Exchange Rate Forecasting

- Controversies in Exchange Rate Forecasting
- The Cases For & Against FX Forecasting
- Performance Evaluation: Accurate vs. Useful
- A Framework for Currency Forecasting
- Empirical Evidence Favorable to Forecasting
- Summary and Conclusions

Controversies in Exchange Rate Forecasting

- The 'random walk' school
  - Exchange rates cannot be forecast
- The 'technical' school
  - Rates have patterns in the short run
- The 'fundamentals' school
  - Rates have patterns in the long run

The Case Against Currency Forecasting (1 of 3)

1. It's very hard to forecast currencies
   - The structural macroeconomic approach
     - Which model? Which variables?
     - Where to get future RHS variables?
   - The non-structural approaches
     - Which approach? Which specification?
   - Common econometric problems
     - How much past data?
     - Will model work out of sample?

The Case Against Currency Forecasting (2 of 3)

Many economists say: It's hard to forecast!

- "Economists do not yet understand the determinants of short- to medium-run movements in exchange rates. Neither models of exchange rates based on macroeconomic fundamentals nor the forecasts of market participants as embodied in the forward rate or survey data can explain exchange rate movements better than a naive alternative such as a random walk model. Worse yet, exchange rate changes are hard to explain after the fact …" (Richard Meese, 1990, p.132)
- "It is now widely accepted that standard observable macroeconomic variables are not capable of explaining, much less predicting ex ante, *the majority of* short-term changes in the exchange rate." [emphasis added] (Jeffrey Frankel and Kenneth Froot, 1990, p. 181)

The Case Against Currency Forecasting (3 of 3)

2. Theory of Market Efficiency
   - "Prices fully reflect available information"
   - Currency markets are very competitive, liquid, few barriers to entry, and populated by very smart people
   - Surprising if obvious (or low risk) currency profit opportunities
3. "Speculative Efficiency" Hypothesis
   - Forecasting is a competitive industry
   - Use of a good forecast undermines its value

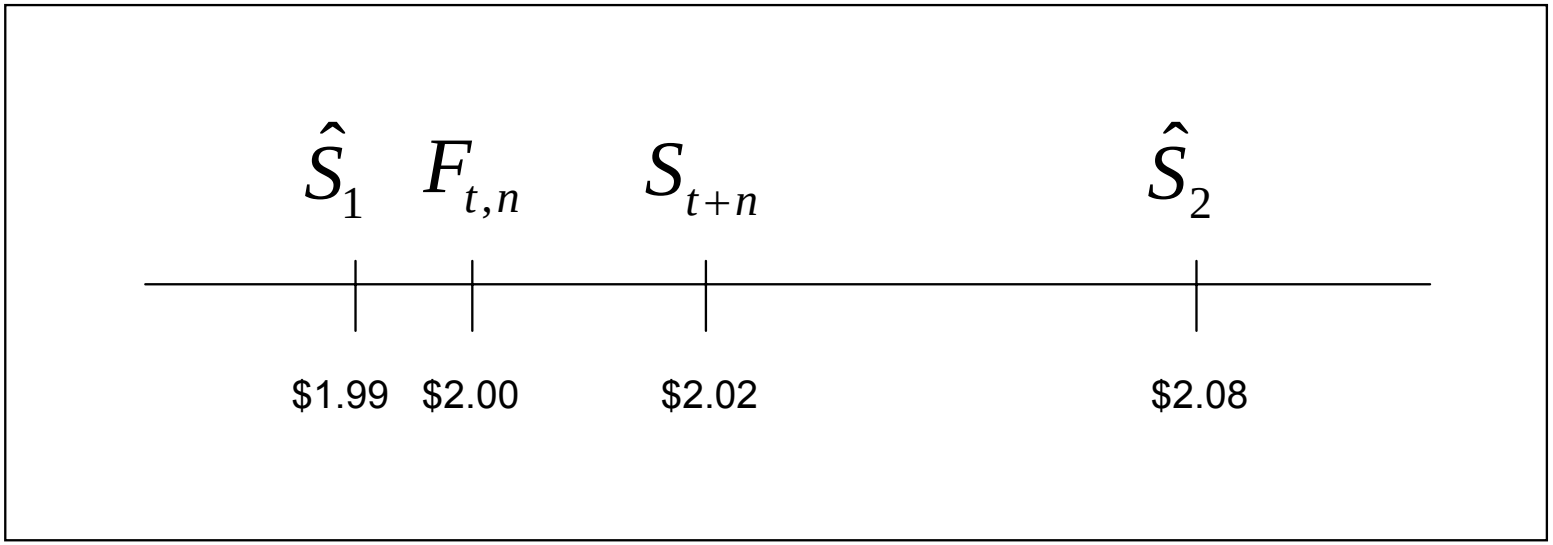
The Case In Favor of Currency Forecasting (1 of 2)

