The information content of aggregate data on financial futures positions

By Caroline Mogford of the Bank's Sterling Markets Division and Darren Pain of the Bank's Foreign Exchange Division.

This article uses statistical analysis to investigate the strength of any empirical relationships between data on speculative financial futures positions and movements in asset prices. It finds strong evidence that speculative positions do indeed tend to move closely with changes in the underlying asset prices. But there is little support for the view that these positions data systematically inform about future changes in asset prices.

Introduction

A futures contract is a binding agreement between a buyer and seller to receive (in the case of a long position) or deliver (in the case of a short position) a commodity or financial instrument sometime in the future, but at a price that is agreed upon today. Futures trades take place through a centralised exchange.(1) Customers who trade futures are required to deposit cash or acceptable securities with the exchange — the so-called initial margin. In doing so, they have an incentive to honour their financial commitments and cover any obligations which might arise out of their trading activities. Given the margin deposits, the exchange clearing house will act as the buyer to the seller and the seller to the buyer in every transaction, thereby guaranteeing performance and reducing counterparty risk.

US futures markets are regulated federally by the Commodity Futures Trading Commission (CFTC), which is responsible for ensuring that prices and outstanding positions are communicated to the public. The CFTC provides the most comprehensive positions data on exchange-traded futures which are watched by a sizable share of market participants. In particular, the data from the CFTC's Commitments of Traders Report (COTR) on speculative positioning is sometimes used by analysts and commentators as an indicator of the future direction of prices in asset markets. For example, extreme net short speculative positions are sometimes thought to signal an imminent rebound in the relevant currency, while extreme net long positions can suggest a currency has already appreciated a great deal and may be poised for a downward correction.(2) Is there any statistical evidence to support such views? More generally, what is the information content of the COTR positioning data about movements in financial asset prices?

The purpose of this article is to examine the empirical links between changes in aggregate reported futures positions and changes in prices in a variety of asset markets. More specifically, it undertakes a basic statistical investigation of the relationships between changes in futures positions and changes in the corresponding underlying asset price. Among these, a particular focus is whether changes to futures positions have any leading indicator properties over asset prices, particularly those associated with the accumulation of large aggregate futures positions.

Some background

Traditional models of asset prices, and in particular exchange rates, are based on publicly available macroeconomic information. In such models, incremental information cannot be conveyed by trading because public information is already incorporated in the price (see Evans and Lyons (2001)). However, in recent years a body of literature has been developed that has sought to relax the strong assumption that all price-relevant information is available publicly and has instead stressed the importance of the process by which

(1) In contrast, forward contracts are traded off-exchange or 'over-the-counter' with market-making intermediaries.
(2) According to Business Reuters on 23 April 2004, '…extreme net-long speculative positions often signal a decline in a currency, especially if that position conflicts with the positioning of the more influential commercial players'.

dispersed information becomes widely known to the market. In particular, a number of authors have examined how order-flows (the number of buyers bidding less than the number of sellers offering) can help to explain and predict short-term movements in exchange rates.(1) The rationale is that order-flows can convey dispersed information about the fundamental determinants of exchange rates — for example news about relative macroeconomic conditions in different countries, changes in investors' risk aversion or hedging technologies etc — that currency markets need to aggregate and which should affect but may not yet be embodied in the current exchange rate.

Cast in this light, the data on futures positions may potentially offer incremental information about asset price developments, because they reveal to the market information about the disparate views of traders and their demands for the particular underlying asset. From an investor's perspective, if knowledge about the overall market position is informative about likely future developments, it could be useful in identifying profitable trading opportunities — especially if combined with proprietary information about their own positions or those of the more influential commercial players.

Knowledge of aggregate market positions data might also be useful from a policy perspective. Asset price developments can be an important element of the monetary policy transmission mechanism. In analysing the policy implications of asset price changes, it is important to assess the reasons behind any change. But if it could be shown that aggregate positions data are informative about potential movements in asset prices, they might be useful indicator variables which policymakers could use to assess possible future developments in asset markets and the macroeconomy more generally.

