# THE PROFITABILITY OF SPECULATORS IN CURRENCY FUTURES MARKETS

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Research Discussion Paper
2004-07

September 2004

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The authors are grateful to Barry Goss, Marianna Grimaldi, Luci Ellis and Anthony Richards for helpful comments. Responsibility for any errors rests with the authors. The views expressed in this paper are those of the authors and should not be attributed to the Reserve Bank.

# Abstract

Using weekly data on the positions of different types of participants in currency futures markets we present evidence that suggests speculators are profitable. Across six currencies, speculators' gross profits are seemingly positive in 60 per cent of weeks. The profits are significant even after accounting for transactions costs. Our estimated speculator profits are consistent both with speculators being paid a risk premium and with speculators having superior forecasting ability.

JEL Classification Numbers: F31
Keywords: exchange rates, futures markets, speculators

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## 1. Introduction

"Amoral maybe, but currency speculators are both necessary and productive"

*The Economist* September 25 1997

Speculators have long been a controversial group in currency markets. Friedman (1953) famously suggested that speculators would be a stabilising force in currency markets, while Nurske (1944) argued the opposite. The disaggregated nature of foreign exchange spot markets and the consequent lack of representative data have impeded research on the role of speculators. However, futures trading does occur on organised markets so authorities are able to collect data on the positions of different types of agents. We use these data on the positions of speculators to estimate the profitability of these controversial traders.

The profitability of speculators in exchange rate futures might also provide some insight into the broader operation of currency markets. Interest differentials are highly persistent and so changes in currency futures prices are almost entirely driven by volatile spot exchange rates. By definition, speculators in currency futures markets trade only to make profits and not for fundamental purposes such as to hedge foreign exchange risk. Since they have no other reason to trade futures, we would expect that if any group of agents is to be profitable in currency markets, it should be speculators. If speculators are indeed profitable, then they must have some working 'model' of exchange rates that allows them to predict movements, however imperfectly. Ever since the work of Meese and Rogoff (1983) the conventional wisdom has been that changes in exchange rates, and so currency futures, are essentially impossible to explain. But, more recent work focusing on the microstructure of currency markets has suggested that exchange rate movements can be partially explained by the types of variables that market participants follow, such as order flow (for a summary see Lyons 1992).

The profitability of speculators may then give some insight into whether a group of specialist traders is able to predict changes in currency futures prices, and so exchange rates. To pre-empt our results, we find evidence that suggests speculators are profitable.

Over the years several papers have examined the profitability of speculators in futures markets. In an early contribution to the literature Houthakker (1957) examined profitability in corn, wheat and cotton markets using monthly positions data. Yoo and Maddala (1991) did likewise using several commodities and currencies. Both papers found that speculators tend to be profitable. Using a four-year sample of confidential daily data for several commodity and interest rate futures, Hartzmark (1987) found that hedgers make large and significant profits, while speculators made small and insignificant profits. This result, however, likely depended on a questionable assumption about the prices at which positions are opened and closed. Two recent papers have used the same data on speculators' currency futures positions that we use. Klitgaard and Weir (2004) provide a good overview of the general properties of the positions of speculators and hedgers in currency futures markets, but do not consider profitability. Wang (2004) suggests that currency speculators are profitable, but does not attempt to estimate profits.

In this paper, we make use of a long 10-year sample of weekly positions in currency futures markets and prices for individual futures contracts to calculate estimates of profitability. Using daily turnover volume and prices we are able to construct weighted average prices to proxy for intra-week trading prices. The data we use are described in Section 2 with the estimates of speculator profitability in Section 3.

We then examine two classes of explanations for speculators' profits in currency futures markets in Section 4. Hedgers, who have fundamental currency risk they want to offload, might pay speculators a premium in the form of a positive expected excess return for taking on their currency risk. There is some evidence this is the case. However, it is not possible to completely attribute profits to risk premia. An alternative explanation is that speculator profits derive from superior forecasting abilities. We consider one commonly used forecasting technique, the use of technical trading rules, or charting techniques. There is a large literature that documents the ability of these rules to generate hypothetical profits (for example Taylor 1992). A significant criticism of these findings is that they may be the result of data mining because the particular form of the trading rules can be selected *ex post*. The profitability of speculators and fact that their positions are broadly consistent with trading rules provides independent evidence for the success of trading rules.

## 2. Description of the Data

Our analysis uses seven major currencies for which futures contracts have traded on the Chicago Mercantile Exchange (CME): the Australian dollar (AUD), British pound (GBP), Canadian dollar (CAD), the euro (EUR), the German mark (DEM), Swiss franc (CHF) and Japanese yen (JPY). Our futures prices and open interest by contract are from the Institute for Financial Markets which collects the data from the CME. Since the prices of the futures contracts we use are quoted in US dollars, we will refer to the other currencies collectively as the 'foreign' currencies.

For each currency there is a contract that expires every third month; in March, June, September and December. Contracts typically start trading around 12 months before expiration, though they don't become highly liquid until just before the previous contract expires and so are highly liquid for just over 3 months. Over 90 per cent of open interest is typically in the next to expire contract. The weekly returns on various expiration date contracts for a given currency move almost identically (the correlations are over 0.99). This is because most movement in currency futures prices come from changes in the spot exchange rate which is the base for all futures prices.

Data on the positions held by speculators and hedgers in currency futures contracts are obtained from the Commodity Futures Trading Commission (CFTC). These data are published at a weekly frequency from 1993. The data are measured at close of business Tuesday, and so references in this paper to a week will refer to the week ending Tuesday. The CFTC aggregates individual trader positions into long and short positions of speculators (non-commercial traders) and hedgers (commercial traders). For each currency, the positions of each trader type are aggregated over contracts with different expiration dates. For example, the CFTC reports the total of the long positions held by speculators in the various Australian dollar futures contracts trading at the end of each week.

The CFTC data only report the total positions of *large* speculators and hedgers. These large traders account for about 70 per cent of the total value of positions in the currency markets considered here.[1] Speculators account for about 20 per cent of the total value of positions and hedgers account for approximately half.

