

The bias of tests for a risk premium in forward exchange rates

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Abstract

The pure expectations theory of unbiased forward exchange rates predicts that the slope coefficient in a regression of the change in the spot rate on the difference between the current forward and spot rates should equal unity. In the recent empirical work by Fama, the estimates of this coefficient turn out to be negative in all regressions for nine major industrialized nations. This paper demonstrates that under the expectations theory, the sampling distribution of the regression estimator of this coefficient is upward-biased relative to unity and strongly skewed to the right. The likelihood of negative values is essentially zero. Thus, the estimator is biased in a direction opposite to what is observed. Since the observed estimates lie far out in the thin left-hand tail of the estimator's sampling distribution, the evidence against the hypothesis of unbiased forward rates is much stronger than previously believed. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

In a recent paper, Fama (1984) reports the evidence of the relationship between spot and forward exchange rates that is generally discrediting towards the expectations theory of unbiased forward rates. In particular, Fama finds that the difference between the current forward and spot rates is an upward-biased estimate of the

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subsequent change in the spot rate. Fama's evidence suggests that the bias in the forward rate is such that when the forward rate exceeds the spot rate, then the spot rate tends to decline on the average, whereas the expectations theory predicts that the spot rate will increase on the average in this situation. The empirical finding holds true for the exchange rates (relative to the US dollar) of a large group of major industrialized nations. Fama interprets the evidence as being generally favorable towards the presence of a time-varying risk premium in forward rates.

The purpose of this paper is to examine the small sample properties of the estimator used by Fama and other workers in related papers (Bilson, 1981; Frankel, 1982; Levich, 1982). In Section 3 below, it is shown that the sampling distribution of the key regression coefficient used in these studies is closely related to the sampling distribution of the estimate of the autoregressive coefficient for an AR(1) model with the root near unity. As is well known in the time series literature, the latter sampling distribution displays several unusual features that are not accounted for in the conventional asymptotic theory and have important implications for statistical inference in finite samples. The sampling distribution of the regression coefficient also can be expected to display these unusual features, and this is verified in the Monte Carlo sampling experiments. Interestingly though, the small sample bias of the regression coefficient is in a direction opposite to what is actually observed. That is, the results below suggest that if the expectations hypothesis was true, then one would expect to find the reverse of what Fama found, i.e., one would expect to find that the forward–spot differential appears to underestimate, not overestimate, the subsequent change in the spot rate. The evidence presented here on the small sample properties of the estimator thus suggests that the case against the expectations hypothesis is much stronger than Fama's results alone indicate.

The fact that autoregressive roots at or near unity may be important for empirical modeling exchange rates has also been noted by Meese and Singleton (1982). These authors find that for three exchange rates (Switzerland, Canada and Germany), there is not enough evidence to reject the null hypothesis of one unit root in AR(2) models for the logs of the spot and forward rates. This paper extends and elaborates upon their work by presenting explicit evidence on the small sample properties of an important test for no-risk premium when the autoregression for the spot rate has a root near unity.

2. Evidence on the expectations theory

Let s_t and f_t denote the logarithms of the spot and one-period forward exchange rates, respectively. Fama points out that the forward rate f_t can be thought of as comprised of two terms, one of which represents the forecast of the spot rate embodied in the forward rate and the other represents a possibly

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