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by

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Exchange Rate Forecasts and Expected Fundamentals*

Christian D. Dick[a], Ronald MacDonald[b], Lukas Menkhoff[**]

Abstract

Using a large panel of individual professionals' forecasts, this paper demonstrates that good exchange rate forecasts are related to a proper understanding of fundamentals, specifically good interest rate forecasts. This relationship is robust to individual fixed effects and further controls. Reassuringly, the relationship is stronger during phases when the impact from fundamentals is more obvious, e.g., when exchange rates substantially deviate from their PPP values. Finally, forecasters largely agree that an interest rate increase relates to a currency appreciation, but only good forecasters get expected interest rates right.

Keywords: Exchange Rate Determination, Individual Expectations, Macroeconomic Fundamentals

JEL: F31, F37, E44

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1 Introduction

Exchange rates are among the most important prices in open economies. In contrast, however, to their importance for firms, investors, and policy-makers, there is a considerable lack of understanding on the underlying determinants of exchange rates. At intermediate horizons, such as a month or half a year ahead, exchange rates seem to be hardly explained at all and, in particular, seem to be disconnected from fundamentals (Obstfeld and Rogoff, 2000; Engel, 2014). This disconnect is surprising, given the fact that foreign exchange markets react to changes in economic fundamentals within minutes (Andersen, Bollerslev, Diebold, and Vega, 2003) and that exchange rates reflect long-term changes in purchasing power (Taylor and Taylor, 2004). At intermediate horizons, however, the relationship between fundamentals and exchange rates seems to be largely unobservable (Frankel and Rose, 1995; Rogoff, 2007; Rossi, 2013). In this paper we suggest a new approach to uncovering potential connections, and provide evidence that fundamentals may indeed shape exchange rates.

Our motivation rests on the notion that the relationship between exchange rates and fundamentals is quite complex, for several reasons. First, the asset market approach to exchange rates emphasizes that *expected* fundamentals can have a greater impact on today's exchange rates than actual observed fundamentals, as emphasized by, for example, Engel and West (2005). Second, it is known that market participants possess and use fundamentals in heterogeneous ways (see Ito, 1990; MacDonald and Marsh, 1996), and that the use of fundamentals may change over time (e.g. Sarno and Valente, 2009). Finally, market participants do not only use fundamentals but also non-fundamentals as information in their decision making (Menkhoff and Taylor, 2007). Each of these sources of complexity may explain why conventional tests of exchange rate models in the spirit of Meese and Rogoff (1983) - regressing exchange rate changes on changes in fundamentals - fail (Cheung, Chinn, and Garcia-Pascual, 2005): the reason is not necessarily the above mentioned "disconnect" but possibly the use of a "false" model, i.e. a model that cannot account well enough for existing complex relations.

In order to circumvent this problem, we propose a research strategy which aims at making potential links between exchange rates and fundamentals visible without requiring a specific exchange rate model: the basic idea is to examine whether there is a positive relationship between good exchange rate forecasting and good forecasting of exchange rate fundamentals by the *same individual*. This approach relies on survey data, i.e. on *expected* rather than *realized* data. Moreover, we do not make structural assumptions on forecasting *behavior*, but consider forecasting *performance* as an objective criterion. The reliance on performance requires no information on how (time-varying) fundamentals are used.

For our sample of more than 1,050 Germany-based professionals, we find that good US Dollar-Euro forecasters also make good interest rate forecasts for the U.S. and the Euro area. Thus we confirm the link between interest rates and exchange rates which is expressed in exchange rate models and by foreign exchange traders

(Cheung and Chinn, 2001). This contemporaneous link is shown here for the first time in individual expectation data. In three more examinations we elaborate this link, suggesting that information about fundamentals is systematically linked to good exchange rate forecasts.

As a first examination we exploit the available panel approach by estimating individual fixed effects. These effects take account of unobserved heterogeneity between professional forecasters and thus control for a general ability to make good forecasts. We find that beyond individual differences in forecasting performance, our relationship of interest remains valid. Next we find that our main result is robust to the consideration of more fundamentals and year-specific effects. Finally, it tentatively holds for additional available currencies. All this does not prove a causal impact from interest rates expectations on exchange rate forecasts but is shows a strong relation between understanding fundamentals and exchange rates; and this relation is not driven by individual ability, certain years or a single exchange rate.

Second, we test an implication of our main result: if good interest rate forecasts go along with good exchange rate forecasts, this relationship will be stronger when the impact of fundamentals on exchange rates is more obvious. The relationship between fundamentals and exchange rates may be closer if there is a consensus about the impact of fundamentals, for example, when exchange rates deviate more strongly from their PPP value. Our evidence supports this time-varying relation.

Third, we test our relationship of interest by applying it to a simple mechanism of exchange rate determination. This mechanism picks up a standard relationship of international macro policy: a currency with a relatively increasing expected interest rate is expected to appreciate over the same period. We find that on average professionals' forecasts are consistent with this mechanism. However, it can be shown that good forecasters are more successful in using the right interest rate differential as an input to this model.

In summary, this procedure demonstrates a link between fundamentals and exchange rates by considering the forward looking nature of this market, the possibly time-varying relation between fundamentals and exchange rates and the heterogeneity of forecasters. We are unaware of researchers using the procedures proposed in this paper before. Nevertheless, this research is based on, and related to, a number of earlier studies addressing (1) exchange rate modeling and (2) exchange rate expectations.

Regarding exchange rate forecasting some progress has recently been made by relying on Taylor-rule fundamentals (Engel, Mark, and West, 2008; Molodtsova and Papell, 2009; Ince, 2014) or net foreign asset positions (Gourinchas and Rey, 2007; Della Corte, Sarno, and Sestieri, 2012). However, there remains considerable instability (Rossi, 2013). Conventional tests may fail because coefficients in exchange rate models seem to vary over time (e.g., Rossi, 2005). Bacchetta and Van Wincoop (2013) argue that market participants attach too much weight to a certain "scapegoat" variable diminishing the importance of other exchange rate fundamentals (see also ter Ellen, Verschoor, and Zwinkels, 2013). According to the order flow approach, there is dispersed private information about how to anticipate and interpret fundamental information which drives a wedge between published fundamentals and exchange rates (e.g. Evans and Lyons, 2002; Bacchetta and Van Wincoop, 2006; Chinn and Moore, 2011). Finally, Engel and West (2005) highlight the fact that exchange rates, as financial market prices, are determined by expectations about *future* fundamentals so that exchange rates do not need being related to *contemporaneous* fundamentals (see also Engel, Mark, and West, 2008). Overall, the relationship between exchange rates and fundamentals may be difficult to detect by a Meese-Rogoff approach.

Regarding exchange rate expectations, Ito (1990) was the first to examine a small group of exchange rate forecasters individually, finding that they differ from each other. Further studies have analyzed heterogeneity (see the survey by Jongen, Wolff, and Verschoor, 2008), focusing on different currencies (Chinn and Frankel, 1994; MacDonald and Marsh, 1996), on the process of expectation formation (Bénassy-Quéré, Larribeau, and MacDonald, 2003), on the use of charts and fundamentals (Menkhoff and Taylor, 2007), on individual differences in forecasting performance (Elliot and Ito, 1999) or on individual expectations about fundamentals (Dreger and Stadtmann, 2008). We learn from these studies that there are various dimensions of heterogeneity among individual exchange rate forecasters and that heterogeneity is important for modeling (Frankel and Froot, 1990; De Grauwe and Grimaldi, 2006) and pricing in foreign exchange (Beber, Breedon, and Buraschi, 2010). This motivates analyzing individual data and considering potentially rival influences from non-fundamental forces, such as chartism.

Our study is based on the Centre for European Economic Research's (ZEW, Mannheim) monthly survey among financial market professionals, who give their forecasts about several variables, including exchange rates, interest rates and other macroeconomic fundamentals. As responses are marked by a personal identification number, every single forecast response during the 18-year history of the survey can be related to an actual individual. We decided to include individuals with a minimum of 10 responses, i.e. considering holidays etc. equal to about one year. This leaves us with more than 1,050 professionals and more than 63,000 responses.

The paper is structured as follows. Section 2 presents data used and Section 3 documents our measurement of forecasting performance. Results are discussed in Section 4. Section 5 presents robustness exercises and Section 6 concludes.

2 Data

Microdata of forecasts We consider USD/EUR exchange rate forecasts by financial professionals as collected in a unique panel spanning 18 years of individual forecasts made in the context of the Financial Market Survey by the Centre for European Economic Research (ZEW) in Mannheim, Germany. These forecasters work in various areas of the financial industry or in financial departments of industrial companies. The forecasts collected in the ZEW Financial Market Survey have been used in various recent empirical studies in finance and macroeconomics, such as Schmeling and Schrimpf (2011) or Schmidt and Nautz (2012). The reason for the popularity of this data set lies in the relatively high frequency of the survey point (monthly), and the relatively high number of responses per point: the data set comprises 216 survey points from 12.1991 to 11.2009, with an average number of responses of 307; hence, the microeconomic panel is both relatively long and broad, summing up to a total of more than 1,700 forecasters and 64,000 observations. As a meaningful measurement of forecasting performance requires a certain minimum number of responses per forecaster, we omit forecasters with less than 10 USD/EUR forecasts. This reduces the sample to 1,054 forecasters. Table 1 provides more details on the structure of the survey responses. The US Dollar forecasts are of a qualitative nature; i.e., forecasters indicate whether the USD is expected to appreciate, remain unchanged or depreciate compared to the Euro within the subsequent six months.[1]

Table 1 about here

This data set is well suited for the particular research topic of this paper for three reasons: first, and consistent with, for example, Consensus Forecasts, the ZEW Financial Market Survey includes a variety of targeted macroeconomic and financial variables, and the forecasters tend to respond to all of the central questions when they take part (there are only 1.3% missing responses for USD/EUR forecasts, and even less than 0.5% for European interest rate forecasts). This allows us to consider the USD/EUR forecasts in connection with the interest rate forecasts of the identical forecaster at the same point in time, which is the main focus of our study; in addition, we also have simultaneous forecasts with respect to other exchange rates (GBP/EUR, JPY/EUR), inflation rates and economic activity, which we use as control variables in our regressions. Second, we have access to the *individual* forecasters' predictions rather than the consensus forecasts and as the observations are associated with person-specific IDs, we are able to study the heterogeneity in forecasting performance across forecasters. Third, we have exact information about the date on which an individual forecaster replies to the survey, which allows us to relate forecasts to precise exchange rate realizations, such as the reference point of a forecast, or the trend of the last 30 days before the forecast was made.

Exchange rates The period of interest between 12.1991 and 11.2009 includes the transition from national currencies to the Euro. We therefore consider the US Dollar (USD) with respect to the D-Mark (DM, before 01.1999) and the Euro (EUR, after 01.1999). Hence, we convert the DM/USD exchange rates into USD/EUR rates for the period before 01.1999.[2] We consider both spot exchange rates as well as the one-month

[1] The relevant survey question was (after 01.1999) "*In the medium-term (6 months), the following currencies compared to the Euro will appreciate/stay constant/depreciate.*" or (before 01.1999) "*The exchange rate (D-Mark per one unit foreign currency) of the following currencies will increase/not change/decrease.*".

[2] Please note that in this paper the spot rate S_t and also the forward rate $F_{t,k}$ are given as units of foreign currency per Euro, which implies that $S_{t+1} - S_t > 0$ corresponds to a depreciation of the foreign currency with respect to the Euro.

forward exchange rates on a daily basis. In a few cases we replace missing exchange rates (e.g. from weekends) with those recorded on the preceding trading day.

3 Forecasting performance

This section introduces in the way we measure forecasting performance and why we choose specific concepts for exchange rates and fundamental variables, respectively.

Measuring forecasting performance with respect to exchange rates For the measurement of forecasting performance, we follow several authors who have argued that forecasts about marketable assets should be evaluated from an investor's perspective by a zero net investment trading rule (Leitch and Tanner, 1991; Anatolyev and Gerko, 2005). Accordingly, we translate the qualitative forecasts of respondents into a long/short position, i.e., we translate an appreciation expectation into a buy etc. In detail, we follow Elliot and Ito (1999) who formulate a trading strategy in which sophisticated investors take a long USD position using the forward market when they expect the US Dollar to appreciate, such that $F_{t,k} > E_{i,t}[S_{t+k}]$, and take a short USD position when they expect the US Dollar to depreciate, such that $F_{t,k} < E_{i,t}[S_{t+k}]$, where $E_{i,t}[S_{t+k}]$ represents the subjective expectation of forecaster i.[3]

The usage of trading rules is easily adaptable in the context of monthly qualitative forecasts. In the underlying survey, the professional forecasters have to respond to the question: do they expect a foreign currency to appreciate or depreciate compared to the Euro with the current *spot* rate as the reference point. A natural trading strategy, T_{ind}, triggers a trade in the forward market according to the expected direction of change of spot exchange rates. Given the monthly intervals of decision points, but a six-month horizon of forecasts, a decison regarding this incongruence has to be made. We assume that forecasters will focus on the latest available information, i.e. that they prefer to consider eventual monthly forecasting updates over earlier formed six-months expectations. Thus the implementation of a trading rule relies on *one*-month-forwards regardless the *six*-month forecast horizon: the one-month forward contract will then be settled one month later in the spot market, and a new trade will be made in the forward market according to the subsequent forecast. As forward rates are linked to interest rates differentials through covered interest rate parity, the log returns of the trading rule take account of refinancing costs.[4] We consider the log returns of T_{ind} based on the prediction of forecaster j, i.e.

$$r_{j,t,t+1} = I_t(s_t > E_{j,t}[s_{t+1}])(f_{t,1} - s_{t+1}) + I_t(s_t < E_{j,t}[s_{t+1}])(s_{t+1} - f_{t,1}) \quad (1)$$

[3]Strictly speaking forecasts refer to spot rates but the trading rule also considers interest rate differentials. We show in the robustness section that this slight inconsistency does not drive our results.

[4]As the paper aims at comparing forecasting performance rather than establishing evidence for profitable trading strategies for investors, *transaction* costs (e.g., bid/ask spreads) are ignored.

as the performance measure for exchange rate forecasts. $r_{j,t,t+1}$ varies across forecasters and time and may thus be used in the context of panel regressions.