Aggregate data on positioning might also help to assess prospective financial stability conditions. In particular, some past episodes of financial market instability have been associated with the build-up and subsequent unwinding of speculative positions. An example of this is the sharp decline of the dollar against the yen in October 1998. The combination of an appreciating dollar and the large interest rate differential between Japan and the United States during the first half of 1998 prompted many market participants to establish similar positions by borrowing yen and buying dollar assets. This so-called 'yen-carry' trade was very common among hedge funds, proprietary trading desks of investment banks and even treasury departments of large corporations. The unwinding of this 'yen-carry' trade began following the Russian debt default in August 1998 and was exacerbated by stop-loss orders, the cancellation of barrier options(2) and associated hedging positions by dealers. Monitoring speculative positions may possibly be useful in spotting potential vulnerabilities in financial markets that could lead to this sort of dynamics in financial markets.

The COTR data

The COTR provides a breakdown of positions in futures for markets traded on a number of exchanges, including the Chicago Mercantile Exchange (CME).(3) The positioning data are published every Friday, and refer to positions held at the close of business on the preceding Tuesday. The COTR provides positions figures for the futures markets for traders holding positions equal to or above the reporting levels established by the CFTC. Other flow and survey data publicly provided by individual investment banks or custodians are not as comprehensive and may be subject to sampling or response bias and are therefore not included in this analysis.

The COTR data contain the long and short futures positions held in a variety of markets. The *net* position in a future can be defined as the total number of long less short positions for a particular group of participants. Every futures contract has both a buyer (who is long) and a seller (who is short) so the net positions must sum to zero across all traders, although not for different subgroups.

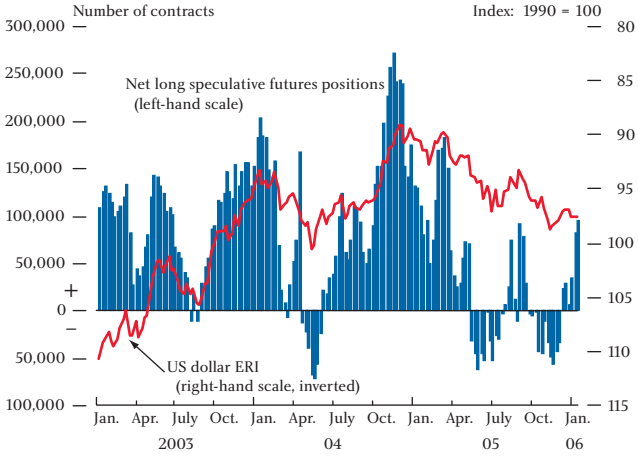
The COTR separates those positions held by commercial and non-commercial traders. This distinction is based on how firms identify themselves to the exchanges, although the exchanges monitor the behaviour of firms to confirm their self-designation. Commercial positions are often transactions of firms that use futures to hedge

(1) See, for example, Evans and Lyons (2001 and 2002), Fan and Lyons (2003), Lyons (2001) and Dominguez and Panthaki (2005).
(2) A barrier option is a type of financial option where the option to exercise depends on the price of the underlying asset crossing or reaching a given barrier level.
(3) The International Money Market (IMM), a division of the CME, was established in 1972 for the trading of seven currency futures contracts. Financial futures markets have since expanded, and the markets analysed in this article, including the IMM, represent a small subsample of the markets regulated by the CFTC.

their business operations, but also include transactions of dealers that are not necessarily in the market to hedge or speculate. Non-commercial data are generally interpreted as reflecting the speculative community's positioning, although some authors have previously questioned this interpretation. For example, Sanders, Boris and Manfredo (2004) maintain that, because position limits are placed on non-commercial investors, there may be some incentive for traders to self-classify as commercials. And as commercial firms' true cash positions are unknown, it is possible that some of their positions could be speculative in nature. Nonetheless, Sanders *et al* suggest that 'reporting non-commercials most likely represent a relatively pure subset of total speculative positions' and, in particular, they may be considered a reasonable indicator of how the large commodity trading advisors (CTAs) are positioned.(1)

