CIRCUIT BREAKERS AND MARKET QUALITY: EVIDENCE FROM CHINA

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ABSTRACT

Circuit breakers were triggered four times in Chinese stock market in 2016 and provided a valuable opportunity to empirically examine the impacts of circuit breakers on market quality. By comparing price movement, liquidity and market efficiency in the days when circuit breakers were triggered with the time-matched benchmark and the return-matched benchmark, this letter investigates the negative effects of circuit breakers. Empirical results suggest that circuit breakers failed to improve the market quality and brought huge welfare losses to investors.

Keywords: Circuit breaker, Market quality, Investors' welfare

1. INTRODUCTION

The circuit breaker mechanism refers to the measures adopted by the exchanges to avoid abnormal price fluctuations in the market, which temporarily halts trading when the target index rises or falls beyond a certain degree. Since 2016, three exchanges in China (Shanghai Stock Exchange, Shenzhen Stock Exchange and China Financial Futures Exchange) started to implement circuit breakers. The target index is CSI 300 index, the most popular stock index in China, which consists of 300 actively traded stocks with the largest market capitalization listed on Shanghai and Shenzhen Stock Exchanges. According to the rule, Level 1 circuit breaker will be triggered when CSI 300 index rises or falls more than 5% and three exchanges will temporarily halt trading for 15 minutes. After that, if CSI 300 index rises or falls more than 7%, Level 2 circuit breakers will be triggered and both the stock market and index futures market will stop trading until the next trading day.

Due to the lack of empirical data, most studies on circuit breakers are theoretical or experimental. The impact of circuit breakers on the market is controversial in the previous literature. Some findings support the idea that circuit breakers serve as an effective way to decrease volatility, improve liquidity and market efficiency. For example, Westerhoff (2003) claims that circuit breakers overcome the informational distortion problems by decreasing price deviations driven by noise traders. Linton et al. (2012) point out that circuit breakers can mitigate the risk of price instability during short time horizons caused by high frequency trading. However, other researchers hold a different view that circuit breakers fail to achieve the above objectives. Kim and Yang (2004), Bildik and Gulay (2006) argue circuit breakers only put off transactions that should have happened. Even worse, Gomber et al. (2013) find that circuit breakers decrease the market volatility at the cost of lower market quality and higher implicit costs. Besides, Ackert et al. (2001) and Chen et al. (2018) show the evidence of the magnet effect towards the threshold of circuit breakers.
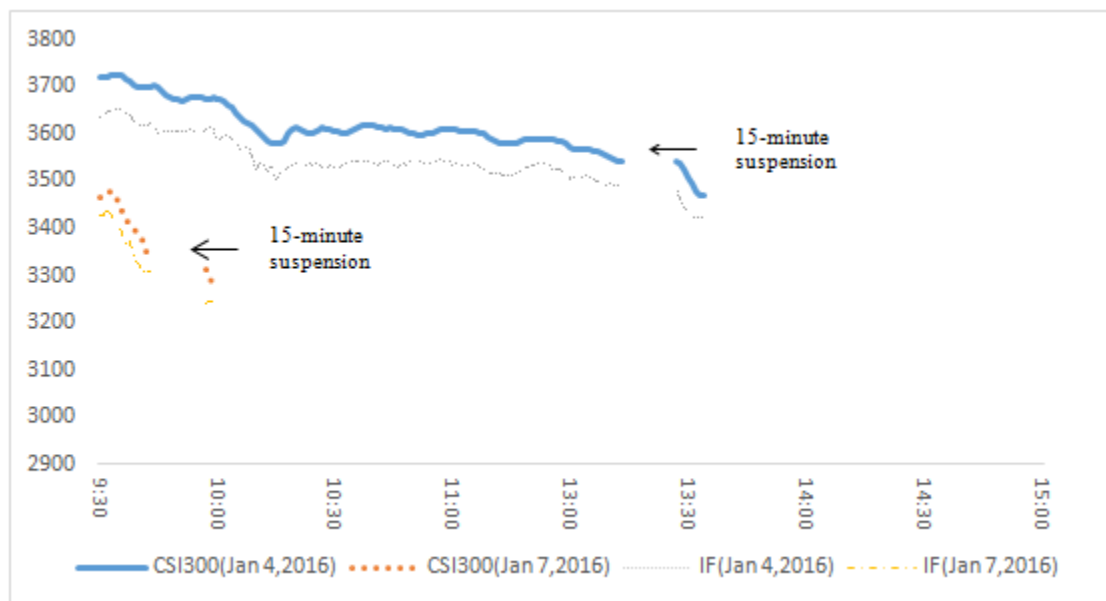
Circuit breakers in Chinese stock market provide a valuable opportunity to empirically investigate the effects of circuit breakers on market quality. Exchanges started to implement circuit breakers on Jan 4, 2016. Level 1 and Level 2 circuit breakers were both triggered on Jan 4, 2016 and Jan 7, 2016. After the 15-minute trading halt following Level 1 circuit breaker was triggered, market volatility became even more intense and liquidity quickly deteriorated. The mechanism failed to calm the market down and were abolished for the fierce public criticism, which lasted only 4 trading days and became the most short-lived rules in the Chinese stock market. This letter contributes to the literature by empirically investigating the relationship between circuit breakers and market quality using the field data from China.

