Recursive co-integration analysis of foreign exchange market stability: An application for ASEAN countries

Mei-Se Chien*
Professor, Department of Finance, National Kaohsiung University of Applied Sciences,
415 Chien Kung Road, Kaohsiung, Taiwan
Tel.: 886-7-3814526 ext. 6353  Fax: 886-7-3814526
Email: cms@kuas.edu.tw

Te-Chung Hu
Department of Finance, National Kaohsiung University of Applied Sciences,
415 Chien Kung Road, Kaohsiung, Taiwan

Meng-Huei, Su
Graduate Student, Department of Finance, National Kaohsiung University of Applied Sciences
415 Chien Kung Road, Kaohsiung, Taiwan

Abstract

The aim of this paper is to study the dynamic market efficiency of foreign exchange markets in four ASEAN countries. Considering the importance of time-varying linkages in foreign exchange markets, this paper employs recursive cointegration to examine the dynamic evolution of foreign exchange market integration. The paper presents the following empirical results. First, according to the empirical results of Zivot and Andrew (1992) unit root tests, there are two main breakpoints for each country. Two financial crises, the 1997-1998 Asia financial crisis and the 2008-2009 global financial crisis, indeed caused the breakpoints of exchange rates in four ASEAN countries. Second, examining the results of recursive cointegration on the foreign exchange markets, Singapore’s spot and forward foreign exchange markets show earlier cointegration, beginning around 2000, than other countries’ foreign exchange markets. As to the other countries’ foreign exchange markets, the beginning times for cointegration to emerge in Thailand and Philippines are around 2006, while cointegration in Indonesia does not appear until 2008. Thirdly, applying the recursive coefficients to test the forward rate unbiased hypothesis demonstrates that Singapore’s foreign exchange market is efficient almost over the whole sample period, while Indonesia’s foreign exchange market shows the existence of efficiency after 2004. The examining results present that the foreign exchange markets of Thailand and the Philippines are inefficient.

Keywords: Foreign exchange market efficiency, Forward unbiasedness hypothesis, Recursive cointegration, ASEAN

*Corresponding author.
1. Introduction

There are many related papers in the literature that study different issues for the relationships between forward, futures, and spot prices. Whether or not foreign exchange markets are efficient is of great interest to researchers and market participants. Under the assumption of the risk neutral efficient market hypothesis, the forward rate should be an unbiased predictor of the future spot exchange rate. In other words, if exchange rate markets are efficient, then the current exchange rate fully reflects all available information of past exchange rates. In this case, investors can know the correct pricing of assets and there are no permanent opportunities for excess profit.

To confirm whether the forward rate is an unbiased predictor of the future spot rate, many studies apply cointegration analysis, but their empirical results are inconsistent. Some researchers in the literature report that the relationship between future spot returns and the forward discount rate is cointegrated, such as Crowder (1994), Rapp and Sharma (1999), Jeon and Lee (2002), Kenourgios et al. (2006), Goldman (2006), and Shmilovici et al. (2009), while others such as Chianga et al. (2010) and Kumar (2011) proclaim that it diverges from cointegration. Most of these papers unfortunately do not study any dynamic relationship by considering the time-varying aspect between spot and forward exchange rates. To capture the dynamic behaviors of exchange rates, Kutan and Zhou (2003) apply rolling cointegration tests to examine the dynamic relationship between spot and forward exchange rates, and the results confirm the existence of cointegration between the forward and spot rates for nearly all sub-sample periods. Kanas and Ioannidis (2012) employ recursive and rolling estimations to test the effects of some events, and the results show that the long-run correlation coefficients are significantly influenced by the UK’s general election and by the ERM sterling crisis.

