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The forward market in emerging currencies: Less biased than in major currencies

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A B S T R A C T

Many studies have replicated the finding that the forward rate is a biased predictor of the future change in the spot exchange rate. Usually the forward discount actually points in the wrong direction. But, at least until recently, those studies applied only to advanced economies and major currencies. We apply the same tests to a sample of 14 emerging market currencies. We find a smaller bias than for advanced country currencies. The coefficient is on average positive, i.e., the forward discount at least points in the right direction. It is never significantly less than zero. To us this suggests that a time-varying exchange risk premium may not be the explanation for traditional findings of bias. The reasoning is that emerging markets are probably riskier; yet we find that the bias in their forward rates is smaller. Emerging market currencies probably have more easily-identified trends of depreciation than currencies of advanced countries.

1. Introduction: tests of bias in the forward discount

Thirty years ago, researchers found the forward exchange rate to be a biased predictor of the future spot exchange rate. Worse, in a regression of the future change in the spot rate against the forward discount, the exchange rate was found on average to move in precisely the *opposite*

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direction from what was predicted.[1] This surprising finding has been replicated many times since, on many sets of data, and with many refinements. But virtually all the tests have been applied to major currencies and industrialized countries, not to currencies of developing countries. By now enough emerging market currencies are represented by forward markets that it is possible to apply the same tests to them.[2]

Although many explanations have been given for the finding of bias in the forward market, they fall into two categories. The first category of explanations, to which an apparent majority of authors subscribe, maintains the assumption of rational expectations, and interpret the systematic component of the forward market's prediction errors as a risk premium. The second category attributes the systematic component of the forward rate's prediction errors to expectation errors on the part of market participants that are themselves systematic, at least within the sample.[3] Algebraically, the regression equation is

$$\Delta s_{t+1} = \alpha + \beta f d_t + \varepsilon_{t+1} \tag{1}$$

where Δs_{t+1} is ex post future percentage depreciation, defined as $s_{t+1} - s_t$, fd_t is the forward discount, of a maturity matching that of the ex post depreciation, defined as $f_t - s_t$, $s_t \equiv$ log of the spot exchange rate at time t (defined as domestic units per foreign), and $f_t \equiv$ log of the forward exchange rate at time t.

The null hypothesis of unbiasedness is $\beta = 1$. The null would imply that there is no systematic time-varying component to the prediction errors: $E_t\Delta s_{t+1} - \mathrm{fd}_t = \alpha$. The null hypothesis is actually a joint hypothesis, comprising two distinct conditions: rational expectations: $E_t\Delta s_{t+1} = \Delta s_t^e$, plus no time-varying risk premium: $rp_t \equiv E_t\Delta s_{t+1} - \mathrm{fd}_t - \alpha = 0$, where $E_t\Delta s_{t+1}$ is the mathematical expectation (within-sample), and Δs_t^e is the expectation held by investors. ε_{t+1} is the error term, which would be equal to the unpredictable forward market prediction error under the null hypothesis. But the null hypothesis is almost always rejected statistically, and often the finding is $\beta < 0$. The question then becomes whether the findings of bias are to be interpreted as a time-varying risk premium, or as systematic expectation errors.

The simple purpose of this paper is to test for bias in the forward markets in emerging market currencies, and to see how the bias compares to that for major currencies. One motivation is to shed some possible light on the two competing interpretations of bias. Intuitively, emerging market currencies are probably riskier to hold than major currencies; one might think that the risk premium would therefore be larger and more variable than for major currencies. At the same time, emerging market currencies are more prone to bouts of high inflation and other sources of medium-term trends, so that one might think it would be easier to forecast the direction of movement of the spot rate than is the case for major currencies, where the exchange rate is closer to a random walk.[4] If the bias is greater

[1] The first tests included Rogoff (1977), Hansen and Hodrick (1980), and Frankel (1980); they included consideration of two problems of the error term distribution: moving average errors (from overlapping contracts) and non-normal distributions (from the "peso problem"). Tryon (1979) was the first to run the regression in the form of changes relative to the contemporaneous spot rate, and Fama (1984) made this specification famous. Useful surveys of the original literature include Hodrick (1987), Froot and Thaler (1990), Engel (1996) and Lewis (1995). More recent contributions to the literature include Bacchetta and van Wincoop (2005), Backus et al. (2001), Breuer (2000), Verschoor and Wolff (2001), Lustig and Verdelhan (2007), Verdelhan (2006), Lustig et al. (2008), Burnside et al. (2009), Gospodinov (2009), and Farhi and Gabaix (2008), among others.

[2] Bansal and Dahlquist (2000) test whether the interest differential for developing countries is an unbiased forecast of future exchange rate changes. Similarly, Lee (2006) includes 16 countries in his study of uncovered interest parity. Flood and Rose (2002) find that the bias in the interest differential is less for crisis countries, while not significantly different between developed versus developing. But one cannot invoke covered interest parity, and thereby associate such findings with forward rate bias, in the same way one could for advanced countries. The reason is that many of these countries have capital controls, default risk, and interest rates that are not freely determined in the marketplace. More recently, Gilmore and Hayashi (2008) have analyzed the forward premium puzzle for emerging market currencies.

[3] This phrasing is intended to be broad enough to include the peso problem, learning, and other sources of error patterns that appear statistically significant within the sample. The definition need not necessarily imply that market participants are irrational. Among those who fall into the category of attributing the findings of bias to expectational errors are Froot and Frankel (1989) and Campbell et al. (2007).

[4] Huisman et al. (1998) find less bias in periods when the forward discount or premium is large. Similarly, Lothian and Wu (2005) find that large interest rate differentials have significantly stronger forecasting powers for currency movements than small interest rate differentials.

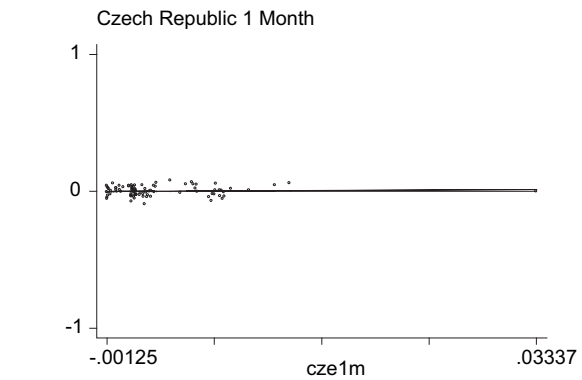
Table 1
Individual advanced country regressions (12/31/96–04/30/04). Coefficients with robust standard errors (forecast horizon is 1 month): $s_{t+1} - s_t = \alpha + \beta (f_t - s_t) + \varepsilon_{t+1}$.