Compared to alternative measures, there are important advantages to using trading rules as a forecast performance measure: first, conventional statistical measures (such as the mean squared error) underlie narrow assumptions about a forecasters' loss function (e.g., quadratic).[5] Second, the trading rule-approach avoids the loss of information by a categorization of continuous realizations of exchange rate movements into an *appreciate*, a *constant* and a *depreciate* range. Third, we are able to compute the average profit and the Sharpe ratio for each forecaster. The latter is relevant in cross sectional analysis as profits from trading strategies typically depend on their risk, which may be different for several forecasters.[6] Sharpe ratios can also be linked to other studies on exchange rate models (Jordà and Taylor, 2012; Rime, Sarno, and Sojli, 2010) or carry trade strategies (Burnside, Eichenbaum, Kleshchelski, and Rebelo, 2011; Menkhoff, Sarno, Schmeling, and Schrimpf, 2012). For example, Jordà and Taylor (2012) compare Sharpe ratios in their analysis of carry trades to the longer-run Sharpe ratio for the S&P 500 of about 0.4.

TABLE 2 ABOUT HERE

It can be seen from Table 2 that the annual Sharpe ratio of the median forecaster amounts to 0.11, which is rather low. This indicates that a trading strategy based on some average exchange rate forecast is unlikely to be profitable in practice, in particular as transaction costs are not yet taken into account. However, the annual Sharpe ratio for the forecaster at the 95% percentile amounts to 1.19, which is substantial. Table 2 also shows that Sharpe ratios of greater than 0.4 can be achieved by the forecasts of almost 30% of the forecasters. Overall, these statistics demonstrate the heterogeneity in forecasting performance across the sample, which is central to the strategy followed in our analysis.

Measuring forecasting performance with respect to fundamentals

Unlike currencies, macroeconomic fundamentals are not tradeable assets. As performance measures based on trading rules are not available, we rely on a measure of *forecast errors* by comparing forecasts with their respective realizations. For this purpose, the directional forecasts (e.g., the interest rate rises, stays constant, or decreases)[7] are coded for simplicity in $X^e_{i,t+6} \in \{1, 0, -1\}$, an approach also applied by, for example, Souleles (2004). Likewise, the realizations (observed interest rates, inflation rates, growth rates of industrial production) are also categorized into three corresponding groups. It has to be noted, however, that the latter step depends

[5] While we argue that trading rules are more appropriate to measure exchange rate forecast performance in our setting, we also apply an error-based concept in the robustness section, and find similar results.

[6] The choice of the neutral ("no change") category provides an opportunity to reduce the risk by following a trading strategy. Furthermore, we are considering an unbalanced panel, such that some forecasters may have been active in phases with higher volatility (and higher profit opportunities at the same time).

[7] For economic activity, the Financial Market Survey asks whether the *economic situation* will improve, remain unchanged, will worsen over 6 months.

on the choice of threshold values for a no-change category. In our baseline regression, we choose symmetric threshold values such that, over the entire time span, the share of observations in the no-change category for *realizations* is equally large as the share of *forecasts* in this category. In the robustness part of the paper, we deviate from this principle and also use asymmetric as well as broader and wider thresholds. Table 3 summarizes our chosen threshold values.

Table 3 about here

Regarding the baseline regressions, for instance, we group realizations into this category if the yearly industrial production growth rates (inflation rates) six months ahead are not more than 2.2 (0.345) percentage points different from the current ones. Short-term interest rates are categorized into this middle category if they have not changed by more than 11 percent within a six-month horizon. As a consequence, the share of forecasts in the no-change category is 40 percent for short-term interest rates, 45 percent for industrial production and for inflation in the Eurozone/Germany. The figures are similar for the U.S. for inflation and interest rates; for industrial production, however, the unchanged category contains 54 percent of the observations.

It has to be noted that in this setting, forecasters can be wrong to two different extents: they make a *small* error when they predict an unchanged variable, whereas the actual outcome is an increase, but a *severe* error if they predict a decline. We take account of the severity of these errors by computing absolute forecast errors by $|_t\varepsilon_{i,t+6}(X)| = |_tX^e_{i,t+6} -_t X_{t+6}|$, which takes on 2 for a severe error, 1 for a small error and 0 for a correct prediction.

Table 4 presents the cross-section of average absolute forecast errors, $|\varepsilon(\bar{X}_{j,t})|$ for different macroeconomic fundamentals, including U.S. and Eurozone interest rates. It can be seen that the forecasters tend to commit less severe forecast errors for the interest and inflation rate in the Eurozone compared to the United States, while this is reverse for industrial production.

Table 4 about here

Relating exchange rates to fundamentals We argue that an economic performance measure is in general preferable to a pure error measure. Hence, we apply such a measure in the context of exchange rate predictions. Unfortunately, a similar performance measure is not available for fundamental forecasts. Consequently, some asymmetry between the LHS and RHS variables, regarding measure and horizon, seems unavoidable. Nevertheless, we show in the robustness section that more symmetric definitions of LHS and RHS variables, including a 6-month error measure for both sides, do not change qualitative results.

4 Empirical analysis

This section presents results starting with describing the fundamental relationship between (forecasting performance with respect to) fundamentals and exchange rates (Section 4.1). We then test whether this relation holds in a panel approach (Section 4.2), whether an implication holds (Section 4.3) and whether it can be revealed from forecasters' implicitly expected relation between interest rate and exchange rate forecasts (Section 4.4).

4.1 Performance on exchange rate and interest rate forecasts

This paragraph shows the basic relationship that we find throughout various analyses of our data: a positive link between forecast performance for exchange rates and for an important fundamental variable; namely, interest rates. As introduced above, the measurement units for the respective performance measures are the *average return* of T_{ind} for exchange rate forecasts, and *absolute forecast errors* for interest rate forecasts. We find for the 1,054 forecasters in our sample a negative relationship between the U.S. interest rate forecast errors and the returns earned from their USD/EUR-forecasts; that means, performance is positively related across the forecasted variables. In fact, the correlation coefficient of -0.23 is statistically significant at any conventional level. Also a negative, although weaker relationship is found between forecast errors with respect to Eurozone interest rates and U.S. dollar forecast performance; the corresponding correlation coefficient is -0.08, which is significant at the 5% level.

This contemporaneous relation between good exchange rate forecasts and good interest rate forecasts has, to the best of our knowledge, not been demonstrated before and indicates that the understanding of fundamental variables may be helpful for understanding exchange rates. However, this relation needs further examination to prove that it is not accidental but meaningful.

4.2 Panel analyses

While we have demonstrated *correlation* between the performance with respect to interest rate and exchange rate forecasts further analyses are required: (i) to rule out that forecasting ability for both interest rates and exchange rates does not jointly arise because a forecaster is particularly skilled, (ii) to check that this result is robust to the consideration of alternative fundamental forecasts and (iii) to test whether results depend on specific years. This section introduces a panel approach which looks into the individual forecasts rather than the forecaster-specific aggregates and uses fixed effects, further fundamental variables and year dummies to address (i)-(iii), respectively.

The model We conduct fixed effects panel regressions of the individual return of a trading strategy

T_{ind}, $r_{j,t,t+1}$, based on an individual forecast by forecaster j in period t on the absolute error the forecaster makes with respect to the interest rates in the Eurozone ($\varepsilon_{j,t}(i^{EUR})$) or the United States ($\varepsilon_{j,t}(i^{USD})$), as well as on a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$ in different specifications, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}. \tag{2}$$

By following the fixed effects methodology we rule out that unobserved heterogeneity across forecasters drives our results, in particular, that a general individual forecasting ability drives forecasting performance. By doing so we can attribute a change in exchange rate forecast performance (compared to an individual forecaster's average performance) to changes in $|\varepsilon_{j,t}(i^{EUR})|$, $\Phi_{j,t}$ or $\Psi_{j,t}$. In line with this idea, the Breusch-Pagan tests reject the null of no individual-specific effects particularly for the simpler specifications (i.e. (i)-(iv) from Table A6). Moreover, the Hausman tests confirm that a fixed effects estimator should be applied, as random effects are inconsistent for virtually all specifications.[8]

The effect of interest rate forecasts

Table 5 reports the results of the fixed effects regression of the return earned from T_{ind} (i.e., our forecasting performance measure) on the absolute forecast error with respect to interest rates as well as various control variables: *negative* coefficients for the error variables $|\varepsilon(i)|$ indicate that *more severe* errors in the predictions of interest rates are associated with *lower* success in predicting exchange rates.

Table 5 about here

Specifications (i) and (ii) only consider the influence of absolute interest rate forecast errors on returns, and find a negative and significant relationship. This effect is economically important as, for example, an increase in U.S. interest rate forecast error by one error point is associated with a decrease of the monthly return by 19 basis points. A similar relationship (14 basis points) holds for the forecast error with respect to the Eurozone interest rates. These exact basis point figures depend of course on the definition of LHS and RHS dimensions. We emphasize that the meaningful relation also holds when we change the LHS-variable from a trading rule return to an error measure (see robustness section).

Controlling for other fundamentals and year effects Depending on the specification, the vector of control variables, $\Phi_{j,t}$, includes individual forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. These control variables are chosen to single out the effect of *interest rate* forecasts while at the same time acknowledging that inflation and economic activity are further important fundamentals to exchange rates. As columns (iii) and (iv) in Table 5

[8] See Table A1 in the Appendix for detailed results.

show, the coefficients for the interest rate forecast errors remain virtually unchanged when further fundamentals are controlled for.

It has to be highlighted that the results are confirmed when we control for the cross-sectional average error with respect to inflation and industrial production growth forecasts (see specifications (v) and (vi)); hence, our findings are not driven by those periods in which it is particularly easy or difficult to forecast the macroeconomic environment. Moreover, the results are also stable and even more pronounced when we additionally control for year dummies in specifications (vii) to (ix).

We also find tentatively negative relationships between forecasting errors made for the non-interest rate fundamentals and exchange rate forecasting performance. However, we do not want to overinterpret these coefficients because some correlations between variables may be at work which go beyond our research agenda. At least, it can be noticed from specification (x) that the coefficients for inflation and growth forecast errors remain stable when interest rate forecast errors are excluded from the regression; hence, interest rate forecast errors appear to be important as such and not as a matter of their relation to other macroeconomic forecasts.

4.3 Exchange rate and fundamentals: interaction in market phases

In the following, we test an implication of our main result, namely that the impact of correctly expected fundamentals on exchange rates depends on *market phases*, which is motivated by studies mentioned above finding a time-varying influence of fundamentals on exchange rates (e.g., Rossi, 2005; Bacchetta and Van Wincoop, 2013). In order to define relevant market phases, we build on insights from the empirical literature on exchange rate behavior: Following several studies on PPP (e.g. Taylor, Peel, and Sarno, 2001; Christopoulos and Leon-Ledesma, 2010) we hypothesize that fundamentals are more important for exchange rate forecasts when there is a strong obvious misalignment of the nominal exchange rate from its PPP value.

Defining market phases We define market phases on the basis of the prevailing market conditions. When the nominal exchange rate deviates strongly from its PPP value, the exchange rate can be expected to revert to its fundamental value. Thus, we capture such *value phases* by a dummy variable labeled FUND_t. More specifically, following the concept of real exchange rates, we compute a ratio of the CPI in Germany compared to the CPI in the United States,[9] i.e. (in logs)

$$q_t = s_t + p_t^{EUR} - p_t^{US}, \qquad (3)$$

where p_t represent the CPIs, s_t the log exchange rate and q_t the ratio. If q_t is relatively large (small), the USD is relatively undervalued (overvalued) compared to the EUR in real terms. We take a recursive approach by

[9] To avoid a structural break, we take the German CPI as reference base for the entire time span. Using the CPI for the entire Eurozone for the entire time span yields similar results.

comparing q_t to its distribution over the preceding ten years at each point in time. FUND_t equals unity if q_t belongs to the bottom or top quartile, and zero otherwise.[10]

The interaction model To investigate how the impact of correctly anticipated fundamentals depends on the market phases introduced above, we consider interaction models following regressions of the type

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i)| + \beta_2\text{SIG}_{j,t} + \beta_3\left(|\varepsilon_{j,t}(i)| \times \text{SIG}_{j,t}\right) + \epsilon_{j,t}, \tag{4}$$

where $\text{SIG}_{j,t}$ represents the signal for the respective market phase; we conduct the regressions for $|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$ separately and without instruments. Controlling for different states of the value (or momentum or interest rate differential) phases, we focus on the estimate of the marginal effect of an interest rate forecast (error) on the return earned by the exchange rate forecast, i.e. $\frac{\partial r}{\partial|\varepsilon(i)|} = \hat{\beta}_1 + \hat{\beta}_3 \times \text{SIG}_{j,t}$.[11]

Forecasting fundamentals depending on value phases We model interaction effects of the absolute interest rate forecast error in dependence of the value market phase by setting $\text{SIG}_{j,t} = \text{FUND}_t$ in Eq. 4. Table 6 shows the coefficient estimates and the computed marginal effects.

Table 6 about here

Table 6, (i)-(ii), shows that the negative marginal effects of an interest rate forecast error are larger when $\text{FUND}_t = 1$, i.e. when the exchange rate deviates substantially from its fundamental value according to PPP: the marginal effect of an error with respect to Eurozone interest rates is almost twice as large in these market phases with fundamental mispricing. The average return from T_{ind} decreases by 20 basis points for each increase in error points with respect to U.S. interest rates when currencies are fundamentally mispriced; in contrast, this effect only amounts to 13 basis points in market phases when exchange rates are more aligned to fundamental values. To illustrate this finding, Figure 1 shows predictions of returns conditional on the forecast error and the degree of deviation of the current nominal exchange rate from its PPP level.

Figure 1 about here

While these findings suggest that it is more important to understand *interest rates* in times in which a severe mispricing of exchange rates calls for value strategies, it is worth noting that a similar effect can be documented for industrial production, whereas there is a mixed pattern for inflation rates, see Table 6, (iii)-(vi).

[10] In addition to the market phases presented here, i.e. the so-called value phases, we also give results for two differently defined market phases in the robustness section. These other phases build on the strength of exchange rate momentum and the size of the interest rate differential.

