Ch. 15. Forecasting Exchange Rates

Context:

- Chapter 11: significant and persistent deviations from Purchasing Power Parity. That is, there is real exchange rate risk.
- Chapter 14: the forward rate's performance as a predictor of the future spot rate is hardly impressive.

  $\Rightarrow$ Do we fare any better if we use other models to predict the exchange rate?
  - Balance of Payments theory of exchange rates
  - Portfolio theory of exchange rates
  - Forecasting methods based on the time series properties of the exchange rate and mechanical trading rules.
  - Specialists' forecasts

Classification:

- *technical* vs. *fundamental* forecasting models.
- weak form tests, semi strong form tests, and strong form tests.

1. Technical Analysis / Weak-Form Tests

1.1. Autocorrelation Models

(1) $$s_{t,T} = \alpha + \beta_L \, s_{t-L} + e_{t,T}$$

$$s_{t,T} = \alpha + \beta_1 \, s_{t-1} + \beta_2 \, s_{t-2} + \beta_3 \, s_{t-3} + \beta_4 \, s_{t-4} \ldots + e_{t,T}$$

Interpretation? e.g. first-order autocorrelation coefficient β_1:

- Positive autocorrelation:
  - bandwagons
  - Slow dissemination of new information
  - Slow changes in risk or in the degree of risk-aversion in the market.
- Negative autocorrelation: overreaction to new information (*technical corrections*).

Results:

- typically significantly positive autocorrelations at daily, weekly, monthly frequencies; frequently larger than for common stocks. Negative autocorrelations intra-day (e.g. every 5 minutes)
- The economic predictability is not impressive.

1.2. Runs Tests

Runs tests: + + / – / + / – – / 0 / – – / + + + / –

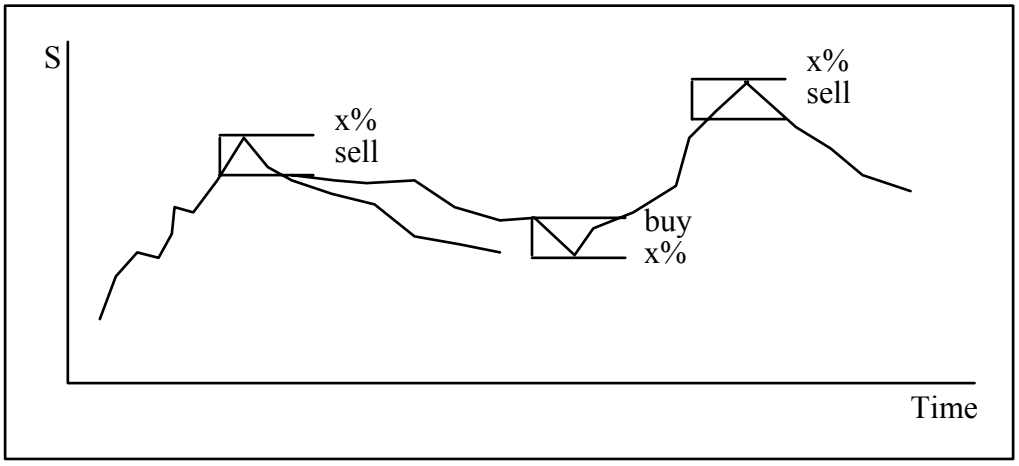
Can the observed series could possibly be drawn from a model which randomly generating pluses, minuses, and zeros from a constant distribution?

Results:

confirm the (weak) persistence in exchange rate movements found in autocorrelation tests.

1.3. Filter Rules and Chartism

- Sweeney [1988] (Alexander filter)



Statistically significant returns, before transaction costs, from using the Alexander filter in the exchange market. This confirms the weak persistence of movements found in runs tests and autocorrelation tests.

- Gernaey [**], tests 584 different trading rules, finds that not even 10% of the rules produced profits that are significant at the 10% level before transaction costs; and only 0.3% of the rules were profitable after accounting for transaction costs.
- Curcio and Goodhart [1991] Decision makers' performance does not improve when they use chartist packages. Nor does it matter whether traders are professionals or inexperienced students.

1.4. Does Autocorrelation Imply Market Inefficiency?

- Expected returns may change slowly over time. E.g. Expected RPPP hypothesis of Roll (1979):

$$E_t\tilde{s}_{t,t+1} = E_t(I_{t,T}) - E_t(I^*_{t,T})$$

- Transaction costs may wipe out any profits from the so-called predictability of exchange rates (see, e.g., Levich [19**]).

2. Fundamental Models of Exchange Rate Forecasting

2.1 Properties of the Exchange Rate and the Fundamentals

As in Meese (1990): standard deviation and correlations of the log-levels or changes in the USD/JPY and USD/DEM and the fundamentals (differences in inflation rates, in money supply and in industrial production)

Variable	*Standard deviation (*of level*)*	*Standard deviation* × 100 (of first difference)
Log of spot USD/JPY	0.262	3.340
Log of spot USD/DEM	0.178	4.181
US-Japanese interest differential	0.026	0.801
US-German interest differential	0.016	0.785
Log of US-Japanese CPI	0.127	0.671
Log of US-German CPI	0.126	0.329
Log of US-Japanese M1	0.110	4.289
Log of US-German M1	0.085	2.2029
Log of US-Japanese industrial production	0.064	1.479
Log of US-German industrial production	0.072	2.056

