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Forward Exchange Rate Biasedness across Developed and Developing Country Currencies
Do Observed Patterns Persist Out of Sample?

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Abstract

Forward exchange rate unbiasedness hypothesis (FRUH) has been a widely researched subject for decades. Recently, the sample populations of these studies have expanded to include developing country currencies. The majority of these findings have been that forward rate biasedness is more pronounced for developed country currencies than it is for developing country currencies. One such paper (Frankel and Poonawala 2010) has further suggested that this phenomenon may contradict risk premium theory since developing country currencies are relatively more volatile. Our analysis first replicates the results of Frankel and Poonawala and then extends the study out of sample using an updated composition of currency classifications. The results of this extended period of analysis show that forward rate biasedness is *less* pronounced for developed country currencies than for developing country currencies and consequently does not establish grounds to challenge risk premium theory. Furthermore, our results are consistent with another branch of literature which suggests that conflicting FRUH test results may be particular to the time period

examined. It is therefore possible to speculate that period-specific factors were responsible for the results found in previous research.

1 Introduction

Parity Issues

Does the observed pattern that forward exchange rate biasedness is more pronounced for developed country currencies than it is for developing country currencies persist out of recent samples? Recent research (Frankel and Poonawala 2010) suggests that over the 1996-2004 period there are distinct differences between emerging and developed market currencies, with developed markets showing more evidence of failure of parity conditions. We update this analysis and suggest that this finding is time and sample dependent.

Covered interest parity (CIP) states that the risk-free interest rate differential between two countries must equal the countries' forward exchange rate premium (discount)

(1) $i_{t,t+1} - i^*_{t,t+1} = f_{t,t+1} - s_t$

Where:
$i_{t,t+1}$ is the risk-free interest rate of the domestic country at time t for period $t+1$
$i^*_{t,t-1}$ is the risk-free interest rate of the foreign country at time t for period $t+1$
$f_{t,t+1}$ is the forward exchange rate of the domestic and foreign currencies at time t for expiration at period $t+1$
s_t is the spot exchange rate of the domestic and foreign currencies at time t

Uncovered Interest Parity (UIP) can be implied by replacing the forward premium (discount) in equation *(1)* with the expected change in the spot exchange rate yielding

(2) $i_{t,t+1} - i^*_{t,t+1} \approx E_t[s_{t+1} - s_t]$

Replacing the risk-free interest rate differential in expression *(2)* with the forward premium (discount), one arrives at expression *(3)*.

(3) $E_t[s_{t+1} - s_t] \approx (f_t - s_t)$

Forward exchange rate unbiasedness hypothesis (FRUH) is a joint hypothesis of the conditions of UIP and rational expectations given risk neutrality. If UIP holds, then the risk-free interest rate differential should be an unbiased predictor of the future spot exchange rate movement. If UIP and rational expectations given risk neutrality hold, then the ex-post spot exchange rate appreciation (depreciation) should equal the forward exchange rate premium (discount) plus a random forecasting error (Isard 2006). Replacing the expected changes in the spot rate in expression *(3)* with the ex-post changes in the spot rate and adding an error term, one arrives at equation *(4)*.

(4) $(s_{t+1} - s_t) = (f_{t,t+1} - s_t) + u_t$

The focus of FRUH is not on how *accurate* of a forecaster the forward exchange rate is but is rather on whether or not the forecast *errors* are actually random. If this is not the case, the errors are systematically biased. If the forward exchange rate is truly determined based only and completely on all known information at time *t*, although future information could result in that forward exchange rate being a poor ex-post forecaster, the forecast itself would not be considered biased.

The fact that the forward exchange rate has, in fact, frequently been observed to be a biased predictor of the future spot exchange rate goes by many names in literature including the forward premium (discount) puzzle and the forward premium (discount) anomaly. we refers to the phenomenon simply as the failure of FRUH and thus this is inclusive of statistical biasedness of the forward exchange rate or of the interest rate differential as CIP dictates that the two must be in equilibrium.