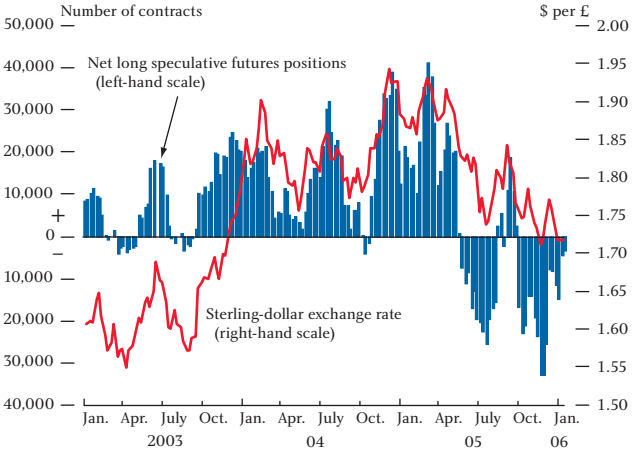
Futures positions are available from the CFTC for a large number of currencies, although this article only considers the seven major currencies for which futures contracts are traded on the CME: euro, sterling, yen, Canadian dollars, Swiss francs, Mexican pesos and Australian dollars. Positions in each currency are typically given against the US dollar. In addition, this article also investigates a selection of other markets traded on the CME: interest rate markets (Libor, eurodollar and US Treasury notes), equity indices (S&P 500, Nasdaq and Nikkei) and oil futures (NYMEX). Weekly net speculative positions for all these markets are calculated from COTR data.(2)

Chart 1
Net long speculative futures positions in all seven currencies (against the dollar) and the dollar ERI



Sources: Commodity Futures Trading Commission and Bank calculations.

Chart 2
Net long speculative positions in sterling (against the dollar) and the sterling-dollar exchange rate



Sources: Commodity Futures Trading Commission and Bank calculations.

Empirical analysis

The box on page 60 outlines some possible theoretical links between movements in asset prices and positioning in futures. A casual review of the empirical data also indicates that there may be a relationship between the strength of a currency and the number of net long speculative positions in that currency. Chart 1 shows total net long speculative positions in the seven available currencies (against the US dollar), plotted against the dollar ERI. And Chart 2 shows net long speculative positions in sterling against the sterling-dollar exchange rate. A general build-up in long (short) positions would seem to be associated with an appreciation (depreciation) in the exchange rate. But more formal statistical analysis can be used to uncover the strength of any relationship and more generally the information content of the COTR data for markets other than foreign currency.

In order to investigate this issue, we consider four empirical questions. First, we investigate whether there is any contemporaneous relationship between changes in speculative positions and changes in asset prices, and whether the strength of this relationship varies between asset markets. Second, we examine whether changes in net speculative positions *precede* changes in asset prices. Third, we consider whether *extreme* net speculative

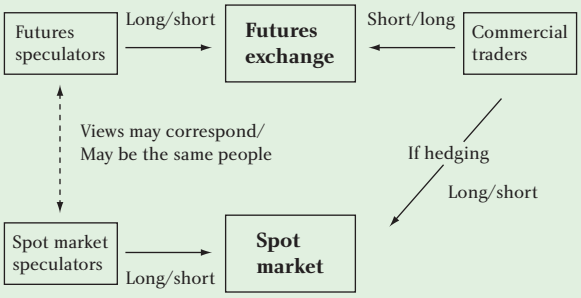
(1) A CTA is an individual or firm which advises others about buying and selling futures and/or futures options and manages associated trades for its clients or on its own behalf.
(2) The data have been published at a weekly frequency since 1993 (with the exceptions of the euro (from 1999), the Mexican peso (from 1995), the US Treasury bills (from 1997), the S&P 500 (from 1997) and the Nasdaq (from 1996)).

Possible links between futures positions and movements in asset prices in spot markets

In the spot or 'cash' market, financial assets are traded for immediate delivery at the prevailing price. This differs from a futures market, where the delivery will be made at a future date. Futures contracts are traded on an exchange, have standardised features and provide a mechanism that gives both parties some form of guarantee that the contract will be honoured.

Figure 1 outlines the possible interactions between the spot and futures markets. There are a number of reasons why changes in net speculative futures positions might be associated with changes in the underlying spot price. First, the views of the main players in the speculative futures community may closely correspond to those of the main players in spot markets. That is, investors take similar directional positions in either 'cash' or futures markets. In fact, it is likely that some speculators are involved in both futures and spot markets. Market news may influence both futures speculators' adjustments to the number of futures positions they hold and spot market participants' views of how the asset price will move.

