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Combining mean reversion and momentum trading strategies in foreign exchange markets

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ABSTRACT

The literature on equity markets documents the existence of mean reversion and momentum phenomena. Researchers in foreign exchange markets find that foreign exchange rates also display behaviors akin to momentum and mean reversion. This paper implements a trading strategy combining mean reversion and momentum in foreign exchange markets. The strategy was originally designed for equity markets, but it also generates abnormal returns when applied to uncovered interest parity deviations for five countries. I find that the pattern for the positions thus created in the foreign exchange markets is qualitatively similar to that found in the equity markets. Quantitatively, this strategy performs better in foreign exchange markets than in equity markets. Also, it outperforms traditional foreign exchange trading strategies, such as carry trades and moving average rules.

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1. Introduction

Foreign exchange market trading strategies have attracted much attention, especially since Fama (1984) introduced the "forward puzzle," which argues that forward exchange rates are biased predictors of spot exchange rates. This paper sets forth a new strategy in the foreign exchange (FX) markets that combines mean reversion and momentum. Even though the strategy was originally designed for equity markets, I find that it produces higher Sharpe ratios than traditional FX strategies.

The starting point of this paper, the "forward puzzle," results from the rejection of the uncovered interest parity (UIP) theory. UIP states that the change in the exchange rate should incorporate any interest rate differentials between the two currencies. A large literature exists examining if and when UIP holds.[1] This paper tries to find a pattern in the deviations from UIP and to explore the similarity between this pattern and that of stock returns. The literature reveals what looks like mean reversion and momentum in both markets. A long-run mean reverting pattern in currency values has been uncovered by Engel and Hamilton (1990); a short-term momentum effect generates profitability in FX market trading (Okunev and White, 2003).[2] Chiang and Jiang (1995) notice that foreign exchange returns show strong positive correlations in the short-run (momentum behavior) and negative correlations in the long-run (mean reverting behavior). This paper generates abnormal returns by employing a strategy that combines the long-run and short-run patterns of the deviations from UIP.

The success of the combined momentum-mean reversion strategy brings about another interesting issue: the puzzling relationship between stock and FX markets. The similarities between the stock and FX markets are perplexing because macroeconomic fundamentals explain stock returns, but not exchange rates (Meese and Rogoff, 1983). Traditional theory dictates that two markets not relying on the same fundamental variables cannot behave similarly. Yet, I find the two markets comparable. This result is in line with early studies that depict similar empirical regularities in FX and stock markets (Mussa, 1979). One possible explanation springs from Engel and West (2005), who find that exchange rates explain macroeconomic fundamentals, not the reverse. This finding, corroborated with the finding that fundamentals explain stock

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[1] For more details on UIP, see for instance Froot and Frankel (1989).

[2] Okunev and White actually use a moving average rule to create profits for the speculators on the FX market, but they name this "a simple momentum strategy." The strategy in my paper is different from theirs.

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returns, provides one possible channel for the relation between the two analyzed markets. Another fascinating explanation is that the risk factors affecting both stock and FX returns remain unknown but are somehow connected. An additional explanation is that similar behavioral biases operate in both markets, leading to similar inefficiencies.

To explore the similarities between the stock and FX markets, I first consider the non-parametric approach that Jegadeesh and Titman (1993) exploit. These papers construct portfolio deciles based on previous months' returns and choose a winner and a loser decile. By buying the winner and selling the loser a zero-investment portfolio is constructed and this portfolio is held for less than a year. The authors find that the return on their zero-investment portfolio is always positive. If this portfolio is held for more than a year, however, the return becomes zero or negative. The aforementioned non-parametric strategy is used in the FX market by identifying a winner and a loser currency based on previous deviations from UIP. I find that the winner continues to have high returns and the loser low returns for the subsequent 9–12 months, but, in the subsequent 4–5 years, the winner and loser portfolios switch positions. However, one cannot combine mean reversion and momentum strategies with this approach.

Balvers and Wu (2006) use an alternative approach to generate trading profits in the stock market: a parametric strategy. They consider the effect of momentum and mean reversion jointly and conclude that the resulting strategy can lead to significant profits when applied to the stock markets of 18 developed countries. A contrarian strategy or a momentum strategy by itself leads to lower abnormal returns than the combination strategy. I find that the parameters obtained for the FX market are quantitatively similar to those for the stock market; hence we expect similar trading strategy returns for the zero-investment portfolios. The FX market returns have lower volatility than equity market returns. Consequently, I consider the Sharpe ratios, which allow me to compare risk-to-reward profiles of the same strategy, but in the two different markets. The Sharpe ratios obtained in the FX market are significantly larger than those obtained in the stock market.