2 Previous Literature

What explains the failure?

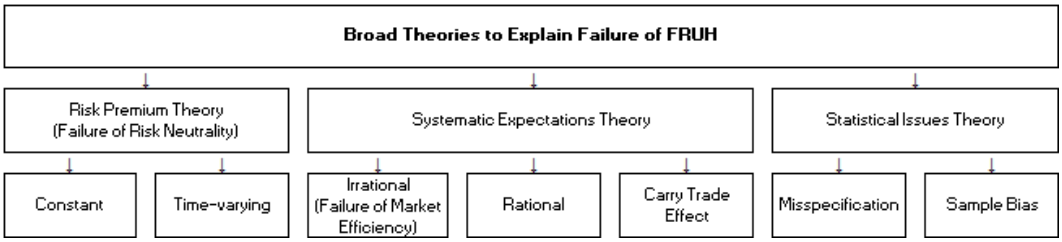
Early empirical studies of FRUH generally supported the hypothesis (Cornell 1977) (Levich 1979). However, these papers used simple levels specifications of forward and spot rates, an approach now superseded methodologically (Meese and Singleton 1982) (Barnhart and Szakmary 1991).

The first researcher (Tryon 1979, 9) that used the forward premium (discount) specification comprehensively rejected FRUH in an analysis of six currency pairs. This rejection of FRUH has since been replicated several times in literature, including papers addressing serial correlation (Geweke and Feige 1979) (Bilson 1980) ; heteroskedasticity (Hsieh 1982); structural breaks ; and a variety of parameterizations (Aggarwal, Lucey and Mohanty 2009).

Consistent with the observed failure of FRUH is a well-known finding that a random walk without drift model performed as well as various other models in the short-term forecasting of exchange rates (Meese and Rogoff 1983). More recently, models using the expectations hypothesis of the term structure of interest rates have also been shown to be no better at forecasting exchange rates than a random walk model (Bekaert, Wei and Xing 2007). Also recently, the failure of FRUH has been specifically attributed to the fact that interest rates reflect inflation expectations, while spot exchange rates follow a random walk process (Thornton 2007).

Finally, in tests on whether the predictability of exchange rates using interest rate differentials still occurs given random walk expectations, such were found to possibly explain the failure of FRUH if participants do not revise positions frequently (Bacchetta and van Wincoop, Random Walk Expectations and the Forward Discount Puzzle 2007). Finally (Chinn and Meredith 2005) tested, across periods and currencies, whether the interest rate differential was a biased predictor of the change in the future spot exchange rate for longer horizons and found the bias to be comparatively less severe and the regression slope coefficient to be insignificantly different from one.

Over the decades, several theories in three broad categories have emerged to explain the observed failures of FRUH ; that a risk premium is embedded in forward exchange rates, that market participants make systematic expectations errors, and finally, that statistical issues are responsible.



the risk premium approach posits the failure of the assumption that foreign exchange market participants are risk neutral and implies, instead, that they are risk averse. Consequently, a risk premium is embedded in forward exchange rates. (Hansen and Hodrick 1983) can be seen as the foundation of this approach, while (Fama 1984) decomposed the forward exchange rate into the expected future spot rate and a time-varying risk premium. He with expected spot exchange rates. Freezing the assumption of rational expectations, Fama attributed the negative slope coefficient arising from the forward premium (discount) regression to the fact that the variance of the risk premium is greater than the variance of the expectation errors. (Hodrick and Srivastava 1985) have extended this variance analysis and confirmed the basic finding (Kellard and Sarantis 2007). In a time varying sense A time-varying approach has attributed the failure to a risk premium which is negatively correlated with spot exchange rate expectations (Bernoth, Von Hagen and De Vries 2005) , arising from adverse selection between market makers and foreign exchange traders which is more severe when there is an expectation that the currency will appreciate (Burnside, Eichenbaum and Rebelo, Understanding the Forward Premium Puzzle: A Microstructure Approach 2007).

