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Effect of Short Selling on Market Liquidity, Price, and Volatility: A Dynamic Perspective

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Abstract

In order to verify the effect of short selling activities on market efficiency, volatility, and price, I conduct the Granger causality test, impulse response analysis, and variance decomposition using a vector autoregressive model. Empirical tests show that short selling enhances market efficiency by reducing trading costs. On the other hand, short selling does not significantly increase stock volatility or decrease prices. This study verifies that short selling improves market quality without a negative effect on volatility and price.

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1. Introduction

Short selling refers to the sale of securities that are not held by investors. Short selling serves as an important tool in the stock market in that it improves market efficiency, plays an important role in price discovery (toward fundamental values that all information should be reflected in), and provides liquidity to reduce transaction costs. Therefore, most stock markets around the world allow short selling in normal financial market conditions. However, short selling may be accompanied by a negative investment sentiment during market crises, which may lead to a sudden drop in stock prices, an unnecessary increase in volatility, and ultimately a stock market crash. In addition, while institutional investors are often the main players of short selling, individual investors may have to suffer damage from institutional investors' short sales due to asymmetric information between individual and institutional investors. For such reasons, short selling often faces a negative misunderstanding despite its essential role in improving market quality.

In order to confirm that short selling improves market efficiency, it is necessary to demonstrate empirically how short selling affects market efficiency, volatility, and price from a dynamic perspective. Previous studies examine how short-selling constraints affect market efficiency, volatility, and price movement. Boehmer and Wu (2013) find that active short selling improves stock price accuracy. Saffi and Sigurdsson (2010) examine the effect of short-selling constraints on price efficiency using international data. According to their findings, a shock in the market is slowly reflected in prices due to short-sale constraints. Beber and Pagano (2012) investigate the effect of short-selling restrictions on liquidity, price discovery, and stock prices based on the fact that the short sale ban was applied at different timelines during the 2007-2009 global financial crisis. They show that short selling could have a crucial impact on liquidity in small firms and could facilitate price discovery in the bear market. Bris, Goetzmann, and Zhu (2007) explore the effect of short-selling constraints on market efficiency and find that the less restrictive short-selling constraints, the faster negative information can be reflected in prices. As for the effect of short selling on volatility, Ho's (1996) study on the Singaporean stock market discovers that volatility increases with short-selling constraints, implying short selling serves to stabilize market volatility. Daouk and Charoenrook (2005) use short sales data from 111 countries to show that volatility reduces and liquidity improves when short selling is active, suggesting that short selling improves market quality. In terms of the effect of short selling on the stock price crash, they find no evidence. Helmes, Henker, and Henker (2010) discover that short-sale constraints shrink trading activity, widen bid-ask spreads and increase volatility. Overall, short selling increases price efficiency by providing liquidity and reducing volatility, but there is little evidence that short sale transactions lead to a stock market plunge.

This study uncovers how short selling activities dynamically affect market efficiency, volatility, and price using a time-series approach. By analyzing the impact of short selling on the stock market from a dynamic perspective, this study provides a more solid basis for the positive effect of short selling on the market microstructure. Using the Granger causality test, impulse-response analysis, and variance decomposition for the Korean stock market data from 2009 to 2018, I find that short selling improves market liquidity and efficiency. Also, short selling does not deteriorate volatility and price, contrary to the claim that short selling could bring about a positive volatility shock and a negative price shock. This study contributes to the literature by confirming that short selling improves market quality without a negative effect on volatility and price in the overall period.

This study is developed in the following order. Section 2 presents the methodology used in this study. Section 3 describes the results of the empirical analysis, and my conclusion is given in Section 4.

2. Data and Methodology

I measure short sales as the daily short selling volume on the KOSPI 50 index divided by market capitalization for the period from 2008 to 2018. The relevant data is provided by FNGUIDE. Market efficiency is proxied by the following commonly known Amihud's illiquidity measure.