Figure 1
Possible interaction between changes to net speculative positions and asset prices



A second possible explanation stems from the fact that aggregate *net* speculative positions in the futures market are taken against commercial investors: either firms with hedging requirements or traders. When speculative positions are taken against commercial traders, the traders may hedge their positions in the cash market. This could cause movements in speculative positions to correlate with moves in asset prices. For example, an increase in net speculative positions will correspond to a decrease in net commercial traders' positions. The commercial traders may then hedge this position by buying the asset in the spot market, which might lead to an increase in the asset price.

Another reason for a positive relationship between changes in net speculative positions and changes in an asset price could be that speculators tend to react to asset price movements. If futures speculators trade on 'trend-following' models, they would go long (short) after an asset price increases (decreases). When weekly data are used, this should result in a significant contemporaneous relationship. But, if markets were fully efficient, such trend-following behaviour would not be profitable as movements in the asset price should contain no information about future changes in the asset price.

None of these hypotheses necessarily imply the existence of leading indicator relationships in either direction between changes in net speculative positions and changes in the asset price. However, it is possible that the interaction between spot and futures markets takes some time to work through, so that the transactions in one market have a lagged impact on the other. Such dynamic effects could relate to the perceived asymmetry of information. Large traders in financial markets may be considered to be relatively well informed about financial markets. Adjustments in their positions could therefore be used as a signal for other traders in the market to adjust their positions, and so may precede changes in asset prices. Another reason why spot and futures positions may be dynamically related is that traders with positions in futures may choose to close out or hedge those positions using the spot market at a later date. For example, a trader who is short may choose to close out his exposure by buying the security in the cash market (so called 'short-covering').

positions tend to precede changes in the exchange rate. And finally, using information from options prices, the article assesses whether the views of option speculators tend to correspond to the views of speculators in futures markets.

Do net speculative positions and asset prices tend to move together?

Klitgaard (2004) analysed weekly net speculative COTR foreign exchange data between 1993 and 2004. He found a strong contemporaneous relationship between weekly changes in speculators' net positions and exchange rate moves. This article adopts a similar approach for the seven currencies considered, but also extends the analysis to include oil, interest rate and equity markets.

Table A shows the percentage of weeks between January 1993 and January 2006 in which changes in net speculative positions and percentage changes in asset prices moved in the same direction for the markets under investigation. If there were no contemporaneous relationships between changes in speculative futures positions and changes in asset prices, the two variables would be expected to move together approximately half of the time. This hypothesis can be evaluated using a simple statistical test. Markets for which the percentage is significantly different from 50% at the 5% level are shown in bold in the table.

Table A
Percentage of weeks that changes in speculative positions move in the same direction as the asset price, for all asset markets under investigation (Jan. 1993 – Jan. 2006)[a]

Asset market	Percentage (p-value)[b]
Euro — US dollar	**69% (0.00)**
Sterling — US dollar	**71% (0.00)**
Yen — US dollar	**74% (0.00)**
Canadian dollar — US dollar	**69% (0.00)**
Swiss franc — US dollar	**74% (0.00)**
Mexican peso — US dollar	**67% (0.00)**
Australian dollar — US dollar	**68% (0.00)**
Oil	**71% (0.00)**
Two-year US Treasury yields[c]	46% (0.07)
Five-year US Treasury yields[c]	**43% (0.00)**
Ten-year US Treasury yields[c]	**45% (0.03)**
Libor[c]	47% (0.20)
Eurodollar[c]	50% (0.94)
S&P 500	**56% (0.00)**
Nasdaq	54% (0.09)
Nikkei	52% (0.34)

(a) Start dates differ across markets.
(b) Based on a two-tailed z-test or t-test of the null hypothesis that percentage is equal to 50%. Where the null can be rejected at the 5% significant level, the result is shown in bold.
(c) Test was constructed using yields rather than prices and hence the statistic might be expected to be less than 50%.

In fact, at the 5% significance level, the null hypothesis of zero contemporaneous correlation was rejected for all seven currencies, the oil market and the S&P 500 and long-maturity US dollar government bond yields. For most of these markets, changes in the asset price and changes in the net speculative positions tended to move together significantly more than 50% of the time.

Do changes in net speculative futures positions lead moves in asset prices?

