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Patterns in Exchange Rate Forecasts for 25 Currencies

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Abstract

The properties of exchange rate forecasts are investigated, with a data set encompassing a broad cross section of currencies. Over the entire sample, expectations appear to be biased. This result is robust to the possibility of random measurement error in the survey measures. There appear to be statistically significant differences in the degree of bias in subgroupings of the data: (i) the bias is lower for the high-inflation countries; (ii) the bias is greater for the major currencies studied in earlier papers; and (iii) the bias is also greater for the EMS currencies.

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1. INTRODUCTION

In this paper we apply a new data set to the problem of assessing whether exchange rate expectations are unbiased. It consists of survey data derived from Currency Forecasters' Digest (hereafter CFD). CFD collects and publishes forecasts for over 25 exchange rates, and includes several for newly industrializing countries in Asia, Latin American LDCs, and smaller developed countries in Europe and elsewhere, each month. The hope is that with a much broader and more heterogeneous set of currencies than that in earlier studies of survey data, interesting new patterns can be identified.[1] Indeed, we find that (i) the amount of information in the survey data is much higher with respect to high-inflation countries; (ii) the forecasts for the minor currencies exhibit less bias than those for the main currencies previously studied, and (iii) the EMS currency forecasts exhibit more bias than those for other currencies, especially at the 12 month horizon. It is perhaps reassuring that there is at least some degree of predictive power in the cases of smaller countries with less stable currencies.

The data and general approach are discussed in the next section. Section 3 assesses the question whether the exchange rate expectations are biased forecasts of future spot rates for the entire sample. Section 4 examines whether subsamples of the data exhibit differing patterns. Section 5 concludes.

2. DATA AND GENERAL METHODOLOGY

Survey data are generally viewed with suspicion by economists. Some argue that, as social scientists, we should pay more attention to what people do, rather than to what they say.

Unfortunately, alternative measures of expectations have their own limitations. Consequently, macroeconomists have resorted to various survey measures such as the Livingstone survey of inflationary expectations. Several recent studies have found that survey data do contain useful information about future events (e.g. Dokko and Edelstein, 1989; Englander and Stone, 1989). Indeed, to the extent that the forecasters represented in the CFD survey participate directly in the relevant markets (see below), the case for using such data is perhaps even firmer than that for the aforementioned domestic surveys.

The exchange rate forecasts are usually compiled on the fourth Thursday of each month. Our data set runs from February of 1988 to February of 1991, for about 25 exchange rates.[2] The survey includes some additional exchange rates that we exclude from our sample because they either begin toward the end of the sample period, or appear too intermittently to be useful.

The survey respondents are reported to number approximately 45, of which two-thirds are multinational firms and the remainder forecasting firms or the economics departments of banks. We use as the measure of expectations the "consensus forecast" that <u>CFD</u> emphasizes. This measure is the harmonic mean:[3]

$$\bar{X} \equiv [\Sigma_i w_i (1/X_i)]^{-1} \qquad \Sigma_i w_i = 1$$

where X_i is the individual forecast

$w_i = 1/N$

N is the number of forecasts.

The spot rates used to compute expected rates of change are the London midday interbank middle rate, as reported in <u>CFD</u> and are contemporaneous with the forecast compilation.[4] The forward rates are similarly dated London close rates, and are the arithmetic average of the bid and ask rates.

The regressions are run on a pooled time series/cross section.[5] In this paper, we will be investigating the nature of the three and twelve month horizon forecasts. Regressions involving the ability to forecast <u>ex post</u> exchange rates encounter the econometric problem of overlapping observations. Since the data are sampled at intervals finer than the forecast horizon, the regression residuals will exhibit a moving average process of order k-1 (where k is the forecast horizon). Since generalized least squares yields inconsistent estimates, this means that in order to make correct inferences, a Hansen (1982) heteroskedasticity and serial correlation robust estimate of the parameter covariance matrix should be used.[6]

3. ARE CONDITIONAL EXPECTATIONS UNBIASED?

Previous studies examining the issue of unbiasedness in expectations have usually imposed the auxiliary assumption of risk neutrality under which the forward rate equals the expected future rate. Unbiasedness of the forward discount has been overwhelmingly rejected, as it is in our sample (Frankel and Chinn, 1991). But it is impossible to tell whether the rejection of the null hypothesis is due to a bias in investors' expectations or to a risk premium that separates the forward rate from the expected future spot rate, without additional information such as that provided by the surveys.