Advanced economies	Dates	N	β (SE)	t: $\beta = 0$	t: $\beta = 1$	DW	F prob
Australia	12/96–4/04	88	−5.6437 (2.1666)	−2.60	9.40	1.95	0.0108
Austria	12/96–4/04	88	−5.2804 (1.9551)	−2.70	10.32	1.75	0.0083
Belgium	12/96–4/04	88	−5.5236 (1.9642)	−2.81	11.03	1.75	0.0061
Canada	12/96–4/04	88	−3.2183 (1.8926)	−1.70	4.97	1.96	0.0927
Denmark	12/96–4/04	88	−5.5150 (2.0319)	−2.71	10.28	1.76	0.0080
Euro	12/96–4/04	86	−5.6024 (2.0813)	−2.69	10.06	1.81	0.0086
Finland	12/96–4/04	88	−5.4680 (1.9057)	−2.87	11.52	1.78	0.0052
France	12/96–4/04	88	−5.1522 (1.9419)	−2.65	10.04	1.74	0.0095
Germany	12/96–4/04	88	−5.2964 (1.9384)	−2.73	10.55	1.75	0.0076
Greece	12/96–4/04	88	2.4052 (2.0348)	1.18	0.48	1.77	0.2405
Ireland	12/96–4/04	88	−5.6322 (2.1612)	−2.61	9.42	1.77	0.0108
Italy	12/96–4/04	88	−3.6422 (2.2115)	−1.65	4.41	1.66	0.1032
Japan	12/96–4/04	88	−1.2805 (2.0472)	−0.63	1.24	2.14	0.5333
Netherlands	12/96–4/04	88	−5.1816 (1.9166)	−2.70	10.40	1.76	0.0083
New Zealand	12/96–4/04	88	−3.9942 (2.0142)	−1.98	6.15	1.62	0.0506
Norway	12/96–4/04	88	−3.8507 (1.4636)	−2.63	10.98	2.18	0.0101
Portugal	12/96–4/04	88	−4.4242 (2.1870)	−2.02	6.15	1.69	0.0462
Spain	12/96–4/04	88	−4.8614 (2.2027)	−2.21	7.08	1.68	0.0300
Sweden	12/96–4/04	88	−5.5293 (1.8184)	−3.04	12.89	2.01	0.0031
Switzerland	12/96–4/04	88	−4.3037 (2.0588)	−2.09	6.64	1.85	0.0395
UK	12/96–4/04	88	−3.9999 (2.8715)	−1.39	3.03	2.10	0.1673

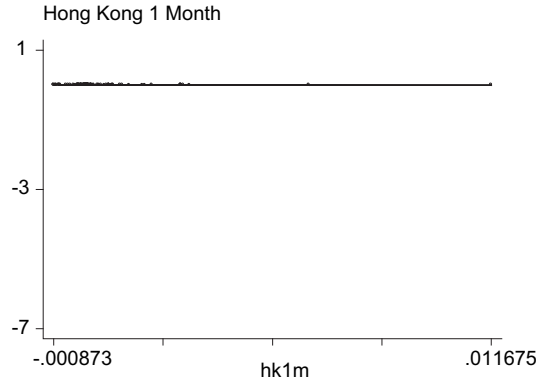
for emerging market currencies, that would point toward the risk premium interpretation; if less, then the other interpretation. We hasten to add that this suggested motivation is not demonstrated on the basis of formal theory. It would be hard to do so. It would not be easy, for example, to rule out the possibility that even though emerging market currencies have higher variance, their risk is highly diversifiable so that the risk premium could in theory go the other way.[5] However, there is a bit of evidence, from survey data, that investors indeed find it easier to forecast the direction of movement of emerging market currencies than of major currencies.[6]

In the financial markets, efforts to exploit the forward discount bias generally go under different-sounding names. Exploiting the bias means "going long" in the currency that sells at a forward discount, relative to others. By covered interest parity, this is the same thing as going long in the currency that pays a higher short-term nominal interest rate, relative to others. Among European currencies in the early 1990s – with Italian interest rates, for example, above German interest rates – this strategy was known as the *convergence play*. The convergence play again became relevant in the 2000s for Central European currencies hoping to join the euro.[7] In the mid-1990s, with Japanese interest rates very low, the strategy of borrowing in yen and going long in other currencies – especially dollar-linked currencies in Asia – was known as the *yen carry trade*. During the years 2001–2009, with US interest rates very low, the strategy of borrowing in dollars and going long in euros or emerging market currencies has been known as the *dollar carry trade*. One striking pattern about these episodes is that there are long intervals during which one would have happily made money on average with these strategies, but that these intervals were dramatically punctuated (though not fully reversed) by crises, in 1992 in Western Europe, 1997–1998 in East Asia, and 2008 in Central Europe, Iceland, and elsewhere.[8] Again, all these strategies are equivalent to attempts to exploit the finding of forward discount bias. Thus they constitute another motivation for testing to see whether the finding extends equally to emerging market currencies.

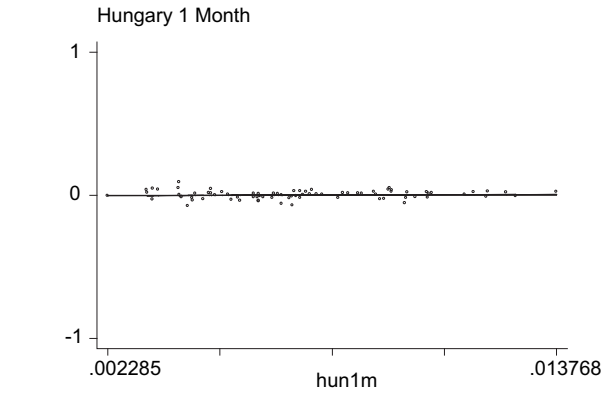
[5] Poonawala (2004).
[6] Chinn and Frankel (1994, 2002).
[7] Residents of Hungary and Poland went short in euros and Swiss francs.
[8] Brunnermeier et al. (2008) document the sudden unwinding of carry trades in crashes. Farhi et al. (2009) find that crash risk premia account for about 1/4 of average carry trade returns in advanced countries. Frankel (2008) offers a view of the carry trade for non-specialists.