2. DATA AND METHODS

This letter examines the relationship between circuit breakers and market quality by comparing price movement, liquidity and market efficiency on the days when circuit breakers were triggered with the matched benchmarks. The one-minute return is used to measure price movement, computed by the logarithm of the price change within one minute. Market illiquidity is measured by Amihud Ratio, the absolute return divided by dollar trading volume within one minute. And we test market efficiency using the serial correlation of one-minute returns. Trading data of CSI 300 index and the index futures are from WIND database.

We construct the time-matched benchmarks and the return-matched benchmarks as two control groups and therefore our sample covers 10 trading days: 2 event days when circuit breakers were triggered (Jan 4, 2016 and Jan 7, 2016), 4 time-matched days and 4 return-matched days. For the time-matched benchmark, following Boulton et al. (2014), we match the event day with the day

before the event day (pre-event benchmark) and the day after the event day (post-event benchmark). Specifically, Dec 31, 2015[1] and Jan 5, 2016 are matched for Jan 4, 2016, and Jan 6, 2016 and Jan 8, 2016 are matched for Jan 7, 2016. For the return-matched benchmark, we match the event day with the trading days when CSI 300 index fell by more than 7% in the recent one year. Thus, Jun 26, 2015, Jul 27, 2015, Aug 24, 2015 and Aug 25, 2015 are chosen as the return-matched benchmarks. Besides we divide each event day into two sessions to examine the inter-change in market quality before and after Level 1 circuit breaker is triggered. As shown in figure 1, in the first session, CSI 300 index fell by 5% and Level 1 circuit breaker was triggered. And after 15-minute trading halt, in the second session, CSI 300 index fell by 7% and Level 2 circuit breaker was triggered. The markets closed in advance until the next trading day.[2]

Fig. 1: Circuit Breakers in Chinese Stock Market

Note: This figure displays the price movements of CSI 300 index and index futures on Jan 4, 2016 and Jan 7, 2016. Chinese stock markets open at 9:30 and close at 15:00. Level 1 circuit breaker was triggered after a 5% drop in CSI 300 index and imposed a 15-minute trading suspension at 13:13 (9:43) on Jan 4, 2016 (Jan 7, 2016). Level 2 circuit breaker was triggered after a 7% drop in CSI 300 index and the markets closed in advance at 13:34 (9:59) on Jan 4, 2016 (Jan 7, 2016).