The systematic expectations theory implies that market participants make systematic prediction errors. Using survey responses of traders' expectations to

decompose the forward rate into future spot rate expectation and risk premium components, one study was able to replicate the usual negative slope coefficient (Frankel and Froot 1986). recent research supports irrational expectations as a cause (Yu 2012) (Moon and Velasco 2011), while failure has also been attributed to investor overreactions, (Burnside, Han, et al. 2010), and to the failure of rational expectations, which is consistent with why relatively small deviations from unity in the level specification are greatly magnified in the forward premium specification (Chakraborty and Stephen, Econometrics of the Forward Premium Puzzle 2008). Arising from (Lewis 1989) this research includes the incomplete information approach of (Chakraborty, Learning, the Forward Premium Puzzle and Market Efficiency 2009)and to "rational inattention" (Bacchetta and van Wincoop, Rational Inattention: A Solution to the Foward Discount Puzzle 2005). A subcategory of systematic expectations theory involves the impact of the carry trade. It has been suggested that the failure of FRUH could be due in part to a "carry trade effect" which can cause deviations from fundamentals in the short term (Boudoukh, Richardson and Whitelaw 2011). The hypothesis failure has also been suggested to be specifically related to the use of leverage in carry trades (Darvas 2009).
Other research has attributed the failure of FRUH to a time-varying risk premium related to "order flow," it has also been observed that the resulting carry trade and subsequent exploiting by market participants possibly further contributes to the hypothesis failure (Breedon, Rime and Vitale 2010). At any rate, simple carry trade strategies exploiting the failure of FRUH have still been found to be profitable (Pojarliev 2009).

The final broad set of papers posits failure as a result of any number of statistical issues such as sample quality or misspecification. Examples include sampling error (Breuer and Wohar 1996); near cointegration (Maynard 2003); small sample sizes and serial correlation in the forward premium (discount) (Baillie and Bollerslev 2000); nonlinearities in the data (Clarida, et al. 2001) ; and omitted variables (Pippenger 2011) (McBrady 2005). It hasalso been suggested that the conflicting results of FRUH found in literature may be in part due to the time period used (Barnhart and Szakmary 1991). Similarly, (Lothian and Wu 2011) suggested that the recorded failure of FRUH is in part the result of the particular 1970s and 1980s sample of data. They furthermore determined

that the negative slope estimates of the 1980s were result of expectation errors to US and UK monetary policy changes.

FRUH in developed and emerging markets

A further complication in evident when one examines the failure or otherwise of FRUH in developed versus emerging market currencies. By comparison with the generalized failure noted above the majority of research in currency pairs involving a emerging country currency reaches the conclusion that forward exchange rate biasedness appears to be comparatively less pronounced.

Thus (Bansal and Dahlquist 2000) in direct tests of UIP for 28 developed and developing country currencies found that failure of the parity was confined to the developed country currency set and noted that their findings were "counter intuitive" to a systematic risk premium but not necessarily to a non-systematic risk premium. Similarly (Lee 2006) also found UIP to hold comparatively better for emerging market currencies More recently (Frankel and Poonawala 2010) also found forward rate biasedness to be less pronounced for emergin country currencies than for developed country currencies. After finding the usual highly significant negative slope coefficient for most of the set of developed country currencies, the study went on to find that the average regression slope coefficient was positive for the emerging country currencies. These researchers therefore suggested that this finding contradicts risk premium theory since developing country currencies are riskier, yet the forward exchange rates of these currencies are less biased. This finding has been confirmed (Mulder, Tims and Ben 2011) and may be in part attributable to the different action and channels of monetary policy in emerging markets (Moore and Roche 2012). Other research does suggest failure in emerging markets. Failure for the Rand (Wesso 1999), Rupee (Kumar and Mukherjee 2007) and the Tunisian dollar (Azouzi, Kumar and Aloui 2011) have been discussed in the literature

3 Data

We examine a set of developed and emerging country currency pairs first to replicate previous findings for the period 31st December 1996 to 30th April 2004 , and then over an extension period from 31st May 2004 to 30th September 2011 as show in Table 1. In addition to subperiod analyses we also analyse 10 developed and 10 emerging currency pairs over the entire period . Only those currencies which remained in the same developed or emerging category in the Replication Period and the Extension Period are included in this analysis.

