

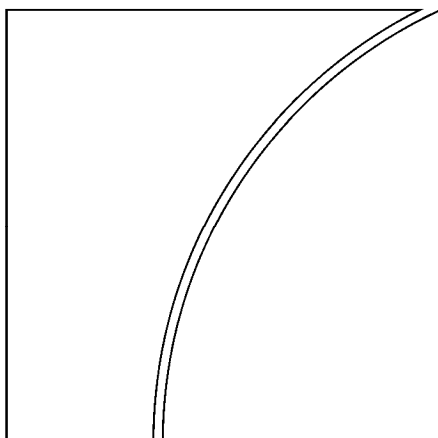


BANK FOR INTERNATIONAL SETTLEMENTS

BIS Quarterly Review

December 2010

International banking
and financial market
developments



BIS Quarterly Review
Monetary and Economic Department

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Notations used in this Review

e	estimated
lhs, rhs	left-hand scale, right-hand scale
billion	thousand million
...	not available
.	not applicable
–	nil
0	negligible
\$	US dollar unless specified otherwise

Differences in totals are due to rounding.

The term "country" as used in this publication also covers territorial entities that are not states as understood by international law and practice but for which data are separately and independently maintained.

Monetary policy and sovereign debt concerns drive markets¹

In the period from late August to the beginning of December, two themes dominated global financial markets. Through early November, the perceived slow pace of economic recovery in the major advanced economies helped intensify investor expectations that central banks would introduce further accommodative measures. Since early November, concerns about sovereign risk in several euro area economies have resurfaced and become the dominant theme.

Much of the focus during the initial period was on the US Federal Reserve and its early November announcement of a second round of large-scale Treasury bond purchases. The Fed's ultimate announcement followed a prolonged period during which senior officials gave speeches combined with other public statements in an effort to prepare markets. As a consequence, US real and nominal bond yields dropped significantly while equity prices rose strongly between August and early November as investors increasingly priced in the expected actions. At the same time, market indicators suggested that bond investors were revising upwards their US inflation expectations.

The Fed's anticipated monetary easing had a visible impact on market prices well beyond the United States as well. The US dollar depreciated against most other major currencies. Together with even lower US interest rates, this made the dollar the funding currency of choice for foreign exchange carry trades and intensified capital flows to emerging markets. The result, which was reflected in higher equity and bond prices in the faster-growing emerging market economies, prompted a number of these countries to introduce policy measures aimed at dampening the rate of capital inflows.

Since early November, attention has shifted to the euro area, with market participants becoming increasingly concerned about exposures to Ireland and other economies. Once again, credit spreads increased significantly on government bonds issued by affected countries. This time concerns were driven by two factors: the deteriorating fiscal situation in Ireland that stemmed

¹ This article was produced by the Monetary and Economic Department. Questions related to this article can be directed to Jacob Gyntelberg (jacob.gyntelberg@bis.org) and Peter Hördahl (peter.hoerdahl@bis.org). Questions about data and graphs should be addressed to Magdalena Erdem (magdalena.erdem@bis.org).

from continued government support for troubled banks; and consideration of EU treaty changes that would make it possible to impose losses on holders of bonds issued by governments in financial distress. Even as an EU support package for Ireland was agreed in late November, the stress persisted, with attention turning first to Portugal and Spain and later to Belgium and Italy. The situation did, however, stabilise in early December in anticipation of possible ECB support.

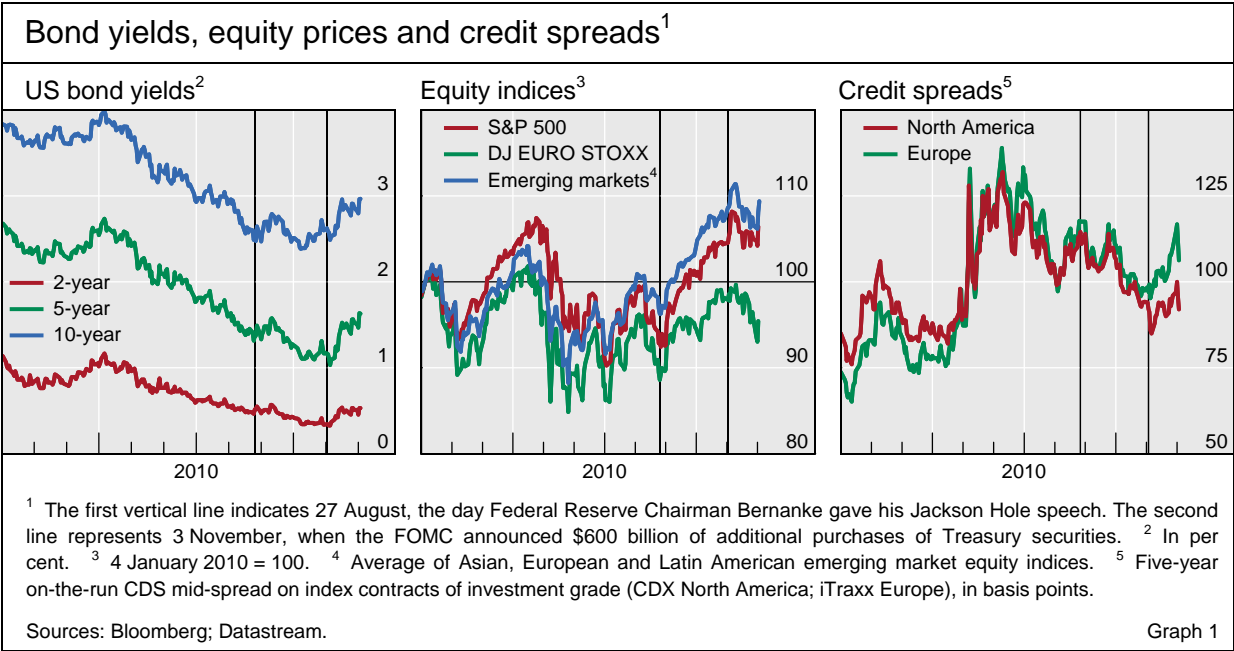
Investors price in further central bank easing

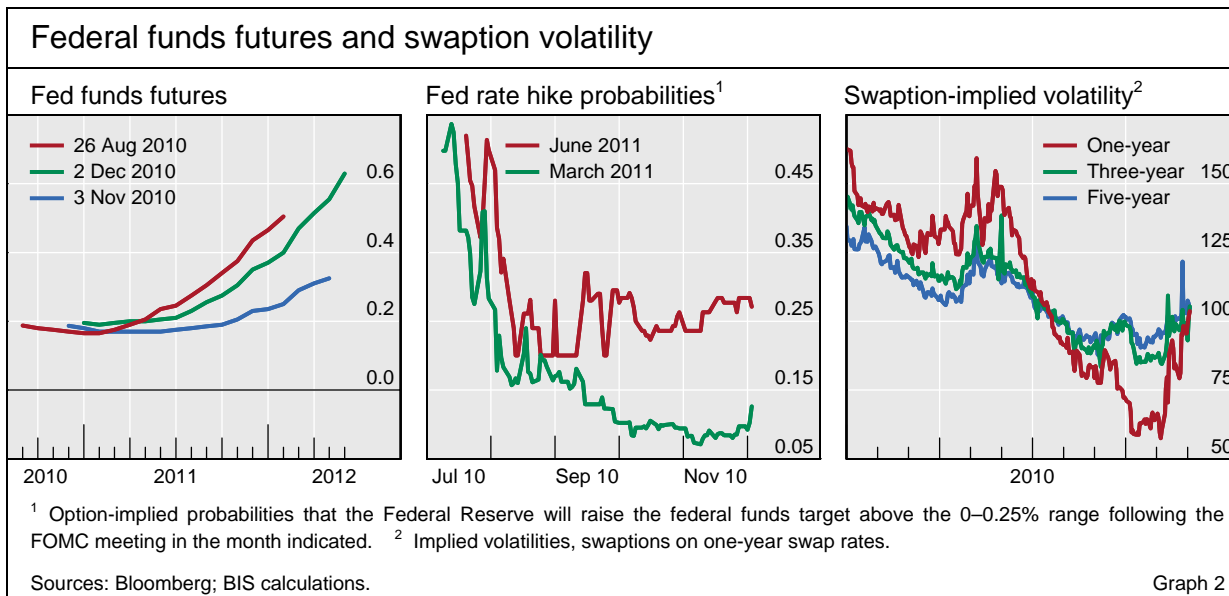
As investors grew increasingly concerned about the economic recovery in major advanced economies, expectations intensified that some central banks would ease monetary policy further. This was particularly the case for the United States, where expectations grew that the Federal Reserve would announce a second round of Treasury bond purchases, which it eventually did in early November. Even before that, in early October, the Bank of Japan had taken further steps to ease monetary conditions. The Bank announced that it would establish a ¥5 trillion Asset Purchase Programme, under which it would buy government bonds, commercial paper, corporate bonds, exchange-traded funds and real estate investment trusts in order to lower risk premia and push up asset prices. In the United Kingdom too, expectations that the Bank of England would expand its quantitative easing programme resurfaced. However, with UK headline inflation staying above target, investors remained divided in their views on the likelihood of such a move.

Expectations of further Fed easing ...

In the United States, yields on US government bonds had been moving downwards since around early May as investors had been increasingly anticipating that the Fed would expand its purchases of Treasuries (Graph 1, left-hand panel). The first concrete signs of additional monetary easing came in early August, when the Federal Open Market Committee (FOMC) announced that principal payments from agency debt and agency mortgage-backed

... push yields down ...





securities would be used to purchase additional Treasury securities, thereby keeping the Federal Reserve’s holdings of securities at the prevailing level.

... and lift risky asset prices

Yields fell further from late August until early November, as Federal Reserve communications reinforced expectations of further monetary easing (Graph 1, left-hand panel; see also the box). In particular, in his Jackson Hole speech on 27 August, Chairman Bernanke discussed a range of policy options, including additional purchases of Treasuries. US equity prices benefited from lower yields both directly, via lower discount rates on expected future earnings, and indirectly, as a result of expected portfolio shifts away from lower-yielding Treasuries into riskier investments such as stocks (Graph 1, centre panel). Moreover, credit spreads tightened in the course of September–October (Graph 1, right-hand panel). These effects on prices of risky assets were not confined to the United States; to varying degrees, they were visible also in Europe and a number of emerging markets.

Investors priced in a further delay in the timing of the first US rate hike, as the Federal Reserve began hinting that it might keep the target for the federal funds rate close to zero for longer than markets had expected. The federal funds futures curve flattened, while the option-implied probability of near-term increases in the target rate edged downwards between late August and early November (Graph 2, left-hand and centre panels). These rate expectations reinforced the downward pressure on bond yields, especially for medium maturities. At the same time, implied interest rate volatilities retreated further, especially over short horizons, suggesting that investors had become less uncertain about the interest rate outlook (Graph 2, right-hand panel).

Break-even rates rise on expected Fed move ...

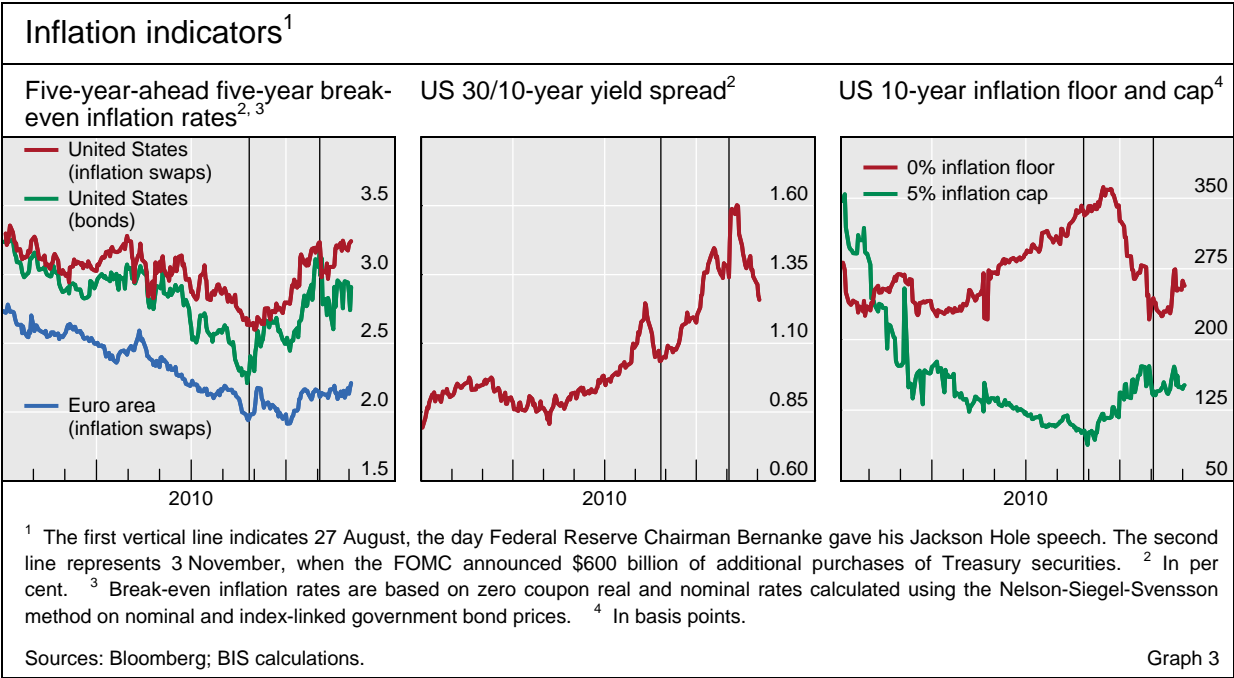
Market indicators of expected inflation in the United States moved in a way consistent with expectations of higher inflation between late August and early November. Although nominal yields declined as further Treasury purchases were priced in, real yields on inflation-linked bonds fell by substantially more as break-even inflation rates increased. In particular, the five-year forward break-even rate five years ahead – a standard measure of long-term inflation expectations – rose by almost 100 basis points between late

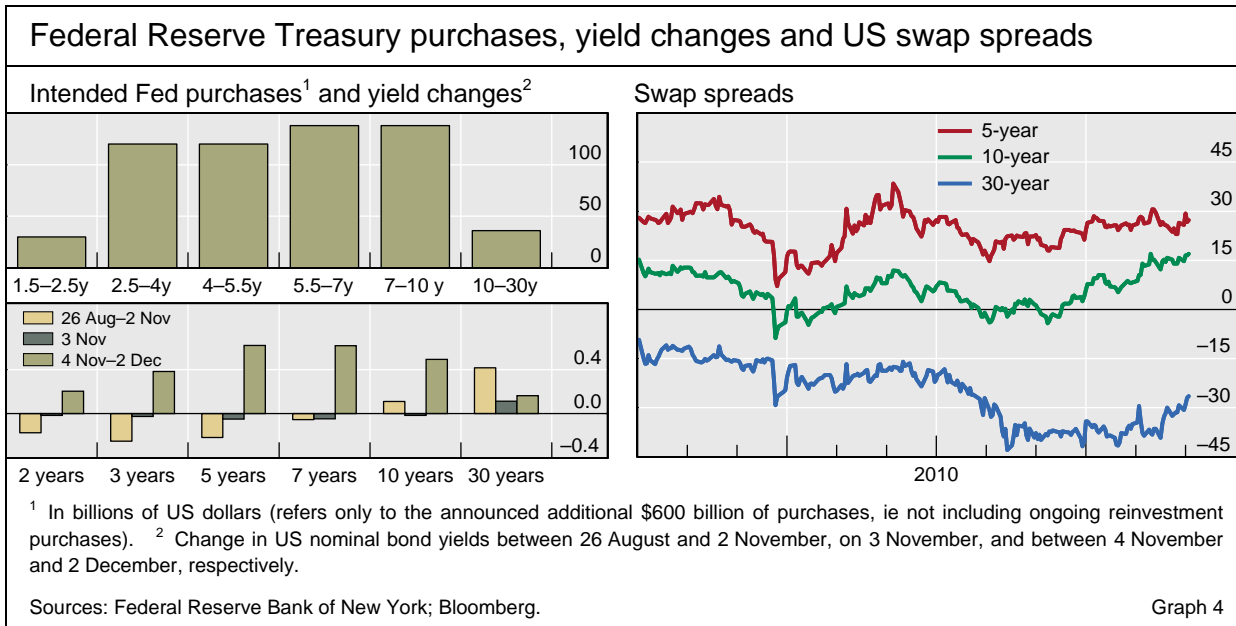
August and early November to over 3% (Graph 3, left-hand panel). This increase contrasted with developments in the euro area, where investors did not anticipate further monetary easing. The corresponding euro forward break-even rate edged upwards only some 30 basis points over the same period. Another long-term inflation indicator, namely the spread between US 30-year and 10-year nominal bonds, also signalled higher expected inflation, widening by around 60 basis points (Graph 3, centre panel). Taken at face value, this would indicate that the Fed had raised inflation expectations, even as recent readings of underlying inflation dropped further below the level seen as consistent with its mandate.

Prices in inflation derivatives markets also suggest that concerns about deflation in the United States began to abate from around September onwards. For example, the price of a US 10-year 0% inflation floor, which had been trending upwards since April, fell back significantly in the course of September and October (Graph 3, right-hand panel). This instrument pays off if the US CPI falls in any of the next 10 years, and is therefore seen as less valuable as the likelihood of deflation decreases. At the same time, prices of derivatives that pay off in case of high rates of inflation climbed after having declined slowly in previous months. The price of a 10-year 5% inflation cap, for instance, rose by about 50% in September and October, indicating that investors saw greater value in an instrument that would pay off if consumer prices were to rise by more than 5% in any of the coming 10 years. As such, this was an indication that market participants considered that the likelihood of high inflation rates – while still small – had increased.

... and deflation concerns dissipate

Bond yields moved little immediately following the widely anticipated announcement on 3 November that the Federal Reserve would extend its Large-Scale Asset Purchases (LSAP) programme and purchase a further \$600 billion of longer-term Treasury securities. Most of the Fed’s intended purchases (86%) were earmarked to take place in the 2½- to 10-year segment





(Graph 4, top left-hand panel). Yields in this range had fallen in the weeks leading up to the announcement, as investors correctly anticipated much of the maturity concentration of the Fed's purchases, but also as a result of growing expectations that the near zero policy would be extended further (Graph 4, bottom left-hand panel). However, market participants appear to have overestimated the Fed purchases at the very long end of the yield curve. As it turned out, only 4% of the purchases were planned for the 17- to 30-year maturity segment, and consequently the 30-year bond yield rose by more than 10 basis points on the day of the FOMC announcement. The diverging effects along the Treasury curve were also evident from swap spreads, with short- to medium-term spreads rising over September–October in contrast to the 30-year spread (Graph 4, right-hand panel).

In the weeks following the Fed's LSAP announcement, much of the yield declines and some of the other asset price effects seen in the lead-up to the announcement were undone (Graph 4, bottom left-hand panel, and Graphs 1–3). In part, this was probably due to profit-taking in an environment where LSAP-related trades had been put on en masse. Some better than expected macroeconomic data in November contributed too. The rise in yields also appears to have reflected a downward revision by investors of the likelihood that the Fed would introduce additional LSAPs or other unconventional easing measures. This change in mood, in turn, came as concerns were voiced about possible unintended consequences of such policy moves.

Whereas expectations of easing monetary policy in major advanced economies helped lift prices of risky assets, investors had to digest news that monetary policy was being tightened in a number of major emerging economies. Having rebounded quickly after the crisis and continued to grow briskly thereafter, many of these countries were seeing growing inflationary pressures. The Reserve Bank of India increased the repo rate for the sixth

Yields rise again in November

Emerging economies tighten policy

Negative real yields on US Treasury Inflation-Protected Securities (TIPS)

On 25 October 2010, the US Treasury for the first time ever issued TIPS[®] at a negative real yield. TIPS are bonds that pay coupons on a principal that is indexed to the US CPI, and that pay a principal at maturity that compensates for increases in the CPI since the bond was issued. At the auction, investors bought \$10 billion of 4½-year TIPS bonds, for which they paid \$105.51 for \$100.00 principal and a 0.50% coupon. The pricing of the bonds implied that the real yield to maturity was –0.55% annually, meaning that investors who bought this issue were expecting to lose over ½% annually on their investment in real terms.[®] Why did investors accept this deal?

The high prices paid at the auction were in line with the prevailing pricing in the TIPS market, where real yields had already fallen well below zero, in particular for short- to medium-term bonds (Graph A, left-hand panel). While real yields, together with nominal yields, had been falling throughout much of 2010, the slide accelerated following Federal Reserve Chairman Bernanke’s Jackson Hole speech on 27 August, which investors saw as signalling additional Fed Treasury purchases (Large-Scale Asset Purchases (LSAPs)). In the two months after this event, the fall in real yields outpaced the decline in the nominal yields, eventually pushing real five-year yields below zero.

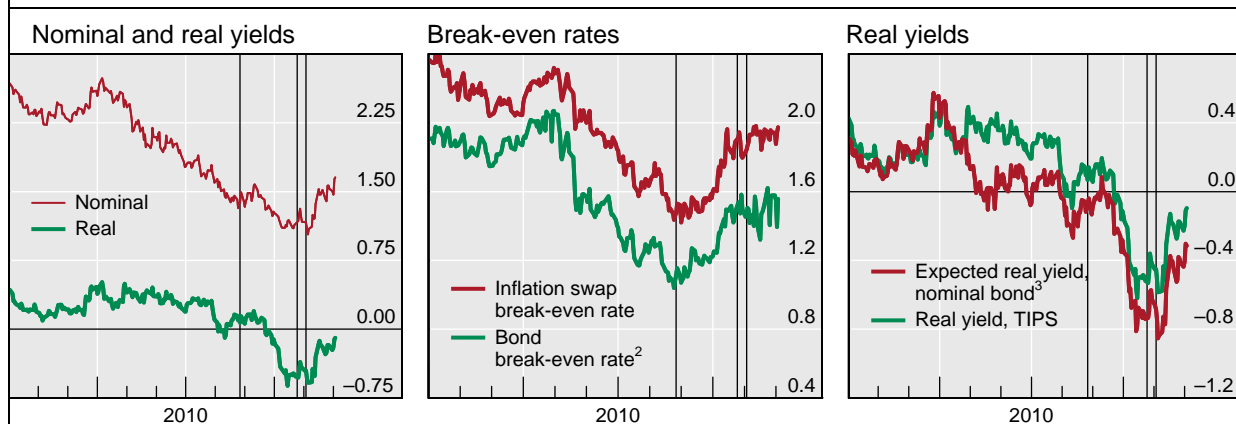
The drop in real yields mainly reflected increasing inflation compensation (expected inflation and inflation risk premium) among investors in September–October (Graph A, centre panel), in line with growing expectations of easier US monetary policy. In an environment where LSAP expectations were placing particular downward pressure on nominal yields, higher inflation expectations or inflation risk premia had to be accommodated by real yields dropping even more.[®]

There was little evidence to suggest that bond market-specific factors (such as bond liquidity considerations) were behind the rise in bond break-even rates. Inflation swap rates rose broadly in parallel with the bond break-evens in September–October.[®] If, instead, changing investor perceptions about the relative liquidity of the nominal and the index-linked bond market segments had been driving developments, the two break-even measures would probably have moved less in sync. The same argument would apply to the possibility that the bond break-even rate could have been “distorted” by expectations of Fed interventions in bond markets.

The negative real yields were also in line with the pricing of nominal bonds. For example, a rough measure of the *expected* real yield on five-year nominal Treasuries, obtained by subtracting the five-year inflation swap rate from the nominal yield, moved essentially in parallel with the real TIPS yield, and was also deeply negative on the day when the aforementioned TIPS auction took place (Graph A, right-hand panel).[®] This too suggests that there was nothing “odd” about the pricing of TIPS bonds around that time.

Five-year Treasury yields and break-even rates¹

In per cent



¹ The first vertical line represents 27 August, the day Federal Reserve Chairman Bernanke gave his Jackson Hole speech. The second line represents 25 October, the date of the TIPS auction discussed in this box. The third line represents 3 November, when the FOMC announced \$600 billion of additional purchases of Treasury securities. ² Based on zero coupon nominal and real yields. ³ Approximated as the nominal five-year Treasury yield minus the five-year inflation swap rate.

Sources: Bloomberg; BIS calculations.

Graph A

The negative real yields also reflected market expectations that future short-term real yields would be negative for some time. According to the standard expectations hypothesis, the yield on a Treasury bond reflects the average future short-term interest rate during the life of the bond plus a term premium component. This applies to nominal as well as real bond yields. With the Fed continuing to signal that it is committed to keeping the nominal fed funds rate close to zero for a prolonged period, short-term real interest rates will be negative for as long as inflation is positive. Hence, abstracting from term premia, TIPS yields should turn negative over maturities where average short-term real rates are expected to remain negative.

An additional factor contributing to higher TIPS prices, and hence lower real yields, is that these bonds incorporate an option-like feature that is valuable in times of high uncertainty about the future path of inflation. First of all, TIPS – in contrast to nominal bonds – offer investors insurance against inflation surprises. In addition, this inflation insurance is asymmetric. While investors are compensated for higher inflation by having the principal indexed to the CPI, the principal is not reduced in case of deflation.^⑥ Hence, TIPS investors benefit from deflation in the same way as nominal bond investors, but they receive the extra benefit of protection from rising inflation.^⑦ Put differently, TIPS have a built-in inflation option with a strike price of 0% inflation. This option, as any option, is particularly valuable when it is at the money (close to the strike price) and when uncertainty (volatility) is high. This essentially characterises the current US situation. It therefore adds further value to TIPS bonds, thereby depressing their yields more.^⑧ Thus, investors accepted a negative real yield in order to protect the principal from inflation while maintaining the option to benefit from possible deflation.

^⑥ These instruments are sometimes also referred to as Treasury Inflation-Indexed Securities (TIIS). ^⑦ This is unless the US CPI were to fall over the period until the maturity of the bond; see below. ^⑧ Investors widely anticipated that the Fed would concentrate almost all of its purchases in the nominal Treasury market. ^⑨ An inflation swap (zero coupon) pays the CPI inflation accrued on a notional value over the relevant maturity of the swap against a fixed payment, which reflects the inflation swap price. ^⑩ On 25 October, the date of the TIPS issue, the five-year nominal yield stood at 1.18% while the five-year inflation swap rate (which is a rough measure of expected inflation over the next five years) was 1.91%, implying an expected real yield on the nominal bond of around -0.73%. ^⑪ This is by construction. The US Treasury will repay the higher of par and the inflation-adjusted principal at maturity. ^⑫ There is still a small disadvantage for TIPS holders in case of deflation over the life of the bond, compared with holders of nominal bonds, in that the deflation floor applies only to the principal, not to the coupons. TIPS coupons are based on the inflation-adjusted principal, even if inflation turns out to be negative. ^⑬ This option is especially valuable for newly issued TIPS, which have not accrued much inflation and for which the principal therefore is close to par. As a result, yields on such bonds tend to be lower than for more seasoned bonds with similar outstanding time to maturity.

consecutive time this year in early November, while the People's Bank of China increased the benchmark deposit and loan rates by 25 basis points in October and announced two further 50 basis point hikes of the renminbi reserve requirement ratio for depository financial institutions in November. Equity indices in Hong Kong and Shanghai dropped sharply in mid-November as news of accelerating consumer prices in China spurred fears of additional policy moves.

