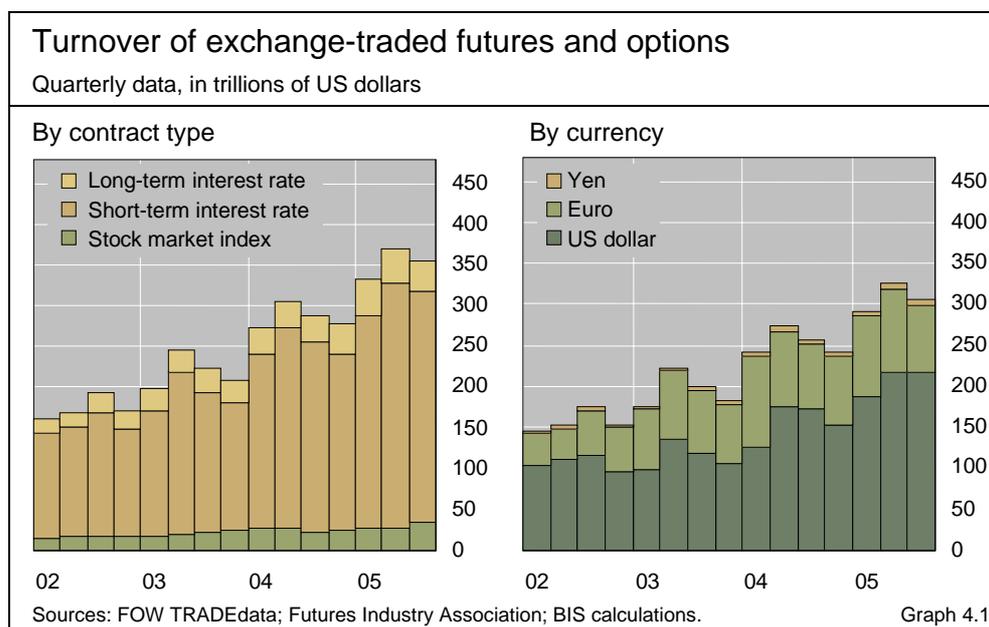


4. Derivatives markets

Trading on the international derivatives exchanges declined during the third quarter of 2005. Combined turnover in fixed income, equity index and currency contracts fell by 4% quarter-on-quarter to \$357 trillion (Graph 4.1), although this was due to seasonal factors, which tend to depress activity in the interest rate segment in the third quarter. By contrast, the year-on-year rate of growth increased slightly to 23%, after 21% in the preceding quarter.

Growth was particularly strong in the market for futures and options on stock indices, which expanded by 22% to \$34 trillion in the third quarter, after lacklustre activity in the first half of the year. Turnover in contracts on Korean indices surpassed that in US stock index derivatives for the first time. On the currency front, the growth of the domestic bond market in Mexico has spurred the development of an increasingly sophisticated OTC Mexican peso derivatives market.

Growth in the market for credit default swaps in the first half of 2005 weathered the sell-off in credit markets in the wake of the US auto downgrades in spring. Notional amounts outstanding increased by 60% to \$10 trillion, far outpacing growth in the underlying credit contracts. This has increased the risk of squeezes, since most contracts stipulate physical delivery of the reference entity's debt in the case of a credit event. In addition, the assignment of trades without notifying

