherlands | 26.6 | 1.6 | 42.8 | 2.0 | 30.5 | 1.8 | 52.1 | 2.0 | 24.8 | 0.6 | 18.3 | 0.4 |
| New Zealand | 7.2 | 0.4 | 7.0 | 0.3 | 4.0 | 0.2 | 7.0 | 0.3 | 12.8 | 0.3 | 8.8 | 0.2 |
| Norway | 7.6 | 0.5 | 8.9 | 0.4 | 0.0 | 0.0 | 14.5 | 0.6 | 32.1 | 0.7 | 22.2 | 0.4 |
| Peru | ... | ... | ... | ... | 0.2 | 0.0 | 0.3 | 0.0 | 0.8 | 0.0 | 1.4 | 0.0 |
| Philippines | ... | ... | 0.8 | 0.0 | 1.1 | 0.1 | 0.7 | 0.0 | 2.3 | 0.1 | 5.0 | 0.1 |
| Poland | ... | ... | 2.7 | 0.1 | 5.1 | 0.3 | 6.5 | 0.3 | 9.2 | 0.2 | 7.8 | 0.2 |
| Portugal | 2.4 | 0.1 | 4.4 | 0.2 | 1.7 | 0.1 | 1.9 | 0.1 | 4.3 | 0.1 | 3.7 | 0.1 |
| Romania | ... | ... | ... | ... | ... | ... | ... | ... | 2.5 | 0.1 | 3.2 | 0.1 |
| Russia | ... | ... | 6.9 | 0.3 | 9.6 | 0.6 | 29.8 | 1.1 | 50.2 | 1.2 | 41.7 | 0.8 |
| Saudi Arabia | ... | ... | 2.4 | 0.1 | 2.1 | 0.1 | 2.1 | 0.1 | 4.5 | 0.1 | 5.3 | 0.1 |
| Singapore | 107.3 | 6.6 | 144.9 | 6.9 | 103.7 | 6.1 | 133.6 | 5.1 | 241.8 | 5.6 | 266.0 | 5.3 |
| Slovakia | ... | ... | ... | ... | 0.8 | 0.0 | 1.6 | 0.1 | 3.5 | 0.1 | 0.4 | 0.0 |
| Slovenia | ... | ... | ... | ... | 0.1 | 0.0 | 0.1 | 0.0 | 0.3 | 0.0 | ... | ... |
| South Africa | 5.2 | 0.3 | 8.9 | 0.4 | 9.9 | 0.6 | 9.8 | 0.4 | 14.0 | 0.3 | 14.4 | 0.3 |
| Spain | 18.4 | 1.1 | 20.0 | 1.0 | 8.1 | 0.5 | 13.9 | 0.5 | 17.1 | 0.4 | 29.3 | 0.6 |
| Sweden | 20.4 | 1.2 | 16.1 | 0.8 | 24.9 | 1.5 | 31.9 | 1.2 | 43.9 | 1.0 | 44.8 | 0.9 |
| Switzerland | 88.4 | 5.4 | 91.6 | 4.4 | 76.3 | 4.5 | 85.3 | 3.3 | 253.6 | 5.9 | 282.6 | 5.2 |
| Thailand | ... | ... | 3.1 | 0.1 | 1.9 | 0.1 | 3.1 | 0.1 | 6.3 | 0.1 | 7.4 | 0.1 |
| Turkey | ... | ... | ... | ... | 1.0 | 0.1 | 3.5 | 0.1 | 4.1 | 0.1 | 16.8 | 0.3 |
| United Kingdom | 478.8 | 29.3 | 685.2 | 32.6 | 541.7 | 32.0 | 835.3 | 32.0 | 1,483.2 | 34.6 | 1,853.6 | 36.7 |
| United States | 265.8 | 16.3 | 383.4 | 18.3 | 272.6 | 16.1 | 498.6 | 19.1 | 745.2 | 17.4 | 904.4 | 17.9 |
| Total | 1,632.7 | 100.0 | 2,099.4 | 100.0 | 1,691.7 | 100.0 | 2,608.5 | 100.0 | 4,281.1 | 100.0 | 5,056.4 | 100.0 |

¹ Adjusted for local inter-dealer double-counting (ie "net-gross" basis). Tables 1, 2, 3 and 4 are expressed on a "net-net" basis. Estimated coverage of the foreign exchange market ranged between 90% and 100% in most countries. ² Data for 1998 only cover spot transactions. ³ Data from 1998 to 2004 only cover spot transactions.

TURNOVER

These charts represent average daily interdealer trading by time of day.

“Note: The horizontal axis shows hour of day (GMT), and the vertical axis shows the average number of trades. The five lines are for 1997, the three 4-year average for 1998-01, 2002-05, and 2006-09, respectively, and finally for 2010. From e.g. GBP/USD (figure c) we see the growth in number of trades since 1997. The exchange rates EUR/USD and USD/JPY are now primarily traded on the competing platform EBS, hence the decrease in number of trades from 1997 to 2010 for these two exchange rates. Source: Thomson Reuters Matching.”



CURRENCY DISTRIBUTION

The U.S. Dollar is the most dominant, involved with roughly three-quarters of all spot transactions. As a major and “vehicle currency”, it is traded with other minor currencies. If the U.S. Dollar is purchased, the Norwegian Krone is sold, and vice versa.