$\Rightarrow$ Large σs of ?lnS (except relative to ?[lnM – ?lnM*]

Correlations:

- low
- many are *weird*

Corr. of First Diff	$\frac{USD}{JPY}$	$\frac{USD}{DEM}$	JPY Interest	DEM Interest	JPY Price	DEM Price	JPY M1	DEM M1	JPY IndProd	DEM IndProd
$\frac{USD}{JPY}$	1.00									
$\frac{USD}{DEM}$	0.61	1.00								
JPY Interest	**-0.07**	**-0.11**	1.00							
DEM Interest	0.001	-0.05	0.084	1.00						
JPY Price	**-0.05**	-0.09	0.012	0.04	1.00					
DEM Price	0.07	**-0.09**	0.09	0.02	0.24	1.00				
JPY M1	**-0.05**	-0.02	-0.10	-0.09	-0.07	-0.001	1.00			
DEM M1	0.08	**-0.09**	-0.05	-0.01	-0.06	-0.002	-0.01	1.00		
JPY IndProd	0.006	-0.04	0.31	-0.25	0.01	0.10	-0.16	0.04	1.00	
DEM IndProd	-0.02	**-0.02**	0.15	0.16	0.18	0.04	0.04	-0.04	0.13	1.00

2.2 Econometric Models of the Exchange Rate

Meese and Rogoff's tests:

- 'Nested' equation [including PPP, MAE]

$$(2)\quad \ln S = \alpha + \beta_1 (r_{t,T} - r^*_{t,T}) + \beta_2 (P_{t,T} - P^*_{t,T}) + \beta_3 (\ln L_{t,T} - \ln L^*_{t,T}) + \beta_4 (\ln Y_{t,T} - \ln Y^*_{t,T}) + \beta_5 (TB_{t,T} - TB^*_{t,T}) + e_{t,T}$$

- Control models

$$(3)\quad \ln S_{t+1} = \ln S_t + \varepsilon_{t,t+1} \text{ and } \ln S_{t+1} = \ln F_{t,t+1} + \varepsilon_{t,t+1}$$

- test statistic to compare forecasts:

$$\text{RMSE} = \left(\frac{\sum_{t}^{N} [\ln S(t+k) - \ln S(t+k)]^2}{N} \right)^{0.5}$$

Results:

- RMSE obtained from (2) is rarely lower than the RMSE from the random walk model.
- The random walk also does better than the forward rate at forecasting the future spot rate.

But: lnS looks non-stationary—see (3)—and also L, Y, P are non-stationary. Then (2) is misspecified;

Alternative tests (first changes)

$$(4) \qquad s_{t,T} = \alpha + \beta_1 (r_{t,T} - r^*_{t,T}) + \beta_2 (I_{t,T} - I^*_{t,T}) + \beta_3 (l_{t,T} - l^*_{t,T}) + \beta_4 (y_{t,T} - y^*_{t,T}) + e_{t,T}$$

Results:

- R^2: 0.0098 (JPY) and 0.0118 (DEM)
- None of the slope coefficients in either regression is significant even at the 10% level.

Other tests

- Rogalski and Vinso (1977): adding past BoP variables to (2) does not help.
- Roll (1977): adding past deviations from PPP to (2) does not help.

2.3 Possible Explanations for the Failure of Fundamental Models

- estimation problems, such as simultaneity and the peso problem
- actual model may not be linear, or it may have an omitted variables bias.
- parameters of models and statistical moments of the variables may change over time—e.g. GARCH models.

3. Evaluating the Performance of Forecasters

3.1. Evaluating the Performance of Forecasting Services

Goodman (1980-84) surveys the predictions made by forecasting services.

- 'average service is worse than a toss of a coin'
- econometric services do worst
- technical-oriented forecasters do somewhat better, initially, but their records appear to deteriorate over time.

Levich (1979):

- services do badly in terms of MSE, but some do well in terms of indicating the correct direction.
- later update: no consistency over time. Winners become losers and vice versa.

3.2. Evaluating the Performance of Central Banks

Central banks "intervene to maintain an orderly market and to smooth out excessive swings in exchange rates, but do not try and move the exchange rate away from its fundamental value".

- **Hypothesis** (Friedman): If this is true, central banks must be quite good at predicting exchange rates, and should make profits from intervention.
- **Results**:
  - Taylor (1982): seven central banks out of eight actually made substantial losses from currency trading, three of them significantly.
  - Jacobsen (1983): if Taylor's study is extended by two years then the central banks actually make a modest profit from their currency trading.
  - Huysmans: De Nederlandse Bank made money on its spot market interventions, but lost money when it intervened in the forward market.
  - Murray, Zame and Williamson (1990): the Bank of Canada made profits and its trading has tended to be stabilizing, 1975-88. But there have been long periods during which the Bank of Canada incurred substantial losses.

4. Implications for Treasury Management

- The random walk model of exchange rates outperforms fundamental models at predicting exchange rates in the short run. Consistent with the evidence on PPP and UEH.
- Technical models seem to do better than fundamental models at predicting future exchange rates. However, it is not clear whether one can make abnormal returns (over and above the return for the risk taken) using technical analysis.

General conclusion:

- Exchange rate changes do have a 'real' impact.
- Exchange rate changes are quite hard to predict.
- If we can also show that hedging matters (in terms of PV of firm), then there may be a role for a hedging/exposure management policy.