The aim of this paper is to examine the foreign exchange market efficiency for ASEAN countries, as we try to fill the gap of little relative literature on this topic for these countries. Considering the importance of time variation in foreign exchange market linkages, we employ recursive cointegration to examine the dynamic relationships between spot and forward exchange rates in ASEAN countries. A study of ASEAN financial markets is interesting for the following reasons. First, these countries have executed financial reforms to improve their economic efficiency. For example, Singapore was the first to begin liberalizing its financial systems by abolishing exchange controls in the mid-1970s (Phylaktis, 1997). Second, ASEAN countries make up the fourth largest trading region in the world (Lim, 2011). Over the past two decades, the average economic growth of ASEAN counties is approximately 5%, with a strong growing trend even through two major financial crises (Petri et al., 2012). Thirdly, ASEAN countries have recently attracted international fund managers as an opportunity for portfolio diversification.

Based on this backdrop, this study analyzes the foreign exchange markets of four major ASEAN countries - Singapore, Indonesia, Philippines, and Thailand - to discuss their exchange rate movements over the past decade. The aim is to track the dynamic relationships of time-shifting periods and display the impacts of policy changes and currency crises during those periods. The remainder of the paper is structured as follows. Section 2 is the literature review. Section 3 introduces an overview of the background of foreign exchange markets. Section 4 presents and discusses the empirical results of the recursive cointegration analysis. Section 5 concludes the paper.

2. Literature Review

The original study about the theory of market efficiency can be traced back to Fama’s finding in 1970. Hereafter, there have been many various types of tests applied in the study of foreign exchange market efficiency. One of the more popular testing types of this efficiency is to discuss the relationship between spot and forward exchange rates. In an efficient foreign exchange market, the forward exchange rate should be an unbiased predictor of future spot exchange rate (Sarno, 2005), which is the so-called “unbiasedness hypothesis”.

...
Reviewing the relative papers of foreign exchange market efficiency, there are largely inconsistent results with both rejections and confirmations of the hypothesis. The initial empirical literature, using regression analysis, shows a ‘puzzle’ regarding the ability of the forward rate to predict the future spot rate, including Bilson (1981), Cumby and Obstfeld (1984), Fama (1984), and Froot and Frankel (1989). Since the late 1980s, the method of cointegration has also been used to test the relationship between spot and forward exchange rates for confirming market efficiency (Baillie and Bollerslev, 1989). Many studies, such as Crowder (1994), Rapp and Sharma (1999), and Jeon and Lee (2002), apply the Johansen (1991, 1995) cointegration test, with their results supporting an existing cointegrated relationship between spot and forward exchange rates, which is evidence for the efficiency of within-country currency markets. Some papers also apply the cointegration method to examine across-country market efficiency in which the spot exchange rate series of several currencies are tested for cointegration (Baillie and Bollerslev, 1989; Rapp and Sharma, 1999; Jeon and Lee, 2002; Aroskar et al., 2004).

Still other papers find that there is a divergence from cointegration of foreign exchange markets. For example, the results of Kenourgios et al. (2006) exhibit that the foreign exchange market is efficient in the long run, but the forward rate is a biased predictor of the future spot rate in the short run. Goldman (2006) indicates that the weak-form efficiency hypothesis for the St. Petersburg and London markets cannot be rejected. The empirical results of Chianga et al. (2010) show that some foreign exchange markets, including Japan, South Korea, and the Philippines, display weak-form efficiency, whereas the foreign exchange market of Taiwan is inefficient. Kumar (2011) also offers some evidence that the market efficiency hypothesis can be rejected for India’s foreign exchange market.

Most of the above papers unfortunately do not consider structural breaks of exogenous shocks or regime changes. It is important to check for structural breaks if the empirical period covers an unstable time of social and economic development (Chien, 2010). Examining the market efficiency hypothesis of the foreign exchange market under the arrival of the Euro, the empirical results of Kühl (2007), using the Johansen cointegration test and the Gregory-Hansen (1996, GH) cointegration test with a structural break, show that the foreign exchange market is broadly consistent with the market efficiency hypothesis. Considering the impacts of the Asian and global financial crises on foreign exchange market efficiency in Asia-Pacific countries, Ahmad et al. (2012) employ pre-determined breakpoints to separate the crisis period and the non-crisis period. Their results support that the foreign exchange markets are mostly efficient, and the Asian financial crisis, compared to the global financial crisis, caused more severe impacts on the foreign exchange markets in the Asia-Pacific region.