Second is the Euro, involved in 46% of trades, followed by the Japanese Yen at 20% and the British Pound at 14%.

These 4 currencies comprise the G4. They are followed by the Australian Dollar at 7.5%, the Swiss Franc at 6.2% and the Canadian Dollar at 5.2%.

| Currency | 1998 | 2001 | 2004 | 2007 | 2010 |
|-----------------------------------|--------------|--------------|--------------|--------------|--------------|
| US dollar | 86.8 | 89.9 | 88.0 | 85.6 | 84.9 |
| Euro | ... | 37.9 | 37.4 | 37.0 | 39.1 |
| Deutsche mark | 30.5 | ... | ... | ... | ... |
| French franc | 5.0 | ... | ... | ... | ... |
| ECU and other EMS currencies | 16.8 | ... | ... | ... | ... |
| Slovak koruna ² | ... | 0.0 | 0.0 | 0.1 | ... |
| Japanese yen | 21.7 | 23.5 | 20.8 | 17.2 | 19.0 |
| Pound sterling | 11.0 | 13.0 | 16.5 | 14.9 | 12.9 |
| Australian dollar | 3.0 | 4.3 | 6.0 | 6.6 | 7.6 |
| Swiss franc | 7.1 | 6.0 | 6.0 | 6.8 | 6.4 |
| Canadian dollar | 3.5 | 4.5 | 4.2 | 4.3 | 5.3 |
| Hong Kong dollar ^{3,4} | 1.0 | 2.2 | 1.8 | 2.7 | 2.4 |
| Swedish krona ⁵ | 0.3 | 2.5 | 2.2 | 2.7 | 2.2 |
| New Zealand dollar ^{3,4} | 0.2 | 0.6 | 1.1 | 1.9 | 1.6 |
| Korean won ^{3,4} | 0.2 | 0.8 | 1.1 | 1.2 | 1.5 |
| Singapore dollar ³ | 1.1 | 1.1 | 0.9 | 1.2 | 1.4 |
| Norwegian krone ³ | 0.2 | 1.5 | 1.4 | 2.1 | 1.3 |
| Mexican peso ³ | 0.5 | 0.8 | 1.1 | 1.3 | 1.3 |
| Indian rupee ^{3,4} | 0.1 | 0.2 | 0.3 | 0.7 | 0.9 |
| Russian Rouble ³ | 0.3 | 0.3 | 0.6 | 0.7 | 0.9 |
| Polish zloty ³ | 0.1 | 0.5 | 0.4 | 0.8 | 0.8 |
| Turkish new lira ² | ... | 0.0 | 0.1 | 0.2 | 0.7 |
| South African rand ^{3,4} | 0.4 | 0.9 | 0.7 | 0.9 | 0.7 |
| Brazilian real ^{3,4} | 0.2 | 0.5 | 0.3 | 0.4 | 0.7 |
| Danish krone ³ | 0.3 | 1.2 | 0.9 | 0.8 | 0.6 |
| New Taiwan dollar ³ | 0.1 | 0.3 | 0.4 | 0.4 | 0.5 |
| Hungarian forint ³ | 0.0 | 0.0 | 0.2 | 0.3 | 0.4 |
| Chinese renminbi ⁴ | 0.0 | 0.0 | 0.1 | 0.5 | 0.3 |
| Malaysian ringgit ² | 0.0 | 0.1 | 0.1 | 0.1 | 0.3 |
| Thai baht ³ | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Czech koruna ³ | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 |
| Philippine peso ² | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 |
| Chilean peso ² | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| Indonesian rupiah ² | 0.1 | 0.0 | 0.1 | 0.1 | 0.2 |
| Israeli new shekel ² | ... | 0.1 | 0.1 | 0.2 | 0.2 |
| Colombian peso ² | ... | 0.0 | 0.0 | 0.1 | 0.1 |
| Saudi Riyal ² | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 |
| Other currencies | 8.9 | 6.5 | 6.6 | 7.6 | 5.3 |
| All currencies | 200.0 | 200.0 | 200.0 | 200.0 | 200.0 |

¹ Because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200% instead of 100%. Adjusted for local and cross-border inter-dealer double-counting (ie “net-net” basis). ² Data previous to 2007 cover local home currency trading only. ³ For 1998, the data cover local home currency trading only. ⁴ Included as main currency from 2010. For more details on the set of new currencies covered by the 2010 survey, see the statistical notes in Section IV. ⁵ For 1998, the data cover local home currency trading only. Included as main currency from 2007.

INSTRUMENTS TRADED

Spot transactions outweigh other instruments traded considerably, amounting to \$1.5 trillion in 2010.

Outright forwards totaled \$0.5 Trillion.

The remaining futures, currency options, swaps, etc., bring the total to \$4 trillion in turnover.

These other instruments are generally traded for other purposes, so they have little direct impact on exchange rates.

