European Economic Review 60 (2013) 17–31

Contents lists available at SciVerse ScienceDirect

European Economic Review

journal homepage: www.elsevier.com/locate/eer

Carry trade and foreign exchange rate puzzles ☆

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ARTICLE INFO

Article history:
Received 22 November 2011
Accepted 22 January 2013
Available online 1 February 2013

JEL classifications:
G15
F31

Keywords:
Exchange rates
Carry trades
Forward premium puzzle
Heterogeneous agent model
Market volatility

ABSTRACT

This article demonstrates that carry trade is part of the explanation of foreign exchange rate puzzles. We introduce carry traders in a heterogeneous agent model in addition to fundamentalists and chartists. Our model has the ability to produce the stylized facts observed in empirical exchange rates, such as heavy tails, excess volatility, and volatility clustering, as well as the negative relationship between market volatility and carry trade activity. We find that the interaction between carry traders and chartists provides an explanation for the forward premium puzzle. This effect is strengthened by chartists, who extrapolate the trend induced by carry trade.

1. Introduction

Uncovered interest parity (UIP) suggests that the expected change in the exchange rate equals the spread in interest rates over the same period. Fama (1984) has done one of the early studies that test and reject the UIP relationship. After Fama, many others have tested this relationship, and almost all of the researchers concluded that UIP does not hold. Froot (1990) bundles these studies and arrives at an average beta of −0.88. It is striking that 75 studies find an average beta that is closer to negative unity than to unity. This anomaly is known as the forward premium puzzle.

Several possible explanations for the UIP puzzle have been put forward in the literature, surveyed, for example, in Engel (1996). Roll and Yan (2000) propose that the puzzle exists because of the non-stationary time series of the model. Bansal and Dahlquist (1999) find that the puzzle only exists for developed countries. Chinn and Meredith (2004) conclude that the forward premium puzzle is mainly a short-run phenomenon. Cavaglia et al. (1994), using survey data, show that the puzzle is caused by a combination of non-rational expectations and time varying risk premia. Despite a large number of attempts to solve the puzzle, there is no unambiguous solution to the violation of the interest parity condition or the forward premium puzzle.

Sarno (2005) and Obstfeld and Rogoff (1996) give a broad overview of the UIP- and other puzzles in foreign exchange rates. A number of these foreign exchange rate puzzles can be explained by the heterogeneous agent literature. The existence of different types of traders in the foreign exchange market has long been recognized. Frankel and Froot (1990) introduce a model with two types of traders, fundamentalists and chartists, to explain the behavior of the US Dollar in the 1980s. Fundamentalists expect the exchange rate to revert to its fundamental value. Chartists, however, extrapolate the trend in the most recent period(s). Frankel and Froot (1990) show that the chartists extrapolated an initial strong increase

☆ We thank the editor and two anonymous referees for insightful comments. The usual disclaimer applies.
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http://dx.doi.org/10.1016/j.euroecorev.2013.01.007

in the fundamental value from 1980 to 1982 for the subsequent years, causing a strong overvaluation in 1984. In other words, both fundamental and technical elements are important in the foreign exchange market. In addition, their relative importance changes over time.

The notion of trader heterogeneity and switching between strategies has been further developed in the literature on heterogeneous agent models (HAMs), as introduced in Brock and Hommes (1997, 1998) and reviewed in Hommes and Wagener (2009). Brock and Hommes (1997, 1998) introduce a switching mechanism that allows traders to adjust their investment strategy conditional on the relative recent performances of the existing strategies. Focusing on exchange rates in particular, De Grauwe and Grimaldi (2006) present a HAM with a similar structure. The nonlinear switching mechanism introduces interesting dynamics in the exchange rate that cannot be generated by classical linear models. As a result, HAMs have been especially successful in explaining a number of stylized facts in financial markets, such as volatility clustering, the heavy tail property, and the excess volatility and disconnect puzzles.

