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## Intraday Volatility Spillovers between Index Futures and Spot Market: Evidence from China

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### Abstract

This paper examined the volatility spillover effects between futures market and spot market in China, using both VAR model and TVP-VAR model. This study found strong bi-directional volatility spillovers between CSI futures and spot markets, and the change of futures' volatility decreased the change of spot market's volatility. This results support the hypothesis that the risk management function of the futures market could calm the whole market when new shock comes. The innovation of this paper is to capture the dynamic of the relationship by using the TVP-VAR model. The empirical results show that the influence of futures market on spot market enlarged as time passed, especially at the third quarter of 2011. After that, the relationship became stable.

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### 1. Introduction

The Crash of October 1987 in the US stock market and its impact on other stock markets overall have motivated the growth of academic researches on the transmission of volatility across different markets<sup>1</sup>. Since the introduction of index futures, a huge number of researches have concerned about the relationship between

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the futures market and the underlying spot market. To what extent the volatility of futures market could influence the volatility in spot market, or opposite.

According to the efficient market hypothesis, an efficient market should respond simultaneously to any new information, both in the spot market and in the futures market. However, in reality, different market microstructures, transaction costs, liquidity or other restrictions, may reduce the efficiency on disseminating new information, then produce lead-lag relationship between spot and futures markets. Understanding volatility spillover is important for predicting future volatility in both markets<sup>2</sup>.

Researches in this area can be divided into three streams. A lot of studies have suggested that futures markets play a more important role on volatility spillover than the spot market, because of lower transaction costs and lower margins<sup>3-6</sup>. The advocates of futures markets argue that the future market could provide important information to investors on subsequent movements in the spot markets, helping them in managing the risk exposed in spot markets<sup>7-9</sup>. The second stream proposed bi-directional volatility spillover between the futures and spot markets<sup>10-14</sup>. Meanwhile, some researchers found no volatility spillover<sup>15, 16</sup>.

In this paper, we focus on the volatility spillover between CSI index futures and spot market by using high frequency data. Compare to daily data, high frequency data contain much more information about the market, such as the intraday changes and the market microstructures. Earlier researches in this area used GARCH model to capture the volatility characteristics of the markets. But most GARCH models only applied to daily or weekly data, not suitable for analyzing high frequency data. Therefore, in order to capture more information about the market, this paper calculated realized volatility, which was proved to be a better proxy for volatility under the high frequency circumstances<sup>17, 18</sup>.

Another extension of this paper is that we used the TVP-VAR model, which could provide time varying relationship among different markets<sup>19</sup>. Existing researches on volatility spillover are mostly concerned about the relationship at one given point. But there is strong evidence that the relationship between the two markets differ because of the changing of restrictions and market rules. To better evaluate the dynamic characteristic of volatility spillover, this paper applied TVP-VAR model, which is the first time used in Chinese derivative markets.

The rest of this paper is organized as follow. Section 2 introduced the data and provides the descriptive statistics of high frequency data. Section 3 introduced TVP-VAR methodology. Section 4 provided the results, and several conclusions are discussed in Section 5.

## 2. Data and descriptive statistics

### 2.1. Chinese CSI 300 spot and futures markets

The Chinese CSI 300 stock index is one of the most comprehensive indexes in Chinese stock market. The CSI 300 stock index is a capitalization-weighted index composed of 300 largest listed companies in Shanghai and Shenzhen stock markets. These 300 stocks account for approximately 80% of domestic market capitalization.

CSI 300 index future is the first financial future in Chinese capital market, the underlying asset of which is the CSI 300 stock index. CSI 300 index future was listed in April, 2010, the trading volume of which has rapidly become one of largest around the world. Table 1 presents the descriptive statistics for CSI 300 futures contracts.

### 2.2. Descriptive statistics for sample data

One-minute data was used here. From August 23, 2010 to June 21, 2013, there were 681 trading days in total. The daily trading time was 9:30-11:29 am and 13:00-14:59 pm (There were 240 minutes each trading day,

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