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Testing for cointegration with threshold effect between stock prices and exchange rates in Japan and Taiwan

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ABSTRACT

This paper empirically investigates the exchange rate effects of the New Taiwan dollar against the Japanese Yen (NTD/JPY) on stock prices in Japan and Taiwan from January 1991 to Mach 2008. Our study employs the newly threshold error-correction model (TECM) elaborated by Enders and Granger [Enders, W., Granger, C.W.F., 1998. Unit-root tests and asymmetric adjustment with an example using the term structure of interest rates. Journal of Business Economics & Statistics 16, 304–311] and Enders and Siklos [Enders, W., Siklos, P.L., 2001. Cointegration and threshold adjustment. Journal of Business Economics & Statistics 19, 166–176], assuming the nature of the relationship between the variables is on the basis of non-linearity. The empirical evidence suggests that there is a long-run equilibrium relationship between NTD/JPY and the stock prices of Japan and Taiwan during the time period investigated. However, an asymmetric threshold cointegration relationship only exists in Taiwan's financial market. Furthermore, we extend our research by taking into account the effect of the U.S. exchange rate specifically on Taiwan's financial market. This research also finds a long-term equilibrium and asymmetric causal relationships between NTD/USD and the stock prices of Taiwan. In addition, the results of TECM Granger-Causality tests show that no short-run causal relationship exists between the two financial assets considered for both countries' cases. However, in the long run a positive causal relationship running from either the Japan or U.S. exchange rate to the stock prices of Taiwan strongly argues for the traditional approach.

1. Introduction and literature review

It is generally argued that the relationship between exchange rates and stock prices has important implications, especially from the viewpoint of recent large cross-border movement of funds and investments. There are two theories about the dynamic relationship between exchange rates and stock prices – the traditional and portfolio approaches – which have been discussed for a long time, yet have not resulted in any consensus. The traditional approach claims that a depreciation of the domestic currency makes local firms more competitive, leading to an increase in their exports and consequently higher stock prices. This implies a positive correlation between exchange rates (with an American quotation) and stock prices.[2] The inference from the above traditional approach suggests that exchange rates lead stock prices.

The portfolio approach, on the contrary, argues that an increase in stock prices induces investors to demand more domestic assets and thereby causes an appreciation in the domestic currency, implying that stock prices lead exchange rates and they are negatively related.[3,4] The "stock-oriented" model of exchange

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[2] In addition, the theory of the "Uncovered Interest Rate Parity" (UIRP) suggests that the expectations of relative currency values influence the levels of domestic and foreign interest rates. This in turn affects costs of capital and thereby the profitability and price competitiveness of a firm, and consequently the present value (stock price) of a firm may vary.
[3] The appreciation of the domestic currency attracts more foreign capital or investments into the domestic market, and this leads to further currency appreciation.
[4] With a European quotation, the relationship between stock prices and exchange rates of the traditional or portfolio approach is just the reverse.

rates by Branson (1983) specifies the exchange rate as serving to equate the supply and demand for assets such as stocks and bonds.

Whether empirically or theoretically, many economists have suggested a significant relationship between exchange rates and stock prices, but the results have been quite mixed for the sign and causal direction between exchange rates and stock prices.[5] Mok (1993) found weak bi-directional causality between stock prices and exchange rates, while Bahmani-Oskooee and Sohrabian (1992) and Nieh and Lee (2001) argued for a bi-directional causality between stock prices and exchange rates in the short run, but not in the long run. In addition, there are some studies that have found very weak or zero association between stock prices and exchange rates (for instance, Franck and Young, 1972; Bartov and Bodnar, 1994; Fernandez, 2006).

There was a tremendous change in the exchange rate of the Japanese Yen (JPY) and the New Taiwan Dollar (NTD) against USD during the period of 1985–1988, which was primarily the consequence of the "Plaza-Louvre intervention accord". The revaluation of NTD/USD since July 1986 has mainly showed a linked reaction of interference appreciation in JPY/USD since September 1985 as caused by the G-5 "Plaza intervention accord". The Plaza-Louvre cooperation marked the new era of managing floating exchange rates.

Suggestions to build a Yen Bloc[6] were first spurred in the early 1990s, in light of great changes in Asian economies. Foreign capital started to flow into the respective Asian countries at accelerating rates in the 1990s. The weight of exports to the United States in total Asian exports decreased significantly since the mid-1980s, as intra-regional trade increased rapidly. On the other hand, the economic influence of Japan in this region has expanded through its trades and investments in the region. Another important domestic factor considered which has contributed to the huge inflows of foreign capital is the far-reaching liberalization of Japan's financial market. Asia may need an international currency to reduce transaction costs and foreign exchange risks in its regional trades and investments, but it is better for the Japanese yen, rather than the US dollar, to fulfill this objective.

