

Using Machine Learning to Set Exchange Rates for Medium Term Contracts

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1. INTRODUCTION

1.1 Problem Definition

1.2 Related Work

Research on equilibrium in foreign exchange markets is a well developed component of classical economic theory. Classical models rest on two fundamental ideas. The first is that foreign exchange markets achieve equilibrium when the rate of return on deposits is the same across all currencies. The idea that investors will be indifferent between bank deposits denominated in different currencies is known as interest rate parity. The second is that the price of goods will be the same when valued in different currencies. The notion that a basket of goods should cost the same in all currencies is known as purchasing power parity.

Both of these concepts rely on the same basic premise, which is that price differentials create arbitrage opportunities. Interest rate and purchasing power parity hold that price differentials are self-correcting because, as investors move to take advantage of arbitrage opportunities, they push the market back toward equilibrium. To demonstrate this idea, suppose that a laptop costs \$500 in the United States and the Euro equivalent of \$550 in Germany. Someone in Germany could take advantage of this fact by buying cheap laptops in the US and selling them in Germany. This would create more demand for dollars, which are required to buy the laptops in the US, and push up US price levels. This trend would continue until price levels are high enough that laptops cost the same in the US as in Germany. When laptop prices are the same in both countries, the market is in equilibrium since there is no longer an opportunity for arbitrage.

The following equations summarize the relationship between exchange rates and interest rates under interest rate parity and the relationship between exchange rates and price levels under purchasing power parity, all else held equal. In these equations, e_t represents the exchange rate at time t in terms of the foreign currency, i is the real interest rate and

π is the inflation rate.

$$e_{t+1} = e_t \left(\frac{1 + i_d}{1 + i_f} \right) \quad (1)$$

$$\frac{e_{t+1} - e_t}{e_t} = \frac{1 + \pi_d}{1 + \pi_f} - 1 \quad (2)$$

Obstfeld and Taylor show that arbitrage opportunities between foreign and domestic assets are near zero under floating currency regimes, which suggests that exchange rates behave as predicted by interest rate parity. Likewise, Frankel and Rose provide evidence that exchange rates converge to levels predicted by purchasing power parity in the long run. The relevant time-frame for the *long run* in this context is about four years. Under shorter time horizons, purchasing power parity performs considerably less well. Likewise, difficulty in predicting the relative performance of financial assets in different countries makes it difficult to use interest rate parity to predict exchange rates. In fact, Meese and Rogoff famously demonstrated that a random walk outperforms structural models for the exchange rate over a one to twelve month window. The dismal ability of standard economic models to predict exchange rates over the medium runs calls for a different approach.

[overview of ML literature on exchange rates here ...]

2. DATA

3. RESULTS

4. CONCLUSION

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