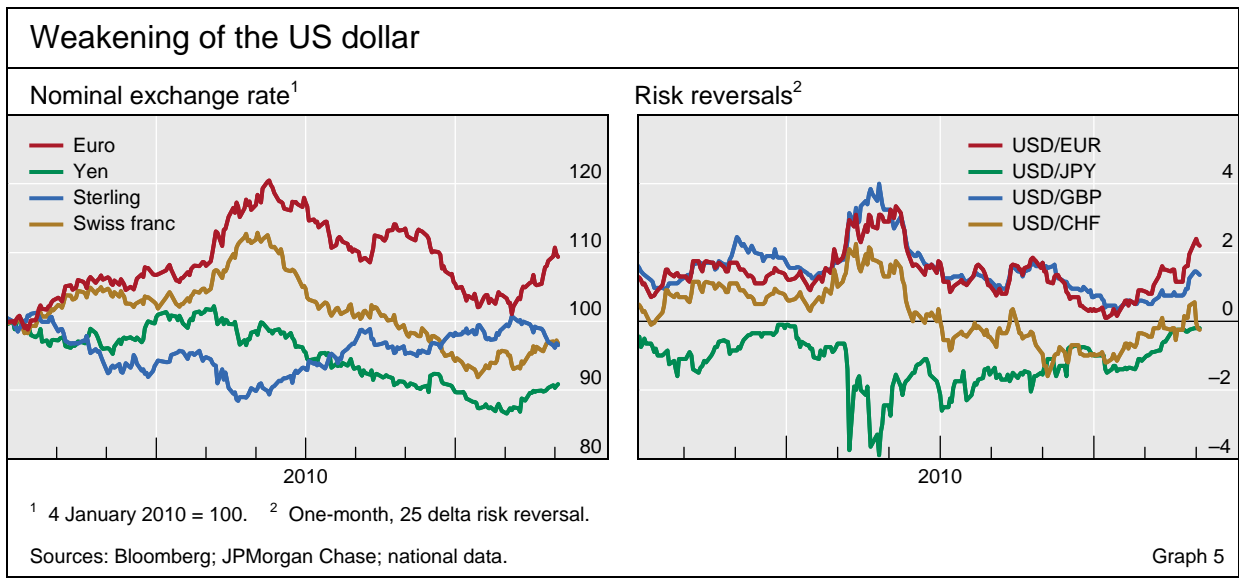
Capital flows increase and the US dollar depreciates

The US dollar depreciates ...

Between late August and early November, expectations of further US monetary easing contributed to a broad-based depreciation of the dollar (Graph 5, left-hand panel). As the dollar weakened, several countries, including China, Chinese Taipei, Japan and Korea, intervened in foreign exchange markets to avoid further currency appreciation.

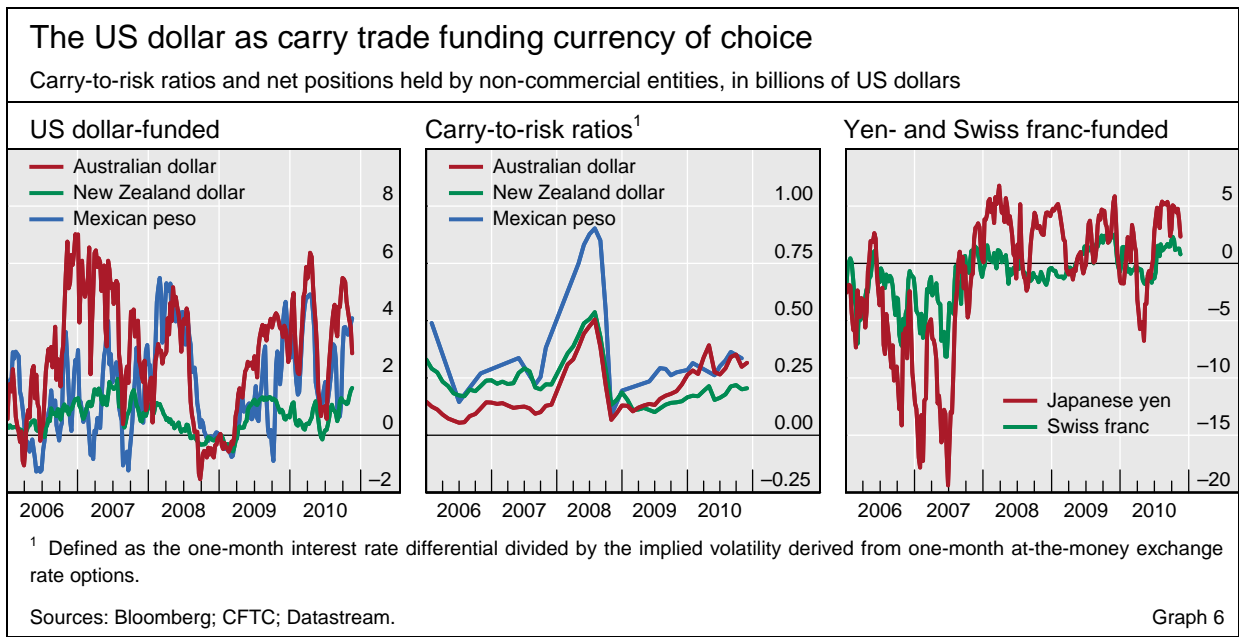
... and becomes the carry trade funding currency of choice

The low US interest rates combined with almost unidirectional expected exchange rate moves made the dollar the new funding currency of choice for FX carry trades. This can be seen from the price of risk reversals for the US



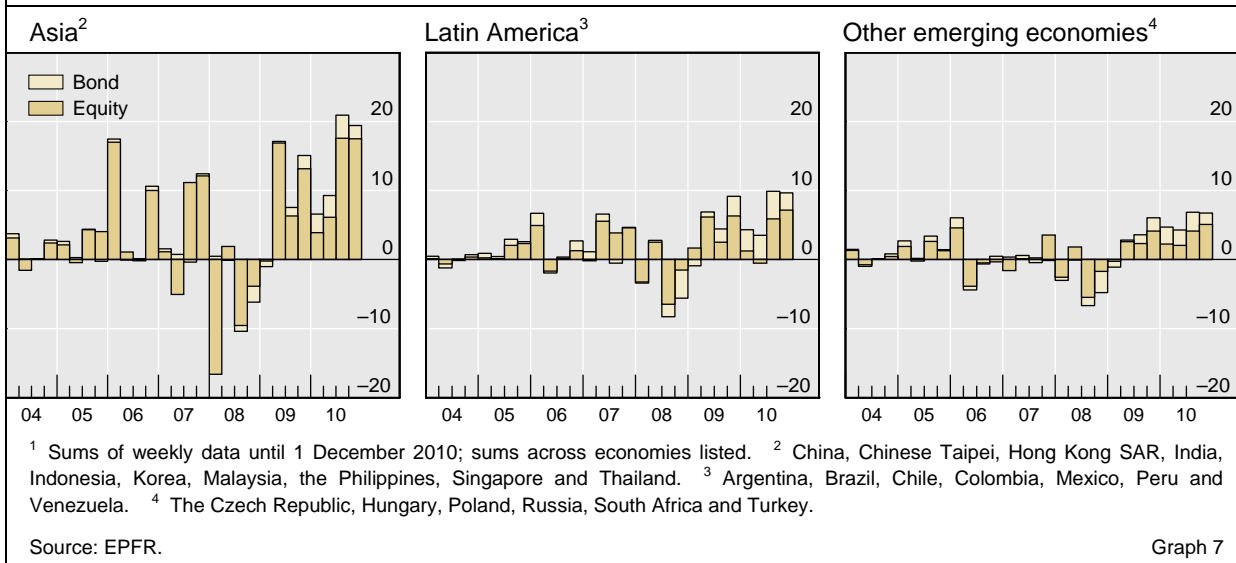
dollar against the major currencies. Risk reversals are defined as the price differential for two equivalently out-of-the-money options. They thus reflect option-market participants' relative willingness to hedge against appreciation and depreciation of the target currency, yielding a rough estimate of the skew (asymmetry) of the expected exchange rate movements. The risk reversal price for the period between late August and early November (Graph 5, right-hand panel) broadly confirmed that investors were willing to pay more for an out-of-the-money option that paid out if the dollar depreciated than one that paid out if the dollar appreciated.

Foreign exchange carry trade volumes are notoriously difficult to track due to lack of data. This partly reflects the fact that carry trades are often implemented through derivatives such as cross-currency positions in futures, forwards and swaps, for which reliable quantitative information is scarce. One can, however, obtain a sense of the direction of cross-currency carry trades using information on net positioning by non-commercial entities from the



Capital flows into emerging markets¹

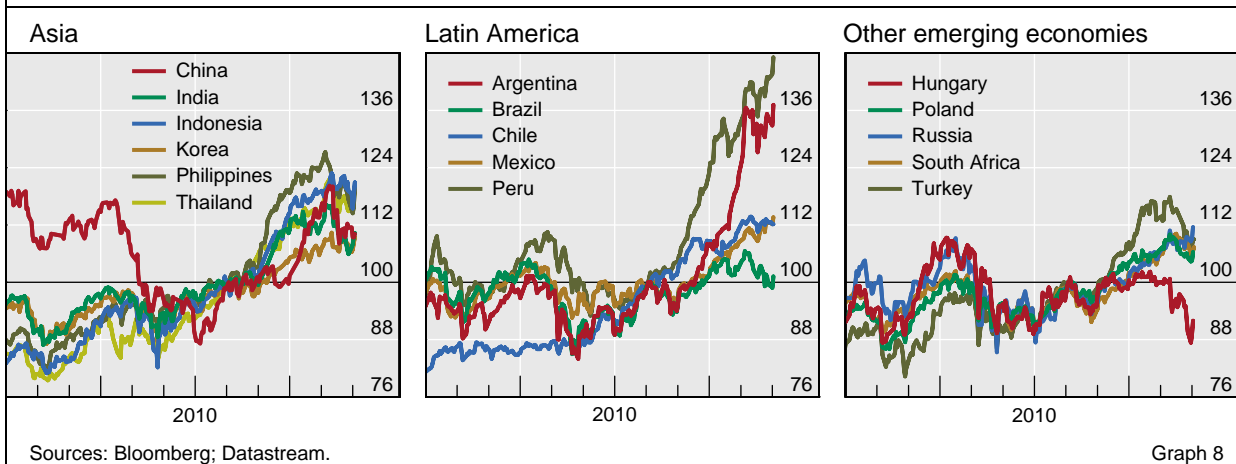
In billions of US dollars

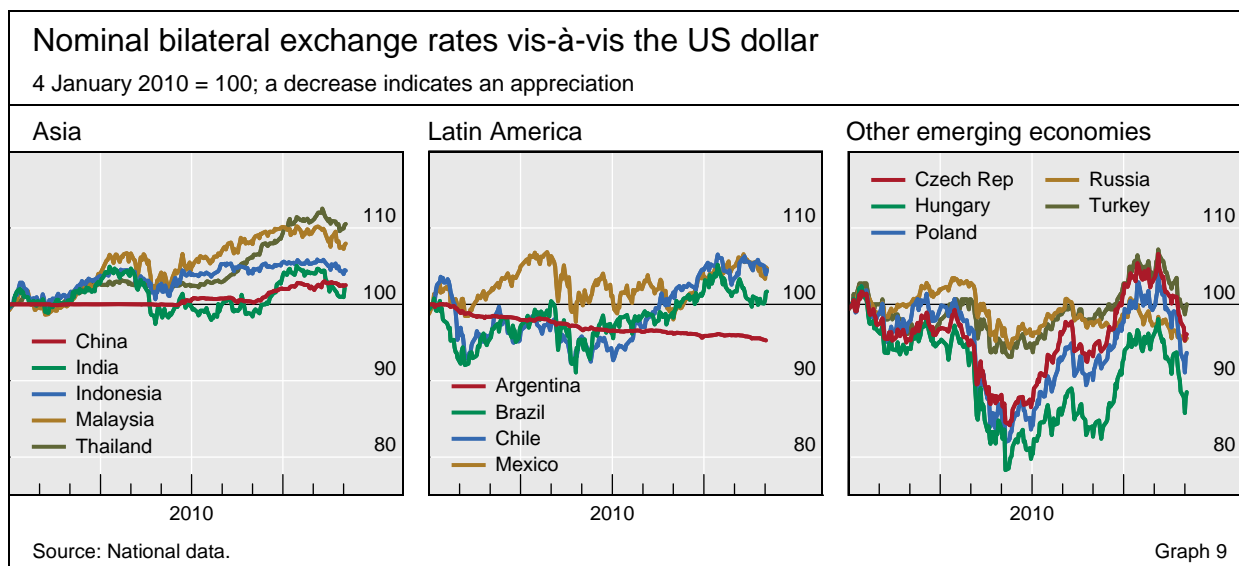


Chicago currency futures markets. Non-commercial entities are those that do not have business in the underlying currency of the derivatives contract, including hedge funds and other non-bank financial institutions. This commonly used indicator clearly suggests that net short positions in US dollars increased from late August onwards, although they reversed somewhat as from early November. Target currencies included the Australian dollar, New Zealand dollar and Mexican peso. Positions involving the Australian dollar, in particular, reached levels last seen in 2006 and early 2007 (Graph 6, left-hand panel). This pattern is broadly in line with the relatively high forward-looking market-implied carry-to-risk ratios (Graph 6, centre panel). Rising net long positions in the yen and the Swiss franc, which have historically been the preferred carry trade funding currencies, were also consistent with expectations of US dollar weakening (Graph 6, right-hand panel).

Emerging market equity prices

In local currency; 2 August 2010 = 100





Between late August and early November, expectations of continued low growth and further monetary easing in the United States also led to an acceleration of capital inflows into higher-growth emerging market economies. Asia, in particular, saw a significant increase in equity inflows (Graph 7, left-hand panel). Latin America and other emerging market economies too experienced significant inflows into both equities and bonds (Graph 7, centre and right-hand panels). The acceleration of capital inflows was clearly reflected in higher equity prices in a number of emerging market countries (Graph 8) but was also visible in bond prices.

Capital flows into emerging economies increase ...

... leading to higher equity and bond prices ...

Continued capital inflows were accompanied by rapid appreciation of several emerging market currencies against the US dollar between late August and early November (Graph 9). Appreciation pressures were stronger for countries with high growth prospects and larger interest rate differentials. Appreciation was generally smaller for the currencies of countries that continued to manage their exchange rate fully or partially against the US dollar. As a result, appreciation was less pronounced in Asia, and China in particular.

Several countries resisted, or at least tried to moderate, rapid nominal exchange rate appreciation by a variety of means. These included further reserve accumulation, increased issuance of local currency bonds to foreign investors, and making domestic currency markets less attractive, inter alia by imposing higher taxes on foreign bond investors. Brazil increased its transaction tax on foreign fixed income investments in two steps from 2% to 6% during October, interrupting the upward trend of the Brazilian real compared with other regional currencies. The reduced attractiveness of real-denominated assets for foreign investors was also reflected in a significant spread widening between on- and offshore deposit rates. Thailand reduced the attractiveness of foreign portfolio investment by removing tax breaks for foreign investors on domestic bonds. In mid-November, Korea announced that it would reimpose a 14% tax on foreign investors' returns on government bond investments.

... and currency appreciation

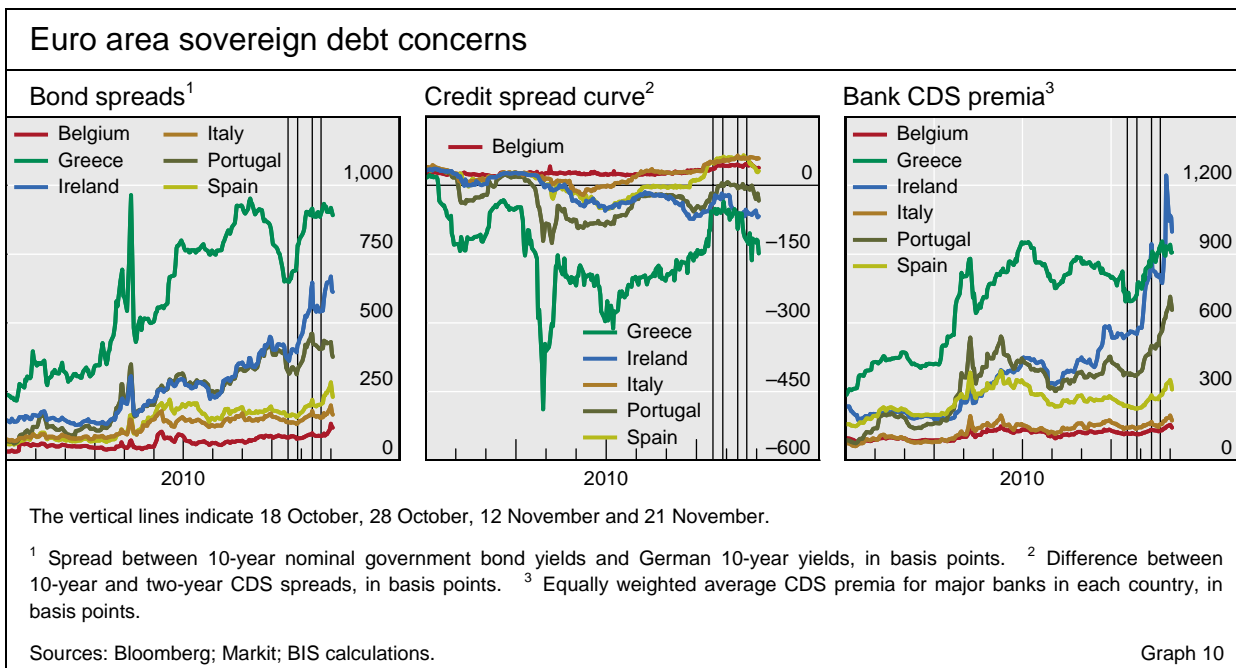
Euro area sovereign risk concerns resurface

Sovereign risk worries return ...

Concerns about credit risk in a number of economies in the euro area surged in late October and November. Irish government bonds came under particularly strong pressure, but Greek, Portuguese, Spanish and later Belgian and Italian government bonds were also affected (Graph 10, left-hand panel). Sovereign yield spreads between these countries and Germany continued to reflect concerns about their public finances and, in the case of Ireland, the budgetary impact of the banking problems. In this atmosphere, proposals to establish a crisis resolution mechanism that could impose losses on bond holders in situations where governments face financial distress contributed to a sharp increase in spreads and ultimately to a support package for Ireland.

... partly on the prospect of government bond haircuts

The surge in sovereign credit spreads began on 18 October, when the French and German governments agreed to take steps that would make it possible to impose haircuts on bonds should a government not be able to service its debt. Spreads widened further after a European Council statement on 28 October made it clear that other EU governments had agreed to the proposal. In the following two weeks, Irish spreads went up by more than 200 basis points and the CDS spread curve inverted (Graph 10, centre panel), indicating that market participants now saw a more immediate risk of a negative credit event.² To forestall further spread increases, the finance ministers of several European countries on 12 November reiterated that burden-sharing would apply only to bonds issued after 2013. This announcement brought merely a temporary calm. Focus quickly turned to the Irish banking system, which had grown more reliant on the central bank as repo market loans using Irish government bonds as collateral had become



² Credit events specified by CDS contract clauses include default on scheduled payments and involuntary debt restructurings.

prohibitively expensive. Irish banks' funding problems were clearly reflected in their credit spreads, which surpassed those of Greek banks (Graph 10, right-hand panel).

In the weeks that followed, the turbulence spread to several other euro area countries. Following intense investor and financial press speculation, policymakers responded by announcing on Sunday 21 November that Ireland would receive financial assistance in order to safeguard financial stability in the European Union as a whole. The support would be given in the context of a joint EU and IMF programme financed via the European Financial Stabilisation Mechanism (EFSM) and the European Financial Stability Facility (EFSF), supplemented by loans from other EU member states. Investors reacted positively to the announced support package, but the respite was short-lived due to a number of new developments. First, disagreements within the Irish coalition government resulted in an Irish election being called for early 2011. Second, on 24 November Standard & Poor's downgraded Irish government debt from AA- to A with a negative outlook, prompting further increases in Irish credit spreads. With no obvious new information as the trigger, investor attention turned first to Portugal and Spain and later to Belgium and Italy. Government bond and CDS spreads in those countries reached new highs.

Markets stabilised somewhat in early December in anticipation of possible ECB support. On 2 December, the ECB announced that it would continue to provide exceptional liquidity support via three-month financing at fixed rates with full allotment until April 2011. According to market commentary, the ECB also initiated bond purchases at larger than usual trade sizes on that same day. Yields fell by around 50 and 25 basis points on 10-year Irish and Portuguese bonds, respectively, in a just a few hours.

The impact of the Irish rescue package is short-lived ...

... as attention shifts to Portugal, Spain and later Belgium and Italy

Highlights of international banking and financial market activity

The BIS, in cooperation with central banks and monetary authorities worldwide, compiles and disseminates several datasets on activity in international banking and financial markets. The latest available data on the international banking market refer to the second quarter of 2010. The discussion on international debt securities and exchange-traded derivatives draws on data for the third quarter of 2010. OTC derivatives market statistics are available up to mid-2010.

The international banking market¹

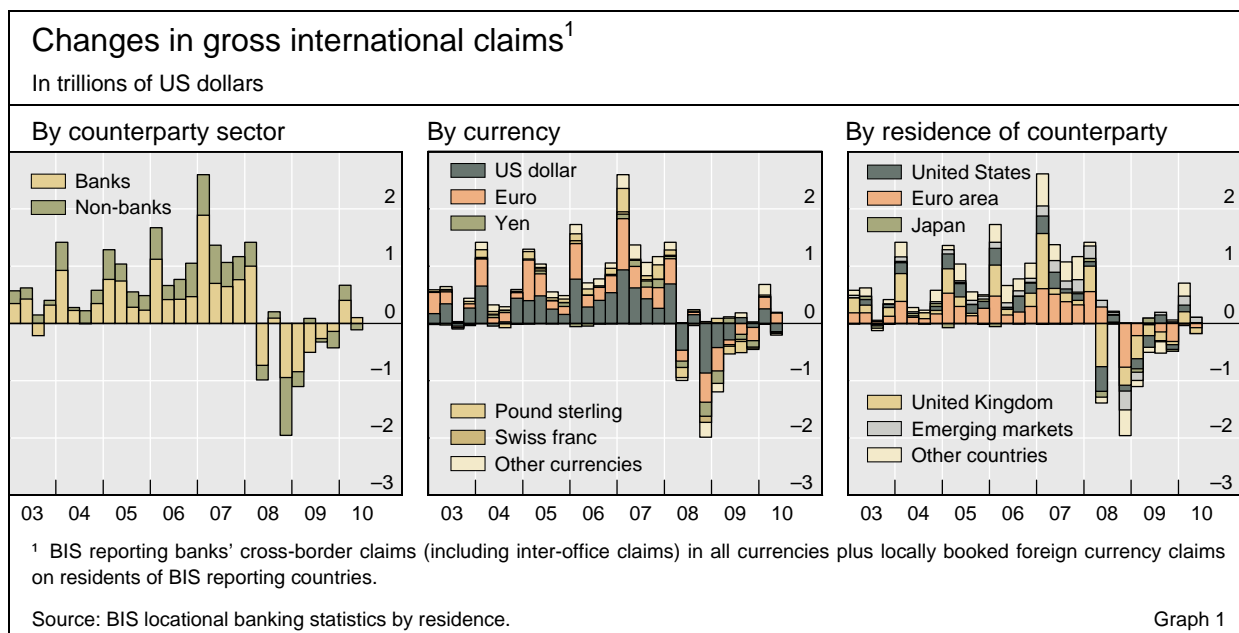
The international balance sheets of BIS reporting banks, which in the first three months of this year had expanded for the first time since the start of the crisis, ceased to grow during the *second quarter of 2010*. That said, at a more disaggregated level, several trends that had characterised international bank lending over the past few quarters remained in place. Banks continued to direct funds towards the faster-growing emerging markets at the expense of slower-growing mature economies. Just as in the previous couple of quarters, lending patterns diverged considerably across the four emerging market regions. In particular, banks continued to increase their exposures to the buoyant economies of Asia-Pacific and Latin America-Caribbean, but cut cross-border lending to residents of the slower-growing emerging Europe and Africa-Middle East regions. Amidst the turmoil in global financial markets triggered by concerns about the fiscal situation in Greece, Ireland, Portugal and Spain, foreign claims on these four countries decreased during the second quarter.

Growth in international lending comes to a halt²

The size of the aggregate international balance sheet of BIS reporting banks remained virtually unchanged during the second quarter of 2010. The marginal \$7 billion (0.02%) shrinkage in overall claims, which followed a \$670 billion expansion in the first three months of the year, was the net result of a

¹ Queries concerning the banking statistics should be addressed to Stefan Avdjiev.

² The analysis in this and the following subsection is based on the BIS locational banking statistics by residence. All reported flows in international claims have been adjusted for exchange rate fluctuation and breaks in series.



\$109 billion (0.9%) decline in claims on non-banks and a \$102 billion (0.5%) increase in interbank claims (Graph 1, left-hand panel).

Internationally active banks continued to direct funds towards the faster-growing emerging market economies (Graph 1, right-hand panel). International claims on the residents of that group of countries expanded by \$93 billion (3.1%). By contrast, claims on US residents remained virtually unchanged and those on residents of the euro area declined slightly (by \$74 billion or 0.7%), a contraction largely driven by a \$100 billion fall in the claims of euro zone banks. Claims on residents of the United Kingdom also shrank (by \$101 billion or 1.6%).

International claims on fast-growing economies increase

Claims denominated in euros and in US dollars moved in opposite directions for the first time since the third quarter of 2009 (Graph 1, centre panel). Even though, as just mentioned, overall claims on the euro area declined during the period, euro-denominated claims on its residents actually rose by \$89 billion (1.3%), contributing to a \$180 billion (1.5%) increase in aggregate euro-denominated claims. Yen-denominated claims also increased, by \$15 billion (1.2%). Conversely, claims denominated in US dollars declined by \$142 billion (1.0%). Claims denominated in Swiss francs and in pounds sterling also contracted, falling by \$19 billion (2.9%) and \$13 billion (0.7%), respectively.

