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Regime switches in exchange rate volatility and uncovered interest parity

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A B S T R A C T

We use a regime-switching model to examine how exchange rate volatility is related to the failure of uncovered interest parity. Main findings are as follows. First, exchange rate returns are strongly influenced by regime switches in the relationship between the returns and interest rate differentials. Second, low-yielding currencies appreciate less frequently, but once it occurs, their movements are faster than when they depreciate. Third, depreciation of low-yielding currencies and low volatility are mutually dependent on each other. Finally, these three findings are more evident for shorter horizons. The second and third results are consistent with a market participants' view: short-term carry trades in a low-volatility environment and their rapid unwinding substantially influence exchange rates. We consider the effects of funding liquidity to explain these results.

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1. Introduction

Low-interest-rate currencies tend to depreciate relative to high-interest-rate currencies. This observation is inconsistent with one of the most popular theories, uncovered interest parity (UIP), but has been confirmed for many currencies and periods in the extensive literature on the subject. Even though more than 25 years have passed since Fama (1984) called this inconsistency the "forward

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discount puzzle", the failure of UIP is still one of the most prominent puzzles in economics. In fact, there is no consensus on how to explain the puzzle yet, and researchers still continue to tackle the problem.[1]

In contrast, many market participants including monetary authorities have reached a consensus that depreciation of low-interest-rate currencies has been influenced by carry trade activities in a low-volatility environment.[2] This view is well described in the speech of de Rato (2007), then Managing Director of the IMF. He said that the carry trades at that time reflected the environment of low volatility and wide interest rate differentials, and exerted downward pressure on one of the lowest-interest-rate currencies, the Japanese yen. This pressure, in fact, resulted in the gradual depreciation of the yen until the middle of 2007. He also warned that unwinding of carry trades could lead to rapid reversal movements of exchange rates, mentioning the episode that a disruptive reduction in carry trade positions forced the yen into sharp appreciation in October 1998.[3] His warning, in fact, materialized. After the middle of 2007, the yen sharply appreciated several times while volatility increased and carry trades were unwound. In particular, after the bankruptcy of Lehman Brothers in September 2008, the yen appreciated by more than 15 percent against the U.S. dollar in three months. As illustrated in the episode of the yen, low-interest-rate currencies have experienced gradual depreciation and sharp appreciation. This behavior of exchange rates is described among currency traders that "exchange rates go up by the stairs and down by the elevator".

Brunnermeier and Pedersen (2009) construct a theoretical model in which volatility and financial positions influence each other, although this model does not focus on the foreign exchange markets. In this model, speculators borrow from financiers, who accept speculators' positions as collateral but require margins to control the risk of losses on the collateral. The margins must be financed with the speculators' own capital. So, when financiers set higher margins, speculators are more likely to hit funding constrains and be forced to reduce their positions. Such forced reductions in speculator positions increase volatility and thus the risk of losses on the collateral, which forces financiers to set even higher margins. Brunnermeier and Pedersen (2009) call the mutually dependent relationship between volatility and speculators' positions through margins "the margin spiral". In their model, the market switches between two equilibriums: one is the low liquidity equilibrium with high volatility and reduced positions, while the other is the high liquidity equilibrium with low volatility and increased positions.

Only recently, a few papers including Brunnermeier et al. (2009) empirically study the relationship between exchange rate returns and market volatility. They find that low-interest-rate currencies are more likely to sharply appreciate when VIX, a stock market volatility measure, is higher. Brunnermeier et al. (2009) also argue that sharp appreciation of low-interest-rate currencies may be the underlying cause of the failure of UIP. That is, speculators may require risk premiums for taking short positions in low-interest-rate currencies, with which speculators would face losses when the low-interest-rate currencies sharply appreciated. If so, the premiums move depending on the interest rate differentials. The time-varying premiums may be a source of the failure of UIP, in which the premiums are assumed to be time-invariant.

We study what role exchange rate volatility, rather than stock market volatility, plays in the failure of UIP. To this end, we apply a regime-switching model to exchange rate data. The idea of using regime-switching models for examining exchange rates is not new. After Hamilton (1989) proposed the regime-switching model to examine the persistency of recessions and booms, many papers, including Engel and Hamilton (1990), Bekaert and Hodrick (1993), Engel (1994), Bollen et al. (2000), and

[1] See Chinn and Meredith (2004), Lusting and Verdelhan (2007), Alvarez et al. (2009), Burnside et al. (2011) and Plantin and Shin (2011) for instance.

[2] A simple definition of carry trade is "borrowing in a low-interest-rate currency to invest in a higher one to earn the interest differential".

[3] de Rato said, in his speech: "As a result, despite a large current account surplus, there has been downward pressure on the yen in the short run. Indeed, in real effective terms, the yen is now at a 20-year low". "The carry trade is not a consequence of global imbalances. Rather, it reflects the globalization of financial markets and the current environment of low volatility and wide interest rate differentials". "Moreover, both financial markets and countries are exposed to risks if there is a sudden reversal of financial flows. For example, a disruptive unwinding of carry trade positions occurred in October 1998, when the U.S. dollar fell by 15 percent against the Japanese yen in 4 days".

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