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# Market efficiency of floating exchange rate systems: Some evidence from Pacific-Asian countries

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## ABSTRACT

This paper examines the random walk hypothesis (RWH) and the martingale difference hypothesis (MDH) for the Australian dollar and five Asian emerging currencies relative to three benchmark currencies. We use Wright's (2000) non-parametric procedure to test the RWH and Kuan and Lee's (2004) procedure to test the MDH. The results of Wright's tests and Kuan and Lee's test are adjusted for size distortion. The RWH is rejected for all currencies before and after the Asian crisis. The results of Kuan and Lee's test are consistent with the fact that the RWH is more stringent than the MDH. For the three testing periods, the MDH fails to reject the AUD. For all other currencies the MDH is rejected at least for one benchmark over two periods, indicating that the market efficiency in these markets have not significantly improved under the floating rate systems following the Asian financial crisis.

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## 1. Introduction

In the aftermath of the Asian currency crisis of 1997, many Asian emerging economies changed their exchange rate regimes from de facto pegs to floating systems. By most accounts, the exchange rate systems in these countries are still evolving within the broad framework of “managed” “free” or “independent float systems.”<sup>1</sup> The literature abounds with findings that nominal exchange rates generally follow a random walk and that most foreign exchange markets are at least weak-form efficient.<sup>2</sup>

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<sup>1</sup> Ee, Robinson and Lee (2004) allude that Singapore pursues a managed floating system. Ryoo (2001) and the Bank of Korea webpage show that Korea pursued a managed floating until April 2002. The country's exchange regime afterward is said to be “free” or “independent” floating. IMF (2006) shows the classification of “floating.”

<sup>2</sup> Belaire-Franch and Opong (2005) provide a good survey on testing the random walk hypothesis.

In a weak-form efficient market, risk-adjusted excess return is unattainable. This is because the series of returns of exchange rate  $s_t, s_{t-1}, s_{t-2}, \dots$  is a martingale. Thus, by definition, price history does not help improve the forecast of future returns from its current level or trend.

In contrast to martingales, which are not necessarily Markov processes, random walks are Markovian. Thus the assumption underlying the random walk hypothesis is stronger than that of the martingale hypothesis, in that in addition to being a martingale, the expected value of  $s_t$  in a random walk depends only on the latest return  $s_{t-1}$  as opposed to the whole history  $s_{t-1}, \dots, s_{t-n}$ , in the case of a martingale.

Testing the martingale and random walk hypotheses provides analysts with the benefits of the plausibility of stochastic economic models, which are of great interest to traders, academicians and, in particular, regulators at both national and multinational levels. Why? Both the martingale or the random walk property should preclude misalignments of foreign exchange rate that can be exploitable by “noise” traders or speculators, both of whom heavily rely on technical analyses of trends and attendant reverting patterns of price changes. In a weak-form efficient model, future movements of foreign exchange are unpredictable from known past prices or trends. In this model, currency traders and speculators cannot beat the market by “noise trading”, the well known trading technique which relies on technical analysis of trends, changes in market sentiment, advice of opinion leaders and statements of government officials. Yet, there are reports that such techniques are widely practiced in the interbank currency markets worldwide including East Asia, and that foreign exchange markets in many emerging economies are still inefficient.<sup>3</sup>

The purpose of our study is to investigate the weak-form market efficiency through random-walk and martingale behaviors of the Australian dollar and five Asian emerging market currencies – the Korean won, Malaysian ringgit, Singaporean dollar, Thai baht and Taiwanese dollar – before and after the Asian currency crisis of 1997.<sup>4</sup> All currencies are studied in terms of their nominal rates relative to three benchmark currencies – the U.S. dollar, Japanese yen and euro. These three currencies are used as the benchmarks because of their credibility and influence on the region's trading patterns, which has become increasingly tied to the Japanese yen, Euro and Australian dollar.<sup>5</sup> The Australian dollar is included, as it is fast becoming a major trading currency in the region (Bowman, 2005). The Chinese yuan and the Hong Kong dollar are excluded because the former is heavily controlled by the Chinese government while the latter pegged to the U.S. dollar under a currency board.

Previous studies of the RWH focus on the least restrictive (weakest) form known as the RW-type III, which assumes that asset returns are linearly independent. By contrast, the MDH for asset returns denies the presence of any linear or *non-linear* combinations of past asset returns that could improve their forecastability. If an asset return follows a martingale difference process, then the returns become purely non-predictable. Besides testing the RWH using Wright's non-parametric VR test, we also employ the procedure of Kuan and Lee (2004) to test whether the currency markets in our sample follow a martingale difference process. Thus, our methodology for testing the weak-form efficiency of foreign exchange markets goes beyond previous research which is generally confined to testing the RWH under restrictive assumptions.

A fresh evaluation of the market efficiency of Pacific-Asian currencies, especially in terms of the U.S. dollar, yen and euro, is timely for several reasons. First, Asian trade and investment are increasingly linked beyond the U.S. dollar to include Japan, Europe and Australia (Kearney & Muckley, 2008). Second, the Asian financial crisis has revived active policy discussions by government official and academia in the region to devise mechanisms under which monetary and exchange rate cooperation among Asian countries is enhanced. Examples are the “Chiangmai initiative” by the seven ASEAN countries plus China, Japan and Korea, and the feasibility of integrating Asian currency markets under an optimum currency area (see Eichengreen & Park, 2004 and Mishra & Sharma, 2010). Third, the massive rise in dollar-denominated assets in the Asian countries' reserve accounts caused downward pressure on the U.S. dollar relative to the euro and frequent government interventions in the exchange markets. As a result, a realignment of currencies has taken place, with Asian foreign exchanges gaining strength against the dollar in response to

<sup>3</sup> See Neely, Weller, and Ulrich (2009) for developed country currencies, and Lee, Gleason, and Mathur (2001), Ahn et al. (2002) and Ee, Robinson and Lee (2004) for emerging country currencies.

<sup>4</sup> The Malaysian ringgit has been pegged to the U. S. dollar since the Asian financial crisis. See Fig. 2.

<sup>5</sup> See Bowman (2005). Kearney and Muckley (2008) suggest that more than 40% appreciation of the U. S. dollar against the yen between 1995 and 1998 precipitated the Asian financial crisis. Kang and Wang (2002) report that with a 10% increase in the yen/dollar rate, Korea's export prices decline an average of 2.7%.

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