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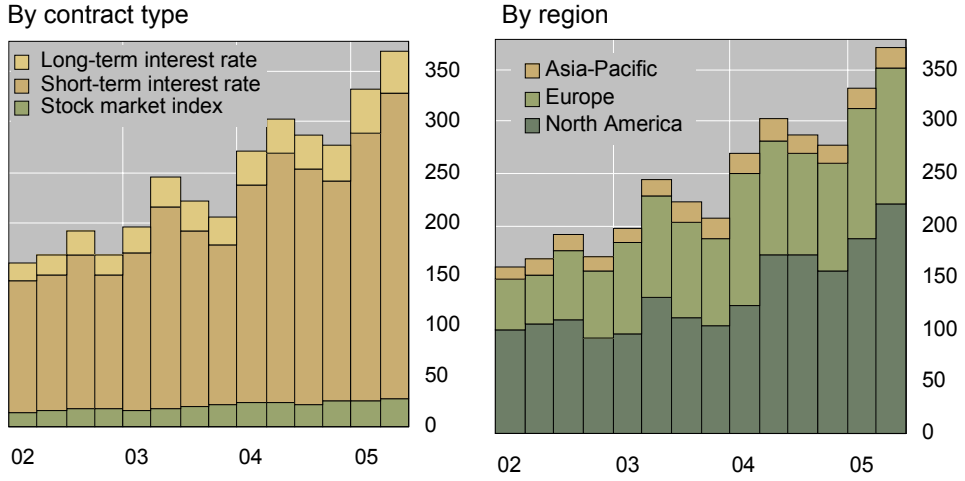
4. Derivatives markets

Trading on the international derivatives exchanges continued to be buoyant during the second quarter of 2005. Combined turnover in fixed income, equity index and currency contracts increased by 11% to $372 trillion, after a 20% rise in the previous quarter.

The growth in activity was mainly due to market participants' changing perceptions about the future path of policy rates. Consequently, the increase in turnover was greatest in derivatives on short-term interest rates, both futures and options, whereas activity in long-term bond contracts declined slightly (Graph 4.1). The trading volume of equity index contracts rose for the third quarter in a row, albeit at a reduced pace. Turnover in exchange-traded currency derivatives increased by 15% in the second quarter, but at $3 trillion remains modest compared to interest rate and equity index contracts.[1]

Turnover of exchange-traded futures and options

Quarterly data, in trillions of US dollars



Sources: FOW TRADEdata; Futures Industry Association; BIS calculations. Graph 4.1

[1] This section focuses exclusively on exchange-traded derivatives. Semiannual data on the OTC market are published in the June and December issues of the *BIS Quarterly Review*. In December 2004, the BIS started to collect data on credit default swaps (CDSs) as well as concentration measures for the OTC market. They were published in May 2005 in Tables 4 and 5 of *OTC derivatives market activity in the second half of 2004* (available on the BIS website).