1. It's *not* so hard to forecast currencies
   - Accuracy is not essential, getting direction right adds value
   - Traditionally econometric models are evaluated on the basis of accuracy (Mean Squared Error), but "percentage correct" may be a better indication of a forecasts value for certain hedging or speculation programs
   - Models that explain a small percentage of FX *changes* (R^2 = 5-10%) may be very valuable in certain hedging or speculation programs

The Case In Favor of Currency Forecasting (2 of 2)

2. Shortage of speculators who act on forecasts
   - Corporate treasurers who always hedge
   - Investment managers who are not permitted to take open currency positions
   - FX traders who close positions at day's end
3. FX markets may violate efficiency
   - Government intervention
   - Rates "overshoot," then "mean revert" longer run

Forecast Performance Evaluation:
Accurate versus Useful Forecasts



Consider two forecasters ($\hat{S}_1$ *and* $\hat{S}_2$) as above.

$\hat{S}_1$ is more accurate, but $\hat{S}_2$ is on the "right side of the forward rate." Which would you prefer to follow?

Measuring Forecast Accuracy

- The traditional econometric approach begins with the forecast error made at time *t* :

$$e_t = \frac{\hat{S}_{t,j} - S_{t+j}}{S_{t+j}}$$

where $\hat{S}_{t,j}$ is the *j*-period ahead forecast made at time *t*

S_{t+j} is the actual spot rate at time *t*+*j*

- The mean squared error (MSE), $\frac{\left(\sum_i e_i^2\right)}{n}$, and the root mean squared error, $\sqrt{\text{MSE}}$, are commonly used to estimate the average error size.

Measuring Forecast Usefulness

- In the absence of a currency risk premium, the "right side of the market" implies the "right side of the forward rate".

		Actual Exchange Rate Change $S_{t+j} > F_{t,j}$	$S_{t+j} < F_{t,j}$
Predicted Exchange Rate Change	$\hat{S}_{t,j} > F_{t,j}$	**Correct**	**Incorrect**
	$\hat{S}_{t,j} < F_{t,j}$	**Incorrect**	**Correct**

Measuring Usefulness

- To measure usefulness, calculate:

$$\textbf{the \% of correct forecasts, } p = \frac{\textbf{number of correct forecasts, } r}{\textbf{total number of forecasts, } n}$$

