Finance Research Letters 17 (2016) 158–166

Contents lists available at ScienceDirect

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Volatility spillovers across stock index futures in Asian markets: Evidence from range volatility estimators

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ARTICLE INFO

Article history:
Received 7 January 2016
Revised 20 January 2016
Accepted 5 March 2016
Available online 15 March 2016

JEL codes:
G15
F36
F65
C18
C51

Keywords:
Stock markets
Volatility spillovers
Range volatility estimators
Asian markets

ABSTRACT

This paper investigates the channels of volatility transmission across stock index futures in 6 major developed and emerging markets in Asia. We analyse whether the popular volatility spillovers tests are susceptible to the choice of range volatility estimators. Our results demonstrate strong linkages between markets within the Asian region, indicating that the signal receiving markets are sensitive to both negative and positive volatility shocks, which reveals the asymmetric nature of volatility transmission channels. We find that some markets play a destabilizing role while other countries - contrary to popular belief - have a stabilizing effect on other markets in Asia.

1. Introduction

The growing role of Asian financial markets in the world economy has recently attracted much attention to the problem of transmission of volatility shocks within the Asian region and beyond (e.g., Sin, 2013; He et al., 2015; Rughoo and You, 2015). The existing literature has been increasingly focusing on this issue after the Asian financial crisis of 1997 (e.g., Caporale et al., 2006; Yilmaz, 2010). Parallel to that the introduction of the stock index futures in Asian markets stimulated a debate about the intensity, speed and directions of international information transmission across futures markets (see e.g., Li, 2015). Since the early papers by Cox (1976) and Harris (1989) the empirical evidence tends to show that futures trading improves the channels of information transmission because the news are conveyed by futures markets faster than by underlying spot markets. Therefore, the question how the signals are transmitted across the futures markets and what is the dynamics of cross-markets information flows is highly relevant. Due to the fact that stock index futures are relatively new instruments in Asia, the analysis of directions and intensity of transmission of volatility shocks across futures markets is par-

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http://dx.doi.org/10.1016/j.frl.2016.03.005

ticularly interesting using this new Asian data[1]. Thus, this paper aims to address the question: who are the net-contributors and net-recipients of volatility shocks within the Asian markets? We deal with this issue by exploring the direction and asymmetric nature of volatility transmission across emerging and developed Asian markets employing stock index futures data.

This paper is distinctly different from previous studies in two major ways. First, whilst most of the existing papers employed stock indices data in their analysis of volatility transmission across Asian markets, we argue that using stock index futures data provides more practically relevant results. Stock indices cannot be traded by investors as financial instruments, therefore from the point of view of the construction, testing and execution of actual trading strategies, the analysis of volatility transmission is much more realistic using the futures data (see, e.g., Yarovaya et al., 2016). Second, the existing literature on volatility spillovers often fails to provide consistent results. One of the underlying problems is that volatility spillovers tests are sensitive to the choice of volatility estimators (e.g., Shu and Zhang, 2006). The advantages of the range volatility estimators have been widely discussed in the previous literature (see, e.g., Garman and Klass, 1980; Parkinson, 1980; Rogers and Satchell, 1991, Yang and Zhang, 2000; among others) and the emphasis in the earlier studies has been on their sensitivity analysis. In this paper we do not aim, however, to compare the accuracy of range volatility estimators, which has been already done before in previous studies, but our purpose is to demonstrate how the results of volatility spillovers analysis may depend on the choice of volatility estimators.

2. Data and methodology

2.1. Database

We use the data about the weekly volatility of stock index futures of 6 major Asian markets. The selection of countries includes both developed markets, i.e. Hong Kong, Singapore and Japan, and emerging markets, i.e. China, South Korea and Taiwan. Since in China the stock index futures have been introduced only in the year 2010, our sample period starts in September 2010 and extends until September 2015, so it includes 260 weekly frequency observations for each country.[2] The daily opening, closing, high and low prices for futures contracts with the closest expiration dates were collected from Bloomberg database.

2.2. Estimation of volatility

The classical measures of assets price variance are based on close-to-close prices from *n*-period historical datasets. In this paper, we provide the evidence from range estimators, i.e. Parkinson (1980), Garman and Klass (1980), Rogers and Satchell (1991), denoted respectively as P, GK and RS, which are described below following the notation from Shu and Zhang (2006) and Yang and Zhang (2000) by Eqs. (1)–(3):

$$\sigma_P^2 = \frac{1}{4ln2}(h-l)^2 \tag{1}$$

$$\sigma_{GK}^2 = 0.511(h-l)^2 - 0.019[c(h+l) - 2hl] - 0.383c^2 \tag{2}$$

$$\sigma_{RS}^2 = h(h-c) + l(l-c) \tag{3}$$

where: c, h and l are the normalized closing, high and low prices, respectively.

The weekly volatilities are estimated for all 6 futures markets in our sample.

2.3. Methodology

First, we use Diebold and Yilmaz (2012) methodology which provides the measure for volatility spillovers based on forecast error variance decompositions from a vector autoregressive (VAR) model.[3] Total volatility spillover index captures the intensity of volatility spillovers across the selected markets, while net volatility spillover indices are used to identify net-contributors and net-recipients of volatility shocks.

Second, our procedure employs Gauss code written by Hatemi-J (2012) to run asymmetric causality test. The cumulative sums of positive and negative shocks of each underlying variables can be defined as follows:

$$\theta_{1t}^+ = \sum_{i=1}^{t} \Delta\theta_{1i}^+,\ \theta_{1t}^- = \sum_{i=1}^{t} \Delta\theta_{1i}^-,\ \theta_{2t}^+ = \sum_{i=1}^{t} \Delta\theta_{2i}^+,\ \theta_{2t}^- = \sum_{i=1}^{t} \Delta\theta_{2i}^- \tag{4}$$

[1] The first stock index futures contract traded in China was IFBK10 (04/16/10-05/21/10), in Hong Kong it was HIJ92 (04/01/92-04/29/92), in Taiwan it was FTU98 (07/21/98-09/17/98), in Singapore it was QZV98 (09/07/98-10/30/98), in South Korea it was KMM96 (05/03/96-06/13/96) and in Japan it was NKZ88 (09/05/88-12/08/88).

[2] Due to the fact that trading volume on contracts with expiration dates from May till August was comparatively low, the first futures contract used to generate continuous futures series for China is IFBU10 starting in September 2010.

[3] For more details regarding the description of this methodology please see Diebold and Yilmaz (2012).