A Quarter Century of Currency Expectations Data: The Carry Trade and the Risk Premium

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Abstract: For almost four decades economists have been finding that the forward discount and interest differential are both very biased forecasts of future changes in the exchange rate. I.e., the carry trade makes money, on average. For just as long, they have been debating the appropriate interpretation of the bias. Is it evidence of an exchange risk premium? Under that interpretation, a currency that sells at a forward discount does so not because it is expected to depreciate in the future but because it is perceived as risky. Using data on survey-based expectations over 25 years, we reject that interpretation of the forward bias. We find that when investors sell a currency at a forward discount, it is indeed because they expect it to depreciate. But we also find concrete evidence of a risk premium, in that failure of uncovered interest parity is correlated with the VIX measure of risk -- even though the risk premium can't explain forward bias.

Keywords: forward rate unbiasedness, efficient markets hypothesis, risk premium, survey data, rational expectations.

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1. INTRODUCTION

One of the key puzzles in international macroeconomics is the systematic failure of the forward rate to predict future movements in the spot exchange rate. Similarly, interest differentials are biased predictors of future changes in the exchange rate. (Either proposition implies the other, if covered interest parity holds.) Typically the interest differential and forward discount fail to predict even the direction of exchange rate changes. One can make money on average by going short in the low-interest-rate currency and going long in the high-interest-rate currency, the strategy known as the carry trade. This *seeming* violation of uncovered interest parity is one of the most robust stylized facts in the discipline.[1] The outcome is usually interpreted by appealing to the presence of an exchange risk premium. But the difficulty in relating measured risk premiums to observable macroeconomic variables that are considered determinants of risk has meant that dispensing with one puzzle leads to yet another puzzle.

We emphasize the word "seeming" because in fact most empirical papers assessing uncovered interest parity are actually joint tests of uncovered interest parity and the validity of the rational expectations methodology.[2] Frankel has termed this composite the "unbiasedness hypothesis". The forward rate unbiasedness hypothesis is consistent with the combination of UIP, rational expectations and covered interest parity (so that the

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[1] There are numerous surveys of the literature, including Hodrick (1987), Froot and Thaler (1990) and Engel (1996, 2014).

[2] We use the term "rational expectations methodology" to describe the proposition that *ex ante* expectations can be inferred from *ex post* outcomes up to an expectational error term that is statistically uncorrelated with information available today. We prefer this terminology because rejection of the proposition would not require that market participants are irrational, but would allow such interpretations as the "peso problem" or learning within a finite sample (e.g., Lewis, 1989).

forward discount equals the interest differential). These distinctions, while straightforward, are critical for understanding why the forward rate might not be of use in predicting the future spot rate. It could be because of an exchange risk premium; or it could be because expectations are not on average unbiased within finite samples.

In this paper, we eschew the approach of imposing the rational expectations hypothesis, and instead use survey based measures of exchange rate expectations to proxy for market expectations. Early contributions in this vein were Dominguez (1986), Frankel and Froot (1987), Froot and Frankel (1989), and Ito (1990).[3] The empirical results presented in this paper are based on a data set derived from *FXForecasts*, the successor to *Currency Forecasters' Digest* and *Financial Times Currency Forecaster*. This data set has the advantage of spanning nearly a quarter of a century for eight currencies, from 1986 to 2009.[4] To our knowledge, this is the longest sample period over which survey data have been used to analyze the foreign exchange market.

To anticipate the results, we find that the forward discount does positively correlate with *expected* depreciation as measured by survey data, in a manner consistent with uncovered interest parity. In contrast, confirming that our sample is not atypical, the usual relationship holds for *ex post* exchange rate changes, over the corresponding sample periods – that is the forward discount tends to point in the wrong direction for subsequent changes in exchange rates.

These results are consistent with systematic errors in exchange rate expectations. We show that for many cases (particularly where the results differ

[3] Takagi (1991) surveys the early use of the survey data. Also Engel (1996).
[4] For a shorter sample, we examine data for 16 currencies.

substantially between regressions using the actual *ex post* changes and expected changes) the bias in expectations is significant.

We do find that there is an exchange risk premium identified using survey data, but it behaves much differently than that implied by the standard rational expectations methodology. This is a finding that is more clearly highlighted when using a longer sample period. In particular, the risk premia based on survey data are much more persistent than the risk premia obtained using the conventional approach. The evidence suggests negative risk premia for the Japanese yen and Swiss franc (relative to the US dollar), both of which are widely considered "safe haven" currencies.

The paper is organized in the following fashion. In section 2, we discuss the uncovered interest parity condition, combined with the rational expectations hypothesis (sometimes called the risk-neutral efficient markets hypothesis, or "RNEMH"), and in section 3, UIP is evaluated empirically, under the conventional rational expectations methodology as well as the methodology that uses survey data to measure expectations. Section 4 examines the contrasting behavior of the exchange risk premium, measured using rational expectations versus using survey data. Section 5 concludes.

2. Uncovered Interest Parity, the Unbiasedness Hypothesis and the Risk Neutral Efficient Markets Hypothesis

Let s_t be the price of foreign currency in units of domestic currency at time t, $f_{t,t+k}$ is the forward value of s for a contract expiring k periods in the future (both in logs). Suppose the forward rate (in logs, f) differs from the expected future spot rate (denoted by the e superscript) by a premium that compensates for the perceived riskiness of holding domestic versus foreign assets. The risk premium, η, is defined as:

$$f_{t,t+k} = s^{e}_{t,t+k} + \eta_{t+k}. \qquad (1)$$

Subtracting the log spot rate at time t from both sides, and rearranging yields:

$$s^{e}_{t,t+k} - s_t = \left(f_{t,t+k} - s_t\right) - \eta_{t+k}. \qquad (2)$$

Expected depreciation equals the forward discount, minus the risk premium.

If covered interest parity holds,

$$f_{t,t+k} - s_t = (i_{t,k} - i^{*}_{t,k}). \qquad (3)$$

and the risk premium is zero, then equation (2) becomes the familiar uncovered interest parity condition:

$$\Delta s^{e}_{t,t+k} = (i_{t,k} - i^{*}_{t,k}) \qquad (4)$$

Where $i_{t+,k}$ is the *k*-period yield on the domestic instrument, and i^{*}_{t+k} is the corresponding yield on the foreign instrument.