Table 2

Global foreign exchange market turnover by instrument, counterparty and maturity¹

Daily averages in April, in billions of US dollars and percentages

| Instrument/counterparty/ maturity | 1998 | | 2001 | | 2004 | | 2007 | | 2010 | |
|--|--------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| | Amount | % | Amount | % | Amount | % | Amount | % | Amount | % |
| Spot | 568 | 37 | 386 | 31 | 631 | 33 | 1,005 | 30 | 1,490 | 37 |
| with reporting dealers | 347 | 61 | 216 | 56 | 310 | 49 | 426 | 42 | 518 | 35 |
| with other financial institutions | 121 | 21 | 111 | 29 | 213 | 34 | 394 | 39 | 755 | 51 |
| with non-financial customers | 99 | 18 | 58 | 15 | 108 | 17 | 184 | 18 | 217 | 15 |
| Outright forwards | 128 | 8 | 130 | 11 | 209 | 11 | 362 | 11 | 475 | 12 |
| with reporting dealers | 49 | 38 | 52 | 40 | 73 | 35 | 96 | 27 | 113 | 24 |
| with other financial institutions | 34 | 27 | 41 | 31 | 80 | 38 | 159 | 44 | 254 | 54 |
| with non-financial customers | 44 | 35 | 37 | 29 | 56 | 27 | 107 | 30 | 108 | 23 |
| Foreign exchange swaps | 734 | 48 | 656 | 53 | 954 | 49 | 1,714 | 52 | 1,765 | 44 |
| with reporting dealers | 511 | 70 | 419 | 64 | 573 | 60 | 796 | 46 | 837 | 47 |
| with other financial institutions | 124 | 17 | 177 | 27 | 293 | 31 | 682 | 40 | 758 | 43 |
| with non-financial customers | 98 | 13 | 60 | 9 | 89 | 9 | 236 | 14 | 170 | 10 |
| Currency swaps | 10 | 1 | 7 | 1 | 21 | 1 | 31 | 1 | 43 | 1 |
| with reporting dealers | 5 | 55 | 4 | 53 | 12 | 58 | 12 | 39 | 20 | 47 |
| with other financial institutions | 2 | 23 | 2 | 21 | 5 | 23 | 13 | 41 | 19 | 45 |
| with non-financial customers | 2 | 22 | 2 | 25 | 3 | 14 | 6 | 20 | 4 | 8 |
| FX options and other products² | 87 | 6 | 60 | 5 | 119 | 6 | 212 | 6 | 207 | 5 |
| with reporting dealers | 48 | 55 | 28 | 47 | 49 | 41 | 62 | 29 | 60 | 29 |
| with other financial institutions | 18 | 20 | 15 | 26 | 44 | 37 | 91 | 43 | 113 | 55 |
| with non-financial customers | 21 | 24 | 16 | 27 | 21 | 18 | 59 | 28 | 33 | 16 |
| Total | 1,527 | 100 | 1,239 | 100 | 1,934 | 100 | 3,324 | 100 | 3,981 | 100 |
| with reporting dealers | 961 | 63 | 719 | 58 | 1,018 | 53 | 1,392 | 42 | 1,548 | 39 |
| with other financial institutions | 299 | 20 | 346 | 28 | 634 | 33 | 1,339 | 40 | 1,900 | 48 |
| with non-financial customers | 266 | 17 | 174 | 14 | 276 | 14 | 593 | 18 | 533 | 13 |
| Local | 698 | 46 | 525 | 42 | 743 | 38 | 1,274 | 38 | 1,395 | 35 |
| Cross-border | 828 | 54 | 713 | 58 | 1,185 | 61 | 2,051 | 62 | 2,586 | 65 |
| Outright forwards | 128 | 100 | 130 | 100 | 209 | 100 | 362 | 100 | 475 | 100 |
| Up to 7 days | 65 | 51 | 51 | 39 | 92 | 44 | 154 | 43 | 219 | 46 |
| Over 7 days and up to 1 year | 57 | 45 | 76 | 58 | 111 | 53 | 200 | 55 | 245 | 52 |
| Over 1 year | 5 | 4 | 4 | 3 | 5 | 3 | 7 | 2 | 11 | 2 |
| Foreign exchange swaps | 734 | 100 | 656 | 100 | 954 | 100 | 1,714 | 100 | 1,765 | 100 |
| Up to 7 days | 528 | 72 | 451 | 69 | 700 | 73 | 1,329 | 78 | 1,304 | 74 |
| Over 7 days and up to 1 year | 192 | 26 | 196 | 30 | 242 | 25 | 365 | 21 | 444 | 25 |
| Over 1 year | 10 | 1 | 8 | 1 | 10 | 1 | 18 | 1 | 15 | 1 |

¹ Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). Due to incomplete reporting, components do not always add up to totals. ² The category "other FX products" covers highly leveraged transactions and/or trades whose notional amount is variable and where a decomposition into individual plain vanilla components was impractical or impossible.

REGULATION

Without a central exchange, the interbank market itself remains largely unregulated. Many countries, however, have adopted laws by which those that trade in it must follow. Many of these laws are typically established to prevent fraud or other forms of ethical misconduct. In the United States, the primary regulatory body for such activities is the Commodities and Futures Trading Commission, in the United Kingdom, the Financial Services Authority, etc.

Bank of International Settlements:

Because the market is subject to minimal regulation, reporting requirements are scarce, as well. The only comprehensive information source is the Triennial Central Bank Survey of Foreign Exchange Market Activity, a joint effort of central banks around the world coordinated every third year in April by the Bank for International Settlements (BIS).