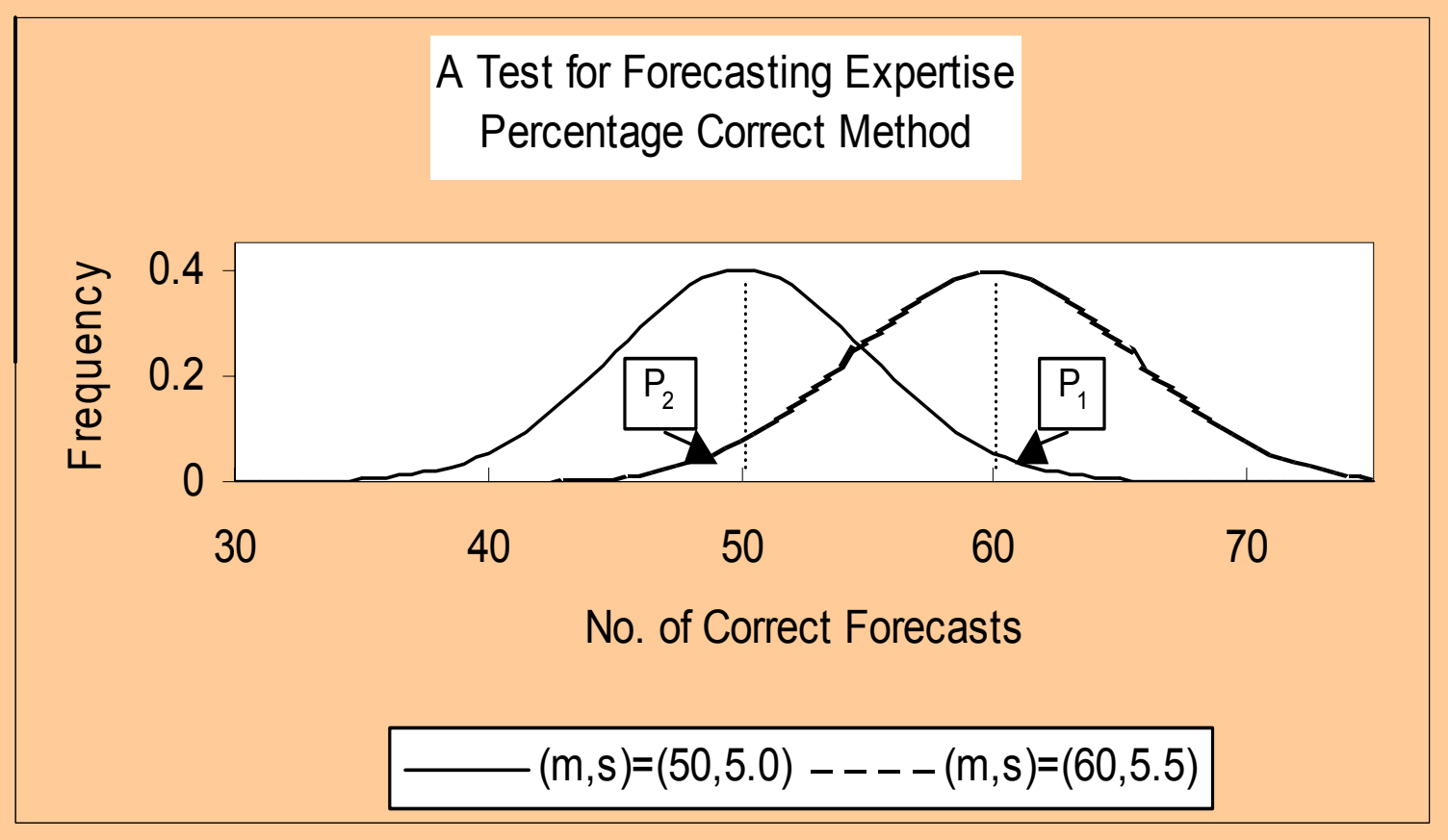
- Then, the test for usefulness is:

$$H_0 : p = 0.5 \text{ (no timing or expertise)}$$
$$H_1 : p > 0.5 \text{ (positive timing or expertise)}$$

- According to the binomial distribution:

$$E(p) = \frac{r}{n} \qquad Var(p) = \frac{p(1-p)}{n}$$

Measuring Statistical Significance of Usefulness (% Correct)



A Framework for Forecasting Exchange Rates

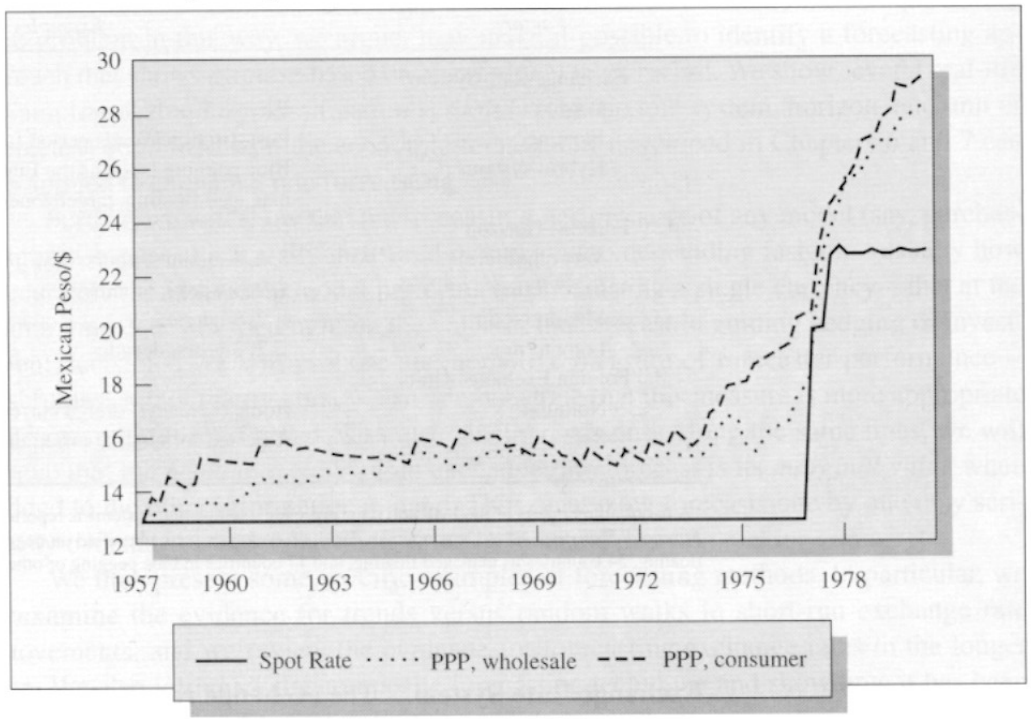
Factor	*Examples*
1. Exchange Rate System	
Pegged	Bretton Woods period
Floating	Post-Bretton Woods period for many countries
Hybrid systems	Bloc pegging, managed floating, target zones
2. Forecast Horizon	
Very short term	1, 2, 3 minutes, hours, days
Short term	1, 2, 3 weeks, months
Medium term	1, 2, 3 quarters
Long term	1, 2, 3 years, decades
3. Foreign Exchange Units	
Nominal	Home currency / Foreign currency
Real	Adjusted for inflation, deviations from PPP