Speculators are traders who do not have a foreign exchange exposure they want to hedge and so their only reason for trading is to make profits. Their demand for a currency future should therefore depend on their expectation of the price change, and perception of the risk in holding the futures contract.[2] Hedgers are traders who have fundamental exposure to the exchange rate in the form of future payments or receipts of that foreign currency, for example future revenue from exports or investment income.[3] Hedgers' demand for a currency future would then be a function of their foreign currency flows as well as their expectations and perceptions of the risk. The net position in the currency future of these groups is defined as:

$$net_{j,t} = long_{j,t} - short_{j,t} \tag{1}$$

where $j$ is either speculators (S) or hedgers (H), $t$ is time, and *long* and *short* are the number of long contracts and short contracts held in the foreign currency by trader type $j$.

These data do not allow us to examine the heterogeneity of positions within the two groups, speculators and hedgers. However the heterogeneity across these groups is far greater than within. When speculators have a particular net position, either long or short, on average 80 per cent of their total contracts are in this direction, while just 30 per cent of hedgers' contracts are in this direction. The relative behaviour of the two classes of investors is therefore of interest because they clearly have different incentives to trade.

Every futures contract has both a buyer (who is long) and a seller (who is short), so the net positions of all traders must sum to zero. The CFTC uses this condition and the reported information on speculator and hedger positions to back out the positions of small traders. We find that the net position of small traders is very

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1 'Large' currently means traders who hold more than 400 contracts in one currency and expiration date. The contract sizes in Table 1 show that these thresholds are 40 million AUD, 25 million GBP, etc.

2 Speculators' demand might also depend on correlations of futures prices with other asset prices.

3 There is a large literature on why firms hedge, for example see Johnson (1960) and Pennings and Leuthold (2000).

highly correlated with that of speculators.[4] In this paper we focus on speculators as this is the most homogenous of the trader groups; it is particularly unclear what the trading motives are for small traders. The results for hedger positions are qualitatively similar to those for speculators but with the opposite sign.

Descriptive statistics for the net position of speculators in currency futures for each of the six currencies are reported in Table 1. The first column is the size of a futures contract in each currency. While comparisons obviously depend on exchange rates, these contracts are broadly similar in value. Over the period speculators were, on average, long in the Australian dollar and the euro and short in the other five currencies.

**Table 1: Net Speculator Positions**

| | Contract size[(a)] | Observations | Mean (number of contracts) | | |
|---|---|---|---|---|---|
| | | | $net_S$ | $\lvert net_S \rvert$ | $\lvert \Delta net_S \rvert$ |
| Australian dollar | 100 000 | 503 | 677 | 4 080 | 1 243 |
| British pound | 62 500 | 529 | −233 | 9 601 | 4 146 |
| Canadian dollar | 100 000 | 529 | −1 729 | 11 111 | 3 758 |
| euro | 125 000 | 216 | 7 956 | 13 372 | 3 883 |
| German mark | 125 000 | 371 | −6 017 | 16 626 | 7 495 |
| Japanese yen | 12.5 m | 529 | −11 700 | 19 914 | 5 653 |
| Swiss franc | 125 000 | 529 | −4 288 | 13 468 | 4 024 |

Notes: (a) Units of foreign currency
Sample 05/01/1993 to 18/2/2003 (weekly) for all currencies except the mark (26/01/1993 to 07/03/2000) and the euro (05/01/1999 to 18/02/2003).
Some observations are missing within the AUD sample where there were not enough large traders.

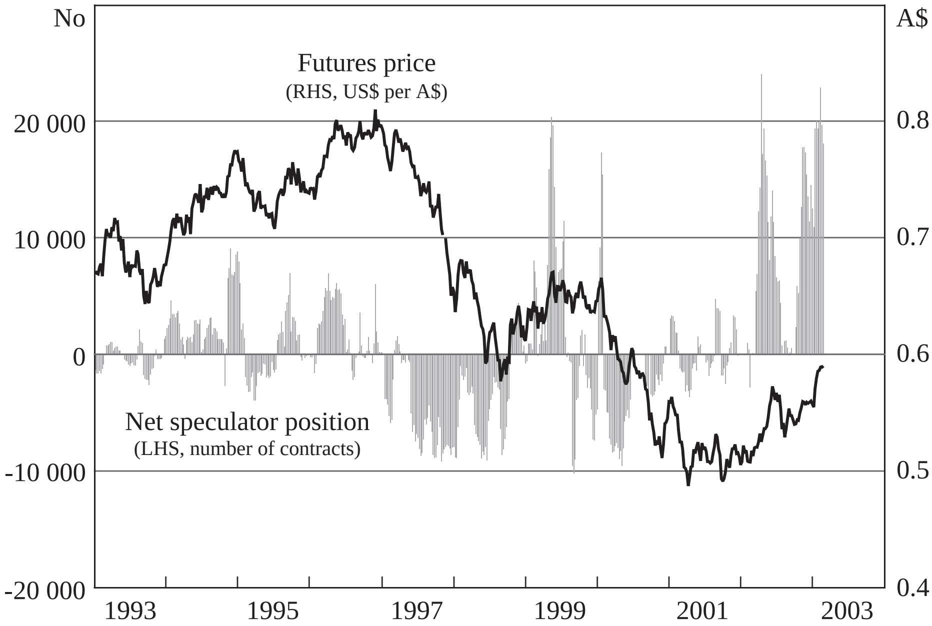
Figures 1 to 4 show the weekly speculator net position and futures price data for the six currencies (with the mark and euro combined). These figures show that speculators' positions demonstrate some persistence with clear bunching of positions of similar magnitude. However, as shown in the Appendix, standard time-series tests strongly suggest that they are stationary. The observed persistence does not preclude large, rapid changes in positions. Table 1 shows that the absolute changes in net positions are large, at least relative to the mean absolute position.

4 The correlation of the net position of speculators and small traders for the Australian dollar is 0.88, for the Canadian dollar 0.60, for the pound 0.82, for the yen 0.77 and for the franc 0.82. The total net positions of small traders are also of a similar magnitude to those of speculators.

Like exchange rates, futures prices are volatile, with average weekly returns of around 1 per cent. The stationarity tests reported in the Appendix demonstrate that the common finding that exchange rates are non-stationary carries over to currency futures prices. We therefore use the first difference of the logged futures price (multiplied by 100) in our analysis.