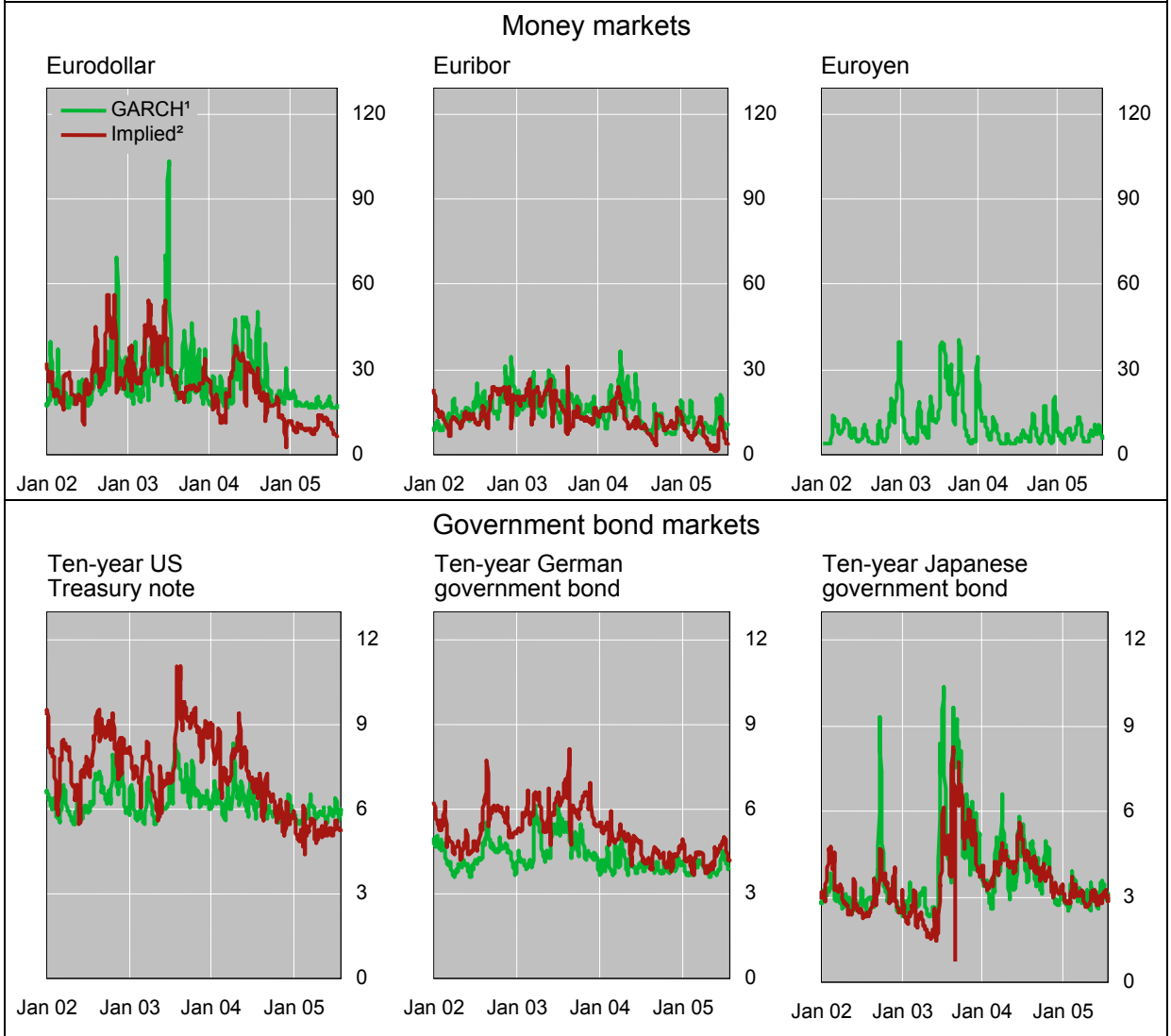
Strong growth in short-term interest rate contracts

Changing rate expectations in the United States ...

Although volatility in money market rates was low during most of the second quarter (Graph 4.2), there were some shifts in investors' expectations about future central bank policy actions that have spurred trading in derivatives markets. In the United States, adverse news on economic activity in April led to a flattening of the short end of the yield curve, as market participants expected the Federal Reserve to slow the pace of its rate increases. This contributed to a surge in trading volume in derivatives on short-term dollar interest rates to $71 trillion in April, the highest monthly value on record in that segment. In the following months, the economy rebounded and it became clear that the Fed would continue its policy of measured rate increases. Turnover in short-term interest rate contracts declined, averaging $59 trillion per month over the remainder of the quarter, although open interest continued to rise in May. For