Forecasting Exchange Rates: The Exchange Rate System Matters

- Under a *pegged rate* regime
  - Once the FX rate becomes *misalinged*, models may assist regarding direction & magnitude of change
  - Timing is political decision, but economics matters
- Under a *floating rate* regime
  - Continuous small changes
  - Profitable forecasting depends on lack of efficiency
- Under a *hybrid* regime
  - Elements of both pegged and floating process

The Mexican Peso: 1954-76

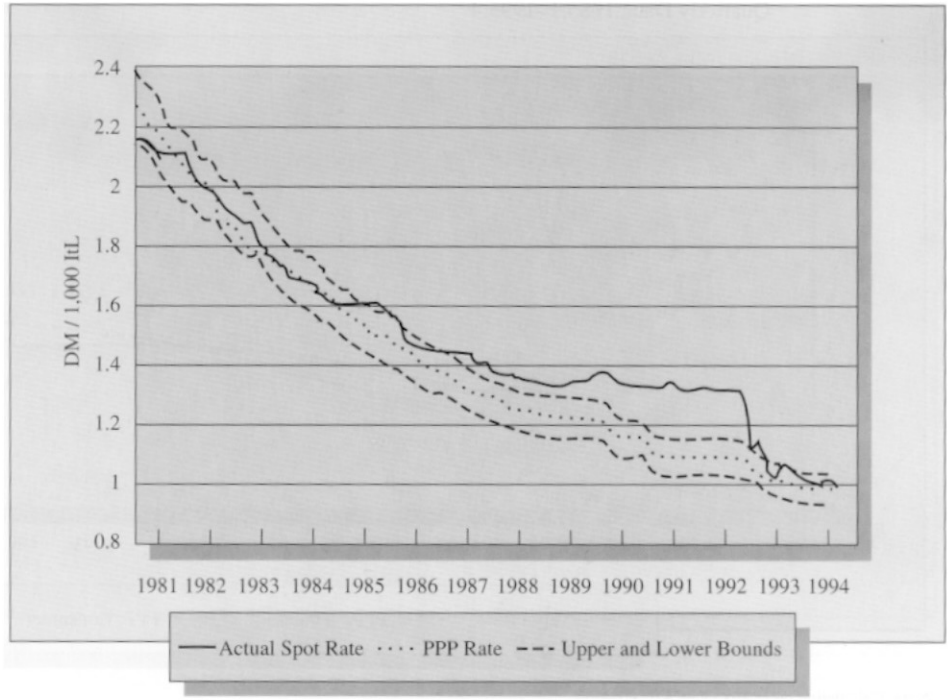
FIGURE 8.2 **Actual and PPP Spot Rates: Mexico**
Quarterly Data, 1957–1979



Note: Calculation uses 1957:1 as a base period.
Source: Author's calculations; data from *International Financial Statistics*.

The Italian Lire: 1981-94

FIGURE 8.4 Actual and PPP Spot Rate—DM/Italian Lira



Note: The three lines moving together in the graph represent the estimated PPP rate and its upper and lower bound. During the late 1980s and early 1990s, the lira became progressively overvalued against the DM on a PPP basis, until the lira was devalued in September 1992.