[11] The standard error of this marginal effect can be obtained by

$$\left(Var(\hat{\beta}_1) + \text{SIG}_{j,t}^2 Var(\hat{\beta}_3) + 2\text{SIG}_{j,t} Cov(\hat{\beta}_1, \hat{\beta}_3)\right)^{\frac{1}{2}}.$$

4.4 The expected relation between interest rate and exchange rate changes

So far, we have demonstrated that there is a specific link between exchange rate forecasting performance and the quality of interest rate forecasts. Now we go a step further by examining the kind of expected relation between interest rate and exchange rate changes. In a first step we test for the total sample of forecasters whether there is a systematic link at all which might constitute a "mechanism" how expected interest rate changes possibly influence exchange rate forecasts. If such a mechanism is widely assumed to work, we can test in a second step whether a better input (interest rate forecasts) does indeed contribute to better output (exchange rate forecasts). To test this line of reasoning, we relate expected changes of the USD/EUR exchange rate to the expected change in Eurozone interest rates relative to the expected change in the U.S. interest rates, i.e.,

$$E_t[\Delta s_{t,t+6}] = \beta_0 + \beta_1[E_t[\Delta i^{EUR}_{t,t+6}] - E_t[\Delta i^{US}_{t,t+6}]] + \epsilon_t \tag{5}$$

If the difference between the expected change in Eurozone interest rates and the expected change in the U.S. interest rates ($E_t[\Delta i^{EUR}_{t,t+6}] - E_t[\Delta i^{US}_{t,t+6}]$) influences expected changes in foreign exchange rates, we would expect the parameter β_1 to be different from zero. We estimate Eq. 5 based on the individual exchange rate and interest rate forecasts with a fixed-effects regression,[12] and report the coefficient estimates in Table 7, Panel A.

TABLE 7 ABOUT HERE

As Table 7, (i), demonstrates, $\hat{\beta}_1$ is found to be significantly larger than zero; consequently, the forecasters expect, on average, the USD to depreciate against the Euro ($\Delta s_{t,t+6} > 0$) when the differential of Eurozone interest rates vs. U.S. interest rates increases. This mechanism is consistent with common practice in international macroeconomic policy. It is also consistent with the comparative static of a Mundell-Fleming model where an interest rate increase leads c.p. to a higher value of this currency.

As there are more candidate influencing factors beyond interest rates, we also augment Eq. 5 by $E_t[\Delta \pi^{EUR}_{t,t+6}] - E_t[\Delta \pi^{US}_{t,t+6}]$, i.e., the difference in the expected changes in inflation. Table 7, (ii), illustrates that nevertheless, the relative interest rate expectations continue to have a strong effect whereas the inflation differential also has an effect, albeit a smaller one. Hence, we conclude that expected interest rate differentials are clearly linked to forecasters' exchange rate expectations.

To disaggregate this average relation, we analyze whether good forecasters think of a different mechanism than bad forecasters. Thus we divide the total sample of forecasters into three groups according to their overall

[12]The forecasters give qualitative information w.r.t. increases or decreases of both U.S. and Eurozone interest rates, which we code 1,0, and -1. For the relative interest rate measure, we take the difference of these forecast. When the expectation is identical for both Eurozone and U.S. interest rates, the differential equals 0. In principle, the differential is given on a scale from -2 to 2. Positive values represent a larger expected increase in Eurozone interest rates compared to the increase in U.S. interest rates.

(*ex post*) forecasting performance (measured by average returns of a forecaster j) and reestimate Eq. 5 for these subgroups (high performer, medium performer, and low performer) separately. It can be seen from Table 7, (iii)-(v), that relative interest rate expectations matter regardless of whether we consider low, medium, or high performers, respectively: the coefficient estimates are found to be significantly positive for all groups.

In a second step, we check whether the individual interest rate forecasts are suited to predict *actual* exchange rate changes, given that the forecasters expect a mechanism with the above mentioned structure (i.e., $E_t[\Delta s_{t,t+6}]$ and $E_t[\Delta i^{EUR}_{t,t+6}] - E_t[\Delta i^{US}_{t,t+6}]$ are *positively* related). In particular, we regress ex post exchange rate changes ($\Delta s_{t,t+6}$) on the RHS variables of Eq. 5 and estimate $\hat{\beta}_0$ and $\hat{\beta}_1$ for the groups of low, medium, and high performers separately. Table 7, Panel B, displays the results. Strikingly, the estimates for $\hat{\beta}_1$ are significantly *negative* for the low and medium performers (see (vi)-(vii)): this shows that on average, the USD has *appreciated* after an increase of the differential of Eurozone interest rates change vs. U.S. interest rates change expectations of these groups. This is contrary to the forecasters' expected mechanism and will lead to misguided forecasts, on average. In contrast, $\hat{\beta}_1$ carries the expected positive sign for the group of high performers (see (viii)).

Overall, the findings in this section provide two pieces of evidence: first, forecasters on average agree on the kind of linkage between future interest rate and exchange rate changes. Second, the qualitative difference between low and high performers (w.r.t. exchange rate forecasts) is thus less likely due to differences in the exchange rate forecasting model than due to differences in a central input factor: the quality of individual interest rate forecasts.

5 Robustness

This section documents some of our robustness calculations showing that the main findings are not unique to the USD/EUR exchange rate (Section 5.1) and do not depend on the specific trading rule (Section 5.2), on the use of trading rules as a performance measure in general (Section 5.3) or on the use of the specific chosen thresholds to categorize realizations (Section 5.4). Finally, Section 5.5 demonstrates that our main results are robust to the chosen estimator and Section 5.6 shows that the effect of market phases on the link between exchange rates and interest rates extends beyond the PPP-phases examined in Section 4.3.

5.1 Further currencies

As our panel data set also includes forecasts for the GBP/EUR and JPY/EUR exchange rates, British and Japanese interest rates and further fundamentals, we can extend the analysis above to further currencies. In doing so, we show that the overall relationship between interest rate forecasts and exchange rate forecasts demonstrated above is not unique to the USD/EUR exchange rate. However, relations are more noisy for these minor currencies, probably because professionals focus on the US dollar.

As introduced in Eq. 2, we run fixed effects regressions of the type

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{\star})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t},$$

i.e., we regress the return of a trading rule based on an individual's forecasts of the GBP/EUR rate (and separately, the JPY/EUR rate) on the forecast error with respect to the European interest rate and the foreign (i.e. British or Japanese) interest rate, $i^{\star}$, and corresponding control variables. Tables 8 and 9 display the results.

Tables 8 and 9 about here

Strikingly, the negative and significant coefficients of absolute interest rate forecast errors remain a common feature in all specifications, while there are larger differences across currencies and specifications for the other fundamentals considered control variables.

5.2 Different specification of the trading rule

So far, we have used a market-based loss function T_{ind} (see Eq. 1) for the evaluation of an individual's forecasting performance, which we repeat here for convenience:

$$r_{j,t,t+1} = I_t(s_t > E_{j,t}[s_{t+1}])(f_{t,1} - s_{t+1}) + I_t(s_t < E_{j,t}[s_{t+1}])(s_{t+1} - f_{t,1}).$$

This rule implies that the investor uses the forward market when taking a long/short position, which is (through covered interest rate parity) equivalent to borrowing in one currency and investing the same amount in the other currency at market interest rates. While this approach is natural for an investor, it has to be noted that we observe exchange rate forecasts expressed in terms of changes of *spot rates* (and not *forward rates*, which incorporate spot rates and the current levels of refinancing costs (i.e., the interest rate differential). Hence, $E_t[s_{t+1} - f_t^1]$ is not directly observable nor can it be backed out indirectly (due to the directional nature of the considered forecasts). To deal with potential objections on these grounds, this section presents an alternative trading rule as a robustness check.

Since the measured return could be driven by changes in the refinancing costs rather than exchange rates, we replace $f_{t,1}$ in Eq. 1 with s_t for an alternative trading rule $T_{ind}(1)$). Intuitively, this trading rule is a gross trading rule which ignores the costs and revenues of borrowing and investing in different currencies. Table 10 presents the estimates.

Table 10 about here

Table 10 confirms the general results from the main part. The alternative trading rule $T_{ind}(1)$ yields results which are closely related to those produced above - it appears that the differences between these two return definitions are mainly captured in the individual fixed effects and year dummies (Panel A). This makes intuitive sense as the considered spot rates and one-month-forward rates are highly correlated ($\rho > 0.99$) at monthly frequency.

5.3 An alternative to *trading rules* as measures of forecasting performance

Average absolute forecasting errors This paragraph documents that our findings do not depend on the use of trading rules to measure exchange rate forecast performance; in contrast, the main insights are similar when the analysis is based on absolute forecasting errors $|\varepsilon_{j,t}(FX)|$ instead (computed as above for the interest rate forecasts).[13] These two measures are negatively related, as a *large* error corresponds to *poor* forecasting performance, which implies low returns. In fact, there is a negative correlation coefficient of -0.8 when considering the entire panel of data over time for all forecasters.

An ordered response model When using exchange rate forecast errors, we have to deal with the categorical nature of the dependent variable, i.e., the 0, 1 or 2 score of the forecast error. Ordered probit models provide a common way to compute $P[(|\varepsilon_{j,t}(FX)| = 0)\big||\varepsilon_{j,t}(i)|]$, i.e. the probability of making a correct exchange rate forecast in dependence of $|\varepsilon_{j,t}(i)|$.[14] We specify both the base model

$$\varepsilon^{\star} = \beta' X = \beta_1 |\varepsilon_{j,t}(i)| + \epsilon_{j,t} \tag{6}$$

and the interaction model

$$\varepsilon^{\star} = \beta' X = \beta_1 |\varepsilon_{j,t}(i)| + \beta_2 \text{SIG}_{j,t} + \beta_3 \left(|\varepsilon_{j,t}(X)| \times \text{SIG}_{j,t}\right) + \epsilon_{j,t}, \tag{7}$$

where the respondents‘ exchange rate forecast errors $|\varepsilon_{j,t}(FX)|$ are related to the unobserved $\varepsilon^{\star}$ with the threshold parameters κ_1 and κ_2. $\text{SIG}_{j,t}$ is the short-cut for the variables $|\varepsilon_{j,t}(i)|$ is interacted with; here, this is a dummy signalling fundamental mispricing phases.

Results Table 11 displays the results from the ordered probit regressions, where the probability

[13] We group the one-month-ahead realizations of log exchange rate changes into "appreciation", "no-change" and "depreciation" categories. The bounds of the "unchanged" category are chosen symmetrically around zero such that the share of realizations in the no-change category equals the share of expectations in that category: the size of the medium category for the USD/EUR forecasts is 27%, leading to a threshold of ±1.1% for the medium category of realizations. The absolute errors are then obtained by taking the difference, such that a severe error is counted as 2, and a smaller one as 1.

[14] For brevity, we focus on $P[(|\varepsilon_{j,t}(FX)| = 0)\big||\varepsilon_{j,t}(i)|]$. The argumentation could obviously also be made on $P[(|\varepsilon_{j,t}(FX)| = 2)\big||\varepsilon_{j,t}(i)|]$, i.e. the probability of making a severe error. Those results would tell the same story.

of making a correct forecast $P(|\varepsilon_{j,t}(FX)| = 0)$ is computed by $\Phi(\kappa_1 - \beta' X)$, with $\Phi(\cdot)$ being the cumulative standard normal density.

Table 11 about here

(i) and (ii) demonstrate that the relationship between an error regarding exchange rate forecasts and an error regarding interest rates forecasts are positively related, which confirms the message from the main part of the paper.[15] In addition, when it comes to the interaction model, the marginal effects of an interest rate forecast error on the probability of a correct exchange rate forecast are computed by $-\phi(\kappa_1 - \beta' X) \times [\beta_1 + \beta_3 x_1]$ (with $\phi(\cdot)$ being the standard normal density). Table 11 also presents these marginal effects at the bottom of (iii) and (iv). It can be seen that the probability of making a correct USD forecast decreases more strongly with more severe interest rate errors when the exchange rate deviates substantially from its fundamentally fair value according to PPP.

5.4 Different thresholds for the categorization of macro variables

As explained in Section 3 in more detail, our RHS macro variables are categorized in three categories based on specific thresholds. For this robustness analysis, we deviate from the thresholds chosen in the baseline regression by considering broader as well as more narrow no-change intervalls as well as intervals based on asymmetric values (see Table 3 for the exact figures). Table A2 to A4 show the results for these specifications, which are qualitatively similar to those from the baseline approach. Hence, we conclude that the mechanism illustrated in this paper does not driven by the choice of the specific thresholds for the no-change-intervals.

5.5 Different estimators

As described in more detail in Section 4.2, we conduct panel fixed effects regressions. Our main result, i.e. a significantly negative relationship between short term interest forecast errors on exchange rate forecasting performance, also holds when we use pooled OLS (see Table A5).

As another aspect we discuss the use of IV estimation. In Eq. 2, we regress the return from a trading strategy (which evaluates the performance of exchange rate forecasts) on a contemporaneous performance measure with respect to interest rates ($\varepsilon_{j,t}(i)$) or, as control variables, with respect to other fundamentals (in $\Phi_{j,t}$). While this setting allows us to focus on the connection between interest rate and exchange rates forecasts, one may be interested in possible causality between variables. We are aware that the determination of exchange rates and interest rates occurs simultaneously in reality. This follows from the logic of international capital movements

[15] Results also hold qualitatively when we measure the error regarding exchange rate forecasts at a six-months horizon.

and it also follows to some extent from the practice of monetary policy which may directly consider exchange rates in their strategy or may consider fundamentals that indirectly influence exchange rates, as formulated for example in Taylor rules. Nevertheless, we address endogeneity as a driving force of our results and therefore rely on a standard IV estimation using the first lagged value of the forecasting errors with respect to interest rates and other fundamentals as external instruments for forecast errors. Despite its limitations, this IV approach may be a valid alternative to an estimator without instruments, according to the results from Davidson and MacKinnon (1989)'s test in the many specifications.[16] We find that the main results remain qualitatively similar when fixed effects regressions are conducted *with* instrumenting for the RHS variables (see Table A6). The same applies if we use a pooled OLS model with instruments (Table A7).