One puzzle that the heterogeneous agent literature has not been able to explain is the aforementioned UIP puzzle. This paper extends the heterogeneous agent literature to explain the failure of the uncovered interest parity relationship. To be more specific, we introduce a third group of investors, carry traders, beyond the archetypical fundamentalists and chartists. The addition of this third group of traders is motivated by the recent contributions of Pojarliev and Levich (2008, 2010), who show that currency traders actively use three different investment styles: value (fundamentalist), trend (chartist), and carry.[1] Using these three investment styles, up to 70% of currency fund managers' performances can be explained. In addition, Jongen et al. (2012) show that the interest differential is an important determinant of the foreign exchange expectations of financial institutions in addition to fundamental and momentum considerations.

Carry trade co-exists with the failure of UIP. Carry trade implies borrowing in a country with relatively low interest rates, converting to the currency of a high interest rate country, and investing in that particular country. Galati and Melvin (2004) identify Switzerland and Japan as the main low interest countries and the United Kingdom, Australia, and New Zealand as the main high interest rate countries. Under UIP, carry trade does not yield excess returns because the interest differential should be compensated for by the change in the exchange rate. Carry trading strategies are profitable thanks to the failure of UIP and are indeed widely seen as a profitable trading strategy; see, e.g., Burnside et al. (2006) and Darvas (2008).

The literature identifies two sources of profit for carry traders (see also Cavallo, 2006). The first is the profit from trading on the interest rate differential. This is a risk-free profit locked-in when engaging into the carry agreement. Second, because the UIP relation typically gives a negative beta the currency of the high interest rate country will appreciate, on average. This implies that when converting the invested capital back to the low-interest currency, on average one makes a currency profit. Brière and Drut (2009), however, show that the profitability of carry strategies declines substantially in periods of crisis. In other words, consistent with the heterogeneous agent literature, there is time variation in the profitability of investment strategies.

We combine the carry trade observation with the heterogeneous agent literature to provide an explanation of the exchange rate puzzles and the forward premium puzzle in particular. To be more specific, we add carry traders to a heterogeneous agent model with fundamentalists and chartists. Agents are then allowed to switch between all three rules, conditional on past performance. The simulation results indicate that the model is able to replicate heavy tails, excess volatility, and volatility clustering. In addition, the model generates a negative relationship between market volatility and carry trade activity, as recently put forward by Brière and Drut (2009) and Menkhoff et al. (2012). Increasing the effect of carry trade, however, slightly reduces the ability of the model to replicate the stylized facts observed in empirical exchange rates. This is explained by the fact that chartists and carry traders, who are typically on the same side of the market, tend to dominate the market with a strong enough carry effect whereas the stylized facts are generated by the switching between stabilizing fundamentalists and destabilizing chartists. By the same token, the interaction between chartists and carry traders explains the forward premium puzzle. Given that interest differentials are persistent, carry traders introduce momentum effects in a currency that is picked up and extrapolated by chartists. Hence, it is only due to the existence of chartists that carry traders can have such a profound effect on foreign exchange markets.

The remainder of the article is organized as follows. In Section 2 we develop a heterogeneous agent model including fundamentalists, chartists, and carry traders. In Section 3 we provide the dynamic properties of the heterogeneous agent model, whereas in Section 4 we explore a number of statistical properties generated by the model. In Section 5 we examine the extent to which carry traders can explain the forward premium puzzle. Finally, Section 6 concludes the article.

2. A heterogeneous agent model including carry trades

This section develops a non-linear behavioral model of the exchange rate. The model is a modified version from De Grauwe and Grimaldi (2006). It includes carry traders because, as mentioned in the previous section, the influence of carry trade flows on global money flows is considered large and increasing.[2]

[1] In fact, Pojarliev and Levich (2010) identify a fourth strategy: currency volatility. They show, however, that this fourth factor typically does not contribute to the explanatory power of the factor model.

[2] It is not straightforward how to quantify the size of carry trade because carry trade flows are part of other monetary flows. McGuire and Upper (2007) study open positions in exchange-traded FX futures. Galati et al. (2007) look at particular sectors where carry trades are expected to have a high