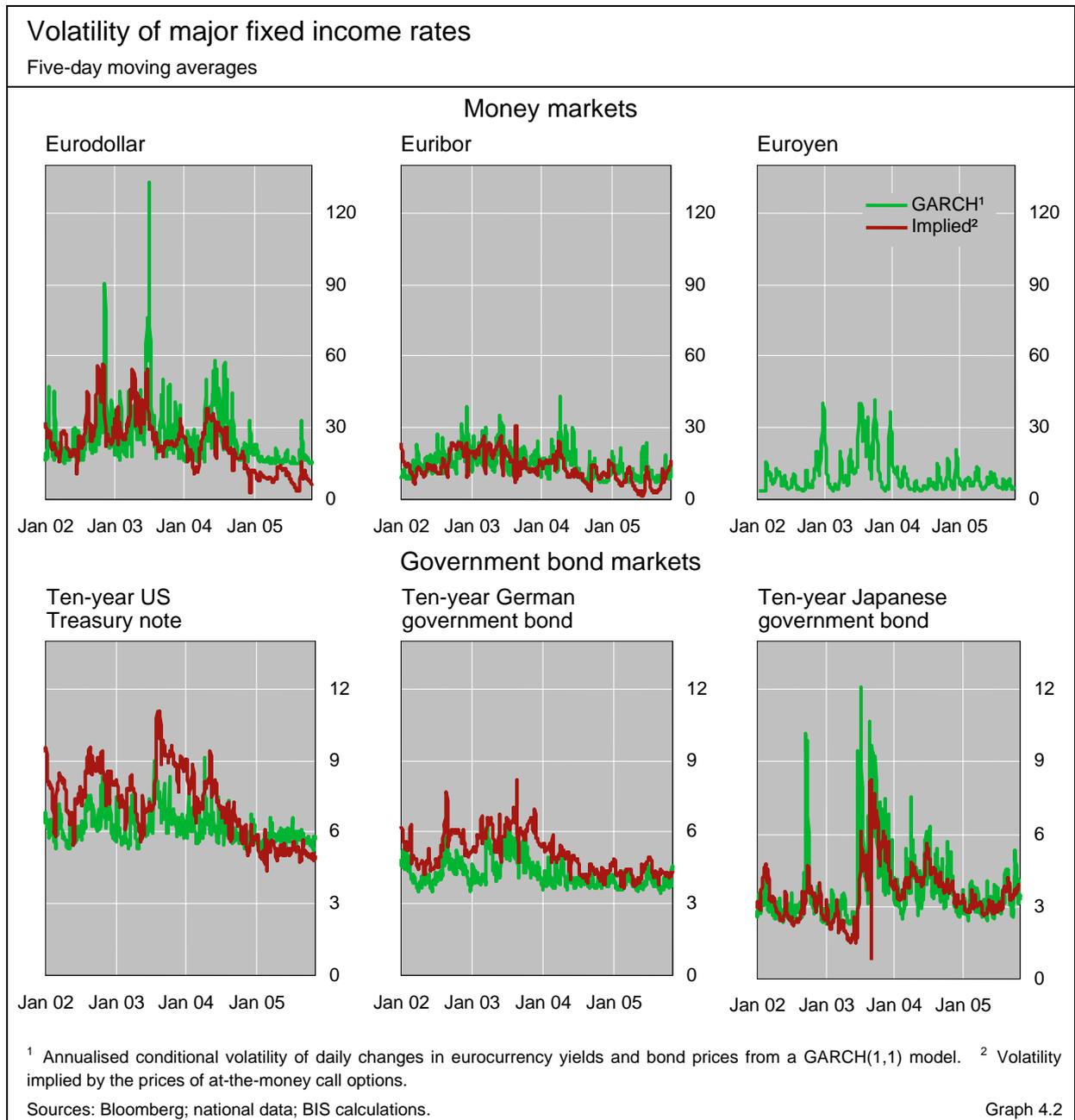


counterparties has contributed to a backlog in trade confirmations. While market participants have promised to address these problems, it is still too early to assess the degree of progress.

Hurricane sustains trading in interest rate derivatives

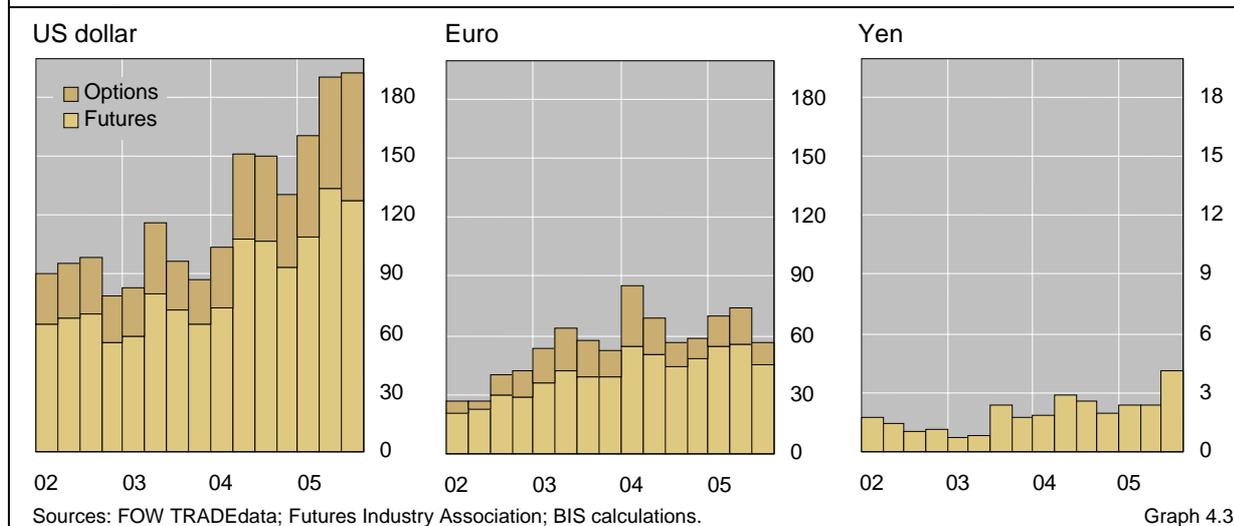
Confirming the experience of the first half of the year, trading in interest rate derivatives in the third quarter of 2005 proved remarkably resilient in view of the generally low level of volatility in bond and money markets (Graph 4.2). The decline of activity in exchange-traded contracts appears to have been entirely due to seasonal factors, and the underlying growth of the market was highlighted by the fact that turnover in that quarter was the second highest on record, even without seasonal adjustment. Comparatively low activity in the