MARKET PARTICIPANTS



WHO IS THE MOST INFORMED?

“Existing theory indicates that information is brought to the market by liquidity takers rather than market makers. Among liquidity takers in FX, the evidence indicates that information comes from financial customers, especially leveraged investors. Information does not come from firms involved in international trade, small individual traders, or governments/central banks.

To identify whether some category of participant is typically informed, it is standard to examine whether their trades anticipate FX returns. If an agent consistently tends to buy (sell) before prices rise (fall) and the subsequent price change tends to be at least partially permanent, researchers infer that the agent was trading based on information about the asset's fundamental value.

Academic studies have long indicated that FX dealers are informed. But until recently both theory and practice assumed that this information originated entirely with end-customers. It is now recognized that dealers bring their own independent information to the market.”

Ultimately, larger dealers are perhaps the best-informed, due to their extensive network of financial customers.

FINANCIAL INSTITUTIONS

Leveraged Institutional Investors

Hedge Funds, CTA's and other Asset Managers

High motivation to be informed, and evidence suggests they are the most

Make or lose money in accordance with the currency's fluctuation in value

Standard practice of charging 20% incentive fee, 2% management

Strategies include: fundamentals, interest rate differentials, momentum and volatility

Unleveraged Institutional Investors ("Real Money")

Mutual Funds, Pension Funds, Endowments, Private Equity, Insurance Firms and Asset Managers seeking to hedge currency risk exposure

Concentration is placed on assets in a foreign territory as opposed to currency value

Many outsource FX activities to firms specializing in mitigating currency risk

CORPORATE CUSTOMERS

- Corporate customers use FX markets to support the treasury operations associated with their core business activities such as mining, shipping, and manufacturing.
- Most corporate customers do not engage in speculative FX trading – indeed some firms explicitly prohibit it. Given their institutional goals, this restriction seems logical.
- Corporations typically only use the FX markets for one side of each exposure. A US multinational needing EUR to pay taxes in Germany, for example, sells it USD to buy the EUR in the FX market but then delivers the currency directly to the German government, bypassing the FX market entirely.

RETAIL AGGREGATORS & INVESTORS

Around the year 2000, “retail aggregators” (brokers) spawned with the arrival of internet-based trading, providing liquidity to retail investors.

By evidence, retail traders are the least informed participants in the market, despite having the most incentive for being informed. Overconfidence and wishful thinking drives them to stay active, while the majority remain statistically unprofitable.

Retail aggregators (brokers) can earn income in one of 2 major ways:

1. Acting purely as brokers, matching retail trades with quotes from banks
2. Combine a broker model with a dealer model, matching some trades but strategically acting as the counterparty for others

Default risk is mitigated by requiring the customer to post margin. When a trade is placed in a customer account, it is posted against the margin required for each trade. If the available margin is exhausted, the aggregator will close the position(s).

ALGORITHMIC AND HIGH-FREQUENCY TRADERS

- *Algorithmic trading is a form of electronic trading* where a computer algorithm (or program) determines an order-submission strategy and executes trades without human intervention.
- *High-frequency trading relies on their technological advantage* to exploit small price discrepancies across different online trading platforms.
- *Popular high-frequency strategies include triangular arbitrage and covered interest rate arbitrage.* More commonly, high-frequency traders simply pick off dealers' posted quotes that are briefly out of line with the market due to slight time delays between trade instructions and execution (known as “price latency arbitrage”).

GLOBAL CUSTODIAN BANKS

Large asset managers typically hire administrators or “custodians” who track their assets, calculate portfolio values, process dividend and interest payments, buy and sell assets, and settle trades. When they need to trade foreign currencies, real-money investors typically do not contact the major banks. Instead, they trade with their custodian, motivated largely by administrative efficiency. Global custodians thus provide a second layer of FX market-making services.

Bid-ask spreads on custodial FX trades average a striking 30-40 basis points more than interbank spreads. A lack of transparency makes it difficult for a fund to monitor execution quality. As a result and in recent years, institutional investors are focusing much more on the cost analysis of their FX trades.

HOW FX DEALERS MAKE MONEY



Dealer to dealer transactions make up approximately 35% of all spot FX trades. This number has declined substantially over the years due to the efficiency in price matching technology and available platforms for liquidity. In recent years, speculative activities of dealers has seen a decline, stemming from the desire to hold less risk in reaction to the banking crisis.

INTERDEALER TRADING

Dealers can either make or take liquidity.

Making Liquidity:

Liquidity is made via a limit order, in which the dealer is willing to buy or sell at a predetermined price and in a specified quantity. Limit orders are placed in an order book until the deal is either executed or cancelled.

Taking Liquidity:

Liquidity is taken and trades made via a market order which are executed against limit orders, for the best possible bid or ask prices in the book. Larger quantities typically move to less attractive prices.

Spreads:

Interdealer bid-ask spreads are typically 0.5 to 2.0 pips, and for less liquid pairs and without exchange rules, can go as high as 40 pips. Spreads are influenced by inventory risk. When trading is light and volatility is low, spreads heighten.

