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Impact assessment of international anti-dumping events on synchronization and comovement of the Chinese photovoltaic stocks

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ABSTRACT

This study investigated the effects of international anti-dumping events on the stock prices of the photovoltaic (PV) sector using sample data from China. Nine international anti-dumping events were tested using the event study methodology, and we found that most of them had significant impact on the stock returns of PV companies. Then, we chose a threshold value to construct stock networks for the different phases of the event development. We studied the changes in the scale and strength of the stock price synchronization, the evolution of the stock price co-movement and the stability of the co-movement between adjacent stocks by analyzing the changes in the topological structure of the stock networks. We found that the international anti-dumping events had different effects on the evolution of the synchronization and co-movement of the prices of Chinese PV stocks. In addition, the stock market of the PV sector exhibits high sensitivity to certain events. This study provides a novel approach that combines the event study methodology and stock-network analysis to help us to better understand the effects of anti-dumping on the PV stocks.

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1. Introduction

Because of the huge global demand for solar power, which is one of the cleanest and most reliable energy sources presently available, the Chinese photovoltaic (PV) industry promises a huge development potential. First, China consumes huge amounts of energy. Second, China has a natural advantage of excellent solar resources [1] and significant financial support from its government [2]. With the rapid development of the China's renewable energy applications in the past 10 years, China has become the biggest producer of PV cells in the world [3]. Third, Chinese enterprises possess the greatest competitive advantage because of the comparatively low production cost of solar cells and module assembly [4]. A growing number of Chinese companies have joined the PV industry in recent years; a number of listed companies are taking advantages of the opportunities provided by this industry. Meanwhile, China's PV industry is also going through a severe challenge, including that from the international trade conflicts, market competition, and so forth [5,6]. Between 2012 and 2013, several international anti-dumping efforts against solar products imported from China were launched by the U.S., the countries of the European Union and India. These events, to some extent, resulted in turbulence in the stock market in the Chinese PV sector. The market capitalization of many Chinese PV firms decreased significantly, and many firms even faced the dilemma of delisting, merger or bankruptcy. Crowley and Song has provided evidence showing that European trade policy had a larger negative influence on China's PV private firms relative to state owned enterprises [7].

Stock price synchronization and co-movement are the key topics in stock-market volatility studies. These are common behaviors of stock markets and can reflect the fluctuation patterns of stock markets. Stock price synchronization is the phenomenon that once a single stock price fluctuates, the average stock price may move up or down in the same direction. It describes the correlation between changes in a single stock price and the average stock-price changes of the stock market. Stock price co-movement refers to associated stocks or stocks of the same type that exhibit a simultaneous rising or falling phenomenon. Financial markets are very sensitive to economic instabilities. They can be impacted by material events. This influence will be reflected in changes in stock price synchronization and co-movement. Among previous studies, very few have considered the impact of material events on stock price synchronization and co-movement. Thus, it is interesting to investigate whether the synchronous and co-movement behavior of stock prices has changed with the occurrence of material events and, if so, how they evolved. Answering these questions can help us to better understand the mechanism that underlies the impact of material events on stock-market volatility behaviors.

However, a material event is likely to undergo a long process from beginning to end. During the process of event development, there are expected to be several sub-events. It is necessary to test whether all these sub-events have significant influences on stock markets. The event study methodology provides us a statistical technique for testing the significance of the effects of events on stock markets. The previous studies have illustrated that different types of events have different effects on the stock markets [8–17].

In our work, we studied the impacts of international anti-dumping events on the evolution of the stock price synchronization and co-movement of the Chinese PV sector. These international anti-dumping events were launched by the U.S., the countries of the European Union and India. Several sub-events occurred during the process of the event development. We used the event study methodology to test the significant effects of each sub-event on the stock returns of Chinese PV firms. After examining the significant effects of the sub-events on the stock returns of PV firms, we then constructed the corresponding unweighted stock-price networks and weighted stock-price networks based on the day that each sub-event occurred. We tried to answer the following three questions: Firstly, did all these sub-events have significant impacts on the stock returns of Chinese PV firms? Secondly, how did the scope and strength of the stock price synchronization change with the occurrence of these international anti-dumping events? Thirdly, how did the stock price co-movement evolve?

This paper is organized as follows. In Section 2 we describe the financial data we used for our analysis and then introduce the methodology, including the event study methodology and the network construction. In Section 3, we analyze the effects of the events on the stock returns of Chinese PV firms. In Section 4, we present the numerical results of our analysis of the changes in the topological properties of the stock-price networks following the occurrence of the sub-events to answer the three questions we proposed above. The paper finishes with a discussion and conclusions.

2. Materials/methods

For analyzing the stock-price synchronisation and co-movement behavior, many scholars have studied financial market volatility using various econometric models [18,19]. Filer and Selover have found that the global stock market synchronization results from a “mode-locking” effect in a nonlinear system [20]. Synchronicity behaviors between the US and Chinese stock markets were present in the periods 1991–1998 and 1999–2008 [21]. Some researchers have quantified the synchronization among the top 40 UK companies using the minimal spanning tree and hierarchical tree methods [22]. Liow has found that the global real-estate stock correlations co-move significantly and positively with regional real-estate stock correlations and local real-estate stock correlations [23]. Li and Zou have investigated the impact of policy and information shocks on the co-movements of China's T-bond and stock markets [24]. These studies of stock market synchronization and co-movement were based on cross-correlations between stocks. Using the correlations between stocks, some researchers have studied stock cross-correlations using minimal spanning trees [25–27] or the random matrix approach [26,28,29]. Many econophysicists have constructed stock networks and investigated their topological properties or topological stability using complex network theory [30–32]. Sun et al. studied the stock market characteristics of China's PV enterprises through building a hierarchical network model [33]. Via research concerning the topological properties of a financial network, we were able to analyze the synchronization and co-movement behavior of

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