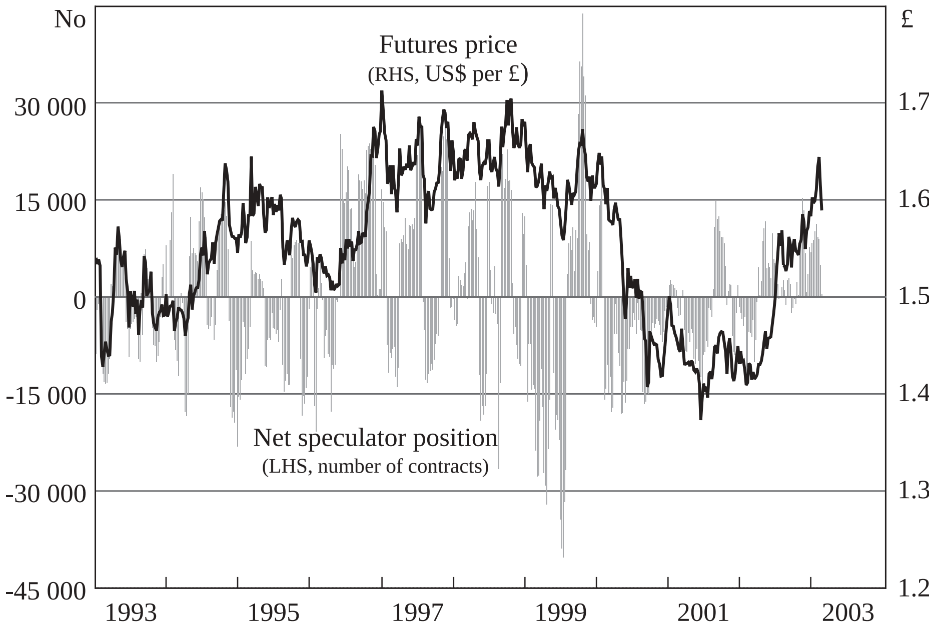
For all currencies, Figures 1 to 4 suggest that speculators, as a group, appear to have a long foreign currency futures position when the futures price is rising and be short when the price is falling. This suggests that these positions were profitable. For example, Figure 1 shows that speculators were short during the depreciation of the Australian dollar in 1997. Speculators also appear to increase their net long position when the futures price is rising, and conversely decrease these positions when the futures price is falling. This is confirmed by correlations of the change in net speculator position and the change in the futures price for different currencies of between 0.45 and 0.62, which are all significant at the 1 per cent level. We now move on to attempt to quantify these profits.