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[1] The market is closed for holidays from Jan 1 to Jan 3, 2016.
[2] Impressively, the trading hours of the whole day on January 7, 2016 are less than 20 minutes.

3. EMPIRICAL RESULTS

Table 1 shows the summary statistics of price movement for the event days, time-matched benchmarks (pre-event benchmarks and post-event benchmarks), and return-matched benchmarks. Panel A displays the results of CSI 300 index. On the event days, the average one-minute stock index return was -0.06% before the triggering of Level 1 circuit breaker and the average return fell sharply to -0.357% after that, lower than all matched samples. Besides, the volatility measured by standard deviation of one-minute return was 0.144% before the triggering of Level 1 circuit breaker and increased sharply to 0.292% after that, higher than all matched samples. The results show that a 15-minute suspending of trading following the triggering of Level 1 circuit breaker has hastened the decline and increased the volatility.

Table 1: Summary Statistics of Minute Returns

Intervals	Event Day		Pre-Event Benchmark	Post-Event Benchmark	Return-Matched Benchmark
	Session 1	Session 2			
Panel A Stock Index					
mean	-0.0600	-0.357	0.00175	0.00537	-0.0192
sd	0.144	0.292	0.0542	0.164	0.165
median	-0.0398	-0.314	0.00135	-0.00790	-0.0291
min	-0.696	-0.999	-0.200	-0.782	-0.897
max	0.397	0.0146	0.197	0.940	1.166
skewness	-1.188	-0.765	0.162	0.812	0.628
kurtosis	7.102	3.189	4.309	9.942	8.230
Panel B Index Future					
mean	-0.0535	-0.417	0.000613	-0.00146	-0.0305
sd	0.222	0.661	0.104	0.219	0.296
median	-0.0170	-0.264	-0.00540	-0.00600	0
min	-1.103	-2.055	-0.332	-1.612	-1.430
max	0.454	0.170	0.479	1.018	1.392
skewness	-1.522	-1.829	0.401	-0.886	0.0113
kurtosis	7.415	5.467	4.803	12.58	6.134

Note: This table reports the summary statistics of minute returns of CSI 300 index and index futures, including mean, standard deviation, median, minimum value, maximum value, skewness and kurtosis.

Similarly, we present the results in the futures market in the Panel B. Compared with the time-matched benchmarks and the return-matched benchmarks, the second session in event days experiences a larger decline in return and increase in volatility.

Table 2 presents the market illiquidity on the event days and the matched samples, measured by minute Amihud Ratio multiplied by 10^{12}. While the circuit breaker aims to provide a cooling-off

period for investors to digest market information and increase liquidity for subsequent transactions，the illiquidity in the second session and post-event benchmarks are higher than the first session, pre-event benchmark and return-matched benchmark, which partially indicates that the circuit breakers fail to improve market liquidity and the deterioration of liquidity carries on to the next trading day.[3]

Table 2: Market Illiquidity

Intervals	Event Day		Pre-Event Benchmark	Post-Event Benchmark	Return-Matched Benchmark
	Session 1	Session 2			
Panel A Stock Index					
mean	0.883	1.216	0.659	1.224	0.808
sd	0.596	0.637	0.511	0.829	0.628
median	0.838	1.495	0.528	1.138	0.656
min	0.00630	0.0854	0	0.00201	0.00110
max	3.304	1.925	2.630	4.380	4.690
Panel B Index Future					
mean	15.63	23.37	14.01	22.65	0.210
sd	12.89	14.49	15.88	18.44	0.200
median	13.59	18.89	11.22	19.08	0.163
min	0	3.900	0	0	0
max	79.58	51.10	278.0	111.7	1.210

Note: This table reports the summary statistics of minute Amihud Ratio of CSI 300 index and index futures, including mean, standard deviation, median, minimum value and maximum value.