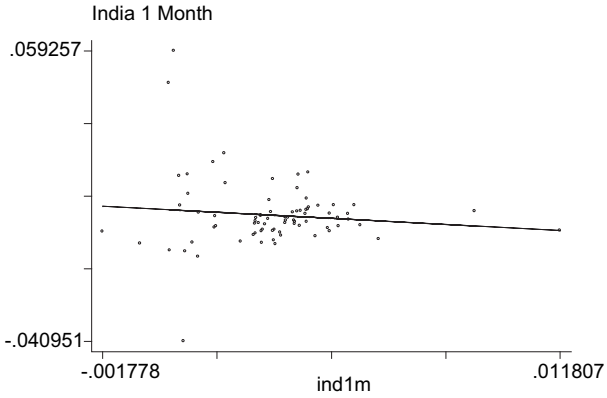
Czech Republic



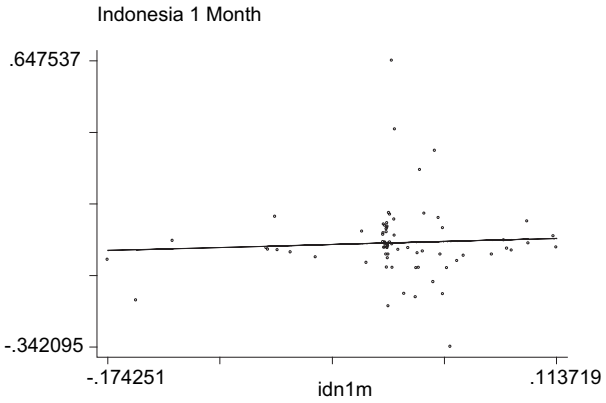
Hong Kong



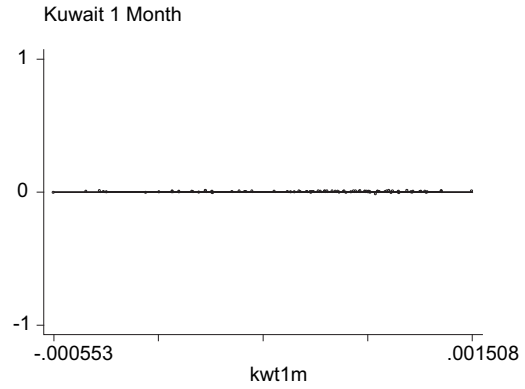
Hungary



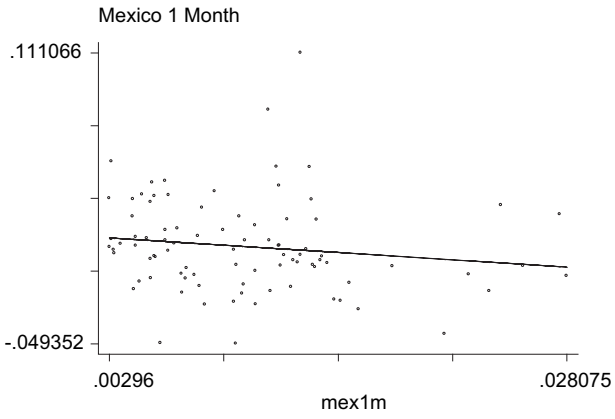
India



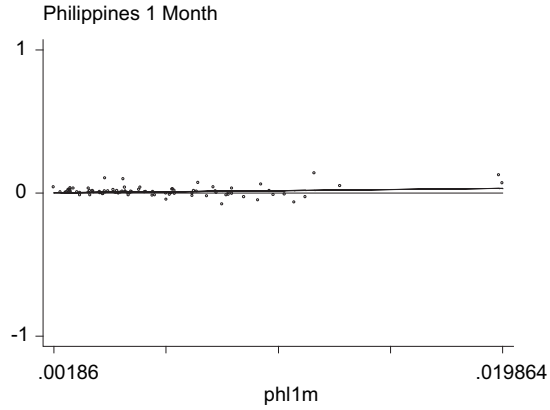
Indonesia



Kuwait



Mexico



Philippines

Fig. 1. Spot on forward regression for emerging economies 12/1996–4/2003.