Ahmad et al. (2012) study exogenous shocks on the Asia-Pacific development of foreign exchange market efficiency, but their method of pre-determined breakpoints has been questioned by Hansen (1992) and Hansen and Johansen (1999). To improve the low power of a model with pre-determined breakpoints, Bai and Mollick (2010) use endogenous multiple structural breaks, as suggested by Zivot and Andrews (1992) and Bai and Perron (1998, 2003), to investigate the effect of the Asian crisis and the Turkish crisis on the forward discount bias in fourteen emerging countries. The results of Bai and Mollick (2010) support the finding of Ahmad et al. (2012) and show that the foreign exchange markets are mostly efficient except for the post-crisis period.

Some papers try to capture a dynamic relationship by considering the time-varying aspect between spot and forward exchange rates. Capturing the dynamic behaviors of the exchange rates by rolling 6-year sub-samples from January 1980 to June 1998, Kutan and Zhou (2003) apply rolling cointegration test to examine the dynamic relationship between the spot and forward exchange rates of Germany, Japan, and Switzerland with respect to the US dollar. The results confirm the existence of cointegration between the forward and spot rates for nearly all sub-sample periods.
Kanas and Ioannidis (2012) employ recursive and rolling estimations to test the effects of some events, including United Kingdom general elections, the European Exchange Rate Mechanism (ERM) sterling crisis, and the introduction of the Euro, on the relationship between spot and the forward rates. The results of the recursive estimations show that the long-run correlation coefficients are significantly influenced by the general elections and by the ERM sterling crisis. The rolling estimations of the long-run correlation coefficients are significant on April 1992 by predicting the election outcome and on September 1992. Moreover, the forward rate is an unbiased predictor under the influences of the major events.

For discussing the impact of the global financial crisis on the relationship between the future spot return and the forward discount rate, Zhao et al. (2013) also apply rolling cointegration to analyze China’s foreign exchange market. The results support the existence of a cointegration between the future spot return and the forward discount rate before March 2008 and over the period from February 2009 to June 2010, but there is no cointegration from March 2008 to February 2009. However, Zhao et al. (2013) indicate that “the cointegration relationship between the future spot return and the forward discount rate is time varying. This dynamic relationship may reflect divergence in the market expectations regarding the exchange rate of the Renminbi.”

This paper examines the foreign exchange market efficiency for ASEAN countries, as we try to fill the gap on few studies in the literature that test the forward rate unbiasedness hypothesis for these countries. Although Ahmad et al. (2012) investigate the relationships between the forward exchange rate and spot rate in emerging economies or Asia-Pacific countries, both angles employ the conventional cointegration technique, which has the problem of low power. Considering the importance of time variation in foreign exchange market linkages, recursive cointegration is applied in this paper to examine the dynamic relationships between spot and forward exchange rates in ASEAN countries. Our aim is to track the dynamic relationships of time-shifting periods and display the impacts of policy changes and currency crises.

3. Background of the foreign exchange markets

ASEAN was established on August 8, 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand (ASEAN-5). Five more countries joined the association by 1999: Brunei, Vietnam, Laos, Myanmar, and Cambodia. This paper examines the foreign exchange market efficiency for four ASEAN countries: Indonesia, the Philippines, Singapore, and Thailand. ASEAN is the fourth largest trading region in the world (Lim, 2011), with 625.1 million people in the region, and a combined gross domestic product of US$2,298.55 billion in 2013. Comparing the members of ASEAN, each country varies substantially in population, per capita income, and economic structure. Over the past two decades, the average economic growth of ASEAN’s countries was approximately 5%, showing a strong growing trend even through two major financial crises (Petri et al., 2012). The most distinguished is the extraordinary upswing of Indonesia, which is the biggest economy in ASEAN.

Figures 1(A) to 4(B) show the changes and trends in the spot and forward exchange rates of these four countries. The post-Asian financial crisis stage shaped a period of macroeconomic instability and a regime of greater volatility among the Asian currencies. Most ASEAN countries are no longer on the common path of financial development. In Thailand, there has been some progress in widening the range of financial liberalization, while more capital account restrictions are still maintained as compared to Singapore.