We also demonstrate that our results are qualitatively unaffected by autocorrelation in the panel. To show this, we report the estimates from the fixed effects estimation technique put forth by Baltagi and Wu (1999) to deal with AR(1) disturbances (Table A8). Moreover, we obtain qualitatively similar results when we consider an alternative IV strategy (Table A9): instead of using lagged values, we use the absolute forecast errors with respect to the interest rates in the *UK* and in *Japan* as exogenous instruments for the forecast errors with respect to the *US* and the *Eurozone*. Likewise, we use the absolute forecast errors with respect to the inflation rate and industrial production in these countries as instruments for the US and Eurozone inflation rate and industrial production, respectively.[17]

5.6 Interactions in further market phases

In Section 4.3 we have demonstrated that good interest rates forecasts are particularly helpful in market phases in which fundamentals appear misaligned based on PPP. In addition, we check this relation here for three further definitions of market phases. In general, we confirm our main insight that deviations from a fundamental ”equilibrium” make good interest rates expectations more important for good exchange rate forecasts; however, results tend to be weaker here than for the concept of PPP which makes sense as PPP is undisputed as longer-run guidline for exchange rate equilibrium.

Fundamental phases based on Taylor rules First, we investigate whether this effect also holds for market phases in which fundamentals appear misaligned based on Taylor rules, knowing that Taylor rules may be useful in understanding the formation of exchange rates (Molodtsova and Papell, 2009; Ince, 2014).

[16] See also Table A1 in the Appendix for further details.

[17] These instruments are valid for two reasons: first, it can be shown from our data that skills in predicting these macroeconomic series are correlated across countries: for example, the cross-sectional correlation between average absolute errors with respect to Eurozone and UK interest rates is 0.51. In the panel context, there still remains a positive correlation of absolute forecast errors with respect to these two series of 0.25. Secondly, there is no theoretical reason to believe that errors in predicting the macroeconomic circumstances in Japan should have a systematic impact on the USD/EUR exchange rate predictions which is not yet covered by the forecast error with respect to the fundamentals in the United States or the Eurozone; hence, the instruments are regarded as exogenous.

Taylor rules are used as the workhorse in approximating proper short-term interest rates. Based on this concept we dinstiguish market states in which the actual interest rate differential deviates much from Taylor rule-based considerations. Such misalignments may be regarded in analogy to misalignments from PPP. In particular, we determine market phases in which the differentials between USD and EUR interest rates deviate from the theoretical interest rates differential which would result from Taylor rules, i.e. we calculate $|(i_t^{USD} - i_t^{EUR}) - (i_t^{\star,USD} - i_t^{\star,EUR})|$ and define $SIG_t = 1$ if the expression exceeds its median and $SIG_t = 0$ otherwise.

To obtain $i_t^\star$, we calibrate a Taylor rule by

$$i_t^\star = 1.5\pi_t + 0.5(y_t - \bar{y}_t)$$

where π_t and y_t represent the country's inflation and GDP growth rate and $\bar{y}_t^{MA5yrs}$ the 5-yrs average (to come close to the concept of an output gap). The calibrated parameters of 1.5 for inflation and 0.5 for the output gap are representative of what is often assumed in the Taylor rule literature.

We are able to show (Table A10) that regressions based on the econometric model proposed in Eq. 4 suggest that good (European) interest rate forecasts appear to be particularly important when interest rate differentials deviate from Taylor-rule based fundamentals; in fact, the marginal effect only turns negative in these circumstances. However, we do not find a similar effect regarding the US-interest rates. Hence, we conclude that the quality of interest rate forecasts might also be more important in phases which appear to be fundamentally misaligned based on Taylor rules, but that this effect is much more pronounced when fundamental misalignment originates from PPP-deviations.

Further market phases Second, traders state that the impact of fundamentals on exchange rates is reduced when technical trading is particularly pronounced (Cheung and Wong, 2000), which is largely consistent with shifts in forecasting approaches (Jongen, Verschoor, Wolff, and Zwinkels, 2012) and with chartist-fundamentalist models (see, for example, De Grauwe and Grimaldi, 2006). We consider the size of the trend of the USD/EUR exchange rate over the previous 30 days as a signal for a prevailing *momentum phase*. Again, we carry out a recursive approach and classify past absolute trends into three equally large subgroups: a phase in which the prevailing trend is relatively low ("low-momentum-phase", belonging to the lowest 33 percent during the 10 years prior to the respective date), a "normal momentum phase" and a "high-momentum-phase" (belonging to the top 33 percent).[18] We capture these phases by dummy variables D^L and D^H which are one for low and high momentum phases, respectively, and zero otherwise (the normal momentum phase will be considered the benchmark).

Third, another market phase involves large interest differentials which may have an impact, as they signal

[18] As we have the exact date of each individual forecast in our data, we are able to attach such a trend-phase as well as a contemporaneous interest rate differential to every forecast.

an exchange rate readjustment according to uncovered interest rate parity (or they invite carry trades, which would tend to reduce the role of fundamentals). We call these market conditions *interest differential phases*. To take this into account, we measure the absolute size of the differential between U.S. and European short term interest rates, $|i^{USD} - i^{EUR}|$.

Results on the second and third market states considered here are presented in more detail in Appendix A.3, including Tables A11 and A12. In sum, these results support the idea that the relation between forecasting performance on exchange rates and fundamentals follows a systematic pattern: this link is closer when the role of fundamentals is more obvious, i.e. when momentum (and possible disturbance from technical trading) is low and when interest differentials are large. Regarding both momentum and interest differential phases, the effects are again clearer for interest rates than for other exchange rate fundamentals.

6 Conclusions

The research reported in this paper suggests an affirmative answer to the question of whether exchange rates are related to economic fundamentals at medium-term horizons, such as a month ahead or longer. As is now widely accepted, it is difficult to obtain a conclusive set of results from conventional tests of exchange rate models at this horizon (Cheung, Chinn, and Garcia-Pascual, 2005; Engel, 2014) and so in this paper we propose another route.

The starting point of our research is the hypothesis that fundamentals determine exchange rates. Given the supposition that individuals who can forecast exchange rates should have a good understanding about exchange rate determinants, we investigate whether the quality of fundamental forecasts is related to the ability to predict exchange rates. As interest rates can be seen as the most important determinant of exchange rates over medium-term horizons, we analyze the connection between interest rate and exchange rate forecast performance. We find that good exchange rate forecasting performance is robustly related to good interest rate forecasts. This main result also holds when we consider individual fixed effects in the panel approach, controlling for general exchange rate forecasting ability, and when we control the main relation for forecasting performance in further fundamentals and year dummies.

While our results indicate that there is an important role for interest rate forecasts in general, we also investigate in what respect the importance of fundamentals varies over market phases. We find evidence that good fundamental forecasts of interest rates and economic growth become even more important when exchange rates substantially deviate from their PPP value.

Finally, we examine the kind of linkage between expected interest rates and exchange rate forecasts. We find that forecasters seem to agree on the mechanism that an interest rate increase strengthens the currency. While this Mundell-Fleming-inspired mechanism is shared by most forecasters, only good exchange rate forecasters also had the "right" interest rate expectations.

Overall, we provide evidence based on a large sample of professional forecasters that their shorter-term forecasting performance is positively related to their performance in forecasting fundamentals, in particular short-term interest rates. This robust relationship suggests that understanding fundamentals helps to understand exchange rates. We also find, however, that this relation is time-varying which may be one reason why it is so difficult to reveal the impact of fundamentals on exchange rates in conventional tests.

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Table 1: Structure of survey responses

This table reports the number of participants and observations with different minimum number of USD/EUR forecasts. (While the entire database consists of 1743 forecasters with USD/EUR forecasts, we consider those forecasters who responded at least 10 times to the survey in the remainder of this analysis.)

Min # of responses	# of forecasters	% of all participants	# of observations
1	1,743	100.00	64,628
10	1,054	60.47	62,724
25	749	42.97	57,871
50	506	29.03	49,121
100	197	11.30	26,901
150	59	3.38	10,785
200	7	0.40	1,451

Table 2: Average exchange rate forecasting performance in the cross section: Mean returns and Sharpe ratios of T_{ind}

This table reports statistics on the cross section of forecasters with respect to the average performance of a forecaster over time when she follows the trading rule T_{ind} according to her forecasts. Panel A includes the performance measures for the 95-percentile, median and 5-percentile forecaster, sorted by (monthly) mean returns and (annualized) Sharpe ratios, respectively. These values are compared to the average value T_0 of a simulation experiment which repeats 10,000 purely random (coin toss) strategies (an investor buys or sells USD against the Euro in the forward market according to a coin toss, and settles her position one month later). Panel B reports the number and percentage share of forecasters with Sharpe ratios within specific intervals.

Panel A	Percentile of forecasters	Mean return	Sharpe ratio
T_{ind}	X_{95}	0.754	1.187
	X_{50}	0.109	0.113
	X_{05}	-0.441	-0.872
T_0	Average	-0.001	-0.001

Panel B	Sharpe ratio	# of forecasters	in %
T_{ind}	x<-1.0	40	3.8
	-1.0<x <-0.4	129	12.2
	-0.4<x<0.4	574	54.4
	0.4<x<1.0	233	22.1
	1.0<x	79	7.4

Table 3: Thresholds for the categorization of realized macro variables

This table displays the threshold values for the categorization of continuous realized macro variables, i.e. interest rates, inflation rates as well as the growth rate of industrial production. A change which amounts to a value below (above) the lower (upper) value is classified as a realied decrease (increase). In the baseline regressions, thresholds are chosen symmetrically such that the intermediate category is approximately as large as the category of no-change expectations (over time). In different robustness excercices, we also consider more narrow and broader intermediate categories as well as asymmetric threshold values. This table displays the thresholds (either in percentage changes or in percentage points) as well as the respective relative size (in percent) of the intermediate category.

		Baseline			**Narrow**		
	Expectations Middle category	Lower threshold	Upper threshold	Realized Middle category	Lower threshold	Upper threshold	Realized Middle category
	in % of obs.	in percent		in % of obs.	in percent		in % of obs.
i_{EUR}	39%	-11%	11%	40%	-5%	5%	27%
i_{USD}	41%	-8%	8%	41%	-4%	4%	24%
		in perc. Points			in perc. Points		
π_{EUR}	45%	-0.35	0.35	45%	-0.17	0.17	24%
π_{USD}	46%	-0.44	0.44	46%	-0.22	0.22	24%
y_{EUR}	44%	-2.20	2.20	45%	-1.10	1.10	24%
y_{USD}	53%	-0.44	0.44	54%	-0.22	0.22	26%
		Broad			**Asymmetric**		
	Expectations Middle category	Lower threshold	Upper threshold	Realized Middle category	Lower threshold	Upper threshold	Realized Middle category
	in % of obs.	in percent		in % of obs.	in percent		in % of obs.
i_{EUR}	39%	-21%	21%	72%	-5%	21%	43%
i_{USD}	41%	-17%	17%	54%	-4%	17%	36%
		in perc. Points			in perc. Points		
π_{EUR}	45%	-0.69	0.69	73%	-0.17	0.69	66%
π_{USD}	46%	-0.88	0.88	71%	-0.22	0.88	66%
y_{EUR}	44%	-4.40	4.40	77%	-1.10	4.40	69%
y_{USD}	53%	-0.88	0.88	79%	-0.22	0.88	70%

Table 4: Macroeconomic fundamentals: average absolute forecast errors

This table reports the distribution of forecasts (median and quartiles) of the average absolute forecast errors $|\varepsilon_i(X)|$ across the cross section with respect to different macroeconomic variables X, i.e. the short term interest rate i, the inflation rate π, and the yearly growth rate of the industrial production y. A severe forecast error (wrong direction of change) is counted as 2, a small forecast error (e.g., constant instead of increase or decrease) is counted as 1.

	$\|\varepsilon_i(i)\|$ Eurozone	$\|\varepsilon_i(i)\|$ USA	$\|\varepsilon_i(\pi)\|$ Eurozone	$\|\varepsilon_i(\pi)\|$ USA	$\|\varepsilon_i(y)\|$ Eurozone	$\|\varepsilon_i(y)\|$ USA
X_{25}	0.58	0.65	0.53	0.58	0.62	0.48
X_{50}	0.71	0.77	0.63	0.69	0.73	0.57
X_{75}	0.83	0.90	0.73	0.79	0.84	0.68

Table 5: Panel Fixed Effects Regression

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (x), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.141		-0.141		-0.140		-0.172		-0.143	
	***(0.015)		***(0.015)		***(0.015)		***(0.016)		***(0.017)	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.185		-0.186		-0.186		-0.174	-0.147	
		*** (0.016)		***(0.016)		***(0.016)		***(0.017)	***(0.018)	
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			-0.002		-0.017		-0.034		-0.033	-0.032
			(0.016)		(0.017)		**(0.016)		*(0.017)	*(0.017)
$\|\varepsilon_{j,t}(\pi^{USD})\|$				0.046		0.044		-0.035	-0.029	-0.037
				***(0.016)		***(0.016)		**(0.016)	*(0.017)	**(0.017)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.076		-0.091		-0.023		-0.014	-0.011
			***(0.016)		***(0.017)		(0.016)		(0.017)	(0.017)
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.032		-0.033		-0.075	-0.069	-0.066
				*(0.017)		*(0.018)		***(0.017)	***(0.018)	***(0.018)
$\bar{\varepsilon}_t(\pi, y)$					0.164	0.0137				
					***(0.062)	(0.059)				
$\bar{\mu}$	0.195	0.240	0.250	0.228	0.162	0.220	0.736	0.712	0.858	0.614
	***(0.015)	***(0.016)	***(0.021)	***(0.022)	***(0.039)	***(0.040)	***(0.255)	***(0.257)	***(0.257)	**(0.257)
Year dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
$N \times T$	62,432	62,004	62,213	61,515	62,213	61,515	62,213	61,515	61,381	61,633
R^2_B	0.007	0.052	0.033	0.058	0.042	0.058	0.182	0.187	0.179	0.134
R^2_O	0.001	0.003	0.002	0.003	0.002	0.003	0.026	0.026	0.027	0.025
R^2_W	0.001	0.002	0.002	0.002	0.002	0.002	0.023	0.023	0.025	0.022

Table 6: Interaction model: signals for value trade phases

This table reports the results of a panel regression with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on a fundamental forecast error (in absolute terms) $|\varepsilon_{j,t}(X)|$, a dummy variable FUND_t taking on unity if the exchange rate strongly deviates from its PPP value and zero otherwise, and an interaction of the these two variables, i.e.,

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(X)| + \beta_2\text{FUND}_t + \beta_3\left(|\varepsilon_{j,t}(X)| \times \text{FUND}_t\right) + \epsilon_{j,t}.$$

Depending on the specification (i) to (vi), X represents the interest rates i, the industrial production growth rate (yoy) y and the inflation rate π projections for the U.S. and the Eurozone, respectively, made by j in t. Clustering-robust standard errors (by observational unit) are provided in parentheses. We also report the covariance between $\hat{\beta}_1$ and $\hat{\beta}_4$ or $\hat{\beta}_1$ and $\hat{\beta}_5$, respectively. The table also provides the marginal effects of a fundamental forecast error in both value phases ($F_t = 1$) and non-value phases ($F_t = 0$). Significance: ***:1%, **: 5%, *: 10%.