Volatility of major fixed income rates

Five-day moving averages

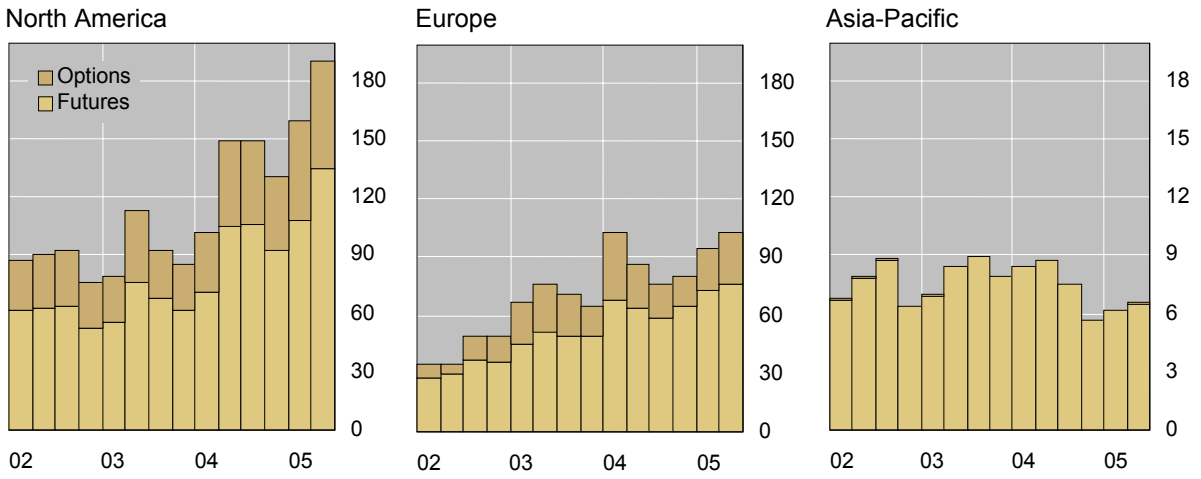


[1] Annualised conditional volatility of daily changes in eurocurrency yields and bond prices from a GARCH(1,1) model. [2] Volatility implied by the prices of at-the-money call options.

Sources: Bloomberg; national data; BIS calculations. Graph 4.2

Turnover of short-term interest rate contracts

Quarterly contract turnover, in trillions of US dollars



Sources: FOW TRADEdata; Futures Industry Association; BIS calculations. Graph 4.3

the second quarter as a whole, turnover in short-term interest rate derivatives denominated in US dollars reached $190 trillion, with options accounting for $56 trillion (Graph 4.3).

… and Europe

In Europe, signs of slowing economic activity as well as remarks by ECB officials towards the end of the quarter led markets to revise their expectations concerning future monetary policy. Rather than pricing in rate increases (as in April and May), market participants began to assign a small probability to a rate cut. Implied volatility from options on three-month Euribor soared in June. Owing to the increasingly uncertain outlook for policy rates, trading in short-term interest rate options denominated in euros more than doubled to $9 trillion in June, and activity in the underlying futures rose to $23 trillion from $15 trillion in May. During the entire second quarter, trading in short-term interest rate derivatives in euros amounted to $74 trillion, 6% higher than in the previous quarter. A pickup in trading activity was also observed in short-term sterling contracts. For the second quarter in a row, turnover increased at a rate of around 20%, as investors became more convinced that a rate cut was in the offing.

Activity in bond contracts declines in the euro area …

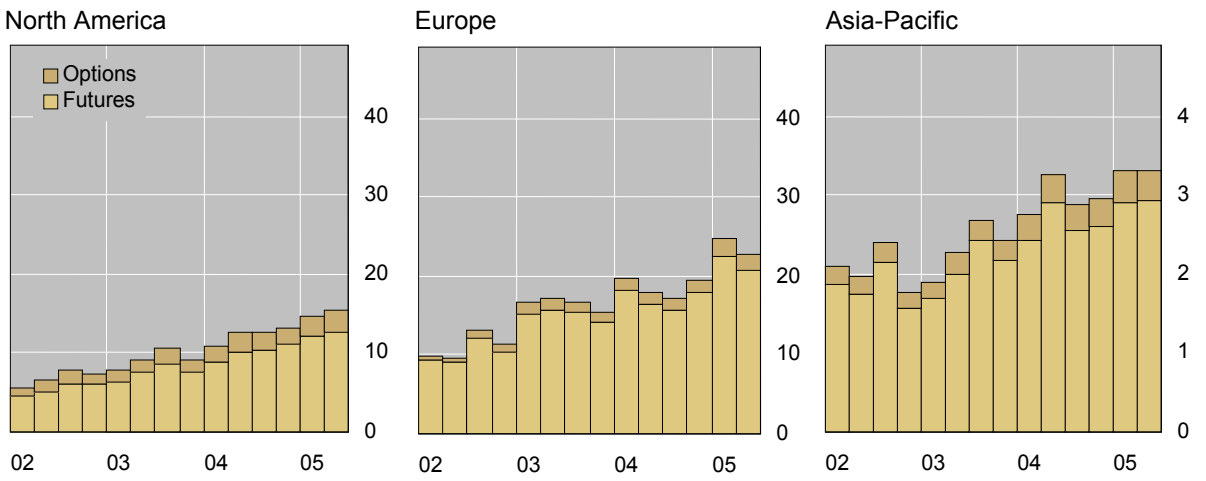
Business in exchange-traded long-term interest rate derivatives remained more contained than activity at the short end, with global turnover decreasing by 3% to $41 trillion in the second quarter. The decline was led by a 9% drop in euro-denominated contracts (Graph 4.4). However, at $22 trillion, activity in long-term euro fixed income derivatives remained greater than that in all other currencies taken together. The fall in turnover during the second quarter reflected weak activity in April and May, which was followed by heavier trading in June.

