



The precise form of uncovered interest parity: A heterogeneous panel application in ASEAN-5 countries

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ABSTRACT

A notable feature of the empirical studies on uncovered interest parity (UIP) is that almost all published papers rely on the approximate form of UIP using substantially the same database of developed economies. It can, therefore, not be ruled out that the refusal of UIP condition is simply the outcome of a misspecification of a commonly used model and an elaborate data snooping process. In order to overcome this specification problem, this paper uses the precise form of UIP and examines its empirical validity based on a sample of ASEAN-5 member countries. Using the heterogeneous panel cointegration tests, our empirical results indicate that the gross domestic return and the uncovered gross foreign return are cointegrated in the long run. The long-run cointegrating coefficients are then estimated using the fully modified OLS (FMOLS) and the dynamic OLS (DOLS) proposed by Pedroni. The estimated long-run coefficients suggest that UIP only holds for Singapore. These results indicate that the Singapore financial market is highly integrated with the US market. As for the other four countries, the precise UIP hypothesis is strongly rejected suggesting that the financial markets in these emerging economies have not fully liberalized and, therefore, limited the international financial market integration. By examining international finance market linkages between ASEAN-5 and the US economy, we provide some policy implications that can be used as guiding tools for financing and investment decisions in ASEAN-5.

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1. Introduction

Under the equilibrium condition of uncovered interest parity (hereafter UIP) hypothesis, the returns on an investment in a domestic financial asset should equate with the domestic currency value of the expected returns on an unhedged investment in a foreign financial asset. If this condition is violated, the UIP postulates that exchange rate movements are adjusted periodically with respect to the interest rate differentials to re-establish the UIP condition of the international financial market equilibrium. In the short run, a temporary disequilibrium in the global market may lead to enormous arbitrage opportunities. Likewise, without instantaneous adjustment a market is in short-run disequilibrium, implying arbitrage profits may be possible when traders attempt to exploit these market inefficiencies.

Numerous studies have been conducted on this doctrine, and have mainly focused on developed countries rather than developing countries.¹ This study will concentrate on five leading countries of the Association of Southeast Asian Nations (ASEAN-5); Indonesia, Malaysia, the Philippines, Singapore and Thailand. Most of the ASEAN

member countries have experienced a wave of financial liberalization during the 1980s along with deregulated financial system and strong economic performance, often called the “Asian miracle”. However, in recent years, the worldwide trend of economic integration has forced each ASEAN member country to enhance economic cooperation in order to strengthen its competitiveness and to sustain its rapid economic growth. This common economic setting in ASEAN provides an opportunity to investigate the level of financial integration amongst the ASEAN member countries, and with the US market.

In addition, empirical studies that examine both the developed countries and the developing countries in the context of the UIP hypothesis have yielded mixed results with considerable heterogeneity among the two groups of countries. For instance, studies by Bansal and Dahlquist (2000), Flood and Rose (2002), Frankel and Poonawala (2006) and Mehl and Capiello (2009) provide results for the developed economies and the emerging economies. The majority of findings suggest that the two groups of countries are heterogeneous relating to the UIP hypothesis. Thus, it is sensible to separate the developed economies and the emerging economies in testing the UIP hypothesis.² In light of the empirical literature already available

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¹ Studies of UIP hypothesis in developing countries include Candelon and Gil-Alana (2006), Goh et al. (2006) and Mehl and Capiello (2009).

² See Alper et al. (2009) for a comprehensive survey on the UIP hypothesis for the emerging markets.

for developed economies, it is the lack of empirical study for the ASEAN-5 member countries that motivates this study.

This study is mainly motivated by the recent empirical works on the UIP hypothesis that have broadly followed the conventional specification (i.e. the approximate UIP), which is usually written in the following approximate form of linear regression:

$$\Delta S_{t+1} = \alpha + \beta(i - i^*)_t + \varepsilon_t \quad (1)$$

where ΔS_{t+1} is the first difference of nominal exchange rate expressed in terms of domestic currency per unit of foreign currency, $(i - i^*)_t$ is the interest rate differentials between the domestic interest rate i and the foreign interest rate i^* . Testing of the approximate UIP hypothesis using this specification generally proceeds with a theoretical value of unity for the slope coefficient β in the above regression. However, [Froot and Thaler \(1990\)](#) report that the average value of β across 75 published studies is -0.88 . According to Froot and Thaler, 'a few are positive, but not one is equal to or greater than the null hypothesis of $\beta = 1$ ' (p. 182). Numerous other studies have also confirmed that the relationship between the nominal exchange rate changes and interest rate differentials (or forward premium) is negative rather than positive as expected from UIP. The study by [McCallum \(1994\)](#), for instance, reports estimated slope coefficients around -3 instead of $+1$. The evidence indicates not just that exchange rate movements fail to offset the interest rate differentials, but rather that these movements are large and in the opposite direction to that implied by UIP, suggesting that the approximate UIP is likely to be misspecified to a certain extent.