To investigate whether either variable has any predictive power over the other, we use Granger-causality tests.(1) In simple terms, Granger causality measures whether one thing happens before another thing and can help to predict it. More formally, pair-wise Granger-causality tests assess whether a variable (X) can be used to forecast movements in another variable (Y) over and above simply using past values of Y. Thus, in the current investigation, these tests can be used to assess (i) whether past values of net speculative positions have any predictive power over moves in an asset price, beyond using past values of asset prices alone, and conversely (ii) whether past asset price movements can inform about future speculative positions, over and above past movements in futures positions. If movements in speculative positions provide incremental information about future movements in an asset price, then they can be said to 'Granger cause' that asset price and *vice versa*.

Table B shows the results of Granger-causality tests for all markets. For most futures contracts, there was no significant evidence that movements in speculative positions either lead or lag changes in the (spot) asset prices. Indeed, if anything, it is more likely that movements in asset prices 'Granger caused' movements in futures positions. Arguably, changes in net speculative positions do seem to have preceded moves in the ten-year US Treasury and the euro-dollar exchange rate.(2) But it may be that these statistically significant results reflect no more than the random variation in the detectable leading indicator relationships across the markets considered.(3)

(1) It should be stressed that these tests all use weekly data. It is quite possible that closer relationships exist over different time horizons, but data availability limits such research.
(2) At face value, the existence of leading indicator relationships in any of the asset markets could perhaps suggest profit-making opportunities. However, the CFTC data are released three days after the date to which they refer. It is not clear therefore that investors could in practice profit from knowledge of the CFTC data even if after the event, it were found to be useful in anticipating asset price changes.
(3) Put another way, a *joint* test of Granger causality across markets might show little evidence of leading indicator relationships even though they could be marginally statistically significant in a few markets.

Table B
Results of Granger-causality tests[a] between changes in net speculative positions and changes in the underlying asset price (Jan. 1993 – Jan. 2006)[b]

Asset market	p-value of test:[c] changes in speculative positions precede changes in asset price	p-value of test:[c] changes in asset prices precede changes in speculative positions
Euro	**0.05**	0.06
Sterling	0.42	**0.00**
Yen	0.90	0.06
Canadian dollar	0.12	0.01
Swiss franc	0.88	**0.00**
Mexican peso	0.50	0.77
Australian dollar	0.06	**0.00**
Oil	0.24	**0.01**
Two-year US Treasury	0.81	0.99
Five-year US Treasury	0.77	**0.02**
Ten-year US Treasury	**0.05**	0.17
Libor	0.78	0.64
Eurodollar	0.40	0.58
S&P 500	0.64	0.71
Nasdaq	0.29	0.92
Nikkei	0.97	0.49

(a) Formally, the different possible Granger-causal relations between assets prices (S) and speculative futures positions (F) can be expressed using the parameters of equations:

$$S_t = \sum_{i=1}^{n} \alpha_i S_{t-i} + \sum_{i=1}^{n} \beta_i F_{t-i} \qquad (1)$$

$$F_t = \sum_{i=1}^{n} \gamma_i F_{t-i} + \sum_{i=1}^{n} \delta_i S_{t-i} \qquad (2)$$

There is Granger causality from futures positions to asset prices if $\beta_i \neq 0$ and $\delta_i = 0$ for all i. Similarly, there is causality from asset prices to futures positions if $\beta_i = 0$ and $\delta_i \neq 0$ for all i. The causality is considered as mutual if $\beta_i \neq 0$ and $\delta_i \neq 0$ for all i. Finally, there is no link between asset price movements and futures positions if $\beta_i = 0$ and $\delta_i = 0$ for all i.

(b) Start dates differ across markets.

(c) Result of an F-test of coefficient significance; 2 lags used ($n = 2$). Where the coefficients are significantly different from zero, the result is shown in bold. Tests with shorter and longer lags produced broadly similar results.

Do extreme net speculative positions precede changes in the exchange rate?

Some foreign exchange market contacts have reported that their main interest in the net speculative position data is when positions are unusually large or small. The rationale behind this view is that extreme positions are unlikely to persist. This suggests that there could be an inverse relationship between the sign of an extreme position and future changes in the exchange rate.

One way to investigate this is to ascertain whether currencies tend to increase (decrease) in value, ie appreciate (depreciate), the week after net speculative positions are extremely low (high). For the purposes of this article, extreme is defined as outside the range of a 52-week rolling mean plus or minus either one or two standard deviations.