… but rises in the United States

Turnover in the dollar market, by contrast, rose slightly to $15 trillion in the second quarter. While trading was muted in April, a record level of open interest shows that market participants increased their positions in long-term interest rate risk beyond the already high level observed at the end of March. Trading in futures on US government bonds picked up in May as yields

Turnover of government bond contracts

Quarterly contract turnover, in trillions of US dollars



Sources: FOW TRADEdata; Futures Industry Association; BIS calculations. Graph 4.4

continued to decline, although open interest fell back to a level similar to the one that had prevailed during the first two months of the year. Interestingly enough, neither the short-lived rise in yields nor the surge in mortgage prepayments in June produced any noticeable rise in derivatives trading. In fact, turnover in futures went down, although trading in options did rise somewhat. The reduced levels in volume and open interest in June point to only subdued hedging activity preceding the decrease in bond prices the following month.

Fear of a shortage of deliverable Treasuries leaves volumes unaffected

The decline in activity in June is unlikely to have been related to fears of a shortage of deliverable bonds for the June 10-year Treasury future, as contracts on bonds with other maturities showed a similar time pattern. The announcement by the Chicago Board of Trade on 29 June of a rule capping deliveries of underlying bonds depressed futures prices, but came too late to have any visible effect on volume in the same month.

Turnover growth in Asia-Pacific currencies

Trading in interest rate derivatives in the Asia-Pacific region rose by 4% to $10 trillion. The increase was driven mainly by higher turnover in contracts denominated in Australian dollars, which was up by 11% to $5 trillion. As in most other regions, trading concentrated on the short end of the yield curve, as market participants revised downwards their expectations of future interest rates. Trading volume in options on short-term Australian interest rates climbed by a remarkable 58%, with heavy activity in April and May. However, at $104 million, turnover in options remains minuscule relative to trading in futures ($4.7 trillion). In contrast to most other large markets, activity in interest rate contracts denominated in yen remained virtually unchanged at $4.7 trillion, which is in line with low and stable volatility at both the short and the long ends of the curve.

Slowing growth in equity derivatives

Decline in risk appetite dampens growth in equity contracts

Business in stock index derivatives went up by 4% to $28 trillion between April and June, after an increase of 9% in the previous quarter. Growth slowed in spite of a rise in implied volatility in major equity markets in the first half of the quarter. The hedging needs associated with this increase in uncertainty may have been offset by a reduced inclination on the part of traders to take positions in equity risk, which would be consistent with the decline in risk appetite indicators over the period (see the Overview in the June 2005 *BIS Quarterly Review*). Open interest in stock index contracts rose by 2%, half the rate of growth in turnover. In the first quarter, open interest had soared by 22%. The slowing growth in open positions is in line with the increase in implied volatility already mentioned, which was only partly offset by the effect of heightened disagreement on future profit growth among equity analysts. In the past, open interest in stock index contracts has been positively related to analyst disagreement and negatively related to implied volatility (see the box on page 52).

The growth in turnover was more or less evenly spread across the major derivatives markets, in line with similar patterns in equity prices and volatility. The major exceptions to this general picture were contracts on Korean and UK stock indices, where trading volume fell by 5% to $7 trillion and by 3% to $0.8 trillion, respectively. Among the smaller markets, activity strongly increased in the Scandinavian countries, going up by 34% in Denmark, 27% in Norway, and 14% in Sweden. Stock prices in these countries rose at a considerably higher rate during the second quarter than those in the major European markets. In the Asia-Pacific region, turnover picked up in Taiwan (China) (+26%) and Australia (+15%). In Latin America, trading went up by 15% in Brazil, but dropped by 6% in Mexico. Finally, activity in the South African market also declined by 6%.