	(i)- $X: i_{EUR}$	(ii)- $X: i_{USD}$	(iii)- $X: \pi_{EUR}$	(iv)- $X: \pi_{USD}$	(v)- $X: y_{EUR}$	(vi)- $X: y_{USD}$
$\|\varepsilon_{j,t}(X)\|$	-0.086	-0.1298	-0.080	0.265	-0.057	-0.024
	***(0.029)	***(0.037)	***(0.029)	***(0.028)	**(0.029)	(0.030)
F_t	-0.050	-0.065	-0.190	0.155	-0.107	-0.126
	(0.033)	(0.041)	***(0.035)	***(0.039)	***(0.037)	***(0.033)
$\|\varepsilon_{j,t}(X)\| \times F_t$	-0.062	-0.073	0.105	-0.360	-0.028	-0.003
	*(0.033)	*(0.041)	***(0.036)	***(0.036)	(0.034)	(0.040)
$\bar{\mu}$	0.224	0.282	0.230	-0.037	0.222	0.197
	***(0.024)	***(0.034)	***(0.026)	(0.030)	(0.028)	(0.025)
$N \times T$	62,432	62,004	62,449	61,914	62,497	62,094
R^2_{corr}	0.002	0.004	0.001	0.003	0.002	0.001
$Cov(\hat{\beta}_1, \hat{\beta}_3)$	-0.0008	-0.0014	-0.0009	-0.0008	-0.0008	-0.0009
$\left.\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}\right\|_{F_t=0}$	-0.086	-0.129	-0.081	0.265	-0.057	-0.024
	***(0.029)	***(0.038)	***(0.029)	***(0.028)	**(0.029)	(0.030)
$\left.\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}\right\|_{F_t=1}$	-0.148	-0.202	0.025	-0.094	-0.086	-0.026
	***(0.017)	***(0.019)	(0.020)	***(0.019)	***(0.018)	(0.021)

Table 7: Expected mechanisms linking exchange rates and fundamentals

Panel A summarizes what kind of mechanisms regarding the relationship between exchange rates and fundamentals forecasters have in mind. Panel B relates these mechanisms to actual exchange rate changes. To explain expected exchange rate changes in Panel A, we conduct fixed-effects regressions of the type

$$E_{t,j}[\Delta s_{t,t+6}] = \beta_0 + \beta_1[E_{t,j}[\Delta i^{EUR}_{t,t+6}] - E_{t,j}[\Delta i^{US}_{t,t+6}]] + \epsilon_{t,j}$$

where $E_{t,j}[\Delta s_{t,t+6}]$ represents an expected change in exchange rates, and $E_{t,j}[\Delta i^{EUR}_{t,t+6}] - E_{t,j}[\Delta i^{US}_{t,t+6}]$ the difference between the expected change in Eurozone interest rates and the expected change in the U.S. interest rates. A second specification (ii) augments the RHS by $E_{t,j}[\Delta \pi^{EUR}_{t,t+6}] - E_{t,j}[\Delta \pi^{US}_{t,t+6}]$, while (iii)-(v) display the estimated coefficients when low performers (w.r.t exchange rate forecasts), medium performers and high performers are considered separately. The regressions in Panel B replace expectations on the LHS of the regression equation with actual changes in exchange rates; (vi)-(viii) display the coefficient estimates for low, medium and high performers, respectively.
For brevity, Diff(Δi) is a shortcut for $[E_{t,j}[\Delta i^{EUR}_{t,t+6}] - E_{t,j}[\Delta i^{US}_{t,t+6}]$, and Diff($\Delta\pi$) for $E_{t,j}[\Delta \pi^{EUR}_{t,t+6}] - E_{t,j}[\Delta \pi^{US}_{t,t+6}]$. Standard errors are provided in parentheses. Significance: ***:1%, **: 5%, *: 10%.

	Panel A- LHS: $E^j[\Delta FX]$					Panel B - LHS: ΔFX		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	all	*all*	*low p.*	*medium p.*	*high p.*	*low p.*	*medium p.*	*high p.*
Diff(Δi)	0.183	0.159	0.187	0.210	0.142	-0.679	-0.247	0.518
	***(0.004)	***(0.004)	***(0.007)	***(0.006)	***(0.007)	***(0.069)	***(0.058)	***(0.068)
Diff($\Delta\pi$)		0.069						
		***(0.005)						
const	2.047	2.058	1.876	2.024	0.234	-0.106	0.218	1.057
	***(0.003)	***(0.003)	***(0.006)	***(0.005)	***(0.005)	*(0.059)	***(0.048)	***(0.053)
$N \times T$	62,725	62,315	17.556	25,538	19,631	17,513	25,479	19,563
N	1053	1052	351	352	350	351	352	350
$R^2_{overall}$	0.08	0.09	0.10	0.09	0.05	0.00	0.00	0.01
R^2_{within}	0.04	0.04	0.05	0.05	0.02	0.01	0.00	0.00
$R^2_{between}$	0.43	0.41	0.49	0.43	0.30	0.04	0.03	0.11

Table 8: Robustness: JPY/EUR exchange rate

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and Japanese interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{JPY})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{JYP})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (x), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.166		-0.169		-0.186		-0.198		-0.213	
	***(0.016)		***(0.016)		***(0.017)		***(0.017)		***(0.019)	
$\|\varepsilon_{j,t}(i^{JYP})\|$		-0.196		-0.205		-0.205		-0.136	-0.135	
		***(0.020)		***(0.021)		***(0.021)		***(0.022)	***(0.022)	
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			0.111		0.127		0.121		0.150	0.144
			***(0.016)		***(0.018)		***(0.017)		***(0.019)	***(0.018)
$\|\varepsilon_{j,t}(\pi^{JYP})\|$				-0.157		-0.192		-0.092	-0.100	-0.119
				***(0.020)		***(0.021)		***(0.021)	***(0.021)	***(0.021)
$\|\varepsilon_{j,t}(y^{EUR})\|$			0.036		0.037		-0.043		-0.029	-0.029
			**(0.016)		**(0.018)		**(0.017)		(0.019)	(0.018)
$\|\varepsilon_{j,t}(y^{JYP})\|$				-0.116		-0.166		-0.188	-0.176	-0.186
				***(0.018)		***(0.020)		***(0.019)	***(0.020)	***(0.019)
$\bar{\varepsilon}_t(\pi, y)$					-0.059	0.406				
					(0.063)	***(0.064)				
$\bar{\mu}$	0.266	0.248	0.172	0.390	0.194	0.182	0.676	0.765	0.879	0.603
	***(0.015)	***(0.015)	***(0.022)	***(0.022)	***(0.039)	***(0.040)	***(0.262)	***(0.279)	***(0.279)	**(0.275)
Year dummies	NO	NO	NO	NO	NO	NO	JA	JA	JA	JA
$N \times T$	59329	57308	59137	51216	53994	51216	59137	51216	51101	52167
R^2_B	0.007	0.014	0.008	0.024	0.022	0.018	0.064	0.033	0.037	0.034
R^2_O	0.002	0.002	0.003	0.005	0.003	0.006	0.019	0.018	0.022	0.018
R^2_W	0.002	0.002	0.003	0.004	0.003	0.005	0.017	0.016	0.020	0.017

Table 9: Robustness: GBP/EUR exchange rate

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and Japanese interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{GBP})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{GBP})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (x), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.098		-0.099		-0.099		-0.102		-0.0898	
	***(0.011)		***(0.011)		***(0.011)		***(0.011)		***(0.012)	
$\|\varepsilon_{j,t}(i^{GBP})\|$		-0.062		-0.067		-0.068		-0.076	-0.058	
		***(0.011)		***(0.011)		***(0.011)		***(0.011)	***(0.012)	
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			0.014		0.006		-0.000		-0.001	-0.001
			(0.011)		(0.012)		(0.011)		(0.012)	(0.012)
$\|\varepsilon_{j,t}(\pi^{GBP})\|$				-0.004		-0.016		-0.027	-0.028	-0.026
				(0.012)		(0.012)		**(0.012)	**(0.013)	**(0.012)
$\|\varepsilon_{j,t}(y^{EUR})\|$			0.043		0.032		0.038		0.032	0.029
			***(0.011)		***(0.012)		***(0.011)		***(0.012)	**(0.012)
$\|\varepsilon_{j,t}(y^{GBP})\|$				0.003		-0.012		0.049	0.043	0.038
				(0.013)		(0.013)		***(0.013)	***(0.013)	***(0.013)
$\bar{\varepsilon}_t(\pi, y)$					0.100	0.179				
					**(0.044)	***(0.042)				
$\bar{\mu}$	0.099	0.080	0.061	0.085	0.012	-0.009	0.155	0.101	0.174	0.0543
	***(0.010)	***(0.011)	***(0.015)	***(0.015)	(0.026)	(0.027)	(0.176)	(0.183)	(0.184)	(0.179)
Year dummies							JA	JA	JA	JA
$N \times T$	59,895	58,530	59,707	57,283	59,707	57,283	59,707	57,283	57,169	57,728
R^2_B	0.032	0.031	0.029	0.027	0.028	0.019	0.119	0.108	0.105	0.102
R^2_O	0.002	0.001	0.002	0.001	0.002	0.001	0.024	0.023	0.025	0.023
R^2_W	0.001	0.001	0.002	0.001	0.002	0.001	0.022	0.022	0.023	0.021

Table 10: Robustness: Panel Fixed Effects Regression with an alternatively specified trading rule

We consider the forecast returns obtained by the alternative trading rule $T_{ind}(1)$, given by

$$r^{(1)}_{j,t,t+k} = I_t(s_t > E_{j,t}[s_{t+1}])(s_t - s_{t+1}) + I_t(s_t < E_{j,t}[s_{t+1}])(s_{t+1} - s_t)$$

This table presents the results of panel fixed-effects regressions of $r^{(1)}_{j,t,t+k}$ on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$) as well as for the respective inflation rates ($|\varepsilon_{j,t}(\pi)|$) and industrial production growth rates ($|\varepsilon_{j,t}(y)|$) and on year dummies. Significance: ***:1%, **: 5%, *: 10%.

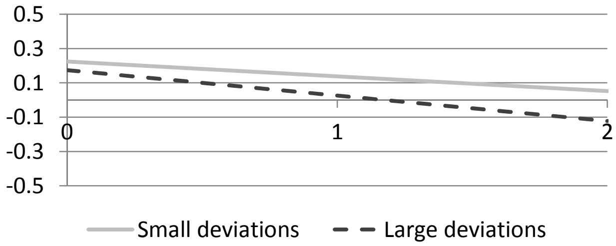
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.142		-0.143		-0.142		-0.171		-0.142	
	***(0.015)		***(0.015)		***(0.015)		***(0.016)		***(0.017)	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.189		-0.190		-0.190		-0.176	-0.149	
		***(0.016)		***(0.016)		***(0.016)		***(0.017)	***(0.018)	
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			0.005		-0.011		-0.029		-0.028	-0.027
			(0.016)		(0.017)		*(0.016)		(0.017)	(0.017)
$\|\varepsilon_{j,t}(\pi^{USD})\|$				0.040		0.038		-0.035	-0.030	-0.038
				***(0.016)		**(0.016)		**(0.016)	*(0.017)	**(0.016)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.077		-0.093		-0.023		-0.015	-0.012
			***(0.016)		***(0.017)		(0.016)		(0.017)	(0.017)
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.023		-0.025		-0.067	-0.061	-0.058
				(0.017)		(0.018)		***(0.017)	***(0.018)	***(0.018)
$\bar{\varepsilon}_t(\pi, y)$					0.168	0.025				
					***(0.061)	(0.059)				
$\bar{\mu}$	0.223	0.271	0.275	0.257	0.185	0.243	0.904	0.885	1.027	0.781
	***(0.015)	***(0.016)	***(0.021)	***(0.022)	***(0.039)	***(0.040)	***(0.255)	***(0.256)	***(0.256)	***(0.256)
Year dummies							JA	JA	JA	JA
$N \times T$	62,432	62,004	62,213	61,515	62,213	61,515	62,213	61,515	61,381	61,633
R^2_B	0.040	0.101	0.075	0.096	0.087	0.097	0.182	0.191	0.187	0.137
R^2_O	0.002	0.003	0.002	0.003	0.002	0.003	0.027	0.027	0.028	0.025
R^2_W	0.001	0.002	0.002	0.002	0.002	0.002	0.025	0.025	0.026	0.023