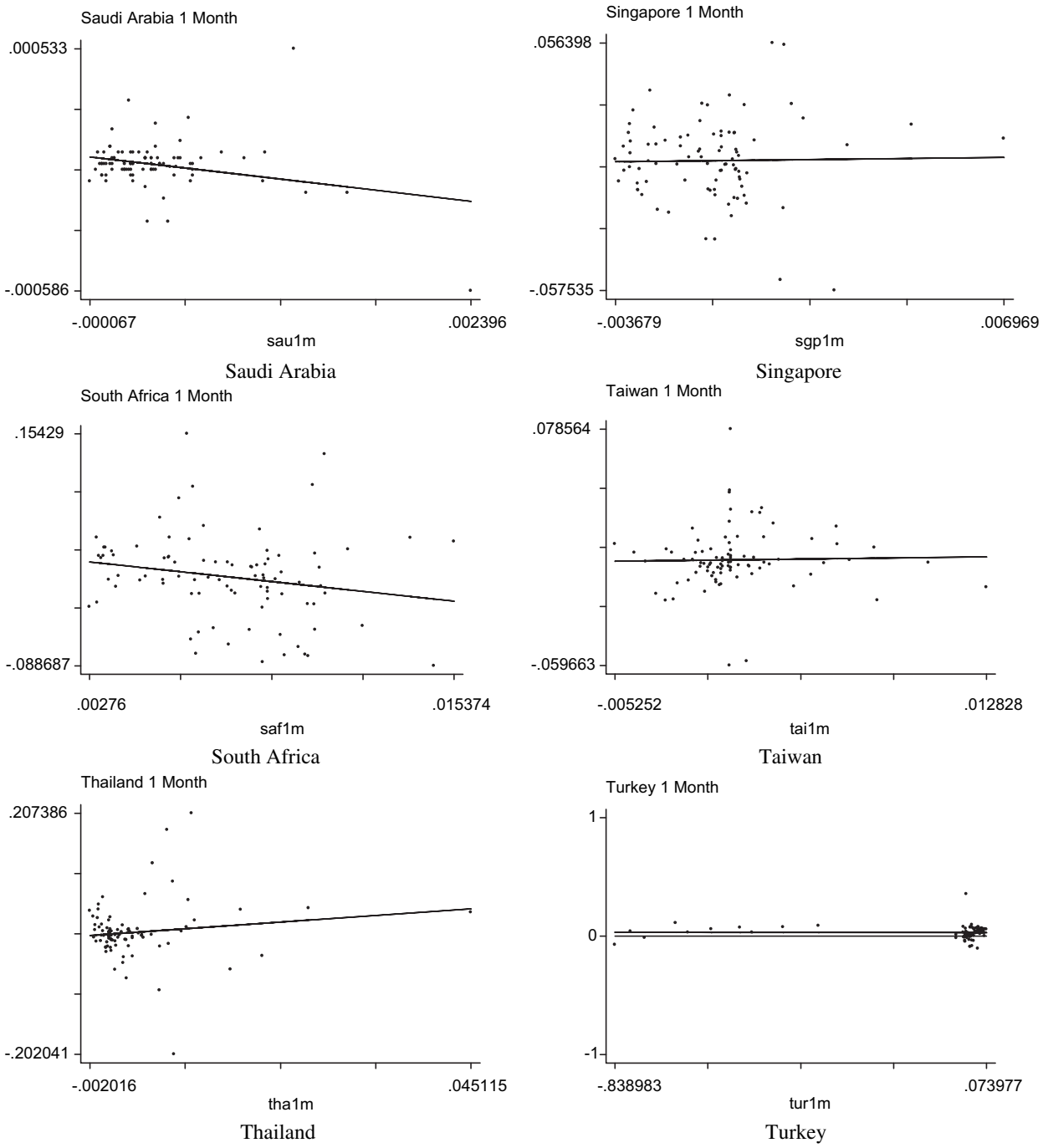


Fig. 1. (*continued*)

The paper examines forward markets for 35 currencies, classified under the two broad groupings of emerging market currencies versus the currencies of advanced economies countries (including the 11 original European Monetary Union countries).

Our results show that the bias in the forward discount for emerging market economies is smaller than for advanced economies. While we reproduce the standard finding that the coefficient is substantially less than zero for industrialized economies, and generally highly significant statistically, we find that the coefficient is much closer to zero for emerging market currencies: often positive and seldom significantly less than zero. To us the fact that the bias is stronger for advanced country currencies, which are presumably more stable, suggests that it may not be entirely due to an exchange risk premium.

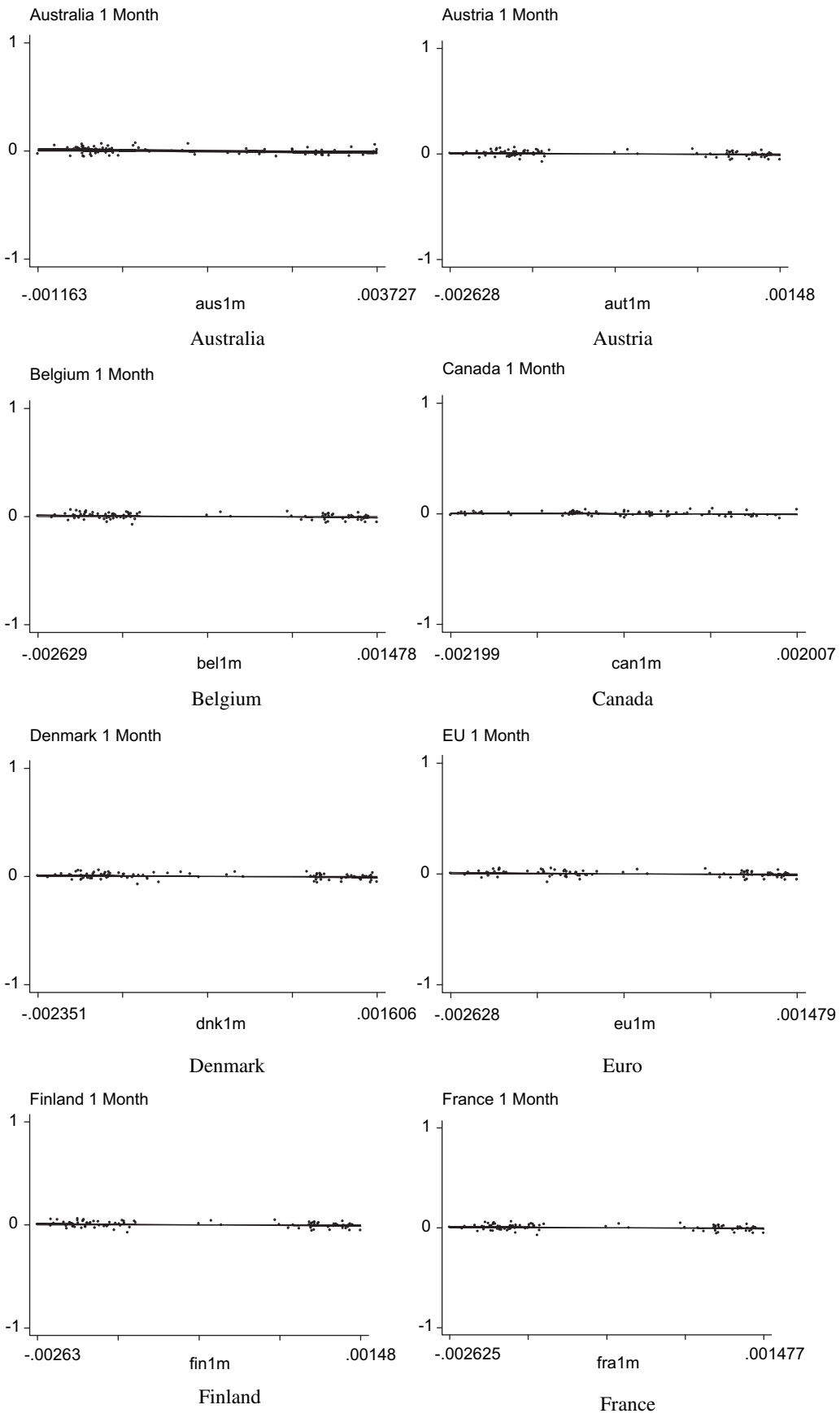


Fig. 2. Spot on forward regression for industrialized economies 12/1996–4/2003.