The forward discount equals expected depreciation if the risk premium is zero.[5] This is sometimes termed the forward rate efficient markets hypothesis. Equations (2) and (4) are not directly testable, however, in the absence of observations on market expectations of future exchange rate movements. To make this hypothesis testable, it is standardly tested jointly with the assumption of rational expectations. Using the rational expectations methodology, future realizations of s_{t+k} will equal the value expected at time

[5] Note that some approximations and simplifying assumptions have been made in order to arrive at this expression. See Engel (1996).

t plus a white-noise error term ξ_{t+k} that is uncorrelated with all information known at *t*, including the interest differential and the spot exchange rate:

$$s_{t+k} = s^{re}_{t,t+k} + \xi_{t+k} , \qquad (5)$$

Where the "re" superscript denotes the rational expectations measure. Then, applying the expression (2) one obtains the following relationship,

$$\Delta s_{t,t+k} = \left(f_{t,t+k} - s_t\right) - \eta_{t,t+k} + \xi_{t+k} , \qquad (6)$$

where the left-hand side of equation (6) is the realized change in the exchange rate from t to t+k. According to the forward rate efficient markets hypothesis, the error term is orthogonal to the right-hand side variable while the risk premium is possibly zero or is at least also orthogonal.

In a regression context, the estimated parameter on the forward premium will have a probability limit of unity in the following regression:

$$\Delta s_{t,t+k} = \beta_0 + \beta_1 \left(f_{t,t+k} - s_t\right) + \varepsilon_{t+k} . \qquad (7)$$

If the joint hypothesis holds, then the disturbance in equation (7) becomes simply the rational expectations forecast error $\xi_{t,t+k}$, which by definition is orthogonal to all information known at time t, including the forward discount.

Forward rate unbiasedness is a weaker condition than the risk neutral efficient markets hypothesis. All that is required for forward rate unbiasedness is that any risk premium and/or non-rational expectations error be uncorrelated with the forward discount, while the risk neutral efficient markets hypothesis requires in addition that no other regressors known at time t should have explanatory power.[6]

Estimates of equation (7), assuming covered interest parity, using values for k that range up to one year typically reject the unbiasedness restriction on the slope parameter. For instance, the survey by Froot and Thaler (1990) finds an average estimate for β of -0.88.[7] This result means that on average, one can make on average an excess profit by borrowing in the low interest rate currency and lending in the high interest rate currency, known as the carry trade.

One can relax the assumption regarding expectations, and replace it with the assumption that survey-based expectations are a good measure for market expectations. More precisely, the survey data can be measured with error, provided the error is uncorrelated with the other variables.[8] Hence, instead of equation (7), estimate.

$$\Delta\hat{s}^{e}_{t,t+k} = \beta_0^{'} + \beta_1^{'}\left(f_{t,t+k} - s_t\right) + \tilde{\varepsilon}_{t+k} . \qquad (8)$$

where $\hat{s}^{e}_{t,t+k} \equiv \hat{s}^{e}_{t,t+k} - s_t$ is the expected depreciation implied by survey data. Under the null hypothesis of uncovered interest parity, the probability limit of β' equals unity as long as the as long as error term is uncorrelated with the interest differential.

Froot and Frankel (1989) demonstrate that the standard tests for bias yield radically different results when one uses survey-based forecasts of exchange rate

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6 The constant term may reflect a constant risk premium demanded by investors on foreign versus domestic assets. Default risk could play a similar role, although the latter possibility is less familiar because tests of UIP (as well as CIP) generally use returns on assets issued in offshore markets by borrowers with comparable credit ratings. Alternatively, the constant term could reflect a convexity term, arising from the use of logs [which in turn arises as a way to address the so-called Siegel Paradox].

7 Similar results are cited in surveys by MacDonald and Taylor (1992) and Isard (1995).

8 This is the same as what we require of the rational expectations methodology: that the *ex post* change in the exchange rate measures *ex ante* expectations with an error that may be large but that is uncorrelated with the other variables.

depreciation. They find that most of the variation of the forward discount appears to be related to expected depreciation, rather than a time varying risk premium, thereby lending credence to UIP. Chinn and Frankel (1994) confirm the extent of forward rate bias in a larger set of currencies (17, versus 5 in Froot and Frankel), using forecasts provided by the *Currency Forecasters' Digest* (*CFD*).[9]

3. Empirics

In this section, we compare the results from the standard unbiasedness tests and the test for UIP using survey data.

3.1 Unbiasedness

We first consider the results of estimating equation (7):

$$\Delta s_{t,t+k} = \beta_0 + \beta_1 \left(f_{t,t+k} - s_t\right) + \varepsilon_{t+k} \, . \qquad (7)$$

Table 1 reports the results from estimating the standard *ex post* UIP regression (UIP incorporating rational expectations), often known as the "Fama regression" (1984), though it was first tested by Tryon (1979). While data are available at the 1, 3, 6 and 12 month horizons, only results for the three and 12 months horizons are reported. Under the maintained hypothesis, the errors should be serially uncorrelated at the one month horizon. At the multi-month horizons, even under the null of rational expectations, there

[9] Bacchetta and van Wincoop (2009) would argue that the object we identify as the risk premium need not be a true exchange risk premium. In their case, infrequent portfolio decisions account for the gap between the forward rate and the expected spot rate. Another objection often leveled against survey based measures of exchange rate expectations is that the forecasters derive their response from interest rate parity. In their survey of New York City forex traders, Cheung and Chinn (2001) found that at horizons of up to 6 months, "economic fundamentals" (broadly defined) only accounted for about a third of the factors affecting exchange rate movements. That share rises up to 87% over the horizon greater than six months.

should be moving average serial correlation of order k-1 (Hansen and Hodrik, 1980), i.e., order 2 and order 11 for the three month and 12 month horizon regressions, respectively. However, we report the estimates using Newey-West standard errors, as there appears to be serial correlation, according to the Durbin Watson statistics, above and beyond that implied by overlapping horizons.

In the top panel of Table 1.1 and 1.2 are presented the estimates for the euro legacy currencies (as well as the euro). For the legacy currencies, the sample ends in such a way that the last forecasted exchange rate is 1998M12. That means that at the three month horizon, the sample ends at 1998M09. For the euro, the sample begins at 1999M01 and ends at 2009M10 (and thus incorporates forecasts of the euro in 2010M01). Slightly over half the point estimates are negative. Despite this, the standard errors are so large that one can reject the null of a coefficient of unity less than half of the time.