Table C shows the percentage of weeks when extreme speculative positions preceded an inverse move in the relevant exchange rate. Overall, the results provide little support for the existence of a *systematic* relationship of this nature in any of the foreign exchange markets. Co-movements between extreme changes in net positions (those at least one standard deviation larger or smaller than the average weekly position over the sample) and subsequent exchange rate moves were not statistically significant (at the 5% level) over the sample period.

Table C
Percentage of weeks in which an extreme position (against the dollar) preceded an inverse move in the exchange rate (Jan. 1993 – Jan. 2006)[a]

Currency	One standard deviation (p-value)[b]	Two standard deviations (p-value)[b]
Euro	45% (0.28)	48%[c]
Sterling	55% (0.12)	51% (0.88)
Yen	46% (0.23)	60% (0.15)
Canadian dollar	49% (0.63)	41% (0.16)
Swiss franc	51% (0.75)	54% (0.65)
Mexican peso	48% (0.42)	54% (0.59)
Australian dollar	47% (0.33)	38% (0.05)

(a) Start dates differ across markets.

(b) Based on a two-tailed z-test or t-test of the null hypothesis that percentage is equal to 50%. Where the null can be rejected at the 5% significant level, the result is shown in bold.

(c) Too few observations to make test reliable.

Do speculators in options and futures tend to have similar views?

One way of quantifying changes in the views of options purchasers is by considering changes in risk reversals. Risk reversals are a combination of call options on a particular asset (instruments that give an investor the right but not the obligation to buy an asset at a specified price within a specific time period) and put options (instruments that enable the investor to sell an asset on pre-agreed terms). They are commonly traded in foreign exchange options markets and the market price of the risk reversal can be interpreted as a reflection of market participants' views on the balance of risks to an exchange rate. According to market convention, risk reversals are typically expressed so that a positive number indicates that calls are preferred to puts and that the market assesses an appreciation in the underlying currency is more likely than a depreciation. Likewise, a negative number indicates that puts are preferred to calls and that the market perceives a greater risk of a depreciation in the underlying currency than an appreciation.

If risk reversals and net speculative positions in a particular currency pair moved in the same direction, this could suggest that options and futures speculators had similar views regarding the balance of risks to future exchange rate moves. But it should be noted that market participants other than speculators use options (for example for hedging), so changes to risk reversals are not a perfect indicator of changes to the views of options speculators.

The contemporaneous relationship between net speculative positions and risk reversals was investigated for sterling, euro and yen.(1) Table D shows the percentage of weeks in which speculative positions and risk reversals moved in the same direction for these currencies. Over the period considered, net speculative positions and the corresponding exchange rates moved in the same direction significantly more than 50% of the time for all three currencies against the dollar. This indicates that there may be a relationship between the views of futures speculators regarding potential exchange rate changes and those of purchasers of options.

Table D
Percentage of weeks that risk reversals and net speculative positions move in the same directions (Aug. 2001 – Jan. 2006)

Currency	Percentage (p-value)(a)
Sterling	**66% (0.00)**
Euro	**68% (0.00)**
Yen	**73% (0.00)**

(a) Based on a two-tailed z-test or t-test of the null hypothesis that percentage is equal to 50%. Where the null can be rejected at the 5% significant level, the result is shown in bold.

To consider the dynamic relationship between speculative positions and risk reversals, Table E details the results of Granger-causality tests for the two variables. On the basis of this test, there is some evidence that risk reversals preceded changes in net euro speculative positions. That is, changes in risk reversals may provide information about future changes in net speculative positions.

Table E
Results of Granger-causality tests(a) between changes in net speculative positions and changes in risk reversals (Aug. 2001 – Jan. 2006)(b)

Currency	p-value of test:(b) changes in speculative positions precede changes in risk reversals	p-value of test:(b) changes in risk reversals precede changes in speculative positions
Euro	0.26	**0.04**
Sterling	0.85	**0.04**
Yen	0.18	**0.01**

(a) See footnotes on Table C for an explanation of Granger causality.
(b) Result of an F-test of coefficient significance; 2 lags used (i = 2). Where the coefficients are significantly different from zero, the result is shown in bold. Tests with shorter and longer lags produced broadly similar results.