We now move to an explicit evaluation of the forecasting characteristics of our expectations measures. A common procedure is to regress the ex post depreciation on the survey measure of expected depreciation. The unbiasedness proposition is represented by the null hypothesis that the coefficient on expected depreciation equal unity. Such a test attempts to detect what Bilson (1981) called "excessive speculation" or "over-excitability": a coefficient less than one. An equivalent test is to run a regression of the forecast error on expected depreciation.

$$\Delta s_{t+k} - \Delta \hat{s}^{e}_{t,t+k} = \alpha_1 + \beta_1 \Delta \hat{s}^{e}_{t,t+k} + u_{1,t+k} \qquad (1)$$

Where:

$\Delta s_{t+k} \equiv s_{t+k} - s_t$

$\Delta \hat{s}^{e}_{t,t+k} \equiv \hat{s}^{e}_{t,t+k} - s_t$

$\hat{s}^{e}_{t,t+k}$ is the expected spot rate at time t+k, based on the survey measures taken at time t.

Now the unbiasedness hypothesis is represented by the null hypothesis that $\beta_1=0$, and the alternative: if expectations are rational, then the forecast errors which appear as the lefthand-side variable should be purely random. If the alternative, $\beta_1 < 0$, is accepted, then investors could make better guesses by betting against the consensus forecast. We ran these regressions on both the entire sample, and a sample excluding the three high-inflation countries, Argentina, Brazil and Mexico.[7] Estimates for the equation are presented in Table 1. Four regressions are reported. Two constrain the intercept for all currencies to be the same; but Chi^2 tests for the restriction are rejected.

[TABLE 1 about here]

Focusing attention on the unconstrained regressions, one finds that the estimate of β_1 is negative, and large in economic terms. One cannot reject the null that the coefficient is -1, at the three month horizon, and can only reject at the 10% level at the 12 month. In both cases, the zero coefficient null is strongly rejected.

When the sample excludes the high-inflation countries of Argentina, Brazil and Mexico, then the rejection of a zero-coefficient becomes even more pronounced. Because the error processes for the high-inflation currencies and the other currencies are unlikely to be similar, we choose to report results for both the entire sample and the sample excluding these currencies. Additional results pertaining to this stratification can be found in the 1991 working paper.

The finding of conditional bias over the 1988-90 period is interesting because it corroborates results in Frankel and Froot (1987) which noted the persistent errors in the wake of the dollar's mid-1980s rise and fall. Here, the results obtain over a period of relative dollar stability.

There may be measurement error in the survey forecasts. Even if the measurement errors are random, then the coefficient estimate in equation (1) is biased.[8] There exists an alternative test that is similar in spirit to equation (1), but is not subject to bias in the event of random measurement error in the survey data. One can substitute the forward discount for the expected depreciation on the right hand side of equation (1), and obtain:

$$\Delta s_{t+k} - \Delta \hat{s}^e_{t,t+k} = \alpha_2 + \beta_2 fd_{t,t+k} + u_{2,t+k} \qquad (2)$$

Where:

$fd_{t,t+k} \equiv f_{t,t+k} - s_t$

$f_{t,t+k}$ is the forward rate at time t for k months ahead.

[TABLE 2 about here]

This equation is similar in spirit to equation (1) because a number of studies have shown that the forward discount is highly correlated with expected depreciation as measured by the survey data (Froot and Frankel, 1989; Frankel and Chinn, 1991). The results are reported in Table 2. At the three and 12 month horizons, very large and negative estimates of β_2 are obtained.[9] The null hypothesis that $\beta_2 = 0$ is even more strongly rejected than before.[10] The implications of this finding are quite interesting -- it means that investors could reduce their forecast errors by betting against the forward rate.

4. PATTERNS IN EXCHANGE RATE EXPECTATIONS

4.1 Overview

Exchange rate expectations appear much less biased when the high-inflation currencies (Argentina, Brazil and Mexico) are included (see the 1991 working paper). This is intuitive, since it is relatively easy to guess the direction of the changes in exchange rates when inflation is extremely high. Hence all regressions will report results with and without the high-inflation currencies included.

