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Random walk and efficiency tests in the Asia-Pacific foreign exchange markets: Evidence from the post-Asian currency crisis data

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ABSTRACT

This paper empirically tests the random walk and efficiency hypothesis for 12 Asia-Pacific foreign exchange markets. The hypothesis is tested using individual as well as panel unit root tests and two variance-ratio tests. The study covers the high (daily) and medium (weekly) frequency post-Asian crisis spot exchange rate data from January 1998 to July 2007. The inferential outcomes do not differ substantially between the unit root tests and the variance-ratio tests when using daily data but differ significantly when using weekly data. With the daily data, both types of unit root tests identify unit root components for all the series and two variance-ratio tests provide the evidence of martingale behavior for majority of the exchange rates tested. With the weekly data, panel unit root tests identify unit root component for the exchange rates and, the unit root tests on a single series basis identify unit root component for 10 foreign exchange markets. However, the variance-ratio tests reject the martingale null for the majority of the exchange rates when using weekly data.

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1. Introduction

The recent study¹ in the financial market efficiency indicates that different kinds of methodologies and data frequencies are used to explain the random walk behavior of the financial market. It is fair to say that economists have not yet reached a consensus about whether exchange rates are unpredictable (or FX markets are efficient). However, the inferences from the different methodologies and from the high or low frequency data should be distinguished with the policy implications conducive to the state of the development of concerned foreign exchange (or financial) markets. Otherwise, both the investors and the policy makers would be puzzled and misled. The distinction of the results across the methodologies and the data frequencies is important for several reasons. First, it reduces the ongoing debates between the finance practitioners and the academics with regard to the market efficiency; the former presume that the markets are inefficient and the latter believe that the markets are efficient. Second, even within the identically developed financial markets, the traders behave differently. For example, some traders behave rationally, primarily relying on the fundamental analysis and hence treated as 'rational arbitrageurs', while some traders do not behave rationally rather primarily relying on 'sentiments' and/or 'noises' and hence treated as 'less rational noise traders' (see Menkhoff, 1998). Third, the high frequency data are better estimates of the market efficiency of developed markets, where the volume of trading is very high, the foreign exchange markets are relatively developed, markets are very competitive and market players are better informed than the underdeveloped or small markets. This indicates that the low and medium frequency data are better estimates of the market efficiency of transitional and undeveloped/developing markets. Thus, unlike Lo and MacKinlay (1988), Liu and He (1991) and Wright (2000), who suggest to use the medium frequency (weekly) data to avoid the shortcomings with the high and low frequency data, we argue that the selection of the data for drawing conclusions on the market efficiency should be based on the type and development of the markets concerned. Los (1999), Lee et al. (2001), Jeon and Seo (2003), Lo and Lee (2006) and among others use the high frequency data to explain the foreign exchange market efficiency. We use both the high and medium frequency data so that the appropriate policies conducive to the capital market development of the respective countries can be alienated.

From the econometric point of view, the random walk implies both that a series has a unit root component and that the increments of a series are uncorrelated (or a series has a martingale property). If both properties are found to exist in a financial market, the financial series is said to follow a random walk. However, a series might have a unit root component but not a martingale property and vice versa. While the first property of the random walk is identified by the unit root tests, the uncorrelated increments are identified by the variance-ratio (VR) tests. These tests supplement each other in investigating the random walk behavior of the financial markets. Lo and MacKinlay (1988, 1989), Cecchetti and Lam (1994) and Gilmore and McManus (2003) argue that the variance-ratio test is more reliable than the traditional unit root tests.

The premise of the random walk and efficiency hypothesis is that if price formation in a foreign exchange market is random and the return from that market is not predictable, then we fail to reject the hypothesis of market efficiency.² In this (efficient) market it is impossible for an exchange trader to gain excess returns over time through speculation, because prices do reflect all relevant and available market information. Conversely, if the return from a financial market is predictable and in this sense non-random, then the markets are not efficient, which implies that the exchange traders can generate (abnormal) returns through speculation. There might be several reasons why the markets are not efficient. First, the prices in these markets do not quickly adjust to the new information (Fama, 1970; Melvin, 2004). Second, the prices in this market are not set at the equilibrium level due to distortions in the pricing of capital and the valuing of risk (Smith et al., 2002). Third, the emergence of a parallel/black market due to the existence of the exchange rate controls and resulting divergence between the equilibrium rate and the official rate (see Diamandis et al., 2007). Fourth, the exchange rate regime is also a major determinant of foreign exchange market efficiency. If the regulatory agencies do not

¹ Appendix A shows 16 papers as those dealing with RW in the foreign exchange markets.

² Economists have not yet reached a consensus about whether there is an explicit link between the random walk hypothesis and the market efficiency. For details, see LeRoy (1973), Lucas (1978) and Lo (2004).

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