Derivatives on individual stocks

Turnover in contracts on individual stocks (data on which are available only in terms of the number of traded contracts) increased by more than 2% in the second quarter. This is similar to the rate of growth in the number of equity index contracts (in contrast to the 4% rise in notional values described above). However, the similarity in the rates of growth is an artefact that arises due to the different regional composition of trading in single stock contracts and index products. In the US and euro area markets, where both types of contracts are traded in parallel, the growth in index derivatives far outpaced that in single stock products. It has been argued that investors tend to use single stock contracts to trade on individual company news and index products to trade on news affecting the aggregate market. If this is true, then the two turning points in equity prices during the second quarter would have been mainly attributable to changing perceptions about aggregate economic activity and systemic risk, rather than being the result of isolated events at major firms.

Differences in opinion and derivatives activity

In principle, trading is not necessary for new information to be reflected in financial market prices; in practice, though, trading does occur. One reason for this is the existence of private information. However, while asymmetric information may explain trading in individual stocks, it is not clear whether it suffices to explain activity in stock index contracts, whose returns tend to be driven more by macroeconomic information.[1] Most of this information is public, but investors may still disagree about how it relates to stock returns. In contrast to private information, which tends to get incorporated into prices very quickly, such differences in opinion may persist over prolonged periods of time and may therefore be associated with high trading volume even at lower frequencies.[2]

In this box, we present some tentative evidence on the relationship between differences in opinion and monthly trading activity, as measured by the BIS derivatives statistics. We find that analyst disagreement is positively related to open interest in stock index derivatives, reflecting increased trading opportunities, whereas high uncertainty is associated with smaller open positions, perhaps due to their increased riskiness. Turnover in index products, by contrast, rises in times of uncertainty, but is not affected by differences in opinion.

We use the disagreement on future profits of stock analysts as a proxy for differences in opinion. Forecasts of the profits per share of the individual firms included in the S&P 500 stock index are collected and aggregated by I/B/E/S on a monthly basis. We relate the standard deviations in each month of these forecasts (stdprofits) to measures for activity (y) such as monthly turnover in S&P 500 stock index futures and options as well as to the open interest in these contracts, giving a total of four regressions.

In addition, we include a measure for price uncertainty in our set of explanatory variables. We proxy the uncertainty on future equity returns by the implied volatility from options on the S&P 500 future (iv). Implied volatility provides a useful measure of the degree of uncertainty in a market, even if one relaxes the fairly restrictive assumptions of the option pricing model under which it is derived. While intuitively one would expect differences in opinion to be more pronounced in periods with a high degree of uncertainty, these two concepts are not the same.[3] This is underscored by the low correlation of 0.22 between implied volatility on the one hand, and our measure for differences in opinion on the other.

Estimations are based on monthly data ranging from June 1994 to June 2005. All variables are integrated of order 1, but standard cointegration tests fail to uncover any long-term relationship. The models are estimated in first differences by OLS, the lag length being determined by the Akaike and Schwartz information criteria. The results are given in the table below. The regressions also include a constant and a full set of monthly dummy variables in order to control for expiration and other seasonal effects, but the respective coefficients are not reported for reasons of space.

The estimation results do not give support to the notion that differences in opinion are associated with higher turnover in stock index futures. For options, there is in fact weak evidence (at the 10% confidence level) that analyst disagreement is associated with lower, rather than higher, turnover in the following month. The coefficient of contemporaneous implied volatility, by contrast, is statistically significant and positive in both equations. This is in line with the literature based on daily frequencies, but differs from the results obtained by Jeanneau and Micu (2003) with monthly data.[4] A possible explanation for this contradiction is that they controlled for reverse causation by using two-stage least squares, while the present OLS estimates merely highlight correlations, not causation.