Source: Swiss Bank Corporation, *PPP Chart Book*, Aug. 1994.

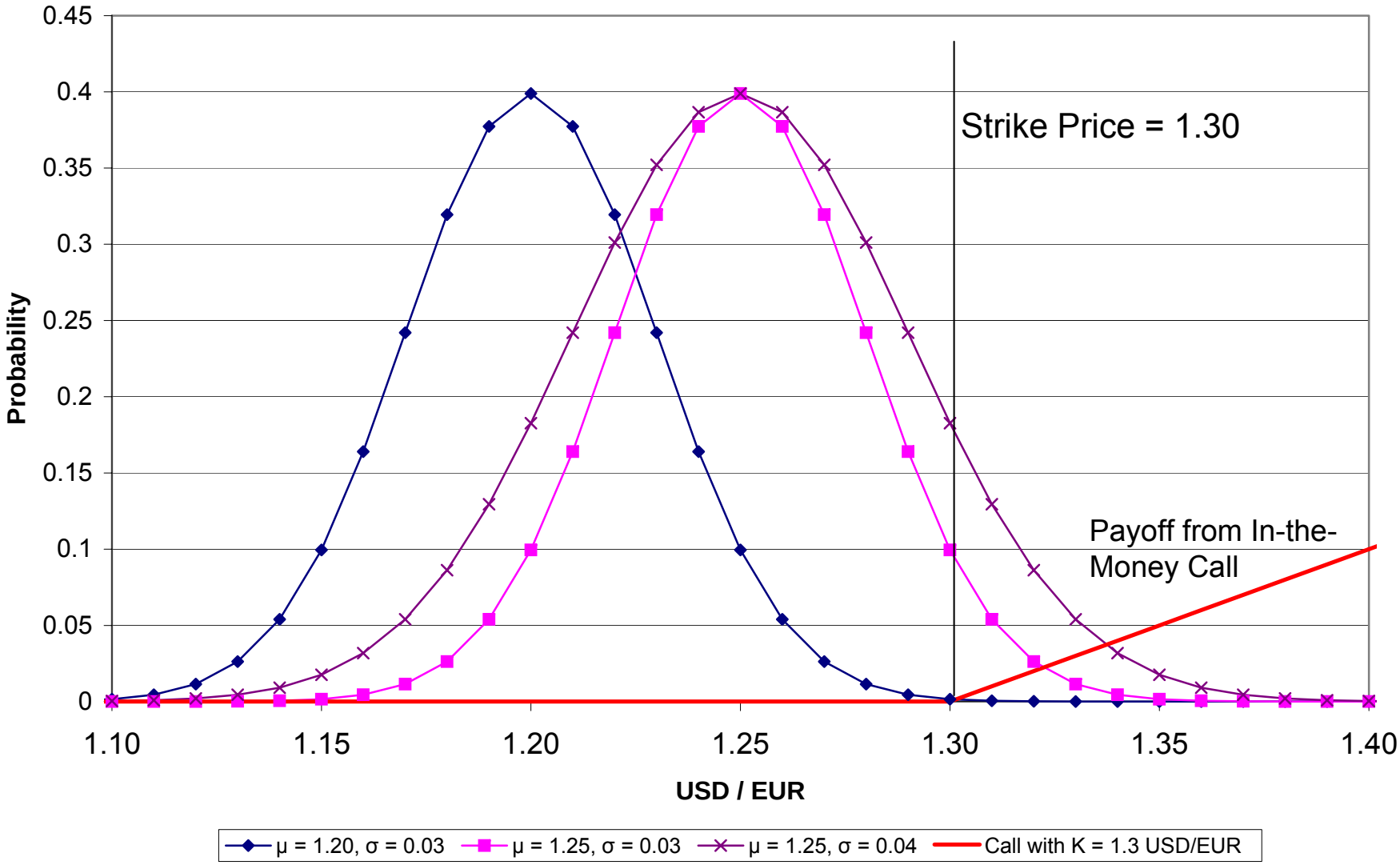
Forecasting Exchange Rates: The Forecasting Horizon Matters

- Surveys show that at short horizons, market participants place greater reliance on technical models
- At longer horizons, the surveys show more reliance on economic fundamentals
- In the middle range of horizons, special approaches, like *composite forecasting* or *out-of-the-money options*, may be useful
  - OTM options: A signal when “too” expensive