Turnover resilient in a period of low volatility



Turnover of short-term interest rate contracts

Quarterly contract turnover, in trillions of US dollars



first two months of the quarter was followed by a burst of trading in the aftermath of Hurricane Katrina, which reached the US Gulf coast in late August (see also the discussion of commodity derivatives below).

Trading in money market contracts boosted by Hurricane Katrina ...

The impact of Hurricane Katrina on derivatives trading was particularly strong in the United States, where serious damage to the oil infrastructure sent energy prices to record highs and threatened to put a brake on economic activity. As a consequence, implied volatility from options on three-month eurodollar futures quadrupled in early September, although it remained well below the average of last year. Uncertainty about the future course of US monetary policy gradually declined during the following weeks as oil prices receded and the solidity of economic activity became more apparent. Turnover in derivatives on short-term US interest rates rose to \$83 trillion in September (Graph 4.3), surpassing the previous peak of \$71 trillion recorded in April (see the September issue of the *BIS Quarterly Review*). Open interest in US money market contracts rose from \$34 trillion at the end of July to \$37 trillion at the end of August, a few days after Hurricane Katrina struck. Weekly data from the US Commodities and Futures Trading Commission reveal that open interest remained high until mid-September, when it dropped by about one fifth.

... as well as the prospect of a rate hike in the euro area ...

The impact of the hurricane was not limited to the United States. High energy prices led to a resurfacing of concerns about inflation in the euro area. Market participants, who had priced in a small probability of a rate cut in June, became increasingly convinced that the ECB was tilting towards higher interest rates. Although the implied volatility of three-month Euribor contracts increased only slightly after the hurricane, it continued to rise as inflation edged up in late September. Turnover in derivatives on short-term euro interest rates increased by more than a third in September relative to the previous month, but at \$22 trillion remained considerably below the level reached in June (\$32 trillion).

Lengthening maturities in the OTC options market

Maturities in the OTC options market lengthened in the first half of the year. In the interest rate segment, open positions in options with maturities over five years rose by 20% to \$7.8 trillion at the end of June, compared to a decline of 16% for contracts with maturities of one year or less (see graph). In the market for foreign exchange risk, growth in options with maturities of more than one year outpaced that in shorter-dated contracts, although the latter continue to account for the bulk of trading. According to market participants, the FX options market is liquid for maturities of up to five years, against maturities of up to 20 years for fixed income swaptions. This is in line with the observation that contracts with maturities of more than five years account for only 1% of all FX options but 29% of all interest rate options.

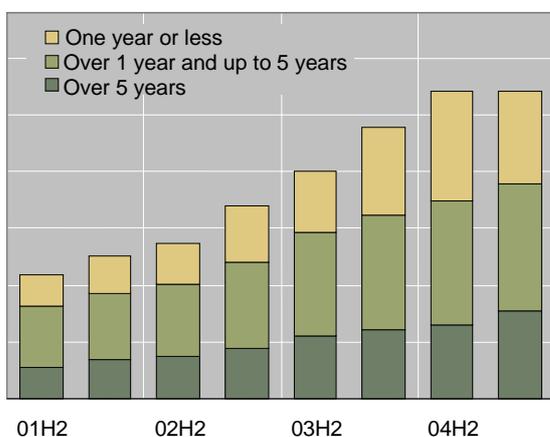
The extension of maturities of OTC options appears to have been driven largely by the high issuance of structured products during the first half of 2005. Structured products bundle a debt security with derivatives and are an important channel through which smaller financial institutions and non-financial investors participate in the options market. The dealers in such issues tend to hedge their exposures in the inter-dealer derivatives market.^①

Another contributing factor has been a shifting of activity in the volatility market into longer maturities. As volatility remained at low levels, participants in this market have increasingly resorted to trading strategies that take advantage of movements in the slope and curvature of the term structure of volatility. For example, the implied volatility of 5x10-year swaptions (an option on entering into a 10-year interest rate swap in five years' time) may be "cheaper" than the implied volatility of a basket of 1x10 and 10x10 swaptions, making a relative position in these contracts attractive. Other trading strategies exploit the imperfect correlation of implied volatilities at different expiries.