We now stratify the sample, first by whether the currency was major or minor, with major including UK, DM, Yen and Swiss Franc; second by whether the currency participated in the Exchange Rate Mechanism (ERM) of the European Monetary System (see the Appendix). Since the UK and Spain entered into the ERM in the middle of the sample period, we decided to omit them from the EMS grouping. The regressions are run both including and excluding them from the sample.

4.2 Major versus Minor

The results reported in Table 3 are for constants constrained to be equal within groupings. The results do not change qualitatively when the constants are unconstrained. Whenever the slope coefficient is allowed to vary between groups, there is a statistically significant difference. The major currencies appear to exhibit a greater bias than the minor currencies.

[TABLE 3 about here]

The point estimates for the minor currencies are less negative than for the major, suggesting that the forecasts for the minor currencies may contain more relevant information than for the major currencies. One might be tempted to conclude that this result is related to the inclusion of several of these major currencies in a managed exchange rate regime (see below). However, there is only one currency in both sets, so that MAJOR and EMS are almost completely non-overlapping.

4.3 The European Monetary System Currencies

To test the proposition that EMS currencies behave differently from others, we created a dummy variable for all EMS currencies, excepting the UK and Spain, and ran regressions allowing the slope coefficient to differ between the groups. The results in Table 4 indicate that there is much less evidence of behavioral differences at the three month horizon, at least when the high-inflation currencies are excluded from the overall sample. At the 12 month horizon, however, a statistically significant difference does appear.

[TABLE 4 about here]

5. CONCLUSIONS

The following points flow from the preceding analysis. Expectations are biased in the sample under investigation. This result does not necessarily imply irrationality, as the observed in-sample bias may reflect a peso problem or learning behavior. The former issue pertains to an extreme non-normality of the realizations, so that certain low-probability events induce an apparent bias in finite samples. The latter aspect has been discussed most recently by Lewis (1989): unbiasedness is implied by rational expectations only when the true model is available to all agents, presumably in some sort of steady-state. If agents are learning about an evolving environment, then errors might not have zero mean.

The rejections of unbiasedness do not appear to be due to measurement error in the survey sample. Our results imply that survey participants could reduce their forecast errors by betting against the forward rate.[11] In fact investors would do better to forecast the exchange rate as a random walk and ignore other current information. This is especially true when the currency in question is either a major currency or an EMS currency. Perhaps forecasters are reluctant to issue predictions of future rates that are the same as today's rate (out of a natural fear of appearing redundant), and this reluctance is more justified when it comes to smaller, less stable, currencies.

DATA APPENDIX

Currency Forecasters' Digest is published monthly. The publication indicates that the forecasts apply to a specific date, usually either the third or fourth Thursday in the month. The forecasts include 1, 3, 6 and 12 month horizon forecasts, with the following measures: Harmonic mean, arithmetic mean and modal mean. Contemporaneously dated spot rate data are also provided. All rates are converted to domestic currency units per US dollar. The following currencies are surveyed:

Mnemonic	Currency		FR	A/T/I	Infl	Main	EMS
DM	West German DM		F			M	E
FFR	French Franc		F				E
DKR	Danish Krone		F				E
UK	UK Pound Sterling		F			M	
NTH	Netherlands Guilder		F				E
SFR	Swiss Franc		F			M	
SKR	Swedish Krone	F					
IRE	Irish Punt		F				E
BFR	Belgian Franc		F				E
LIR	Italian Lire		F				E
NKR	Norwegian Krone		F				
SP	Spanish Peseta	F					
YEN	Japanese Yen		F			M	
TAI	Taiwanese Dollar						
AUS	Australian Dollar		F				
SNG	Singapore Dollar		F	A			
PHL	Philippine Peso		A				
KOR	Korean Won						
SAR	South African Rand		F	A			
CAN	Canadian Dollar	F					
ARG	Argentine Austral				H		
MEX	Mexican Peso				H		
CHL	Chilean Peso			T			
BRZ	Brazilian Cruzeiro/ado		I	H			
BOL	Venezuelan Bolivar			T			

Key: F: Forward rate available. A: Alternating monthly. T: Series terminates before Feb. 1992. I: Many missing values due to currency change. H: high-inflation currency. M: "major" currency. E: EMS currency. Note UK enters EMS in October 1990, Spain in June 1989.

Forward rates are the arithmetic average of bid and ask rates at London close, as reported by DRIFACS.