$$Illiquidity = \frac{|r|}{Dollar\ \ trading\ \ volume} \tag{1}$$

The volatility and return measures are based on the daily volatility and returns of the KOSPI 50 index, also provided by FNGUIDE. Short sales, Amihud’s illiquidity, and daily volatility are differenced for stationarity. According to the Augmented Dickey-Fuller (ADF) test, it is verified that there is no unit root in the data. Also, I run the Engle-Granger test to check whether there is cointegration between short sales and other market variables, and find there is no cointegration at the 5% significance level. I use the vector autoregressive model (VAR) to identify the effect of short sales on market efficiency, volatility, and price. More specifically, in the following section, I analyze the effect of short sales on market efficiency, volatility, and stock return, using the Granger causality test, impulse-response analysis, and variance decomposition of the following vector autoregressive model.

$$\left.\begin{aligned} SS_t &= \alpha_1 + \textstyle\sum_{j=1}^{L} \beta_{1j} SS_{t-j} + \sum_{j=1}^{L} \gamma_{1j} V_{t-j} \ \ + \varepsilon_{1t} \\ V_t &= \alpha_2 + \textstyle\sum_{j=1}^{L} \beta_{2j} SS_{t-j} + \sum_{j=1}^{L} \gamma_{2j} V_{t-j} \ \ + \varepsilon_{2t} \end{aligned}\right\} \tag{2}$$

where SS_t is the stadardized short selling and V_t is Amihud’s illiquidity, volatility, or return on day *t*, respectively.

3. Empirical Results

Table 1 shows the contemporaneous correlation coefficients of short selling, Amihud’s illiquidity measure, volatility, and return.

Table 1 Contemporaneous correlation of short selling, illiquidity, volatility, and return

This table presents the contemporaneous correlation between short selling and illiquidity, volatility, and return. ***, **, and * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

	short selling	illiquidity	volatility	return
short selling	1.000	-0.062***	-0.454***	-0.135***
illiquidity	-0.062***	1.000	0.196	-0.178
volatility	-0.454***	0.196***	1.000	0.046**
return	-0.135***	-0.178	0.046**	1.000

The contemporaneous correlation between short selling and illiquidity is -0.062, significant at the 1% level. This supports that short selling provides liquidity, which would in turn decrease transaction costs and improve market efficiency. In addition, short selling decreases volatility, with a correlation coefficient of -0.454, significant at the 1% level. The estimated value of correlation can be interpreted as evidence of short selling increasing market quality, enhancing market efficiency, and stabilizing volatility. The correlation between short selling and return is estimated to be -0.135 at the 1% significance level. It is very difficult to distinguish whether short selling leads to stock price decline or whether negative information in the stock market has triggered stock price fall and short selling simultaneously. If the market is efficient, negative information is likely to cause both short selling and stock price decline. Thus, from a dynamic point of view, we need to use a time-series analysis to more clearly identify the causal relationship between short selling and market efficiency, volatility, and stock price.

Table 2 Vector autoregressive regression estimation

This table presents the estimation results of the vector autoregressive regression of Equation (2). ***, **, and * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

Panel A							
dependent	inter	$illiq_{t-1}$	$illiq_{t-2}$	$illiq_{t-3}$	$short_{t-1}$	$short_{t-2}$	$short_{t-3}$
Amihud's illiquidity	26.588***	0.065***	0.141***	0.102***	-0.023**	0.005	-0.023**
	15.92	*3.23*	*7.06*	*5.14*	*-2.15*	*0.40*	*-2.22*
	33.901***	-0.031	-0.082**	-0.115***	0.493***	0.176***	0.151***
	10.71	*-0.81*	*-2.18*	*-3.05*	*24.71*	*7.97*	*7.54*
Panel B							
	inter	vol_{t-1}	vol_{t-2}	vol_{t-3}	$short_{t-1}$	$short_{t-2}$	$short_{t-3}$
volatility	51.291***	0.477***	0.164***	0.13***	-0.376	-1.294	1.578**
	11.52	*23.81*	*7.45*	*6.49*	*-0.48*	*-1.10*	*2.02*
	0.293***	-0.001	0.000	0.000	1.103***	0.070**	-0.174***
	2.59	*-1.43*	*-0.49*	*0.44*	*55.35*	*2.34*	*-8.75*
Panel C							
	inter	ret_{t-1}	ret_{t-2}	ret_{t-3}	$short_{t-1}$	$short_{t-2}$	$short_{t-3}$
return	0.137**	-0.009	-0.04**	-0.029	-0.437	-0.069	-0.217
	2.41	*-0.43*	*-1.97*	*-1.41*	*-0.93*	*-0.13*	*-0.46*
	0.026***	-0.001	0.002**	0.000	0.495***	0.184***	0.151***
	10.49	*-1.12*	*2.10*	*-0.39*	*24.57*	*8.27*	*7.51*