Table 1: Replication and Extension Period Currency Composition

Replication Period	
Developed Country Currencies	**Emerging Country Currencies**
1. Australian dollar	1. Czech koruna
2. Austrian schilling	2. Hong Kong dollar
3. Belgian franc	3. Hungarian forint
4. Canadian dollar	4. Indian rupee
5. Danish krone	5. Indonesian rupiah
6. Eurozone euro	6. Kuwaiti dinar
7. Finnish markka	7. Mexican peso
8. French franc	8. Philippine peso
9. German deutsche mark	9. Saudi riyal
10. Greek drachma	10. Singapore dollar
11. Irish pound	11. South African rand
12. Italian lira	12. (New) Taiwan dollar
13. Japanese yen	13. Thai baht
14. Netherlands guilder	14. Turkish lira
15. New Zealand dollar	
16. Norwegian krone	
17. Portuguese escudo	
18. Spanish peseta	
19. Swedish krona	
20. Swiss franc	
21. United Kingdom pound	
Extension Period	
Developed Country Currencies	**Emerging Country Currencies**
1. Australian dollar	1. Bulgarian lev
2. Canadian dollar	2. Hungarian forint
3. Czech koruna	3. Indian rupee
4. Danish krone	4. Indonesian rupiah
5. Eurozone euro	5. Kuwaiti dinar
6. Hong Kong dollar	6. Mexican peso
7. Japanese yen	7. Moroccan dirham
8. Norwegian krone	8. Philippine peso
9. Portuguese escudo	9. Polish zloty
10. Singapore dollar	10. Saudi riyal
11. Swedish krona	11. South African rand
12. Swiss franc	12. Thai baht
13. (New) Taiwan dollar	13. Tunisian dinar
14. United Kingdom pound	14. Turkish lira

The composition of developed and developing country currencies for the Extension Period was created using the World Bank's classification of economies. For the purposes of the Extension Period currency classification, currencies of those countries that were classified as high income for at least half of the period are included in the

developed classification and vice versa. The specific differences between the Replication Period and the Extension Period currency compositions are outlined below. The Austrian schilling, Belgian franc, Finnish markka, French franc, German deutsche mark, Greek drachma, Irish pound, Italian lira, Netherlands guilder, and Spanish peseta are replaced by the euro in the Extension Period. The New Zealand dollar has been removed from the Extension Period due to a highly unstable regression slope coefficient (see the appendix for more details). The classifications of the Czech koruna, Hong Kong dollar, Singapore dollar, and (New) Taiwan dollar change from developing country currency to developed country currency in the Extension Period The Bulgarian lev, Moroccan dirham, Polish zloty, and Tunisian dinar are added to the developing country currencies in the Extension period due to sufficient representation in the forward exchange market

All spot and forward exchange rates are sourced from Thomson DataStream and are taken from the World Market Reuters (WMR) series. It has been observed that the variation of the change in the spot rate is greater than the variation of forward premium (discount) (Fama 1984). The standard deviation of the change in the spot rate is greater than the forward premium (discount) for 48%, 100%, and 70% of the developed country currencies in the Replication Period, the Extension Period, and the Full Period, respectively. The standard deviation of the change in the spot rate is greater than the forward premium (discount) for 57%, 36%, and 10% of the emerging country currencies in the Replication Period, the Extension Period, and the Full Period, respectively.