Table 11: Robustness: absolute forecast errors

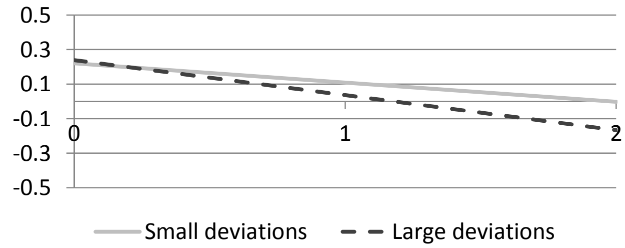
This table reports the results from an ordered-probit regression of the type $\varepsilon^\star = \beta' X = \beta_1 |\varepsilon_{j,t}(i)| + \epsilon_{j,t}$ (in (i) and (ii)), and $\varepsilon^\star = \beta' X = \beta_1 |\varepsilon_{j,t}(i)| + \beta_2 \text{FUND}_1 + \beta_3 \left(|\varepsilon_{j,t}(X)| \times \text{SIG}_t\right) + \epsilon_{j,t}$ in (iii) and (iv)) where the respondents' exchange rate forecast errors $|\varepsilon_{j,t}(FX)|$ are related to the unobserved $\varepsilon^\star$ with the threshold parameters κ_1 and κ_2. $|\varepsilon_{j,t}(i)|$ represents the absolute interest rate forecast error, SIG_t is a short-cut for a fundamental mispricing according to PPP ($\text{FUND}_t = 1$ if mispriced).
For (iii) and (iv), marginal effects of an interest rate forecast error on the probability of making a correct exchange rate forecast ($\left.\frac{\partial P(|\varepsilon(FX)|=0)}{\partial |\varepsilon_{j,t}(X)|}\right|_{\varepsilon_{j,t}(X)=1}$) are computed by $-\phi(\kappa_1 - \beta' X) \times [\beta_1 + \beta_3 \text{SIG}_t]$, whereas the corresponding standard errors are obtained by the delta method. Standard errors are provided in parentheses. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)
$\|\varepsilon_{j,t}(i_{EUR})\|$	0.045		0.033	
	***(0.007)		**(0.013)	
$\|\varepsilon_{j,t}(i_{USD})\|$		0.118		0.103
		***(0.007)		***(0.014)
$\|\varepsilon_{j,t}(\pi_{EUR})\|$	-0.000			
	(0.007)			
$\|\varepsilon_{j,t}(\pi_{USD})\|$		-0.011		
		(0.007)		
$\|\varepsilon_{j,t}(y_{EUR})\|$	0.021			
	***(0.007)			
$\|\varepsilon_{j,t}(y_{USD})\|$		-0.000		
		(0.007)		
$\|\varepsilon_{j,t}(i)\| \times FUND_t$			0.013	0.013
			(0.014)	(0.016)
$FUND_t$			0.013	0.019
			(0.015)	(0.016)
κ_1	-0.335	-0.297	-0.342	-0.282
	(0.009)	(0.010)	***(0.011)	***(0.014)
κ_2	0.701	0.741	0.694	0.756
	(0.009)	(0.010)	***(0.011)	***(0.014)
$N \times T$	62,825	62,040	63,055	62,552
R^2_{corr}	0.000	0.004	0.000	0.002
$\left.\frac{\partial P(\|\varepsilon(FX)\|=0)}{\partial \|\varepsilon(i)\|}\right\|_{\varepsilon(i)=1,\text{FUND}=0}$			-0.012 **(0.005)	-0.039 ***(0.005)
$\left.\frac{\partial P(\|\varepsilon(FX)\|=0)}{\partial \|\varepsilon(i)\|}\right\|_{\varepsilon(i)=1,\text{FUND}=1}$			-0.017 ***(0.005)	-0.047 ***(0.005)

Figure 1: Expected effects of fundamental forecast errors under different exchange rates value phases



(a) i_{EUR}



(b) i_{USD}

This figure depicts predictions of the average returns conditional on 1) the forecast quality of an interest rate forecast and 2) the value phase based on the fixed effects panel regression

$$r_{j,t,t+1} = \mu_j + \beta_1 |\varepsilon_{j,t}(i)| + \beta_2 \text{FUND}_t + \beta_3 \left(|\varepsilon_{j,t}(i)| \times \text{FUND}_t \right) + \epsilon_{j,t}.$$

The x-axis shows the absolute forecast error (0 for no error, 2 for a severe error), while the y-axis displays the returns. In each graph, there is a different line for each a value phase in which the exchange rate strongly deviates from the PPP value, and a market phase with small deviations from PPP.

Supplementary Material

A.1 Data appendix

A.1.1 Exchange Rates

To obtain a long-time series of daily exchange rates (from 01.1976 to 07.2010), we follow Burnside, Eichenbaum, Kleshchelski, and Rebelo (2011), drawing on a set of spot rates and forward rates denominated in terms of FCU/GBP. We then convert Pound quotes into Euro quotes by dividing the GBP/FCU quote by the EUR/GBP quote.[19] These data are taken from Datastream, and were originally collected by WM Company/Reuters. The mnemonics of the considered spot rates are DMARKER (used until 12.1998), ECURRSP (since 01.1999), JAPAYEN, SWISSFR, USDOLLR. The mnemonics of the considered forward rates are DMARK1F (until 01.1998), UKEUR1F (since 01.1999), JAPYN1F, SWISF1F, USDOL1F (all until 01.2007), and UKJPY1F, UKCHF1F, and USGBP1F (after 01.2007). In order to transform the GBP-denominated exchange rates with respect to the DM or Euro, we also make use of the spot rates DMARKER and ECURRSP, respectively. The spot and the forward rates are both midquotes sampled at the same point in time.

A.1.2 Interest Rates

We use the same data sources as Burnside, Eichenbaum, Kleshchelski, and Rebelo (2011) and download three-month interbank interest rates for Germany (until 12.1998), the Eurozone (starting 01.1999), the United States, the United Kingdom, Japan and Switzerland from Datastream. These data were originally collected by the Financial Times and ICAP. The mnemonics are ECWGM3M, ECJAP3M, ECSWF3M, ECUKP3M, ECUSD3M, ECEUR3M.

[19] *Spot* rates which measure directly the foreign value of the Euro/the D-Mark (without making a transformation from GBP) are also available on a daily basis from other sources. To make sure that our results on the forecasting performance of forecasters do not depend on this transformation, we compare our spot rate data with these directly obtained exchange rates. In particular, these are the D-Mark quotes from the historical database of the Frankfurt Stock Exchange provided by the Deutsche Bundesbank, as well the Euro rates downloadable in Datastream (mnemonics EMJPYSP. EMUSDSP,EMCHFSP, EMGBPSP). All those spot rates have a correlation with those from our data sample of > 0.999.

Table A1: Diagnostics

This table reports the diagnostics about the correct estimator for our panel regression of interest,

$$r_{j,t,t+1} = \mu_j + \beta_1 |\varepsilon_{j,t}(i^{EUR})| + \beta_2 |\varepsilon_{j,t}(i^{USD})| + \gamma \Phi_{j,t} + \delta \Psi_{j,t} + \epsilon_{j,t}.$$

We proceed in three steps. In a first step, we conduct Breusch and Pagan (1980)-tests to determine for each specification reported in Table A6 whether or not individual-specific effects are present. Under the null, individual-specific effects are absent. In a second step, we compare the fixed effects and random effects estimators by the means of Hausman tests. If the null can be rejected, there are systematic differences between the coefficient estimates, indicating that random effects does not estimate consistently and hence, fixed effects should be used. Ultimately, we perform regressions in which we take the lagged variables to instrument for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$ and make use of Davidson and MacKinnon (1989)'s test of the null hypothesis that OLS can consistently estimate the model (i.e. there is no need to instrument for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$).

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Breusch/Pagan LM	5.10	3.52	2.70	3.69	0.00	0.00	0.00
df	1	1	1	1	1	1	1
p-value	***0.012*	***0.030*	**0.050*	***0.027*	*1.000*	*1.000*	*1.000*
Hausman							
$(\beta^{FE} - \beta^{RE})'[V_{\beta^{FE}} - V_{\beta^{RE}}](\beta^{FE} - \beta^{RE})$	5.18	6.34	80.95	21.65	44.91	28.03	47.39
df	1	1	3	3	21	21	24
p-value	***0.023*	***0.012*	****0.000*	****0.000*	****0.002*	*0.139*	****0.003*
Davidson-MacKinnon							
F-Statistic	0.11	0.99	1.67	6.91	3.12	2.10	3.50
p-value	*0.743*	*0.319*	*0.170*	****0.000*	***0.025*	**0.098*	****0.002*

Table A2: Robustness: Panel Fixed Effects Regression with more narrow thresholds

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Unlike in the baseline regressions, the forecast errors are computed on the basis of more narrow thresholds (see Table 3) when transforming continuous realizations in categories. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\lvert\varepsilon_{j,t}(i^{EUR})\rvert$	-0.167		-0.170		-0.170		-0.211		-0.206	
	***(0.015)		***(0.015)		***(0.015)		***(0.016)		***(0.016)	
$\lvert\varepsilon_{j,t}(i^{USD})\rvert$		-0.134		-0.133		-0.123		-0.067	-0.025	
		***(0.015)		***(0.015)		***(0.015)		***(0.017)	(0.017)	
$\lvert\varepsilon_{j,t}(\pi^{EUR})\rvert$			0.131		0.100		0.073		0.0993	0.092
			***(0.015)		***(0.016)		***(0.016)		***(0.016)	***(0.016)
$\lvert\varepsilon_{j,t}(\pi^{USD})\rvert$				0.025		-0.002		-0.099	-0.120	-0.118
				*(0.015)		(0.016)		***(0.015)	***(0.016)	***(0.016)
$\lvert\varepsilon_{j,t}(y^{EUR})\rvert$			-0.075		-0.112		-0.023		-0.015	-0.019
			***(0.015)		***(0.016)		(0.015)		(0.016)	(0.016)
$\lvert\varepsilon_{j,t}(y^{USD})\rvert$				-0.022		-0.043		-0.038	-0.034	-0.034
				(0.016)		**(0.017)		**(0.016)	**(0.016)	**(0.016)
$\bar{\varepsilon}_t(\pi, y)$					0.336	0.266				
					***(0.054)	***(0.053)				
$\bar{\mu}$	0.220	0.213	0.185	0.208	-0.016	0.037	0.659	0.636	0.696	0.486
	***(0.015)	***(0.016)	***(0.021)	***(0.024)	(0.039)	(0.042)	***(0.256)	**(0.257)	***(0.257)	*(0.257)
Year dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
$N \times T$	62,432	62,004	62,213	61,515	62,213	61,515	62,213	61,515	61,381	61,633
R^2_B	0.015	0.080	0.051	0.082	0.055	0.069	0.175	0.182	0.168	0.126
R^2_O	0.002	0.002	0.004	0.002	0.005	0.002	0.027	0.025	0.028	0.026
R^2_W	0.002	0.001	0.004	0.001	0.004	0.002	0.025	0.023	0.026	0.023

Table A3: Robustness: Panel Fixed Effects Regression with broader thresholds

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Unlike in the baseline regressions, the forecast errors are computed on the basis of broader thresholds (see Table 3) when transforming continuous realizations in categories. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\lvert\varepsilon_{j,t}(i^{EUR})\rvert$	-0.148		-0.138		-0.134		-0.113		-0.083	
	***(0.018)		***(0.018)		***(0.018)		***(0.019)		***(0.019)	
$\lvert\varepsilon_{j,t}(i^{USD})\rvert$		-0.255***		-0.253***		-0.247***		-0.212***	-0.199***	
		(0.017)		(0.017)		(0.017)		(0.019)	(0.019)	
$\lvert\varepsilon_{j,t}(\pi^{EUR})\rvert$			-0.109		-0.082		-0.076		-0.071	-0.082
			***(0.018)		***(0.019)		***(0.019)		***(0.019)	***(0.019)
$\lvert\varepsilon_{j,t}(\pi^{USD})\rvert$				-0.045		-0.021		-0.038	-0.025	-0.031
				**(0.018)		(0.019)		**(0.018)	(0.019)	(0.019)
$\lvert\varepsilon_{j,t}(y^{EUR})\rvert$			-0.027		-0.007		-0.026		-0.017	-0.024
			(0.020)		(0.020)		(0.020)		(0.020)	(0.020)
$\lvert\varepsilon_{j,t}(y^{USD})\rvert$				0.016		0.029		-0.010	-0.003	-0.003
				(0.020)		(0.020)		(0.020)	(0.021)	(0.021)
$\bar{\varepsilon}_t(\pi, y)$					***-0.449	***-0.523				
					(0.093)	(0.090)				
$\bar{\mu}$	0.201	0.277	0.270	0.296	0.491	0.563	0.655	0.679	0.762	0.619
	***(0.016)	***(0.016)	***(0.022)	***(0.021)	***(0.051)	***(0.051)	**(0.255)	***(0.257)	***(0.257)	**(0.257)
Year dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
$N \times T$	62,432	62,004	62,213	61,515	62,213	61,515	62,213	61,515	61,381	61,633
R^2_B	0.023	0.055	0.025	0.045	0.022	0.055	0.186	0.186	0.181	0.133
R^2_O	0.001	0.004	0.002	0.004	0.002	0.004	0.025	0.026	0.027	0.025
R^2_W	0.001	0.004	0.002	0.004	0.002	0.004	0.022	0.024	0.024	0.022

Table A4: Robustness: Panel Fixed Effects Regression with asymmetric thresholds

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Unlike in the baseline regressions, the forecast errors are computed on the basis of asymmetric thresholds (see Table 3) when transforming continuous realizations in categories. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.167		-0.158		-0.156		-0.210		-0.191	
	***(0.015)		***(0.015)		***(0.015)		***(0.017)		***(0.017)	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.160		-0.159		-0.149		-0.106	-0.060	
		***(0.015)		***(0.015)		***(0.015)		***(0.017)	***(0.018)	
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			-0.048		-0.020		-0.066		-0.054	-0.085
			***(0.017)		(0.018)		***(0.018)		***(0.019)	***(0.018)
$\|\varepsilon_{j,t}(\pi^{USD})\|$				-0.012		0.030		-0.068	-0.051	-0.052
				(0.017)		*(0.018)		***(0.018)	***(0.018)	***(0.018)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.125		-0.095		-0.035		-0.013	-0.014
			***(0.017)		***(0.018)		*(0.018)		(0.018)	(0.018)
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.063		-0.040		-0.111	-0.100	-0.109
				***(0.018)		**(0.019)		***(0.019)	***(0.019)	***(0.019)
$\bar{\varepsilon}_t(\pi, y)$					-0.303	-0.435				
					***(0.066)	***(0.064)				
$\bar{\mu}$	0.218	0.230	0.328	0.272	0.482	0.498	0.801	0.700	0.886	0.683
	***(0.015)	***(0.016)	***(0.021)	***(0.022)	***(0.039)	***(0.040)	***(0.255)	***(0.257)	***(0.257)	***(0.257)
Year dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
$N \times T$	62,432	62,004	62,213	61,515	62,213	61,515	62,213	61,515	61,381	61,633
R^2_B	0.008	0.083	0.030	0.074	0.026	0.076	0.181	0.193	0.181	0.145
R^2_O	0.002	0.003	0.003	0.003	0.003	0.003	0.027	0.026	0.028	0.026
R^2_W	0.002	0.002	0.003	0.002	0.003	0.003	0.025	0.023	0.025	0.023