The positive coefficients are associated with the currencies of Ireland, Italy and Spain – countries that exhibited relatively high inflation during the sample period. This finding is consistent with Chinn and Meredith's (2004) conclusion that the currencies of the higher inflation countries tended to conform to the unbiasedness hypothesis at short horizons. In this earlier sample, all the adjusted R-squared statistics are quite low.

The bias is evident for the newest currency in the data set – the euro. In this case, the imprecision of the estimates is sufficiently large at the 3 month horizon that one cannot reject the null of a coefficient of unity at any horizon. However, the point estimate is very negative, sufficiently so that one can reject unbiasedness at the 12 month horizon.

Panel 2 of Tables 1.1 and 1.2 reports the estimates for currencies estimated over the full sample.The results are much in line with those reported elsewhere in the literature. The slope coefficients are almost always below one, particularly at the 12 month horizon, significantly so. The Swedish krone at the three month horizon is the lone instance where the coefficient is above unity.[10]

3.2 Uncovered Interest Parity

We now turn to estimating the UIP relationship directly, in the sense that we drop the assumption of rational expectations, and replacethe actually realized depreciation with a measure of expected depreciation. These results of estimating *ex ante* uncovered interest parity stand in stark contrast to those from *ex post* UIP.

To do this, we use extended versions of the data used in Chinn and Frankel (1994), which incorporated data only up to 1991. These survey data are collected by *FX Forecasts*, the successor organization to *Currency Forecaster's Digest*, and the data used are at the 3 and 12 month horizons.

Table 2 presents the results of estimating equation (8). The most obvious and striking difference is that there is only one negative estimated coefficient for all the currencies (Japan at the 3 month horizon). In all other instances, the estimated

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[10] An interesting result is that the point estimates are quantitatively close to the posited value of unity in two cases – Sweden and Spain. Italy's coefficients at the short horizon is very high, in excess of 2. In the latter two countries' currencies, the rate of the inflation over the sample period (which ends in 1998M12) is the highest. [Again, this result is consistent with the findings in Chinn and Meredith (2004). High inflation currencies tend to exhibit positive coefficients in unbiasedness regressions.].

coefficients are positive, are close to the posited value of unity, and in most cases reject the null of a zero coefficient. In other words, whereas the regressions involving *ex post* depreciation cluster on the wrong side of zero, here we have much more evidence in accord with UIP. Moreover, of the eight cases in which one *can* reject the null hypothesis of a unit coefficient consistent, four show point estimates above unity.

In economic terms, this means that the forward discount actually does tell us a lot about the direction in which market participants think the exchange rate will move in the future, despite the usual conclusion that they tell us nothing about what it will actually do. Hence, forward rate bias cannot be interpreted as primarily the result of a risk premium, as is commonly assumed .

If one wants to focus on the major currencies, such as the Deutschemark and the euro, the UK pound, Swiss franc, and Japanese yen, one finds that in almost all instances, one cannot reject the null of a unit coefficient. The exceptions are the Japanese yen and UK pound at the three month horizon. Hence, for key currencies, UIP does seem to hold.

Why do the results differ so widely between the two approaches to measuring expectations? One can examine this from a mechanical perspective. If exchange rate expectations, as measured by the survey data, point in a substantially different direction from the actual exchange rate changes, then one would expect differing results. One can quantify the differences by examining whether expected changes exhibit bias.

$$\Delta s_{t,t+k} = \theta_0 + \theta_1 (\Delta \hat{s}^e_{t,t+k}) + u_{t+k} . \qquad (9)$$

These results are reported in Tables 3.1 and 3.2, for the 3 month and 12 month horizons, respectively. Almost all the survey-based forecasts are biased, and exhibit very small correlation with the actual exchange rate changes. However, it is also notable that most of the cases where the θ coefficients switch from negative to positive are the instances where the survey-based expected changes are negatively correlated with the actual changes.

Another point of commonality with the rational expectations-UIP hypothesis is that the proportion of variation explained is very low, with the exception of the 12 month horizon. Moreover, a high degree of serial correlation is evident in both the unbiasedness and UIP regressions.

4. Does the Risk Premium Behave as If Related to Risk?

The risk premium is typically defined as the gap between the forward rate and the expected future spot rate, as shown in equation 1. In simple finance models, the exchange risk premium arises from the correlation of currency returns with the marginal utility of consumption. Yet older models link the risk premium to stocks of government debt. As is well known, numerous researchers have failed to relate the risk premium identified using rational expectations to macroeconomic fundamentals.[11]

Here, we examine how the risk premium defined under rational expectations differs from that defined using survey data. The three month risk premia are illustrated in Figure 1. The blue line presents the risk premia obtained using survey data, while the red line depicts the conventional risk premia implied by the rational expectations hypothesis. Clearly, the risk premia obtained using the survey data are much more persistent than the

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[11] See Froot and Thaler (1991), Engel (1996, 2014) for extensive reviews of the literature, including the survey-based studies.

rational expectations implied; they also exhibit much less high frequency volatility.

To formally quantify the degree of persistence, we sampled the three month risk premia every three months (end of each quarter), so as to eliminate the overlapping data issue. We then regressed the current premium on the lagged, assuming an AR(1) specification can capture the dynamics fairly well. The results of regressing these are presented in Table 5.

The pattern is striking. In almost every case, the risk premium obtained using survey data is highly persistent. This is what one would expect if the fundamental determinants of risk were persistent. In contrast, the "risk premium" estimated using the traditional rational expectations methodology is not persistent. In fact it would be hard to distinguish the latter from white noise in most cases. The exceptions are the Belgian franc, Irish punt Swedish krone, Canadian dollar and New Zealand dollar. In those cases, one can reject the null of a zero AR(1) coefficient.; However, in each of those cases, the survey-based measure is more persistent. The half-life of a typical survey-based risk premium is about 2 quarters. The maximal half-life for a risk premium assuming rational expectations is about 2 months (New Zealand dollar).

It is conceivable that the earlier stylized fact that the exchange risk premium is unrelated to macroeconomic variables is in fact an artifact of the questionable methodology of rational expectations. In order to investigate this issue, we examine the correlation between the risk premium defined both ways and the VIX. The regressions take the form:

$$\eta_{t+k} = \lambda_0 + \lambda_1 VIX_t + u_t \qquad (10)$$

There appears to be a relationship between the VIX and the *ex ante* risk premium. Notably, however, the relationship between the VIX and the *ex post* risk premium does not exhibit a pattern. These results are reported in Table 5.