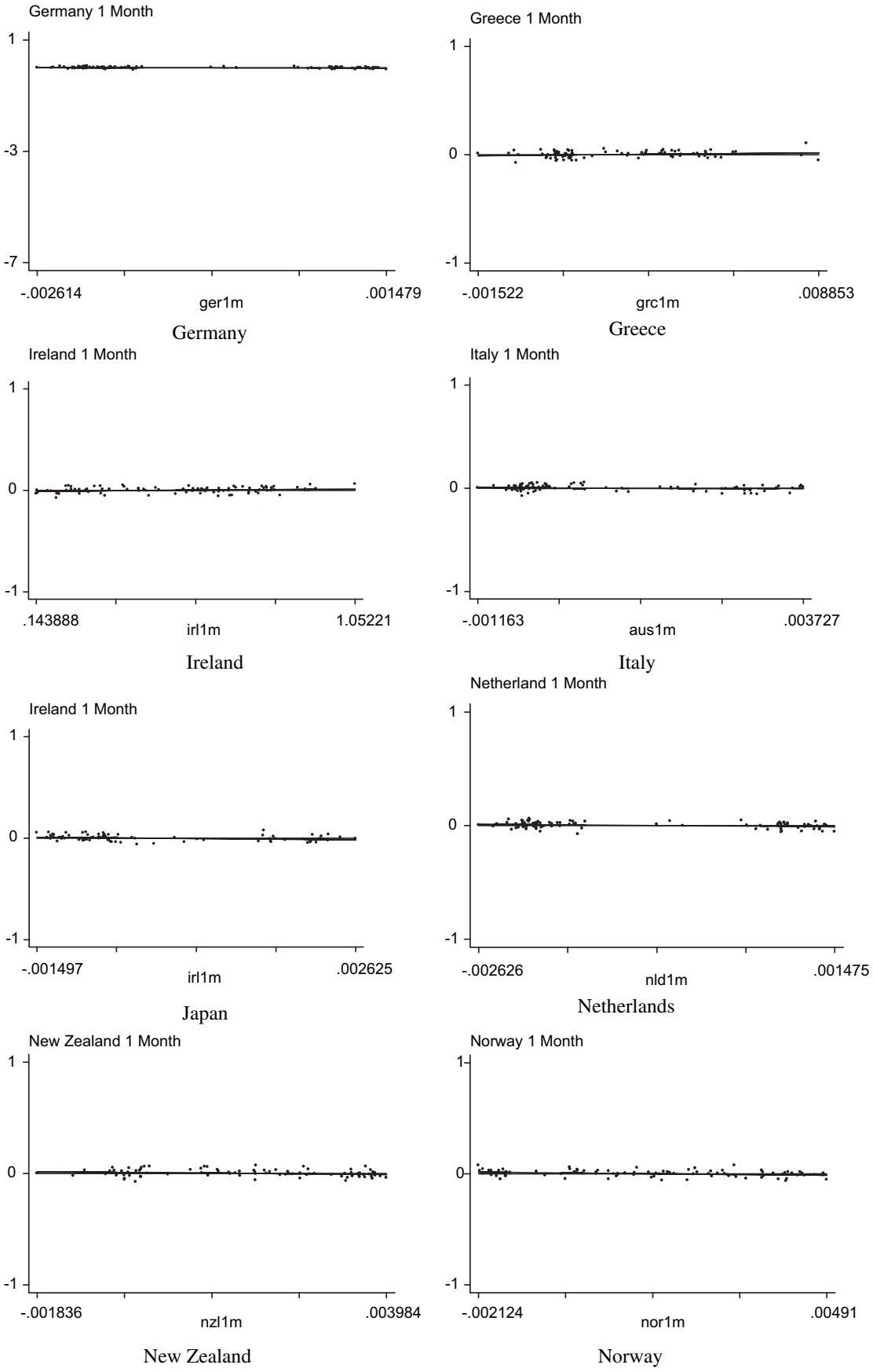


Fig. 2. (*continued*)

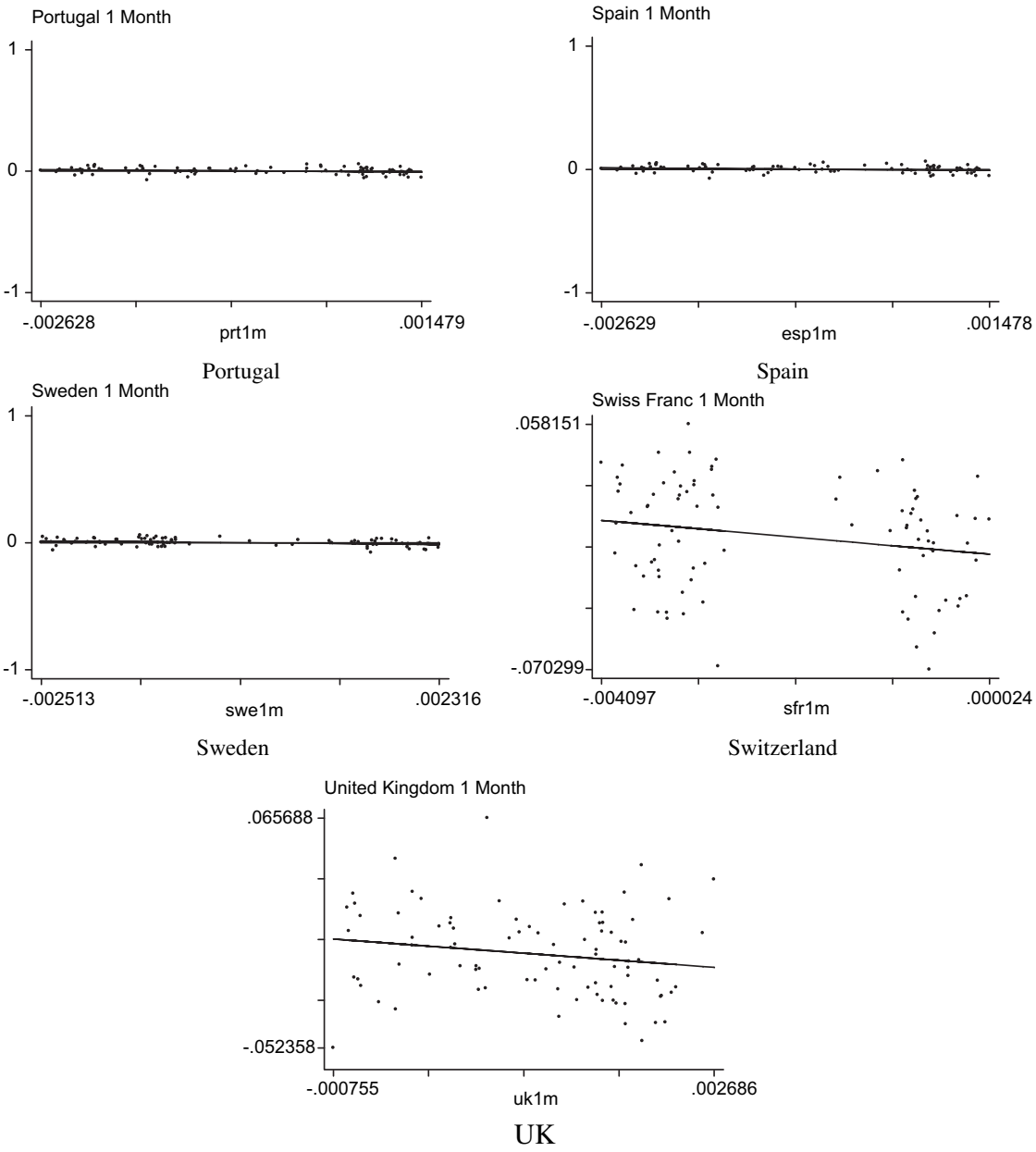


Fig. 2. (*continued*)

