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A multivariate GARCH in mean approach to testing uncovered interest parity: Evidence from Asia-Pacific foreign exchange markets

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Abstract

The existence of time-varying risk premia in deviations from uncovered interest parity (UIP) is investigated based on a conditional capital asset pricing model (CAPM) using data from four Asia-Pacific foreign exchange markets. A parsimonious multivariate generalized autoregressive conditional heteroskedasticity in mean (GARCH-M) parameterization is employed to model the conditional covariance matrix of excess returns. The empirical results indicate that when each currency is estimated separately with an univariate GARCH-M parameterization, no evidence of time-varying risk premia is found except Malaysian ringgit. However, when all currencies are estimated simultaneously with the multivariate GARCH-M parameterization, strong evidence of time-varying risk premia is detected. As a result, the evidence supports the idea that deviations from UIP are due to a risk premium and not to irrationality among market participants. In addition, the empirical evidence found in this study points out that simply modeling the conditional second moments is not sufficient enough to explain the dynamics of the risk premia. A time-varying price of risk is still needed in addition to the conditional volatility. Finally, significant asymmetric world market volatility shocks are found in Asia-Pacific foreign exchange markets.

JEL Classifications: C32; F31; G12

Keywords: UIP; Time-varying risk premium; CAPM; Multivariate GARCH-M

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1. Introduction

The uncovered interest parity (UIP) hypothesis states that the domestic nominal interest rate equals the foreign nominal rate on a comparable asset plus the expected change in the exchange rate over the period to maturity of the asset. Under the standard assumption of rational expectations, and risk neutral agents, the ex post excess returns of holding foreign currency deposits just equal the market true expected excess returns plus a forecast error that is unpredictable *ex ante*. Given this joint assumption, tests of UIP are essentially tests of the efficiency of the forward market for exchange rates if covered interest parity (CIP) holds.[1] One important conclusion from this market efficiency study is that there exist predictable components in excess returns from holding foreign currency deposits.[2] This predictable excess return is one of the puzzles in international finance literature.[3] Although the hypothesis that forward exchange rates are unbiased predictor of future spot rates has usually been rejected, most researchers are still inconclusive as to whether the forward bias is due to market inefficiency (irrationality) or to the presence of a time varying risk premium.[4]

Since the zero risk premium is hardly compatible with the existing applied finance literature, this time-varying risk premium argument has led to an intensive search for proper specification of the risk premium in foreign exchange markets. Theoretical international finance models developed by Solnik (1974), Roll and Solnik (1977), Hodrick (1981), Adler and Dumas (1983), and Stulz (1981, 1984) consider the pricing of foreign currency deposits in much the same way as that of other financial assets. In these model, the nominal return from holding a foreign currency deposit in excess of domestic risk-free rate results from a risk premium that has to be paid to risk averse speculators for taking the risk of future changes in exchange rates. If this foreign exchange risk cannot be diversified when forming a well-diversified portfolio, then standard portfolio theory tells us that this risk is systematic and should be priced in an asset market in equilibrium. However, if the foreign exchange risk is completely diversifiable, it should not command a risk premium. As a result, if currency speculation involves systematic risk, speculative returns should be nonzero and are predictable. In this case, UIP will be violated even if rational expectations hold.

Most existing models of time-varying risk premia in foreign exchange markets do not have much empirical success. For example, Mark (1985), Cumby (1988), Kaminsky and Peruga (1990), Backus, Gregory and Telmer (1993) use the intertemporal asset pricing model (IAPM) to test the existence of a time-varying risk premium in the foreign exchange market. In this model the risk premium is due to consumption risk measured by the covariance between returns and the marginal utility of money. The results from these studies are disappointing because the observable ingredients in the risk premium models do not vary sufficiently to explain the high degree of variability in asset returns without implausibly large estimates of the coefficient of relative risk aversion.[5]

Instead of using the consumption-based IAPM, Mark (1988) uses a single-beta capital asset pricing model (CAPM) to price the forward foreign exchange contracts from the point of view of a U.S. investor. He specifies the betas as ARCH-like process and estimates the model jointly for four currencies using a generalized method of moments (GMM) procedure. His results show significant time variation for the betas and tests of the overidentifying restrictions are not rejected. However, as pointed out by Mark (1988), the GMM estimator