The results concerning open interest differ substantially from those on turnover. A rise in disagreement among analysts is initially associated with larger positions in both futures and

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[1] The unattractiveness of index contracts for traders with private information reduces the adverse selection cost of trading in that market, making it particularly attractive to uninformed investors. See A Subrahmanyam, "A theory of trading in stock index futures", *Review of Financial Studies*, 4(1), 1991, pp 17–51. [2] On a more abstract level, C T Shalen, "Volume, volatility, and the dispersion of beliefs", *Review of Financial Studies*, 6(2), 1993, pp 405–34, and M Harris and A Raviv, "Differences in opinion make a horse race", *Review of Financial Studies*, 6(3), 1993, pp 473–506, find that a dispersion in traders' beliefs may exert a positive influence on trading volume over an extended period of time. [3] If analyst disagreement merely reflected risk, it should be positively related to future stock returns, reflecting a risk premium. Instead, the relationship between disagreement and returns appears to be negative. See K B Diether, C J Malloy and A Scherbina, "Differences of opinion and the cross section of stock returns", *Journal of Finance*, 57(5), 2002, pp 2113–41. [4] S Jeanneau and M Micu, "Volatility and derivatives turnover: a tenuous relationship", *BIS Quarterly Review*, March 2003, pp 57–65.

Differences in opinion and activity in S&P 500 stock index derivatives

	Turnover		Open interest	
	Futures	Options	Futures	Options
Δy_{t-1}	–0.748*** (0.0734)	–0.403*** (0.0844)	–0.295** (0.116)[1]	–0.045 (0.084)[1]
Δy_{t-2}	–0.648*** (0.0741)	–	–0.180* (0.096)[1]	–0.095 (0.103)[1]
Δy_{t-3}	–	–	–	0.362*** (0.092)[1]
Δstdprofits$_t$	–50,770 (73,405)	40,697 (39,124)	17,106** (8,282)[1]	61,850*** (21,021)[1]
Δstdprofits$_{t-1}$	–32,611 (73,576)	–72,475* (37,325)	3,771 (6,705)[1]	–25,926 (22,578)[1]
Δstdprofits$_{t-2}$	–87,430 (72,027)	–	–15,633** (6,113)[1]	–52,760** (22,955)[1]
Δstdprofits$_{t-2}$	–	–	–	7,349 (24,386)
Δiv_t	11,506*** (3,415)	3,709** (1840)	–817*** (277)[1]	–2,833*** (980)[1]
Δiv_{t-1}	3,602 (3,470)	–1,548 (1,917)	–81 (327)[1]	–1,157 (954)[1]
Δiv_{t-2}	–270 (3,586)	–	–541 (375)[1]	–1,853* (953)[1]
Δiv_{t-3}	–	–	–	1,323 (985)[1]
Adjusted R^2	0.84	0.41	0.61	0.82
Durbin-Watson	1.88	2.19	1.88	1.93

Note: Standard errors in brackets. ***, ** and * stand for significance at the 1%, 5% and 10% level, respectively.

[1] White heteroscedasticity-consistent standard error.

options, but the effect reverses after two months. Incidentally, two months is roughly equivalent to the average time to maturity of the most heavily traded contract. Since at maturity positions have to be either closed or rolled over to the next contract, it is not surprising to find a reversal in open interest.

The coefficient on contemporaneous implied volatility is positive and highly significant. This relationship, which is robust to changes in sample length or the selection of variables, is at odds with a large literature that explores the relationship between trading activity and volatility at a daily level, although it supports the work of Jeanneau and Micu using monthly data. It appears that an increase in uncertainty boosts trading in the short term but reduces investors' willingness to hold open positions once the immediate adjustment is completed.