Option Prices and Forecasting

- Option prices and the credibility of a target zone
  - If a target zone with limits $\underline{S}$ and $\overline{S}$ is fully credible, then there are limits
    - on the strike prices of options that are sensible to write
    - and on the prices of options with strikes: $\underline{S} < K < \overline{S}$
- The basic intuition is
  - If the target zone is fully credible, realizations of $S > \overline{S}$, or $S < \underline{S}$ are ruled out. So options to buy at $K > \overline{S}$, and options to sell at $K < \underline{S}$ should be worthless.
  - Option prices (both puts and calls) more expensive if buyers think that extreme occurrences outside the target zone are possible.
  - Option prices are sensitive to variance
  - The amount by which an option price exceeds a theoretical price conditional on "no break" in a target zone measure market expectation of a break in the zone.

Option Valuation Under Several Exchange Rate Distributions

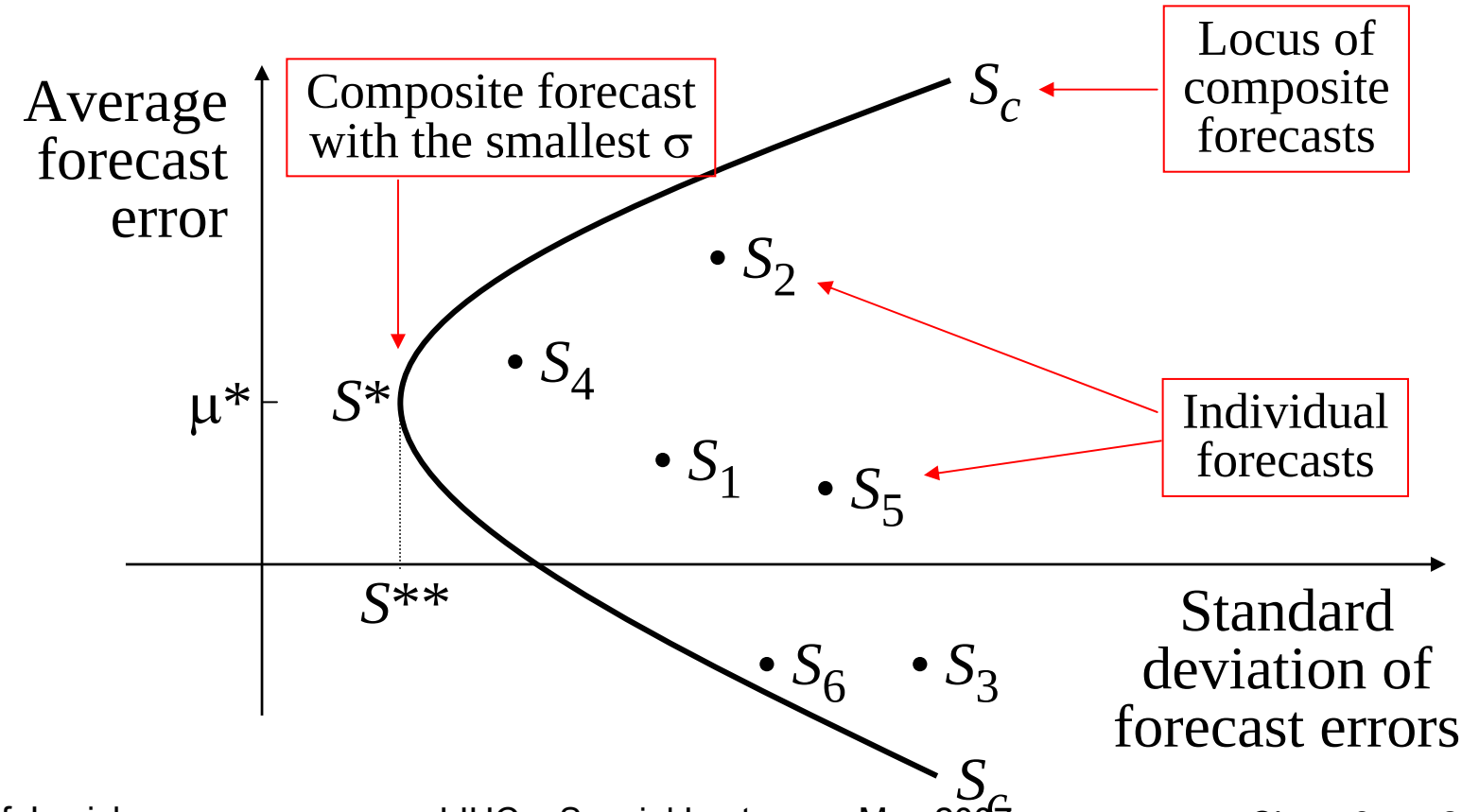


Composite Forecasts: Theory and Examples

- A composite forecast brings together the information in alternative forecasting models to try to outperform the individual forecasts.