Cross-border claims on residents of emerging markets continue to expand

BIS reporting banks increased their cross-border claims on residents of emerging market economies for a fifth consecutive quarter (Graph 2). Almost all of the \$53 billion (2.1%) expansion was due to a 4.3% increase in interbank claims. Claims on non-banks also expanded, but at a very modest pace (\$0.6 billion or 0.1%). As in the previous couple of quarters, there was a clear divergence in lending patterns across the four regions. Banks continued to increase their exposures to the more dynamic economies of Asia-Pacific and

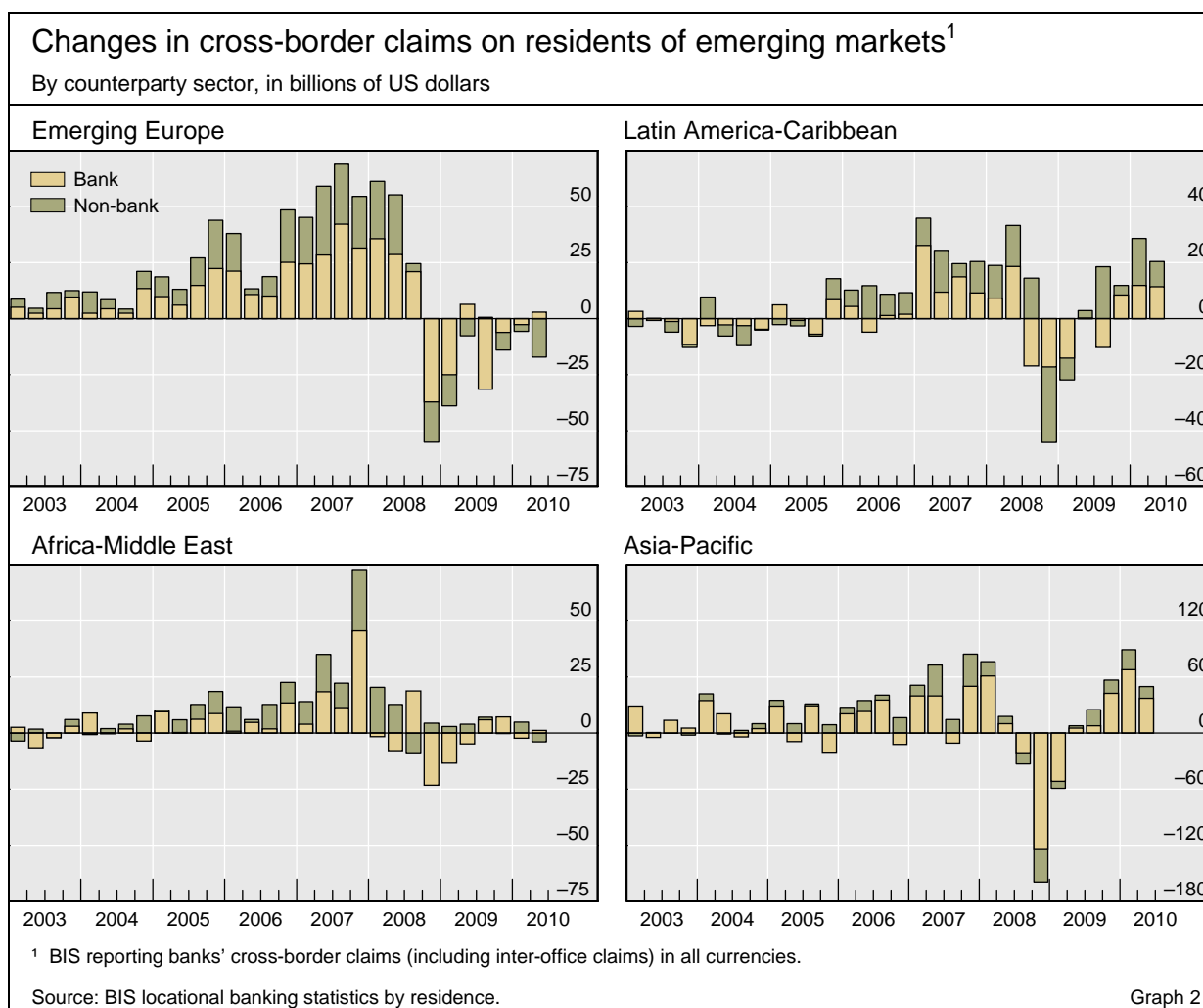
Latin America-Caribbean, but reduced cross-border lending to residents of the slower-growing emerging Europe and Africa-Middle East regions.

Claims on Asia-Pacific expand

Once again, Asia-Pacific was the region that saw the largest increase in cross-border lending to its residents. The \$50 billion (5.8%) overall expansion in cross-border claims reflected a \$37 billion (6.8%) increase in interbank claims and a \$13 billion (4.0%) rise in claims on non-banks. Cross-border claims on China rose by \$28 billion (13%), the largest absolute increase at the individual country level in the region. Claims on India (\$9.5 billion or 6.3%), Chinese Taipei (\$8.2 billion or 14%) and Korea (\$5.8 billion or 2.8%) also went up significantly. India was the only one of the above countries for which claims on non-banks increased (\$7.8 billion or 12%) by more than those on banks (\$1.7 billion or 2.0%). Meanwhile, cross-border claims on Thailand grew by \$2.2 billion (8.0%) despite political unrest in the country during the quarter.

Cross-border lending to Brazil leads growth in claims on Latin America-Caribbean

Cross-border claims on Latin America and the Caribbean expanded for a fifth consecutive quarter. The growth in claims on the region, unlike that in Asia-Pacific, which was largely driven by interbank claims, was fairly balanced across sectors. The \$20 billion (4.7%) overall increase was roughly evenly split between an \$11 billion (8.8%) rise in interbank claims and a \$9.0 billion (3.0%) increase in claims on non-banks. Most of the new funds went to residents of Brazil, which recorded a \$22 billion (12%) inflow. Claims on banks in that



country grew by \$8.7 billion (12%) and those on non-banks by \$13 billion (12%). By contrast, claims on non-banks in Mexico shrank by \$4.0 billion (4.8%), while cross-border lending to residents of Argentina contracted for the seventh time in the last eight quarters (by \$0.2 billion or 1.1%).

Against the background of continuing sluggish economic activity in emerging Europe, claims on the region shrank for the seventh quarter in a row. Although claims on banks located in the area grew by \$2.9 billion (0.8%), that increase was more than offset by a \$17 billion (4.5%) drop in claims on non-banks. At the individual country level, lending to Russia declined the most (\$7.3 billion or 5.4%). Claims on Poland, which had increased steadily for the past four quarters notwithstanding the overall decline in international lending to the region, fell by \$3.8 billion (3.2%). Claims on Estonia also declined (by \$0.7 billion or 4.4%), despite the fact that during the quarter the ECB granted the country approval to join the euro area starting in January 2011. Meanwhile, cross-border claims on Hungary increased by \$0.5 billion (0.5%) in the second quarter of 2010, despite statements by officials from the newly elected government that the country's fiscal situation was worse than previously believed.

Claims on emerging Europe contract further

BIS reporting banks' foreign exposures to Greece, Ireland, Portugal and Spain³

As of the end of the second quarter of 2010, the total consolidated foreign exposures⁴ (on an ultimate risk basis) of BIS reporting banks to Greece, Ireland, Portugal and Spain stood at \$2,281 billion (Table 1). At \$1,613 billion, *foreign claims* represented slightly over 70% of that amount. The remaining \$668 billion was accounted for by the positive market value of derivative contracts, guarantees extended and credit commitments (ie other exposures).

For each of the four countries, cross-border claims substantially exceeded local claims. The weighted average share of cross-border claims in total foreign claims on the above group of countries was 70%, with local claims accounting for the remaining 30%. The proportion of cross-border claims ranged from 60% for Portugal to 76% for Ireland. The corresponding shares for Greece and Spain were 64% and 69%, respectively.

How did foreign claims on Greece, Ireland, Portugal and Spain change during the second quarter? As the consolidated banking statistics do not include a currency breakdown, it is not possible to produce precise estimates. Nevertheless, on the (admittedly imperfect) assumption that all foreign claims on these countries are denominated in euros, the quarter saw a combined decline of \$107 billion (Graph 3). This amount is considerably smaller than the \$276 billion contraction that would be obtained by simply taking the difference

US dollar appreciation overstates actual decline in claims

³ The analysis in this subsection is based on the BIS *consolidated* international banking statistics on an *ultimate risk* basis. Since this dataset does not contain a currency breakdown, we adjust all flow variables for exchange rate fluctuations by assuming that all exposures to residents of Greece, Ireland, Portugal and Spain are denominated in euros.

⁴ *Total foreign exposures* consist of two main components: *foreign claims* and *other exposures*. In turn, *foreign claims* consist of cross-border claims and local claims in all currencies; *other exposures* consist of the positive market value of derivative contracts, guarantees extended and credit commitments.

between the outstanding stocks (measured in US dollars) at the respective ends of the first two quarters of 2010. This suggests that most of the latter

Foreign exposures to Greece, Ireland, Portugal and Spain, by bank nationality											
End-Q2 2010; in billions of US dollars											
	Type of exposures	Bank nationality									
		DE ¹	ES ²	FR ³	IT	OEA ²	GB	JP	US	ROW	Total
Greece	Public sector	22.6	0.6	17.8	2.7	15.0	2.9	1.0	1.5	1.0	65.0
	+ Banks	4.7	0.0	0.8	0.9	1.3	1.6	0.5	1.2	1.2	12.3
	+ Non-bank private	9.6	0.2	38.7	1.7	12.4	7.6	0.7	4.5	3.8	79.2
	+ Unallocated sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	= Foreign claims	36.8	0.9	57.3	5.3	28.8	12.1	2.2	7.2	6.1	156.6
	+ Other exposures ⁴	28.6	0.5	25.7	1.6	2.8	4.8	0.1	29.0	2.4	95.5
	= Total exposures	65.4	1.3	83.1	6.8	31.6	17.0	2.3	36.2	8.5	252.1
Ireland	Public sector	3.4	0.2	6.1	0.8	3.2	3.5	1.6	1.5	1.8	22.2
	+ Banks	47.5	3.3	18.9	2.9	8.8	31.1	1.6	19.8	11.7	145.7
	+ Non-bank private	87.7	10.5	18.5	10.7	44.7	97.0	17.6	35.9	26.1	348.5
	+ Unallocated sector	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	1.0	1.5
	= Foreign claims	138.6	14.0	43.6	14.6	56.9	131.6	20.8	57.2	40.5	517.9
	+ Other exposures ⁴	47.9	3.7	33.7	10.0	7.3	55.9	1.2	51.0	18.2	228.9
	= Total exposures	186.4	17.7	77.3	24.7	64.2	187.5	22.0	108.3	58.8	746.8
Portugal	Public sector	7.4	8.1	14.2	0.8	7.5	2.3	1.2	0.8	1.6	44.0
	+ Banks	17.1	7.0	13.8	2.5	5.0	5.6	0.3	1.1	0.8	53.2
	+ Non-bank private	12.7	62.7	13.3	1.3	6.6	14.4	0.8	1.4	1.5	114.6
	+ Unallocated sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	= Foreign claims	37.2	77.8	41.3	4.6	19.1	22.2	2.2	3.3	4.0	211.8
	+ Other exposures ⁴	7.0	20.6	7.2	3.0	2.1	6.8	0.4	32.3	1.5	80.8
	= Total exposures	44.3	98.3	48.5	7.6	21.2	29.0	2.6	35.6	5.5	292.6
Spain	Public sector	26.2	...	40.4	2.5	16.2	9.2	8.8	4.5	3.4	111.2
	+ Banks	81.1	...	50.2	9.2	48.2	28.8	4.4	23.8	9.6	255.3
	+ Non-bank private	74.4	...	74.0	13.9	87.2	66.7	8.7	24.2	10.5	359.5
	+ Unallocated sector	0.0	...	0.0	0.2	0.1	0.0	0.0	0.0	0.4	0.7
	= Foreign claims	181.6	...	164.6	25.9	151.7	104.7	21.9	52.5	23.9	726.7
	+ Other exposures ⁴	34.9	...	36.7	11.4	12.4	31.8	3.2	120.4	12.3	263.0
	= Total exposures	216.6	...	201.3	37.2	164.1	136.5	25.1	172.8	36.2	989.8

DE = Germany; ES = Spain; FR = France; IT = Italy; OEA = other euro area; GB = United Kingdom; JP = Japan; US = United States; ROW = rest of the world.

¹ Foreign claims of German banks on the four countries are on an immediate borrower basis. ² Exposures of banks headquartered in the respective country are not included, as these are not foreign exposures. ³ Exposures of French banks to the four countries are currently under review and are subject to revisions. ⁴ Positive market value of derivative contracts, guarantees extended and credit commitments.

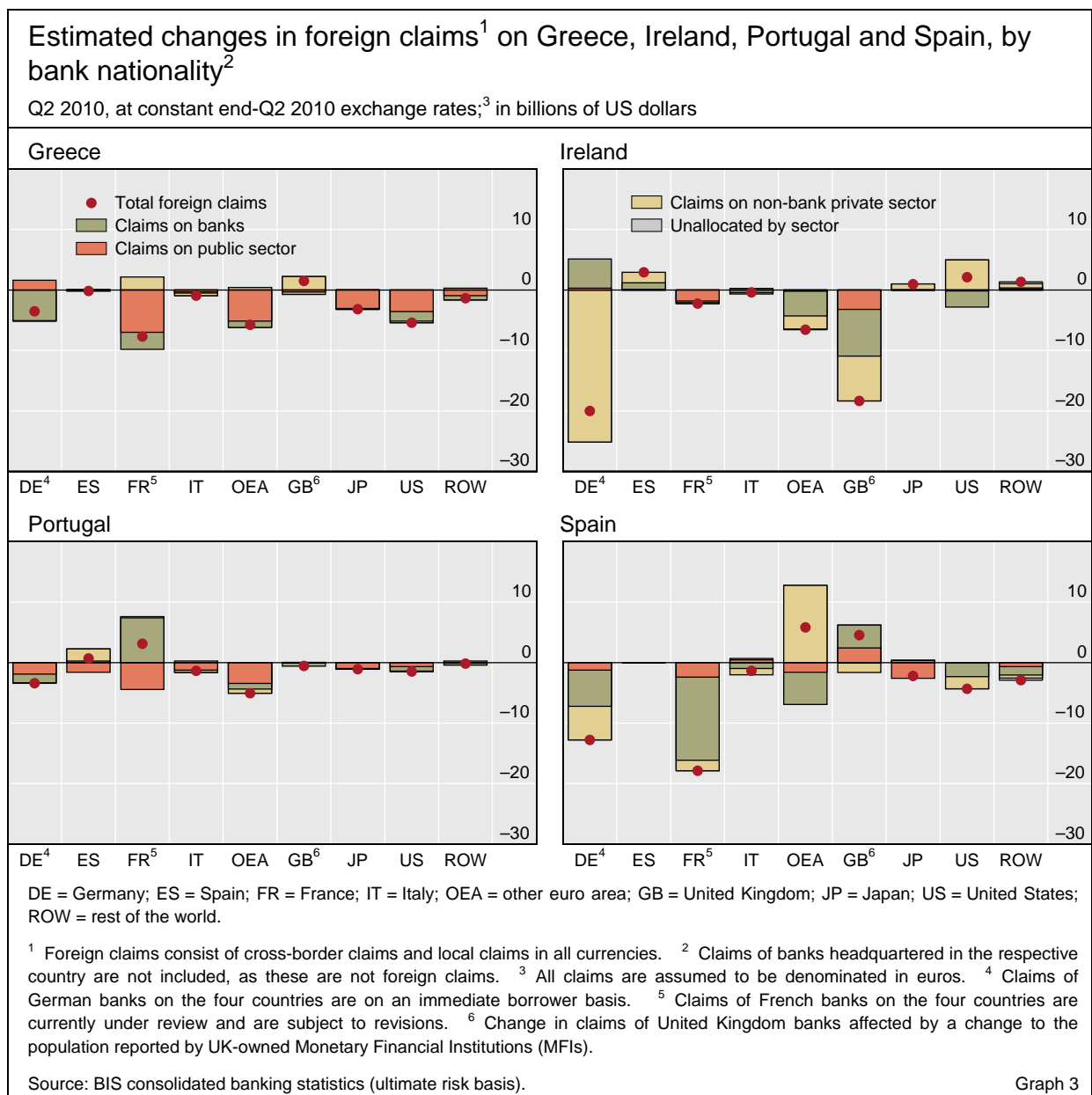
Source: BIS consolidated banking statistics (ultimate risk basis). Table 1

decline reflects the significant appreciation of the US currency versus the euro during the period.

The exchange rate adjusted fall in foreign claims on these four countries affected all sectors, although to differing degrees. Claims on the public sector shrank the most, in both absolute (\$44 billion) and relative (14%) terms.⁵ Foreign lending to banks also contracted considerably (by \$43 billion or 7.6%). Finally, claims on the non-bank private sector recorded the smallest decline (\$20 billion or 2.1%), despite accounting for the largest share of the stock of foreign claims.

The most significant exchange rate adjusted declines occurred in BIS reporting banks' exposures to Greece. Total foreign claims fell by \$27 billion.

Foreign claims on Greece contract



⁵ The box on page 19 outlines the main sources of discrepancies between the BIS data on public sector foreign claims and the CEBS data on sovereign exposures.

Why do the BIS data on public sector foreign claims differ from the CEBS data on sovereign exposures?

In July 2010, as part of the EU-wide stress testing exercise, the Committee of European Banking Supervisors (CEBS) asked the 91 participating banks to disclose their sovereign exposures to EEA countries. Since then several media outlets have attempted to compare the CEBS stress testing numbers with the figures on public sector foreign claims obtained from the BIS consolidated banking statistics (on an ultimate risk basis). As noted in the *CEBS Statement on the disclosure of sovereign exposures in the context of the 2010 EU-wide stress testing exercise*,^① the data obtained from these two sources are not directly comparable.

There are several potential sources of variation in the numbers derived from the two datasets. First, the two reporting populations are not the same, as more banks report to the BIS consolidated banking statistics than took part in the CEBS stress testing exercise. Second, in their individual disclosures accompanying the publication of the stress test results, banks were allowed to deduct offsetting short positions (where the immediate counterparty was the same sovereign) from the gross exposures recorded on their trading book. This is generally not the case when banks report their positions for the BIS consolidated banking statistics. Third, the numbers disclosed as part of the CEBS stress testing exercise are on an immediate borrower basis. The BIS consolidated banking statistics contain data on both an immediate borrower basis and an ultimate risk basis, but the figures that are most often referred to in the context of sovereign debt exposures, including all of the public sector foreign claims numbers in this section of the *BIS Quarterly Review*, are on an ultimate risk basis.^② Fourth, the two datasets also differ in the levels of consolidation that they use in order to assign the holdings of various banking units across national jurisdictions.

^① The CEBS statement is available at [www.c-ebs.org/documents/News---Communications/2010/CEBS-2010-194-rev2-\(Statement-on-disclosures-of-so.aspx\)](http://www.c-ebs.org/documents/News---Communications/2010/CEBS-2010-194-rev2-(Statement-on-disclosures-of-so.aspx). ^② For a discussion of the reasons for using the BIS consolidated banking statistics on an ultimate risk basis (as opposed to those on an immediate borrower basis) when measuring banking systems' exposures to specific public sectors, see Box 1 ("Measuring banking systems' exposures to particular countries") in the highlights section of the June 2010 *BIS Quarterly Review*, page 20.

Claims on banks in the country shrank by \$12 billion, while those on the public sector fell by \$19 billion. These declines were partially offset by a \$4.2 billion increase in claims on the non-bank private sector.

Virtually all the major banking systems included in Graph 3 reported exchange rate adjusted declines in their foreign claims on Greece during the second quarter of 2010.⁶ The foreign claims of French banks on residents of Greece decreased the most (by \$7.7 billion). The declines recorded by US (\$5.4 billion), German (\$3.5 billion) and Japanese banks (\$3.2 billion) also contributed significantly to the overall contraction in foreign claims on the country.

The international debt securities market⁷

Net issuance
bounces back ...

Activity in the primary market for international debt securities rebounded in the *third quarter of 2010*, reversing most of the sharp drop that occurred during the

⁶ The relatively small increase in the foreign claims of UK banks on Greece was more than accounted for by a change to the population reported by UK-owned Monetary Financial Institutions (MFIs).

⁷ Queries concerning the international debt securities statistics should be directed to Christian Upper.

European sovereign debt turbulence in the second quarter. Completed gross issuance increased to \$1,934 billion in the third quarter, 15% higher than in the previous three months but short of the \$2,175 billion recorded in the first quarter (Graph 4, left-hand panel). With repayments down 7%, net issuance rose to \$475 billion, from \$111 billion in the second quarter. Between January and March, issuers had raised \$603 billion in the international debt securities market.

The key factor behind the rebound in issuance was the return to the market of borrowers resident in the developed economies as confidence recovered from the lows reached in early May. European issuers, whose net redemptions had mainly driven the sharp drop in activity in the second quarter, began to tap the market again in August and September. Over the quarter as a whole, they issued \$215 billion worth of international debt securities, after net repayments of \$60 billion in the previous three months (Graph 4, centre panel). Issuance also rose in most other advanced economies.

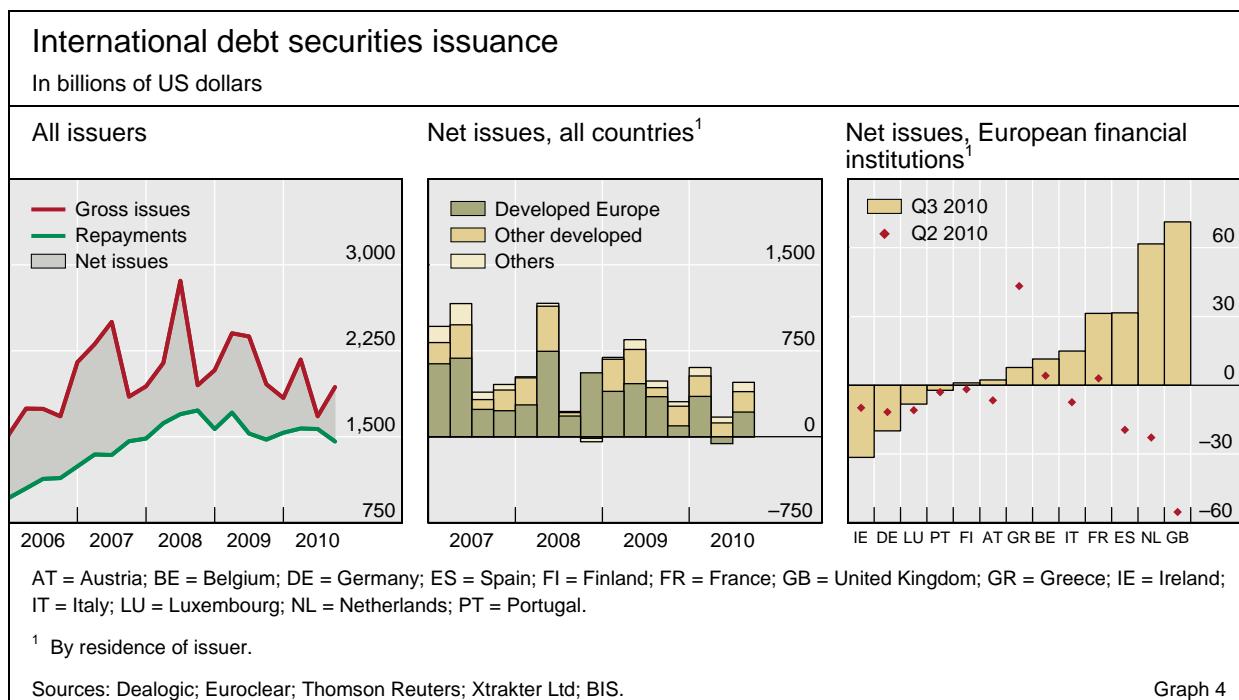
... as European borrowers return to the market

The recovery of issuance by residents in European developed economies was largely driven by financial institutions. At \$159 billion, financial institutions accounted for almost three quarters of total issuance in the region. UK, Dutch and Spanish financial institutions, which had seen net redemptions in the second quarter, raised \$71 billion, \$62 billion and \$32 billion, respectively (Graph 4, right-hand panel). Financial institutions in France borrowed \$31 billion, 10 times more than between April and June. By contrast, net repayments by financial institutions resident in Germany increased to \$20 billion, after \$12 billion in the previous period. Finally, issuance by Greek banks fell by 82% to \$8 billion.

European financials raise large amounts

The large Irish banks found it increasingly difficult to raise funding in the international debt securities market during the third quarter of 2010. Allied Irish

Large net repayments by Irish banks



Bank, Anglo-Irish Bank and Bank of Ireland issued new debt in the amount of \$9 billion (gross), but large repayments resulted in net redemptions of \$35 billion for these three institutions. The Irish “bad bank”, the National Asset Management Agency, raised \$5 billion on net, and other financial institutions resident in Ireland saw net redemptions of \$2 billion.

Surge in non-financial issuance, particularly in the United States

Non-financial corporations in the United States and other advanced economies took advantage of the low yields and issued the highest amount (\$140 billion) in the international market since the second quarter of 2009. Net issuance by the US non-financial corporate sector rose by 68% to \$111 billion, almost entirely straight fixed rate bonds. Canadian issuance also surged, to \$8 billion, from \$1.4 billion in the second quarter. European firms raised \$17 billion through the issuance of international debt securities, 22% more than in the previous quarter. As in previous quarters, approximately one third of gross US non-financial issuance was rated below investment grade, compared to less than one fifth in Europe.

Developing economies continue to borrow ...

Issuance by residents in developing economies continued to grow, by 26% to \$39 billion, just short of the high in the final quarter of 2009 (\$42 billion). Issuance increased in all regions except Latin America and the Caribbean, where it fell by 8% on the back of sharply lower issuance by non-financial corporations in Mexico.

... in US dollars and local currency

The US dollar remained the main choice of currency for emerging market issuers, but the third quarter also saw some notable issues in local currency. The share of the dollar remained stable at 83% of developing economy issuance, whereas that of the euro halved to 9%. Ten per cent of international issuance was denominated in an emerging market currency, the highest in a year. That said, volumes remained relatively small compared to US dollar issuance.

Over-the-counter derivatives⁸

Asset price moves and counterparty risk concerns drive OTC derivatives markets ...

Sharp movements in asset prices and ongoing efforts to mitigate counterparty risk both had a strong influence on over-the-counter (OTC) derivatives markets in the first half of 2010. The notional amount of outstanding OTC derivatives fell by 3% in dollar terms during this period.⁹ However, substantial movements in asset prices, partly related to growing concerns about sovereign risks, drove up the gross market value of these contracts by 15% and the gross credit exposures associated with them by 2% (Graph 5). The smaller rise in gross credit exposures than in gross market values reflects increased netting, which is consistent with greater use of central counterparties (CCPs) in some segments of the market.¹⁰ The ratio of gross credit exposures to gross market

⁸ Queries concerning the OTC derivatives markets should be addressed to Nicholas Vause.