---

1Malaysia is excluded in our investigation, because it decided to reverse its liberalization policy by imposing capital controls and pegging the exchange with the US dollar (US$1 = RM3.8) during October 1998 to July 2005, because of the breakout of the Asian financial crisis in 1997.
the confidence of international financial markets in the short term, Indonesia has received IMF’s assistance of US$43 billion to stabilize the exchange rate through a combination of macroeconomic discipline, which results in the availability of sufficient foreign reserves and reforms towards good corporate governance and market transparency. However, the economic recovery and financial reforms in Indonesia are slower than other crisis-affected countries (Chan et al., 2005).

Figures 1(A) and 1(B) illustrate the changes and trends in the spot and forward exchange rates of Singapore. Since 1985 the Singapore dollar has floated under the monitor of the Monetary Authority of Singapore (MAS), and it has appreciated along with rapid economic development, high productivity growth, and a high savings rate. Singapore plunged into a short recession under the Asian financial crisis, but fortunately its economy recovered and continued to grow within one year. From 1997 to 2009, its exchange rate against the US dollar varied between 1.40 and 1.90. Generally, the foreign exchange rate market of Singapore is efficient and is less impacted by a financial crisis, because of its strong economy.

Thailand was the country that triggered the Asian financial crisis of 1997. The Thai baht, in Figures 2(A) and 2(B), dramatically depreciated due to massive speculative attacks in 1997, which caused Thailand’s authority to decide to replace the fixed rate of 25 baht to the US dollar by a managed floating exchange rate regime on June 30, 1997. The Thai baht devalued quickly and reached its lowest point of 53 to the US dollar in January 1998, losing more than half of its value. By 2001, Thailand’s economy had mostly recovered from the recession. From 2001 to 2010, the managed float of the Thai baht appreciated from around 46 to 29 against the US dollar. However, the Asian crisis in 1997 resulted in a managed floating exchange rate regime, and the exchange rate of the Thai baht is now determined by market forces. The Bank of Thailand (BOT) only intervenes to avoid excessive volatilities or to attain economic policy targets. To encourage outward direct investment, BOT started relaxing regulations in its foreign exchange market since 2010.

The Philippine peso, in Figures 3(A) and 3(B), dropped from 26 pesos per US dollar to 45 pesos between 1997 to mid-1999. The Philippines experienced rare occurrences of foreign exchange intervention that only were executed to prevent large fluctuations. The independent floating exchange rate system and monetary policy continued to be adopted even pre-crisis in 1997. The Philippines saw less capital flight and suffered fewer economic damages by the shock of the Asian crisis, because of less short-term foreign currency borrowings. The peso’s value declined to about 54 pesos to the US dollar, because of a scandal in the Philippine president’s administration in 2001. When the economy was growing by more than 7%, the peso appreciated 23% between 2005 and 2008. The peso reached its highest level, around 41, against the US dollar in 2012, because of increasing confidence by investors and improving economic conditions.

The Indonesian rupiah, in Figures 4(A) and 4(B), depreciated significantly from 2,200 rupiah against the US dollar to 15,000 over the period of the Asian financial crisis, which was caused by the impacts from the depreciation of Southeast Asian currencies and fundamental factors, including huge private and government offshore debts and greater deteriorated risk. Regardless of a decrease in interest rates, the stimulus policy failed to support confidence in the rupiah. In 1998, Bank Indonesia changed the exchange rate system and replaced it with a free-floating exchange rate regime. To lessen exchange rate volatility, Bank Indonesia contemporaneously restricted the free movement of currency between banks and governed all transactions on forward exchange sales to non-residents. By the end of 1999, the exchange rate became relatively stable, partially from strong demand for the rupiah related to fiscal year tax payments and loan disbursements from official creditors.
Figure 1(A). Spot rate of Singapore Dollar to US Dollar

Figure 1(B). Forward rate of Singapore Dollar to US Dollar

Figure 3(A). Spot rate of Thai Baht to US Dollar

Figure 3(B). Forward rate of Thai Baht to US Dollar
Reference