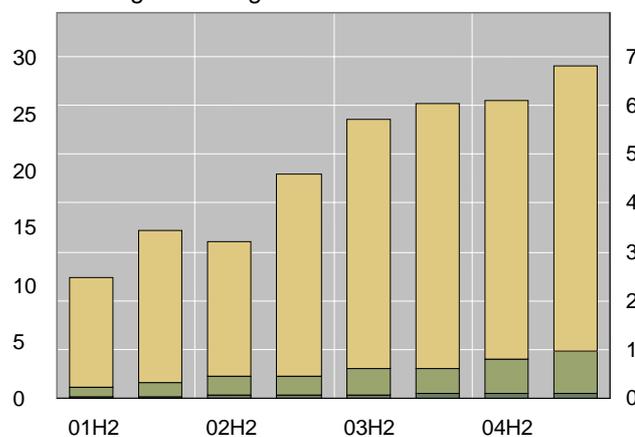
Maturities in OTC options contracts

In trillions of US dollars

Interest rate derivatives



Foreign exchange derivatives



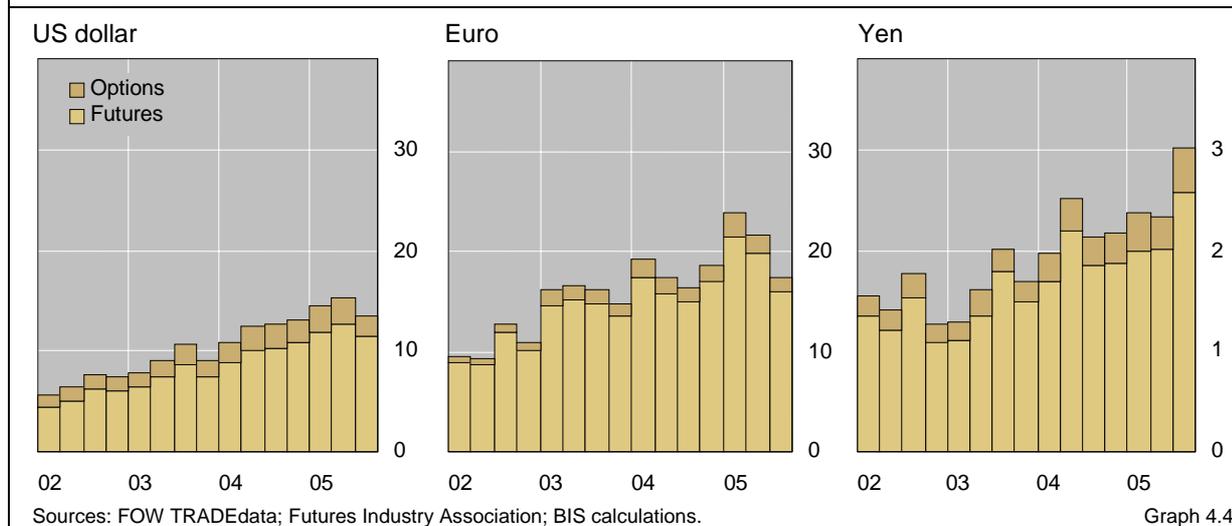
Source: BIS.

^① Data on the issuance of structured products are provided by the commercial data provider mtn-i. The BIS OTC derivatives data contain the option component of structured notes issued by reporting dealers. They are reported according to the source of risk and type of counterparty involved.

In the market for derivatives on long-term interest rates, the impact of the hurricane was less noticeable than in short-term contracts (Graph 4.4). Trading in futures and options on government bonds fell in the third quarter of 2005, even if seasonality is taken into account. This is in line with the very moderate increase in implied volatility of US and euro area 10-year bond yields in the aftermath of Hurricane Katrina.

Turnover of government bond contracts

Quarterly contract turnover, in trillions of US dollars



... and of a return to inflation in Japan

Trading activity in derivatives on yen interest rates reflected mainly improved domestic economic conditions. The possible return of inflation and the perceived end of the zero interest rate policy spurred trading in short-term interest rate contracts, which soared by 78% in the third quarter. Open interest rose by 36% to \$1.6 trillion, similar to the level recorded one year ago, before disappointing data dampened expectations of a return to “normal” economic conditions.

Strong growth in East Asian equity derivatives

Korea overtakes United States as busiest market

Rising prices on most of the world’s stock exchanges boosted activity in equity derivatives during the third quarter of 2005, with trading volume in stock index futures and options rising by more than one fifth to \$34 trillion. The increase in activity was particularly strong on Asian derivatives exchanges. Turnover surged by 71% in Korea to \$12 trillion, overtaking the United States as the world’s busiest market for stock index derivatives. Turnover growth remains impressive even when expressed in terms of the number of contracts traded (+50%), which strips out the valuation effect arising from the sharp rise in the KOSPI 200 index over the period. Robust growth was also recorded in Japan, where turnover in stock index products increased by one third (20% in terms of the number of contracts). The number of contracts traded remained stable in the euro area, although stock price and exchange rate movements drove up volume measured in dollar terms by 10%. Turnover in derivatives on US stock indices declined slightly in terms of both notional amounts and the number of contracts traded.