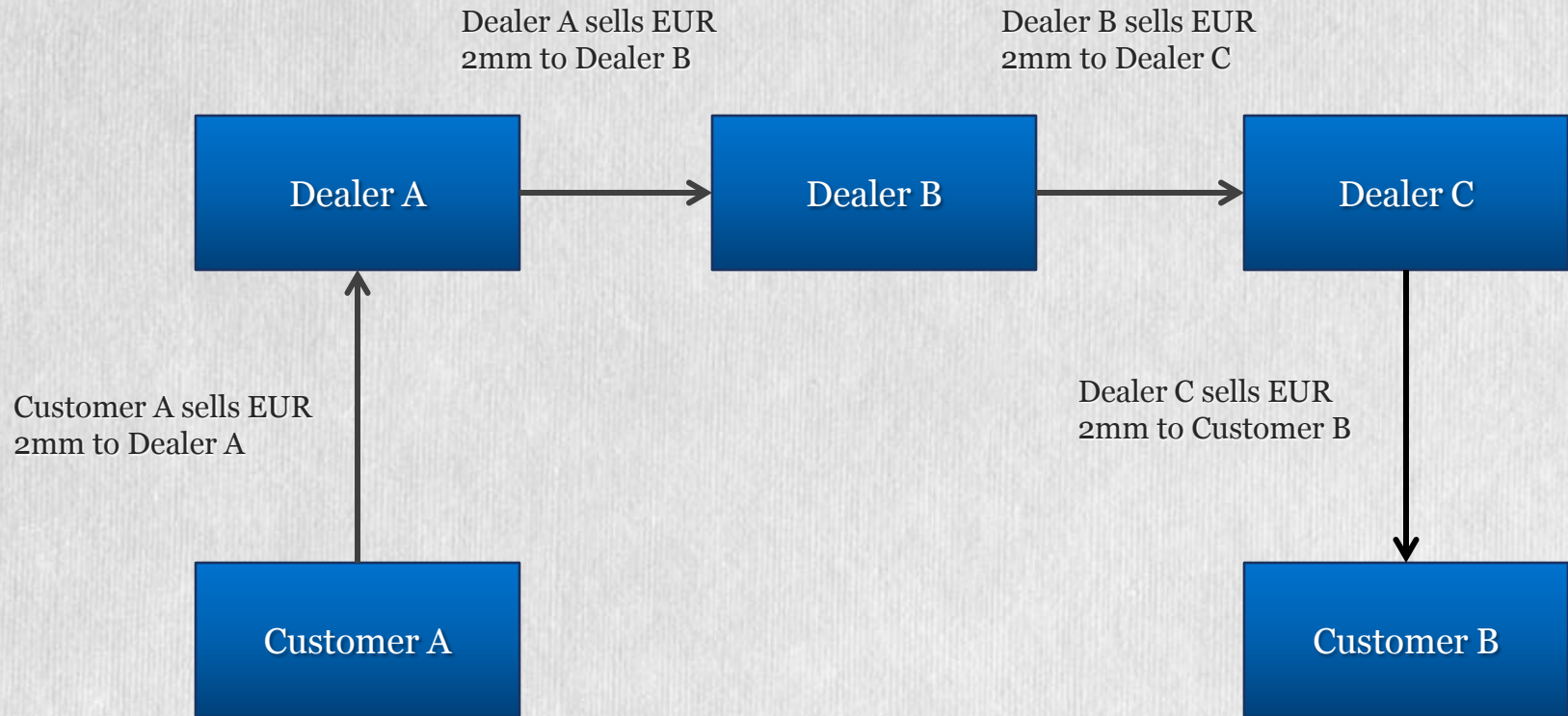
DEALER INVENTORIES

Dealers generally prefer to have zero inventories, in that after a trade is made with a customer, the dealer passes any accumulated inventory quickly onto other dealers. Estimated “hold times” for such inventories are less than a minute at large banks to as many as twelve minutes at small banks.

“Hot potato trading” occurs from the successive passing of inventory from dealer to dealer, until the inventory is finally passed along to another customer.

This varies from activity in bond markets, where dealers warehouse the risk and eliminate the inventory via later customer trades.

“HOT POTATO” TRADING



ASYMMETRIC INFORMATION AND EXCHANGE RATE DETERMINATION

It is important to know not just which agents bring information to the market but also how their information becomes embedded in the market price. In FX markets, this process appears to have at least three steps:

1. End-customers reveal their information to market makers indirectly by trading with them
2. The information becomes embedded in interdealer prices
3. The information is disseminated widely as quotes in the customer segment of the FX market are adjusted to reflect the new interdealer prices.

ASYMMETRIC INFORMATION AND EXCHANGE RATE DETERMINATION (cont.)

“...a dealer that has bought currency from a customer then sells that currency in the interdealer market. The dealer will be especially anxious to trade quickly and aggressively after trading with informed customers.