## Figure 1: Australian dollar



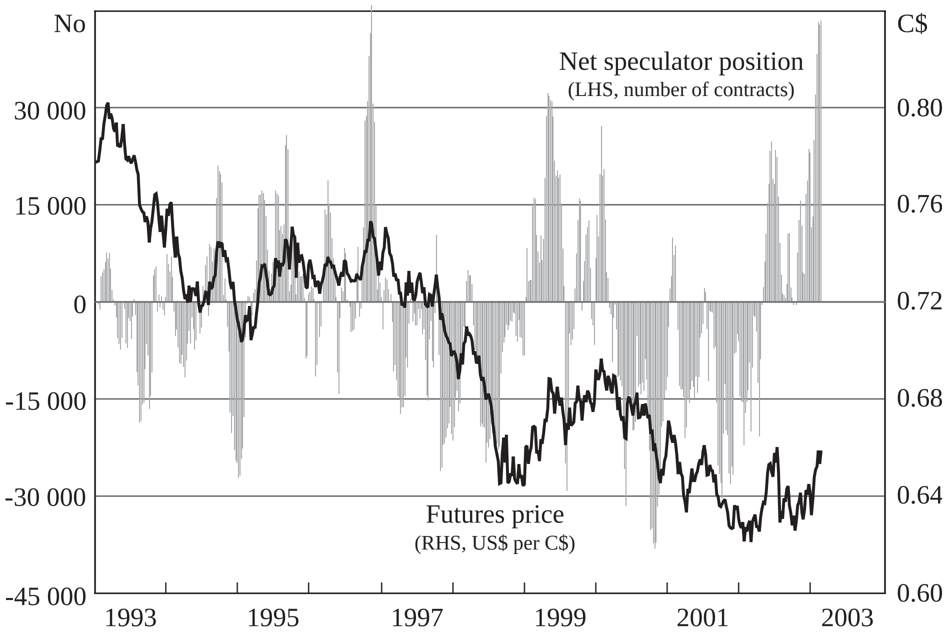

Note: Futures price is for next to expire contract

## Figure 2: British pound



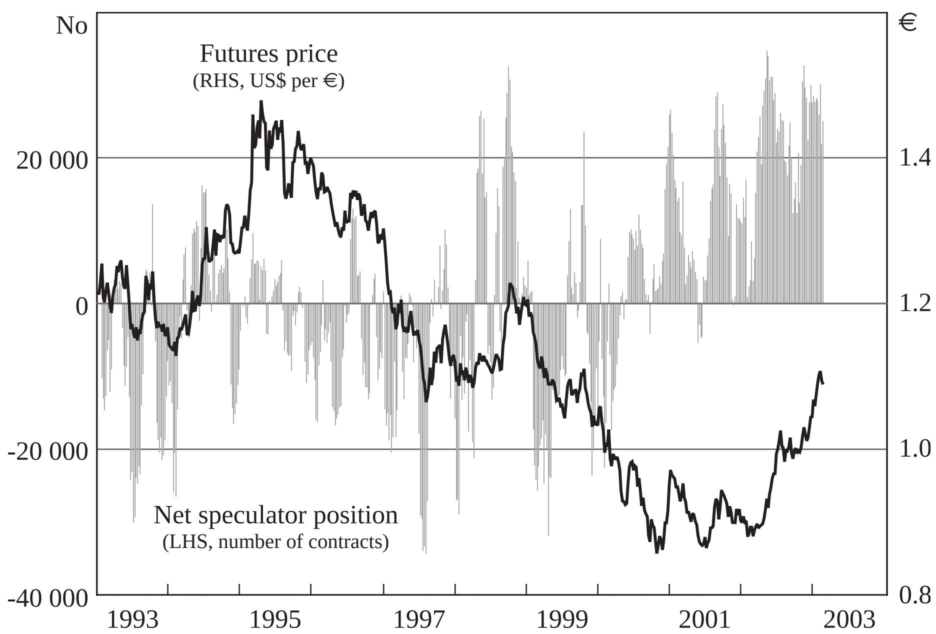

Note: Futures price is for next to expire contract

## Figure 3: Canadian dollar



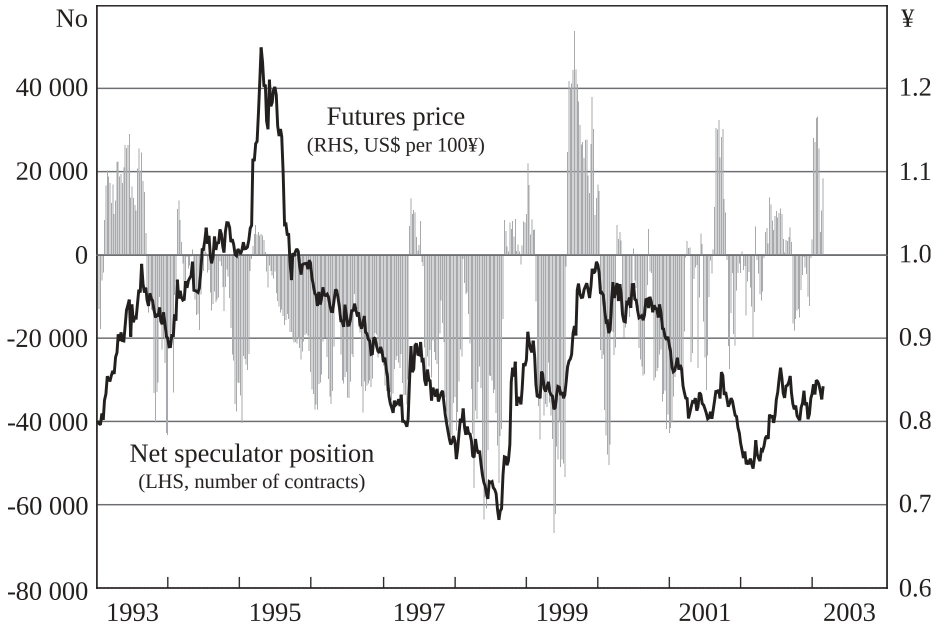

Note: Futures price is for next to expire contract

## Figure 4: Euro/German mark



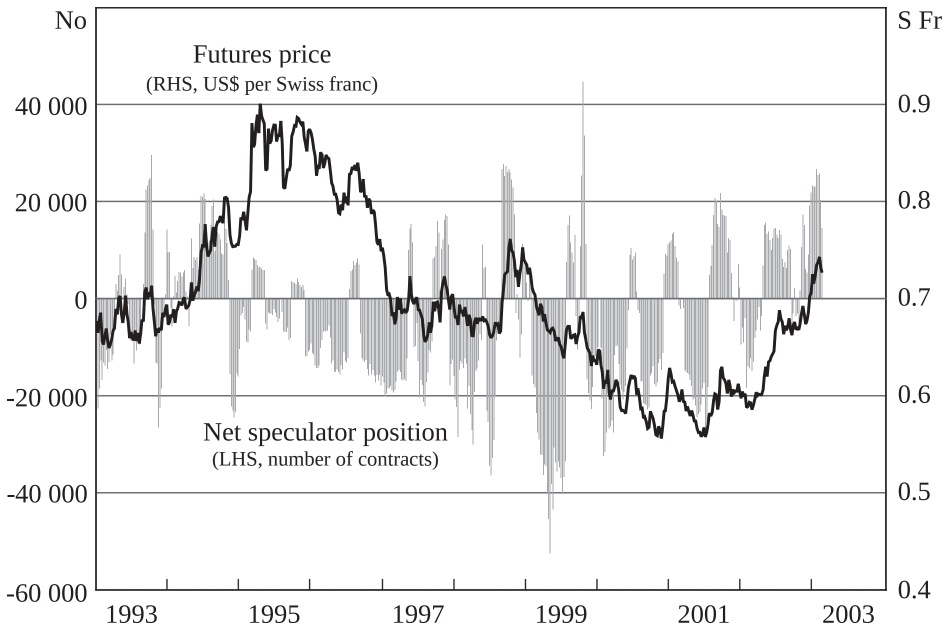

Note: Futures price is for next to expire contract, prior to 1999 the series relate to the mark, and thereafter the euro

## Figure 5: Japanese yen




Note: Futures price is for next to expire contract

## Figure 6: Swiss franc




Note: Futures price is for next to expire contract

# 3. Profitability

## 3.1 Calculation Method

We estimate profits each week for each trader group, speculators and hedgers, in each currency. Since speculators and hedgers trade through the week, the number of futures contracts held at the beginning of the week will almost certainly not equal the number held at the end of the week. It is therefore necessary to include in the profit calculations the proceeds from selling contracts or the cost of purchasing new contracts. We calculate profits for each currency. Profits are estimated as the change in the value of the group's futures portfolio plus (or minus) the amount of money that the group withdraws from (or injects into) their holdings of that futures contract. That is, weekly profits equals the value of the contracts held by that group at the end of the week, less the value of the contracts they held at the start of the week, plus (less) the value of the contracts sold (bought):

$$\Pi_{j,t} = \sum_i \left( net_{j,i,t+5} P_{i,t+5} - net_{j,i,t} P_{i,t} - \Delta net_{j,i,t} P_{i,[t,t+5]} \right) \cdot size \qquad (2)$$

where $j$ is the type of trader (speculator, S, or hedger, H), $t$ is time and is counted in business days, $i$ indexes the contracts for that currency with different expiration dates trading at time $t$, $net_{j,i,t}$ is the net position in number of contracts of trader type $j$ in contract $i$ and $\Delta net_{j,i,t}$ is the change in this, $P_{i,t}$ is the price for futures contract $i$ at time $t$, quoted as US dollars per unit of foreign currency, and *size* is the size of the contract in units of the foreign currency. The first term inside the brackets in Equation (2) is the value of the futures at the end of the week, the second term is their value at the beginning of the week and the third term, $\Delta net_{j,i,t} P_{i,[t,t+5]}$, is the value of net purchases made through the week, which will be discussed in more detail below. Multiplying the bracketed term by *size* converts the number of contracts into a US dollar value. Average weekly profits in a given currency are then the average of these weekly profits over the sample period. To calculate profits using Equation (2) we need to make two assumptions.

The first assumption relates to the prices at which transactions through the week take place, $P_{i,[t,t+5]}$. Since net position is only observed at close of business each Tuesday we do not know when trades take place through the week. Our baseline assumption (Assumption I) is that the change in position occurs through the week in proportion to the turnover on each day, so that $P_{i,[t,t+5]}$ is the volume-weighted average of the daily futures prices for the five days after time $t$. Here we use the average of the open and close prices for the daily price. This seems the most reasonable assumption given the data limitations. For robustness we also report speculator profits based on the assumption that the change in speculator position occurs smoothly through the week (Assumption II). That is, $P_{i,[t,t+5]}$ is the unweighted average of the daily futures prices for the five days after time $t$.