An increase in the VIX tends to increase the exchange risk premium for most currencies that span the entire sample. A similar finding applies to the euro legacy currencies (with the exception of the Irish punt). The Japanese yen, Canadian and Australian dollars do not exhibit a statistically significant relationship. Finally, the New Zealand dollar risk premium is negatively related to the VIX.

Given the definition of the variables -- the dollar is defined as the foreign currency -- whenever the VIX rises, the risk premium on the US dollar assets falls, or equivalently, the risk premium on the non-US dollar asset rises. This is in line with the common "safe haven" characterization that associates an increase in risk perception with a strengthening of the US dollar.

Interestingly, while there is some literature relating the VIX to the carry trade in portfolios of currency, there is little in the way of analyses pertaining to specific currency pairs. Brunnermeier, Nagel and Pedersen (2008) document that excess returns (essentially the *ex post* risk premium) are higher when the interest differential is high, but more importantly when the interest differential is positive and the VIX is high, at horizons greater than one quarter. In their regression, this shows up as a positive coefficient on the interaction of the sign of the lagged interest differential, and the current VIX. The economic motivation is that risk is particularly high when the likelihood of a currency crash – marked by an elevated VIX – is high.

We replicate this result in our sample as well. In Table 6, we present panel regression results with the dependent variable as three month excess returns (columns 1-4), and the risk premium (columns 5-6). The sample varies between one using the complete data set, and one excluding the euro legacy currencies. Instead of the interest differential, we use the forward discount, which is equivalent as long as covered interest parity holds.

We confirm that excess returns appear higher when the interest rate differential is high – at least in the complete data set. The result is not robust to excluding the euro legacy currencies (column 2). Consistent with the findings of Brunnermeier et al., "signed" VIX enters in significantly and renders the interest differential insignificant.

One salient question is whether the risk premium – as opposed to realized excess returns – respond to the same factors. We replace the excess returns with the survey based risk premium, and re-estimate the regression including the VIX. We find that for the full data set, expected excess returns (i.e., the risk premia) do depend on the VIX: a higher VIX when the differential is in favor of a given currency means a larger risk premium. The result is less pronounced in a restricted sample that excludes the euro legacy currencies. However, the VIX term is still significant at the 13% level.

Hence, we find that the relationship between realized excess returns and crash risk as proxied by the VIX is not attributable solely to expectations errors. Rather, expected return differentials respond to risk associated with crash risk.

5. Conclusions

In this study, we have re-examined the uncovered interest parity hypothesis, both using the rational expectations methodology and using the survey data methodology to identify expected exchange rate changes. We arrive at the following conclusions:

- Forward rate unbiasedness is generally rejected on a currency by currency basis.
- The forward discount deviates from expected depreciation in about a third of the currencies when using survey data based expectations. Assuming covered interest parity holds, this means the interest differential does on average predict correctly the direction of *expected* exchange rate changes. Nonetheless, one can still reject the null of uncovered interest parity in many cases, particularly at the three month horizon.
- Oftentimes, the difference in the results is linked to the finding of bias in exchange rate expectations. This pattern suggests that biased expectations are an important reason why the forward discount (and hence the interest differential) point in the wrong direction for subsequent *ex post* exchange rate changes.
- The risk premium identified using survey data differs substantially in terms of persistence and high frequency volatility from the standard risk premium. The survey-data based risk premium is much more persistent. This is consistent the with idea that the fundamental determinants of risk are persistent.
- The risk premium identified using survey data depends on the VIX— a standard measure of risk perceptions -- in a direct fashion. No such relationship is found using *ex post* realizations of exchange rate changes to proxy for expected depreciation.

- Both excess returns and the risk premium estimated using survey data depend indirectly on the VIX; when the interest differential is positive, then a higher VIX means higher returns.

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Table 1.1. Unbiasedness Regressions, Three Month Horizon

$$\Delta s_{t,t+k} = \beta_0 + \beta_1 \left(f_{t,t+k} - s_t\right) + \varepsilon_{t+k}.$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU
constant	0.011	0.008	0.008	-0.006	-0.055	0.008	-0.037	0.003
	0.032	0.030	0.031	0.032	0.061	0.031	0.053	0.034
Forward discount	-0.551	-0.010	**-0.243**	0.712	2.477	-0.115	1.509	0.220
	0.912	0.854	**0.283**	1.020	1.819	0.999	1.284	1.315
Obs.	146	146	146	146	146	146	146	130
adj.R Sq.	-0.002	-0.007	-0.003	0.005	0.067	-0.007	0.032	-0.007
DW	0.542	0.546	0.568	0.579	0.665	0.562	0.706	0.677

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	0.008	0.013	0.016	0.001	0.002	-0.065	0.034	0.004	0.003
	0.023	0.027	0.029	0.029	0.022	0.025	0.029	0.019	0.058
Forward discount	-0.051	**0.366**	1.562	-0.403	0.956	**-2.358**	-0.378	**-0.492**	0.745
	0.705	**0.291**	0.453	0.855	0.659	**0.855**	0.965	**0.565**	2.300
Obs.	279	279	279	279	279	279	279	279	250
adj.R Sq.	-0.004	0.001	0.140	-0.002	0.010	0.049	-0.003	-0.001	-0.002
DW	0.614	0.615	0.607	0.604	0.647	0.597	0.834	0.771	0.448

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1998M09, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of beta=1.