The conventional specification of UIP hypothesis has been tested extensively using various econometric techniques. For example, by using the time-series cointegration analysis, [Bhatti and Moosa \(1995\)](#) show evidence in line with the UIP hypothesis. [Alexius \(2001\)](#) examines the UIP hypothesis using data on long-term government bond yields in different maturities. Based on the instrumental variable techniques, she finds evidence consistent with the UIP hypothesis at long horizons. Using short-horizon and long-horizon regression analysis, [Chinn and Meredith \(2004\)](#) show that the results of long-horizon regressions are consistent with the UIP hypothesis. In line with Chinn and Meredith, [Mehl and Capiello \(2009\)](#) find that UIP performs well in predicting exchange rate movements at long horizons for mature economy currencies, but the results for emerging market currencies are far less supportive of UIP. According to their findings, the violation of UIP seems to be influenced by the political risk and the exchange risk premium in the emerging market currencies. [Beyaert et al. \(2007\)](#) developed formulas to test the UIP hypothesis using the Markov-switching VAR models and find some evidence consistent with the UIP. Beyaert et al. argue that as the economies are subject to regime shifts stemming from institutional, political and economic changes, these changes are responsible for the UIP puzzle. The empirical findings shown by [Sul \(1999\)](#) – GMM, GARCH and Kalman filter methods, [Cooray \(2003\)](#) – seemingly unrelated regressions (SUR) and spectral analysis, and [Han \(2004\)](#) – regression analysis, however, point to the rejection of UIP.

To our knowledge, only two empirical studies have attempted to examine the empirical validity of UIP using the precise form. [Sachsida et al. \(2001\)](#) find some evidence in favour of UIP hypothesis in Brazil for a period with floating exchange rate. Using the panel approach, [Carvalho et al. \(2004\)](#) do not reject the UIP hypothesis for the group consisting of Argentina, Chile, and Mexico with the sample covering the period of economic and financial stability in these countries. However, with the inclusion of Brazil in the group, the UIP hypothesis is strongly rejected for all the sub-periods suggesting the presence of peso problem for Brazil in the pre-floating period. Both papers focus on Latin American countries and neither takes into account the issue of heterogeneity across the countries.

A notable feature of the empirical studies on UIP is that almost all published papers rely on the approximate form. The approximate UIP is derived by ignoring the term $\Delta S_{t+1} \times i^*$ on the assumption that it is too small. This form of regression will lead to model misspecification if there are large changes in exchange rates and/or when the interest rates are too high. In terms of econometric methods, we do not consider the approximate UIP due to the fact that ΔS_{t+1} and $(i - i^*)_t$ in Eq. (1) are stationary in their levels,³ which renders spurious cointegration. This is because the first difference of the spot exchange rates and the interest rate differential are usually stationary and using these in standard OLS analysis may lead to biased estimates. Instead of using the approximate form, the precise UIP hypothesis is tested in this paper using the panel cointegration technique. As noted by [King \(1998\)](#), non-stationary variables only can be used in an OLS regression if they prove to be cointegrated. This problem can be circumvented using the panel cointegration technique, and to address the question of whether UIP holds as a long-run equilibrium relationship. The panel cointegration technique provides a more flexible and powerful alternative than the traditional time-series cointegration approaches because of the limited sample sizes and time spans typically available in financial economics. Besides, the use of the panel cointegration method developed by [Pedroni \(2004\)](#) allows us to test the cointegration relationship between the variables without imposing the homogeneity assumption on the long-run cointegrating vectors.

The objective of the current paper is to examine the empirical validity of the UIP hypothesis for five ASEAN countries. The sample range covers three decades, a period often characterized by increasing financial liberalization in these emerging markets. We examine the validity of the UIP hypothesis by testing it using the precise form in specifying the UIP equation. For this purpose, in [Section 2](#), we formally define a theoretical model yielding the UIP relationship and present an empirical model to be used in the proposed panel estimation. [Section 3](#) presents the sources of data and discusses the empirical findings. The conclusion is presented in [Section 4](#).

2. Model and econometric methodology

2.1. Theoretical model

The UIP hypothesis is typically justified through the joint assumptions of rational expectations, risk neutrality, free capital mobility and the absence of taxes on capital transfers ([Baillie and Bollerslev, 2000](#)). These assumptions imply that at international financial market equilibrium, abnormal arbitrage profits must equal to zero. In the context of efficient market hypothesis, the removal of regulations and capital controls on foreign exchange markets would further support the validity of UIP hypothesis. The foreign exchange markets become more information efficient and any arbitrage profits will be diminished. However, as a result of foreign exchange market inefficiencies, generating arbitrage profits is achievable if investors are able to forecast the exchange rate movements corresponding to the interest rate differentials.

The precise form of UIP relationship is a no-arbitrage condition which says that the returns in a domestic currency denominated asset must equate with returns in a foreign currency denominated asset. This relationship can be expressed as:

$$(1 + i_t) = \frac{S_{t+1}^e}{S_t} (1 + i_t^*) \quad (2)$$

where S_t is the domestic price of one unit of the foreign currency at time t , i_t is the yield on the domestic asset, and i_t^* is the corresponding

³ Our preliminarily panel unit root tests (not reported) show that the null hypothesis of non-stationarity cannot be rejected in levels, suggesting that the two series are $I(0)$.

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