2. The data sample

Although many national money markets have been liberalized since the 1970s, there is still only a relatively limited set of currencies in which forward exchange contracts are actively traded by international investors. Thus Asia is more heavily represented in our sample than Latin America or, certainly, Africa. Countries in our analysis have been classified as emerging market economies based on the IMF Country Grouping Classification.[9] These also include some countries that are classified by the IMF as newly industrialized economies: Hong Kong, Singapore and Taiwan.

Our regression analysis proceeds first country by country, and then pooled. We start on December 31, 1996, because data are not available for enough emerging markets before then. In order to understand the impact of the Asian Financial Crisis of the late 1990s, two sets of regressions have been

[9] See Appendix I of the working paper RWP09-023, Harvard Kennedy School, Frankel and Poonawala (2009) for more details on data set. Appendices are available in Poonawala (2004).

Table 2
Individual emerging market country regressions (12/31/96–04/30/04). Coefficients with robust standard errors. Forecast horizon is 1 month: $s_{t+1} - s_t = \alpha + \beta (f_t - s_t) + \varepsilon_t$.

Emerging and newly industrialized economies	Dates	N	β (SE)	t: $\beta = 0$	t: $\beta = 1$	DW	F prob
Czech Republic	12/96–4/04	88	0.4260 (0.6604)	0.65	0.76	1.90	0.5206
Hong Kong	12/96–4/04	88	−0.0439 (0.0376)	−1.17	768	2.44	0.2468
Hungary	10/97–4/04	78	0.7541 (1.2594)	0.60	0.04	1.82	0.5511
India	10/97–4/04	78	−0.6181 (0.8612)	−0.72	3.53	1.43	0.4751
Indonesia	12/96–12/02	73	0.1456 (0.2055)	0.71	17.28	1.55	0.4807
Kuwait	12/96–4/04	88	0.4050 (0.9394)	0.43	0.40	1.89	0.6674
Mexico	12/96–4/04	88	−0.6399 (0.4079)	−1.57	16.16	1.99	0.1204
Philippines	12/96–4/04	88	1.6770 (1.7128)	0.98	0.16	1.87	0.3303
Saudi Arabia	12/96–4/04	88	−0.0831 (0.0835)	−1.00	168.17	2.94	0.3223
Singapore	12/96–4/04	88	0.1911 (1.2898)	0.15	0.39	1.86	0.8826
South Africa	12/96–4/04	88	−3.2693 (1.8403)	−1.78	5.38	1.74	0.0792
Taiwan	12/96–4/04	88	0.1442 (0.5252)	0.27	2.65	1.75	0.7842
Thailand	12/96–4/04	88	0.9613 (0.6853)	1.40	0.00	1.62	0.1643
Turkey	12/96–4/04	88	−0.0031 (0.0284)	−0.11	1241	1.54	0.9133

Note on DW stat: For the test of null hypotheses (no autocorrelation) at the 5% significance level, the appropriate dL and dU critical values for 80–99 observations and one explanatory variable are 1.61 and 1.66 respectively, i.e., we reject if $d < 1.61$ and do not reject if $d > 1.66$. For 60–79 observations, d$L = 1.55$ and d$U = 1.62$.

conducted: one includes the period of financial crisis, while the other does not. The results from the regression analysis starting December 1996 onwards are presented in Section 3. Regression results for post Asian financial crises (from December 1998 onwards) are reported in Appendix V of the working paper RWP09-023, Harvard Kennedy School, Frankel and Poonawala (2009). We use seemingly unrelated regressions (SUR) to correct for the likely correlation of the error term across currencies.

We have 14 currencies classified as emerging[10] (dates and graphs of exchange rates over time are available in Appendices I–IV of the working paper RWP09-023, Harvard Kennedy School, Frankel and Poonawala, 2009). Some countries with tightly fixed exchange rates were not included in the analysis. Hong Kong has been included, even though it has a currency board, because there is a small band which allows some room for movement. Leaving out specifically all those emerging market currencies that had stable currencies might bias the sample in favor of volatile emerging market currencies. Recent literature has emphasized the difficulty in establishing whether a declared flexible exchange rate regime is in fact just de jure or also de facto. Countries with capital controls (India) are not excluded from our sample. An established forward market in these countries shows that there exists a demand for forward exchange transactions.

As has long been recognized in this literature, the use of overlapping contracts (3-month forward contracts observed at a 1-month frequency) creates a moving average error process. We address this problem in the simplest way possible: by using non-overlapping contracts. Our data are sampled at the same frequency as the horizon of the forward exchange rate – 1 month. It is necessary to avoid 'mis-matching' which would involve incorrect pairing of the forward exchange rate and the future spot rate to which it pertains. Specifically, we use the forward and spot exchange rates from the last working day of each month[11] (raw data are reported in Appendix VI of the working paper RWP09-023, Harvard Kennedy School, Frankel and Poonawala, 2009).

3. Results country by country

We begin with the country by country regression results, presented in Table 1. The scatter plots for each country are illustrated in Figs. 1 and 2. To repeat the regression equation,

[10] Indonesia, where the end date of available forward exchange rate data does not coincide with the data-sets available for other countries, was included in individual country regressions, but was dropped from the pooled regression.