Table A5: Panel Pooled OLS Regression, no instruments

This table reports the results of panel pooled OLS regressions of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \beta_0 + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (ix), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. Unlike in Table A6, we do not use instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
$\lvert\varepsilon_{j,t}(i^{EUR})\rvert$	-0.133		-0.135		-0.163		-0.132	-0.133	
	***(0.015)		***(0.015)		***(0.016)		***(0.016)	***(0.015)	
$\lvert\varepsilon_{j,t}(i^{USD})\rvert$		-0.200		-0.201		-0.175	-0.150		-0.201
		***(0.017)		***(0.017)		***(0.019)	***(0.019)		***(0.017)
$\lvert\varepsilon_{j,t}(\pi^{EUR})\rvert$			0.007		-0.037		-0.038	-0.015	
			(0.015)		**(0.017)		**(0.017)	(0.017)	
$\lvert\varepsilon_{j,t}(\pi^{USD})\rvert$				0.064		-0.028	-0.026		0.062
				***(0.015)		*(0.016)	*(0.016)		***(0.016)
$\lvert\varepsilon_{j,t}(y^{EUR})\rvert$			-0.110		-0.034		-0.025	-0.133	
			***(0.016)		*(0.016)		(0.016)	***(0.017)	
$\lvert\varepsilon_{j,t}(y^{USD})\rvert$				-0.024		-0.074	-0.066		-0.026
				(0.017)		***(0.017)	***(0.017)		(0.018)
$\bar{\varepsilon}_t(\pi, y)$								0.254	-0.0249
								***(0.050)	(0.045)
β_0	0.183	0.246	0.257	0.217	0.697	0.670	0.804	0.120	0.203
	***(0.015)	***(0.016)	***(0.021)	***(0.021)	***(0.207)	***(0.209)	***(0.211)	***(0.030)	***(0.031)
Year dummies	NO	NO	NO	NO	YES	YES	YES	NO	NO
$N \times T$	64,316	63,843	64,079	63,323	64,079	63,323	63,184	64,079	63,323
R^2	0.001	0.003	0.002	0.003	0.026	0.026	0.028	0.002	0.003

Table A6: Panel Fixed Effects Regression, with instruments

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the USD/EUR forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (ix), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. We use lagged values as external instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables, or the cross-sectional average error made with respect to inflation and industrial production forecasts for the U.S. and the Eurozone ($\bar{\varepsilon}_t(\pi, y) = \frac{1}{4}(\bar{\varepsilon}_t(\pi^{EUR}) + \bar{\varepsilon}_t(\pi^{USD}) + \bar{\varepsilon}_t(y^{EUR}) + \bar{\varepsilon}_t(y^{USD})))$. Unlike in Table 5, we use lagged values as instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$.
Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.108		-0.105		-0.184		-0.158	-0.104	
	***(0.032)		***(0.032)		***(0.040)		***(0.042)	***(0.321	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.137		-0.151		-0.165	-0.126		-0.152
		***(0.037)		***(0.038)		***(0.055)	**(0.057)		***(0.038)
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			-0.096		-0.149		-0.195	-0.101	
			**(0.045)		***(0.053)		***(0.071)	*(0.053)	
$\|\varepsilon_{j,t}(\pi^{USD})\|$				0.182		0.024	0.086		0.225
				***(0.046)		(0.057)	(0.061)		***(0.054)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.044		0.085		0.111	-0.049	
			(0.065)		(0.087)		(0.097)	(0.078)	
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.066		-0.172	-0.203		-0.027
				(0.056)		***(0.060)	***(0.070)		(0.062)
$\bar{\varepsilon}_t(\pi, y)$								0.041	-0.343
								(0.136)	***(0.101)
$\bar{\mu}$	0.184	0.217	0.274	0.138	0.432	0.475	0.606	0.253	0.311
	***(0.025)	***(0.031)	***(0.059)	**(0.058)	***(0.100)	***(0.097)	***(0.113)	***(0.136)	***(0.054)
Year dummies	NO	NO	NO	NO	YES	YES	YES	NO	NO
$N \times T$	51,352	50,069	50,199	49,392	50,199	49,392	49,188	50,199	49,392
R^2_B	0.003	0.008	0.001	0.013	0.139	0.129	0.095	0.000	0.016
R^2_O	0.001	0.002	0.001	0.001	0.021	0.023	0.021	0.001	0.001
R^2_W	0.001	0.002	0.001		0.018	0.019	0.017	0.001	

Table A7: Panel Pooled OLS Regression, with instruments

This table reports the results of panel pooled OLS regressions of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \beta_0 + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (ix), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. We use lagged values as external instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$. $\Psi_{j,t}$ represents purely exogenous control variables such as year specific dummy variables. Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.056		-0.056		-0.142		-0.114	-0.050	
	*(0.029)		*(0.030)		***(0.038)		***(0.039)	*(0.030)	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.136		-0.146		-0.158	-0.131		-0.148
		***(0.034)		***(0.035)		***(0.050)	**(0.053)		***(0.347)
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			-0.060		-0.147		-0.182	-0.088	
			(0.041)		***(0.048)		***(0.052)	*(0.048)	
$\|\varepsilon_{j,t}(\pi^{USD})\|$				0.203		0.028	0.062		0.244
				***(0.042)		(0.051)	*(0.083)		***(0.048)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.166		0.040		0.085	-0.189	
			***(0.056)		(0.075)		(0.055)	***(0.063)	
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.038		-0.154	-0.165		-0.001
				(0.051)		***(0.055)	***(0.062)		(0.055)
$\bar{\varepsilon_t}(\pi, y)$								0.227	-0.357
								*(0.118)	***(0.094)
β_0	0.147	0.216	0.304	0.103	0.571	0.343	0.657	0.184	0.289
	***(0.024)	***(0.029)	***(0.053)	**(0.052)	***(0.080)	*** (0.067)	***(0.657)	***(0.049)	***(0.052)
Year dummies	NO	NO	NO	NO	YES	YES	YES	NO	NO
$N \times T$	50,508	50,069	50,199	49,392	50,199	49,392	49,188	50,199	49,392
R^2	0.000	0.002	0.001	.	0.022	0.023	0.000	0.000	.

Table A8: Panel Fixed Effects Regression with AR(1) correction, no instruments

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and U.S.-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$ and $\Psi_{j,t}$, i.e.

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{USD})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (ix), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. $\Psi_{j,t}$ represents purely exogenous control variables such year specific dummy variables. Unlike in Table A6, we do not use instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$. We control for first-order autocorrelation by the fixed-effects method proposed by Baltagi and Wu (1999). Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
$\lvert\varepsilon_{j,t}(i^{EUR})\rvert$	-0.153		-0.153		-0.172		-0.148	-0.153	
	***(0.017)		***(0.017)		***(0.018)		***(0.019)	***(0.017)	
$\lvert\varepsilon_{j,t}(i^{USD})\rvert$		-0.179		-0.178		-0.166	-0.140		-0.178
		***(0.018)		***(0.018)		***(0.019)	***(0.019)		***(0.018)
$\lvert\varepsilon_{j,t}(\pi^{EUR})\rvert$			0.002		-0.017		-0.015	0.013	
			(0.017)		(0.017)		*(0.018)	(0.018)	
$\lvert\varepsilon_{j,t}(\pi^{USD})\rvert$				0.006		-0.046	-0.042		0.022
				(0.017)		***(0.017)	**(0.018)		(0.018)
$\lvert\varepsilon_{j,t}(y^{EUR})\rvert$			-0.081		-0.038		-0.030	-0.068	
			***(0.017)		**(0.017)		*(0.018)	***(0.018)	
$\lvert\varepsilon_{j,t}(y^{USD})\rvert$				-0.064		-0.084	-0.075		-0.049
				***(0.018)		***(0.019)	***(0.019)		**(0.019)
$\bar{\varepsilon_t}(\pi, y)$								-0.133	0.194
								**(0.066)	***(0.064)
$\bar{\mu}$	0.231	0.265	0.290	0.299	0.824	0.791	0.786	0.364	0.413
	***(0.014)	***(0.015)	***(0.019)	***(0.019)	***(0.108)	***(0.106)	***(0.106)	***(0.033)	***(0.033)
Year dummies	NO	NO	NO	NO	YES	YES	YES	NO	NO
$N \times T$	60,329	60,951	61,159	60,463	62,346	60,463	60,329	61,159	60,463
R^2_B	0.168	0.021	0.012	0.015	0.163	0.175	0.165	0.007	0.015
R^2_O	0.027	0.002	0.002	0.002	0.025	0.025	0.027	0.002	0.002
R^2_W	0.017	0.002	0.002	0.002	0.015	0.015	0.016	0.002	0.002
DW (Bhargava et al.)	1.03	1.63	1.63	1.63	1.66	1.66	1.66	1.63	1.63
DW (Baltagi/Wu)	1.87	1.87	1.87	1.87	1.90	1.90	1.90	1.87	1.87

Table A9: Panel Fixed Effects Regression, alternative instruments

This table reports the results of panel regressions with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on the absolute forecast error made for European and US-American interest rates ($|\varepsilon_{j,t}(i^{EUR})|$ and $|\varepsilon_{j,t}(i^{USD})|$, respectively) as well as a battery of control variables $\Phi_{j,t}$, i.e.,

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(i^{EUR})| + \beta_2|\varepsilon_{j,t}(i^{EUR})| + \gamma\Phi_{j,t} + \delta\Psi_{j,t} + \epsilon_{j,t}.$$

Depending on the specification (i) to (ix), $\Phi_{j,t}$ includes forecast errors with respect to other fundamentals than interest rates, i.e. inflation ($|\varepsilon(\pi)|$) and industrial production growth forecast errors $|\varepsilon(y)|$. $\Psi_{j,t}$ represents year specific dummy variables.
Unlike in Table A6, we use *alternative* instruments for $|\varepsilon_{j,t}(i^{EUR})|$, $|\varepsilon_{j,t}(i^{USD})|$ and $\Phi_{j,t}$, which are correlated with these variables but uncorrelated with the unexplained portion of Eq. 2. Doing so, we make use of the facts that: (i) our dataset covers a broader set of countries than the US and the Eurozone, i.e. the UK and Japan; and that, (ii), skills in predicting macroeconomic series persist across countries. We thus employ the absolute forecast errors with respect to the interest rates in the *UK* and in *Japan* as exogenous instruments for the forecast errors with respect to the *US* and the *Eurozone*. Likewise, we use the absolute forecast errors with respect to the inflation rate and industrial production in these countries as instruments for the US and Eurozone inflation and industrial production, respectively. These instruments are valid for two reasons: first, it can be shown from our data that skills in predicting these macroeconomic series are correlated across countries: for example, the cross-sectional correlation between average absolute errors with respect to Eurozone and UK interest rates is 0.51. In the panel context, there still remains a positive correlation of absolute forecast errors with respect to these two series of 0.25. Secondly, there is no theoretical reason to believe that errors in predicting the macroeconomic circumstances in Japan should have a systematic impact on the USD/EUR exchange rate predictions which is not yet covered by the forecast error with respect to the fundamentals in the United States or the Eurozone; hence, the instruments are exogenous.
Significance: ***:1%, **: 5%, *: 10%.

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
$\|\varepsilon_{j,t}(i^{EUR})\|$	-0.411		-0.447		-0.986		-0.494	
	***(0.058)		***(0.065)		***(0.081)		***(0.0619)	
$\|\varepsilon_{j,t}(i^{USD})\|$		-0.518		-0.378		-0.839		-0.452
		***(0.067)		***(0.082)		***(0.104)		***(0.080)
$\|\varepsilon_{j,t}(\pi^{EUR})\|$			-0.101		0.229		0.046	
			(0.090)		**(0.105)		(0.097)	
$\|\varepsilon_{j,t}(\pi^{USD})\|$				-0.351		0.209		-0.177
				***(0.107)		*(0.110)		(0.125)
$\|\varepsilon_{j,t}(y^{EUR})\|$			-0.078		0.158		0.029	
			***(0.077)		*(0.088)		(0.091)	
$\|\varepsilon_{j,t}(y^{USD})\|$				-0.268		-0.276		-0.163
				**(0.126)		*(0.110)		(0.159)
$\bar{\varepsilon}_t(\pi, y)$							-0.116	0.248
							(0.168)	(0.207)
$\bar{\mu}$	0.375	0.488	0.530	0.781	1.196	1.071	0.469	0.491
	***(0.042)	***(0.054)	***(0.073)	***(0.102)	***(0.310)	***(0.307)	***(0.063)	***(0.074)
Year dummies	NO	NO	NO	NO	YES	YES	NO	NO
$N \times T$	57,448	57,435	51,259	51,182	51,259	51,182	51,259	51,182
R^2_B	0.007	0.042	0.013	0.015	0.054	0.067	0.010	0.030
R^2_O	0.002	0.003	0.002	0.001	0.016	0.018	0.001	0.002
R^2_W						0.001		

Table A10: Interaction model: signals for value trade phases based on Taylor rules

This table reports the results of a panel regression with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on a fundamental forecast error (in absolute terms) $|\varepsilon_{j,t}(X)|$, a dummy variable FUND_t taking on unity if interest rates differentials strongly deviate from differentials postulated by Taylor rules (and zero otherwise), and an interaction of the these two variables, i.e.,

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(X)| + \beta_2\text{FUND}_t + \beta_3\left(|\varepsilon_{j,t}(X)| \times \text{FUND}_t\right) + \epsilon_{j,t}.$$

Depending on the specification (i) to (vi), X represents the interest rates i, the industrial production growth rate (yoy) y and the inflation rate π projections for the U.S. and the Eurozone, respectively, made by j in t. Clustering-robust standard errors (by observational unit) are provided in parentheses. We also report the covariance between $\hat{\beta}_1$ and $\hat{\beta}_4$ or $\hat{\beta}_1$ and $\hat{\beta}_5$, respectively. The table also provides the marginal effects of a fundamental forecast error in both value phases ($F_t = 1$) and non-value phases ($F_t = 0$). Significance: ***:1%, **: 5%, *: 10%.