Table 1.2. Unbiasedness Regressions, Twelve Month Horizon

$$\Delta s_{t,t+k} = \beta_0 + \beta_1 \left(f_{t,t+k} - s_t \right) + \varepsilon_{t+k} .$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU	
constant	0.002	0.000	-0.003	-0.005	-0.034	-0.003	-0.029	-0.021	
	0.018	0.020	0.018	0.020	0.031	0.018	0.041	0.019	
Forward discount	**-0.954**	-0.071	**-0.295**	0.429	1.668	**-0.526**	1.068	**-1.963**	
	0.848	0.791	**0.616**	0.803	0.838	**0.662**	0.930	**1.265**	
Obs.	137	137	146	137	137	137	137	130	
adj.R Sq.	0.031	-0.007	0.000	0.005	0.116	0.009	0.048	0.064	
DW	0.182	0.188	0.197	0.174	0.285	0.183	0.154	0.265	

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	-0.001	-0.001	0.003	-0.034	-0.003	-0.091	0.018	-0.008	0.011
	0.014	0.015	0.017	0.019	0.016	0.014	0.022	0.011	0.043
Forward discount	**-0.527**	**0.054**	0.697	**-1.301**	0.404	**-2.492**	**-0.875**	-0.017	-0.361
	0.637	**0.467**	0.644	**0.700**	0.930	**0.534**	**0.545**	0.552	1. 597
Obs.	279	279	279	279	279	279	279	279	250
adj.R Sq.	0.010	-0.003	0.022	0.059	0.001	0.214	0.026	-0.004	-0.002
DW	0.190	0.185	0.150	0.227	0.181	0.284	0.185	0.181	0.122

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1997M12, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of beta=1.

Table 2.1. Uncovered Interest Parity Regressions, Three Month Horizon

$$\Delta\hat{s}^{e}_{t,t+k} = \beta_0^{'} + \beta_1^{'}\left(f_{t,t+k} - s_t\right) + \tilde{\varepsilon}_{t+k}\,.$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU	
constant	0.032	0.036	0.033	0.023	-0.002	0.036	0.032	-0.019	
	0.018	0.018	0.017	0.019	0.021	0.017	0.027	0.010	
Forward discount	0.956	0.825	0.609	1.260	1.309	1.659	0.326	0.628	
	0.439	0.477	0.258	0.614	0.346	0.431	0.452	0.267	
Obs.	141	140	141	141	141	141	141	128	
adj.R Sq.	0.071	0.048	0.112	0.122	0.141	0.166	0.004	0.007	
DW	0.366	0.374	0.379	0.526	0.433	0.309	0.410	2.255	
coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	0.002	-0.027	0.001	0.034	0.018	0.010	-0.053	-0.012	-0.068
	0.011	0.013	0.011	0.012	0.011	0.015	0.010	0.005	0.082
Forward discount	0.953	0.857	**0.198**	1.243	**0.176**	**-0.473**	**1.781**	**0.591**	2.347
	0.342	0.267	**0.150**	0.344	**0.226**	**0.415**	**0.189**	**0.188**	1.912
Obs.	272	235	272	272	272	272	272	272	243
adj.R Sq.	0.055	0.153	0.028	0.071	0.000	0.007	0.188	0.018	0.009
DW	1.272	0.857	0.666	1.263	0.959	0.654	1.430	2.282	0.141

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1998M09, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of beta=1.

Table 2.2. Uncovered Interest Parity Regressions, Twelve Month Horizon

$$\Delta \hat{s}^{e}_{t,t+k} = \beta_0' + \beta_1'\left(f_{t,t+k} - s_t\right) + \tilde{\varepsilon}_{t+k}.$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU	
constant	0.046	0.044	0.048	0.039	0.022	0.046	0.032	-0.029	
	0.007	0.007	0.006	0.008	0.009	0.007	0.008	0.008	
Forward discount	0.908	0.748	1.340	0.663	0.930	1.211	**0.429**	1.333	
	0.190	0.187	0.209	0.307	0.161	0.203	**0.189**	0.358	
Obs.	130	131	132	132	130	132	130	128	
adj.R Sq.	0.177	0.119	0.419	0.106	0.173	0.320	0.056	0.142	
DW	0.504	0.459	0.519	0.582	0.483	0.421	0.484	0.838	

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	-0.002	-0.018	-0.012	0.031	-0.009	0.030	-0.056	-0.012	-0.056
	0.007	0.007	0.007	0.007	0.008	0.008	0.005	0.003	0.027
Forward discount	1.417	0.842	1.198	1.417	1.575	**0.401**	**1.656**	0.781	1.727
	0.231	0.243	0.257	0.299	0.299	**0.268**	**0.124**	0.156	0.746
Obs.	272	233	272	272	272	272	272	272	243
adj.R Sq.	0.251	0.143	0.305	0.175	0.233	0.017	0.484	0.163	0.070
DW	0.528	0.438	0.568	0.439	0.467	0.313	0.630	1.002	0.191

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1997M12, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of beta=1.

Table 3.1 Bias, Three Month Horizon

$$\Delta s_{t,t+k} = \gamma + \theta(\Delta \hat{s}^{e}_{t,t+k}) + u_{t+k}.$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU	
constant	-0.005	0.003	0.003	-0.007	0.022	0.001	0.017	-0.003	
	0.035	0.033	0.033	0.033	0.035	0.034	0.035	0.032	
Expected depreciation	**0.222**	**0.074**	**0.059**	**0.223**	**0.254**	**0.080**	**0.256**	**-0.091**	
	0.271	**0.255**	**0.262**	**0.243**	**0.279**	**0.269**	**0.334**	**0.131**	
Obs.	141	140	141	141	141	141	141	128	
adj.R Sq.	0.003	-0.006	-0.006	0.007	0.002	-0.006	0.004	-0.006	
DW	0.548	0.554	0.558	0.580	0.482	0.562	0.662	0.711	

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	0.005	0.019	0.043	0.005	0.021	0.000	0.020	-0.001	0.009
	0.022	0.030	0.037	0.022	0.026	0.021	0.032	0.015	0.031
Expected depreciation	**-0.038**	**-0.160**	**0.150**	**-0.037**	**-0.184**	**0.010**	**-0.476**	**-0.154**	**0.106**
	0.145	**0.249**	**0.228**	**0.145**	**0.171**	**0.216**	**0.204**	**0.251**	**0.069**
Obs.	272	235	272	272	272	272	272	272	272
adj.R Sq.	-0.003	0.000	-0.002	-0.003	0.001	-0.004	0.017	0.000	0.019
DW	0.622	0.696	0.456	0.600	0.610	0.560	0.933	0.848	0.459

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1998M09, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of theta=1.