A second assumption is necessary because the net position data for each currency are aggregated over contracts with different expiration dates and so prices. We assume that the positions of the two trader groups in each expiration date is proportional to the open interest in that expiration date. That is, the proportion of net position in the contract with expiration date $i$ equals the open interest for contract $i$ ($OI_{i,t}$) divided by the total open interest for that currency ($OI_t$):[5]

$$net_{j,i,t} = \frac{OI_{i,t}}{OI_t} net_{j,t} \tag{3}$$

where $net_{j,t}$ is the reported net position of trader type $j$ at time $t$ in all contracts for the currency in question. This method of dividing the net position between contracts seems the most sensible. In practice our results are exceptionally robust to different assumptions because most open interest is concentrated in the next to expire contract and returns on different expiration date contracts are very highly correlated.

### 3.2 Estimates of Profits

First we consider gross profits, then in Section 3.3 we calculate estimates of net profits accounting for estimates of transaction costs. Table 2 suggests that speculators make large gross profits from their futures trades. From 1993 to 2003 using our baseline trading price assumption, Assumption I, speculators made positive returns for all currencies while hedgers made losses. The most profitable currency was the yen in which speculators made over US$5 million per week, while the mark and euro were not far behind. We can calculate p-values for the

5 Data for the open interest and price by contract for four years for the Australian dollar and one and a half years for the euro are not available. Instead we use the price of the the next to expire contract from Bloomberg and assume traders' entire position is in this contract.

weekly average gross profits using the distribution of weekly gross profits. These p-values reported in parentheses indicate that average speculator gross profits are significantly positive for six of the seven currencies. Speculator gross profits aggregated over all currencies are a substantial US$13 million per week, and are also significantly greater than zero. Speculator profitability is very similar under Assumption II. As an additional robustness check we also calculated profits using other assumptions for intra-week transaction prices, such as speculators trading on only a selection of days through the week. Even under extreme assumptions, for example that speculators sell (buy) at the average of the three lowest (highest) daily prices through the week and buy (sell) at the average of the three highest (lowest) daily prices, speculators are still profitable. Understandably the precise level of gross profits is sensitive to the price assumption, but the result that gross profits are significantly positive is robust.[6]

Not surprisingly, speculators' gross profits are highly variable, with the median proportion of profitable weeks across currencies just 0.53, as shown in Table 3. However, when we combine the currencies to get weekly data for all speculators, thereby lessening the influence of currency-specific idiosyncratic factors, total gross profits are positive in an impressive 60 per cent of weeks.

### 3.3 Transaction Costs

The profits we have calculated so far are gross returns and do not account for the costs of trading. While trading costs in futures markets are relatively small, given there is high turnover in these markets it is important to account for these costs in assessing speculator profitability.[7] We calculate transactions costs based on the total volume of contracts traded over the week, not just the change in speculators' net position. Since transactions costs have changed over the course of our sample and individual traders may face different transactions costs, we consider two alternative assumptions.

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6 Results using other pricing assumptions are available on request.

7 Large speculators could themselves be members of the exchange and hence receive transactions costs or pay much lower transactions costs than other market participants. We ignore these considerations.

**Table 2: Average weekly gross profits by trader type**
US$ millions

| | Speculators | | Hedgers |
|---|---|---|---|
| | Assumption I | Assumption II | Assumption I |
| Australian dollar | 0.45 | 0.36 | −0.72 |
| | **(0.03)** | **(0.08)** | **(0.05)** |
| British pound | 0.05 | 0.20 | −0.58 |
| | (0.92) | (0.70) | (0.49) |
| Canadian dollar | 0.62 | 0.62 | −0.63 |
| | **(0.05)** | **(0.05)** | (0.20) |
| euro | 4.97 | 4.20 | −7.71 |
| (1999–2003) | **(0.00)** | **(0.01)** | **(0.04)** |
| German mark | 3.63 | 3.81 | −5.71 |
| (1993–1999) | **(0.00)** | **(0.00)** | **(0.00)** |
| Japanese yen | 5.42 | 5.51 | −8.62 |
| | **(0.00)** | **(0.00)** | **(0.00)** |
| Swiss franc | 1.85 | 1.85 | −3.52 |
| | **(0.03)** | **(0.03)** | **(0.00)** |
| **Total** | 12.72 | 12.66 | −20.84 |
| | **(0.00)** | **(0.00)** | **(0.00)** |

Notes: The profits of non-reporters is the residual so that total profit sums to zero.
The p-values in parentheses are for the hypothesis that average profit is zero. Rejections of the null, i.e. findings that net profits are different from zero, are shown in bold.
Assumption I is that the change in position occurs through the week in proportion to daily volume.
Assumption II is that the change in position occurs smoothly through the week.

**Table 3: Speculator profit statistics**
US$ millions

| | **Weekly average** | **Standard deviation** | **Observations** | **Proportion > 0** |
|---|---|---|---|---|
| Australian dollar | 0.45 | 4.64 | 492 | 0.52 |
| British pound | 0.05 | 12.17 | 528 | 0.50 |
| Canadian dollar | 0.62 | 7.18 | 528 | 0.52 |
| euro | 4.97 | 25.26 | 215 | 0.57 |
| German mark | 3.63 | 23.43 | 340 | 0.57 |
| Japanese yen | 5.42 | 38.17 | 528 | 0.59 |
| Swiss franc | 1.85 | 19.20 | 528 | 0.53 |
| **Total** | 12.72 | 63.68 | 528 | 0.60 |

We take a base assumption of 0.03 per cent of the trade value following Aliber, Chowdhry and Yan (2002) (Assumption Ia).[8] As a robustness check, we use a fixed transaction cost of US$60 per contract traded, which is likely to be an upper bound on transaction costs for our large traders (Assumption Ib).[9]

Table 4 shows the average weekly transactions costs *for all market participants* based on daily turnover for our two assumptions. We don't know what proportion of total volume is accounted for by speculators' trades but we do know their share of open interest each week (the average is shown in column 3 of Table 4). If we assume speculators have a weekly trading volume in proportion to their share of open positions in that week then speculators are profitable in six of the currencies, significantly so for five of these under our baseline transaction cost assumption (column 4 of Table 4). If we use the high fixed-cost transaction cost assumption, Assumption Ib, six currencies are still profitable but only two of these are significantly so. However, for both transaction cost assumptions the total profits are positive and highly significant.