Dominance of individual investors ...

The Korean market for stock index derivatives differs from more established markets in several important respects. First, trading is heavily geared towards options, which in the third quarter accounted for 93% of trading volume. By contrast, the share of options in total volume is just under one half in the US market and even lower in other markets. Secondly, the high trading

volume in Korea is not reflected in large open positions. Open interest in Korean stock index contracts at the end of September amounted to a mere \$64 billion, whereas that in US contracts stood more than 50 times higher at \$3.3 trillion, even as Korean turnover exceeded trading in US indices. Both the predominance of options and the low level of open interest are related to a third characteristic that sets the Korean derivatives market apart from those in other countries. Individual investors account for approximately two thirds of trading in options and one half of trading in futures on the KOSPI 200, far higher than in other markets.¹ Individuals tend to prefer contracts which involve smaller cash outlays, which explains the dominance of options over futures, and usually do not have large, diversified portfolios to hedge, hence the low level of open interest.

The Korean derivatives market is also characterised by a limited participation of institutional investors. Foreigners, predominantly institutions, in 2004 held 40% of all shares listed on the Korean Stock Exchange, but accounted for less than one fifth of derivatives trading. This may be related to a regulatory environment that restricts foreign access to the derivatives market to transactions which involve some trading in the underlying securities. The share of domestic institutional investors (other than securities companies) was even lower at 6% of derivatives turnover. Korean pension funds were not permitted to hold equities, let alone equity derivatives, until early 2004, after which this outright prohibition was replaced by ceilings on their holdings of equity instruments. While the available data suggest that the actual holdings remain below these ceilings, it may only be a matter of time before there is a higher participation of institutions in the derivatives market. The sale of several conglomerates' captive pension funds to independent financial institutions may also bring more sophisticated investors into the market.

... over institutions

Local bond markets and emerging market derivatives

Many countries in Latin America and Asia have responded to the financial crises of the 1990s by developing markets for local currency bonds.² Foreign investors are important participants in some of these markets, and their presence has spurred the development of derivatives trading as they seek to hedge their currency and interest rate exposures from such bonds.

Local currency bond trading ...

¹ In Japan, individual investors account for 12% of customer trading (ie excluding inter-dealer transactions) in Nikkei 225 futures and 8% in options, while their share in the more heavily traded TOPIX contracts is essentially zero. Comparable data for the United States and Europe do not exist, but all the available evidence suggests that individual investors account for only a small proportion of derivatives trading.

² This issue is explored in more depth in S Jeanneau & C Pérez Verdia, "Reducing financial vulnerability: the development of the domestic government bond market in Mexico", and in C E Tovar, "International government debt denominated in domestic currency: recent developments in Latin America", in this issue of the *BIS Quarterly Review*. For a discussion of the Asian experience see G Jiang & R McCauley, "Asian local currency bond markets", *BIS Quarterly Review*, June 2004.

... boosts OTC market for derivatives in Mexican pesos ...

The impact on the derivatives market of trading in local currency debt has been particularly noteworthy in Mexico, where a higher issuance of long-term domestic bonds has been complemented by a number of international peso-denominated bonds of foreign financial institutions taking advantage of the demand for highly rated peso paper. Since these issuers tend to swap the proceeds into other currencies, they provide a natural counterpart to foreign investors wishing to hedge peso bonds. As a consequence, the Mexican peso has become one of the few emerging market currencies with significant activity in OTC derivatives. At the end of June 2005, the notional amount of all outstanding derivatives reported by the dealers included in the semiannual survey stood at \$535 billion, almost twice as much as one year before.³ Trading in OTC derivatives on the Mexican peso is heavily geared towards foreign exchange risk. Such instruments account for 86% of OTC trading in Mexican pesos, compared to only 12% of worldwide activity. The increasing sophistication of the market is reflected in a shift of turnover from relatively simple instruments such as forwards to more complex contracts like options and currency swaps. The share of options in the notional amount of all instruments on the peso rose from 12% in June 2002 to more than 50% three years later. Currency swaps with one leg denominated in pesos hardly existed three years ago and have since become the most rapidly growing part of the peso derivatives market. During the first half of 2005, their notional amounts more than trebled to \$53 billion.