Table 3.2 Bias, Twelve Month Horizon

$$\Delta s_{t,t+k} = \gamma + \theta(\Delta \hat{s}^{e}_{t,t+k}) + u_{t+k}.$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU	
constant	0.008	0.010	-0.001	0.003	0.012	-0.002	0.003	-0.008	
	0.025	0.023	0.022	0.021	0.019	0.022	0.021	0.022	
Expected depreciation	**-0.171**	**-0.228**	**-0.019**	**-0.010**	0.279	**-0.010**	**0.297**	**0.237**	
	0.331	**0.307**	**0.268**	**0.306**	0.386	**0.281**	**0.353**	**0.331**	
Obs.	130	131	132	132	130	132	130	128	
adj.R Sq.	-0.002	0.004	-0.008	-0.008	0.008	-0.008	0.005	0.005	
DW	0.161	0.179	0.168	0.155	0.154	0.162	0.132	0.163	

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	-0.006	-0.004	0.009	-0.012	-0.003	-0.017	-0.007	-0.006	-0.004
	0.013	0.015	0.016	0.013	0.012	0.013	0.016	0.011	0.016
Expected depreciation	**0.052**	**0.308**	**0.247**	**0.055**	**0.311**	**-0.036**	**-0.055**	0.425	**0.562**
	0.182	**0.190**	**0.273**	**0.167**	**0.228**	**0.236**	**0.266**	0.393	**0.148**
Obs.	272	233	272	272	272	272	272	272	272
adj.R Sq.	-0.003	0.027	0.011	-0.002	0.023	-0.003	-0.003	0.021	0.164
DW	0.167	0.191	0.154	0.192	0.162	0.176	0.182	0.170	0.127

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1997M12, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of theta=1.

Table 4. Persistence in the Risk Premium, Three Month Horizon

coefficient	RatEx BE	Survey BE	RatEx FR	Survey FR	RatEx GY	Survey GY	RatEx IR	Survey IR	RatEx IT	Survey IT	RatEx NE	Survey NE	RatEx SP	Survey SP	RatEx EU	Survey EU
constant	-0.004	-0.013	0.002	-0.015	0.003	-0.015	0.006	-0.008	-0.003	-0.002	-0.007	-0.009	0.011	0.002	0.005	-0.006
	0.028	0.014	0.027	0.014	0.035	0.017	0.026	0.014	0.029	0.010	0.029	0.011	0.031	0.012	0.028	0.018
Lagged dep. Var.	**0.215**	**0.573**	0.185	**0.567**	0.084	0.326	**0.219**	**0.555**	0.143	**0.648**	0.142	**0.674**	0.180	**0.657**	0.150	**0.390**
	0.102	**0.108**	0.109	**0.098**	0.102	0.248	**0.089**	**0.115**	0.109	**0.075**	0.089	**0.075**	0.115	**0.087**	0.110	**0.041**
Obs.	49	49	49	49	49	49	49	49	49	49	49	49	49	49	43	43
adj.R Sq.	0.025	0.299	0.012	0.295	-0.014	0.086	0.025	0.284	-0.001	0.404	-0.001	0.433	0.010	0.413	0.001	0.129
Q(4)-stat	7.438	2.705	7.665	3.056	3.612	5.174	10.04	2.391	6.182	3.424	9.009	2.193	0.879	4.872	2.594	0.801
p-value	0.114	0.608	0.105	0.548	0.461	0.270	0.04	0.664	0.186	0.490	0.061	0.700	0.928	0.301	0.628	0.938

coefficient	RatEx DE	Survey DE	RatEx NO	Survey NO	RatEx SN	Survey SN	RatEx SW	Survey SW	RatEx UK	Survey UK	RatEx JP	Survey JP	RatEx AU	Survey AU	RatEx CA	Survey CA	RatEx NZ	Survey NZ
constant	0.011	-0.007	0.015	0.006	-0.010	0.002	-0.016	-0.025	0.002	-0.001	-0.031	-0.023	0.012	0.018	0.010	0.012	0.008	0.015
	0.020	0.010	0.024	0.010	0.028	0.009	0.023	0.012	0.024	0.007	0.025	0.008	0.024	0.009	0.014	0.005	0.025	0.029
Lagged dep. var	0.146	**0.493**	0.100	**0.545**	**0.256**	**0.458**	0.072	**0.447**	0.157	**0.632**	0.041	**0.631**	0.154	0.260	**0.154**	**0.235**	**0.349**	**0.764**
	0.080	**0.078**	0.093	**0.128**	**0.071**	**0.097**	0.084	**0.101**	0.090	**0.069**	0.064	**0.056**	0.106	0.167	**0.051**	**0.104**	**0.100**	**0.090**
Obs.	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	82	82
adj.R Sq.	0.011	0.228	-0.001	0.284	0.055	0.203	-0.006	0.191	0.014	0.392	-0.009	0.379	0.013	0.059	0.013	0.045	0.113	0.603
Q(4)-stat	4.861	1.069	1.841	1.532	2.329	6.154	6.139	2.039	6.069	7.227	12.71	9.669	0.552	4.730	3.356	14.22	1.155	3.693
p-value	0.302	0.899	0.765	0.821	0.675	0.188	0.189	0.729	0.194	0.124	0.013	0.046	0.968	0.316	0.500	0.007	0.885	0.449

Notes: Estimates from autoregression. Newey-West standard errors. Top panel, 1986q3-1998q4, except for EU, 1999q1-2009q3. The date pertains to when forecasts are made. Bottom panel, 1986q3-2009q3. Entries in **bold face** denote significance at the 5% level, for null hypothesis of rho=0.

Table 5.1: Three month ex ante Risk Premium and VIX

$$\eta_{t+k} = \lambda_0 + \lambda_1 VIX_t + u_t$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU
constant	-0.18	-0.196	-0.193	0.178	-0.161	-0.211	-0.177	-0.013
	0.043	0.043	0.043	0.042	0.038	0.041	0.053	0.031
VIX	**0.006**	**0.007**	**0.007**	**-0.007**	**0.007**	**0.008**	**0.008**	0.001
	0.003	**0.003**	**0.003**	**0.003**	**0.003**	**0.003**	**0.004**	0.002
Obs.	101	100	101	101	101	101	101	128
adj.R Sq.	0.153	0.196	0.144	0.208	0.202	0.233	0.167	0.007
DW	0.632	0.671	1.126	0.785	0.801	0.594	0.612	2.233

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	-0.095	-0.124	-0.127	-0.115	-0.091	-0.033	0.005	-0.022	0.126
	0.024	0.028	0.038	0.026	0.033	0.029	0.034	0.018	0.033
VIX	**0.004**	**0.007**	**0.006**	**0.004**	**0.004**	-0.002	0.002	0.002	**-0.006**
	0.001	**0.001**	**0.002**	**0.001**	**0.002**	0.001	0.002	0.001	**0.002**
Obs.	232	195	232	232	232	232	232	232	232
adj.R Sq.	0.094	0.263	0.185	0.061	0.086	0.02	0.017	0.038	0.171
DW	1.51	1.346	1.335	1.427	1.229	0.728	1.445	2.328	1.605

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1997M12, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of lambda=0.