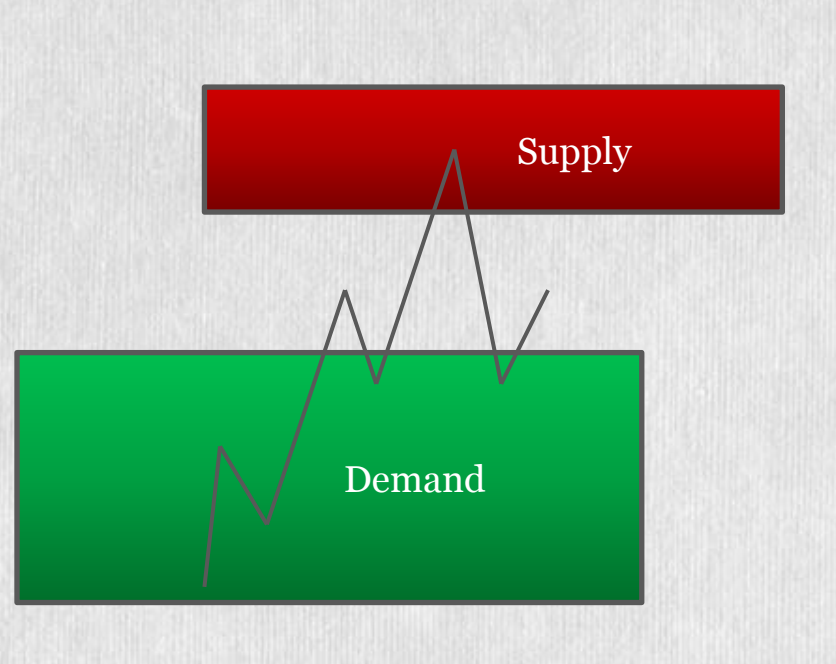
An informed customer's purchase implies that the price is likely to rise. If the dealer is short the appreciating currency as a result of the trade, the inventory position represents a bad risk. If the customer is uninformed, however, the dealer has no strong reason for trading aggressively as there is a 50-50 chance that the associated inventory position will be a winner.

Consistent with this hypothetical dealer behavior, Osler et al. (2011) provide evidence that, after customer trades, dealers are more likely to trade aggressively and in the same direction as the customer if the customer is informed.

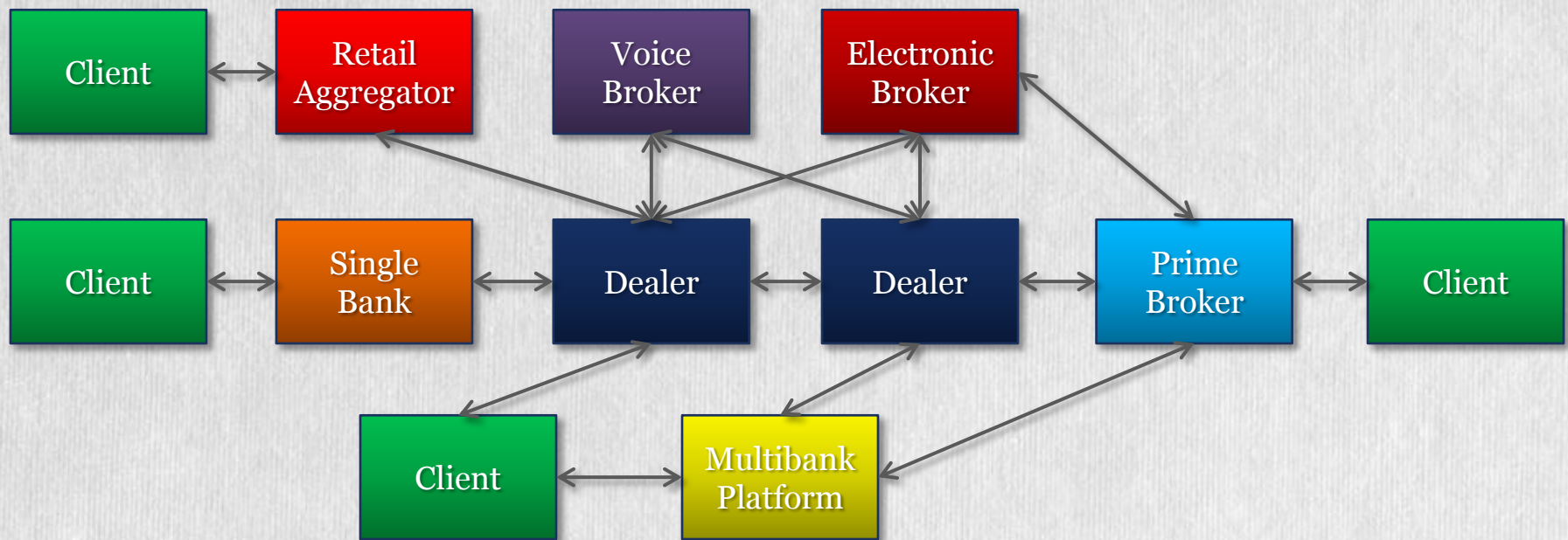
The interdealer price thus naturally moves to embed the information brought to the market by end customers. The price shift can be sustained because other dealers move their own quotes in parallel when they observe the interdealer trade.”

ORDER FLOW / SUPPLY AND DEMAND

One can relate certain areas of informed order flow consistency to simple supply or demand zones. When the “hot potato” is passed and price reaches a new objective, a new line of customers enter the market seeking opposing needs of liquidity. Price turns when one need for liquidity is exhausted and another takes hold.



MARKET STRUCTURE



INTERDEALER TRANSACTIONS

Dealer to dealer transactions are primarily conducted via [*Thompson Reuters Matching*](#) and the [*Electronic Broking Service \(EBS\)*](#). Over time, liquidity naturally gravitated to just one platform for each currency.