These results for the risk reversal data raise the question as to whether changes in risk reversals, unlike speculative positions data, precede changes in exchange rates. Indeed, comments by contacts in the foreign exchange market suggest that they tend to concentrate more on risk reversals than COTR data, not least because they are more frequently available.

However, the results of Granger-causality tests (shown in Table F) do not indicate a strong relationship between movements in risk reversals and subsequent changes in currency rates. If anything, over the sample period, changes in the euro-dollar exchange rate have tended to precede movements in risk reversals. Moreover, other studies have highlighted that any empirical association between risk reversals and spot exchange rates may not be particularly straightforward to interpret. In particular, Campa, Chang and Reider (1997) found evidence of a strong *positive* correlation between the level of the spot exchange rate and risk reversals — the stronger the currency, the greater the risk of a large appreciation of that currency. This contrasts with the general market view that risk reversals and spot rate are *negatively* correlated: large falls in exchange rates are assigned a greater probability of occurring when the spot rate has previously appreciated significantly and is therefore relatively strong.

Table F
Results of Granger-causality tests(a) between changes in risk reversals and changes in exchange rates (Aug. 2001 – Jan. 2006)(b)

Currency	p-value of test:(b) changes in exchange rates precede changes in risk reversals	p-value of test:(b) changes in risk reversals precede changes in exchange rates
Euro	**0.01**	0.43
Sterling	0.87	0.23
Yen	0.06	0.09

(a) See footnotes on Table C for an explanation of Granger causality.
(b) Result of an F-test of coefficient significance; 2 lags used (i = 2). Where the coefficients are significantly different from zero, the result is shown in bold. Tests with shorter and longer lags produced broadly similar results.

Concluding remarks

Overall, the statistical results reported in this article suggest that a strong *contemporaneous* relationship exists between weekly changes in net speculative positions and changes in exchange rates and oil prices, although this is less true for interest rate and equity markets. One possible explanation is that speculators in foreign exchange and commodity markets may tend to follow trends. It could also be the case that significant market news could move both the futures and spot markets, resulting in a close association between developments in the two markets. Another potential explanation is that commercial traders may choose to simultaneously hedge their futures positions in the spot market.

(1) One-month risk reversals were used in this analysis since they should reflect market participants' near-term views, and the underlying options are reasonably liquid.

However, the empirical results lend little support to the view that the COTR speculative positioning data are systematically informative about *future* changes in asset prices. There is little evidence that changes in non-commercial positions have significant predictive power regarding asset prices. And at least over the sample of currencies and the period considered, there would appear to be little statistical evidence to corroborate the market anecdote that extreme speculative positions systematically precede inverse moves in the major exchange rates. This could be because the publication of these aggregate data does not provide incremental information about the underlying determinants of asset prices. Put another way, asset prices tend to move as soon as the data are released to reflect any news in these data.

References

Campa, J, Chang, P and Reider, R (1997), 'Implied exchange rate distributions: evidence from OTC options markets', *NBER Working Paper no. 6179*.

Dominguez, K and Panthaki, F (2005), 'What defines 'news' in foreign exchange markets?', *NBER Working Paper no. 11769*.

Evans, M and Lyons, R (2001), 'Why order flow explains exchange rates', *mimeo*, Haas School of Business, UC Berkeley.

Evans, M and Lyons, R (2002), 'Order flow and exchange rate dynamics', *Journal of Political Economy*, February, pages 170–80.

Fan, M and Lyons, R (2003), 'Customer trades and extreme events in foreign exchange', published in *Monetary history, exchange rates and financial markets: essays in honour of Charles Goodhart*, Paul Mizen (ed), Edward Elgar: Northampton, MA, USA, pages 160–79.

Klitgaard, T (2004), 'Exchange rate changes and net positions of speculators in the futures market', *Federal Reserve Bank of New York Economic Policy Review*, May.

Lyons, R (2001), 'Foreign exchange: macro puzzles, micro tools', *Economic Review 2002*, Federal Reserve Bank of San Francisco, pages 51–69.

Sanders, D, Boris, K and Manfredo, M (2004), 'Hedgers, funds, and small speculators in the energy futures markets: an analysis of the CFTC's Commitments of Traders reports', *Energy Economics*, Vol. 26, Issue 3, pages 425–45.