Table 5.2: One year ex ante Risk Premium and VIX

$$\eta_{t+k} = \lambda_0 + \lambda_1 VIX_t + u_t$$

coefficient	BE	FR	GY	IR	IT	NE	SP	EU
constant	-0.099	-0.093	-0.107	0.073	-0.054	-0.112	-0.064	0.03
	0.015	0.017	0.015	0.019	0.018	0.014	0.022	0.012
VIX	**0.003**	**0.003**	**0.003**	-0.002	0.002	**0.003**	0.003	-5.00E-06
	0.001	**0.001**	**0.001**	0.001	0.001	**9.00E-04**	0.001	6.00E-04
Obs.	101	100	101	101	101	101	101	128
adj.R Sq.	0.203	0.177	0.247	0.111	0.072	0.307	0.131	-0.008
DW	1.035	0.982	1.026	0.94	0.945	1.032	0.694	0.819

coefficient	DE	NO	SN	SW	UK	JP	AU	CA	NZ
constant	-0.038	-0.036	-0.034	-0.059	-0.03	-0.032	0.033	0.015	0.044
	0.015	0.015	0.015	0.017	0.015	0.018	0.013	0.008	0.016
VIX	**0.002**	**0.003**	**0.002**	**0.002**	**0.001**	-0.001	7.00E-04	-4.00E-05	**-0.002**
	7.00E-04	**7.00E-04**	**7.00E-04**	**7.00E-04**	**6.00E-04**	8.00E-04	7.00E-04	4.00E-04	**7.00E-04**
Obs.	232	195	232	232	232	232	232	232	232
adj.R Sq.	0.069	0.143	0.089	0.05	0.042	0.024	0.011	-0.004	0.08
DW	0.484	0.552	0.493	0.443	0.447	0.347	0.592	0.99	0.393

Notes: OLS regression estimates; Newey-West standard errors. Top panel, 1986M08-1997M12, except for EU, 1999M01-2009M10. The date pertains to when forecasts are made. Bottom panel, 1986M08-2009M10, except for NZ, 1989M01-2009M10. Entries in **bold face** denote significance at the 5% level, for null hypothesis of lambda=0.

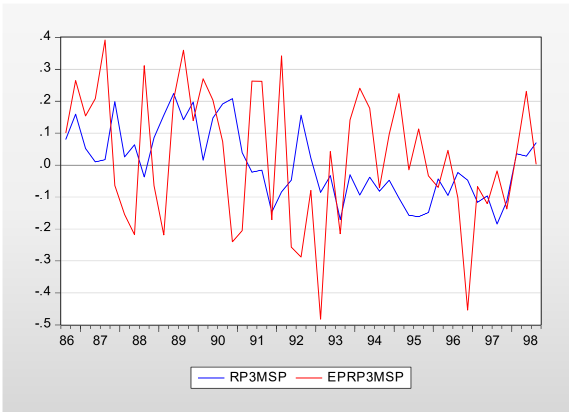
Table 6: Three Month Excess Returns and Risk Premium and VIX

$$\eta_{t+k} = \kappa_0 + \kappa_1(f_{t,t+k} - s_t) + \kappa_2 sign(f_{t,t+k} - s_t)_{t-1} \times VIX_t + u_t$$

coefficient	(1) Excess returns	(2) Excess returns	(3) Excess returns	(4) Excess returns	(5) Risk premium	(6) Risk premium
Forward discount$_t$	**0.317**	0.241	-0.018	-0.180	**0.311**	**0.441**
	0.165	0.241	0.162	0.281	**0.180**	**0.239**
Sign(forward discount)$_{t-1}$xVIX			**0.001**	**0.001**	**0.0005**	0.0005
			0.0003	**0.0005**	**0.0002**	0.0003
Obs.	3777	2379	2984	1944	2968	1938
adj.R Sq.	0.002	0.002	0.002	0.002	0.141	0.152
Cross-section	17	9	17	9	17	9

Notes: OLS regression estimates; PCSE corrected for within heteroscedasticity and first order serial correlation. Entries in **bold face** denote significance at the 10% level, for null hypothesis of coefficient=0. The forward discount stands in for the interest differential

Figure 1
Three Month Risk Premia



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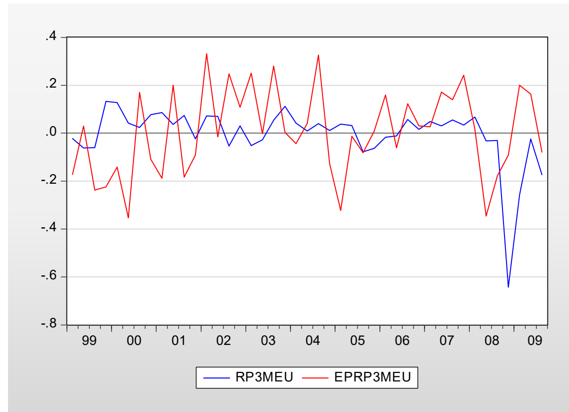

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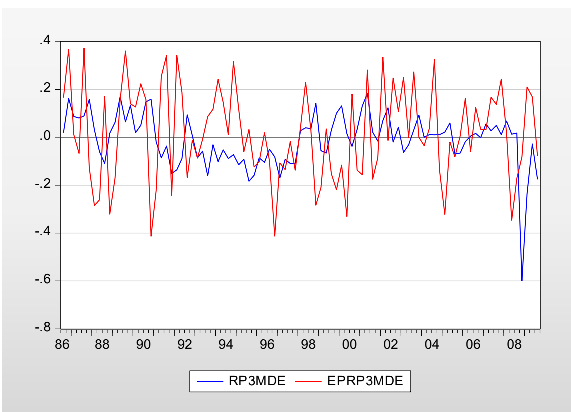