- EBS: EUR, JPY, and CHF
- Reuters: GBP, AUD, CAD, and the Scandinavian currencies.

Voice brokers remain important for less liquid currencies – which are not traded over electronic brokers – so in 2010 they still accounted for 10 percent of global spot FX trading.

As a solution to act as a Multibank Trading System, Reuters and EBS (both originally started as an interdealer electronic broker) offer means for end-customers to trade through relationships conducted via a prime broker. This change occurred in 2005 and 2004, respectively.

MULTIBANK TRADING PLATFORMS FOR END-CUSTOMERS

Multibank Trading Systems allow customers to trade directly with a range of dealers over computer networks. While the structure of this system has changed modestly over the last 10 years, they essentially allow banks to stream quotes simultaneously with customers, both providing liquidity and trading anonymously. Multibank Trading Systems comprise approximately 1/6th to 1/9th of all spot transactions worldwide, contingent on region and trader type. Interdealer and customer direct methods are still the most widely used (see next slide for a breakdown).

| | Launched | Instruments that can be traded | | | | |
|---|----------|--------------------------------|----------|------|---------|-------|
| | | Spot | Forwards | NDFs | Options | Swaps |
| a) Request-for-quote service | | | | | | |
| State Street's FXConnect | 1996 | y | | | | y |
| FXall | 2001 | y | y | y | | y |
| 360 Trading Networks | 2002 | y | y | y | y | y |
| Reuters Trading for FX | 2005 | y | | | | y |
| b) Pre-trade anonymous limit order book | | | | | | |
| Thomson Reuters Matching | 1992 | y | y | y | y | y |
| EBS | 1993 | y | | y | | |
| Currenex | 1999 | y | | | | y |
| Hotspot FX | 2000 | y | | | | |
| Lava | 2001 | y | y | y | | y |

EXECUTION METHODS FOR FX TRADING (% SHARES)

| | Inter-dealer direct | Voice broker | Electronic broker | Customer direct | Multibank trading system | Total |
|------------------------|---------------------|--------------|-------------------|-----------------|--------------------------|-------|
| All FX instruments | | | | | | |
| UK, US and Japan | 15 | 16 | 19 | 39 | 12 | 100 |
| Next 7 countries | 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 |
| - Dealers | 29 | 10 | 34 | 16 | 11 | 100 |
| Next 7 countries | 20 | 11 | 20 | 39 | 11 | 100 |
| - Dealers | 37 | 7 | 28 | 15 | 13 | 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 | 26 | 23 | 17 | 25 | 9 | 100 |
| Remaining 43 countries | 33 | 15 | 22 | 18 | 12 | 100 |

“Note: When comparing national results, FX turnover is on a “net-gross” basis (i.e., only adjusting for local inter-dealer double-counting). ‘Next 7 countries’ are, in descending order of global FX activity: Singapore; Switzerland; Hong Kong SAR; Australia; France; Denmark and Germany. “Inter-dealer direct” are trades directly between reporting dealers executed either electronically or by telephone, and “Customer direct” are all direct trades between a customer and a dealer executed either by telephone or on a single-bank trading system. Source: BIS Triennial FX Survey.”

WHITE LABELING

White labeling allows small banks to ensure their customers have access to liquidity by providing single-bank trading platforms under their own name. The benefits to large banks introducing these platforms include:

- Lets them view small banks trading flows thus extract any relevant information,
- Provides them with a new revenue stream.

Market shares for single-bank trading platforms:

| | Share (%) | #Top 10 |
|-------------------------------|-----------|---------|
| Deutsche Bank (Autobahn) | 36 | 7 |
| UBS (FX Trader) | 22 | 7 |
| Barclays Capital (BARX) | 12 | 7 |
| Citi (Velocity) | 6 | 7 |
| JPMorgan (MorganDirect) | 3 | 3 |
| Goldman Sachs (REDI) | 3 | 5 |
| RBS (SmartPrime) | 3 | 6 |
| HSBC (HSBCnet FXHub) | 2 | 7 |
| Credit Suisse (PrimeTrade FX) | 2 | 3 |
| Morgan Stanley (Passport) | 2 | 2 |

OTHER INNOVATIONS BY THE MAJOR DEALING BANKS

Internalization of Customer Trades

Due to the rising market share of dealing banks, they are better able to internalize customer trades. By providing in-house liquidity the banks are better positioned to capture the bid-ask spread with less market risk.