To minimize the number of missing observations, a recursive Chow-Lin (1976) procedure for interpolation was used for the expectations series. The missing observations are November 1989, February 1990 and April 1990. The related series used in the interpolation procedure is the contemporaneous (log) spot rate.

REFERENCES

Bilson, John. "The Speculative Efficiency Hypothesis." Journal of Business 54 (July 1981), 435-51.

Chinn, Menzie D. and Jeffrey A. Frankel. "Are Exchange Rate Expectations Biased? A Test for a Cross-Section of 25 Currencies." NBER Working Paper #3807 (August 1991).

Chow, Gregory C., and An-Loh Lin. "Best Linear Unbiased Estimation of Missing Observations in an Economic Time Series." Journal of the American Statistical Association. 71 (1976), 719-21.

Dokko, Yoon and Robert H. Edelstein. "How Well Do Economists Forecast Stock Market Prices? A Study of the Livingstone Surveys." American Economic Review. 79 (September 1989), 865-871.

Dominguez, Kathryn. "Are Foreign Exchange Forecasts Rational? New Evidence from Survey Data?" Economics Letters 21 (1986), 277-82.

Englander, A. Steven and Gary Stone. "Inflation Expectations Surveys as Predictors of Inflation and Behavior in Financial and Labor Markets." Federal Reserve Bank of New York Quarterly Review. 14 (Autumn 1989), 20-32.

Frankel, Jeffrey A. and Menzie D. Chinn. "Exchange Rate Expectations and the Risk Premium: Tests for a Cross Section of 17 Currencies." NBER Working Paper #3806 (August 1991). Forthcoming, Review of International Economics.

Frankel, Jeffrey A. and Kenneth A. Froot. "Exchange Rate Forecasting Techniques, Survey Data, and Implications for the Foreign Exchange Market." IMF Working Paper. WP/90/43. Washington, D.C.: IMF (May 1990). Forthcoming Current Issues in International Trade and International Finance, edited by Dilip Das. Oxford, UK: Oxford Univ. Press.

Frankel, Jeffrey A. and Kenneth A. Froot. "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations." American Economic Review 77 (March 1987), 133-153.

Froot, Kenneth A. and Jeffrey A. Frankel. "Forward Discount Bias: Is It an Exchange Risk Premium?" Quarterly Journal of Economics. 104 (February 1989), 139-161.

Goodhart, Charles. "The Foreign Exchange Market: A Random Walk with a Dragging Anchor." Economica 55 (November 1988): 437-460.

Hansen, Lars. "Large Sample Properties of Generalized Method of Moments Estimators." Econometrica 50 (1982), 1029-1054.

Hansen, Lars, and Robert J. Hodrick. "Risk Averse Speculation in the Forward Foreign Exchange Market: An Econometric Analysis of Linear Models." in Exchange Rates and International Macroeconomics, edited by Jacob A. Frenkel, pp. 113-142. Chicago: University of Chicago Press, 1983.

Hansen, Lars and Robert J. Hodrick. "Forward Exchange Rates As Optimal Predictors of Future Spot Rates: An Econometric Analysis." Journal of Political Economy 88 (Octoer 1980), 829-853.

Ito, Takatoshi. "Foreign Exchange Rate Expectations: Micro Survey Data." American Economic Review 80 (June 1990), 434-49.

Lewis, Karen K. "Changing Beliefs and Systematic Rational Forecast Errors with Evidence from Foreign Exchange." American Economic Review 79 (September 1989), 621-636.

Liu, Peter, and G.S. Maddala. "Rationality of Survey Data and Tests for Market Efficiency in the Foreign Exchange Markets." Journal of International Money and Finance 11, no.4 (August 1992) 366-81.

Takagi, Shinji. "Exchange Rate Expectations: A Survey of Survey Studies." IMF Staff Papers 38 (March 1991), 156-183.