[11] Breuer and Wohar (1996) identify timing pitfalls, and suggest that they can be reduced by taking data from the middle of the month instead of the end.

$$s_{t+1} - s_t = \alpha + \beta(f_t - s_t) + \varepsilon_{t+1} \quad (2)$$

The coefficient estimates bounce around a lot. This is especially due to the inclusion of countries with capital controls or announced pegs. It is important to remember that the forward discount regression

Table 3
Seemingly unrelated regressions (country-wise).[a]

	Coefficient	SE	z	$P > z$		
Advanced economies						
Australia	−1.247	1.494	−0.83	0.404		
Canada	−0.011	1.738	−0.01	0.995		
Denmark	−2.190	0.624	−3.51	0.000		
European Union	−2.258	0.625	−3.62	0.000		
Japan	1.032	1.463	0.71	0.481		
New Zealand	−1.608	1.338	−1.20	0.229		
Norway	−2.332	0.768	−3.03	0.002		
Sweden	−2.190	0.888	−2.47	0.014		
Switzerland	−1.998	0.780	−2.50	0.012		
UK	−2.040	1.756	−1.16	0.245		
Emerging and newly industrialized economies						
Czech Republic	−0.269	0.626	−0.43	0.667		
Hong Kong	−0.026	0.055	−0.47	0.635		
Hungary	−0.628	0.642	−0.98	0.328		
India	−0.599	0.543	−1.10	0.270		
Kuwait	0.897	0.409	2.19	0.028		
Mexico	−0.863	0.406	−2.12	0.034		
Philippines	−0.758	0.701	−1.08	0.280		
Saudi Arabia	−0.071	0.027	−2.62	0.009		
Singapore	0.174	0.626	0.28	0.781		
South Africa	−1.639	1.470	−1.11	0.265		
Taiwan	0.325	0.411	0.79	0.429		
Thailand	−0.915	0.466	−1.96	0.050		
Turkey	−0.029	0.026	−1.11	0.268		
Equation[b]	Obs	Parms	RMSE	R^2	Chi^2	P
ausspot	78	1	.0319	0.0273	.696	0.404
canspot	78	1	.0185	0.0002	.00004	0.995
dnkspot	78	1	.0266	0.0460	12.326	0.000
euspot	78	1	.0265	0.0522	13.069	0.000
jpnspot	78	1	.0364	−0.0074	.498	0.481
nzlspot	78	1	.0328	0.0275	1.444	0.229
norspot	78	1	.0273	0.0629	9.210	0.002
swespot	78	1	.0269	0.0677	6.086	0.014
sfrspot	78	1	.0271	0.0359	6.245	0.013
ukspot	78	1	.0207	0.0243	1.350	0.245
czespot	78	1	.0350	0.0004	.185	0.668
hkspot	78	1	.0010	0.0009	.225	0.635
hunspot	78	1	.0291	−0.0108	.957	0.328
indspot	78	1	.0118	0.0111	1.218	0.270
kwtspot	78	1	.0040	−0.0066	4.809	0.028
mexspot	78	1	.0254	0.0186	4.512	0.034
phlspot	78	1	.0309	−0.0018	1.169	0.280
sauspot	78	1	.0001	0.0791	6.845	0.009
sgpspot	78	1	.0187	0.0001	.078	0.781
safspot	78	1	.0465	0.0296	1.242	0.265
taispot	78	1	.0162	0.0005	.626	0.429
thaspot	78	1	.0413	−0.0060	3.858	0.050
turspot	78	1	.0580	−0.0049	1.227	0.268

[a] Does not include Euro member countries (to avoid overlap of data with the euro) and Indonesia (end date of available forward exchange rate data does not coincide with the data-sets available for the remaining countries).
[b] Dates for seemingly unrelated regressions are from 10/31/1997–4/30/04.

Table 4
Pooled country regressions (10/31/97–04/30/2004).

Pooled data	Dates	*N*	β (SE)	t: $\beta = 0$	t: $\beta = 1$	DW	*F* prob
Emerging economies[a]	12/96–4/04	1014	−0.0278 (0.0290)	−0.96	1252	1.68	0.3375
Advanced economies[b]	02/97–4/04	780	−2.0231 (0.5426)	−3.73	31.04	1.89	0.0002

[a] Pooled analysis of emerging economies does not include Indonesia. All dates are from 10/97 to 4/04.
[b] Pooled analysis does not include the Euro countries. All dates are from 10/97 to 4/04.

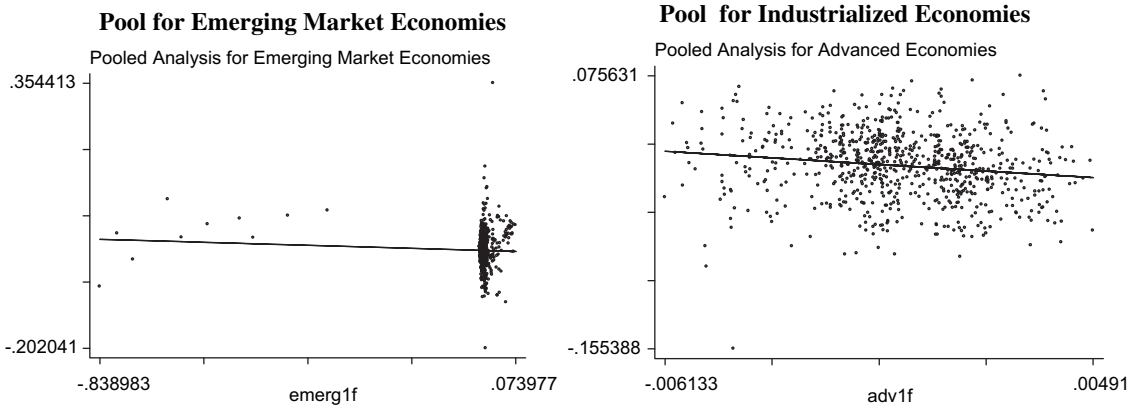


Fig. 3. Pooled analysis (including 13 emerging market currencies).

was always intended to be a test of the null hypothesis of unbiasedness, rather than estimation of any alternative-hypothesis structural equation, so that stable coefficients are not to be expected.

The results confirm the usual finding of a strong forward rate bias for most of the industrialized country currencies. All the currencies except for the Greek drachma and Japanese yen show coefficients that are statistically less than one at very high significance levels. Most of the advanced countries show coefficients that are also significantly less than zero at the 5% level. Only Canada, Greece, Italy, Japan and the UK are not significant at the 5% level. Thus we can reject the hypotheses that the coefficient β is zero for 16 of the 21 advanced economies, and we can also reject the hypotheses that $\beta = 1$ for 19 of the 21 countries in our advanced country sample.

Our key result first appears in Table 2: the emerging market economies have coefficients that are generally less negative than their developed country counterparts. More are greater than zero than negative. The average coefficient for emerging market economies is also positive: 0.0033, versus −4.3331 for advanced economies. To be sure, the forward market is still a biased predictor for more than half of the emerging currencies: we can easily reject the hypothesis that the coefficient is 1.0 for eight of the 14 emerging market economies (Hong Kong, India, Indonesia, Mexico, Saudi Arabia, South Africa, Taiwan and Turkey). But in none of the emerging market currencies is the coefficient statistically less than zero at the 5% significance level.