... but not in Brazilian reais

It is interesting to compare the market for peso exchange rate risk with that in Brazilian reais. Brazilian currency risk is traded mainly on the Bolsa de Mercadorias & Futuros, where the corresponding contracts account for 14% of both turnover and open interest in financial derivatives. This is far higher than the 0.9% (turnover) and 0.3% (open interest) recorded on a worldwide level. By contrast, the OTC market for FX contracts denominated in reais appears to be fairly underdeveloped at present. Neither the semiannual survey nor the more comprehensive triennial survey record much activity in such contracts.

Hurricanes prompt surge in energy derivatives trading

Hurricanes drove up oil prices and trading activity in the United States ...

The destruction of oil rigs in the Gulf of Mexico by Hurricanes Katrina and Rita and interruptions in the refining and transportation of oil left their mark on the market for energy derivatives. Prices for West Texas Intermediate crude oil rose throughout August and peaked at an all-time high of around \$70 per barrel at the beginning of September, a few days after Katrina had reached the Gulf coast. Trading in the “sweet” crude oil contract on the New York Mercantile Exchange (NYMEX) increased by more than one third from 5.7 million contracts in July to 7.6 million contracts in August, reflecting both heavier trading on short-term price movements and higher open interest. Oil

³ The only emerging market currency in which larger positions were recorded was the Hong Kong dollar (\$1,053 billion).

Declining risk premia in the crude oil futures market

Marian Micu

Some energy market analysts have attributed the increase in the price of oil futures in recent years to the existence of a sizeable risk premium. In this box, we estimate the premium as the difference between the price of crude oil futures traded on NYMEX and the mean forecast of WTI oil prices per barrel over the same horizon.^{①, ②} Between 2003 and August 2005, as oil prices steadily increased, so did the risk premia for three-month and 12-month contracts, to \$11 and \$14, respectively (see graph, left-hand panel). But in the subsequent two months, as oil prices receded slightly, the risk premium dropped to about \$0.5 and \$5. What explains these sharp movements?

Following the literature on this subject,^③ four leading factors are considered to explain changes in the risk premium: speculative activity, global oil demand, refining capacity and interest rates. Multivariate regressions are performed on monthly data ranging from July 1995 to October 2005. Speculative activity is approximated by net non-commercial positions in futures contracts, calculated as the difference between the positions of non-commercial investors who buy on the long side and those who buy on the short side. Positive net positions should indicate buying pressure and therefore be associated with a higher risk premium. Similarly, a high demand for oil or low spare capacity in the refining sector should increase the risk of bottlenecks that may result in sharp price movements and therefore be associated with a high risk premium. Interest rates, measured by three-month Libor, could impact risk premia through a variety of channels. For example, low interest rates boost economic activity and oil demand, which in turn raises the premium on oil futures. Alternatively, low levels of interest rates may prompt investors to search for higher yields and assume higher risks in commodity futures markets, exerting an upward pressure on the risk premium.

All of the variables have the expected sign and, with one exception, are statistically significant. The risk premium appears to be particularly closely related to net speculative positions, which dropped from more than 10% of total non-commercial positions in August to virtually zero in September (see table and graph, right-hand panel). Similarly, global oil demand declined and short-term interest rates increased, adding to the downward pressure on the risk premium. Taken together, these two variables explain two thirds of the \$7 decrease in the three-month risk premium and one half of the \$5 drop in the 12-month risk premium in September. According to the model, variations in the utilisation of refining capacity appear to have had only a small impact on the 12-month risk premium, and none on the three-month premium. This may be due to longer reaction lags of crude oil prices to refinery bottlenecks.

Determinants of the risk premium in crude oil futures

	Changes in the three-month risk premium	Changes in the 12-month risk premium
Net speculative futures positions ¹	1.14 (3.82)***	0.63 (2.49)***
Global oil demand gap ²	0.19 (2.03)**	0.15 (2.15)**
US spare refining capacity	-0.10 (-1.23)	-0.11 (-1.70)*
Three-month Libor	-0.12 (-2.01)**	-0.13 (-2.56)***

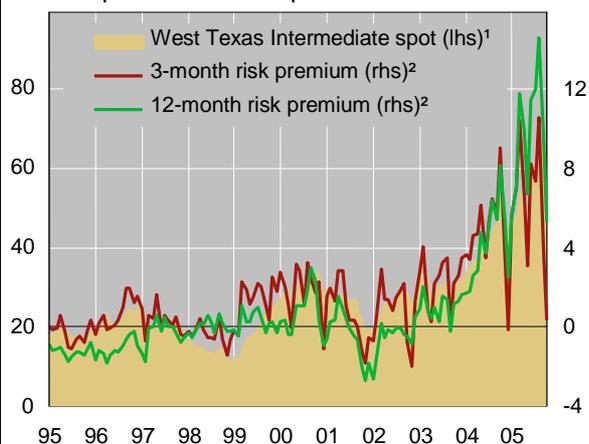
¹ Net non-commercial positions as a percentage of total non-commercial positions. ² Detrended global oil demand using the Hodrick-Prescott filter. Regressions have been estimated with monthly data for the period July 1995–October 2005. Standard errors are corrected for heteroskedasticity using the Newey-West method. Asymptotic t-statistics are shown in parentheses. * indicates a coefficient significantly different from zero at the 10%, ** at the 5% and *** at the 1% confidence level.

