

THE PREDICTABILITY OF EXCHANGE RATES BY PRICE-DIVIDEND RATIOS  
USING MONTE CARLO SIMULATION

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## Abstract

This paper focus on whether exchange rates can be predicted by price-dividend ratios in a two-country two-good economy based on models from Colacito and Croce (2011). In this setting, consumption is more driven by short-run shocks, while exchange rates and stochastic discount factor (SDF) are more responsive to long-run shocks. Since long-run component also drives price-dividend ratios in financial markets, the exchange rates should be forecasted by the price-dividend ratios differential in two countries.

Methodology used is Monte Carlo simulation, which simulates short-run and long-run shocks first, and then obtains exchange rate growth and cross-country price-dividend ratios differential in monthly frequency. Total 15 cases are considered, with sample size of 40, 80, 120, 160, and 200 years, as well as correlation of long-run shocks of 1, 0.95 and 0.90. Thereafter, OLS regression is conducted after the annual aggregation of data, and it is executed 1,000 times with resampling. Results with statistics including goodness of fit and significance of slope coefficients indicate that given parameter values, it would be impossible to detect predictability in sample sizes considered. However, a lower correlation of long-run shocks presents a stronger predictability with the same sample size. As the long-run shocks correlation parameter ranges from 0 to 0.90, the slope coefficient can be statistically significant at 10% level except the case where a sample size is 40 years. Only with a sample size of 200 years can it be significant at 1% level, though the correlation of long-run shocks is as small as 0.01.

## 1. Introduction

The objective of this paper is to test whether exchange rate can be predicted by price-dividend ratios or not. In literature, the exchange rate is difficult to forecast using economic models since Meese and Rogoff (1983a, 1983b, 1988). Commonly used model is random walk, which can forecast exchange rate better than any other economic models. However, recent literature found that exchange rate could be predicted using fundamental models. These fundamentals include macroeconomic (Engel and West 2005, 2006; Rogoff and Stavrakeva 2008; Molodtsova and Papell 2009; Chinn 2008; Giacomini and Rossi 2010; Molodtsova et al. 2011; Rossi and Inoue 2012) and financial indicators (Chen and Rogoff 2003; Gourinchas and Rey 2007; Chen et al. 2010; Ferraro et al. 2011; Della Corte et al. 2012).

Colacito and Croce (2011) construct an equilibrium model to provide explanations for exchange rate movements. In this model, the real exchange rates depend on the relative consumption values in two economies and news about long-run growth prospects. To be more precise, the exchange rate growth reflects the difference between cross-country stochastic discount factors (SDF). Under the assumption that a representative consumer has Epstein and Zin (1989) recursive preferences, the marginal utility of today is highly affected by the long-run news about future consumption. Furthermore, the long-run news drive price-dividend ratios as well. Since both SDF and price-dividend ratio are driven by long-run shocks, the exchange rate fluctuations might be predicted.

Based on this conjecture, this paper utilizes the models proposed by Colacito and Croce

(2011) and investigates the predictability power of price-dividend ratio. The structure of the paper is constructed as follows. First, a brief literature review will be conducted on the subject of forecasting exchange rates. Different fundamentals and methods will be reviewed accordingly. Second, I formulate the theoretical models. Third, simulation strategy is identified and processed. The method used is Monte Carlo simulation with calibrated parameters in monthly frequency. Followed are the simulation results and analysis. Finally, the conclusion drawn is that exchange rates cannot be well predicted by price-dividend ratio in this equilibrium model given parameter values adopted in the literature.

## 2. Literature Review

This section provides a short literature review on predictors used to forecast exchange rates. There are some traditional predictors, like interest rate and price. Fisher (1896) proposed uncovered interest rate parity (UIP) theory, which states that cross-country nominal interest rates differential equals the relative values of foreign exchange rates in the same period. The UIP equation is the following:

$$E_t(s_{t+h} - s_t) = \alpha + \beta(i_{t+h} - i_{t+h}^*), \quad (1)$$

where  $s_t \equiv \ln(S_t)$  and  $S_t$  is the bilateral exchange rate,  $i_{t+h}$  is interest rate paid between time  $t$  and  $t + h$ ,  $i_{t+h}^*$  is the foreign interest rate paid,  $\alpha = 0$ ,  $\beta = 1$ ,  $t$  and  $h$  are time horizon.

Meese and Rogoff (1988) forecasted exchange rates using both UIP and random walk.