⁹ Note that the US dollar appreciated against several other major currencies during the first half of 2010. It rose by 17% against the euro, for example, reducing the value of euro-denominated derivatives when reported in dollar terms.

¹⁰ Gross credit exposures are equal to gross market values less any contributions from offsetting positions between counterparties that are governed by legally enforceable netting

values consequently fell to 14.5% at the end of the first half of 2010, down from 16.3% at the end of 2009 and 24.0% at the end of the first half of 2007 (Graph 5, right-hand panel).

There was considerable variation in changes in notional amounts and market values across segments of the OTC derivatives market. Outstanding notional amounts increased for foreign exchange (8%) and equity (5%) derivatives, declined for credit (7%) and commodity (3%) derivatives and were broadly unchanged for interest rate contracts. Gross market values increased for foreign exchange (22%) and interest rate (25%) derivatives, declined for credit (7%) and commodity (16%) contracts and remained stable for equity derivatives.

... within which there is much variation by asset class

In the OTC foreign exchange derivatives market, growth in the notional amount of outstanding contracts was supported by particularly strong increases in the volume of contracts linked to the Canadian dollar (20%) and the Swiss franc (23%). The gross market value of outstanding contracts linked to the Swiss franc more than doubled as the currency appreciated by 12% against the euro over the period.

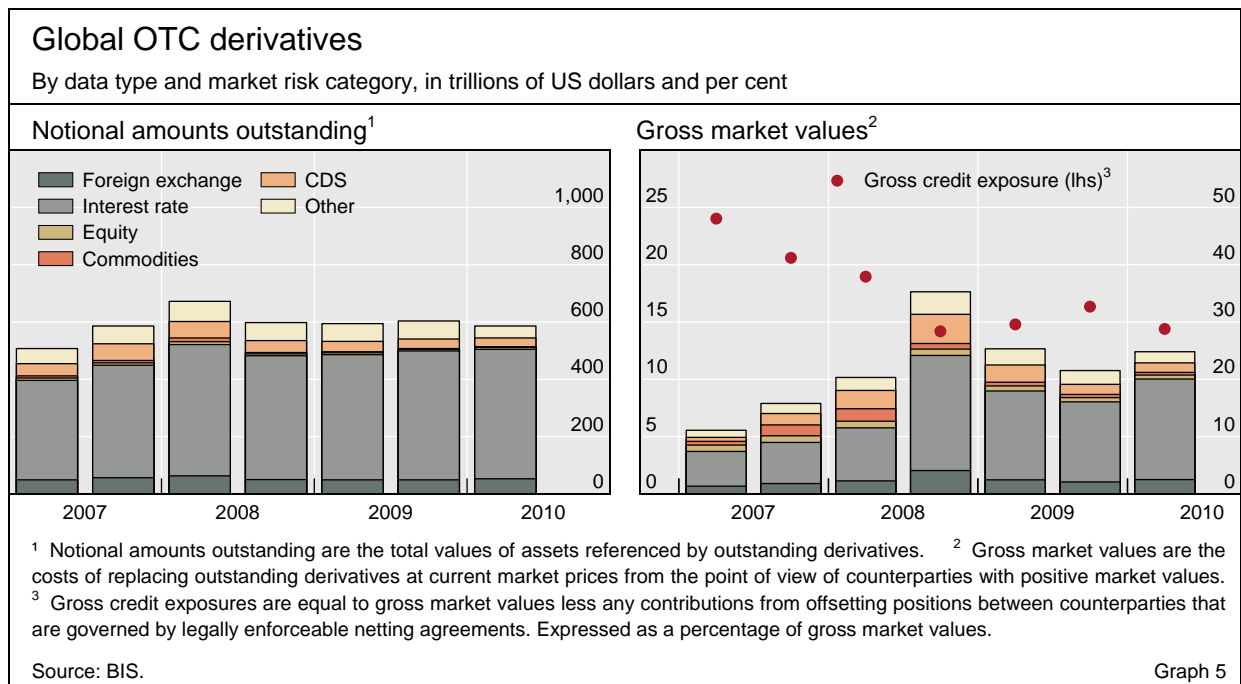
Exchange rate moves sharply boost the value of Swiss franc FX contracts ...

In the interest rate derivatives market, the sharp increase in gross market values was associated with falls in major currency swap rates. The gross market value of derivatives linked to US dollar rates increased particularly strongly (42%), as long-term swap rates declined by more for the US dollar than for several other major currencies.

... and moves in swaps rates boost the value of interest rate contracts

There were signs of efforts to reduce counterparty risk in the interest rate derivatives market. For example, the notional amount of outstanding inter-dealer positions decreased by 5% while those between dealers and other

Efforts to reduce counterparty risk evident in interest rate ...

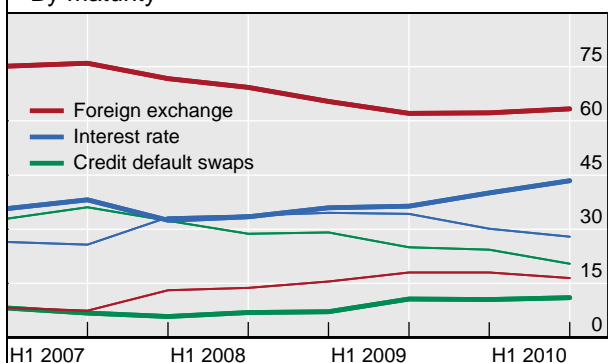


agreements. As such, they approximate more closely to counterparty risk exposures than gross market values. Gross credit exposures do not, however, reflect any collateral that may be held against positions to further reduce counterparty risk exposures.

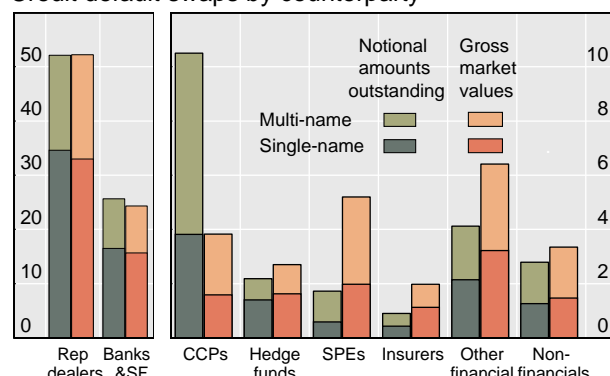
Global OTC derivatives

Distributions by maturity and counterparty, in per cent

By maturity¹



Credit default swaps by counterparty²



¹ Thick lines represent contractual maturities of up to one year. Thin lines represent contractual maturities of over five years. ² For reporting dealers and banks and securities firms (SF), left-hand scale.

Source: BIS.

Graph 6

financial institutions grew by 2%. This is consistent with positions being shifted to CCPs. In addition, there was a further shortening of the maturity profile of interest rate derivatives (Graph 6, left-hand panel).

... and credit derivatives markets

There were also signs of further efforts to reduce counterparty risk in the credit derivatives market. For example, the 7% fall in the notional amount of outstanding OTC credit derivatives in the first half of 2010 reflected ongoing use of portfolio compression services by market participants as well as increased usage of CCPs.¹¹ It brought the total decline since the peak in this volume at the end of 2007 to 48%. In addition, the notional amount of outstanding long-term credit derivatives with maturities in excess of five years fell particularly sharply, declining by 22% in the first half of 2010 and by a total of 67% since the end of 2007 (Graph 6, left-hand panel). This may reflect reduced willingness to commit to counterparties for long periods of time.

New counterparty breakdowns are available for credit derivatives

The semiannual OTC derivatives statistics for the first half of 2010 have introduced a more detailed counterparty breakdown for credit derivatives. This reveals for the first time reporting dealers' positions with CCPs, special purpose entities (SPEs) and hedge funds (Graph 6, right-hand panel). The new data on CCPs are discussed in more detail in a special feature article in this issue.¹²

¹¹ Portfolio compression services replicate the risk exposures of outstanding derivatives with fewer contracts and hence less counterparty risk. CCPs reduce counterparty risk by terminating offsetting positions with clearing members. Both mechanisms are described in more detail in the special feature article referenced in footnote 12.

¹² See "Counterparty risk and contract volumes in the credit default swap market" by Nicholas Vause (this issue).

Exchange-traded derivatives¹³

Trading activity on the international derivatives exchanges declined in the *third quarter of 2010*. Turnover measured by notional amounts fell by 21% to \$438 trillion between July and September. The decline in volumes affected all major risk categories. Trading in interest rate contracts receded by 23% to \$371 trillion, primarily as a result of lower activity in contracts on short-term interest rates (-24%, to \$328 trillion). Turnover in futures and options on stock indices fell by 12% to \$57 trillion, and that in contracts on exchange rates by 22% to \$9 trillion.

Weaker turnover ...

Open positions turned out to be more stable than turnover. Open interest in all financial contracts rose by 4% to \$78 trillion, although this hides some variation across risk categories. Traders increased their derivatives exposures to stock indices (by 16%, to \$6 trillion) and decreased that to exchange rates (by 5%, to \$0.4 trillion). Open interest in interest rate contracts remained roughly stable at \$71 trillion.

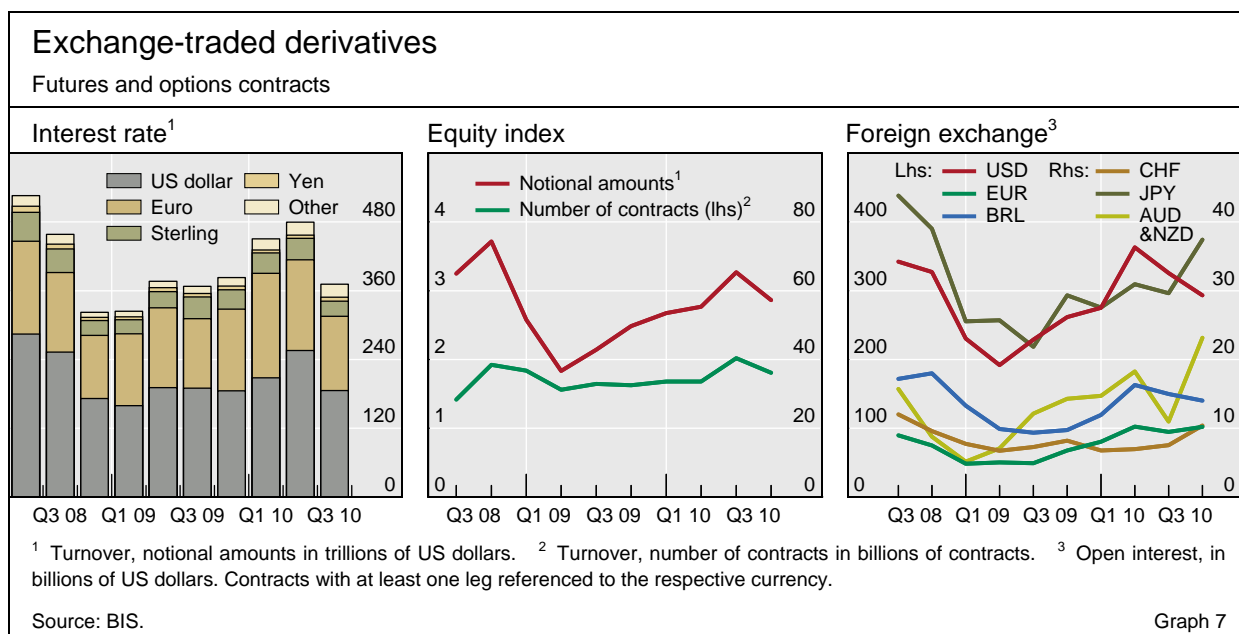
... but stable positions

The decline in trading in interest rate contracts affected all major currencies except the yen. Trading volumes of yen-denominated contracts went up by 25% to \$7 trillion, with little difference in terms of growth rates between derivatives on short and on long-term rates (Graph 7, left-hand panel). By contrast, turnover in futures and options on US dollar interest rates fell by 27% to \$185 trillion, mainly owing to lower activity in money market contracts. Trading volumes of interest rate derivatives denominated in the euro and pound sterling dropped by 18% and 29%, respectively, to \$130 trillion and \$27 trillion.

Yen interest rate contracts buck decline

The decline in turnover in futures and options on stock indices was similarly broad-based as that in the interest rate segment. In most markets,

Lower activity in stock index contracts ...



¹³ Queries concerning the exchange-traded derivatives statistics should be addressed to Christian Upper.

... except in China and India

turnover dropped in terms of both notional amounts and the number of contracts traded, suggesting a true reduction in activity and not just valuation effects (Graph 7, centre panel). China and India were notable exceptions to the decline in trade volumes. Turnover in futures on the Chinese CSI 300 index reached \$2.4 trillion, after \$1.5 trillion in the second quarter. This makes it the world's fifth most traded stock index contract – only a few months after the contract was first traded in April this year. Turnover in contracts on Indian equities increased by 10% to \$1 trillion.

Possible signs of carry trade positions

Market participants increased their positions in some of the classical “carry trade” currencies. Open interest in futures and options on the Australian and New Zealand dollars rose to \$21 trillion and \$2.1 trillion, respectively (Graph 7, right-hand panel). Similarly, open interest in two important funding currencies, the Swiss franc and Japanese yen, increased by 38% and 26%, respectively, to \$10 trillion and \$37 trillion. That said, information on the motivation of trades is not available, so amounts connected with carry trades cannot be identified.

High turnover in agricultural contracts and precious metals lifts commodities activity

Activity on the international commodities exchanges continued to expand. Turnover measured by the number of contracts traded (notional amounts are not available) rose by 8%, the same rate as in the previous quarter. Rapid growth in contracts on agricultural commodities (19%) and precious metals (23%) contrasted with a decline in activity in contracts on energy (–7%) and non-precious metals (–3%).

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)).

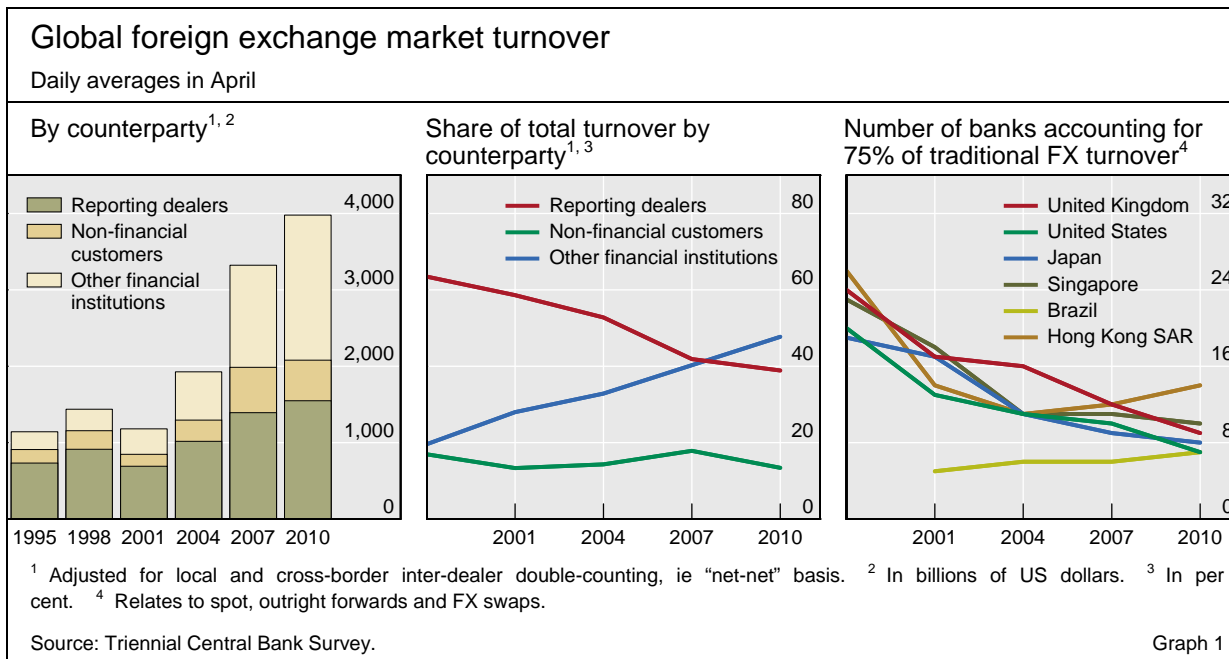
Given that most of the growth in FX market activity since 2007 is due to increased trading by other financial institutions, the \$4 trillion dollar question is: which financial institutions are behind this growth? The Triennial data do not break down trades within this category of counterparty. Discussions 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.

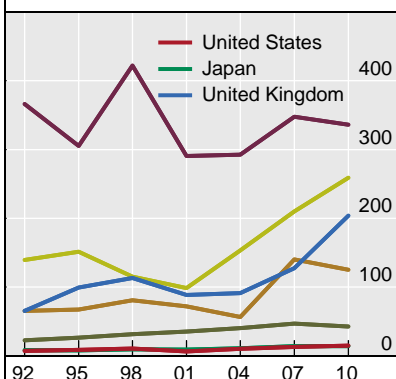
The motives for trading a currency may be divided into transactions linked to cross-border trade in goods and services, and transactions related to cross-border financial flows. The left-hand panel of Graph A shows the ratio of global FX turnover for a country, compared to the country's GDP.^① FX turnover 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.

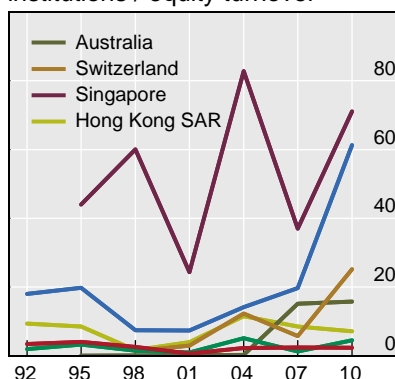
Foreign exchange market turnover and rationale for trading

In per cent

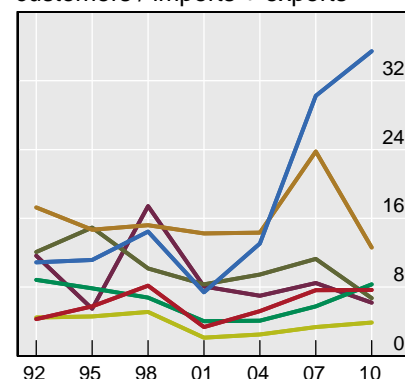
Total FX turnover / GDP¹



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.

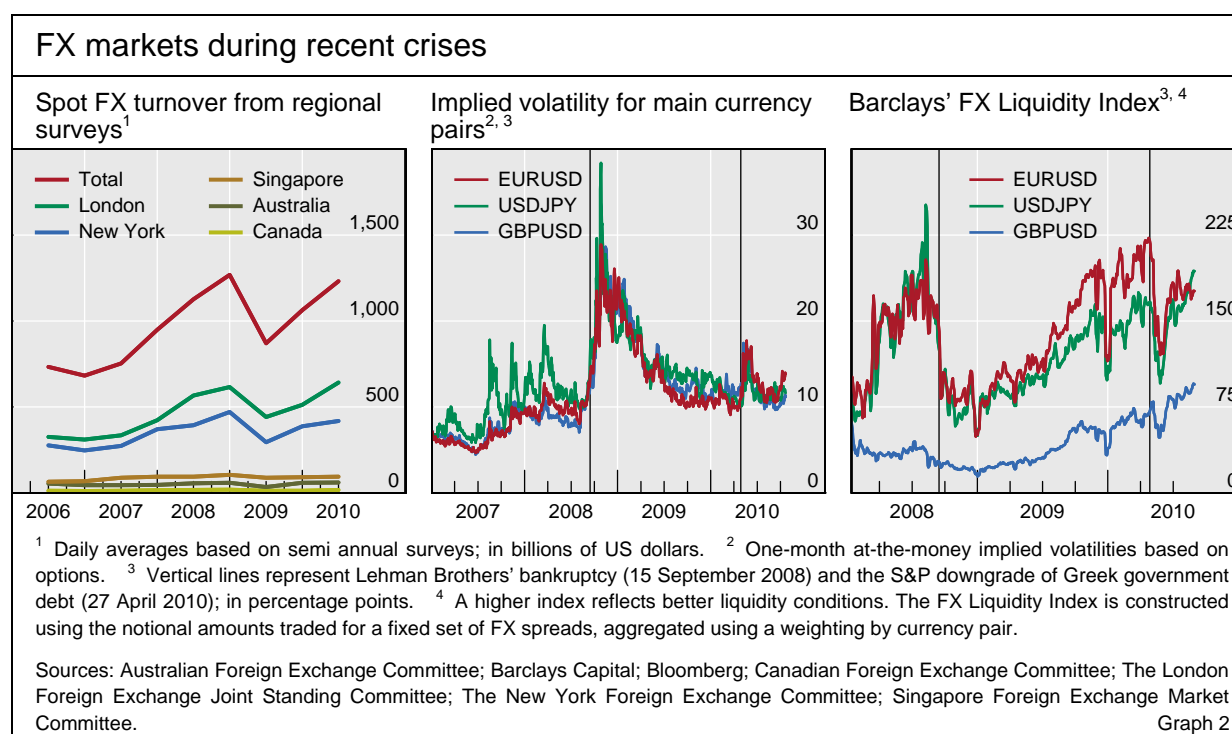
The 2007–09 financial crisis and its impact on FX markets

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.

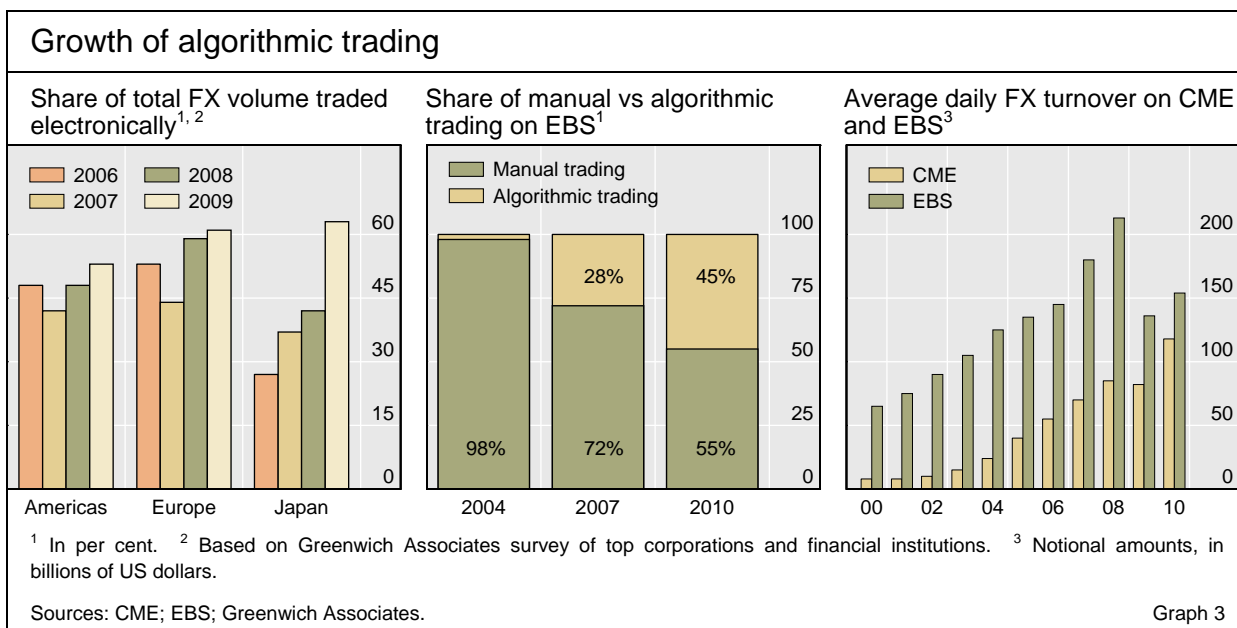
... followed by multi-bank ECNs in the late 1990s ...

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

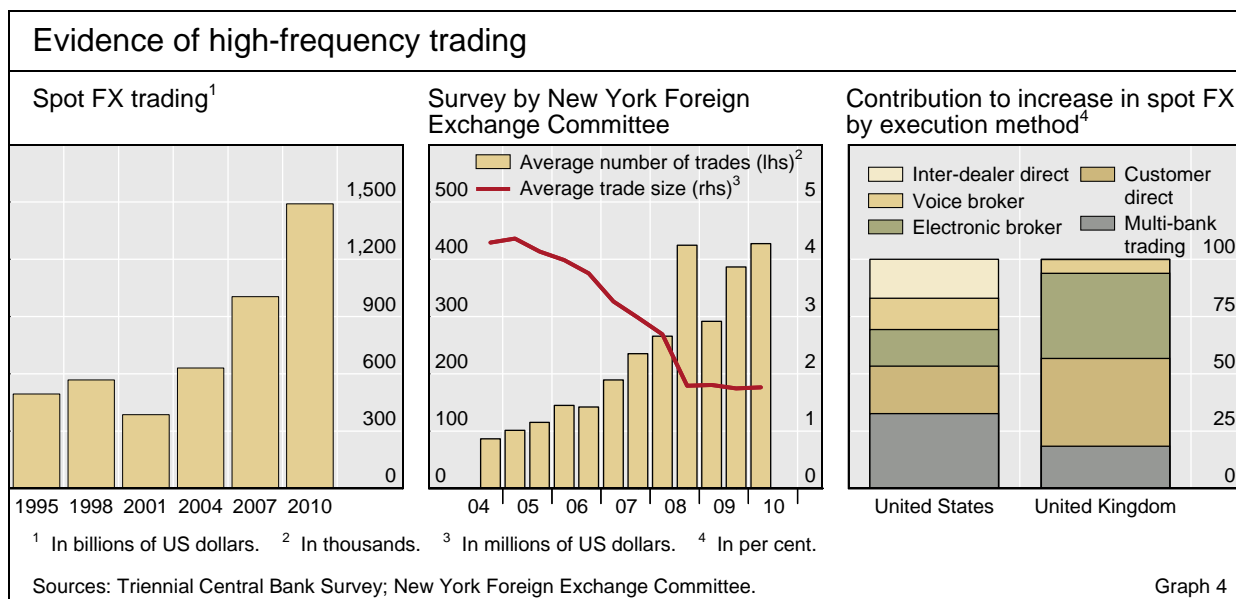
Market estimates suggest HFT accounts for around 25% of spot FX activity. While many commentators suggest much of the growth in spot turnover is due to HFT, the contribution of HFT to the increased FX turnover between 2007 and 2010 is not known with precision (Hughes (2010), Lambert (2010)). Neither 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.

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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.

Derivatives in emerging markets¹

Turnover of derivatives has grown more rapidly in emerging markets than in developed countries. Foreign exchange derivatives are the most commonly traded of all risk categories, with increasingly frequent turnover in emerging market currencies and a growing share of cross-border transactions. As the global reach of the financial centres in emerging Asia has expanded, the offshore trading of many emerging market currency derivatives has risen as well. Growth in derivatives turnover is positively related to trade, financial activity and per capita income.