TABLE 1
Regression of forecast error on expected depreciation
$\Delta s_{t+k} - \Delta \hat{s}^{e}_{t,t+k} = \alpha_1 + \beta_1 \Delta \hat{s}^{e}_{t,t+k} + u_{1,t+k}$

Term (k)	3 month (intercept constrained)	3 month	3 month (No Arg., Brz.,Mex.)	12 month (intercept constrained)	12 month	12 month (No Arg., Brz.,Mex)
$\hat{\beta}_1$	-0.187	-0.861	-1.456	0.612	-1.770	-1.408
GMM SE	(0.150)	(0.267)	(0.117)	(0.268)	(0.397)	(0.141)
t: $\beta_1=0$	-1.245	-3.228***	-12.44***	+2.285***	-4.456***	-9.986***
t: $\beta_1=-1$	+5.420***	+0.521	-20.99***	+6.015***	-1.940*	-17.078***
df	765	741	648	565	539	481
$\overline{R}^2$	0.04	0.18	0.20	0.27	0.71	0.45
DW	0.502	0.424	0.614	0.183	0.282	0.223

Notes:

"Intercept constrained" indicates that all the exchange rates are constrained to have the same intercept term. OLS $\hat{\beta}$ is the point estimate from the OLS regression. GMM is a heteroskedasticity and serial correlation consistent-Generalized Method of Moments standard error. GMM SE is from regressions with de-meaned data when the constants are unconstrained.

*(**)[***] indicates significance at 10% (5%) [1%] level.

TABLE 2
Regressions of forecast error on forward discount

$$\Delta s_{t+k} - \Delta \hat{s}^{c}_{t,t+k} = \alpha_2 + \beta_2 fd + u_{2,t+k}$$

Term (k)	3 month (intercept constrained)	3 month	12 month (intercept constrained)	12 month
OLS $\hat{\beta}_2$	-1.624	-3.468	-1.072	-5.201
OLS SE	(0.279)	(0.478)	(0.204)	(0.375)
Het. SE	(0.294)	(0.539)	(0.189)	(0.377)
GMM SE	(0.464)	(0.732)	(0.488)	(0.722)
t: $\beta_2=0$	-3.500***	-4.738***	-2.197**	-7.200***
df	553	537	410	394
$\bar{R}^2$	0.06	0.09	0.06	0.36
DW	0.661	0.777	0.199	0.415

Notes: "Intercept constrained" indicates that all the exchange rates are constrained to have the same intercept term.

OLS $\hat{\beta}$ is the point estimate from the OLS regression.

SE is the OLS asymptotic standard error. OLS Het. SE is a heteroskedasticity-consistent standard error. GMM is a heteroskedasticity and serial correlation consistent-Generalized Method of Moments standard error.

*(**)[***] indicates significance at 10% (5%) [1%] level.

TABLE 3
Regression of Forecast Error on Expected Depreciation

$$\Delta s_{t+k}-\Delta\hat{s}^e_{t,t+k} = \alpha_3+\beta_3\Delta\hat{s}^e_{t,t+k}+\Gamma_3 MAJOR+\delta_3(MAJOR*\Delta\hat{s}^e_{t,t+k})+u_{3,t+k}$$

Term (k)	3 month	3 month (No Arg., Brz.,Mex.)	12 month	12 month (No Arg., Brz.,Mex.)
OLS $\hat{\beta}_3$	-0.185	-0.632	0.622	-0.635
GMM SE	(0.151)	(0.125)	(0.267)	(0.184)
t:β_3=0	-1.225	-5.056***	+2.329***	-3.450***
t:β_3=-1	+5.397***	+2.944***	+6.075***	+1.984**
OLS $\hat{\delta}_3$	-1.916	-1.469	-2.633	-1.376
GMM SE	(0.314)	(0.303)	(0.401)	(0.352)
t:δ_3=0	-6.102***	-4.849***	-6.566***	-3.915***
df	765	667	561	500
$\bar{R}^2$	0.05	0.16	0.29	0.29
DW	0.491	0.597	0.186	0.169

NOTES: All intercepts are constrained to be the same across currencies, except between the groups MAJOR and all others. OLS $\hat{\beta}$, $\hat{\delta}$ are the estimate from the OLS regression. GMM is a heteroskedasticity and serial correlation consistent-GMM standard error.
*(**)[***] indicates significance at 10% (5%) [1%] level.