Sources: Bloomberg; Commodity Futures Trading Commission; BIS calculations.

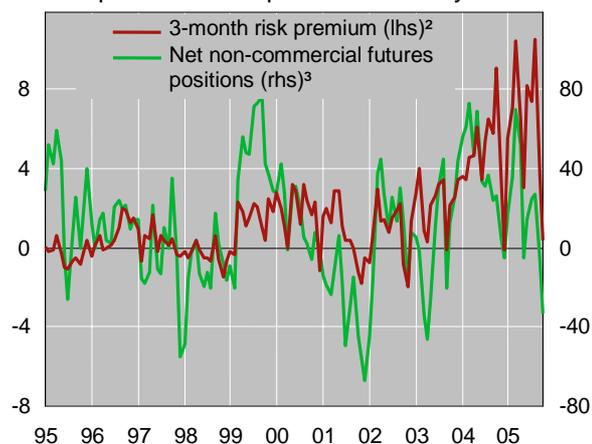
① The risk premium can be either positive or negative, depending on the balance of risk perceived by the marginal investor. It is distinct from the basis of the futures contract (the difference between futures prices and current spot prices). For a comparison of the two concepts, see E F Fama and K R French, "Commodity futures prices: some evidence on forecast power, premiums, and the theory of storage", *Journal of Business*, vol 60, no 1, 1987, pp 55–73. ② Consensus Economics carries out surveys on forecasts for WTI spot prices at three- and 12-month horizons. These are combined with the futures prices on the day when the survey was made. The number of analysts contributing to the surveys ranges between 60 and 130. In our study we use the mean value of the individual forecasts. Statistical tests for the period from July 1995 to October 2005 suggest that these forecasts are unbiased but do not incorporate all information available. ③ See A Merino and A Ortiz, "Explaining the so-called "price premium" in oil markets", *OPEC Review*, vol 29, issue 2, 2005, pp 133–52.

Risk premia in oil futures

Risk premium and oil price



Risk premium and speculative activity



¹ In US dollars per barrel. ² In US dollars. ³ In thousands of contracts of one thousand barrels each.

Sources: Bloomberg; Consensus Economics; BIS calculations.

Despite its recent performance, over the entire 10-year sample period the estimated model explains only 10% of the variation in the risk premium at both three- and 12-month horizons. This suggests that other factors such as political and social tensions, terrorist attacks and military conflicts may have an even stronger impact on the risk premium over and above the fundamental factors suggested in the literature.

prices declined during the first half of September, before Hurricane Rita led to another, slightly lower, spike. Trading in futures and options on crude oil listed on the NYMEX fell back to 6.6 million contracts in September. Data from the Commodity Futures Trading Commission (CFTC) reveal that although open interest decreased only slightly that month, there has been an important change in the provision of liquidity to the market. Non-commercial users, or “speculators”,⁴ held net short positions equivalent to over 4% of total open interest in July and August, suggesting that they were betting on declining oil prices. By the end of September, however, these positions had declined to 2% of total open interest, contributing to the drop in the risk premia in oil futures prices (see the box on page 50). A similar decline in the net open positions of non-commercial users occurred in April and May this year, when oil prices fell by around \$10 per barrel.

... but were less important elsewhere

Trading in energy contracts in other regions of the world was less affected by the hurricanes than activity in the United States, even though the high prices of oil were essentially a global phenomenon. Turnover in crude oil futures on the International Petroleum Exchange in London rose by 20% in August, well below the 32% increase in New York. On the Shanghai Futures Exchange,

⁴ The CFTC distinguishes between commercial users, who are “... commercially engaged in business activities hedged by the use of futures and options markets” and non-commercial users. The latter group are often referred to as “speculators” and the former as “hedgers”. However, there are no restrictions preventing “hedgers” from engaging in purely speculative position-taking.

trading in fuel oil (there is no contract on crude oil) actually declined in August. In Japan, activity in oil-related contracts increased in August, but remained below the levels recorded during the previous quarters.