JEL classification: F31, G15, G20, P45.

This article represents a first attempt to review derivatives markets in emerging market economies (EMEs) on a comprehensive basis. We try to answer some basic questions: How big are the derivatives markets in EMEs? What are their structure and dynamics? Which derivatives are traded in EMEs, and who trades them? How does this all differ from mature markets? In which emerging market countries are derivatives most traded? Which factors might explain differences in the growth of derivatives markets across countries and time?

The picture of derivatives markets in EMEs that one gets from the existing literature is highly fragmented. Most evidence is limited to individual countries, types of derivatives or specific episodes of market development. One reason for this fragmentation is the lack of a unified database; another is the lack of familiarity with existing data sources. This paper aims to start filling this gap. It combines data from the Triennial Central Bank Survey of OTC derivatives market activity with those on derivatives traded on emerging market exchanges. The Triennial survey provides a unique snapshot of OTC derivatives activities in emerging markets, at a level of granularity and multidimensionality that is unmatched.² In turn, data on exchange-traded derivatives, compiled by commercial providers and published on a regular basis in the *BIS Quarterly Review*, provide detailed information on standardised derivative contracts listed and traded on emerging market exchanges.

¹ We are grateful to Claudio Borio, Stephen Cecchetti, Robert McCauley and Christian Upper for helpful comments and discussions, and to Branimir Gruić, Emese Kuruc and Carlos Mallo for excellent research assistance. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

² Detailed results of the FX part of the 2010 Triennial survey are available at www.bis.org/publ/rpfx10.htm.

Together, these two data sources enable us to start mapping the world of derivatives in emerging markets.

Our main findings are as follows. First, daily turnover in derivatives markets in EMEs has expanded four times over the past decade, to over 6% of emerging market GDP. Second, derivatives in emerging markets are traded in almost equal proportions over the counter and on exchanges. Third, unlike in advanced economies, FX derivatives are still the most traded derivatives in EMEs (50% of total turnover), while interest rate derivatives remain underdeveloped. Fourth, the FX derivatives turnover in emerging markets is becoming increasingly global, with a growing share of transactions being done cross-border, and transactions in emerging market currencies increasingly taking place offshore. Fifth, the largest derivatives markets in EMEs are located in Korea, Brazil and the two Asian financial centres of Hong Kong SAR and Singapore. And sixth, trade, financial activity and per capita GDP are positively related to the growth of derivatives markets in EMEs.

The remainder of this article is organised as follows. The first section looks at the size, structure and growth of derivatives markets at an aggregate emerging market level. The second section focuses on OTC derivatives, comparing the markets in EMEs and advanced economies. The third section further disaggregates the data on derivatives at the regional and country levels. The fourth section attempts to identify factors underpinning the growth in FX derivatives turnover. The final section concludes.

The size and structure of derivatives markets in EMEs

Derivatives markets in EMEs remain small compared to those in advanced economies. Average daily turnover of derivatives in 33 EMEs for which data are available was \$1.2 trillion in April 2010 (6.2% of those economies' GDP), compared to \$13.8 trillion (36% of GDP) in advanced economies.³ Though small, derivatives markets in EMEs have expanded rapidly: average daily turnover has increased by 300% since 2001, and by 25% over the past three years, despite the crisis in 2008–09 (Graph 1, left-hand panel). This was higher than the growth of turnover in advanced economies (250% since 2001, and 22% since 2007).

Rapid growth of turnover ...

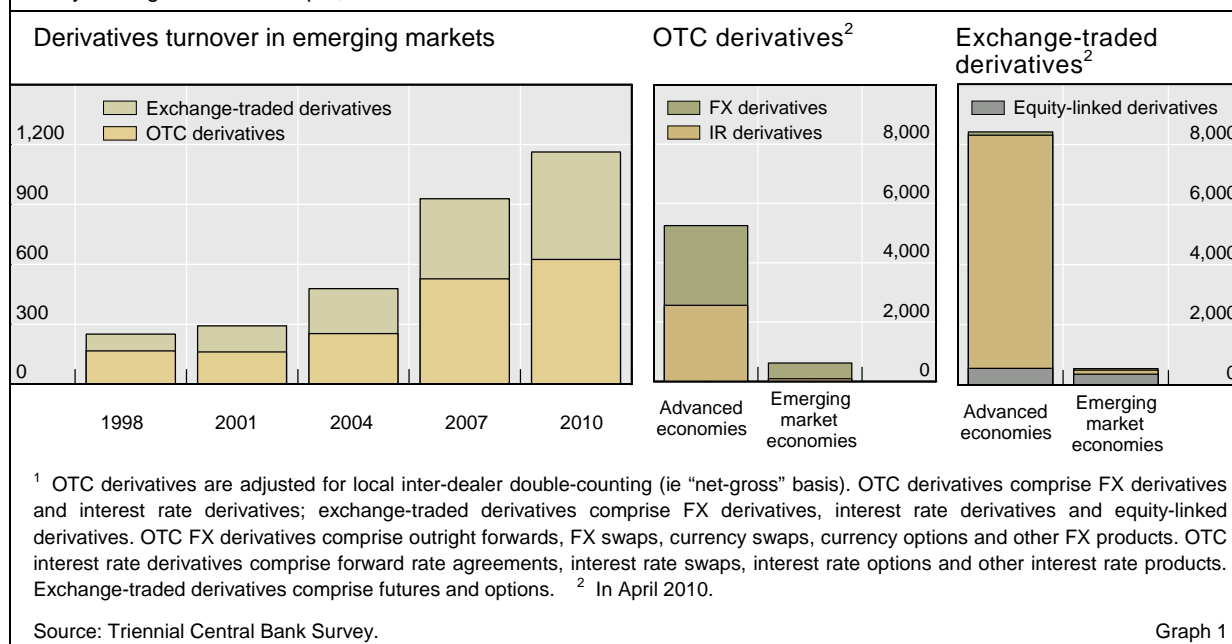
OTC derivatives are relatively more important in emerging markets than in advanced economies. In EMEs, derivatives are traded in almost equal proportions over the counter and on exchanges (Graph 1, centre and right-hand panels). By comparison, in advanced economies almost two thirds of derivatives are traded on exchanges (right-hand panel) and 38% over the counter (centre panel). Furthermore, the relative size of the exchange-traded

... in both OTC and exchange-traded markets

³ In this paper we focus on derivatives traded in emerging market *countries* rather than derivatives in emerging market *risk* traded worldwide. One exception is OTC foreign exchange derivatives in emerging market currencies (see below). The aggregate figures in this section cover foreign exchange and interest rate derivatives (both OTC and exchange-traded) and exchange-traded equity-linked derivatives. Commodity derivatives and credit default swaps are not considered in this article. For details on the methodology and changes in coverage in the 2010 Triennial Survey, see King and Mallo (this issue)

Derivatives turnover in advanced and emerging markets¹

Daily average turnover in April, in billions of US dollars



derivatives market is distorted by two special cases with well developed derivatives exchanges, Brazil and Korea, which together account for nearly 90% of all emerging market turnover of exchange-traded derivatives.

FX derivatives most important in EMEs

Derivatives in EMEs are used mainly to hedge or speculate on exchange rate and, to a lesser extent, equity market risk. FX derivatives account for 50% of total turnover in emerging markets, equity-linked derivatives for 30% and interest rate derivatives for the rest. By contrast, derivatives in advanced economies are used by and large to trade interest rate risk (77% of total turnover), with FX derivatives and in particular equity-linked derivatives being less important. These differences reflect above all the depth and liquidity of bond and money markets in developed countries, and the relatively limited concern with exchange rate risk in advanced compared to emerging market economies.

The sections that follow further disaggregate these data. We first take a look at OTC derivatives at the aggregate emerging market level, and then at derivatives markets in individual emerging market countries.

OTC derivatives markets

Over-the-counter derivatives represent the most developed segment of the derivatives market in EMEs. The average daily turnover of OTC derivatives in April 2010 was \$625 billion, or roughly 3% of EMEs' (annual) GDP.⁴ The OTC market in EMEs is dominated by FX derivatives, which account for nearly 90% of total turnover, versus 50% in advanced economies. Despite these

⁴ By comparison, the average daily turnover of OTC derivatives in advanced economies was \$5.3 trillion (13% of their GDP).

differences, trading of OTC derivatives in EMEs has converged towards advanced economy patterns in terms of instruments, counterparties and currencies being traded.

OTC foreign exchange derivatives

The turnover of OTC foreign exchange derivatives in EMEs – \$535 billion per day in April 2010 (Table 1) – increased 24% between 2007 and 2010. This represents a slowdown compared to the previous three-year period, when turnover almost doubled, but was much faster than the growth in advanced economies (just 5.6%). No doubt the recent financial crisis has taken some of the shine off the use of OTC foreign currency derivatives in advanced economies, particularly FX swap markets, where growth over the entire three-year period was only 0.3%. At the same time, the financial crisis had a relatively small impact on FX derivatives markets in emerging market economies.

Higher turnover of FX derivatives despite the crisis

Geographical distribution of OTC foreign exchange derivatives turnover ¹				
Daily averages in April				
	In billions of US dollars			Percentage share ²
	2004	2007	2010	2010
Total emerging market economies	222	430	535	100
<i>Total advanced economies</i>	<i>1,546</i>	<i>2,546</i>	<i>2,689</i>	<i>503</i>
Asia	184	354	442	83
Hong Kong SAR	70	143	194	36
Singapore	91	153	175	33
China	...	1	11	2
India	3	24	14	3
Korea	10	18	25	5
Other	9	16	22	4
Latin America	7	14	21	4
Brazil	1	1	5	1
Mexico	5	11	12	2
Other	1	3	4	1
Central and eastern Europe	19	43	50	9
Poland	5	7	6	1
Russia	6	16	19	4
Turkey	2	3	11	2
Other	6	17	13	2
Other emerging market economies	12	19	22	4
South Africa	8	11	10	2
Other	4	8	12	2

¹ Outright forwards, FX swaps, currency swaps, currency options and other FX products. 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. Adjusted for local inter-dealer double-counting (ie "net-gross" basis). ² As a percentage of total emerging market economies.

Source: Triennial Central Bank Survey. Table 1

Foreign exchange derivatives turnover by instrument, counterparty and location¹

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

	Emerging market economies				Advanced economies	
	2004	2007	2010	% share	2010	% share
OTC FX derivatives²	159	299	380	100	2,110	100
Outright forwards ³	21	47	73	19	402	19
FX swaps ³	125	231	277	73	1,488	71
Currency swaps	3	4	7	2	36	2
Currency options and others ⁴	10	18	24	6	184	9
With reporting dealers	91	184	221	58	809	38
With other financial institutions	44	70	115	30	1,029	49
With non-financial customers	20	45	44	12	271	13
Local	61	108	127	33	700	33
Cross-border	94	191	254	67	1,410	67
<i>Memo: Spot transactions³</i>	<i>119</i>	<i>188</i>	<i>203</i>	<i>100</i>	<i>1,287</i>	<i>100</i>
<i>Local</i>	<i>52</i>	<i>84</i>	<i>84</i>	<i>42</i>	<i>484</i>	<i>38</i>
<i>Cross-border</i>	<i>67</i>	<i>104</i>	<i>119</i>	<i>58</i>	<i>803</i>	<i>62</i>
<i>Derivatives/spot ratio⁵</i>	<i>1.3</i>	<i>1.6</i>	<i>1.9</i>		<i>1.6</i>	

¹ Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). ² Due to incomplete reporting, components do not always add up to totals. ³ Previously classified as part of the so-called traditional FX market. ⁴ 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. ⁵ Ratio of foreign exchange derivatives to spot transactions.

Source: Triennial Central Bank Survey.

Table 2

Instruments similar to advanced economies

In terms of FX instruments, the OTC markets in EMEs have already converged to the advanced economies' pattern. In both groups of countries, FX swaps comprise the lion's share of turnover (over 70%), followed by outright forwards (19%), options and currency swaps (Table 2). The relative size of FX spot and derivatives markets has also converged. The ratio of FX derivatives to spot transactions increased in EMEs to 1.9 in 2010 (Table 2), continuing the steady rise evident since 1998. Meanwhile, the ratio of derivatives to spot transactions in advanced economies declined to 1.6 in 2010.⁵

Shift towards trading with financial customers ...

Turning to the question of who is trading derivatives in emerging markets, we see that trades with other financial institutions – such as pension funds and hedge funds – increased the most, to 30% of total turnover in 2010 (Table 2). At the same time, the shares of trade with other reporting dealers (usually commercial and investment banks) and non-financial customers declined to 58% and 12%, respectively. The shift towards trading with financial customers represents the resumption of a trend that started in 1998, when the share of this counterparty type was as low as 15%. The trend is present across all foreign exchange instruments, especially the three largest categories.

⁵ The fact that the ratio of FX derivatives to spot transactions in developed countries fell below that in emerging markets probably reflects the degree to which FX swap markets were dislocated in developed countries and became illiquid during the 2007–09 crisis (Baba and Packer (2009), CGFS (2010)). Given that strains in FX swap markets first became apparent in advanced economies, the shift towards spot transactions was more evident there.

Increased dealing with other financial institutions (to nearly 50% of total turnover) can also be seen in developed countries.

Factors underpinning the shift towards trading with financial customers include the increasingly active pursuit of carry trades and other short-term investment strategies. Indeed, many high interest rate currencies commonly identified as carry trade targets, such as the Australian dollar, the Indian rupee and the Korean won, experienced particularly strong growth over the past three years. In addition to these factors, noted already by the analysts of earlier Triennial surveys (Galati and Melvin (2004), Galati and Heath (2007)), high-frequency trading, which is more prevalent in financial centres such as Singapore, also appears to have contributed to the FX turnover growth (King and Rime (2010)).

... possibly driven by carry trades

Convergence towards developed country patterns is also evident in the shift towards cross-border transactions (Table 2). Counterparties to FX derivatives trades are increasingly from different reporting jurisdictions: the share of cross-border transactions grew to 67% in 2010 from 59% in 2004. This is the same as the share of cross-border transactions in advanced economies.

More derivatives traded cross-border

OTC interest rate derivatives

The interest rate derivatives markets in EMEs are much smaller than the FX markets, with total daily turnover of \$90 billion in April 2010 (Table 3). In sharp

Interest rate derivatives turnover is smaller ...

OTC interest rate derivatives turnover in emerging markets ¹				
Daily averages in April				
	In billions of US dollars			Percentage share ²
	2004	2007	2010	2010
Total emerging market economies³	31	98	90	100
<i>Total advanced economies³</i>	<i>1,301</i>	<i>2,075</i>	<i>2,564</i>	<i>2,849</i>
Asia³	23	86	73	81
Hong Kong SAR	11	17	18	21
Singapore	9	57	35	38
Korea	1	5	11	12
Other	2	5	9	10
Latin America³	2	3	9	10
Brazil	1	0	7	8
Mexico	1	3	1	2
Central and eastern Europe³	2	4	2	2
Poland	1	3	2	2
Other emerging market economies³	3	5	6	7
With reporting dealers ⁴	12	43	39	61
With other financial institutions	9	20	22	34
With non-financial customers	1	3	3	5

¹ Forward rate agreements, interest rate swaps, interest rate options and other interest rate products. ² As a percentage of total emerging market economies; percentage share for the breakdown by counterparty is calculated using the total (\$64 billion) adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). ³ Adjusted for local inter-dealer double-counting (ie "net-gross" basis). ⁴ Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis).

Source: Triennial Central Bank Survey.

Table 3

contrast to the FX derivatives market, turnover of interest rate derivatives decreased by 8% since 2007. Meanwhile, in advanced economies interest rate derivatives turnover increased by 24%. Note, however, that the decrease in turnover in emerging markets represents one exceptional case rather than a trend – a major dealer, which accounted for 40–50% of interest rate derivatives trading in emerging Asia in 2007, shifted its trading desk out of the region during the crisis. Net of trades by that desk, turnover of interest rate derivatives in emerging markets nearly tripled, which compares with growth in the previous three-year period.

... as local money and bond markets lag behind FX markets

The overall activity in interest rate derivatives in EMEs nevertheless remains extremely low relative to that in advanced economies: emerging market turnover is less than 4% of the global total, versus 15% for FX derivatives turnover. This asymmetry – also noted by Saxena and Villar (2008) – probably reflects the lagging development and liquidity of emerging market bond and money markets relative to those in developed countries.

The relative immaturity of interest rate derivatives markets in EMEs is also apparent in the degree to which trading still takes place with reporting dealers (61% of total turnover; Table 3). By contrast, in advanced economies there has been a long-standing shift of OTC derivatives trading – similar to FX derivatives – away from reporting dealers, which constituted over 60% of turnover in 2001, but only 43% in 2010.

Currency composition of OTC derivatives in emerging markets

US dollar still the currency of choice for EMEs ...

According to the 2010 Triennial, the US dollar remains the pre-eminent global currency in OTC derivatives markets of EMEs. In the FX derivatives markets, the dollar was one of the currencies in more than 95% of transactions in 2010 (Table 4). This fraction was virtually unchanged from the 2007 survey, thus confirming the dollar's ongoing status as the leading currency for international financial transactions, paralleling its continued leading role in critical areas of international trade and finance (Goldberg (2010)). Even for the currencies of central and eastern European countries, which have strong economic linkages with the euro area, the dollar is the cross-currency for FX derivatives transactions more frequently than the euro.⁶ It is also striking that the dominance of the US dollar is much greater in emerging market venues than elsewhere – worldwide, 85% of the transactions are dollar-denominated.

... but EME currencies gain market share in FX derivatives ...

Another interesting development is that emerging market currencies gained share in EMEs' FX derivatives trading. The percentage of transactions in EMEs involving emerging market currencies on one side increased to 60% in 2010 from 55% in 2007 (out of a potential 200%).⁷ By contrast, the turnover of

⁶ According to the 2010 Triennial, OTC turnover in FX derivatives on the Hungarian forint-dollar, Polish zloty-dollar and Czech koruna-dollar currency pairs was higher than that on the forint-euro, zloty-euro and koruna-euro pairs, by about 260%, 150% and 30%, respectively. See BIS (2010a, p 57), for a discussion of the dollar's resilience as a means of exchange during the crisis, with a focus on forward trading of the forint and zloty.

⁷ This percentage is smaller for transactions in Hong Kong and Singapore than in other emerging markets, where trading in developed country currency pairs is less common.

OTC foreign exchange derivatives turnover by currency ¹			
Daily averages in April, percentage shares			
	2004	2007	2010
US dollar	95.5	95.2	94.7
Euro	19.3	15.1	15.8
Japanese yen	16.6	14.0	9.7
Australian dollar	7.5	5.7	8.0
Pound sterling	7.9	6.7	4.3
Swiss franc	1.5	2.4	1.2
Hong Kong dollar	12.4	17.3	15.9
Korean won	6.3	6.2	8.3
Singapore dollar	4.9	6.2	6.7
Chinese renminbi	0.4	1.6	4.8
Indian rupee	2.0	4.5	4.4
Russian rouble	1.1	2.0	2.6
Mexican peso	1.9	2.7	1.8
South African rand	3.1	2.2	1.6
Brazilian real	0.7	0.2	1.0
Polish zloty	1.7	1.2	0.9
Emerging market currencies	43.5	55.0	60.4

¹ Outright forwards, FX swaps, currency swaps, currency options and other FX products. Because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200% instead of 100%. Because not all of the currencies are listed in the table, the total of the listed percentage shares is less than 200%. Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis).

Source: Triennial Central Bank Survey. Table 4

global reserve currencies other than the US dollar – such as the euro, yen, pound sterling and Swiss franc – generally declined in relative terms in 2010. In particular, the share of the Swiss franc halved, probably reflecting the unwinding of derivatives positions which had hedged Swiss franc loans made in emerging Europe before the crisis. The Australian dollar was an exception among advanced economy currencies, as its share in total turnover in EMEs increased to around 8%, which is quite similar to its share in advanced economies. This undoubtedly reflected Australia's position as a major supplier of commodity exports to much of emerging Asia.

Within interest rate derivatives turnover, the US dollar also plays an important, though not quite as dominant, role, constituting nearly 20% of all turnover in emerging markets. However, the dollar's share is much higher than that of currencies of other major advanced economies – for instance, the share of euro interest rate derivatives turnover stands at just 8%. Interest rate derivatives in emerging markets are distinguished by the outsized growth of turnover in the Korean won, which in 2010 constituted more than one quarter of all turnover of interest rate derivatives in emerging markets.

... and interest rate derivatives trade

Where have derivatives markets grown the most?

Four emerging market economies stand out in terms of the size and maturity of their derivatives markets: Korea, Brazil and the two Asian financial centres of Hong Kong and Singapore. Brazil and Korea are exceptional in terms of the size of their exchange-traded derivatives markets, and Hong Kong and Singapore in terms of their OTC derivatives markets (Graph 2, left-hand panel). In addition, no less than 10 EMEs now have total daily derivatives turnover of around \$10 billion or more (right-hand panel).

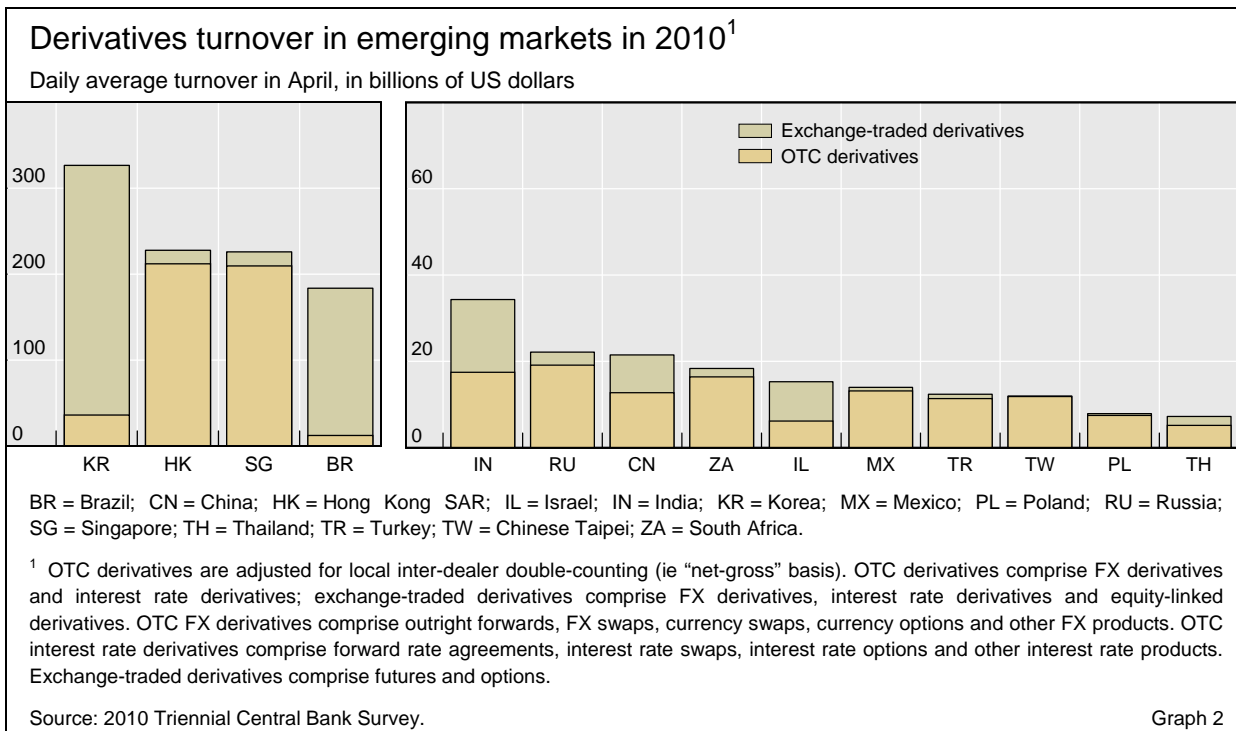
High turnover of interest rate derivatives in Brazil ...

Brazil is outstanding in terms of the turnover of interest rate and FX derivatives traded on its exchanges. The former doubled between 2007 and 2010, and the latter increased by 45%. Market in exchange-traded derivatives in Brazil dwarfs that of OTC derivatives: average daily turnover of exchange-traded FX derivatives in April 2010 was \$31 billion, versus \$5 billion in OTC markets, and that of interest rate derivatives as much as \$126 billion, versus \$7 billion in OTC instruments.

The other major centre for exchange-traded derivatives is Korea, with \$2 billion daily turnover in FX and \$8 billion in interest rate derivatives in April 2010. Elsewhere, the FX derivatives turnover on exchanges in Mexico and Russia has doubled since 2007, while in India turnover of FX derivatives surged to \$4 billion per day in April 2010, within just a year or so of their launching on the local exchange.

... and of equity-linked derivatives in Korea

Several EMEs, above all Korea, also have very large turnover of equity-linked derivatives. With \$270 billion daily turnover of these derivatives in April 2010, the Korea Exchange was second globally only to the United States' CME Group – and trailing closely behind it. Significant trading of equity-linked derivatives also takes place on exchanges in Brazil, Hong Kong, India and Singapore (\$12–16 billion daily in April 2010), as well as in China, Israel and



Russia (\$3–9 billion daily). Although still increasing, growth in turnover of equity-linked derivatives has slowed considerably since 2007, reflecting the general decline in stock market activity after the crisis. In particular, income losses due to the crisis seem to have affected previously widespread margin trading by households on several Asian exchanges.

Trading of OTC derivatives is highly concentrated in Hong Kong and Singapore. The two financial centres together accounted for 69% of all OTC foreign exchange and 59% of all interest rate OTC derivatives turnover in EMEs in April 2010. Hong Kong increased its share in FX turnover between 2007 and 2010 (to 36% of the EME total), while Singapore's share decreased (to 33%). In trading of interest rate derivatives, Singapore maintained its dominant position (39% of the EME total).

OTC derivatives traded most in Hong Kong and Singapore

Outside those two financial centres, trading of OTC derivatives has made notable strides in several countries. China, Brazil and Turkey have seen remarkable growth in FX derivatives – in China, turnover has risen by a factor of 10 since 2007, albeit from a very low base (Table 1). Trading in OTC interest rate derivatives has also surged in Brazil and Korea – in Brazil, from \$100 million per day in April 2007 to \$7 billion per day in April 2010 (Table 3). Compared with the mid-2000s, when only a few countries had average daily turnover of OTC derivatives around \$1 billion, in 2010 every emerging market region had at least one country with more than \$10 billion in daily turnover. In Asia, these were China, Chinese Taipei, India and Korea; in Latin America, Mexico; and elsewhere, Russia, Turkey and South Africa. Strong growth of international trade over the past decade, the rapid spread of financial globalisation and regulatory reforms in individual emerging market countries have all contributed to these developments.

Other EMEs expand derivatives trade ...