Thus far the results support a substantial difference between the results of the industrialized economies and the emerging markets. That the absolute values for emerging markets are smaller suggests that the forward exchange rate is a less biased indicator for the future expected spot rate in emerging market economies.[12]

Next, in Table 3, we correct for correlation of the error term across countries in the error term, using the technique of seemingly unrelated regressions (SUR).[13] The SUR analysis starts from October 1997, which is the starting point for India and Hungary in our dataset, so as to standardize the number of observation dates. Therefore all currencies have 78 data points.

[12] Appendix V in the working paper RWP09-023, Harvard Kennedy School, Frankel and Poonawala (2009) presents the regressions results for the data set not including the turbulent period covering the Asian financial crisis.
[13] Such a correlation is almost inevitable when using bilateral exchange rates. For example, a strong dollar or a contagious currency crisis in a particular month would likely show up across many of the bilateral dollar exchange rates.

Table 5a
Seemingly unrelated regressions (pooled).[a]

	Coef.	SE	z	$P>\|z\|$		
Advanced economies	−1.666	0.4503	−3.70	0.000		
Emerging market economies	0.152	0.1896	0.80	0.422		
Equation	Obs	Parms	RMSE	R^2	χ^2	P
advspot	780	1	.0281	0.0220	13.679	0.0002
emergspot	780	1	.0255	−0.0004	.645	0.4219

[a] Does not include Euro member countries (to avoid overlap of data with the euro) and Indonesia (end date of available forward exchange rate data does not coincide with the data-sets available for the remaining countries).

Table 5b
Pooled country regressions (10/31/97–04/30/04).

Pooled data	Dates	N	β (SE)	t: $\beta=0$	t: $\beta=1$	DW	F prob
Emerging economies	12/96–4/04	780	0.0377 (0.2436)	0.15	15.60	1.84	0.8769
Advanced economies	02/97–4/04	780	−2.0231 (0.5426)	−3.73	31.04	1.89	0.0002

Except for South Africa, and Canada and Japan, which appear as outliers in their sets – emerging market economies and advanced economies respectively – the emerging markets under SUR all continue to yield coefficient estimates that are less negative than all the industrialized economies. Among advanced currencies, five of 10 show coefficients that are clearly significantly less than zero, while among emerging markets only two of 14 do (Mexico and South Africa).

4. Results from pooled analysis

We next attempt, in Table 4, to capture more information from our data set by running a pooled country regression analysis with all currencies constrained to have the same coefficient within each class of countries. The pooled analysis lets us bring all the data to bear at once to get the best estimator. We keep separate pools for the emerging market economies and the industrialized economies (see Fig. 3.) To eliminate double counting of observations, only the euro has been included in the pooled analysis for industrialized economies; individual EMU member countries have been excluded. This brings the number of advanced countries included in the pooled regression analysis from 21 to 10.

The β for the pooled analysis for emerging market currencies is −0.028. This estimate is significantly less than 1.0 at the 5% level. However we cannot reject the hypotheses that $\beta=0$. The coefficient for the pooled analysis for advanced economies is −2.023 Fig. 3. Again, while we can reject the hypothesis $\beta=1$ at the 5% level, and we can reject $\beta=0$ for the advanced economies, we cannot do so for the

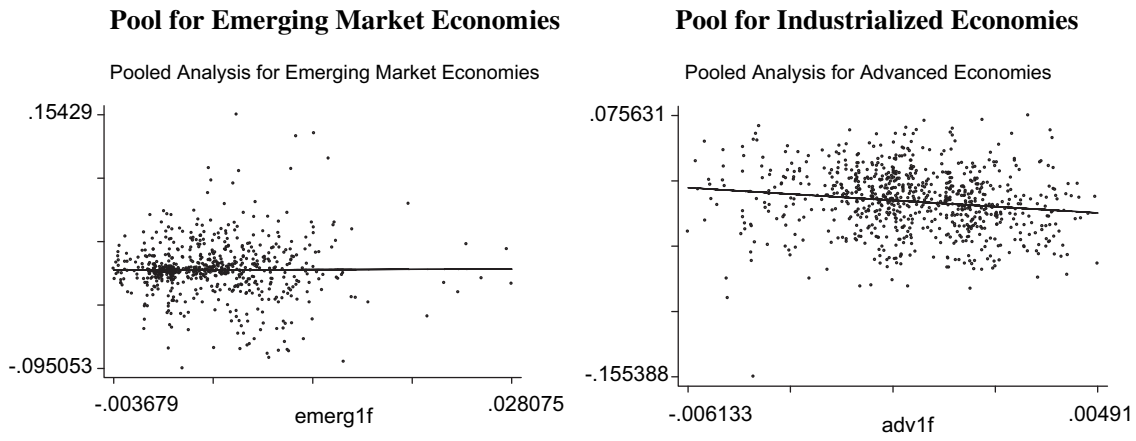


Fig. 4. Pooled analysis (10 currencies in each category).

emerging markets. Increasing the "*n*" leads us to a sharper difference in the estimated β with a more negative value for the industrialized economies than for the emerging markets.

We also run seemingly unrelated regressions in the pooled regression analysis to address cross-currency correlation (Table 5a). The pooled SUR analysis dropped observations for the last three countries, alphabetically (Taiwan, Thailand and Turkey), to make the number of emerging market observations equal the advanced countries (10 currencies for each).

A similar analysis of the simple (i.e., without SUR) pooled country analysis without Taiwan, Thailand and Turkey is reported in Table 5b, to allow comparison. The results are similar: the estimated coefficient is above zero, but insigificantly so (Fig. 4).

5. Conclusions

The regression analysis conducted in this paper produces a striking result. While the bias in the forward discount as a predictor of the future change in the spot exchange rate is present among emerging market currencies and advanced country currencies alike, the bias is less severe in the former case than in the latter. Unlike major currencies, which generally show a coefficient significantly less than zero, suggesting that the forward rate actually points in the wrong direction, the coefficient for emerging market currencies is on average slightly above zero, and even when negative is rarely significantly less than zero. One implication for traders is that the "yen carry trade" and "dollar carry trade" on average may not be as profitable when the strategy is to go long in emerging market currencies as when it is to go long in major currencies. An implication for international finance theorists, in light of the intuitively high riskiness of emerging currencies, is that the source of forward discount bias does not lie entirely in the exchange risk premium.

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