The impact of the hurricanes on commodity markets went beyond the energy sector. New Orleans was an important hub not only of the petroleum industry but also for the shipment of grains. In addition, the city housed important stockpiles of commodities ranging from coffee and sugar to zinc. It is not clear, however, to what extent this left a mark on turnover in commodity derivatives. Although trading in the main US-traded contracts on sugar, wheat and coffee did increase by more than 50% in August, outpacing growth in products less directly affected by the hurricanes, turnover in all three categories remained below the all-time high recorded in June.

Growth in credit default swaps exposes cracks in market infrastructure

Growth in the market for credit default swaps (CDSs) was remarkably robust during the first half of the year, given the sell-off in credit markets triggered by downgrades in the US auto industry in March.⁵ Notional amounts outstanding of CDSs rose by 60% during the first half of 2005 to \$10.2 trillion.⁶ Growth was particularly strong in multi-name contracts, whose notional amount more than doubled to \$2.9 trillion. Single-name CDSs increased by 43% to \$7.3 trillion.

High growth in credit default swaps...

Growth in CDSs has far outpaced growth in the underlying loans and bonds. For many companies, the volume outstanding of CDS contracts now greatly exceeds the supply of deliverable debt. As the overwhelming majority of CDS contracts stipulate settlement through the physical delivery of debt owed by the reference entity,⁷ this has increased the risk of "squeezes", in which the demand for the debt of a firm exceeds the supply of such debt, resulting in the breakdown of the normal pricing relationship between credit derivatives and the underlying debt contracts. This in turn may cause traders to withdraw from the market, thereby draining liquidity.

... increases risk of squeezes ...

Since the bankruptcy of US auto parts supplier Collins & Aikman in June 2005, CDS dealers have repeatedly resorted to a resolution procedure involving a shift to cash rather than physical settlement following a credit event. Such a procedure has been applied to the resolution of CDS contracts on Delta Airlines, Northwest Airlines and, most prominently, Delphi. The debt of Delphi was included in various CDS indices as well as being referenced by a large volume of single-name contracts. Following the bankruptcy of Delphi on 8 October, dealers in a first step identified contracts that could be offset

⁵ See "Overview: repricing in credit markets", in the *BIS Quarterly Review*, June 2005.

⁶ The total notional amount outstanding is calculated as the sum of contracts bought and sold minus half of the sum of contracts bought and sold between reporting dealers.

⁷ According to the British Bankers' Association, 86% of transactions were settled through physical delivery in 2003.

against each other while maintaining the existing net positions. Such multilateral netting is a key feature of organised exchanges but is not common in OTC markets. This procedure eliminated about 70% of open gross positions in single-name CDSs on Delphi. In a second step, the final price for the benchmark Delphi bond was fixed at 63.375% in an auction on 4 November. This price is in line with historical estimates of losses-given-default, although the wide range of such estimates makes it difficult to assess whether it differs from the one that would have prevailed without the influence of CDS trading. It is substantially lower, though, than the price at which Delphi's debt traded during the squeeze before the changeover to cash settlement. It is widely accepted that this price had been out of line with the firm's fundamentals.

Even before Delphi filed for bankruptcy, it had become apparent that the infrastructure of the CDS market had not kept up with the growth in volume. In particular, market participants and regulators had expressed concerns that incomplete documentation and the large backlog of unconfirmed trades posed risks to the normal functioning of the CDS market. This backlog is related to the fact that derivatives are mostly processed manually, often involving extensive paperwork.⁸ Much of the incomplete documentation is linked to trades that have been assigned (transferred) to third parties. According to the Report of the Counterparty Risk Management Policy Group II (the "Corrigan Report"), assignments may affect as much as 40% of trading volume and play an important role in the provision of liquidity to the market. Although assignments require the written consent of all parties involved in the transactions under most master agreements currently in use, this rule does not appear to have been enforced in the past, leading to uncertainty about the identity of counterparties.

In response to an initiative by the Federal Reserve Bank of New York in September, the largest CDS dealers pledged to improve back office processes, including reducing the number of unconfirmed trades, clarifying procedures for assigning trades and automating the processing of trades. In addition, they committed to supply figures on whose basis progress in these areas could be judged. If implemented, such initiatives would greatly strengthen the infrastructure supporting CDS markets, thereby helping to ensure that they continue to function normally even during periods of market stress. Nevertheless, it remains to be seen to what extent the newly developed assignment ("novation") protocols will be implemented in practice. In particular, some hedge funds appear to be reluctant to subscribe to such standards. It is also unclear whether there is that much scope for further automation of back office procedures. Electronic confirmation should pose little problem for plain vanilla contracts but may be more of a challenge in the case of more complex products. Automation may also be slowed by the fact that many players in the market undertake only a limited number of trades, making them reluctant to invest in systems for the electronic processing of trades.

⁸ According to the survey by the International Swaps and Derivatives Association in June 2005, only about 40% of all trades are processed electronically.

