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Measuring the risk premium in uncovered interest parity using the component GARCH-M model

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ABSTRACT

The aim of this study is to analyze the potential risk premium inherent in the uncovered interest parity (UIP) condition. The component GARCH-in-mean model is used to measure the time-varying risk premium in UIP and separates the permanent and transitory risks. The results show that the risk premium is significant in most countries studied in this analysis. This suggests that risk is an important part of modeling exchange rates and needs to be considered in both empirical and theoretical models. In general, the results suggest that emerging countries work better in terms of UIP and the risk premium than developed countries.

1. Introduction

With the development of international financial markets, financial instruments have contributed to international capital market integration by increasing capital mobility between developed and emerging countries. Therefore asset parity has become a vital consideration for all international investors. Uncovered interest parity (UIP) is one of the most important theoretical relations used in analytical work in both international finance and macroeconomics. It is also a key assumption in many of the models of exchange rate determination.

UIP implies that the interest rate differential should be equal to the exchange rate change. However, in reality, low interest rate currencies tend to depreciate relative to high interest rate currencies. This is inconsistent with UIP and has been confirmed by an extensive literature for different countries and periods. Overall there has been no consensus on how to explain the failure of UIP. A number of explanations for the deviations from UIP include the failure of rational expectations, the time-varying risk premium and nonlinear behavior. The time-varying risk premium is one of the most frequently cited reasons leading to the failure of UIP (see Froot & Thaler, 1990; McCallum, 1994; Meredith & Chinn, 2004). Therefore, it is necessary to continue investigating whether the time-varying risk premium could affect the validation of UIP especially over the periods of the Asian financial crisis and the recent credit crisis.

The two contributions of this paper are as follows. First of all, following the financial and credit crises over the sample period considered in this study, there has been a rapid change in risk across the world. To account for this, the CGARCH-in-mean model incorporating asymmetric adjustment is used to reflect the substantial rapid change in risk and separates out the permanent and transitory risk in the UIP condition. It is a superior volatility model for exchange rates, as it can distinguish the permanent and

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transitory volatility components to describe volatility dynamics better than other GARCH models (Black & McMillan, 2004; Byrne & Davis, 2005; Christoffersen, Jacobs, & Wang, 2006; Guimarães & Karacadag, 2004; Guo & Neely, 2008; Pramor & Tamirisa, 2006; Simón & Amalia, 2011 and Wei, 2009). Separating permanent and transitory risk is important in assessing whether this uncertainty is driven by macroeconomic fundamentals or by market sentiments, which could affect the investment strategies. This is the first time that the CGARCH model has been used to measure the risk premium in UIP, which could partly explain the UIP puzzle. Secondly, both developed and emerging countries are considered for comparison. The majority of the literature on UIP concentrates on low inflation and floating exchange rate regime countries. However Flood and Rose (2002), Hausmann, Panizza, and Rigobon (2006), Huisman, Mahieu, and Mulder (2007) and Ichiue and Koyama (2011) demonstrate that countries which have high exchange rate and interest rate volatility work better regarding UIP than others. Comparing the different UIP results between developed and emerging countries could help us to understand the volatility effect for both sets of countries.

The main result of this study is that including the risk premium in UIP improves the precision of the estimation, but it is still hard to explain the failure of UIP even using a sophisticated measure of risk. This study finds a significant risk premium in most countries, suggesting that risk is an important part of modeling exchange rates and needs to be considered in both empirical and theoretical models. The transitory shifts in financial market sentiment tend to be less important determinants of risk than shocks to the underlying macroeconomic fundamentals. In general, emerging countries work better in terms of UIP than developed countries.

The remainder of this paper is organized as follows. Section 2 presents the theory of UIP and the previous literature related to the risk premium. The methodology is described in Section 3. Section 4 presents the data and the main empirical analysis in order to see whether UIP holds and Section 5 concludes and suggests further areas of study.

2. Uncovered interest parity and the risk premium

2.1. Uncovered interest parity

UIP suggests that the domestic currency is expected to depreciate when the domestic interest rate exceeds the foreign interest rate.[1] It is a non-arbitrage condition between investing in domestic currency denominated assets and foreign currency denominated assets, so it can be expressed as:

$$\left(1 + i_{t,k}\right) = \left(1 + i^{*}_{t,k}\right)\frac{E_t S_{t+k}}{S_t} \tag{1}$$

where $i_{t,k}$ represents the domestic interest rate at time t of maturity k, $i^{*}_{t,k}$ is the foreign interest rate, S denotes the exchange rate which is the domestic currency price of a unit of foreign currency and E_t is the expectations at time t. Taking natural logarithms of the above Eq. (1) and imposing the rational expectation and risk neutrality assumptions to get the following empirical equation for UIP:

$$\Delta s_{t+k} = s_{t+k} - s_t = \alpha + \beta\left(i_{t,k} - i^{*}_{t,k}\right) + \varepsilon_{t+k} \tag{2}$$

where Δs_{t+k} is the change in the log of the spot exchange rate over k periods and $(i_t - i^{*}_t)$ is the current k period home interest rate less the k period foreign interest rate. The null hypothesis for UIP is that $\alpha = 0, \beta = 1$. We also expect that the error term is Gaussian and stationary. However, most empirical evidence on developed economies suggests that exchange rate changes and interest rate differentials are negatively correlated, with high domestic interest rates predicting an appreciation. Froot and Thaler (1990) summarize the coefficient results from 75 published studies, most giving a negative β coefficient and those with positive coefficients having less than the hypothesized value of one, the average value of the coefficient is −0.88.

2.2. Risk premium

Most empirical tests of UIP are based on assumptions of rational expectations and risk neutrality, one obvious explanation for the UIP failure is the existence of a time-varying risk premium. The time-varying risk premium is a part of the OLS residuals and its correlation with the exchange rate change causes the estimated beta coefficient to be biased. If market participants are risk averse, then the forward rate will equal the expected spot exchange rate plus a risk premium (Chinn, 2006; Meredith & Chinn, 2004). The risk premium δ is written as:

$$f_t = E_t s_{t+1} + \delta_{t+1}. \tag{3}$$

If we assume that CIP holds ($f_t - s_t = i_t - i_t^{*}$), Eq. (3) could change to:

$$i_t - i^{*}_t = E_t s_{t+1} - s_t + \delta_{t+1}. \tag{4}$$

[1] As Holmes, Otero, and Panagiotidis (2011) note, the UIP literature and the literature on the international links between the term structure are closely related, so the analysis on these two topics share many common features.