TABLE 4
Regression of Forecast Error on Expected Depreciation

$$\blacktriangle s_{t+k}-\blacktriangle \hat{s}^{e}_{t,t+k} = \alpha_4+\beta_4\blacktriangle \hat{s}^{e}_{t,t+k}+\theta_4 EMS+\phi_4(EMS*\blacktriangle \hat{s}^{e}_{t,t+k})+u_{4,t+k}$$

Term	3 month	3 month (No ABM)	3 month (No ABM, UK, Sp.)	12 month	12 month (No ABM)	12 month (No ABM, UK, Sp.)
$\hat{\beta}_4$	−0.192	−0.734	−0.678	0.606	−0.629	−0.571
GMM SE	(0.150)	(0.137)	(0.140)	(0.263)	(0.165)	(0.140)
t: $\beta_4=0$	−1.278	−5.364***	−4.839***	+2.306***	−3.821***	−4.068***
t: $\beta_4=-1$	+5.387***	+1.943*	+2.300**	+6.106***	+2.248**	+3.064***
$\hat{\phi}_4$	−0.900	−0.358	−0.414	−2.005	−0.770	−0.828
GMM SE	(0.254)	(0.246)	(0.248)	(0.321)	(0.247)	(0.231)
t: $\phi_4=0$	−3.541***	−1.451	−1.667*	−6.252***	−3.123***	−3.582***
df	763	667	599	561	500	450
$\overline{R}^2$	0.05	0.14	0.13	0.30	0.32	0.34
DW	0.499	0.557	0.556	0.199	0.254	0.261

NOTES: All intercepts are constrained to be the same across currencies, except between the groups EMS and all others. EMS excludes UK and Spain. No ABM indicates no Argentina, Brazil and Mexico. $\hat{\theta}$, $\hat{\phi}$ are the estimate from the OLS regression. GMM is a heteroskedasticity and serial correlation consistent-GMM standard error. *(**)[***] indicates significance at 10% (5%) [1%] level.

ENDNOTES

1. Earlier papers using survey data are restricted to five major currencies: the yen, mark, pound, French franc and Swiss franc. See Dominguez (1986), Frankel and Froot (1987, 1990), Froot and Frankel (1989), Goodhart (1988), Ito (1990) and Liu and Maddala (1992). A review of this emerging literature is available in Takagi (1991).

2. These data are proprietary with Currency Forecasters' Digest of White Plains, NY, and were obtained by subscription by the Institute for International Economics. The survey has apparently been conducted for some years, but the subscription of the IIE did not begin until 1988.

3. The harmonic mean is a measure of central tendency that reduces the weight on outliers. It contrasts with other measures of central tendency which give either more weight to the extremes (such as arithmetic averages) or no weight (as in the trimmed mean). The modal or median response is available, but looks very similar to the harmonic mean. Regressions of the harmonic mean on either the arithmetic mean, or the mode yield adjusted R^2 statistic in excess of 94%.

4. We estimated the data collection date to be approximately one week before the compilation date. Problems with dating have been encountered in other samples (such as the AMEX survey in Frankel and Froot, 1987) where attempts to adjust the data to accommodate different dating schemes have had little effect on the regression results. In this study, some sensitivity analyses have been performed on time series data, using an alternative timing scheme. Different point estimates are obtained in the regressions, but the conclusions on the hypothesis tests are usually unchanged.

5. We also ran regressions for individual time series (reported in the 1991 working paper version of this study). The results are consistent with those reported in this paper in a qualitative sense, although there is much variation in the estimated slope coefficients, as one would expect from the relatively small number of observations in each time series.

6. This is case (v) of Hansen's (1982) GMM technique. Other applications to overlapping exchange rate forecasts, in a strictly rational expectations methodological framework, include Hansen and Hodrick (1980, 1983). There is also the possibility of cross-rate correlation, which in principle suggests another correction. However, estimates of the cross-rate correlation over the entire sample are not statistically significant, so our estimator is appropriate.

7. A regression allowing a separate slope coefficient for this group of three countries indicates that (for the three month horizon) the null that all slope coefficients are the same can be rejected at the 1% level. Other divisions of the sample are plausible (e.g. Argentina, Brazil, Chile), but the differential slope coefficient is usually smaller, as is the t-statistic.

8. When two-stage least squares is implemented on a regression of ex post depreciation on expected depreciation, the coefficients become even more negative. Because the standard errors become larger, however, one can reject the null hypothesis of unity in only one case.

9. These results are similar to those reported in Frankel and Froot (1990, Table 3).

10. Note that the set of currencies covered by this test constitute a subset of the ones in Table 1.

11. This finding applies to low-inflation currencies, which happen to be the ones with forward markets. Different conclusions might arise if one could evaluate this hypothesis for Argentina, Mexico and Brazil, for example.