- To draw information from the available pool of *n* forecasts, a variety of alternative weighting systems are possible:
  - weight $w = 1/n$ [arithmetic average]
  - $w_i = \dfrac{1/\sigma_i}{\sum_i 1/\sigma_i}, \quad i = 1, \ldots, n$ [heavier weight for more accurate forecasts]

A Composite Forecast Example

– choose w_i to minimize the average forecast error, conditional on the standard deviation.

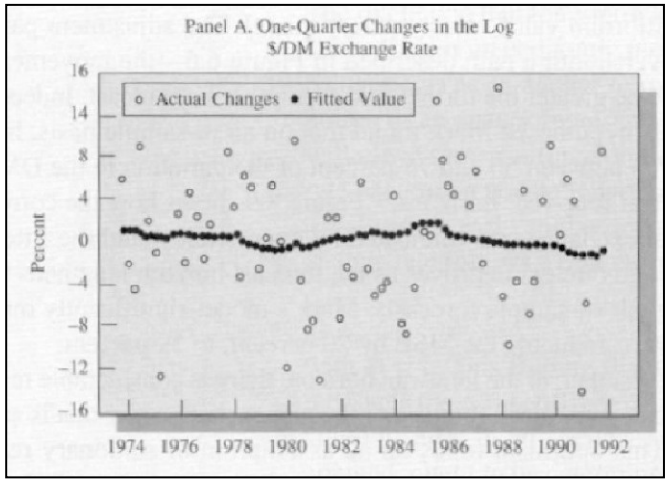


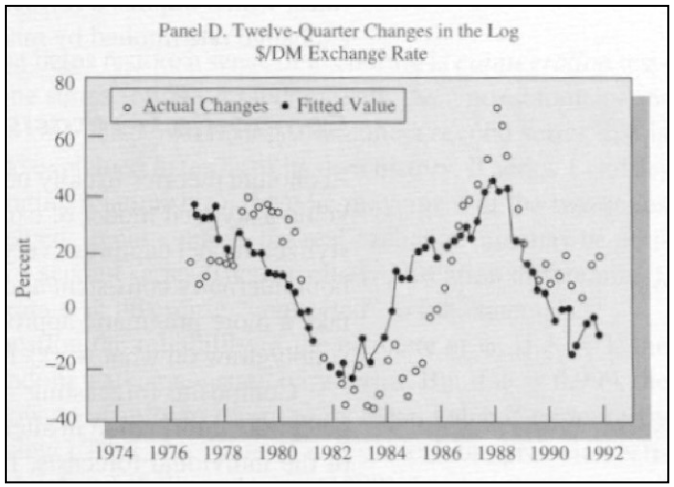
Forecasting Exchange Rates: The Units of the Forecast Matter

- Forecasters must distinguish between the "real" and "nominal" exchange rate
  - Why? Real vs. nominal assets and liabilities
- Real and nominal FX may be similar in the short run, but very different in the long run.
- The nominal exchange rate may be non-stationary, but tend toward an equilibrium.
- The real exchange rate could be a stationary series, implying mean reversion in the long run.

Long-Horizon Predictability in $/DM

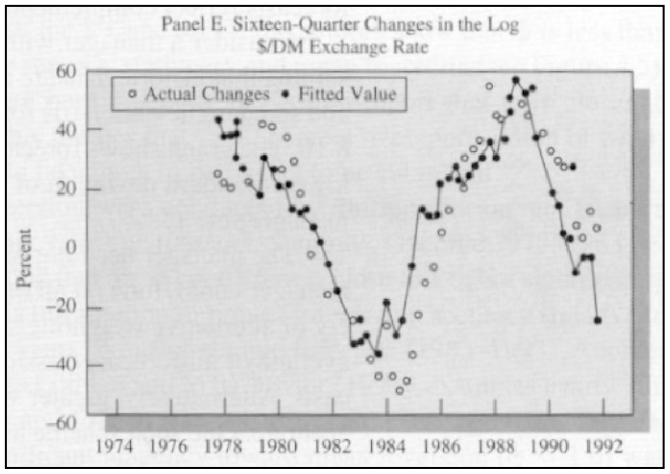
1 Qtr





12 Qtr

Fig. 8.9



16 Qtr

Source: Nelson Mark, "Exchange Rates and Fundamentals …," *Amer. Econ. Rev.,* March 1995.