Speculators may trade more frequently than hedgers. If we assume speculators' share of trading volume is double that of their share of open positions then total net speculator profits are still significantly greater than zero under both transaction cost assumptions. We can find a theoretical maximum volume of trade attributable to speculators by assuming that the total trading volume of hedgers and small traders is equal to the change in their reported open positions over the week. This assumes all other trading is undertaken by speculators. Even under this extreme and implausible assumption, speculators are profitable under our baseline transaction cost assumption, although not significantly so. Speculators are no longer profitable under the higher transactions cost assumption. We conclude that speculator profits are reasonably robust to transactions costs.

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8 Aliber *et al* (2002) suggest their transaction cost estimate is a lower bound as it is an estimate for larger traders. However, we are only looking at large trader positions, our sample is more recent and they found costs were falling quickly.

9 US$60 per contract equates to a bid-ask spread of around 0.0005 for most currencies. Such spreads are frequently quoted by foreign exchange dealers for small trades. An Australian dealer gave us a discretionary quote of US$15 per contract.

**Table 4: Transaction costs and speculator profits**
Weekly average, US$ millions

| | **Transactions costs** (All traders) Assumption Ia | Ib | **Speculators' average share of open interest** | **Profits after transaction costs** (Speculators) Assumption Ia | Ib |
|---|---|---|---|---|---|
| Australian dollar | 0.24 | 0.76 | 0.14 | 0.41 | 0.34 |
| | | | | **(0.08)** | (0.14) |
| British pound | 1.47 | 3.02 | 0.18 | –0.21 | –0.50 |
| | | | | (0.67) | (0.33) |
| Canadian dollar | 0.91 | 2.62 | 0.19 | 0.46 | 0.16 |
| | | | | (0.14) | (0.62) |
| euro | 2.55 | 4.25 | 0.18 | 4.51 | 4.21 |
| | | | | **(0.01)** | **(0.02)** |
| German mark | 3.58 | 9.25 | 0.19 | 2.93 | 1.82 |
| | | | | **(0.03)** | (0.18) |
| Japanese yen | 3.63 | 6.48 | 0.22 | 4.65 | 4.03 |
| | | | | **(0.00)** | **(0.01)** |
| Swiss franc | 2.07 | 4.71 | 0.20 | 1.43 | 0.91 |
| | | | | **(0.07)** | (0.25) |
| **Total** | 11.30 | 24.66 | 0.20 | 10.44 | 7.80 |
| | | | | **(0.00)** | **(0.00)** |

Notes: Assumption Ia uses 0.03 per cent from Aliber *et al* (2002).
Assumption Ib uses a cost of US$60 for each contract traded.
Speculators' average share of open interest is the average of speculators' long plus short positions, divided by twice open interest, for each week.
The p-values in parentheses are for the hypothesis that the average profit is zero. Rejections of the null, i.e. findings that net profits are different from zero, are shown in bold.

## 4. Explaining Speculator Profitability

In this Section we examine the two classes of explanations for speculator profitability discussed in Section 1 – a premium for bearing risk, and the use of technical trading rules. It is important to note that the data we use in this study are the market price of futures and the quantity held by speculators and hedgers. Without further assumptions we cannot back out from these data the underlying demand relationships for each of the trader groups. Given this, our explanation of speculator profitability is one of reduced form, not structural, relationships.

### 4.1 A Premium for Bearing Risk

In an asset-pricing model such as the CAPM individual assets pay a risk premium if their returns are correlated with the return on the market portfolio. Stein (1986) and others have argued that asset-pricing models such as CAPM don't apply to futures because they are in zero net supply – for each long position there is a short position – and so they are not in the market portfolio. In any case, as Table 5 shows, gross speculator returns from futures positions are essentially uncorrelated with US stock and bond index returns. That is, the returns to speculators do not appear to be 'risky' in the sense of having a positive correlation with standard risk factors.

**Table 5**: **Correlation of Gross Speculator Returns with Other Market Returns**

| | S&P 500 Composite index | US bond return index |
|---|---|---|
| Australian dollar | 0.07 | 0.08 |
| | (0.21) | (0.32) |
| British pound | 0.00 | 0.04 |
| | (0.99) | (0.56) |
| Canadian dollar | 0.03 | –0.04 |
| | (0.44) | **(0.03)** |
| German mark/euro | –0.07 | 0.05 |
| | (0.20) | (0.26) |
| Japanese yen | –0.02 | –0.02 |
| | (0.42) | (0.59) |
| Swiss franc | –0.01 | –0.01 |
| | (0.42) | (0.52) |

Notes: The US bond index is for bonds of all maturities, rated A or above.
Newey-west corrected p-values in brackets.
Rejections of the null that a coefficient is insignificantly different from zero are shown in bold.

Even though currency futures are not risky, in that they are uncorrelated with other assets, they still have idiosyncratic risk. This matters as currency futures may be a large part of a trader's portfolio. Hedgers, as a group, may be looking to offload the idiosyncratic risk of their fundamental exchange rate exposure. So one justification for speculators' profitability is that hedgers will pay a premium to induce speculators to take on these risks. Any premium received by speculators will come in the form of a positive expected return on their positions. This intuition has long been applied to physical commodity markets as an argument for futures prices to be backwardated, that is, hedgers generally take short positions so prices rise as they near expiration to compensate speculators for taking offsetting long positions. For a summary of this argument in physical commodity markets see Kolb (1992).

We explore the risk premium as an explanation of speculator profits through the predictability of returns. If returns could easily be predicted by the market then the transfer of predicted returns between traders can be seen as a risk premium. However, the predictability of returns is not conclusive evidence of a risk premium. It could be that traders use different models to generate their expectations of futures price movements and one group, speculators, is more successful. We consider such an explanation in Section 4.2. For now, we examine whether speculators' positions move in line with our particular model-based predicted returns. We then test whether speculators make profits after adjusting for predicted returns.