The paper is organized as follows. The second section describes the data and presents preliminary results showing that deviations from UIP exhibit momentum initially and subsequent mean reverting behavior. The third section describes the model and the fourth examines the model empirically and compares the results to the existing literature. The final section concludes.

2. Data description and preliminary statistics

2.1. Data description

The data set consists of the 1-month forward and spot exchange rates from the Bank of International Settlements and Datastream. Due to availability, the data come from two sources: for the period December 1978–December 2001 from the BIS dataset, and for January 2002–February 2008 from Datastream. I obtain monthly data for the Canadian Dollar, German Mark/Euro, UK Pound and Japanese Yen. I focus on well-developed currencies with liquid markets, in which currency speculation can be easily implemented. Due to data availability, the literature on the FX market usually only covers these currencies. I work with December 1978 through February 2008 as the time period.[3] The US Dollar serves as the home currency.

The monthly equity market returns are obtained from the Morgan Stanley Capital International (MSCI) Barra equity market price indexes for the same set of four developed countries plus the US. The sample period is December 1978 through February 2008. The risk free rate is the one-month Treasury bill rate (from Ibbotson Associates), obtained from Kenneth French's website.

2.2. Interest parity conditions

UIP states that the currencies at a forward premium should appreciate. The "forward puzzle" suggests that the exact opposite happens: these currencies actually tend to depreciate. An investor who borrows money in their home country (with an interest rate of r_t) and lends it in another country with a higher interest rate (r_t^i) should expect a zero return due to the changes in exchange rate (denoted at time t by S_t^i, in units of home country currency per foreign country currency) . In other words:

$$1 + r_t = (1 + r_t^i)\frac{E(S_{t+1}^i)}{S_t^i}, \tag{1}$$

With this strategy, investors leave their position uncovered from t to $t+1$ and only make arrangements to change the foreign currency into domestic currency at time $t+1$. The UIP states that the markets equilibrate the return on the domestic currency asset with the expected yield of the uncovered position in the foreign currency. If the investors leave nothing to chance and make arrangements to convert foreign to domestic at $t+1$ by using a forward exchange rate F_t, absence of riskless arbitrage profits implies that:

$$1 + r_t = (1 + r_t^i)\frac{F_t^i}{S_t^i}, \tag{2}$$

Eq. (2) is known as Covered Interest Parity (CIP). Taking logs of (1) and (2) and ignoring expectations, we obtain:

$$r_t - r_t^i = s_{t+1}^i - s_t^i, \quad \text{with } s_t^i \equiv \ln S_t^i, \tag{3}$$

$$r_t - r_t^i = f_t^i - s_t^i, \quad \text{with } f_t^i \equiv \ln F_t^i, \tag{4}$$

If both conditions hold, it follows that:

$$s_{t+1}^i - s_t^i = f_t^i - s_t^i, \tag{5}$$

Eq. (5) accounts for the interest rate differential implied by the CIP condition.[4]

This paper is concerned with the deviations from UIP, denoted by y_t^i and defined as follows:

$$y_{t+1}^i = (s_{t+1}^i - s_t^i) - (f_t^i - s_t^i) = s_{t+1}^i - f_t^i. \tag{6}$$

Table 1 presents summary descriptive statistics of the returns for UIP positions in the four currencies and for various similar positions in the stock market: annualized mean returns, standard deviations and Sharpe ratios. Given the low mean returns in the FX market (relative to the stock market), leverage is widely used in practice to provide the desired mean returns. The Sharpe ratios provide the proper comparison between the FX and equity markets since they remain invariant to the degree of leverage.

Panel A displays summary statistics for UIP positions in the FX market, Panel B describes stock market excess returns computed from the MSCI Barra price indexes, and Panel C shows descriptive statistics for a strategy of buying US index and short selling a foreign index, the stock market counterpart of the UIP positions in the FX market. The mean returns for the UIP positions in Panel A range

[3] Most of the literature only considers data on the FX market starting in the 1970's, after the collapse of the Bretton Woods System. Due to data availability, the sample in this paper starts in December 1978. The choice of currencies was limited to avoid multicollinearity problems in the parameters' estimation (i.e., this paper considers currencies that are not highly correlated with each other).

[4] The CIP is the condition used by large banks for determining the exchange rates and interest rates at which trading is actually conducted. See for instance Taylor (1987) and Baba and Packer (2009).

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