APPENDIX TO
ARE EXCHANGE RATE EXPECTATIONS BIASED?

This appendix reports the results of the regressions performed on the individual time series for individual countries. The regression is the ex post depreciation on the ex ante expected depreciation.

$$\Delta s_{t+k} = \alpha_1 + \beta_1 \Delta s^e_{t,t+k} + u_{1,t+k}$$

The regressions are implemented in this form so as to make explicit the amount of correlation between the ex post and ex ante measures, as indicated by the adjusted R^2 statistics. To make the results comparable to those in Table 3, subtract one off the coefficient on expected depreciation.

The asymptotic OLS estimates of the standard errors are in parentheses (.). The Newey-West GMM serial-correlation and heteroskedasticity robust standard errors (using equal weights) are in brackets [.].

TABLE A1
Tests of Bias in Survey Expectations

$$\Delta s_{t+k} = \alpha_1 + \beta_1 \Delta s^e_{t,t+k} + u_{1,t+k}$$

February 1988 - February 1991

Exch Rate	Term (k)	Const.	β_1	$\overline{R}^2$	SER	DW LM F	d.f.
German mark	3	-9.193 (5.957) [6.306]	-0.640 (0.594) [0.430]	0.01	22.409	0.558 2.827**	32
	12	-4.690 (2.541) [6.301]	-0.446 (0.429) [0.499]	0.00	11.893	0.184 8.784***	23
French franc	3	-3.646 (4.491) [7.579]	0.119 (0.529) [0.505]	-.03	22.185	0.535 3.576***	32
	12	-4.065 (3.327) [7.018]	-0.401 (0.471) [0.485]	-.01	12.323	0.176 7.832***	23
Danish krone	3	-3.186 (4.977) [7.448]	0.201 (0.589) [0.441]	-.03	22.740	0.519 3.482***	32
	12	-4.286 (3.380) [7.239]	-0.342 (0.359) [0.820]	-.02	13.437	0.144 11.409***	23
British pound sterling	3	-13.230 (5.570) [6.878]	-1.802 (0.657) [0.583]	0.17	22.220	0.833 1.940*	32
	12	3.552 (2.423) [3.365]	-1.366 (0.359) [0.311]	0.36	10.187	0.432 3.370*	23
Dutch guilder	3	-6.347 (5.866) [6.888]	-0.286 (0.566) [0.414]	-.02	23.091	0.563 2.980**	32
	12	-4.572 (2.597) [6.402]	0.472 (0.452) [0.534]	0.00	12.067	0.178 8.403***	23

Exch Rate	Term (k)	Const.	β_1	$\overline{R}^2$	SER	DW LM F	d.f.
Swiss franc	3	-11.166 (6.847) [7.024]	-1.028 (0.668) [0.436]	0.04	26.048	0.643 2.204*	32
	12	-2.777 (1.721) [8.035]	-0.887 (0.251) [0.678]	0.06	15.281	0.188 8.325***	23
Irish punt	3	-5.827 (5.223) [7.398]	-0.248 (0.576) 0.556]	-.03	21.870	0.460 4.465***	32
	12	-4.051 (2.812) [6.444]	-0.433 (0.396) [0.411]	0.01	12.282	0.170 11.607***	23
Belgian franc	3	-4.864 (5.101) [8.064]	-0.007 (0.531) [0.459]	-.03	22.730	0.525 3.265***	32
	12	-4.500 (3.230) [6.846]	-0.415 (0.453) [0.802]	-.01	12.792	0.168 9.684***	23
Italian lira	3	-3.577 (3.805) [7.073]	0.043 (0.474) [0.558]	-.03	20.530	0.574 3.514***	32
	12	-2.855 (3.089) [6.533]	-0.427 (0.385) [0.436]	0.01	10.251	0.202 7.389***	23
Norwegian krone	3	-4.958 (4.099) [6.088]	-0.325 (0.372) [0.282]	-.01	18.314	0.604 3.256***	32
	12	-2.620 (2.071) [5.026]	-0.182 (0.274) [0.306]	-.02	9.674	0.189 11.057***	23
Spanish peseta	3	-14.161 (4.583) [5.219]	-1.123 (0.434) [0.382]	0.15	19.043	0.731 2.162*	32
	12	-7.383 (2.169) [5.251]	-0.136 (0.315) [0.281]	-.04	10.245	0.202 7.560***	23