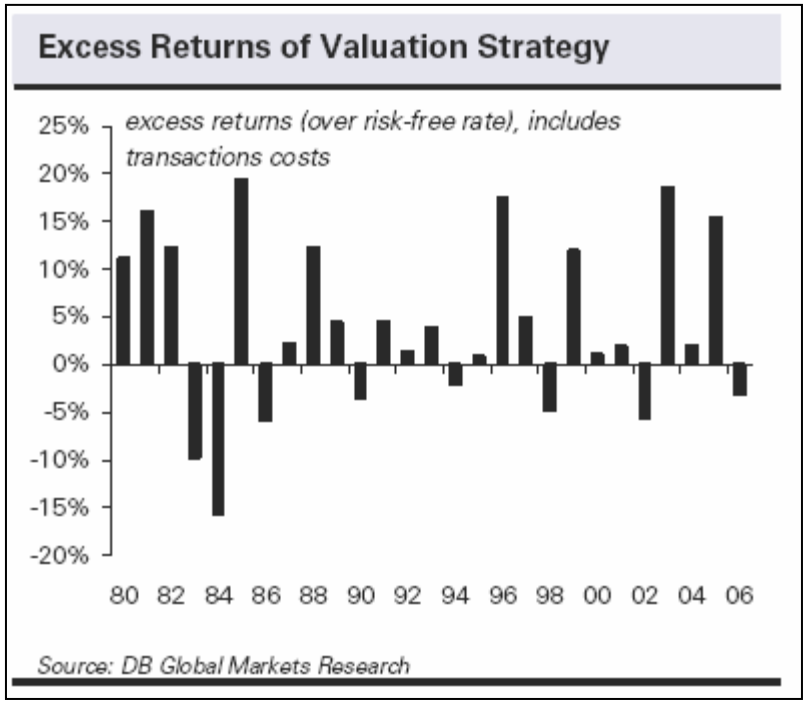
Mean Reversion in Real FX Rates

Estimated Autoregression: Q(t) = a + b Q(t-1)				
Country Pair	Sample Period	b	SD (b)	R^2
$ - £	1792-1973	0.898	0.031	0.80
	1792-1990	0.887	0.031	0.79
FFr - £	1804-1973	0.761	0.076	0.57
	1804-1990	0.776	0.067	0.60

Estimated Autoregression: Q(t) = a + b Q(t-1)				
% Root Mean Squared Forecast Error, 1974-1990 in %				
Country Pair	Horizon - years	RMSE assuming mean reversion	RMSE of random walk	Ratio
$ - £	1	9.63	10.12	0.95
	2	14.97	16.72	0.89
	3	18.94	22.27	0.85
	4	20.48	25.74	0.79
	5	20.25	26.86	0.75
FFr - £	1	5.41	5.53	0.97
	2	8.48	8.93	0.95
	3	10.29	11.60	0.88
	4	11.56	14.98	0.77
	5	12.92	18.27	0.71

Source: Lothian and Taylor, “Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries,” J. of Political Economy, June 1996.

Excess Returns for Valuation Trade



- DB valuation strategy ranks G10 currencies by how under- or over-valued they are relative to the OECD's PPP values. We buy the 3 most undervalued currencies ands sell the 3 most overvalued. Annual excess returns since 1980 have been 4.1% with a Sharpe ratio of 0.54.

Source: Deutsche Bank, "Currencies: Value Investing, March 29, 2007.

Empirical Evidence Favoring Forecasting

- Very Short-Run
  - Technical trading models
  - Exchange rate responses to macro news
- Short- to Medium-Run
  - Technical trading models
  - Out of the money options
  - Composite forecasting
- Long-Run
  - Mean reversion in the real exchange rate
  - Reversion to long-run equilibrium in nominal rate

Summary + Conclusions

- Market efficiency is a “strongly maintained” null hypothesis
- Various empirical studies demonstrate that particular models perform well at gauging the direction or magnitude of currency movements over particular horizons.
- Technical trading rules have been profitable in many currencies
  - Could reflect greater risk or true inefficiency
- Risks and loose ends remain
  - Data mining? If so, results may be invalid in future.
- No universal model, but many useful empirical findings