Customer Profiling

Dealers have utilized technology to exploit the digital trading records of each customer, thus profiling them into three types of trades: directional flows, non-directional flows, and predatory high-frequency trades

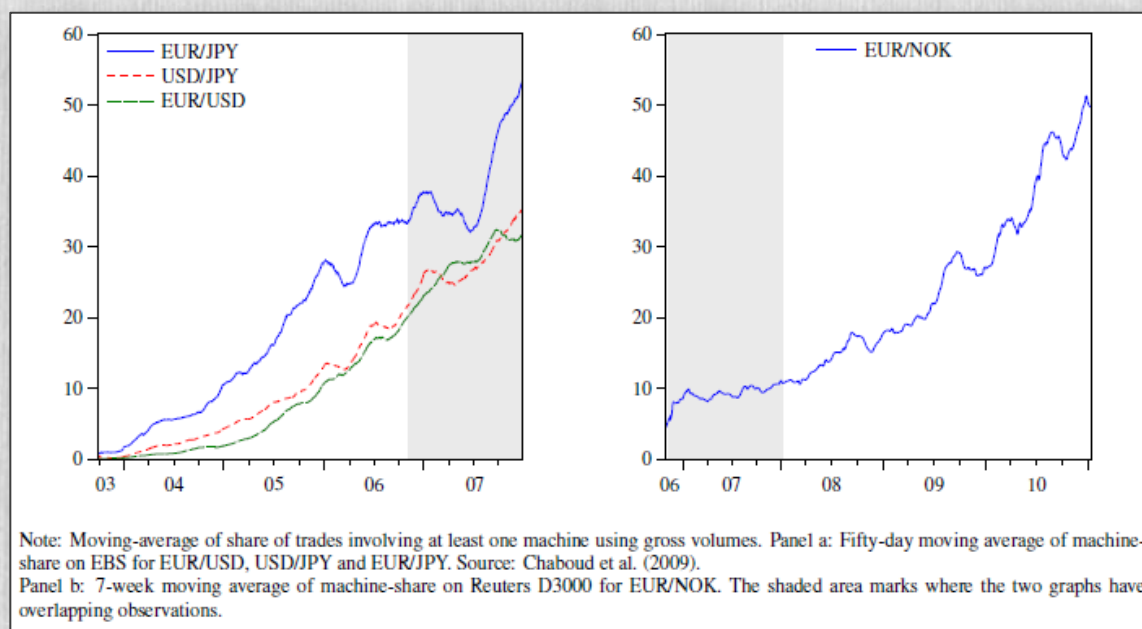
Prime Brokerage

Leveraged investors have begun trading directly in the interbank markets via prime brokerage arrangements with the biggest dealers. Prime brokerage clients trade with other dealers in the prime broker's name using the prime broker's existing credit lines, a privilege for which they pay a fee based on trading volume. Any trades executed with FX dealers other than the prime broker are "given up" to the prime broker, who becomes the counterparty to both legs of the trade. Hedge fund Z, for example, might pay Bank of America to be its prime broker, thereby gaining access to the EBS and Thomson Reuters trading platforms. For the large banks, prime brokerage arrangements generate new, fee-based revenue that leverages their technology and operating infrastructure.

ALGORITHMIC TRADING

In 2003, EBS provided an automated interface for banks, allowing to stream price quotes electronically. This innovation opened the door to algorithmic trading in interdealer markets. A few years later, in response to competition from multibank trading systems, EBS and Reuters extended this service to banks' major customers. This development gave hedge funds and other proprietary traders access to interdealer markets for the first time.

Share of algorithmic trading on EBS and Thomson Reuters Dealing



HIGH-FREQUENCY TRADING

- High-frequency trading involves capturing frequent but tiny profits associated with slight transitory price differences across platforms. King and Rime (2010) estimate that high-frequency trading now accounts for roughly one quarter of spot FX turnover. The rise of high frequency trading explains the concentration of trading growth in spot markets, the concentration of that growth in USD and EUR, and the concentration of reported activity in London and the US. It can also explain why spot trade sizes have been falling while trade numbers have been rising as well as the doubling of exchange-traded contracts on the Chicago Mercantile Exchange (CME) since 2007.
- Dealers have mixed reactions towards high-frequency trading on their single-bank trading systems. Since the high-frequency traders' profit is a dealer's loss. As a result, some banks screen out such "predatory" trading using computer algorithms that profile customers based on their trading activity. Other banks, however, encourage high-frequency trading on in-house systems; they see indirect gains, since the additional liquidity allows them to populate internal pricing engines.
- Dealers are generally happy to sponsor high-frequency trading firms on multibank platforms through prime brokerage relationships, and charge them for using the bank's credit. Nonetheless, FX dealers recognize that they themselves can be "scalped" by price-latency arbitrage, so some post quotes on these platforms only when they proactively want to trade. In addition, most banks have invested heavily in their own high-frequency trading capacity.

RETAIL AGGREGATORS

- With electronic trading, small trades can automatically be aggregated into larger trades and laid off in the liquid interdealer market.
- Retail trading has been one of the fastest growing segments of the market. Such trading, which was negligible in 2001, had by 2010 reached an estimated \$125–150 billion per day, or 8 to 10 percent of global spot turnover (King and Rime, 2010).
- Dealers are happy to provide liquidity to retail aggregators at attractive prices because retail trades are not on average informed, as noted earlier, so there is no adverse-selection risk. Dealers can safely hold retail flows in inventory to cross against future transactions.
- The rapid growth of retail FX trading has led to increased regulation. Online FX dealers must now be registered and capital requirements have been raised. Further, the U.S. and Japan have lowered the cap on retail leverage from 100:1 to 50:1 for major currencies and in Japan the cap should fall further, to 25:1, by January 2012. Greater regulation has brought industry consolidation. The number of U.S. retail platforms shrank from 47 in 2007 to 11 in 2011; the number of Japanese platforms fell from over 500 in 2005 to around 70 in 2011.

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