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Asymmetric dynamics in stock market correlations: Evidence from Japan and Singapore

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ABSTRACT

This paper uses the asymmetric dynamic conditional correlation model developed by Cappiello et al. (2006) to analyze the correlation between the Japanese and Singaporean stock markets and makes two principal findings. First, it finds that financial integration has advanced because of the Japan–Singapore Economic Partnership Agreement, thereby strengthening the bidirectional relationship between Japan and Singapore. Second, it demonstrates empirically that the weight of Asian stocks in portfolios within the Asian region has increased since the global financial crisis, again strengthening the relationships among Asian region economies.

1. Introduction

Using the asymmetric dynamic conditional correlation (A-DCC) model developed by Cappiello, Engle, and Sheppard (2006), this paper investigates the dynamics of the correlations between the Japanese and Singaporean stock markets and examines whether major economic events affect these dynamics. This article contributes to the body of knowledge on this topic in a number of directions.

First, Singapore's financial services are worthy of further scholarly investigation because of their rapid development over recent years. According to statistics released in March 2011 by the Z/Yen Group, a British think-tank, Singapore is ranked fourth on the Global Financial Centers Index, one position ahead of Japan, with London, New York, and Hong Kong ranked first, second, and third, respectively.[1] Although Japan led the world's equity markets throughout the 1980s, it dropped in the rankings after the bursting of its economic bubble in the early 1990s. However, the Japan–Singapore Economic Partnership Agreement (JSEPA), which took effect in November 2002, has contributed not only to improving economic activity but also to liberalizing financial services in both countries over the past decade,[2] thereby helping keep these two financial centers in the top five in the world.

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[1] For details, see: http://www.zyen.com/GFCI/GFCI%209.pdf.
[2] See Kawai and Wignaraja (2011) for details about JSEPA.

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Two noteworthy studies have thus far analyzed the financial markets of Singapore and Japan. Maysami and Koh (2000) assess the long-term equilibrium relationships among the stock indices of Singapore, Japan, and the U.S., with their empirical results conclusively indicating that Singaporean stock markets are significantly and positively cointegrated with those of both Japan and the U.S. Meanwhile, Johnson and Soenen (2002) examine the factors that affect the level of economic integration between 12 stock markets in Asia and the Japanese stock market, finding that the stock markets of Australia, China, Hong Kong, Malaysia, New Zealand, and Singapore are highly integrated with that of Japan.

The A-DCC model adopted in this paper is based on the DCC model developed by Engle (2002), which takes a two-step approach. The first step in using the original DCC model is to fit each of the time series to univariate GARCH models, while the second step is to estimate the dynamic conditional correlation. Cappiello et al. (2006) modify the model by considering the possibility of occasionally observed events in which the conditional correlation of stock or bond returns is more significantly influenced by negative shocks than it is by positive shocks.

Many empirical studies have used Engle's (2002) DCC model to analyze stock returns (e.g., Kuper & Lestano, 2007; Savva, Osborn, & Gill, 2009; Yang, 2005; Yiu, Ho, & Choi, 2010). In addition, the DCC (or extended DCC) model has been widely employed in the examination of bonds, foreign exchange, and commodity markets.[3] To the best of our knowledge, however, few have considered how major economic events, such as the Asian financial crisis, JSEPA, and the recent global financial crisis, have influenced Japan and Singapore.

We examine this gap in the literature by formulating and finding support for two hypotheses. First, we show that financial integration has advanced because of JSEPA, thereby strengthening the bidirectional relationship between Japan and Singapore. Second, we demonstrate empirically that the portfolio within the Asian region has increased since the global financial crisis, again strengthening the relationships among Asian region economies.

The remainder of this paper is organized as follows. Section 2 discusses the data and descriptive statistics. Section 3 presents the empirical results and discusses the findings. Section 4 summarizes the findings and concludes the paper. Appendix A presents the empirical techniques.

2. Data and descriptive statistics

Our data set consists of daily data on Japanese and Singaporean stock market indices (i.e., the Tokyo Stock Price Index and the Straits Times Index) from January 4, 1994, to July 29, 2011 (see Fig. 1). The entire sample period is divided into the following four subperiods based on the dates of major economic events that have influenced Japan and Singapore during this time:

- Sample A: from January 4, 1994, to July 29, 1997 (relatively calm market conditions);
- Sample B: from August 1, 1997, to November 29, 2002 (Asian financial crisis);
- Sample C: from December 2, 2002, to July 31, 2007 (JSEPA); and
- Sample D: from August 1, 2007, to July 29, 2011 (global financial crisis).

Table 1 shows the descriptive statistics for Japanese and Singaporean stock returns. The measures for skewness and kurtosis, together with the Jarque–Bera (1978) statistics, are also reported in order to demonstrate whether stock returns are normally distributed. The Jarque–Bera statistics reject normality at any significance level for all variables. This result indirectly supports the existence of an ARCH effect in the distribution of stock returns.[4]

3. Empirical results

3.1. AR-EGARCH specification

The first step of this specification is to estimate the univariate AR(k)-EGARCH(p,q) models for each series of stock returns.[5] The present paper, unlike those of Yang (2005) and Yiu et al. (2010), considers the asymmetric effect.

Table 2 shows the estimates for the AR(k)-EGARCH(p,q) model. First, the EGARCH(1,2) model is chosen for Japanese stock returns. All the parameters of the EGARCH model are significant at the 1% level. Second, the EGARCH(1,1) model is chosen for Singaporean stock returns. All its parameters are significant at 1%. Table 2 also reports the estimates of the coefficient β_1, which measures the degree of volatility persistence. We find that β_1 for Japanese and Singaporean stock returns is 0.969 and 0.984, respectively. From these estimates, we can infer that the persistence in shocks to volatility is relatively large.

Table 2 also describes the diagnostics of the empirical results of the AR-EGARCH model. While $Q(20)$ is a test statistic for the null hypothesis that there is no autocorrelation up to order 20 for standardized residuals, $Q^2(20)$ is a test statistic for the null hypothesis that there is no autocorrelation up to order 20 for standardized residuals squared.[6] As shown in this table,

[3] Some examples include Laopodis (2010), Chong and Miffre (2010), Ku and Wang (2008), and Toyoshima, Tamakoshi, and Hamori (2012).
[4] We found that autocorrelations in squared returns are statistically significant.
[5] Before estimating the univariate AR(k)-EGARCH(p,q) models, we verified that the stock returns do not have unit roots.
[6] See Ljung and Box (1978).