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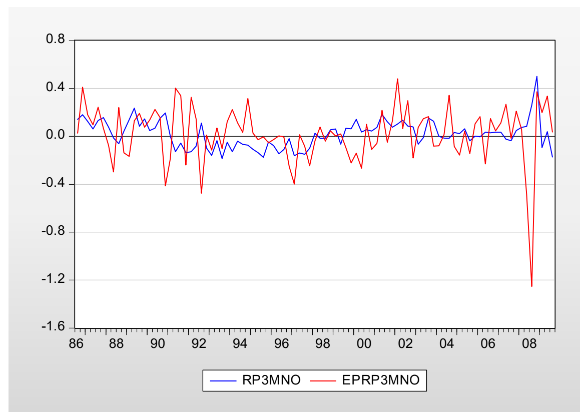

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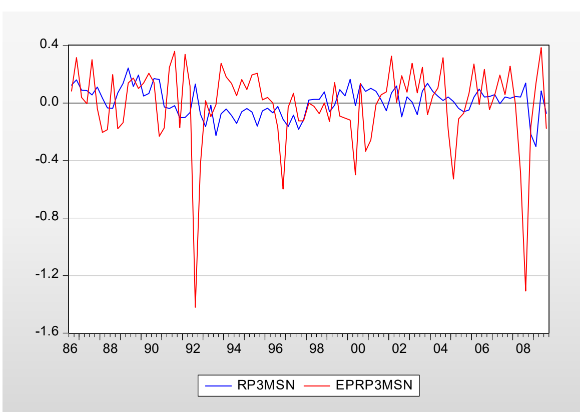

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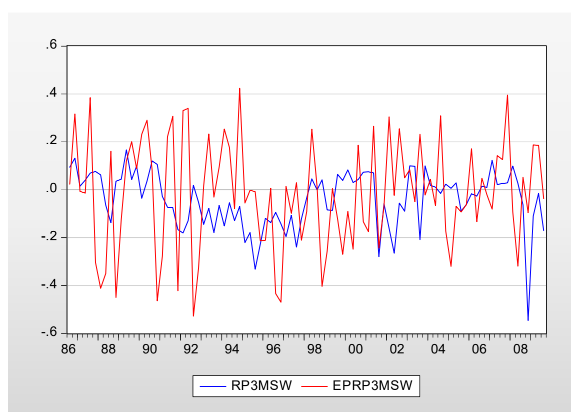

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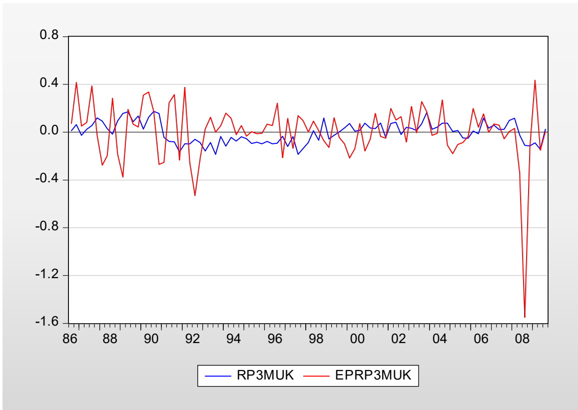
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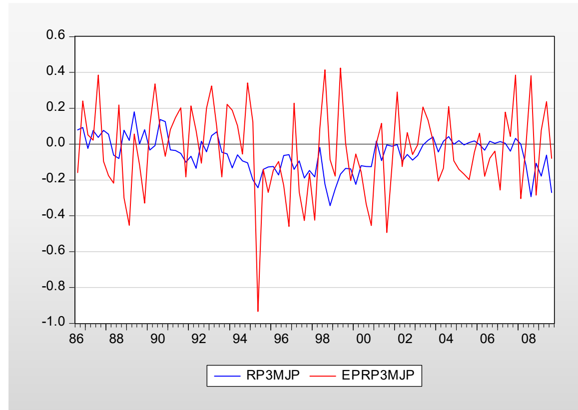
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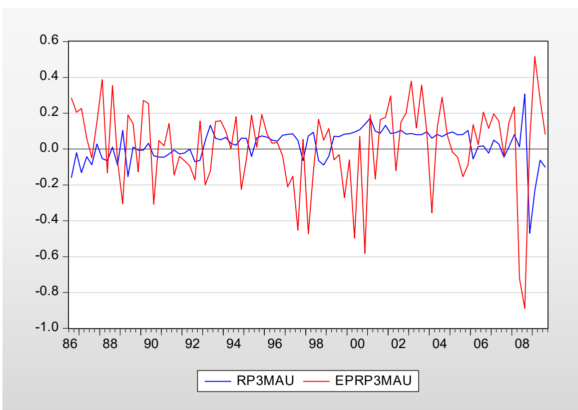
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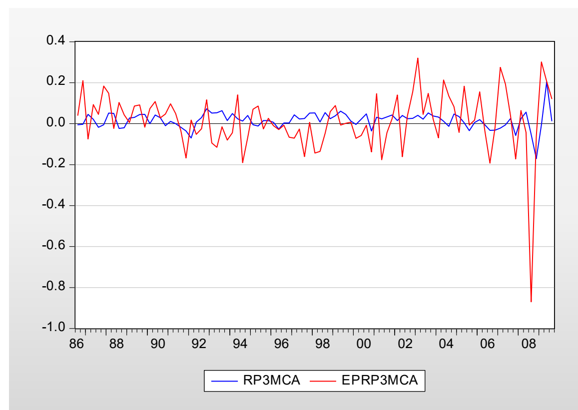
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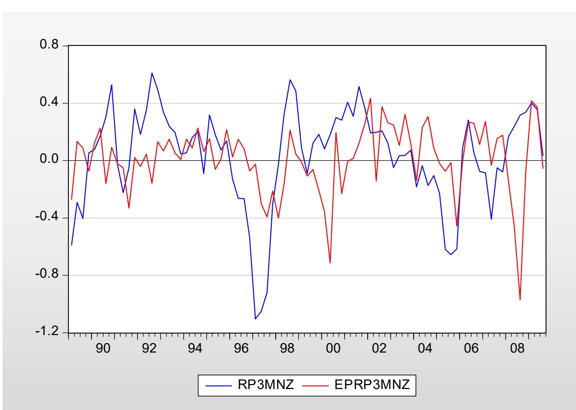
RP3MNZ
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