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Abstract

This paper investigates the determinants of forecast heterogeneity in the Yen-US dollar market using a panel data set from Consensus Economics. Regardless of the particular model specification and consideration of control variables we find that exchange rate misalignments increase forecast dispersion, while foreign exchange intervention of the Japanese Ministry of Finance dampens expectation heterogeneity.

JEL classification: F31, D84, C33
Keywords: Exchange rates, forecast heterogeneity, survey data

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1 Introduction

Since the seminal work of Allen and Taylor (1990) and Ito (1990) survey data of FX-market participants are used to shed light on the question of how exchange rate expectations are built. One important stylized fact of the literature is that – in contrast to the prevailing assumption of the rational representative agent – real world forecasters are heterogeneous in a number of aspects. This finding has also gained attention in other strands of the literature: For instance, Elliot et al. (2008) recently examine heterogeneity in output projections, while Mankiw et al. (2003) and Capistran and Timmermann (2009) investigate expectation heterogeneity with respect to inflation forecasts. MacDonald and Marsh (1996), Elliot and Ito (1999), Bénassy-Quéré et al. (2003), and Dreger and Stadtmann (2008) all find evidence in favor of foreign exchange forecasters' heterogeneity. Investigating the determinants of forecast dispersion, Menkhoff et al.(2009) find strong support for the chartist and fundamentalist approach pioneered by Frankel and Froot (1990). The authors show that the recent exchange rate change as well as the degree of misalignment explain the dispersion of forecasts.

From a policy maker's perspective it is important to understand that market heterogeneity seems to be a major source of exchange rate volatility (Evans, 2002), constituting an additional channel by which central bank intervention may *calm disorderly markets* (Dominguez and Frankel, 1993). In addition, the relationship between exchange rate misalignment and forecast heterogeneity is also important for the so-called *coordination channel* of intervention (Reitz and Taylor, 2008). Using Japanese interventions in the Yen-US dollar market Beine et al. (2007) analyze the influence of central bank operations on the heterogeneity among FX-forecasters. The authors find that neither expected nor unexpected interventions have an impact on forecast heterogeneity between 1992 and 1994, while the estimated

coefficients based on the period 1996 – 2001 are statistically significant but ambiguously signed. Against the backdrop of the results presented in Menkhoff et al. (2009) and studies of Bank of Japan reaction functions (Frenkel et al., 2005; Ito and Yabu, 2007) these findings may be due to an omitted variable problem, as current misalignment and recent returns of the exchange rate seem to be important not only for central bank intervention activity, but also for forecast heterogeneity.

This paper investigates the determinants of forecast heterogeneity in the Yen-US dollar market by applying a large panel data set from *Consensus Economics Inc.* We consider a number of control variables such as the prevailing volatility regime as well as the risk premium at the foreign exchange market. Moreover, the data set contains expectations for GDP and CPI allowing for cross-sectional correlation between dispersion of exchange rate forecasts and forecast dispersion of related macro variables. We find that increasing misalignments raise forecast heterogeneity, while the estimated coefficient of the recent exchange rate return is positive, but generally insignificant. In addition, central bank interventions reduce forecast dispersion, regardless of the particular specification and consideration of control variables.

The paper is structured as follows: Section 2 describes the data set. In section 3, we explain our econometric set up and present the regression results. The last section concludes.

2 Description of the data set

The panel data set of foreign exchange forecasters stems from *Consensus Economics Inc.* The survey takes place on a monthly basis and we concentrate on the one-month-ahead forecast. As a consequence, we do not run

into a problem of overlapping forecast horizons. We focus on the currency pair of the Yen against the US dollar. The sample under consideration ranging from 10/1995 to 12/2007 includes 146 monthly forecasts of 31 individual forecasters. Thus, our data set significantly extends the one used in Beine et al. (2007) ending in 2001. The *Japanese Ministry of Finance* (JMoF) intervened on 173 days (Direction: 167 buy US dollar/ 6 sell US dollar). The *Federal Reserve* intervened only once, so that this intervention is not considered in our study. The daily average size of intervention was about 34.46 Million Yen.[1]

3 Empirical analysis

In Specification I we regress the dispersion measure $disp_t$ on a constant and on the absolute volume of JMoF interventions $|JMoF_t|$ during the preceding month. Dispersion is measured as the standard deviation of all individual exchange rate forecasts at each point in time. In Specification II we estimate the following equation:

$$disp_t = \alpha + \lambda|JMoF_{t-1}| + \beta|s_t - s_{t-1}| + \gamma|s_t - s_{116}| + \epsilon_t, \tag{1}$$

and additionally control for the recent change in the exchange rate, $s_t - s_{t-1}$, as well as the deviation of the exchange rate from an exchange rate target $(s_t - s_{116})$. To determine an exchange rate target, we apply the methodology suggested by Benassy-Quere et al. (2003) and use the average nominal exchange rate level of 116 Yen/USD that prevailed during the time period of our study.