The recent crisis has dented the growth of OTC derivatives markets mainly in central and eastern Europe, which was seriously affected by the contraction of cross-border financing during the crisis. The Baltic states, Hungary and Poland experienced decreases in FX derivatives turnover ranging from 15 to 30% between 2007 and 2010. As demand for major currencies in both onshore cash markets and short-term credit markets surged in October 2008, banks in these countries had major difficulties exchanging euros and Swiss francs for domestic currency in foreign currency swap markets. This prompted several central banks to step in as counterparties in swap transactions and to lend euros to local banks. Since mid-2009, local FX swap markets have gradually recovered. That said, with the exception of Poland they are not likely to return to pre-crisis levels of activity in the near term, given the ongoing contraction of foreign currency lending.⁸

... except in central and eastern Europe

Regarding the amounts outstanding of OTC derivatives, emerging Asia was clearly ahead of other regions in terms of FX derivatives, but not in terms

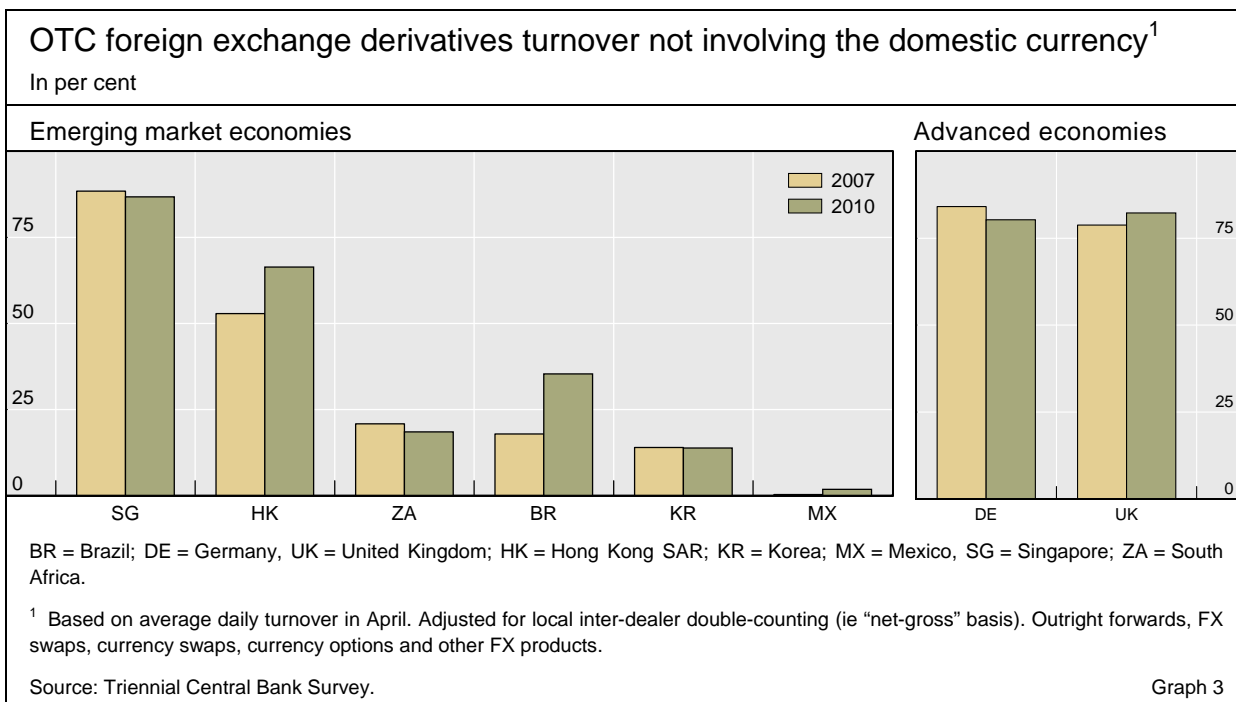
Asia and South Africa top in amounts outstanding

⁸ India was the only emerging market outside of central and eastern Europe to experience a decrease in OTC turnover over the past three years (of 40%); however, this development reflects the shift in FX derivatives trading to an organised exchange rather than any crisis-related developments.

of interest rate derivatives.⁹ The total notional amount outstanding of OTC foreign exchange derivatives by banks headquartered in Asia at the end of June 2010 was \$1.7 trillion, compared to \$150–280 billion by banks from other regions. At the same time, the total notional amount outstanding of OTC interest rate derivatives in emerging Asia was \$1.8 trillion, and in all other EMEs as much as \$1.7 trillion. The latter is largely due to South African banks, reflecting the country’s well developed and mature financial system. The amounts outstanding of interest rate derivative contracts at end-June 2010 in Latin America (\$120 billion) and central and eastern Europe (\$70 billion) were a fraction of these figures. This might reflect the importance of major international banks operating subsidiaries in these two regions, which report their derivatives positions in the country of their headquarters.

Trends in the global hubs and offshore trading

As noted earlier, emerging markets include global financial centres where other currencies are commonly traded. While the role of the Singapore and Hong Kong dollars is significant in Asian markets, much more noticeable is the degree to which the two centres serve as a trading platform for other currencies.¹⁰



⁹ In the Triennial, data on amounts outstanding are collected on a consolidated basis, whereas turnover data are locational. This means that the amounts outstanding refer to the global positions of banks headquartered in EMEs, irrespective of where they are booked. Conversely, the data do not include positions by EME affiliates of banking groups headquartered in advanced economies.

¹⁰ For instance, 69% of all turnover in FX derivatives markets in EMEs took place in Singapore or Hong Kong as of April 2010 (Table 1). At the same time, the Singapore or Hong Kong dollar was one of the currencies in FX derivatives transactions in only 16% and 7%, respectively, of all transactions in EMEs in 2010 (Table 4).

OTC foreign exchange derivatives turnover by currency offshore ratio ¹					
Daily averages in April 2010, in per cent					
	Total ^{2,3}	Outright forwards	FX swaps	Currency swaps	Currency options
Asia					
Chinese renminbi	71.0	90.8	8.3
Indian rupee	59.7*	76.0	16.4	55.6	79.1
Indonesian rupiah	81.3*	94.7	29.3	22.5	99.5
Korean won	56.8*	90.7	11.2	53.5	98.6
Malaysian ringgit	69.4*	91.1	29.7	17.9	84.9
Philippine peso	55.8*	90.0	14.3	1.8	23.2
Thai baht	34.5	23.4	39.6	6.1	6.4
Latin America					
Brazilian real	90.8	90.8	81.1	13.0	99.0
Chilean peso	58.9*	65.2	12.8	86.1	95.2
Mexican peso	96.0*	95.6	96.2	76.6	98.1
Central and eastern Europe					
Hungarian forint	91.8*	88.0	91.5	...	99.3
Polish zloty	94.7*	92.0	94.9	98.7	97.1
Russian rouble	62.6*	93.5	54.4	...	99.7
Turkish lira	94.8*	87.3	98.3	95.7	88.8
Other emerging market economies					
Israeli new shekel	78.0*	83.0	80.7	64.6	59.1
South African rand	86.5	86.7	86.4	98.1	86.0
Total emerging market currencies³	77.2*	86.7*	71.1	76.7*	91.5*
<i>Total emerging market currencies in April 2007³</i>	<i>75.5</i>	<i>83.3</i>	<i>72.0</i>	<i>63.2</i>	<i>87.0</i>
An asterisk indicates higher observations compared to 2007. Comparison was made only for the total figures.					
¹ This ratio defines turnover in any given currency outside the home market as a percentage of the total turnover in the same currency. Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). ² Total of the listed instruments. ³ Since the turnover data for the home market are not available in some economies for some segments, percentages for the total currency offshore ratio for those economies are an upper-bound estimate, since the calculation assumes that the total turnover for that segment is traded outside the home economy.					
Source: 2010 Triennial Central Bank Survey.					Table 5

Graph 3 illustrates the degree to which trading in currencies other than the home currency occurs in a few financial centres, and how that has changed since the last survey. As expected, Hong Kong and Singapore score highly, with 66% and 87% of FX derivatives turnover in those jurisdictions occurring in currency pairs that do not include the Hong Kong dollar or the Singapore dollar, respectively. The elevated numbers are comparable to those of the United Kingdom and Germany. In Hong Kong, trading in currencies other than the Hong Kong dollar has increased by 14 percentage points over the last three years.

A very different set of issues is raised by the trading of emerging market currency derivatives "offshore", or outside the jurisdiction of the monetary authority. Such trade is often the result of foreign exchange or capital controls

Derivatives turnover in EME hubs increasingly global

Offshore trading of EME currencies widespread ...

in the home jurisdiction.¹¹ In fact, a very large share of trading in EME currency derivatives takes place at such locations. (Offshore locations for trading in emerging market currencies tend to be the global financial centres identified above). Table 5 documents the degree to which trading in the FX derivatives of certain emerging market currencies takes place offshore. For instance, more than 90% of trading in the Brazilian real, the Mexican peso, the Hungarian forint, the Polish zloty and the Turkish lira takes place outside the home market. Offshore trading is particularly pronounced in FX options and outright forward contracts, where around 90% of all trading takes place abroad.

... and growing in importance

Offshore trading of emerging market currencies appears to have increased in both absolute and relative terms since the 2007 Triennial. For instance, the share of all FX derivatives transactions in emerging markets in which neither side of the currency pair is within the jurisdiction of the monetary authority has risen to 77%. In each of the categories of outright forwards, currency swaps and FX options, the share of FX derivatives transactions in emerging markets taking place offshore has grown by 3–5 percentage points. Currencies for which the offshore ratio has increased by more than 20% over the past three years include the Indian rupee, the Chilean peso, the Colombian peso and the Russian rouble.

Explaining FX derivatives turnover

Which factors drive growth of FX derivatives ...

As noted above, OTC FX derivatives represent the most important derivatives market in EMEs, so it is natural to ask which factors help explain differences in turnover in this market across countries and time. This section reports the results of a preliminary statistical analysis of this question. We look at simple bivariate correlations of FX derivatives turnover with some structural economic factors that are generally associated with the growth of derivatives markets.¹² The aim is to identify potential drivers of turnover as a first step in a more rigorous econometric analysis. One tentative finding is that variables such as trade, financial openness and the growth of bond and equity markets seem more promising in explaining FX derivatives turnover than the volatility of exchange rates or the level of interest rates. In addition, there might be a threshold level of per capita GDP above which the development of FX derivatives markets takes off.

... in a panel dataset of EMEs?

The panel dataset we use covers 30 EMEs over six Triennial surveys conducted since 1995. Hong Kong and Singapore are excluded as outliers. The dependent variable is daily turnover of OTC FX derivatives (outright forwards, FX swaps, currency swaps, options and other FX derivatives) measured in US dollars, in country i ($i = 1, \dots, 30$) at Triennial survey year t ($t = 1995, \dots, 2010$).

¹¹ For a further discussion of the impact of foreign exchange controls on derivatives turnover, see Tsuyuguchi and Wooldridge (2008).

¹² For stylised facts on the development of OTC derivatives markets, see Schinasi et al (2000), and for emerging markets, Saxena and Villar (2008). Potential drivers of FX turnover are discussed by, among others, Galati and Heath (2007) and King and Rime (2010).

Reflecting the demand for foreign currency to settle cross-border trade transactions, as well as the traditional role of derivatives as a hedge against exchange rate risk, the first variable that suggests itself intuitively when we think about explaining the turnover of FX derivatives is gross trade flows. There is indeed a strong positive relationship between the two variables in our sample: 10% higher gross trade flows are associated with 8.8% higher daily turnover of FX derivatives (Graph 4, left-hand panel).¹³ An even stronger relationship holds in terms of growth rates: a 10% growth of gross trade flows is associated with a 14% growth of FX derivatives turnover.

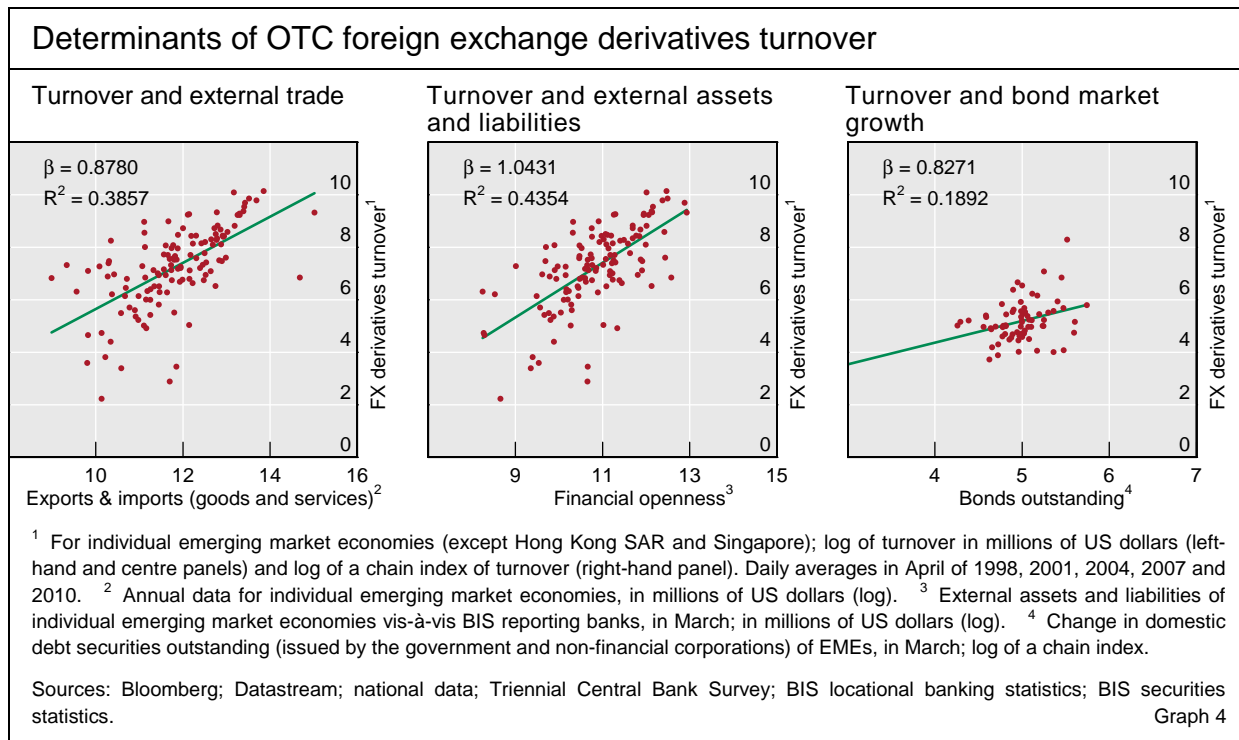
Growth of trade is an important factor ...

The second candidate for explaining turnover of FX derivatives is the size of external assets and liabilities. Again, the two variables are strongly correlated: 10% higher holdings of external assets and liabilities by EMEs in our sample are associated with 10.4% higher turnover of FX derivatives (Graph 4, centre panel). As with gross trade flows, the correlation holds for both levels and growth rates: a 10% growth of external assets and liabilities is associated with a 10% increase in FX derivatives turnover.

... as are holdings of external assets and liabilities ...

The third group of factors potentially explaining turnover of FX derivatives is activity in emerging bond and equity markets. Investors in emerging market assets – especially institutional investors such as pension funds – frequently hedge their positions in bonds and, to a lesser extent, equities. We would therefore expect turnover in EMEs’ derivatives markets to be positively correlated with turnover in their bond and equity markets. This turns out to be the case: a 10% growth in bonds outstanding of the government and non-financial corporate sectors is associated with an 8.3% increase in daily FX

... and activity in local bond and equity markets



¹³ Standard econometric tests suggest that virtually all variables used in regressions reported in this section are stationary.

derivatives turnover (Graph 4, right-hand panel).¹⁴ Similarly, a 10% increase in equity market turnover is associated with a 3% increase in FX derivatives turnover.

Exchange rates and interest rates are less important

The statistical relationship of FX derivatives turnover with other potential determinants identified in the literature is much weaker in our sample. For instance, the correlation between exchange rate volatility (measured by the standard deviation of monthly changes in the nominal effective exchange rate of individual EMEs) and FX derivatives turnover is positive but statistically insignificant. In particular, greater volatility of emerging market exchange rates in the latest crisis period has not been associated with increased turnover of FX derivatives. There is also a positive but weak relationship between growth of FX derivatives turnover and the level of domestic interest rates across the main FX instruments – outright forwards and FX swaps.¹⁵

Derivatives markets take off at higher income levels

On a more structural level, turnover of FX derivatives is statistically highly correlated with per capita income. While even lower-income countries such as India have started to develop dynamic derivatives markets, it is only at a fairly high level of per capita income that such markets begin to take off. In a sample covering both advanced and emerging market economies, the vast majority of countries with daily turnover of FX derivatives of \$10 billion or more have per capita income above \$30,000 (measured at PPP exchange rates). In the emerging markets, this level of per capita income is found, for instance, in Israel and Korea, which have, unsurprisingly, some of the most developed derivatives markets among EMEs. These results are tentative and should be interpreted with caution; nonetheless, they are indicative of some of the structural reasons for the observed gap in the development of derivatives markets between advanced economies and EMEs.

Conclusion

The growth of derivatives turnover in emerging markets remains more rapid than in advanced economies. The largest emerging market derivatives markets are now located in Korea, Brazil and the two Asian financial centres of Hong Kong and Singapore. About half of the derivatives turnover in emerging markets occurs over the counter, compared to one third in advanced economies. FX derivatives are by far the most commonly traded. Growth of FX derivatives turnover appears to be positively related to trade, financial activity and per capita GDP.

Derivatives turnover in emerging markets is becoming more and more global. Not only is an increasing share of emerging market transactions cross-border as opposed to domestic, but the two large financial centres of emerging

¹⁴ We use growth of amounts outstanding because turnover data are generally not available for bond markets. Note that there can be some reverse causality between FX derivatives turnover and financial market activity, especially foreign non-financial corporate issuance in local bond markets in EMEs.

¹⁵ The level of interest rates is a potential determinant of FX derivatives turnover because carry trades and other leveraged investment strategies exploit interest rate differentials and exchange rate trends in emerging vis-à-vis advanced market economies.

Asia continue to grow in importance as home to an increasingly large share of OTC derivatives trades not involving the local currency.

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Counterparty risk and contract volumes in the credit default swap market¹

After more than a decade of rapid growth, the volume of outstanding credit default swaps peaked at almost \$60 trillion at the end of 2007. Since then it has nearly halved, while turnover has continued to rise. The decline in volumes outstanding reflects intensified efforts to reduce counterparty risk, which have eliminated more than \$65 trillion of offsetting positions.

JEL classification: G23, G28.

After rapid growth, the outstanding volume of CDS fell sharply ...

The notional amount of outstanding credit default swaps (CDS)² grew rapidly from the market's beginnings in the mid-1990s to a peak of almost \$60 trillion at the end of 2007,³ but then declined sharply to just over \$30 trillion at the end of the first half of 2010 (Graph 1, left-hand panel). This feature argues that the decline did not occur because CDS lost some of their appeal in the light of the recent financial crisis. Indeed, trading volumes have continued to rise. New trade volumes at the major CDS dealers were almost twice as high in the first nine months of 2010 as in the same period in 2007, according to Markit. Instead, the sharp drop in the volume of outstanding CDS is due to trade compression and the move to central counterparties in the CDS market.

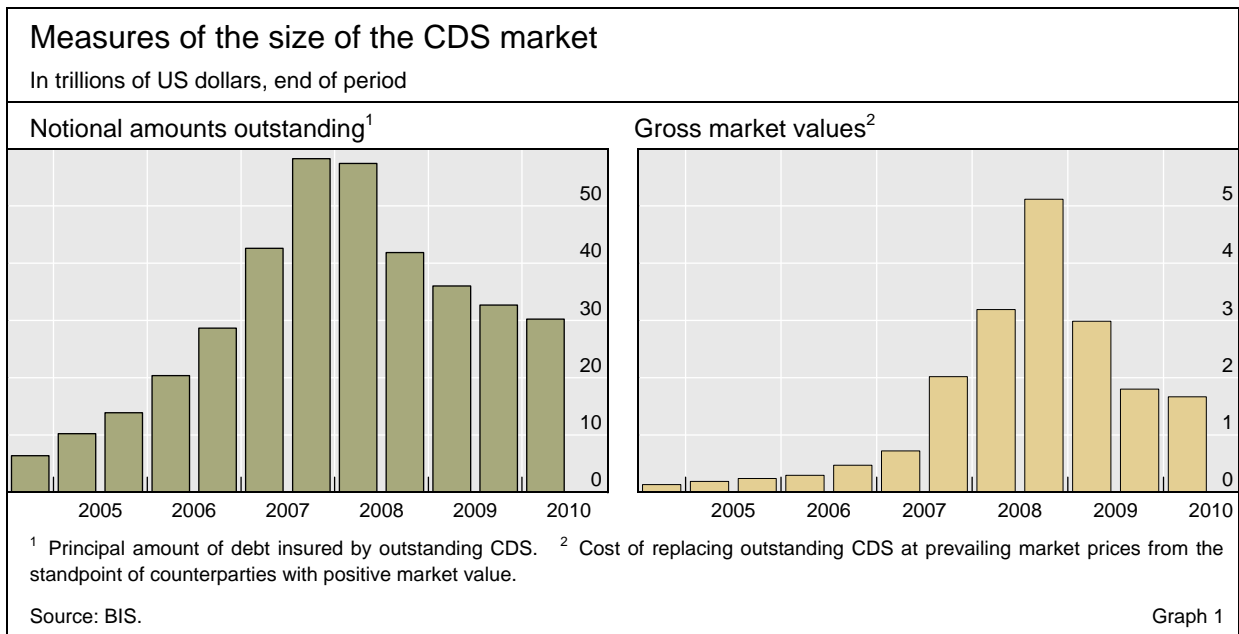
... reflecting concerns about counterparty risks ...

Perceptions of counterparty risk can explain both the rise and subsequent fall in the volume of outstanding CDS. Until the onset of the subprime mortgage

¹ I thank Claudio Borio, Stephen Cecchetti, Jacob Gyntelberg and Christian Upper for helpful comments. The views expressed are those of the author and do not necessarily reflect those of the BIS.

² CDS provide protection against default losses. In case of a credit event – a default on scheduled payments or a debt restructuring – the seller of protection makes a payment equal to the losses on specified debt obligations. The protection buyer, in turn, pays regular premiums for this protection. Notional amounts are the principal amounts of the debt obligations referenced by CDS. The market value of outstanding CDS, which is the cost of replacing contracts at prevailing market prices, shows a similar pattern of rapid growth followed by a substantial decline in the past few years (Graph 1, right-hand panel).

³ Reasons for this growth are described in Packer and Suthiphongchai (2003), Amato and Gyntelberg (2005), Ledrut and Upper (2007) and Fender and Scheicher (2008).



crisis in 2007, market participants perceived counterparty risks to be small. As a result, if a party to a CDS wished to exit its position, it would often establish a new offsetting position rather than try to negotiate early termination of the original CDS with its counterparty.⁴ This would leave existing counterparty exposures in place while adding new ones. Concern about counterparty risk then surged in the second half of 2007 and in 2008, when major CDS dealers incurred substantial valuation losses on financial contracts linked to subprime mortgages. There were also fears of significant credit losses arising from the default of counterparties to undercollateralised subprime-linked contracts.

A significant aspect of counterparty risk concerns was that the major CDS dealers were important counterparties to one another. Although inter-dealer exposures were often small on a net basis, they were frequently large in gross terms, and there were fears that any agreement to net obligations across contracts might not be enforceable in the event of default. Furthermore, the value of these exposures grew substantially as credit spreads widened during the crisis. The fates of major CDS dealers were therefore perceived to be somewhat intertwined.⁵ This limited the scope for shifting CDS business from weaker to stronger dealers. Box 1 discusses the manifestation and measurement of CDS counterparty risk in more detail.

... which are interdependent

The remainder of this feature describes the main actions that have been taken to mitigate counterparty risk in the CDS market in the light of the crisis. These include shifts in trading patterns, which market participants were able to implement quickly, as well as structural changes, which required coordination. Structural measures have helped to locate and tear up more offsetting

⁴ This would allow quotes from several possible new counterparties to be compared, potentially delivering better value than dealing with the single counterparty to the original CDS.

⁵ Fender et al (2008) describes in more detail how the crisis affected major dealers and how emergency measures were taken to reduce the chance of knock-on failures after the default of Lehman Brothers.

Box 1: Measuring counterparty risk exposures in the CDS market

The notional amount of a CDS is the principal amount of debt “insured” by the contract. This is the maximum amount that a seller of protection might have to pay to the buyer. Such an obligation would arise if the entity referenced in the contract defaulted and the recovery rate on its debt was zero. Notional amounts therefore reflect the maximum potential future counterparty exposure of the protection buyer to the protection seller.

The market value of a CDS records the cost of replacing the contract with an equivalent new contract at current market prices. As such, it provides an indication of current counterparty exposure. Market values are typically much smaller than notional amounts. This is because they reflect the difference between the present values of anticipated future premiums and default-linked payments, and the likelihood of default-linked payments is often small.

Neither notional amounts nor market values, however, are comprehensive measures of counterparty risk exposures, as they ignore netting arrangements and collateral. Most outstanding CDS contracts include “closeout netting” provisions, which have proved legally enforceable in the past. This means that current exposures can generally be netted in the event of a counterparty default. Since CDS market participants often hold with the same counterparty some contracts with positive market value and some contracts with negative market value, current counterparty exposures tend to be much lower than gross market values. Gross credit exposures, as reported in the BIS semiannual over-the-counter derivatives statistics, take this into account. They record the sum of market values of all outstanding contracts from the point of view of counterparties with positive market value, after allowing for legally enforceable netting. Credit exposures still overstate current counterparty risk exposures, however, as market participants with positive market value often demand collateral from their counterparties. This would offset losses should the counterparty default.

positions. Indeed, over \$65 trillion of CDS have been eliminated in this way since the end of 2007. After allowing for some offsetting upward influences, such as continued growth in trading volumes, this explains the decline of almost \$30 trillion in the volume of outstanding CDS during this period.