#### *4.1.1 Calculating predicted returns*

Bessembinder and Chan (1992) showed that returns on currency, agricultural and metal futures could be partly explained by several risk factors. We follow Bessembinder and Chan in using US dividend yields, interest rates and corporate spreads to generate a series of predicted returns. We estimate the coefficients in Equation (4) using information available at time $t$ and then use these coefficient estimates and the risk factors at time $t$ to generate out-of-sample predicted changes in futures prices looking forward from time $t$:

$$P_{t+\tau} - P_t = \alpha_0 + \alpha_1(i_{t,AAA} - i_{t,BAA}) + \alpha_2 DY_{t,US} + \alpha_3 i_{t,US} \tag{4}$$

where $i_{t,AAA}$ and $i_{t,BAA}$ are the Moody's AAA and BAA corporate bond rates, $DY_{t,US}$ is the US dividend yield, $i_{t,US}$ is the US euro interest rate and $P_t$ is the price of the next to expire futures contract. We use three-year rolling regressions to account for possible changes in the way our risk factors affect predicted returns.[10]

From Equation (2) traders need to predict both the end of the week price ($P_{i,t+5}$) and the intermediate price ($P_{i,[t,t+5]}$) to find their expected profits of a particular

[10] The regressions are run using OLS, but the results do not differ if instead we use SUR to account for possible correlation of residuals across currency equations.

trading strategy. We therefore run regressions of Equation (4) for $P_{t+\tau}$ equal to both $P_{t+5}$ and $P_{[t,t+5]}$. Note, we run these regressions only for the first to expire contract and then assume that the returns will be the same for all other trading contracts.[11]

Weekly predicted price changes are small (about 0.3 per cent) relative to actual changes in futures prices (typically around 1 per cent) and are also much more persistent. There is only a weak relationship between predicted and actual price changes, as shown by the small and insignificant correlation coefficients in the first column of Table 6. This is not surprising given the volatility of futures returns and the general inability to predict exchange rate changes out of sample, and accords with earlier work.

Despite the low forecasting power of our model, there is a significant positive relationship between net speculator position and weekly predicted price changes (second column of Table 6). When our model predicts a price increase speculators take longer positions. This is suggestive of speculator profits being a risk premium – hedgers transfer expected returns to speculators as compensation for transferring currency risk.

Next we consider what proportion of speculators' profits is compensation for the transfer of risk. In order to calculate predicted returns we need not only predicted prices but also the positions held by the traders. In the absence of intra-week positions data, we assume that speculators commit to a trading strategy at the beginning of the week when they calculate the expected returns. This allows us to use realised position data to calculate expected profitability. The third and fourth columns of Table 6 divide speculator profits into the part that is predictable, using our model, and the part that is not. The predictable part is found by combining forecast futures prices found by Equation (4) with actual speculator positions in the profit calculation from Equation (2). The unpredictable part of profits is then the difference between total profits and predicted profits. Predictable profits accounts for most of actual profits, and are significantly greater than zero for all currencies. Abnormal profits is often negative and in no cases is it significantly greater than zero. These results suggest that speculators' profits could be a transfer for bearing risk. An alternative explanation is that speculators form more accurate

[11] This assumption seems reasonable since, as noted in Section 2, the weekly returns on contracts with different expiration dates for a given currency have a correlation over 0.99.

expectations of changes in futures prices, in particular it could be that they use better forecasting techniques. One such possibility is technical trading rules, to which we know turn our attention.

**Table 6: Are Speculator Profits a Return for Bearing Risk?**

| | **Weekly predicted price changes** (Correlations and p-values) | | **Predictability of profits** (Weekly average, US$ millions) | |
|---|---|---|---|---|
| | Actual price changes | Net speculator position | Predictable profits | Abnormal profits |
| Australian dollar | 0.07 | 0.50 | 0.67 | –0.22 |
| | (0.11) | **(0.00)** | **(0.00)** | (0.29) |
| British pound | 0.01 | 0.26 | 1.05 | –1.01 |
| | (0.72) | **(0.04)** | **(0.00)** | **(0.05)** |
| Canadian dollar | –0.15 | 0.43 | 0.48 | 0.10 |
| | **(0.00)** | **(0.00)** | **(0.00)** | (0.76) |
| German mark/euro | 0.06 | 0.38 | 3.07 | 1.46 |
| | (0.17) | **(0.01)** | **(0.00)** | (0.21) |
| Japanese yen | 0.02 | 0.29 | 4.20 | 1.16 |
| | (0.58) | **(0.02)** | **(0.00)** | (0.54) |
| Swiss franc | 0.04 | 0.48 | 2.71 | –0.85 |
| | (0.36) | **(0.00)** | **(0.00)** | (0.26) |

Notes: Price changes are in per cent.
Gross profits are used.
P-values in parentheses are generated by Monte Carlo simulations.
Rejections of the null that a coefficient is insignificantly different from zero are shown in bold.

## 4.2 Trading Rules

There is an extensive literature documenting the use of trading rules by traders in exchange rate markets, notably surveys of market participants by Taylor and Allen (1992), Menkhoff (1998), Cheung and Wong (2000) and Lui and Mole (1998). Traders are also reported to place more emphasis on these rules over short horizons, such as the one-week changes we consider here. Many studies, including Taylor (1992), have also demonstrated that a wide range of trading rules can be profitable in foreign exchange markets. The finding that such rules are profitable is subject to the criticism of data mining, particularly when complicated rules are constructed *ex post*, as in Neely, Weller and Dittmar (1997). However, the long history of trading rules in the exchange rate forecasting literature, for example Goodman (1979) and Sweeney (1986), suggests trading rules may have some value. While there are many different trading rules, the common element to such rules is that they respond to past price changes, with most rules implying a position that positively correlates with past returns.[12] For many rules this dependence on past returns will be non-linear, for example switching between long and short positions based on different length moving averages crossing each other.

If speculators are using such rules we would expect their net positions to be related to past futures returns. We therefore test whether speculators' net positions, in either levels or changes, lag currency futures returns, measured as the change in the price of the next to expire contract. A finding in favour of this hypothesis would be suggestive, but not conclusive, evidence that speculators use these rules. Nor would it necessarily imply that the use of these rules explains speculators' profits. It could be instead that hedgers also use these techniques to produce equally accurate forecasts, but that they take a less profitable position because they are paying speculators a premium to bear risk, as discussed in Section 4.1.

Table 7 reports the probabilities (p-values) from Granger causality tests of futures returns leading net positions. The signs below each of the p-values show the sign of the sum of the coefficients on the three lags of the change in futures prices, the 'causing' variable. For all currencies we reject the null hypothesis that futures returns do not lead the *level* of net speculator position. For four of the currencies futures returns are also found to lead the *change* in net speculator position. With only one exception, the sign on the lagged exchange rate is positive. This indicates that speculators have a longer net position, and increase that position, if there have been positive returns to holding futures in the past.