Furthermore, we test market efficiency using intraday serial correlations of one-minute returns. Theoretically, the more efficient the market is, the closer to zero the serial correlations are. Table 3 presents the results of the market efficiency in stock market and index future market. All of the lag 1 autocorrelations are positive in stock market, indicating price movements are predictable during the short periods. The correlation coefficients decrease with the lags and even becomes negative in some sessions. On the event days, the first-order autocorrelations in the second session are positive and higher than the time-matched and the return-matched benchmarks. It provides evidence that circuit breakers damage the market efficiency in the stock market.

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[3] There are huge differences in liquidity for index futures market between return-matched benchmarks and other samples because the changes of trading rules in index future market damaged market liquidity seriously since Sep 2015. As a result, return-matched benchmarks in index future market are not comparable in this respect.

Table 3: Market Efficiency

Intervals	Event Day		Pre-Event Benchmark	Post-Event Benchmark	Return-Matched Benchmark
	Session 1	Session 2			
Panel A Stock Index					
Lag 1	0.720	0.802	0.670	0.753	0.543
Lag 2	0.431	0.430	0.250	0.312	0.105
Lag 3	0.181	-0.730	-0.109	-0.105	-0.0955
Panel B Index Future					
Lag 1	-0.0449	0.204	-0.0501	-0.0143	-0.0341
Lag 2	0.262	0.377	0.0243	0.128	-0.0254
Lag 3	0.169	0.654	0.0507	-0.0685	-0.0572

Note: This table reports the autocorrelations of minute return of CSI 300 index and index futures.

As for the futures market, the autocorrelations of intraday returns are closer to zero than the stock market, which means the futures market is more efficient than the stock market. And the first-order autocorrelations in the second session of event days are positive and higher than benchmarks, indicating the negative effect of circuit breakers on market efficiency.

4. WELFARE IMPLICATION

We further discuss the impact of circuit breakers on investors' welfare in the stock and futures markets by investigating the loss of traders who believe the market will recover and buy stocks or long futures after Level 1 circuit breakers were triggered. Trading volume and volume-weighted average price (VWAP) in these two sessions for both the stock market and futures market are provided in table 4. Specifically, volume-weighted average prices of CSI 300 index in the second sessions on Jan.4 and Jan.7 were 3504.67 and 3298.25, respectively. And the trading volumes were 16.50 and 14.10 billion RMB respectively. Finally CSI 300 index closed at 3469.07 and 3294.38, respectively. Therefore, the traders who bought stocks after the triggering of Level 1 circuit breaker suffered a loss of 16.76(1.02%) and 0.02(0.12%) billion RMB, respectively. In addition, the index future contract IF1601 closed at 3425 and 3245.2 on Jan.4 and Jan.7. Traders on long open positions after the triggering of Level 1 circuit breaker suffered a loss of 3.81 (0.38%) and 0.65(0.08%) million RMB.

Table 4: Trading Price and Volume

	Event Day (Jan. 4)		Event Day (Jan. 7)	
Intervals	9:30-13:13	13:27-13:34	9:30-9:43	9:57-9:59
Panel A Stock Index				
VWAP	3633.80	3504.67	3416.22	3298.25
Volume (Billion RMB)	129.0	16.50	31.60	14.10
Panel B Index Future				
VWAP	3577.35	3438.88	3383.79	3247.86
Volume (No. of Contract)	11461	979	3832	819

Note: This table reports volume-weighted average price (VWAP) and trading volume of CSI 300 index and index futures on two event days (Jan.4 and Jan.7, 2016).

5. CONCLUSION

The circuit breaker mechanism in China provides unique field data to examine its impact on market quality, such as price movements, market liquidity, and serial autocorrelation of intraday returns. After the triggering of Level 1circuit breakers and 15-minute trading halt, we find that prices accelerated to decline and the market liquidity and efficiency were damaged. Meanwhile, the investors suffered huge welfare losses. The dark side of circuit breakers documented in this letter should be taken seriously by market regulators and we expect further analysis to explain the underlying mechanism.

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