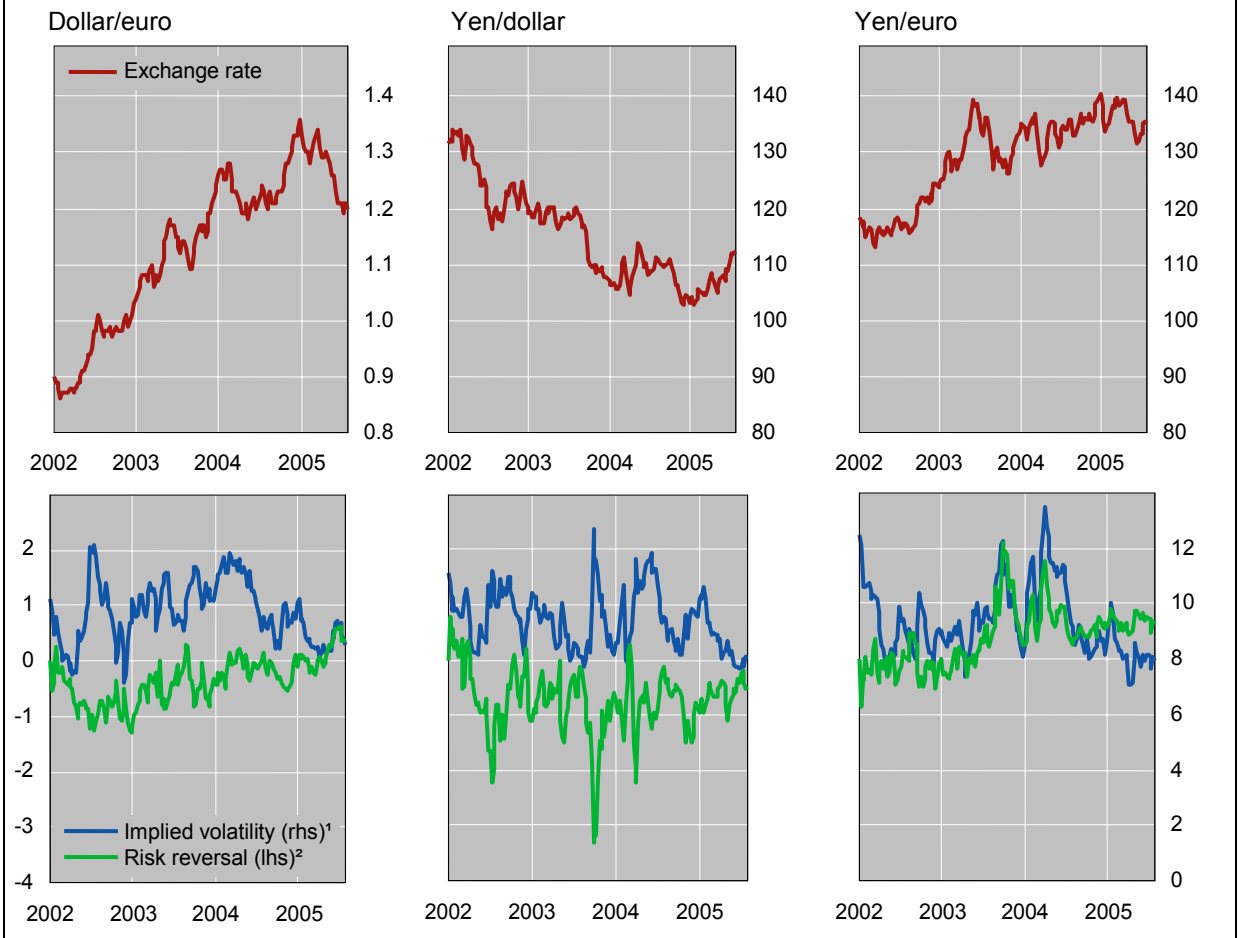
Our findings provide a useful background for the interpretation of monthly movements in turnover and open interest in the present and future issues of the *BIS Quarterly Review*, but for two reasons should not be mistaken for a test of a formal theory. First of all, the opinions of stock analysts may differ from those held by traders. While the two are often employed by the same firm, they perform very different roles and are subject to different incentives. This holds even more so after the recent changes mainly, but not exclusively, in the United States, aimed at increasing the independence of analysts and strengthening the integrity of their forecasts. Moreover, traders and analysts may have different time horizons, which provides yet another reason for why their views may differ. The second caveat concerns the frequency of the data used. A more thorough examination would have to look at the pattern over time by which differences in opinion and uncertainty affect derivatives activity.

Surge in currency contracts

Dollar appreciation the main driver of derivatives turnover

The strength of the US dollar during the second quarter set the scene for yet another surge in activity in exchange-traded currency derivatives. The dollar gained 7% against the euro and 6% against the yen between its low in late April and the end of June (Graph 4.5). Against this backdrop, turnover in exchange-traded currency derivatives rose by 15% to $3 trillion. While activity in April and May remained close to the monthly average in the preceding quarter, it soared to a new high in June. The fact that this pattern holds for euro, yen and pound sterling contracts suggests that investors were trading dollar risk rather than the risk specific to another currency. In particular, the data do not offer any indication that traders used the derivatives market to speculate on a revaluation of the Chinese renminbi, which eventually materialised on 21 July (see the Overview). Although direct trading in renminbi derivatives has been heavily restricted by Chinese regulations, traders may have used the yen/dollar market as a vehicle for speculation on the likelihood of a renminbi adjustment, since the yen was widely expected to appreciate against the dollar were the renminbi to revalue. But while turnover in that

Exchange rates, implied volatilities and risk reversals



[1] One-month horizon, in per cent. [2] A positive value indicates a bias towards dollar strength in the left-hand and centre panels, and towards euro strength in the right-hand panel.