	(i)- $X: i_{EUR}$	(ii)- $X: i_{USD}$	(iii)- $X: \pi_{EUR}$	(iv)- $X: \pi_{USD}$	(v)- $X: y_{EUR}$	(vi)- $X: y_{USD}$
$\lvert\varepsilon_{j,t}(X)\rvert$	0.052	-0.240	-0.030	0.120	-0.061	-0.099
	**(0.021)	***(0.021)	(0.021)	***(0.018)	***(0.020)	***(0.023)
F_t	0.490	0.225	0.254	0.394	0.289	0.178
	***(0.031)	***(0.033)	(0.029)	***(0.027)	***(0.029)	***(0.027)
$\lvert\varepsilon_{j,t}(X)\rvert \times F_t$	-0.265	0.074	0.009	-0.193	-0.044	0.140
	***(0.032)	**(0.033)	(0.034)	***(0.029)	(0.030)	***(0.036)
$\bar{\mu}$	-0.020	0.166	0.007	-0.095	0.031	0.042
	(0.016)	(0.017)	(0.014)	***(0.015)	(0.016)	***(0.014)
$N \times T$	62,432	62,004	62,449	61,914	62,497	62,094
R^2_{corr}	0.005	0.006	0.0024	0.0031	0.0032	0.003
$Cov(\hat{\beta}_1, \hat{\beta}_3)$	-0.0005	-0.0004	-0.0005	-0.0003	-0.0004	-0.0006
$\left.\frac{\partial r}{\partial\lvert\varepsilon_{j,t}(X)\rvert}\right\rvert_{F_t=0}$	0.052	-0.240	-0.030	0.120	-0.061	-0.099
	**(0.021)	***(0.021)	(0.021)	***(0.018)	***(0.020)	***(0.023)
$\left.\frac{\partial r}{\partial\lvert\varepsilon_{j,t}(X)\rvert}\right\rvert_{F_t=1}$	-0.213	-0.166	-0.021	-0.073	-0.105	0.041
	***(0.023)	***(0.027)	(0.024)	***(0.024)	***(0.022)	(0.122)

A.2 Further market phases

A.2.1 Forecasting fundamentals based on momentum phases

In addition to the analysis in Section 4.3, we model interaction effects of the absolute interest rate forecast error in dependence of the momentum market phase by setting $\text{SIG}_{j,t} = \left(D^H_{j,t}\ D^L_{j,t}\right)'$ and $\beta_2 = (\beta_{21}\ \beta_{22})$ and $\beta_3 = (\beta_{31}\ \beta_{32})$ in Eq. 4.[20]

Table A11, (i) and (ii), shows that the marginal effects of interest rate forecast errors vary substantially across momentum phases: they matter most when the momentum is not particularly pronounced.

TABLE A11 ABOUT HERE

The marginal effect of a deterioration of a Euro interest rate forecast by one error point corresponds, on average, to a decline of the monthly trading return of 0.216 percentage points when the forecasts were made in normal momentum phases (see (i)). This value is not far away from the marginal effect in low momentum phases (-0.223), but differs substantially from the marginal effects observed in high momentum phases (0.024). While the former two marginal effects are significantly different from zero, this is not the case for the latter. These results indicate that a good prediction of European interest rates helps improve the exchange rate forecasts unless momentum trading dominates markets.

As it can be seen from the marginal effects in (ii), the results are very similar (and maybe even more pronounced) when the relationship between the forecast of the U.S. interest rate and the exchange rate forecasting performance is considered.

For comparison, Table A11 also demonstrates that the marginal effects of the other fundamental forecast errors (w.r.t inflation, industrial production) show a similar pattern across momentum phases but are smaller in absolute value compared to those of the interest rate forecast errors: to mention the most pronounced effect, an increase of one error point with respect to the forecast of the European industrial production (see (v) in Table A11) leads to a return decrease of 0.156 percentage points in low momentum phases.

[20] The marginal effect is now computed by $\frac{\partial r}{\partial |\varepsilon(i)|} = \hat{\beta}_1 + \hat{\beta}_{31} \times D^L + \hat{\beta}_{32} \times D^H$ and its standard error by

$$\left(Var(\hat{\beta_1}) + (D^L)^2 Var(\hat{\beta_{31}}) + (D^H)^2 Var(\hat{\beta_{32}}) + 2(D^L)Cov(\hat{\beta_1}, \hat{\beta_{31}}) + 2(D^H)Cov(\hat{\beta_1}, \hat{\beta_{32}})\right)^{\frac{1}{2}}.$$

A.2.2 Forecasting fundamentals and interest differential phases

Finally, we also consider interaction models of the absolute forecast error with interest differential phases; hence, we set $\text{SIG}_t = |i_t^{USD} - i_t^{EUR}|$, and we focus on the marginal effects, i.e. $\frac{\partial r}{\partial|\varepsilon_{j,t}(i)|} = \hat{\beta}_1 + \hat{\beta}_3 \times |i_t^{USD} - i_t^{EUR}|$. Table A12 presents the coefficient estimates as well as the marginal effects evaluated at the average absolute interest rate differential over the sample period.

Table A12 about here

For this particular value, there are relatively large negative effects of prediction errors in interest rates forecasts (see (i) and (ii)).

The effects of errors in interest rate forecasts (for both U.S. and EUR interest rates) on exchange rate forecasts are significantly negative; the marginal effects even decrease with increasing interest rate differentials. These results indicate that the ability to predict interest rates is even more pronounced in phases in which interest rate differentials are large in absolute terms. This suggests that large interest rate differentials are rather a sign of a fundamental misalignment (in which fundamental analysis becomes more important) than an opportunity for carry trades.

For comparison, Table A12, (iii)-(vi), also reports similar exercises for the other fundamental forecasts besides interest rates. The findings for interest rate forecasting errors are mainly confirmed by growth forecast errors but not by inflation forecast errors. As for the analysis of value phases, the contribution of good inflation forecasts to good exchange rate forecasts does not fit well into the pattern. One may speculate whether a possible impact of inflation (forecasts) on exchange rates is overruled by very obvious, relatively shorter-term economic forces, i.e. short-term interest rates and business cycle considerations.

Table A11: Interaction model: signals for momentum trade phases

This table reports the results of a panel regression with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on a fundamental forecast error (in absolute terms) $|\varepsilon_{j,t}(X)|$, a trend-phase dummy (for low and high trend phases, D^L and D^H) and an interaction of the forecast error with the trend-phase, i.e.,

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(X)| + \beta_{21}D^L_{j,t} + \beta_{22}D^H_{j,t} + \beta_{31}\left(|\varepsilon_{j,t}(X)| \times D^L_{j,t}\right) + \beta_{32}\left(|\varepsilon_{j,t}(X)| \times D^H_{j,t}\right) + \epsilon_{j,t}.$$

Note that the "normal" trend phase is taken as reference. Depending on the specification (i) to (vi), X represents the interest rates i, the industrial production growth rate (yoy) y and the inflation rate π projections for the U.S. and the Eurozone, respectively, made by j in t. Clustering-robust standard errors (by observational unit) are provided in parentheses. We also report the covariance between $\hat{\beta}_1$ and $\hat{\beta}_4$ or $\hat{\beta}_1$ and $\hat{\beta}_5$, respectively. $\frac{\partial r}{\partial|\varepsilon_{j,t}(X)|}$ represents the marginal effects of a fundamental forecast error on $r_{j,t,t+1}$. Significance: ***:1%, **: 5%, *: 10%.

	(i)- $X : i_{EUR}$	(ii)- $X : i_{USD}$	(iii)- $X : \pi_{EUR}$	(iv)- $X : \pi_{USD}$	(v)- $X : y_{EUR}$	(vi)- $X : y_{USD}$
$\|\varepsilon_{j,t}(X)\|$	-0.216	-0.228	0.061	0.030	-0.113	-0.070
	***(0.027)	***(0.031)	**(0.028)	(0.026)	***(0.029)	**(0.028)
$D^L_{j,t}$	-0.135	-0.017	-0.014	-0.130	-0.112	-0.171
	***(0.033)	(0.037)	(0.034)	***(0.035)	***(0.034)	***(0.032)
$D^H_{j,t}$	-0.249	-0.320	-0.080	-0.116	-0.209	-0.140
	***(0.037)	***(0.040)	(0.034)	***(0.039)	***(0.036)	***(0.033)
$\|\varepsilon_{j,t}(X)\| \times D^L_{j,t}$	-0.013	-0.165	-0.186	-0.015	-0.035	0.051
	(0.037)	***(0.043)	***(0.039)	(0.037)	(0.039)	(0.038)
$\|\varepsilon_{j,t}(X)\| \times D^H_{j,t}$	0.241	0.303	0.005	-0.015	0.188	0.107
	***(0.038)	***(0.039)	(0.040)	(0.037)	***(0.042)	**(0.042)
$\bar{\mu}$	0.319	0.345	0.128	0.148	0.250	0.209
	***(0.023)	***(0.027)	***(0.021)	***(0.023)	***(0.022)	***(0.021)
$N \times T$	62,432	62,004	62,449	61,914	62,497	62,094
R^2_{corr}	0.003	0.005	0.001	0.001	0.002	0.001
$Cov(\hat{\beta}_1, \hat{\beta}_4)$	-0.0007	-0.0010	-0.0008	-0.0007	-0.0008	-0.0008
$Cov(\hat{\beta}_1, \hat{\beta}_5)$	-0.0007	-0.0009	-0.0008	-0.0006	-0.0009	-0.0007
$\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}$ (Low momentum phase)	-0.223	-0.393	-0.125	0.015	-0.156	-0.019
	***(0.026)	***(0.028)	***(0.026)	(0.025)	***(0.027)	(0.027)
$\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}$ (Normal momentum phase)	-0.216	-0.228	0.061	0.030	-0.113	-0.070
	***(0.027)	***(0.032)	**(0.028)	(0.026)	***(0.029)	**(0.028)
$\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}$ (High momentum phase)	0.024	0.075	0.067	0.074	0.065	0.037
	(0.026)	**(0.027)	**(0.029)	**(0.029)	(0.028)	(0.033)

Table A12: Interaction model: interest rate differential phases

This table reports the results of a panel regression with individual fixed effects of the trading rule T_{ind}'s period forecast return, $r_{j,t,t+1}$ (based on the forecast of the forecaster j in t), on a fundamental forecast error (in absolute terms) $|\varepsilon_{j,t}(X)|$, the absolute differential between the U.S. and Euro interest rates, $|i_t^{USD} - i_t^{EUR}|$, and an interaction of the these two variables, i.e.,

$$r_{j,t,t+1} = \mu_j + \beta_1|\varepsilon_{j,t}(X)| + \beta_2|i_t^{USD} - i_t^{EUR}| + \beta_3\left(|\varepsilon_{j,t}(X)| \times |i_t^{USD} - i_t^{EUR}|\right) + \epsilon_{j,t}.$$

Depending on the specification (i) to (vi), X represents the interest rates i, the industrial production growth rate (yoy) y and the inflation rate π projections for the U.S. and the Eurozone, respectively, made by j in t. Clustering-robust standard errors (by observational unit) are provided in parentheses. We also report the covariance between $\hat{\beta}_1$ and $\hat{\beta}_4$ or $\hat{\beta}_1$ and $\hat{\beta}_5$, respectively. The table also provides the marginal effects of a fundamental forecast error on $r_{j,t,t+1}$ evaluated at the average absolute interest rate differential between 1991.12 and 2009.11, $\overline{|i_t^{USD} - i_t^{EUR}|} = 2.84118$. Significance: ***:1%, **: 5%, *: 10%.

	(i)- $X: i_{EUR}$	(ii)- $X: i_{USD}$	(iii)- $X: \pi_{EUR}$	(iv)- $X: \pi_{USD}$	(v)- $X: y_{EUR}$	(vi)- $X: y_{USD}$
$\|\varepsilon_{j,t}(X)\|$	-0.084	-0.113	-0.196	-0.068	0.120	0.151
	**(0.034)	***(0.036)	***(0.034)	*(0.037)	***(0.036)	***(0.038)
$\|i_t^{USD} - i_t^{EUR}\|$	-0.047	-0.047	-0.143	-0.110	0.010	-0.002
	***(0.018)	***(0.019)	***(0.016)	***(0.017)	(0.018)	(0.017)
$\|\varepsilon_{j,t}(X)\| \times \|i_t^{USD} - i_t^{EUR}\|$	-0.040	-0.057	0.120	0.069	-0.125	-0.113
	**(0.018)	***(0.020)	***(0.018)	***(0.020)	***(0.019)	***(0.020)
$\bar{\mu}$	0.272	0.326	0.324	0.242	0.134	0.113
	***(0.033)	***(0.035)	***(0.028)	***(0.029)	***(0.033)	***(0.030)
$N \times T$	62,432	62,004	62,449	61,914	62,497	62,094
R^2_{corr}	0.003	0.004	0.002	0.001	0.003	0.002
$Cov(\hat{\beta}_1, \hat{\beta}_3)$	-0.001	-0.0006	-0.0005	-0.0007	-0.0006	-0.0007
$\left.\frac{\partial r}{\partial\|\varepsilon_{j,t}(X)\|}\right\|_{\overline{\|i_t^{USD}-i_t^{EUR}\|}}$	-0.199	-0.275	0.146	0.128	-0.236	-0.171
	***(0.025)	***(0.030)	***(0.026)	***(0.028)	***(0.027)	***(0.028)