Taiwan is a country with a typical island-style economic system, which is highly open to international trade and investment. Thus, the volatility of NTD/JPY may affect both exporters and importers significantly in Taiwan. For an extended period of time, Taiwan experienced a widening trade gap (deficit) with Japan. The main explanation is likely that the majority of Taiwan imports from Japan are more capital-intensive and comparable expensive goods, while the majority of Taiwan exports to Japan are more labor-intensive and cheaper goods. This degenerating condition of a trade imbalance with Japan has remained unchanged so far. Additionally, as an export-oriented country, Taiwan depends heavily on electronics products exported to its major trading partners. Japan, like most of the other Asia-Pacific countries, is a main competitor to Taiwan. For the case when NTD/JPY appreciates, Taiwan exporters may lose their competitiveness in the world markets and their stock prices usually fall. Studies investigating the causal relations and the international transmission between these two financial assets of Japan and Taiwan can be found in Sewell et al. (1996), Chen and Wu (1997), Granger et al. (2000), Pilbeam (2001), and Yau and Nieh (2006).

Due to the mutual effects of exchange rates and stock prices on each other as mentioned above, it is difficult to predict the overall impact of the varying exchange rate on the stock markets in Taiwan and Japan. Whether it is favorable or unfavorable depends on the entire industrial structure within a country. Studies emphasizing the impact of the exchange rate on stock prices in Taiwan can be found in Wu (1997), Guo and Wu (1998), and Chiao et al. (2001); whereas Choi et al. (1998), He and Ng (1998), Doukas et al. (1999), Caporale et al. (2002), Elyasiani and Mansur (2005), Homma et al. (2005), and Kurihara (2006), among others, studied the relationship between the exchange rate and stock prices in Japan.

In prior empirical studies concerning the exchange rate, the US dollar is mostly utilized as the base currency, while a few studies use the Japanese Yen instead.[7,8] Because Japan is one of the major trading partners of Taiwan, the NTD/JPY plays a crucial role and may possibly influence Taiwan's economy as well as the local stock market. Therefore, while investigating the relationship or financial transmission between these two countries, it may be more appropriate to consider JPY as the base currency.

It has been suggested more recently that linear conventional time series methodologies fail to consider information across regions. This leads to inefficient estimation and therefore lower testing power. One proposed approach to increase power in testing is to consider non-linear techniques instead. Threshold cointegration was introduced by Balke and Fomby (1997) as a practical method to combine non-linearity and cointegration. In particular, the model allows for non-linear adjustment to long-run equilibrium. Later research based on the concept of threshold cointegration include: Obstfeld and Taylor (1997), Enders and Falk (1998), Enders and Granger (1998), Enders and Siklos (2001), Lo and Zivot (2001), Taylor (2001), and Hansen and Seo (2002).

The main purpose of this study tends to concentrate on the cointegration as well as short-term and long-term causal relationships between the two major financial assets, exchange rates and stock prices, of both countries considered, by employing the newly threshold error-correction model (TECM) elaborated by Enders and Granger (1998) and Enders and Siklos (2001). In order to be more persuading than the traditional vector error-correction model (VECM), we attempt to employ the advanced time-series methodologies assuming that the nature of the causal relationship between the variables is on the basis of non-linearity.

The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 introduces all the methodologies used and analyzes the empirical results. Section 4 concludes this paper.

2. Data

This paper looks at NTD/JPY, NTD/USD, closing Taiwan Stock Exchange Index (TW Stock), and the Nikkei 225 Index (JP Stock). Data are collected from the AREMOS Statistical Data Bank of Taiwan's Ministry of Education. Considering that there may be more fluctuations in daily data, this study adopts monthly data. The sample period runs from January 1991 to Mach 2008, with a total of 207 monthly observations obtained for each variable. This specific period is chosen due to the fact that the

[5] For instance, Aggarwal (1981), Soenen and Hennigar (1988), Smith (1992), Bodnar and Gentry (1993), Dropsy and Nazarian-Ibrahimi (1994), Choi and Prasad (1995), Prasad and Rajan (1995), Ajayi and Mougoue (1996), Fang and Loo (1996), Abdalla and Murinde (1997), Kwon et al. (1997), Kanas (2000), and Bhattacharya and Mukherjee (2003), among others.

[6] Yen Bloc refers to a grouping of countries that use the JPY as an international currency and maintain stable exchange rates against the JPY.

[7] Enders and Hurn (1994) believed that using the Japanese Yen as the base currency can be crucial in investigating the macro-fundamental issues, especially among Asian countries.

[8] The issue examining the dominant power or considering the impact of either the U.S. or Japan on other countries' financial markets can be found in Karolyi and Stulz (1996), Varela and Naka (1997), Sun and Tong (2000), and Durand et al. (2001).