Discussion of Anna Naszodi's paper:

The Asset Pricing Model of Exchange Rate and its Test on Survey Data

Discussant:

Genaro Sucarrat*

*Department of Economics
Universidad Carlos III de Madrid

http://www.eco.uc3m.es/sucarrat/index.html

Warsawa, 4 November 2009

- Objective of paper: To test the asset price model of exchange rates using survey data

- Essence of asset price approach: The price of a currency (the exchange rate) is a function of its expected change

- Test strategy used: Compare the asset price (AP) model with the random walk ("no change") and with a linear model of the forecast horison ("trend model") in two ways:

1. Section 3.2: Which model fits best to 3 months ahead survey forecast data? (AP and trend models are estimated using 12 and 24 months ahead forecasts)

2. Section 3.3: Which model predicts exchange rates best 3, 12 and 24 months ahead? (AP and trend models are estimated recursively)

Outline:

- Main comment 1: On section 3.2 (Which model fits the survey data best?)

- Main comment 2: On section 3.3 (Which model forecasts exchange rates best?)

- Main comment 3: An alternative approach to testing the asset pricing model

- Other comments

- Minor comments

Main comment 1:

- In terms of MAEs and RMSEs, table 1 suggests the AP forecasts are always closer to the 3 months ahead survey forecasts

→ But is this also the case for the 12 and 24 months ahead forecasts? For example, does the random walk fit better at 12 and/or 24 horisons than the AP? It seems to me that it is straightforward to implement comparisons also at the 12 and 24 months horisons

- According to the tests in table 1 the AP model is *significantly* closer to the survey data than the random walk. But is the test framework appropriate?

- $g_t = g_t^A - g_t^B$ is the difference in loss at t between model A and B, where $g_t^{(\cdot)}$ is equal to $(\tilde{x}_{t,t+.25} - \hat{x}_{t,t+.25}^{(\cdot)})^2$ in the RMSE case

Main comment 1 (cont.):

- $H_0 : E(g_t) = 0$ (equal fit)
- $H_1 : E(g_t) \neq 0$ (the fit of A and B differ)
- Test statistic:

$$\frac{\sum_t g_t}{\sqrt{\sum_t (g_t - \overline{g})^2}} \sim t(1)$$

where $\overline{g}$ is the sample average of $\{g_t\}$

- Where does the test come from? What is its motivation? Why distributed (asymptotically?) as $t(1)$ rather than, say, $N(0, 1)$?

Main comment 1 (cont.):

- At some point in section 3.2 the work of Clark and West (2006): " Using out-of-sample mean squared prediction errors to test the martingale difference hypothesis", is cited, but the assumptions of their test are not satisfied. Alternatively, their test could maybe (at least approximately?) be valid if:

  $\rightarrow g_t^A = (\Delta\tilde{x}_{t,t+.25} - \Delta\hat{x}^A_{t,t+.25})^2$, etc.

  $\rightarrow \{\Delta\tilde{x}_{t,t+.25}\}$ is a zero-mean martingale difference sequence (stationarity, no trend)

  $\rightarrow$ Loss function is squared error (Clark and West's test is not formulated in terms of absolute errors)

Main comment 1 (cont.):

• Since the forecasts are of the *level* s_t of the exchange rate (rather than of the difference Δs_t), it seems likely that the $\{g_t\}$ are strongly autocorrelated

→ The finite sample properties of the test statistic might be very poor. Simulate!

• From section 3.2 one gets the impression that the test of equal fit is two-sided. But since the objective is to test whether AP fits *better*, would it not be more appropriate to do a one-sided test? That is, $H_1 : E(g_t^A - g_t^B) > 0$, where A is the random walk (say) and B is the AP

Main comment 2:

- Where does the test statistic come from? What is its motivation? Why $t(1)$ instead of $N(0,1)$? At some point West (2006): "Forecast Evaluation" is cited, but this is a survey in a handbook so it is not clear which of the tests one has in mind

- Tables 2-7: The "t-tests", which I interpret to mean test-statistics (asymptotically) distributed as $t(1)$, are all in the interval (-5,5), and some of them (identified with an "*") are significant at 10%. But the associated critical values $\alpha_{0.05}$ and $\alpha_{0.95}$ for a $t(1)$ variable are ± 6.31. Error? Typo? Lack of clarity in exposition?

Main comment 2 (cont.):

- Interpretation of tables 2 to 7 on p. 13: "The remarkable result is that the asset pricing model can beat the random walk for some pairs of exchange rates and forecast horizons". By contrast, I do not think tables 2 to 7 suggest the AP is significantly better than the random walk:

1. Out of 72 tests (66 tests if we exclude the aggregate tests), only 3 times does AP generate forecasts that are *significantly* better than the random walk at 5% or lower

2. By contrast, out of 72 tests the random walk is significantly better than AP 14 times at 5% or lower

3. Out of 72 tests the linear model is significantly better than the random walk 11 times at 5% or lower

Main comment 2 (cont.):

4. Out of 72 tests the survey forecasts perform significantly better than the random walk only once

- With these results in mind, I am surprised by the conclusion that, when AP beats the random walk, it is due to its better fit with survey-data. It is true that the survey data beat the random walk in the three instances where the AP model significantly outperforms the random walk. But so does the linear model. Is beating the random walk simply due to the random walk occasionally doing bad?

Main comment 3: Alternative framework?