Exch Rate	Term (k)	Const.	β_1	$\overline{R}^2$	SER	DW LM F	d.f.
Japanese yen	3	-7.191 (6.365) [9.431]	-1.091 (0.578) [0.592]	0.07	24.887	0.704 2.798**	32
1/	12	6.356 (1.253) [1.768]	-1.169 (0.210) [0.178]	0.56	6.176	0.966 1.201	23
Taiwan dollar	3	-2.556 (2.694) [2.741]	-0.108 (0.264) [0.157]	-.03	10.645	0.581 3.879***	30
	12	-17.723 (3.985) [4.491]	-1.501 (0.369) [0.237]	0.41	5.529	0.671 2.339	21
Austral-ian dollar	3	5.880 (7.054) [12.551]	-1.033 (0.769) [1.056]	0.02	22.318	0.704 3.184**	32
	12	0.135 (5.996) [4.536]	0.169 (0.989) [0.765]	-.04	7.165	0.402 2.065	23
Singapore dollar	3	-4.191 (2.101) [2.439]	-0.565 (0.568) [0.641]	-.00	8.652	NA NA	15
	12	-4.360 (0.837) [NA]	-0.518 (0.379) [NA]	0.07	2.835	NA NA	10
Philip-pine peso	3	NA	NA	NA	NA	NA	NA
	12	-9.053 (7.070) [5.775]	1.996 (0.843) [0.984]	0.32	5.981	NA NA	9
Korean won	3	4.984 (2.005) [3.452]	0.924 (0.237) [0.350]	0.31	7.316	0.407 3.656***	31
1/	12	8.944 (2.834) [1.714]	0.983 (0.288) [0.145]	0.32	5.734	0.227 2.689*	22

Exch Rate	Term (k)	Const.	β_1	$\overline{R}^2$	SER	DW LM F	d.f.
South African Rand	3	16.816 (4.461) [6.616]	-1.255 (0.426) [0.425]	0.21	18.746	0.926 NA	28
	12	15.976 (3.689) [4.161]	-1.618 (0.518) [0.170]	0.27	7.526	0.791 NA	23
Canadian dollar	3	-2.672 (1.041) [1.312]	0.100 (0.412) [0.159]	-.03	6.021	1.157 2.077*	32
1/	12	-1.961 (0.309) [0.207]	-0.561 (0.227) [0.159]	0.18	1.384	1.250 0.231	23
Argentine peso	3	326.514 (105.181) [141.183]	-0.372 (0.431) [0.495]	-.01	264.516	0.488 7.832***	32
	12	453.518 (86.501) [70.521]	-1.097 (0.588) [0.511]	0.09	116.142	0.335 7.924***	23
Mexican peso	3	8.487 (1.660) [2.371]	0.018 (0.038) [0.043]	-.02	7.055	0.164 6.726***	32
	12	14.188 (1.498) [2.584]	-0.069 (0.030) [0.051]	0.15	3.364	0.119 5.080***	23
Chilean peso	3	-7.688 (13.837) [7.151]	1.498 (0.633) [0.250]	0.21	10.928	1.093 0.967	16
	12	6.364 (8.790) [NA]	0.821 (0.411) [NA]	0.27	2.196	1.237 0.547	7
Brazilian cruzeiro	3	94.293 (45.589) [42.411]	0.577 (0.144) [0.160]	0.36	99.966	0.990 NA	26
	12	562.056 (188.546) [NA]	-1.046 (0.864) [NA]	0.04	43.592	0.552 NA	9

Exch Rate	Term (k)	Const.	β_1	$\bar{R}^2$	SER	DW LM F	d.f.
Venezuelan bolivar	3	35.667 (12.442) [14.950]	-0.612 (0.468) [0.386]	0.02	25.103	0.707 NA	30
	12	8.518 (5.548) [3.871]	0.348 (0.219) [0.143]	0.06	7.490	0.652 NA	23

Notes: Term (k) is the forecast horizon in months.

LM F is the Breusch-Godfrey LM F-test for serial correlation of order 12.

Figures in parentheses are asymptotic OLS standard errors; figures in brackets [.] are Newey-West robust standard errors, using equal-weight windows for lag length k-1.

* (**) [***] denotes significance at 10% (5%) [1%] levels.

[1] Bartlett window used in calculating Newey-West standard errors.

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