One interpretation of this positive relationship is that speculators are positive feedback traders, increasing their net position when there have been positive returns to being long in that currency future, possibly because they are using trend-following trading rules. If this is the case, the fact that we find a linear leading relationship would imply that the aggregate degree of non-linearity in trading rules is not too large. Of course, the observed futures return and net speculator position is an equilibrium outcome involving speculators, hedgers and small traders. So the positive leading relationship of speculator net position by returns could alternatively be attributable to the rest of the market being negative

[12] Some trading rules also depend on volume indicators.

**Table 7: Test for Speculator Net Position Responding to Lagged Returns**

P-value for the null hypothesis that futures returns do not Granger-cause speculator net position

| Null hypothesis | AUD | GBP | JPY | CAD | CHF | DEM/EUR |
|---|---|---|---|---|---|---|
| $\Delta f \nRightarrow \Delta net_S$ | **0.00** | 0.16 | 0.32 | **0.00** | **0.06** | **0.05** |
| | $+$ | $+$ | $+$ | $+$ | $+$ | $-$ |
| $\Delta f \nRightarrow net_S$ | **0.00** | **0.00** | **0.07** | **0.00** | **0.00** | **0.02** |
| | $+$ | $+$ | $+$ | $+$ | $+$ | $+$ |

Notes: Sample 05/01/1993 to 18/02/2003 (weekly)
A lag length of three periods was used for all tests.
$f$ is the log futures price of the next to expire contract and $net_S$ is the net speculator position.
The signs reported are the sum of the coefficients on the three lags of the 'causing' variable.

feedback, or contrarian, traders. What we can conclude is that relative to the market as a whole, speculators are positive feedback traders. We take this as evidence that speculators most probably use trend-following trading rules.

## 5. Conclusions

Using data on the net positions of speculators in six currency futures contracts on the CME we have provided evidence that speculators appear to be profitable, even after adjusting for transaction costs. Accounting for reasonable estimates of transaction costs, speculators seemingly make total profits of around US$10 million per week.

Because of the volatility in futures prices, speculator profitability is far from consistent, with the median proportion of profitable weeks in a single currency just 0.53. But by diversifying across currencies the proportion of profitable weeks jumps to 0.60. The fact that a group of traders can seemingly make statistically significant profits at all from trading currency futures is remarkable and suggests that specialist traders do have some ability to predict changes in exchange rates and currency futures price.

We considered two explanations of why speculators could profit at the expense of other market participants. The correlation of speculators' positions with *ex ante* expected returns suggests that profits could be a premium for bearing idiosyncratic risk, that is a reward for taking a position that otherwise they would not have taken.

This is supported by the finding that most of speculators' profits appear to be predictable. An alternative interpretation of this result is that speculators use more accurate forecasting techniques. Some evidence for this is found in the correlation of speculator positions with past futures returns. Given the well-documented use of trend-following trading rules for short-run expectations formation in exchange rate markets it appears that speculators may be using such rules. Trading rules have been shown to be able to make hypothetical profits, though studies are subject to the criticism that rules are selected *ex post*. Our results present additional evidence that these rules are profitable. Unfortunately it is not possible to conclusively distinguish between these competing explanations. Speculators may be more accurate at forecasting the exchange rate. But it is also possible that the two groups are equally accurate in forecasting but hedgers knowingly trade at less favourable prices in order to induce speculators to hold the offsetting position. The evidence suggests that, in all likelihood, both explanations contribute some portion of speculator profits.

## Appendix A: Stationarity Tests

Tables A1 and A2 present stationarity tests for net speculator position and futures prices. Net speculator positions, except for the German mark, are stationary according to these tests. Due to our economic priors, and the results for the other series, for consistency we treat the German mark net speculator position as being stationary. Consequently we use both the level and difference of net speculator positions in our analysis. The stationarity tests on the currency futures prices confirm that, like exchange rates, these are I(1) variables. The results for the British pound suggest it may be fractionally integrated, though for consistency we treat all futures prices as being non-stationary, and so use the log difference of the futures price (in percentage terms) in our statistical analysis.

**Table A1: Persistence of Net Speculator Positions**

| | Unit root tests | | Autoregressive coefficient |
|---|---|---|---|
| | DFGLS | KPSS | |
| Australian dollar | −4.15*** | 0.37* | 0.95 |
| British pound | −6.53*** | 0.10 | 0.85 |
| Canadian dollar | −4.96*** | 0.13 | 0.95 |
| German mark/euro | −3.70*** | 1.32*** | 0.92 |
| Swiss franc | −4.71*** | 0.23 | 0.92 |
| Japanese yen | −5.71*** | 0.27 | 0.93 |

Notes: Sample 05/01/1993 to 18/02/2003 (weekly)
DFGLS is a detrended version of the Augmented Dickey-Fuller test. The null is that there is a unit root.
DFGLS critical values: 1% = −2.57, 5% = −1.94, 10% = −1.62.
Lags are chosen using the Schwarz information criterion.
The null of the KPSS test is that the series is stationary.
KPSS critical values: 1% = 0.74, 5% = 0.46, 10% = 0.35.
* and *** mean that the null is rejected at the 10 per cent and 1 per cent level, respectively.
The autoregressive coefficient is the AR(1) coefficient, corrected for OLS bias using the Andrews median unbiased estimator (Andrews 1993).

**Table A2: Futures Prices**

| | Descriptive statistics | | Unit root tests | | Autoregressive coefficient |
|---|---|---|---|---|---|
| | Observations | Mean return[(a)] | DFGLS | KPSS | |
| Australian dollar | 529 | 1.03 | −0.78 | 2.09*** | 1.00 |
| British pound | 529 | 0.86 | −2.03** | 0.55** | 0.98 |
| Canadian dollar | 529 | 0.58 | 0.15 | 2.67*** | 1.00 |
| German mark/euro | 529 | 1.12 | −0.97 | 2.10*** | 1.00 |
| Swiss franc | 529 | 1.22 | −1.47 | 1.47*** | 1.00 |
| Japanese yen | 529 | 1.25 | −1.36 | 1.02*** | 1.00 |

Notes: (a) return $= |\Delta log f|$ in per cent.
Returns are for being long in foreign currency.
Sample 05/01/1993 to 18/02/2003 (weekly)
See notes under Table A1 for unit root test and autoregressive information.
*,** and *** mean that the null is rejected at the 10 per cent, 5 per cent and 1 per cent level, respectively.

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