4 Findings

We attempt to address the following question. Does the observed pattern that forward exchange rate biasedness is more pronounced for developed country currencies than it is for developing country currencies persist "out of sample"?
Our workhorse regression model is

$$(5)\quad (s_{t+1} - s_t) = \alpha + \beta(f_{t,t+1} - s_t) + u_t$$

Where:
s (spot) is the natural log of the spot rate of a currency against the US dollar and f (forward) is the one month forward rate for that currency against the US dollar at that period. All estimation is with Newey-West robust standard errors.

We test two hypotheses. The first is a test of whether or not there is evidence that the beta coefficient does not equal its theoretical value of unity.In the event that there is evidence that the slope coefficient does not equal its theoretical value of unity, the implication is that market participants may make systematic, time-varying forecast errors. This hypothesis test is detailed below.

The second hypothesis test is a test of whether or not there is evidence that the slope coefficient does not equal zero. This is the default test in the standard regression output. In the event that there is evidence that the slope coefficient does not equal zero, the implication is that market participants may, if the slope coefficient sign is negative, make systematic, time-varying forecast errors that are severe in that the forward exchange rate does not even correctly guess the direction of the future spot rate movement on average. This hypothesis test is detailed below.

The forward premium (discount) specification should correct for the unit root that is known to be present in the level forms of the spot and forward exchange rate variables (Meese and Singleton 1982). An Augmented Dickey-Fuller (ADF) Unit Root Test was conducted on the residuals in the specification outlined in equation *(5)* for all currency pairs in the Replication Period, the Extension period, and the Full Period and

the null hypothesis that the residual has a unit root can be rejected for every currency pair in all three periods, even at the 1% level. (results available on request)

The results of the analyses for the developed and emerging countries for the replication, extension and full period are shown below.

Table 2: Replication Period Developed Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Australian dollar	88	-5.6424	0.0108	0.0029
Austrian schilling	88	-5.2804	0.0083	0.0019
Belgian franc	88	-5.5236	0.0061	0.0013
Canadian dollar	88	-3.2184	0.0927	0.0284
Danish krone	88	-5.5150	0.0080	0.0019
Eurozone euro	64	-6.2978	0.0076	0.0022
Finnish markka	88	-5.4680	0.0052	0.0010
French franc	88	-5.1522	0.0095	0.0021
German deutsche mark	88	-5.2964	0.0076	0.0017
Greek drachma	88	2.4052	0.2405	0.4917
Irish pound	88	-0.9491	0.2096	0.0111
Italian lira	88	-3.6422	0.1032	0.0387
Japanese yen	88	-1.2806	0.5333	0.2684
Netherlands guilder	88	-5.1816	0.0083	0.0018
New Zealand dollar	88	-3.9940	0.0505	0.0151
Norwegian krone	88	-3.8507	0.0101	0.0013
Portuguese escudo	88	-4.4243	0.0462	0.0151
Spanish peseta	88	-4.8615	0.0300	0.0093
Swedish krona	88	-5.5293	0.0031	0.0005
Swiss franc	88	-4.3038	0.0395	0.0117
United Kingdom pound	88	-3.9916	0.1689	0.0863

Shows the results of a regression over the period 31st December 1996 to 30th April 2004 of the form

$s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$.

Table 3: Replication Period Developing Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Czech koruna	88	0.4261	0.5206	0.3873
Hong Kong dollar	88	-0.0439	0.2468	0.0000
Hungarian forint	78	0.7541	0.5511	0.8457
Indian rupee	78	-0.6182	0.4751	0.0641
Indonesian rupiah	73	0.1457	0.4807	0.0001
Kuwaiti dinar	88	0.4051	0.6674	0.5283
Mexican peso	88	-0.6399	0.1204	0.0001
Philippine peso	88	1.6771	0.3303	0.6936
Saudi riyal	88	-0.0832	0.3223	0.0000
Singapore dollar	88	0.1911	0.8826	0.5323
South African rand	88	-3.2694	0.0792	0.0227
(New) Taiwan dollar	88	0.1443	0.7842	0.1069
Thai baht	88	0.9614	0.1643	0.9552
Turkish lira	88	-0.0023	0.9385	0.0000

