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The impact of margin trading on share price evolution: A cascading failure model investigation

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HIGHLIGHTS

- A cascading failure model is proposed to investigate the margin trading.
- The model is performed based a bipartite graph with trader and share nodes.
- The stock market evolves from the stable state to vulnerable state with an external shock.
- The share prices undergo a cascading failure process in the vulnerable stock market.
- The cascading failure of share prices is strongly affected by four key factors of margin trading.

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ABSTRACT

Margin trading in which investors purchase shares with money borrowed from brokers is blamed to be a major cause of the 2015 Chinese stock market crash. We propose a cascading failure model and examine how an increase in margin trading increases share price vulnerability. The model is based on a bipartite graph of investors and shares that includes four margin trading factors, (i) initial margin k , (ii) minimum maintenance r , (iii) volatility v , and (iv) diversity s . We use our model to simulate margin trading and observe how the share prices are affected by these four factors. The experimental results indicate that a stock market can be either vulnerable or stable. A stock market is vulnerable when an external shock can cause a cascading failure of its share prices. It is stable when its share prices are resilient to external shocks. Furthermore, we investigate how the cascading failure of share price is affected by these four factors, and find that by increasing v and r or decreasing k we increase the probability that the stock market will experience a phase transition from stable to vulnerable. It is also found that increasing s decreases resilience and increases systematic risk. These findings could be useful to regulators supervising margin trading activities.

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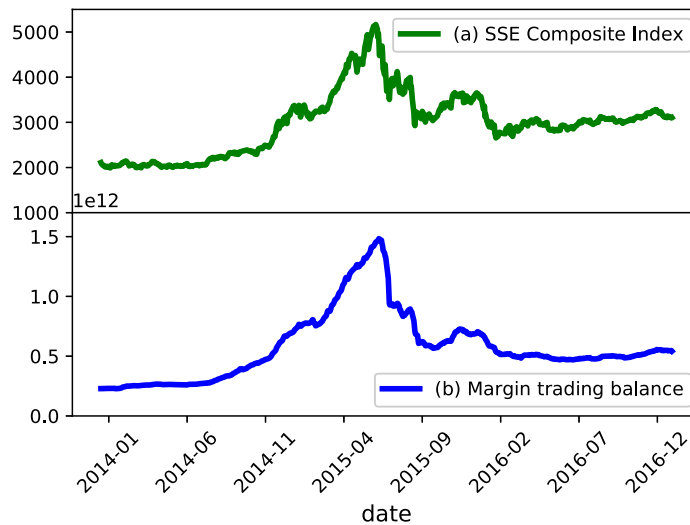


Fig. 1. (Color Online) (a) SSE Composite Index and (b) margin balance changed with time from the beginning of 2014 to the end of 2016.

1. Introduction

During the 2014–2015 period the Chinese stock market experienced extreme volatility and ruinous boom–bust behavior. The important Shanghai Stock Exchange (SSE) Composite Index rose approximately 33% in one month and then fell 29% in seven trading days. Fig. 1(a) shows that the extreme bull market began in July 2014, that the SSE index reached a seven-year high on 12 June 2015, but that within a short period of a few weeks the same index dropped sharply in what came to be known as the mid-2015 Chinese stock market crash.

It is speculated that this erratic Chinese market behavior was caused in part by a huge increase in margin trading [1]. Generally speaking, margin trading uses financial leverage. When investors feel bullish toward an investment opportunity they borrow capital from brokers or other resources, e.g., shadow banks, to purchase shares. To minimize losses, brokers require investors to pay a portion of the share price as a margin and to use the purchased shares as collateral for the loan. There is also a requirement that there be a minimum maintenance margin, above which the total amount of equity must be maintained in the margin account [2].

Margin trading is high risk and can yield huge profits or total losses. Because China's securities market was immature and approximately 90% of its traders were retail investors, margin finance and short-selling services were not made available prior to 2010 [3,4]. In that year the China Securities Regulatory Commission (CSRC) conducted a pilot project and allowed shares of a few dozen companies to be bought on margin or sold short. In September 2014, the approved list of stocks was expanded to include more than 900 companies. Fig. 1(b) shows that margin trading rapidly increased and nearly doubled in the four months from September to December 2014. A huge amount of credit was injected into the securities market and the SSE Composite Index rapidly increased. Fig. 1 shows that the time series of the SSE Composite Index and of margin loans were strongly correlated and fluctuated following the same trends. During this bull market period, share prices and margin financing activities promoted each other, and a huge market bubble was created.

Margin financing is a high-risk double-edged sword. Although some propose that stock price behavior indicates [5–7] that margin eligibility can raise liquidity [8] and stabilize the market [9], others argue that margin trading produces excess volatility and destabilizes the market [10,11]. We conjecture that margin trading activities are a strong factor in the drop in stock prices during a crash and can accelerate the decline. Fig. 1 shows that immediately following the sharp drop in share prices, margin lending also dropped sharply, which in turn accelerated the devaluation of the market index. This behavior was described previously [12,13], but the obtained results were based on observations and regression results and did not explain the mechanism driving the behavior.

Here we propose a cascading failure model [14–18] to identify the mechanism that allows margin trading to amplify the vulnerability of share price and that caused the 2015 Chinese stock market crash. The basic idea is that margin-covering resulting from the minimum maintenance margin requirement rapidly decreases share price, which further triggers more margin-covering and results in a cascading failure of share prices.

2. Model

A bipartite graph is used to show the cascading failure model of margin trading [19–21]. Nodes are divided into two non-overlapping sets of $N = 20000$ margin investors and $M = 1000$ shares. We abstract the margin trading market on this

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