- "Axiom" of empirical econometrics:

$$\Delta s_{t+1} = \underbrace{E_t(\Delta s_{t+1})}_{\text{Explanation}} + \underbrace{\epsilon_{t+1}}_{\substack{\text{Explanation}\\ \text{error}}}$$

- AP: $E_t(\Delta s_{t+1}) = \frac{1}{c}(s_t - v_t)$

- General model that nests the AP, the random walk, the linear model and other models/hypotheses: an error-correction model

$$\begin{aligned}
\Delta s_{t+1} &= \beta_0 + \beta_1 \Delta s_t + \beta_2 \Delta \tilde{x}_{t+1} + \beta_3 [s_t - v_t(\tilde{x}_t, \ldots)] + \epsilon_{t+1}, \\
\epsilon_{t+1} &= \sigma_{t+1} z_{t+1}, \quad z_{t+1} \sim IID(0,1), \\
\sigma^2_{t+1} &= h(\text{ARCH}, \text{option prices}, \ldots)
\end{aligned}$$

Other comments:

- What is the source and nature of the exchange rate data series $\{S_t\}$?

$\rightarrow$ Exchange rate data are often period averages, while professional forecasters typically give *point* forecast

$\rightarrow$ There might be an incompatibility issue between your exchange rate data series and the Consensus Economics data

Other comments (cont.):

Linear model: $E(s_T|\mathcal{I}_t^{LM}) = s_t + (T - t)\mu$

- The forecasts of the linear model are $\hat{x}_{t+.25Y} = s_t + .25Y\hat{\mu}$ (p. 9)

- But what is the value of $\hat{\mu}$? Is it so close to zero that the linear model's forecasts for (most?) practical purposes equal the forecasts of the random walk?

- Related: We have that $(T - t) = .25Y$. But what is the value of ".25Y"? 0.25? As it is written, $.25Y$ could be interpreted as $0.25 \times$ *year*, say, 0.25×1999, etc., or 0.25×1, etc. Now, this would induce an exponentially increasing or decreasing trend in the forecasts

Minor comments:

- Continuous vs. discrete time 1. Footnote 5 on p. 5: Irregular data-sampling is cited as a motivation for the continuous time representation in section 2. But it is not clear from the description of the data that irregular sampling necessitates a continuous time formulation. Is this because the data are not explained well enough?

- Continuous vs. discrete time 2. Appendix A on p. 16: "We demonstrate that the two models [the continuous time and discrete time] versions are identical". This is incorrect from a reduction theory point of view, see Sucarrat (2009b, 2009a, section 4.5). A discrete time model can be compatible (derivable) from more than one continuous time structure. So the assumption that the continuous and discrete time versions are identical is a (potentially) very restrictive assumption on the discrete time model

Minor comments (cont.):

- The title of subsection 3.2 is not very indicative of its content, I think. Suggestion: Change to, say, "Which model fits the survey data best?"
- Section 3.3: At which point t is the recursive estimation initiated?
- Footnote 7 on p. 7: The reference Bartolini and Giorgianni (2001) is missing from the bibliography list

Minor comments (cont.):

P. 7: "Most of the empirical studies in the exchange rate literature avoid to use survey data". Here are some references that might be of interest (some of these make use of data from Consensus Economics):

- R. MacDonald and I. Marsh (1999): Exchange Rate Modelling, Kluwer Academic Publishers
- R. MacDonald and I. Marsh (1997): "On Fundamentals and Exchange Rates: A Casselian Perspective", *Review of Economics and Statistics*, 79
- P. Hallwood, R. MacDonald and I. Marsh (1997): "Crash! Expectational Aspects of the Departures of the United Kingdom and the United States From the Inter-war Gold Standard", *Explorations in Economic History*, 34
- R. MacDonald and I. Marsh (1996): "Foreign Exchange Forecasters are Heterogeneous: Confirmation and Consequences", *Journal of International Money and Finance*, 15
- I. Marsh and D. Power (1996): "A Note on the Performance of Exchange Rate Forecasters in a Portfolio Framework", *Journal of Banking and Finance* 20
- R. MacDonald and I. Marsh (1996): "Forecaster Heterogeneity: An Investigation of the Expectations of Foreign Exchange Forecasters", *Economie et Prévision* 125
- R. MacDonald and I. Marsh (1994): "Combining Exchange Rate Forecasts: What is the Optimal Consensus Measure?", *Journal of Forecasting* 13. Reprinted in Financial Forecasting Volume II: Interest Rates, Exchange Rates and Volatility, Eds R. Batchelor and P. Dua, Edward Elgar, 2003.

References:

Clark, T. E. and K. D. West (2006). Using out-of-sample mean squared prediction errors to test the martingale difference hypothesis. *Journal of Econometrics 135*, 155–186.

Sucarrat, G. (2009a). Econometric Reduction Theory and Philosophy. Forthcoming in the *Journal of Economic Methodology*. Working paper version: UC3M Working Paper 09-10 in the Economic Series. Available via http://hdl.handle.net/10016/3773.

Sucarrat, G. (2009b). Forecast Evaluation of Explanatory Models of Financial Variability. *Economics – The Open-Access, Open-Assessment E-Journal 3*. Available via: http://www.economics-ejournal.org/economics/journalarticles/2009-8.

West, K. D. (2006). Forecast evaluation. In G. Elliott, C. W. Granger, and A. Timmermann (Eds.), *Handbook of Economic Forecasting, Volume 1*. Amsterdam: Elsevier.