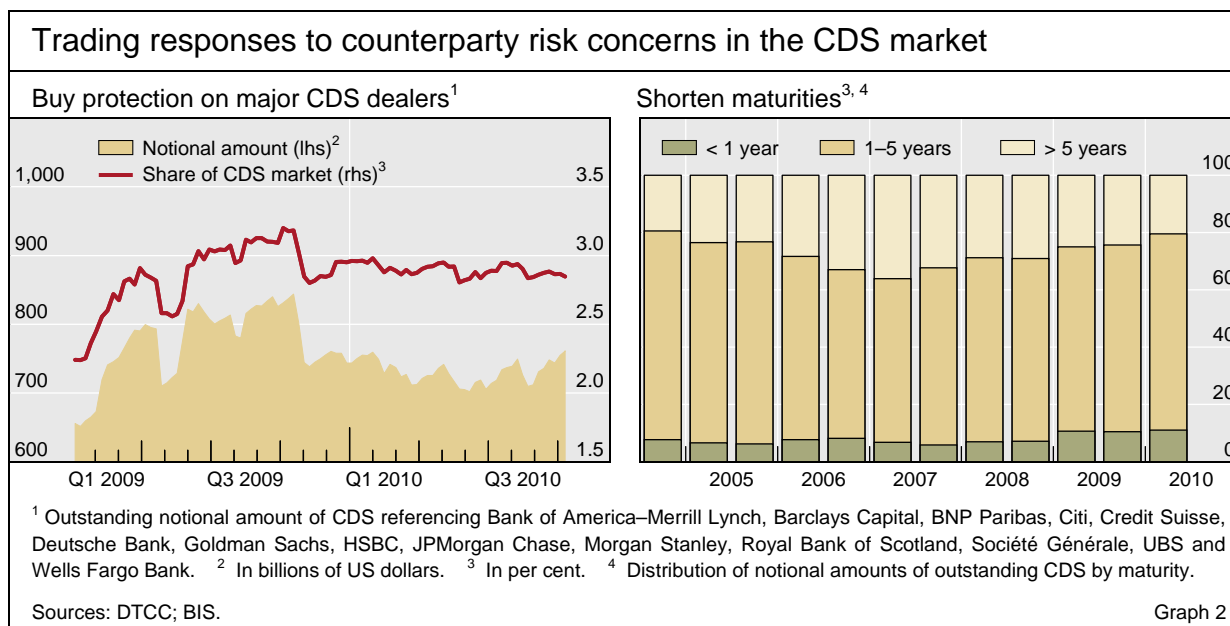
Shifts in trading patterns in the light of counterparty risk concerns

Market participants responded to increased concern about counterparty risk by buying protection on CDS dealers and shortening the maturity of their new contracts. But none of these trading responses represented a comprehensive solution to the problem. Buying protection on one dealer from another dealer is of limited value if there are systemic concerns about the robustness of counterparties in the market. Similarly, shortening maturities may be worth little if potential new counterparties represent as great a risk as the incumbent when it comes to replacing maturing contracts.

Attempts to hedge counterparty risk through CDS were reflected in major CDS dealers moving up the rankings of the most popular individual reference entities on which to buy credit protection, as reported in Fitch Ratings’ Global Credit Derivatives Surveys. Seven major dealers were among the top 25 reference entities in 2008, for example, up from just two in 2006.⁶ Data from

Immediate responses ineffective in systemic crisis

⁶ Major CDS dealers were defined as Bank of America–Merrill Lynch, Barclays Capital, BNP Paribas, Citi, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JPMorgan Chase, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS and Wells Fargo Bank, as well as Lehman Brothers before its failure in 2008.



the Depository Trust & Clearing Corporation (DTCC) then show that the notional amount of outstanding CDS contracts referencing major CDS dealers increased into 2009, rising from around \$660 billion (2.2% of all outstanding CDS) at the start of the year to \$840 billion (3.1% of outstanding CDS) in the third quarter (Graph 2, left-hand panel). Although this response to increased concern about counterparty risk boosted, rather than reduced, the volume of outstanding CDS, its effect was small relative to other influences that have pulled down this volume.

The move to shorter maturities can be seen in the right-hand panel of Graph 2. This shows that the proportion of outstanding CDS contracts with maturities of less than one year has increased since the end of 2007, while that of contracts with maturities in excess of five years has fallen. As long as maturing CDS are replaced with new contracts, however, shortening maturities will not affect the outstanding volume of CDS.

Another response was to shorten maturities

Structural changes to mitigate counterparty risks

The most important structural measures implemented in the CDS market to reduce counterparty risk were to accelerate the pace of trade compression and to introduce central counterparties (CCPs). The effect of both measures is to allow contracts on offsetting positions to be torn up. The scope for such tear-ups, however, greatly depends on how far CDS contracts are standardised.

Structural measures have also been introduced

Standardisation

Standardisation is a low-cost way to increase the number of offsetting CDS by equalising more of the cash flows that they generate.⁷ This, in turn, makes it

These measures have been aided by standardisation ...

⁷ Initiatives to ensure that contract cash flows are clearly defined and readily available for comparison are further prerequisites for a high volume of tear-ups. The Reference Entity Database (Markit (2009)) and the Trade Information Warehouse (DTCC (2007)) are examples of such initiatives.

easier to locate and tear up contracts, thus reducing counterparty risk. The degree of standardisation varies among product types. For example, CDS indices, which offer protection against default losses on portfolios of reference obligations, are highly standardised. They pay standard coupons on particular dates, and any default-contingent payments are generated by a fixed pool of reference obligations, which is determined on a consistent basis. Index tranches, which offer protection conditional on default losses on CDS index portfolios falling within certain ranges, are similarly standardised. Until last year, however, “single-name” CDS, which insure the debt of individual reference entities, were much less standardised. But then a “Big Bang” of numerous changes to contract documentation brought standardisation for single-name CDS up to a level comparable to that applied to CDS indices and index tranches. The Big Bang and its implications for the standardisation of single-name CDS are discussed in more detail in Box 2.

... which facilitates netting ...

Additional offsetting of cash flows is a benefit of standardisation that has helped to reduce counterparty risk in the CDS market without affecting the volume of outstanding contracts. Cash flows may be offset when a pair of counterparties has multiple contracts that require payments to be made in opposite directions on the same day. In general, such contracts cannot easily be torn up because they do not insure the same risks. Netting can significantly reduce payment volumes and, hence, reduce the likelihood of counterparty defaults due to cash flow shortages. In 2009, for example, the contracts recorded in DTCC’s Trade Information Warehouse generated 557,000 payments, whereas 10.9 million payments would have been required if netting had not taken place. The warehouse also provides timely data to regulators on the CDS positions of market participants.⁸

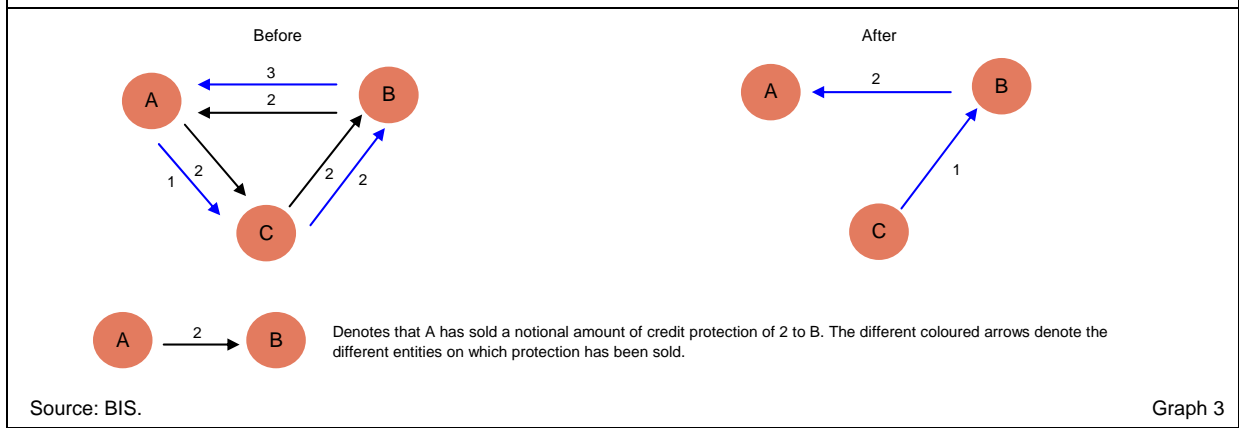
Trade compression

... and trade compression ...

Standardisation has also greatly assisted trade compression, which eliminates counterparty risk in offsetting contracts by tearing them up. Some tear-ups have been arranged bilaterally, but multilateral solutions tend to be more effective in identifying offsetting contracts. Such services input the portfolios of users into an algorithm that reproduces the same portfolio risk exposures for each participant using a smaller volume of contracts while complying with any limits on counterparty exposures specified by users. The redundant contracts may then be torn up, as illustrated in Graph 3. Contracts can simply be eliminated or be replaced with new contracts with smaller notional amounts. Even greater volumes of contracts can potentially be torn up if users of trade compression services agree to minor changes in the risk profiles of their portfolios in exchange for compensating payments. The precise outcome depends on the users, since they can accept or reject proposals created by the algorithm, with acceptance by all users required for a proposal to be implemented.

⁸ Coverage of the DTCC data is reported and compared with BIS data in Gyntelberg et al (2009).

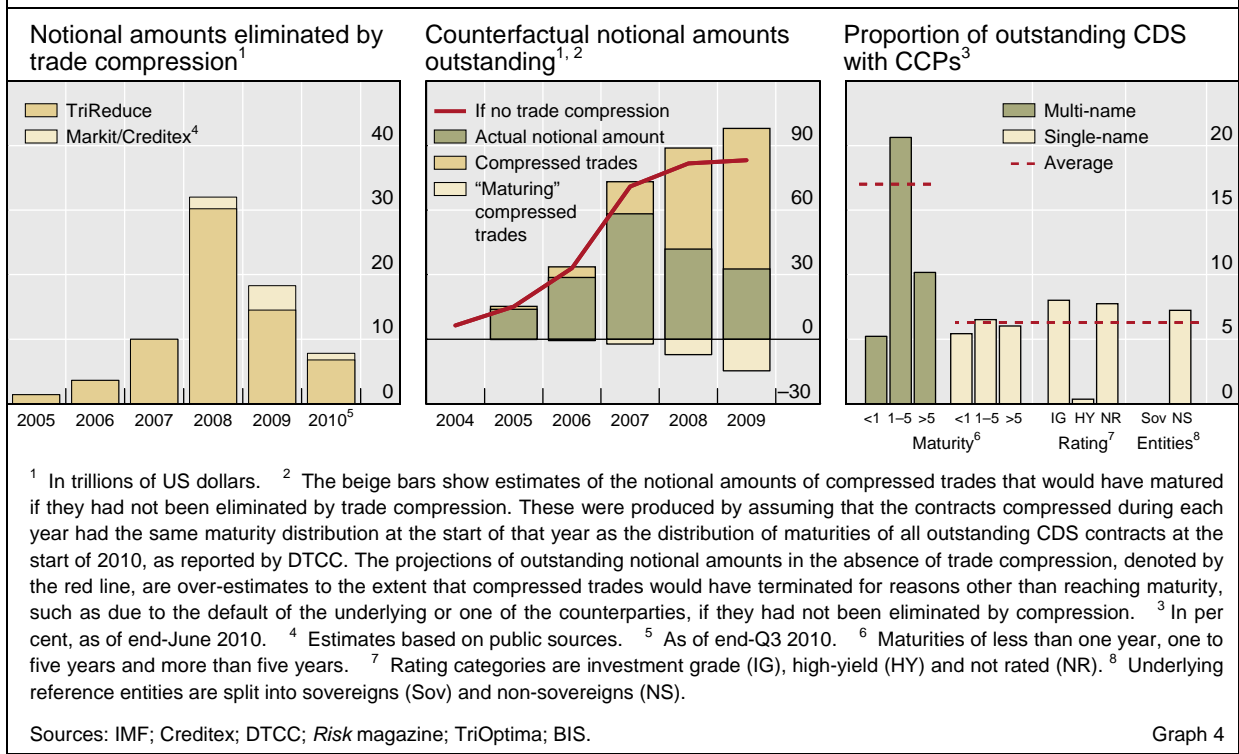
An illustrative example of trade compression



TriOptima became the first company to offer CDS portfolio compression when it extended its TriReduce service from interest rate swaps to the CDS market in 2005. In the CDS market, TriReduce has compressed mainly portfolios of CDS indices and index tranches, but single names have accounted for an increasing share of its compression volumes since standardisation in 2009. In total, TriReduce has eliminated a notional amount of CDS in excess of \$66 trillion. Of this amount, \$30 trillion was eliminated in 2008, when concerns about counterparty risk were at their highest. In August 2008, Markit and Creditex jointly launched a trade compression service for single-name CDS. Since then, this has eliminated a notional amount of CDS contracts in excess of \$6 trillion. The left-hand panel of Graph 4 shows time series of the notional

... which has eliminated \$72 trillion of CDS

Trade compression and CCPs in the CDS market



Box 2: The “Big Bang” in the CDS market

To help standardise single-name CDS contracts, the International Swaps and Derivatives Association (ISDA) introduced a number of documentation changes in its “Big Bang” of April 2009. These helped to standardise both the regular coupon payments made by single-name CDS and the default-contingent payments. The changes are summarised in Table A.

One major change that helped to standardise coupon payments was the introduction of a small number of standard coupon rates. In combination with standard contract sizes, these fixed the size of coupon payments, which were already paid on standard dates (20 March, 20 June, 20 September and 20 December). To compensate for any differences between the appropriate premium and the chosen standard coupon rate, counterparties exchange an upfront payment. A change was also made to the first coupon. Previously, this was either a small coupon paid on the first coupon date or a large coupon paid on the second coupon date, depending on when contracts became effective. Now, first coupons are full coupons, and upfront payments are adjusted accordingly.

To help standardise default-contingent payments, the Big Bang harmonised across contracts the triggers of credit events and their consequences. For example, it established Determinations Committees for determining whether a credit or succession event has occurred as the standard condition in contract documentation. This has reduced the scope for different contracts on the same reference entity to disagree about whether such events have occurred. The Big Bang also hardwired into documentation that the size of payments following credit events would be determined by an auction process. The prices emerging from such auctions ensure that all protection sellers transfer the same value to protection buyers. Finally, the Big Bang changed the dates on which contracts are considered to have become effective from the business day following the trade to a set of standard dates. This ensures that all outstanding contracts are affected by the same events, even when these are reported with a lag.

CDS contract standardisation measures introduced in the Big Bang

Measure	Implication
Standard coupon rates	In combination with standard contract sizes, help to equalise the size of cash flows across contracts
Full first coupons	In combination with standard contract sizes, equalise the size of first coupons on different contracts
Determinations Committees	Consistent treatment of contracts in the light of credit and succession events ¹
Auction protocol	Determines unique prices for settlement of contracts in the light of credit events
Standard effective dates	All outstanding contracts on a given reference entity affected by the same events

¹ Succession events describe situations, such as corporate acquisitions, in which a new entity succeeds to the obligations of the previous reference entity. Table A

amount of CDS eliminated by both trade compression services. After eliminating slightly more than half of the notional amount of outstanding CDS in 2008, the volume of trade compression has necessarily slowed in 2009 and 2010. This also reflects the fact that CCPs began to tear up CDS from early 2009. Nevertheless, in the absence of trade compression, the outstanding volume of CDS would have continued to grow – to an estimated \$80 trillion, which is 2½ times the actual value (Graph 4, centre panel).⁹

⁹ The effect of trade compression on the notional amount of outstanding CDS contracts is also discussed in Gyntelberg and Mallo (2008).

Central counterparties

CCPs further boost the scope for netting and trade compression. Trades are placed with CCPs by replacing bilateral CDS contracts between a protection buyer and a protection seller with a contract between the protection buyer and a CCP and another contract between the same CCP and the protection seller. As illustrated in Graph 5, this initially doubles the volume of outstanding contracts. As the graph also illustrates, however, the substitution of multiple counterparties for the central counterparty also generates more offsetting bilateral positions, which may be torn up. It also generates more bilateral positions that do not fully offset but whose cash flows may offset at particular points in time, and hence may be netted. Counterparty risk is further reduced if the CCP is an especially robust counterparty to remaining contracts. CCPs aim to ensure that this is the case by imposing strict collateral requirements on counterparties and by maintaining an emergency fund to draw on in the event of counterparty defaults.¹⁰

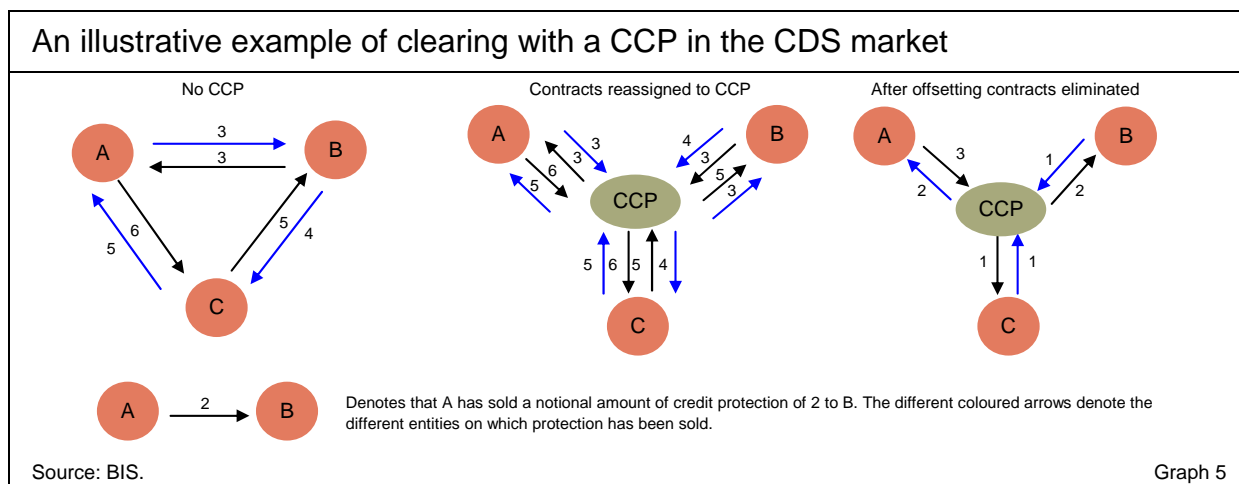
Central counterparties have been introduced ...

Several firms currently operate central counterparty clearing facilities for CDS, but ICE Trust US and ICE Clear Europe have done the vast majority of such clearing to date. Together they have cleared a notional amount of contracts in excess of \$11 trillion since their respective launches in March and July 2009. Both institutions initially offered clearing of CDS indices but have subsequently extended this to single-name CDS. Clearing has also been extended from inter-dealer trades to trades involving hedge funds and other buy-side investors, although a notional amount of only \$4 billion of such contracts has been cleared to date.¹¹

... which have cleared \$11 trillion of CDS

Table 1 shows new BIS data on the proportion of outstanding CDS contracts held with CCPs as of the end of June 2010. Across the market, CCPs were counterparties to a notional amount of \$3.2 trillion of outstanding CDS at

CCPs have eliminated five sixths of cleared volumes ...



¹⁰ The advantages and disadvantages of central clearing in OTC derivatives markets and its implications for financial stability are considered in more detail in Cecchetti et al (2009).

¹¹ Cecchetti (2010) makes a case for greater use of CCPs by non-dealers, including non-financial firms, especially via segregated accounts.

Proportion of outstanding CDS with CCPs				
By notional amounts and gross market values ¹				
	CDS	Total outstanding (\$ trillions)	With a CCP (\$ trillions)	Proportion with CCPs (in per cent)
Notional amounts	All	30.3	3.2	10.5
	Single-name	18.4	1.2	6.3
	Multi-name	11.9	2.0	17.0
Gross market values	All	1.67	0.06	3.8
	Single-name	0.99	0.03	2.7
	Multi-name	0.67	0.04	5.5

¹ As of end-June 2010.
Source: BIS.

Table 1

that time.¹² The total volume of CDS that had been cleared by CCPs by the end of June 2010 was around \$9 trillion, generating positions of \$18 trillion between CCPs and market participants. This suggests that CCPs have eliminated around five sixths of the contract volumes assigned to them. However, this may overrepresent the amount of counterparty risk eliminated from the market by CCPs, as the contracts with CCPs had lower market values than the market average. The new BIS data show that while the outstanding contracts held with CCPs at the end of June 2010 accounted for 10.5% of the notional amount of outstanding CDS, they accounted for only 3.8% of the outstanding gross market value. This at least partly reflects the lower price volatility of indices, which account for a greater volume of contracts cleared by CCPs than single-name contracts.

... focused on CDS indices

Both notional amounts and market values suggest that a higher proportion of CDS indices, index tranches and other “multi-name” CDS are held with CCPs than single-name CDS. This reflects the longer and more complete acceptance of CDS indices than of single-name CDS by CCPs, which in turn proceeds from the generally superior liquidity of CDS indices and index tranches. Superior liquidity may also explain the relatively greater use of CCPs for contracts with one- to five-year maturities and investment grade single-name CDS than for high-yield single-name CDS, as shown in the right-hand panel of Graph 4. The greater use of CCPs for non-rated and non-sovereign single-name CDS may reflect the underlying risk of these contracts, which is often greater than for rated and sovereign contracts respectively. Market participants may have been particularly keen to clear such contracts with CCPs in anticipation of higher chances of large movements in market value that would result in significant counterparty exposures.

¹² This is very similar to the amount of \$3.3 trillion as of end-July 2010 reported by DTCC and published in the table on page 24 of FSB (2010).

Conclusion

The near halving of the outstanding volume of CDS since the end of 2007 does not reflect any broad-based loss of appeal by CDS. Indeed, trading volumes have grown strongly during this period. Instead, it reflects intensified efforts to mitigate counterparty risk, notably via trade compression and central counterparties. Trade compression has eliminated contracts with a notional amount of more than \$58 trillion since the end of 2007, and CCPs have torn up at least a further \$7 trillion. Looking ahead, tear-ups may further reduce outstanding contract volumes, especially for single-name CDS, which have only recently benefited from standardisation. As outstanding volumes have already halved, however, the pace of any further decline must soon slow.

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A user's guide to the Triennial Central Bank Survey of foreign exchange market activity¹

This article provides an overview of the foreign exchange components of the Triennial Central Bank Survey. It highlights key dimensions of this dataset and methodological issues that are important to interpret it correctly. It also compares the methodology of the Triennial to that of more frequent surveys from regional foreign exchange committees.

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

In April of this year, the BIS coordinated the eighth Triennial Central Bank Survey of foreign exchange market activity (“the Triennial”).² The Triennial has been conducted every three years since April 1989, and provides the most comprehensive and internationally consistent information on the size and structure of global over-the-counter (OTC) foreign exchange markets.³

This article provides a user's guide to the Triennial to encourage broader use by market participants, policymakers and academics. While the headline figures for daily average turnover in foreign exchange markets are widely reported, the underlying data remain largely unexplored. This is partly due to the dataset's limited user-friendliness, as up to now the statistics were available only as separate data files for each survey. Beginning with the 2010 Triennial, however, the data since 1995 have been aggregated into a single database and will soon be downloadable from the BIS website. A second obstacle has been the complex structure of the data. This user's guide provides an overview of the key features of the statistics to facilitate their use.

The results of the 2010 survey and more complete detail on the methodology are available on the BIS website at www.bis.org/publ/rpfx10t.htm.

¹ The authors thank Claudio Borio, Tristan Broderick, Grigoria Christodoulou, Chris Cox, Gabriele Galati, Alex Heath, Robert McCauley, Robert Ogrodnick, Jamie Pfeifer and Christian Upper for useful comments and suggestions. The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

² Since 1995, the Triennial has also reported on activity in OTC derivatives markets. This article only discusses the foreign exchange instruments.

³ OTC markets are those in which buyers and sellers transact through a telephone or computer network, rather than through an exchange.

Key dimensions of the Triennial data

Table 1 provides an overview of the Triennial, highlighting key changes in methodology and coverage over the years. The early focus was on expanding the geographical coverage to include all major trading centres. Germany, for example, did not participate in the original survey but joined in 1992. While, in addition to the spot market, the first two surveys covered exchange-traded products, the focus since 1995 has been on the fast-growing but opaque OTC derivatives markets, with data on exchange-traded products no longer reported from 1998 onwards due to their availability from commercial providers. In terms of methodology, since the first survey efforts have been made to improve the adjustment for double-counting of trades between reporting dealers (ie inter-dealer trades). Since 2001, the Triennial has included more currency pairs. In 2004, the number of banks surveyed declined and the reporting basis changed from where the trade is booked to where it is arranged (eg the sales desk).

The Triennial captures many facets of FX markets

Data collected

The Triennial collects data on: (i) foreign exchange *turnover* measured in notional amounts; and (ii) notional amounts *outstanding* and gross market values of foreign exchange instruments (Table 2).⁴ For historical reasons, turnover data are collected in April, and amounts outstanding at the end of

Data are collected on turnover and amounts outstanding ...

Overview of Triennial surveys from 1989 to 2010			
Year of survey	Average daily FX turnover at constant rates (USD billions)	Number of countries participating (and reporting dealers)	Key changes in methodology and coverage
1989 ¹	655	21 (1,089)	Country reports were not fully homogeneous.
1992	890	26 (2,496)	Greater granularity for counterparty types and locations to eliminate double-counting. More currencies covered.
1995	1,165	26 (2,414)	Survey expanded to collect data on turnover of currency swaps and options, and amounts outstanding for OTC derivatives.
1998	1,705	43 (3,100)	Dropped coverage of exchange-traded products. Amounts outstanding reported on worldwide consolidated basis.
2001	1,505	48 (2,530)	Increased coverage of emerging market currencies.
2004	2,040	52 (1,200)	Clarified the concept of reporting dealers. Location based on sales desk. Reporting threshold increased, reducing number of reporting dealers.
2007	3,370	54 (1,260)	Simplified template for execution method to allow adjustment for double-counting of inter-dealer activity.
2010	3,981	53 (1,309)	Dropped the distinction between “traditional foreign exchange markets” and other FX instruments.

¹ While the Triennial formally began in 1986, Canada, Japan, the United Kingdom and United States collected and reported data on turnover in 1986. These data made limited adjustment for double-counting, but were highlighted in the discussion of the 1989 Triennial.

Table 1

⁴ Due to the nature of foreign exchange spot transactions, only turnover data are available.

Key dimensions of the FX part of the Triennial survey		
Dimension	Turnover	Amounts outstanding
Data collected	Turnover in gross notional amounts during April.	Gross notional amounts and gross market values outstanding at end-June.
Instruments	Spot, outright forwards, FX swaps, currency options, currency swaps and other foreign exchange products.	Outright forwards, FX swaps, currency options, currency swaps and other foreign exchange products.
Counterparties	1. Reporting dealers: financial institutions that are active in foreign exchange markets and participate in the Triennial survey. 2. Other financial institutions: banks not classified as reporting dealers, mutual funds, pension funds, hedge funds, insurance companies, central counterparties, central banks or online retail platforms. 3. Non-financial customers: corporations and governments.	
Reporting basis	Locational basis: each reporting dealer reports on its activity to the local monetary authority. As of 2004, based on the sales desk.	Consolidated basis: each bank reports in the country where it is headquartered, aggregates across all its branches and (majority-owned) subsidiaries worldwide and nets out deals between affiliates.
Currencies	Broken down by 41 individual currencies and 28 bilateral currency pairs.	Broken down by 33 individual currencies (not bilateral currency pairs).
Maturities	Transactions in outright forwards and FX swaps are broken down by original maturity: seven days or less; over seven days and up to one year; over one year.	Amounts outstanding in outright forwards and FX swaps broken down by remaining maturity: one year or less; over one year and up to five years; over five years.
Execution methods	Since 2007, broken down for the following categories: 1. Interbank direct 2. Customer direct 3. Voice broker 4. Electronic broker 5. Multibank trading system 6. Single-bank trading system	Not applicable
Additional information	Reporting central banks are asked to provide: 1. The number of participating institutions 2. The estimated percentage coverage of their survey for local FX market activity 3. The number of institutions accounting for 75% of the reported totals	

Table 2

June. All figures are reported in US dollar equivalents. Non-dollar amounts are converted into US dollars using the exchange rate prevailing on the date of the trade for turnover, and using exchange rates at the date of the report for amounts outstanding.