Shows the results of a regression over the period 31st December 1996 to 30th April 2004 of the form

$s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$

Table 4: Extension Period Developed Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Australian dollar	88	2.6834	0.5026	0.6738
Canadian dollar	88	-2.5299	0.7387	0.6417
Czech koruna	88	2.5579	0.4102	0.6156
Danish krone	88	-0.3798	0.9306	0.7516
Eurozone euro	88	0.5933	0.8928	0.9264
Hong Kong dollar	88	-0.3717	0.3359	0.0006
Japanese yen	88	-0.3635	0.8507	0.4807
Norwegian krone	88	3.3842	0.1754	0.3385
Portuguese escudo	88	0.5848	0.8942	0.9248
Singapore dollar	88	0.2894	0.9016	0.7614
Swedish krona	88	3.0106	0.2650	0.4558
Swiss franc	88	0.1978	0.9426	0.7703
(New) Taiwan dollar	88	0.6522	0.3845	0.6423
United Kingdom pound	88	1.1375	0.8058	0.9763

Shows the results of a regression over the period 31st May 2004 to 30th September 2011 of the form $s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$.

Table 5: Extension Period Developing Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Bulgarian lev	88	1.1499	0.5923	0.9443
Hungarian forint	88	-2.8345	0.1359	0.0448
Indian rupee	88	-1.0511	0.4009	0.1031
Indonesian rupiah	88	0.0822	0.3083	0.0000
Kuwaiti dinar	88	3.3690	0.0007	0.0152
Mexican peso	88	1.1927	0.4646	0.9058
Moroccan dirham	88	0.9620	0.3146	0.9682
Philippine peso	88	-0.8805	0.5450	0.1979
Polish zloty	88	3.1059	0.3349	0.5126
Saudi riyal	88	-0.5886	0.4154	0.0299
South African rand	88	-1.3199	0.7100	0.5137
Thai baht	88	-1.1096	0.3919	0.1055
Tunisian dinar	88	-0.09361	0.9479	0.4462
Turkish lira	88	-2.0034	0.0583	0.0051

Shows the results of a regression over the period 31st May 2004 to 30th September 2011 of the form $s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$.

Table 6: Full Period Developed Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Australian dollar	177	-2.3437	0.1993	0.0678
Canadian dollar	177	-3.0680	0.1860	0.0801
Danish krone	177	-3.4307	0.1115	0.0403
Eurozone euro	153	-3.4536	0.1174	0.0440
Japanese yen	177	-1.0602	0.4567	0.1489
Norwegian krone	177	-1.1229	0.3630	0.0864
Portuguese escudo	177	-2.4964	0.2413	0.1014
Swedish krona	177	-2.0555	0.2022	0.0587
Swiss franc	177	-2.67177	0.1438	0.0451
United Kingdom pound	177	-1.7896	0.4983	0.2916

Shows the results of a regression over the period 31st December 1996 to 30th September 2011 of the form $s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$.

Table 7: Full Period Developing Currencies Regression Results

Currency	N	β	Prob β=0	Prob β=1
Hungarian forint	167	-0.4888	0.5874	0.0996
Indian rupee	167	-0.8665	0.2157	0.0082
Indonesian rupiah	177	0.0387	0.6664	0.0000
Kuwaiti dinar	177	3.0739	0.0006	0.2235
Mexican peso	177	-0.1720	0.6246	0.0010
Philippine peso	177	1.9294	0.1060	0.4349
Saudi riyal	177	-0.3528	0.0077	0.0000
South African rand	177	-1.8099	0.2040	0.0493
Thai baht	177	0.9666	0.1688	0.9620
Turkish lira	177	-0.0142	0.6378	0.0000

Shows the results of a regression over the period 31st December 1996 to 30th September 2011 of the form $s_{t+1} - s_t = \alpha + \beta(f_{t,t+1} - s_t) + u_t$.

