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Structural models of exchange rate determination

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Abstract

This study compares the forecasting accuracy of state space techniques based on the monetary models of exchange rate with univariate and random walk models for four countries. It is found that these structural models outperform ARIMA and random walk models for all four countries. A state space vector that contains variables based on the monetary model easily outperforms random walk as well as ARIMA models for France, Germany, UK, and Japan during the sample period of this study. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

It is now recognized that exchange rates are difficult to track and exchange rate models are characterized by parameter instability and dismal forecast performance. Exchange rate models developed over the last two decades proved unreliable and unstable when presented with different data sets compared to naive models such as

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a random walk. For example, Meese and Rogoff (1983) show that a simple random walk forecasts as well as linear exchange rate models. It has also become increasingly apparent that our understanding of exactly what factors affect exchange rates are limited.

Recent research has focused on the importance of non-linearities in exchange rates. The univariate distribution of exchange rate changes is known to be leptokurtic (see, for example, Westerfield, 1977; Hsieh, 1988). Researchers have also shown the existence of conditional heteroskedasticity in the residuals of both time-series and structural models of spot exchange rates[2]. The existence of residual conditional heteroskedasticity or leptokurtosis in exchange rates may not improve our ability to explain the levels of exchange rates. This point is demonstrated in a recent paper by Diebold and Nason (1990).

Multivariate models allow for the analysis of related time series. In such analysis, the task is twofold: (1) identifying the related or explanatory variables that would shed some light on the behavior of the variables of interest; and (2) selecting a suitable multivariate statistical procedure. Sarantis and Stewart (1995) argue that exchange rate modeling should begin with an investigation of equilibrium relationships.

One of the very few papers that attempts to test structural multivariate models of exchange rates with a non-linear technique is Schinasi and Swamy (1987). They show that non-linear random coefficient techniques sometimes lead to improved forecasting ability of exchange rate models. They show that when coefficients of the monetary model are allowed to change, the model can outperform forecasts of a random walk model. Sarantis and Stewart (1995) compare the out-of-sample forecasting accuracy of structural, BVAR, and VAR models and conclude that these structural models outperform other models in medium-term forecasting accuracy.

Wolff (1987) suggests the use of a state space model with the Kalman filtering technique to study exchange rate behavior. He argues that the advantage of this signal extraction approach is that we can empirically characterize the temporal behavior of exchange rates using only data on spot and forward exchange rates. Yin-Wong (1993) employs a state space model, which allows for the covariation of risk premiums and unexpected rates of depreciation to study exchange rate risk premiums.

MacDonald and Taylor (1994) use a multivariate cointegration technique to test for the existence of long-run relationships underpinning the monetary model. They find evidence of cointegration and report that their error correction model outperforms the random walk model. MacDonald and Marsh (1997) in a recent paper demonstrate that a purchasing-power-parity (PPP) based model can outperform the random walk and the vast majority of professional exchange rate forecasts over horizons as short as 3 months.

[2] See, for example, Cumby and Obstfeld (1984), Domowitz and Hakkio (1985), Hsieh (1989), and Engle et al. (1990).