Turnover data provide a measure of market activity, as well as an indication of market liquidity. Turnover is defined as the aggregate gross notional amount of all transactions struck during the calendar month of April (chosen to represent a typical month for foreign exchange market activity) regardless of whether delivery or settlement was made during that month. Daily average turnover is computed by dividing aggregate monthly turnover by the

number of trading days in April for each country.⁵ Each transaction is recorded once, and offsetting contracts are not netted. There is no distinction between sales and purchases. Direct cross-currency transactions (eg Japanese yen for euros) are counted as single transactions; however, cross-currency transactions that pass through the US dollar (eg Swiss francs for Australian dollars) are recorded as two separate deals against the vehicle currency.

Data on *amounts outstanding* serve as a benchmark to assess the representativeness of the more frequent but less comprehensive semiannual survey on OTC derivatives markets. Banks report two types of data. *Nominal (or notional) amounts* outstanding give a measure of market size. *Gross market values*, defined as the sums of the absolute replacement values of all open contracts, provide a proxy of the potential risk transfer in these instruments. The format corresponds to the regular reports on OTC derivatives markets that began in 1998 for G10 countries. Data on amounts outstanding are collected on a *consolidated* basis at the end of June in the survey year. Reporting dealers with global operations aggregate across all international branches and (majority-owned) subsidiaries and report to the monetary authority where the dealer is headquartered. Deals between affiliates are netted out (ie offsetting of positions between two counterparties).

Instruments

The Triennial distinguishes six foreign exchange instruments:

... for six different instruments ...

Spot transactions are single outright transactions involving the exchange of two currencies at a rate agreed on the date of the contract for cash settlement, typically within two business days.

An *outright forward* is an agreement between two counterparties to exchange two currencies at a rate agreed on the date of the contract for cash settlement on an agreed future date which is more than two business days later.⁶ This category also includes non-deliverable forwards (ie forward foreign exchange contracts that do not require physical delivery of a non-convertible currency) and other contracts for differences (ie contracts where only the net market value is exchanged).

A *foreign exchange swap* is a pair of currency transactions (one purchase, one sale) for two different value dates. The exchange rate for both transactions is agreed at the outset of the contract. An FX swap may involve an exchange of spot against a forward, or an exchange of two forwards with different dates (eg three-month forward versus six-month forward). FX swaps are arranged as a single transaction with a single counterparty. Because a customer usually contracts to purchase and sell the same amount of currency at the specified rates, there is no market risk (open position) over the life of the FX swap.

⁵ As a consequence, a comparison of turnover data across time and countries is not distorted by the different number of trading days in different countries in April due to national holidays.

⁶ The forward exchange rate is based on the interest rate differential between the two currencies, with the price quoted in terms of forward points relative to the spot rate. If forward points are added to the spot rate, the forward rate is at a premium to the spot rate. If forward points are subtracted, the forward rate is at a discount to spot.

Currency swaps are contracts committing two counterparties to exchange streams of interest payments denominated in different currencies for an agreed period of time. They typically require an exchange of principal amounts denominated in different currencies at a pre-agreed exchange rate at inception and at maturity of the contract. Interest payments are then on a fixed, floating or zero coupon basis. In effect, a currency swap allows a borrower or lender to swap a loan in one currency for a loan in another without incurring currency risk (assuming the swap is held until maturity).⁷ A currency swap is essentially a spot transaction combined with a series of outright forward transactions.

Currency options are contracts giving the holder the right (but not the obligation) to buy or sell a currency at an agreed exchange rate during a specified period.

Finally, *other foreign exchange products* cover any instrument where the transaction is highly leveraged and/or the notional amount is variable and where decomposition into the instruments listed above is impractical.

Counterparties

... and three types
of counterparties

The Triennial asks dealers to report their foreign exchange transactions for three types of counterparties: other reporting dealers, other financial institutions and non-financial customers.

The category *reporting dealers* covers mainly large commercial and investment banks and securities houses that participate in foreign exchange markets and have active business with end customers. Reporting dealers actively buy and sell foreign exchange instruments both for their own account and to meet customer demand. In the turnover part of the survey, reporting dealers also provide a breakdown of *local* and *cross-border* transactions, according to the location where the sale is arranged (not the country where the head office is based or where the institution is legally incorporated). For each foreign exchange instrument, a reporting dealer specifies trades “with reporting dealers, local” or “with reporting dealers, cross-border”. These categories are used to eliminate double-counting, which occurs when two reporting dealers each report the same transaction.

Other financial institutions are those not classified as reporting dealers for the purposes of the Triennial. Thus, this category includes smaller commercial banks, investment banks and securities houses. It also covers asset managers such as mutual funds, money market funds, insurance companies, pension funds, hedge funds and currency funds. It also includes building societies, leasing companies, financial subsidiaries of corporations, central counterparties and central banks.

Non-financial customers are defined as any counterparty other than those described above. In practice they are mainly non-financial end users, such as corporations and governments.

⁷ Typically, a currency swap is used to hedge a bond issued in one currency into another currency, such that the borrower is not exposed to exchange rate risk.

Reporting basis

Foreign exchange turnover is allocated across countries based on the location where the transaction is arranged (ie the sales desk). The nationality of the reporting dealer does not matter. For example, when Credit Suisse London reports trades to the Bank of England, these transactions are allocated to the United Kingdom. Foreign exchange amounts outstanding, however, are allocated based on the nationality of the reporting dealer (regardless of where the trades are contracted or booked). So, for example, foreign exchange derivatives contracts held by Credit Suisse London will be consolidated by its head office and allocated to Switzerland.

Turnover is based on the location of the sales desk ...

Eliminating double-counting

As noted above, the BIS uses data on counterparties to eliminate double-counting, which arises when two dealers each report the same transaction. In order to derive meaningful measures of foreign exchange market size, these inter-dealer transactions are halved.

... adjusted for local and cross-border double-counting

The first step in this process eliminates local double-counting (“net-gross” basis) when calculating national results. Net-gross data are adjusted for transactions between reporting dealers located in the same country. Transactions classified as “with reporting dealers, local” are divided by two, and the resulting figure is subtracted from total “gross-gross” data to obtain net-gross figures (ie business net of local inter-dealer double-counting). For example, when reporting dealers located in the United States report local transactions with each other the sum of these local inter-dealer transactions is divided by two to arrive at the correct figure for US turnover.

A second step eliminates cross-border double-counting (“net-net” basis) when calculating global results. Net-net data are adjusted for cross-border transactions between reporting dealers located in different countries. Transactions classified as “with reporting dealers, cross-border” are divided by two, and the resulting figure is subtracted from total net-gross data to obtain net-net figures (ie business net of local *and* cross-border inter-dealer double-counting). For example, trades between a reporting dealer located in the United States and a reporting dealer located in Germany are divided by two when calculating global turnover.

Geographical distribution of turnover

The net-gross data are used to generate the geographical distribution of foreign exchange turnover, thus enabling a ranking of the *largest financial centres*. In 2010, for example, the United Kingdom captured 37% of global foreign exchange turnover. Note, however, that the geographical distribution is available at the country level, not the city level. While the majority of UK activity took place in London, the total includes transactions in other UK cities.

The data identify the largest financial centres ...

One shortcoming of the Triennial methodology is that it is based on currencies and not countries. For this reason, it is not possible to construct the flows in various foreign exchange instruments between two countries or regions. While data are available on turnover in the US dollar and Japanese

... but not bilateral activity between countries

yen, for example, the Triennial data do not allow users to calculate flows between the United States and Japan. The US and Japan each report only aggregate cross-border flows with the rest of the world, not flows vis-à-vis each other.

Currency breakdowns

Activity is broken down by currency ...

The Triennial provides a breakdown of activity based on the underlying currencies for each foreign exchange instrument. Figure 1 shows how the currencies are reported. This format allows users to identify which currencies are used most actively for foreign exchange transactions.

In the first column of Figure 1, the value for each foreign exchange instrument is reported for trades involving the *domestic currency* in one leg against eight *major currencies*: the Australian dollar (AUD), the Canadian dollar (CAD), the euro (EUR), the Japanese yen (JPY), the Swedish krona (SEK), the Swiss franc (CHF), the pound sterling (GBP) and the US dollar (USD). Any trades between the domestic currency and currencies not explicitly listed in column 1 are classified as “other”. Transactions that do not involve the local currency (such as EUR/CHF in London) are not reported in this category. The sum of all transactions versus the domestic currency provides a measure of *onshore* trading activity for each currency.

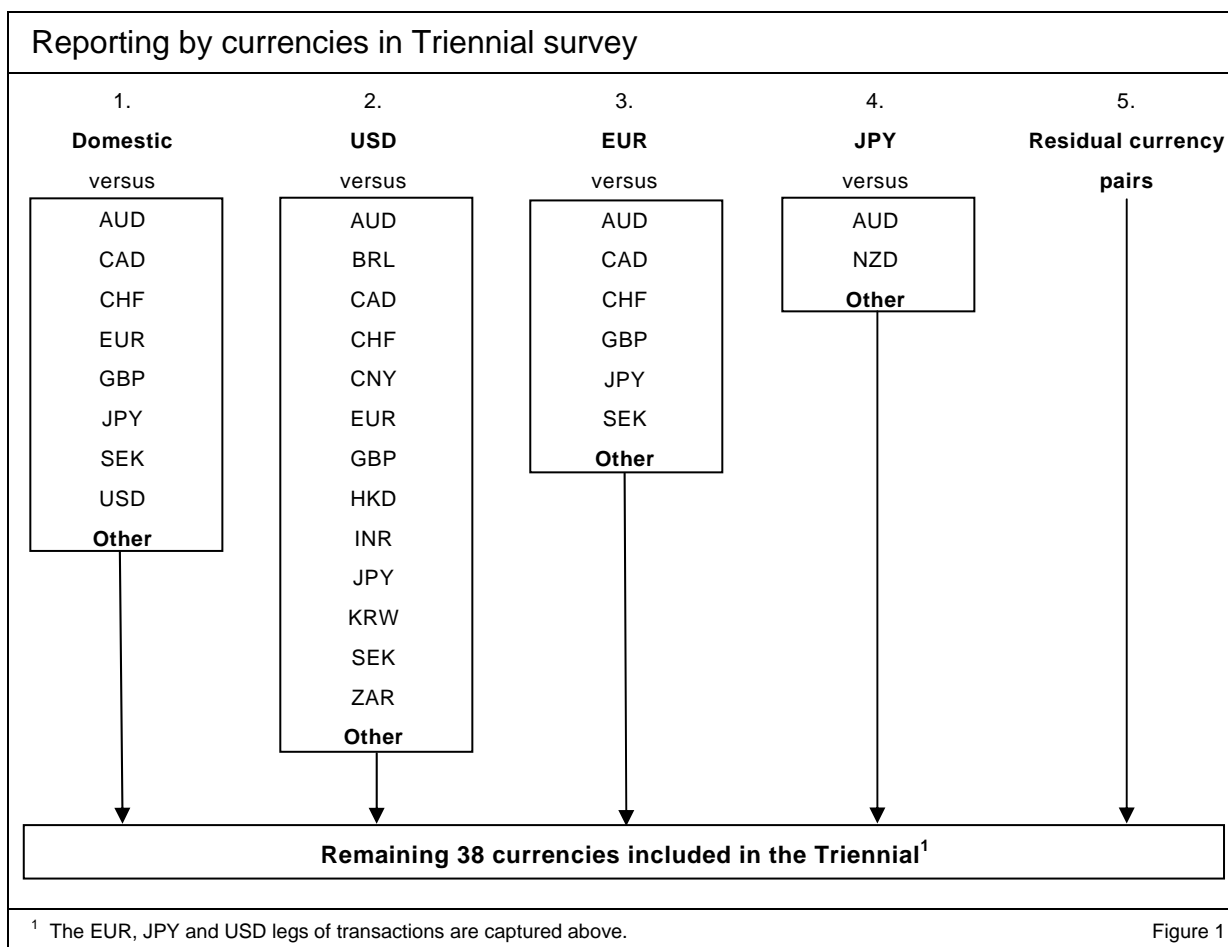
... to calculate a measure of FX activity ...

In the second column of Figure 1, all countries provide data for transactions involving the US dollar in one leg against a list of specified currencies. Beginning in 2010, this list was broadened to include: the Brazilian real (BRL), the Chinese renminbi (CNY), the Hong Kong dollar (HKD), the Indian rupee (INR), the Korean won (KRW) and the South African rand (ZAR). Trades against other currencies not specifically listed are classified as “Other”.

In the third and fourth columns of Figure 1, a similar breakdown is provided for bilateral transactions involving the euro and the yen. Starting in 2010, data are reported against the yen for the Australian (AUD) and New Zealand dollars (NZD). The fifth column of Figure 1, labelled “Residual currency pairs”, collects all transactions that do not involve the domestic currency, the US dollar, the euro or the yen in one leg.

... for the 41 currencies in the survey

In order to calculate global aggregates, the transactions classified as “other” and “residual currency pairs” are allocated against the remaining 38 currencies covered by the Triennial. If the reporting country is Norway, for example, a \$1 million transaction involving Danish kroner (DKK) against USD (USD/DKK) is classified as USD versus “other” (Figure 1, column 2), while a \$1 million transaction involving GBP against CHF (GBP/CHF) would be reported under “residual currency pairs” (Figure 1, column 5). For the USD/DKK transaction, \$1 million is allocated to USD in column 1 and the \$1 million “other” amount is allocated to DKK in column 5. For the GBP/CHF transaction, the \$1 million “residual” is allocated to each of the individual currencies in column 5, ie \$1 million to CHF and \$1 million to the GBP. This process ensures that both currencies in a transaction receive equal credit. The global aggregates for CHF therefore include: (i) all trades reported by Switzerland in its domestic currency; plus (ii) all trades reported by other countries involving the Swiss franc on one of the legs.



The data on currency breakdown provide answers to three questions. First, they can be used to determine the *currency distribution of global activity*. Given that a foreign exchange transaction involves two currencies, each leg is recorded separately. As a result, the sum of the percentage shares of individual currencies totals 200% instead of 100%. For example, the 2010 Triennial shows that the US dollar is used as one leg in 85% of transactions globally. Note that this figure includes both local transactions within the US, cross-border transactions involving one reporting dealer in the US, and transactions between reporting dealers located outside the US (so-called *offshore* transactions).

Second, the Triennial provides an estimate of *turnover by currency pair* for individual currencies against the US dollar, the euro and the yen. Given that a bilateral pair is only counted once, the total of all currency pairs is 100%. For example, the 2010 Triennial found that 28% of foreign exchange transactions were in the bilateral currency pair EUR/USD.

Third, the Triennial data can be used to construct a measure of *onshore* versus *offshore trading* for a currency. For example, a country such as Singapore reports all trades against the domestic currency for reporting dealers located in Singapore, with trades classified as local and cross-border. After eliminating local double-counting (ie net-gross), this turnover represents “onshore” activity in the Singapore dollar, as each trade involves a reporting dealer located in Singapore. Reporting dealers located in other countries also

The data measure the currency distribution of global activity ...

... and the most popular currency pairs

report transactions against the Singapore dollar. In these cases, the reporting dealer is known to be located outside Singapore but the location of their counterparty is not known. A measure of offshore trading in the Singapore dollar can therefore be proxied by taking the difference between the net-gross total and the net-net total.

Execution methods

Since 2007, data are collected on execution methods ...

Since its early days, the Triennial has been concerned with the institutional structure of foreign exchange markets, particularly the manner in which trades are executed. The 1992 Triennial, for example, collected data on the proportion of trading via voice brokers versus automated dealing systems. Starting in 2007, the Triennial collected data on the method used to execute foreign exchange transactions, which is identified for each foreign exchange instrument. The data on execution method were modified in 2010 to include trades “with reporting dealers, local” and “with reporting dealers, cross-border” to allow more accurate elimination of double-counting.

... for six different categories

The reporting template is based on the table developed by the New York Foreign Exchange Committee (FXC), and has six categories:

- Interbank direct (inter-dealer): trades executed with another reporting dealer, whether by telephone or electronically, which are not intermediated by a third party.
- Customer direct: trades executed between a reporting dealer and a customer (ie other financial institution or non-financial customer), whether by telephone or electronically, which are not intermediated by a third party.
- Voice broker: trades executed by telephone via a broker.
- Electronic broking systems: trades executed electronically via a broker, such as EBS or Thomson Reuters Matching.
- Multibank electronic trading systems: trades executed electronically via a third-party platform that aggregates quotes across dealers (such as Currenex, FX Connect, FXall, or Hotspot FX).
- Single-bank electronic trading systems: trades executed electronically via a single-bank proprietary platform (such as Barclays’ BARX, Citigroup’s Velocity, or Deutsche Bank’s Autobahn).

Additional methodological issues

When using and interpreting the Triennial data, users should keep in mind the following methodological issues.

Sales versus trading desk

The location of turnover is based on where the trade is arranged

From 1989 to 2001, the basis for reporting turnover was the location of the office where a transaction was struck, even if deals entered into in different countries were booked in a central location. Starting with the 2004 Triennial, the basis for reporting was clarified as the location of the “sales desk” of any trade (ie where it was arranged), which may not necessarily be the same as where the “trading desk” is located. This distinction is important for smaller financial centres as a significant percentage of foreign exchange sales are

booked and traded out of a larger financial centre, such as London, New York or Tokyo. For example, a customer based in Singapore may call a local bank to arrange a foreign exchange transaction. The salesperson, however, may send the trade to be executed by a trading desk located in Hong Kong SAR. In this case, the foreign exchange trade is deemed to have taken place in Singapore, even though it is executed and booked in Hong Kong. While this distinction does not affect global FX turnover, it does affect reported activity levels for any given country. Note that where no sales desk is involved, the trading desk is used to determine the trade location.

Given the increase in electronic execution methods, it is difficult to identify the location where a trade is arranged as it takes place over the internet. The distinction between trading and sales desks is likely to become less important.

Exchange rate effects

Intertemporal comparisons across different Triennial surveys are complicated by the movement of exchange rates between surveys. Movements in exchange rates vis-à-vis the US dollar from one survey to the next will affect both the turnover and amounts outstanding, even if there are no changes in activity. For example, turnover in GBP/JPY may remain unchanged from one reporting period to the next in terms of those currencies, but if the US dollar rises against both currencies, total turnover reported in US dollar terms will be lower (due to the depreciation of sterling and the yen against the dollar), signalling a decline in turnover where none has taken place. Even in currency pairs involving the US dollar, exchange rate movements affect turnover. A trade for a fixed amount of yen against dollars will enter the aggregates with a smaller or larger dollar amount depending on how the yen moves against the dollar from one Triennial to the next.

Exchange rate movements affect results across surveys

To provide guidance on the impact of exchange rate movements, each Triennial includes a line showing the totals from prior surveys recalculated at constant exchange rates. For example, the 2010 survey reports average daily foreign exchange turnover in 2001 as \$1.24 trillion (in current dollars) but as \$1.5 trillion (in constant dollars) – a difference of more than 20%. To generate a value in constant dollars, all transactions in a given currency are converted into the original currency at the historical exchange rate versus the US dollar, and have then recalculated using the average exchange rate in the current survey month.

Related party trades

For data on turnover, the Triennial instructs reporting dealers to include *related party trades* between a bank's own desks and offices, as well as trades with their own branches, subsidiaries and affiliates. These trades are then identified as an "of which" category. Trades conducted as back-to-back deals, however, are excluded from the Triennial.⁸ Trades to facilitate internal bookkeeping or

Some trades between related parties are included

⁸ A back-to-back transaction is a pair of linked agreements in which all liabilities, obligations, and rights of one agreement or transaction are mirrored in the second.

risk management, such as trades between one trading desk (ie spot) and another (ie options), are also not included.

Prime brokerage trades

Prime brokerage refers to financial, administrative and operational services offered by large banks to hedge funds, asset managers, smaller banks and other clients.⁹ In foreign exchange markets, prime brokers facilitate trades for their clients by either transacting directly with them at attractive prices or providing them with access to electronic platforms that are only available to dealers, such as EBS and Thomson Reuters Matching. In effect, prime brokerage allows clients to trade with other dealers using the prime broker's pre-screened credit and in the name of the prime broker. The client trade is "given up" to the prime broker, who is interposed between the dealer and the client and becomes the counterparty to both legs of the foreign exchange trade as principal.¹⁰

Prime brokerage has grown and leads to an increase in FX turnover

Foreign exchange prime brokerage activity has increased rapidly over the past decade. The April 2010 survey by the London Foreign Exchange Committee reported that 16% of all foreign exchange (and 29% of spot) transactions are conducted via a prime brokerage relationship. The implications for the Triennial are important, as a "give up" trade executed via a prime broker creates twice the turnover of a direct transaction. If a hedge fund trades \$1 with a bank (reporting dealer A) and gives up the trade through its prime broker (reporting dealer B), the Triennial records this transaction as \$1 of inter-dealer trading between dealers A and B, and \$1 of trading between the hedge fund and its prime broker (dealer B).

OTC versus exchange-traded derivatives

Exchange-traded FX derivatives are not included

Currency futures and options are two instruments that are also listed and traded on exchanges such as the Chicago Mercantile Exchange. Data on exchange-traded foreign exchange turnover were reported in the 1989 and 1992 Triennials. Beginning with the 1995 Triennial, however, the focus changed to OTC derivatives markets as timely and comprehensive data were available for exchange-traded products from commercial data sources. The statistics on exchange-traded products published as a memo item line in the summary tables of the central bank surveys are therefore based on the data received from commercial providers. This value is listed along with the OTC aggregates to provide a more comprehensive view of the activity in the global foreign exchange markets.

OTC turnover measures are comparable to exchange-traded volumes ...

The degree of comparability between the two datasets depends on whether turnover or amounts outstanding are considered. Turnover on exchange-traded products is comparable to OTC turnover reported in the

⁹ Prime brokerage services may include global custody, clearing, margin lending, securities borrowing, financing, execution, portfolio reporting and operational support.

¹⁰ This issue is discussed in the 2009 annual report of the New York Foreign Exchange Committee.

Triennial. Turnover on exchange-traded products does not relate to the notional value of the contracts bought or sold but to the US dollar value of the trades themselves. Hence, these aggregates are comparable with the net-net OTC amounts compiled by the central bank surveys.

By contrast, the amounts outstanding reported in the Triennial are not directly comparable with exchange-traded data. The data for exchange-traded products refer to open interest, equivalent to the sum of positive *net* positions in each contract across traders. By contrast, the Triennial data refer to *gross* positions. For example, a trader wishing to close a position in an outright forward usually does not terminate the existing contract, but enters into a new and offsetting contract. The gross amount outstanding doubles, even though the net exposure is zero. On an exchange, the open interest would fall to zero in this case.

... but amounts outstanding are not

The timing of the Triennial is important, as turnover data are compiled based on April data. Activity in exchange-traded futures is concentrated in the “roll months” of March, June, September and December. During these months, exchange-traded turnover increases as traders maintaining open positions in FX futures contracts tend to “roll forward” by liquidating positions in the maturing contract month and re-establishing a position in a deferred contract month. As a result, a comparison of turnover in April underestimates the exchange-traded activity.

Comparability with regional foreign exchange surveys

The Triennial complements more frequent regional surveys conducted by regional foreign exchange committees in Australia, Canada, London, New York, Singapore and Tokyo.¹¹ The regional data provide valuable information on the growth in foreign exchange turnover at a higher frequency than the Triennial survey, and offer greater detail in some areas.

Six regional FX surveys provide more frequent data ...

Differences in methodology between the regional surveys and the Triennial create small but meaningful differences in the turnover figures reported.¹² Table 3 compares all these surveys. To take one example, the New York Foreign Exchange Committee’s (FXC) survey captures turnover in the United States, Canada and Mexico, but does not distinguish local from cross-border transactions, and excludes currency swaps. The US results in the Triennial, in contrast, are only for US-based transactions and include a local/cross-border breakdown. The FXC survey specifies fewer currency pairs, but provides a larger breakdown of counterparties. The most notable difference is the basis of reporting, with the FXC survey using the trading desk rather than the sales desk. Finally, the FXC survey excludes all related-party trades, while certain related-party trades are captured by the Triennial. As a result, spot turnover in the 2010 Triennial was \$451 billion per day but only \$418 billion in

... but there are some differences with the Triennial

¹¹ For a list of these committees and links to their websites, see www.bankofengland.co.uk/markets/forex/fxjsc/links.htm.

¹² The exception is Australia’s monthly survey, which has the same format and methodology as the Triennial (although execution method data are not collected).

Comparison of Triennial with regional foreign exchange surveys							
	Triennial	London	New York ¹	Tokyo	Singapore	Australia	Canada
Frequency	Every 3 years	Semiannual	Semiannual	Annual	Semiannual	Monthly	Semiannual
Reporting month	April	April, October	April, October	April	April, October	Monthly	April, October
Reporting currency	USD	USD	USD	USD	USD	USD	USD
Reporting dealers in April 2010 regional survey (and Triennial)	1,309	31 (48)	25 (26)	20 (45)	30 (54)	27 (27)	8 (16)
Average turnover in April 2010 regional survey (and Triennial)	\$3,981bn	\$1,747bn (\$1,854bn)	\$754bn (\$904bn)	\$294bn (\$312bn)	\$290bn (\$266bn)	\$19bn (\$192bn)	\$60bn (\$62bn)
Basis of reporting	Sales desk	Trading desk	Trading desk	Sales desk ²	Trading desk	Sales desk	Trading desk
Treatment of related party trades	Intragroup included; back-to-back excluded	Intragroup included; back-to-back excluded	Excluded	Intragroup included; back-to-back excluded	Intragroup included; back-to-back excluded	Collected as memo item	Intragroup included; back-to-back excluded
Distinguish local and cross-border trades?	Yes	Yes	No	Yes	Yes	Yes	No
Adjust for double-counting (local and cross-border)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of instruments	5	6	4	4	5	5	5
Currency pairs	30	54	13	> 5	> 16	30	> 4
Counterparty types	3	4	4	3	2	3	4
Execution method categories	6	Same as Triennial	5	6 (different from Triennial)	Not collected	Not collected	5

¹ North America, including Canada and Mexico. ² From 2010, the Tokyo Foreign Exchange Market Committee changed the reporting basis from the trading desk to the sales desk.

Table 3

the FXC survey – a difference of 7%. The other regional surveys show smaller differences in turnover volumes relative to the Triennial, suggesting that these regional surveys provide a good proxy for the Triennial.