The results from the Replication Period analysis were successfully duplicated for nearly all of the currencies in the Frankel and Poonawala study. We find an average beta of -4.3331 for the 21 developed country currencies (with 18 significant at the 10% level) and an average beta of 0.0034 for the 14 developing country currencies (with only the South African rand significant at the 10% level). Furthermore, we reject the hypothesis that beta equals its theoretical value of unity for 19 of the 21 developed country currencies, and for 8 of the 14 developing country currencies. To summarize, forward

exchange rate biasedness appeared to be *more* pronounced in the developed country currency set than in the developing country currency set.

In contrast, in the Extension Period analysis, we find an average beta of 0.8176 for the 14 developed country currencies (with none significant at the 10% level) and an average beta of -0.0041 for the 14 developing country currencies (with the Kuwaiti dinar and the Turkish lira significant at the 10% level). We can reject the hypothesis that beta equals its theoretical value of unity for only one (the Hong Kong dollar) of the 14 developed country currencies, and for 6 of the 14 developing country currencies. In other words, the common finding that forward rate biasedness is more pronounced for developed country currencies than it is for developing country currencies did not persist out of sample in the Extension Period analysis.

Finally, in the Full Period analysis, we find an average beta of -2.3492 for the 10 developed country currencies (with none significant at the 10% level) and an average beta of 0.2304 for the developing country currencies (with only the Kuwaiti dinar and the Saudi riyal significant at the 10% level). Also, we rejected the hypothesis that beta equals its theoretical value of unity for 8 of the 10 developed country currencies, while I rejected the hypothesis that beta equals its theoretical value of unity for 7 of the 10 developing country currencies.

To summarize the Full Period results, there was no considerable difference in forward exchange rate biasedness between developed and developing country currencies.

5 Discussion

The results of the Extension Period analysis are in contrast to the results of many of the studies that consider developing country currencies . However, they are in line with one analysis of developing country currencies which found UIP to hold better for developed country currencies (indicated by a positive slope coefficient with statistical insignificance from unity) in the decade examined, while no difference was found in the parity holding for countries of different incomes (Flood and Rose 2001). Similarly, the

results are consistent with research that suggests that FRUH test results for developed country currencies are particular to the decade examined, possibly due to period-specific factors such as government intervention (Barnhart and Szakmary 1991) (Lothian and Wu 2011).

While the Extension Period of 31st May 2004 to 30th September 2011 encompassed the Financial Crisis, the Replication Period of 31st December 1996 to 30th April 2004 did not. Therefore, it is prudent to consider characteristics of the crisis that could have impacted forward exchange rate biasedness for developed country currencies. One possibility involves the carry trade. –

It has been suggested in previous research that carry trade strategies further contribute to the failure of FRUH (Breedon, Rime and Vitale 2010). Before the crisis, one of the prominent carry trade strategies involved borrowing in yen and purchasing high yielding developed country currencies such as the Australian dollar and the US dollar. This could have resulted in something of a snow-ball effect of forward rate biasedness. The beginning of the financial crisis saw a sharp reversal of many of the popular carry trade trends as well as a decline in trading as a whole, possibly reducing a systematic effect on exchange rates. Notwithstanding, since forward exchange rate biasedness proved to be more pronounced for the developing country currencies than for the developed country currencies in the out of sample analysis, risk premium theory cannot be dismissed entirely.

With the passage of time and the adequate representation of additional developing country currencies in the forward exchange market, the differences in the degrees of forward rate biasedness between the two currency types can continue to be assessed in an out of sample context. What will be particularly interesting is whether the pattern of the Replication Period returns, or if the pattern of the Extension Period persists. In addition, specific analysis on the impact of carry trade strategies on forward exchange rate biasedness is worthy of future research attention.

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