Sources: DrKW Research; Reuters; BIS calculations. Graph 4.5

currency pair was strong (+18% in the second quarter), its growth was very much in line with that in the euro/dollar (+16%) or in the sterling/dollar (+20%) markets.

Decline in open interest …

It appears that the rise in volume in June mainly reflected trading on short-term price movements rather than more long-term position-taking. This is suggested by the development of open interest in euro, yen and sterling contracts. Correcting for exchange rate movements, open interest in these currencies moved broadly in line with turnover during the first two months of the quarter, but then fell in June. Data from the Commodity Futures Trading Commission (CFTC) for the heavily traded euro FX contract of the Chicago Mercantile Exchange show that commercial traders, who use derivatives primarily for hedging purposes, sharply increased both their long and their short positions until the beginning of June and reduced them afterwards. The decline towards the end of the quarter was only partly offset by non-commercial users, who doubled their short positions in the euro between April and June, while holding their long positions constant. This is consistent with evidence from risk reversals, which involve purchasing an out-of-the-money call option and selling an out-of-the-money put option. The price paid on such a strategy reflects, among other factors, the risk of large upward price movements relative to large downward movements. During the second quarter, the risk reversal indicator for the dollar/euro and the yen/dollar currency pairs steadily moved upwards (Graph 4.5), suggesting that investors viewed the upward potential of long positions in the dollar to be larger than the downward risk of such positions.

… despite speculation on further dollar appreciation

High level of open interest in Brazil and Mexico

Similar data on commercial and non-commercial users are not available for contracts traded outside the United States. There is some reason to believe, however, that hedging was an important motivation behind the 35% increase in the open interest in contracts on the US dollar/Brazilian real currency pair, which far outpaced growth in turnover (+14%). At $44 billion at the end of the second quarter, open interest in the real exceeded open positions in all other currencies bar the euro ($49 billion). A development similar to that in Brazil could be observed in Mexico, where turnover declined by 15% in the second quarter, whereas open interest rose by 76%. Domestic bond markets have grown considerably in recent years in both countries, as has the participation of foreign investors in these markets, which could account for the increased hedging needs. The tightness of the spreads paid on Brazilian debt, by contrast, suggests that political turmoil in that country is unlikely to have played a major role in this regard (see page 10 of the Overview).

Growth in commodities picks up as economy grows

Solid growth in commodity contracts …

The favourable outlook for economic activity during most of the second quarter was reflected in solid growth in the market for commodity derivatives. Although the total number of contracts (data on notional value are not available) rose by only 5%, this was in part due to a 12% drop in derivatives on precious metals. These contracts are often preferred as a hedge in times of economic weakness

or turbulence, so a decline in trading volume may be associated with positive news on economic activity.

… boosted by price volatility in the oil market

Sharp price movements in the market for crude oil during the second quarter led to a surge in trading in energy products (+11%) that outstripped turnover growth in non-precious metals (+6%) and in agricultural commodities[2] (4%). The increase in turnover of energy derivatives reflected heavy trading on short-term news rather than long-term position-taking, as open interest declined by 9% in the second quarter. Among the major markets, open interest only increased in the United States, but even there its rate of growth (4%) fell behind that of turnover (11%). CFTC data indicate that the slowing in the growth of open interest followed a reduction in the long positions of non-commercial users, which between the beginning of April and the end of June fell by one quarter. Although non-commercial users, often termed "speculators", only account for a minor fraction of total open interest, their positions are much more variable than those of the commercial users, or "hedgers".

[2] A number of new agricultural contracts have been added to the BIS database since the start of this year. For this reason, the number of contracts traded in the first quarter has been revised upwards from the last *BIS Quarterly Review*. It cannot therefore be compared to the number of contracts traded in previous years.