



# **Exchange Rate Models Are Not as Bad as You Think**

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## I. Introduction

- Standard exchange rate models—as explicated in textbooks and developed in research papers—link movements in exchange rates to variables such as prices, interest rates and output
- Many empirical studies have found the links between exchange rates and such variables are weak, most prominently (but not solely) because a “random walk” model is often found to predict just about as well as any economic model. Other criticisms include supposed difficulty in explaining
  - exchange rate volatility
  - high persistence in real exchange rates
  - high correlation between nominal and real exchange rates
- This has led many researchers to conclude that the current generation of exchange rate models has failed empirically. See quotes in first paragraph of the paper.

- We acknowledge that exchange rate models leave much to be desired but argue that these models are not as bad as some economists think.
- We do not attempt to promote a single “best” model of exchange rates. Rather, we present various related bits of evidence.
- Throughout, we use the class of models in which exchange rates are a present value, and hence fluctuate primarily in response to movements in expectations.
- Among other arguments, we make the following series of loosely connected points:

- Under some plausible parameterizations, popular exchange rate models imply that nominal exchange rates are nearly a random walk (section II of this presentation)
- Recent work on “Taylor rule” models has developed a model that links exchange rate behavior to monetary policy rules for setting interest rates. Ongoing quantitative work (both regression based and calibrated) suggests that the models capture some salient features of exchange rates (section III of this presentation)
- New or updated empirical results find links between exchange rates and fundamentals consistent with the asset pricing view (also in section III of this presentation)

## II. Random walks and exchange rates

The “fit” of a random walk model:

- Classic reference is Meese and Rogoff (1983a)
- Our reading of the evidence: random walk model is not perfect, but in terms of forecasting ability, is difficult to beat
- One interpretation: “...the major weakness of international macroeconomics” (Bacchetta and van Wincoop (2006))

- A second interpretation: in an efficient market, the exchange rate will follow a random walk
- Problem: the classic “efficient market,” model of asset prices does not predict a random walk
- Instead, it states that there are no predictable profit opportunities for a risk-neutral investor to exploit
  - The implication for exchange rates: uncovered interest parity (UIP) should hold, and interest rate differentials should predict exchange rate changes

- Engel and West (2005) claim:

- Under some plausible parameterizations, popular exchange rate models imply that nominal exchange rates are nearly a random walk

- Illustrate with calibration of stochastic, discrete-time version Dornbusch (1976) (example 2 in part 1 of the paper)

- Model essentials:

- simple monetary model, with fundamentals = linear combination of relative money and relative outputs

- fundamentals following a random walk

- uncovered interest parity (i.e., no risk premium)

- only two parameters: interest semi-elasticity of money demand, and speed of price adjustment.

- Familiar result: Because there is price stickiness, movements in exchange rates are predictable. For example, a positive shock to home money supply leads to a jump (depreciation) in the exchange rate—a jump so big that the exchange rate “overshoots.” The exchange rate then predictably declines.

- But: a plausible calibration of the two parameters
  - half-life of price adjustment is 2.4 quarters,
  - interest rate semielasticity consistent with estimates of quarterly money demand

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implies .... that the  $R^2$  of a regression of the change in the exchange rate on past data is about .01.

- General analytical and simulation results in Engel and West (2005):

- basic conditions:

- (1)linear present value model,

- (2)fundamental that is I(1) or nearly so

- (3)discount factor near 1

- ⇒ near random walk

- “fundamental” = linear combination of home and foreign money supplies, outputs, price levels, productivity levels, interest rates ....

- allows various versions of monetary model (sticky price, flexible price, ....) and of Taylor rule model

- allows complex dynamics in the fundamentals, private agents forecasting from a multivariate information set and/or forecasting with data that are not available to the econometrician....

- caveat: formally, requires that risk premium be absent (informally, that the risk premium not be particularly volatile)

- Under the conditions of the previous page, we should not be surprised to find that exchange rate changes seem to be disconnected from previous movements in fundamentals such as relative money supplies, relative outputs or relative inflation rates

- This result is quantitative, and is consistent with the qualitative implication that there are predictable movements in exchange rates

### III. Empirical evidence

- Various bits of evidence indicate that a present value model captures important features of exchange rate behavior

- Volatility: variability of exchange rates is broadly consistent with volatility of fundamentals (section 3 of the paper)

- high volatility in exchange rates may reflect high variability in present values, even if fundamental variables themselves are not highly variable

- Taylor rule models

- “Taylor rule” studies tie exchange rates to interest rate rules

- Clarida and Waldman (2007) and related papers (section 4 of the paper)

- Use of survey data in Taylor rule model leads to reasonable coefficients in equation relating real exchange rates to fundamentals (section 4 of paper)

- Engel and West (2006) and Mark (2007): such models track the broad movements in DM/U.S. \$ real exchange rate, rationalizing high persistence in real exchange rates and high correlation between nominal and real exchange rates

- Out of sample tests of predictability, using bivariate and panel data, structured in such a way as to possibly capture the effects of a risk premium, find some modest predictability of exchange rate changes

## IV. Conclusion

- Reasonable calibrations of some exchange rate models imply that exchange rates should follow an approximate random walk
- Various bits of evidence indicate that exchange rates are tied to fundamentals in ways broadly consistent with present value models