The results are displayed in Table 1 and can be interpreted as follows: The coefficients of both the return and misalignment variable have a positive sign and are significantly different from zero. The latter finding points

[1] See Ito (2002) for an detailed description of the Japanese intervention behavior.

into the direction that forecasters' heterogeneity increases as misalignments grow. Importantly, the coefficient of the intervention measure is significantly negative, which implies a lowering of uncertainty among FX-forecasters in the presence of Japanese intervention operations. This is in contrast to Beine et al. (2007), who find that neither expected nor unexpected interventions have an impact on forecast heterogeneity between 1992 and 1994, while the estimated coefficients based on the period 1996 – 2001 are statistically significant but ambiguously signed.[2]

In Specification III we add a risk and a volatility measure as additional control variables. Risk is measured as the absolute difference between the one month forward rate and the mean expected exchange rate level. This measure is motivated by Menkhoff et al. (2009) referring to the noise trader theory. We also control for the exchange rate volatility. Exchange rate volatility is measured as the standard deviation of daily exchange rate returns during the preceding month and significantly explains forecast heterogeneity. Moreover, these variables seem to dominate the influence of the recent change in exchange rate, as the latter becomes insignificant in all subsequent specifications.

In Specification IV we also introduce expected changes of exchange-rate-related macro-variables. We control for the standard deviation of all individual CPI and GDP forecasts at each point in time for the two economies under consideration. The hypothesis is that a higher dispersion with respect to, for example, CPI forecasts should also lead to a larger dispersion for the FX-forecasts. However, all forward looking control variables are insignificant, only the Japanese CPI forecast is borderline

[2]Our results may differ from Beine et al. (2007) due to a significantly extended sample and the fact that we use the absolute amount of intervention instead of intervention frequency. Subsequently, we provide a robustness check regarding the different choices of the intervention variable.

significant.

Specifications I – IV in Table 1 have been estimated using ordinary least squares. Significant autocorrelation of the error term was present at a lag of one and three while the partial autocorrelation was significant only at lag one. As a consequence, we also specified two AR specifications with a lag of one and three and estimated the equation via maximum likelihood. These specifications are presented as specification V and VI. The estimation results are quite robust against this modification of the econometric technique. In addition, we tested whether or not our results are driven by the choice of the dispersion measure. Following Beine et al. (2007) we used the variation coefficient, defined as standard deviation of all forecasters divided by the mean forecast at each point in time, as an alternative measure of dispersion. The results presented as Specification VII in Table 1 seem to be robust regarding this modification.

The last robustness check considers the number of intervention days in the previous month instead of the cumulated absolute volume of intervention. Re-estimation of models I – VII yields parameter estimates as presented in Table 2. Consistent with Beine et al. (2007) the coefficient of intervention frequency remains statistically insignificant in most of the model specifications. This result suggests that a high frequency of intervention may not be sufficient to diminish controversies among FX-forecasters. A high intervention volume seems to be important to influence the foreign exchange market. This is in line with Ito (2002) showing that Japanese intervention have been more effective after the policy regime shift in the mid 1990s towards larger but less frequent operations.

4 Conclusion

In this paper we analyze the impact of central bank intervention on exchange-rate forecast heterogeneity. We control for misalignments as well as recent returns of the exchange rate as these variables have proven to be important for the heterogeneity among forecasters on foreign exchange markets. Based on a panel data set provided by Consensus Economics we find empirical evidence that Japanese Ministry of Finance interventions exhibited a dampening effect on the dispersion among FX-forecasts. Particularly, the volume of intervention rather than intervention frequency seems to be capable of reducing forecast heterogeneity.

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Table 1: Dispersion with absolute volume of BoJ interventions

	I	II	III	IV	V	VI	VII
constant	2.75***	2.31***	1.45***	1.39***	1.81***	1.72***	1.62***
	(32.64)	(15.12)	(7.07)	(5.52)	(5.44)	(4.51)	(5.19)
$\lvert IntBoJ_{t-1}\rvert$	-0.015**	-0.016**	-0.015**	-0.014**	-0.017*	-0.016*	-0.012*
	(-1.99)	(-2.22)	(-2.29)	(-2.15)	(-1.91)	(-1.89)	(-1.74)
$\lvert s_t - s_{t-1}\rvert$	–	8.00**	1.73	2.85	1.98	2.44	2.20
		(2.19)	(0.50)	(0.78)	(0.69)	(0.91)	(0.92)
$\lvert s_t - s_{116}\rvert$	–	4.34**	3.02*	3.48**	5.83***	5.43**	3.49*
		(2.52)	(1.91)	(2.10)	(2.66)	(2.36)	(1.91)
$\lvert f_t - \bar{E}_t[s_{t+1}]\rvert$	–	–	11.58	10.65	13.54**	10.23*	8.84*
			(1.61)	(1.46)	(2.33)	(1.78)	(1.91)
FX-Volatility Yen/USD	–	–	146.16***	140.02***	60.00*	73.72**	60.54*
			(4.60)	(4.34)	(1.90)	(2.38)	(1.93)
$Stand.Dev.E_{t,i}[JCPI_{t+1}]$	–	–	–	1.32	1.19	0.76	0.67
				(1.51)	(1.51)	(0.80)	(0.89)
$Stand.Dev.E_{t,i}[UCPI_{t+1}]$	–	–	–	-0.87	-1.16	-0.92	-0.98
				(-0.93)	(-1.05)	(-0.82)	(-1.04)
$Stand.Dev.E_{t,i}[JGDP_{t+1}]$	–	–	–	-0.15	-0.10	0.11	0.03
				(-0.36)	(-0.20)	(0.22)	(0.08)
$Stand.Dev.E_{t,i}[UGDP_{t+1}]$	–	–	–	0.03	0.06	0.05	0.067
				(0.26)	(0.09)	(0.07)	(0.11)
$R^2_{adjust.}$	0.0201	0.0808	0.2488	0.2403	–	–	–
AR(1)	–	–	–	–	0.45***	0.39***	0.37***
					(6.47)	(5.12)	(4.34)
AR(2)	–	–	–	–	–	0.045	-0.023
						(0.05)	(-0.23)
AR(3)	–	–	–	–	–	0.18**	0.125
						(2.04)	(1.46)
Log.Likel.	–	–	–	–	-163.8	-161.6	534.11
Obs.	146	146	146	146	146	146	146

Note: t-statistics in parentheses. The coefficients in Specification VII are multiplied by 100. *** (**, *) = significant at the 1 (5, 10) percent level.

Table 2: Dispersion with intervention frequency

	I	II	III	IV	V	VI	VII
constant	2.74***	2.31***	1.46***	1.39***	1.83***	1.73***	1.62***
	(32.46)	(14.87)	(6.93)	(5.43)	(5.47)	(4.49)	(5.14)
$CountBoJ_{t-1}$	-0.042*	-0.040*	-0.034	-0.031	-0.044	-0.039	-0.027
	(-1.68)	(-1.65)	(-1.51)	(-1.37)	(-1.58)	(-1.49)	(-1.24)
$\lvert s_t - s_{t-1}\rvert$	–	7.72**	1.51	2.66	1.96	2.39	2.20
		(2.09)	(0.43)	(0.72)	(0.67)	(0.89)	(0.90)
$\lvert s_t - s_{116}\rvert$	–	4.14**	2.83*	3.31**	5.53**	5.20**	3.27*
		(2.39)	(1.78)	(1.99)	(2.43)	(2.27)	(1.79)
$\lvert f_t - \bar{E}_t[s_{t+1}]\rvert$	–	–	11.94	10.99	14.22**	10.48*	8.96*
			(1.65)	(1.49)	(2.43)	(1.80)	(1.93)
FX-Volatility Yen/USD	–	–	144.52***	138.21***	54.03*	67.29**	55.98*
			(4.49)	(4.24)	(1.68)	(2.16)	(1.76)
$Stand.Dev.E_{t,i}[JCPI_{t+1}]$	–	–	–	1.36	1.14	0.72	0.63
				(1.53)	(1.30)	(0.75)	(0.83)
$Stand.Dev.E_{t,i}[UCPI_{t+1}]$	–	–	–	-0.94	-1.24	-0.90	-0.97
				(-1.00)	(-1.10)	(-0.79)	(-1.01)
$Stand.Dev.E_{t,i}[JGDP_{t+1}]$	–	–	–	-0.13	-0.019	0.18	0.09
				(-0.31)	(-0.04)	(0.36)	(0.21)
$Stand.Dev.E_{t,i}[UGDP_{t+1}]$	–	–	–	0.040	0.066	0.056	0.070
				(0.31)	(0.09)	(0.08)	(0.11)
$R^2_{adjust.}$	0.0124	0.0670	0.2332	0.2253	–	–	–
AR(1)	–	–	–	–	0.45***	0.38***	0.35***
					(6.56)	(5.08)	(4.28)
AR(2)	–	–	–	–	–	0.026	-0.0026
						(0.27)	(-0.03)
AR(3)	–	–	–	–	–	0.177**	0.126
						(2.08)	(1.50)
Log.Likel.	–	–	–	–	-165.8	-163.3	532.5
Obs.	146	146	146	146	146	146	146

Note: t-statistics in parentheses. The coefficients in Specification VII are multiplied by 100. *** (**, *) = significant at the 1 (5, 10) percent level.