Table 2 presents the estimation results of the dynamic relationship between short sales and illiquidity, volatility, and return in Equation (2). Panel A shows that short selling has a statistically significant negative relationship with Amihud's illiquidity measure at the 5% level. The estimated coefficients of short sales with one- and three-day lags are -0.023 (t-value = -2.15) and -0.023 (t-value = -2.22), respectively. This result indicates that short selling may provide liquidity to the stock market and increase market efficiency. According to Panel B, short sales three days before (D-3) are positively correlated with volatility at the 5% level. The coefficient estimate of short sales is 1.578 (t-value = 2.02). In Panel C, short selling is not dynamically correlated with the index return at the 5% level. The coefficient estimates of short sales with one- to three-day lags are -0.437 (t-value = -0.93), -0.069 (t-value = -0.13), and -0.217 (t-value = -0.46), respectively, all of which are statistically insignificant at the 5% level.

Table 3 Granger causality test

This table presents the results of the Granger causality of Equation (2). The null hypothesis to test is H_0: $\beta_{21} = \beta_{22} = \cdots = \beta_{2L} = 0$ in equation (2).

Null hypothesis	Lag Length	F-statistics	p-value
Panel A			
	3	9.951	0.000
Short selling does not Granger Cause illiquidity	4	6.303	0.000
	5	4.051	0.001
Panel B			
	3	1.566	0.196
Short selling does not Granger Cause volatility	4	2.070	0.082
	5	1.096	0.361
Panel C			
	3	1.491	0.215
Short selling does not Granger Cause index return	4	2.113	0.077
	5	1.722	0.126

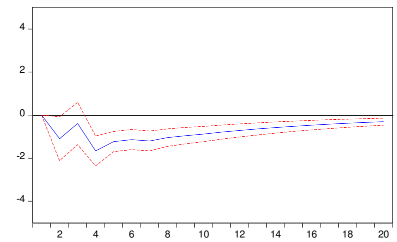
Table 3 displays the estimation results of the Granger causality test between short sales and illiquidity, volatility, and return in Equation (2). The lead-lag relation between short-selling activities and market efficiency is confirmed again from the Granger causality test in Panel A. Consistent with Panel A of Table 2, short sales Granger-cause illiquidity at the 1% significance level. On the other hand, Panel B shows that there is no Granger causality relation between short-selling activities and daily volatility. While an opposing result is found in Panel B of Table 2, it is unlikely that short selling will increase volatility based on the new evidence from the Granger causality test. According to Panel C, there is no lead-lag causality relation between short selling and stock prices as well.

Figure 1 depicts the estimation results of the impulse-response analysis between short selling and illiquidity, volatility, and return in Equation (2). The top three figures, A, B, and C, show that the market illiquidity measure responds negatively to the innovation of short selling from Day 2. As short selling increases, trading costs decrease. It can be inferred that there is a dynamic causality between short selling and market liquidity or market efficiency. On the other hand, the three figures in the middle, D, E, and F, display that short selling activities do not increase the volatility. In addition, according to the results of the impulse response analysis at the bottom of Figure 1, there is no statistically significant evidence that short selling leads to price movements.

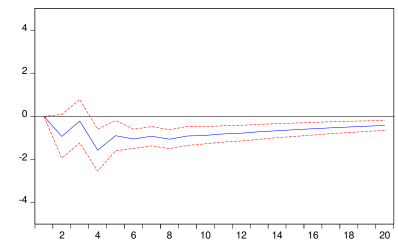
Figure 1 Impulse-Response analysis

This figure presents the results of the impulse-response analysis of Equation (2). The dotted lines indicate the confidence intervals at the 95% level.

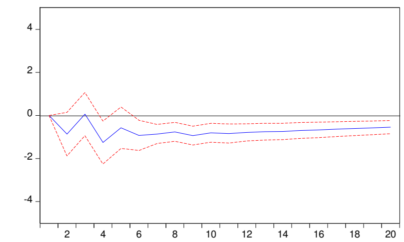
A. Response of illiquidity to short sale shock in lag3



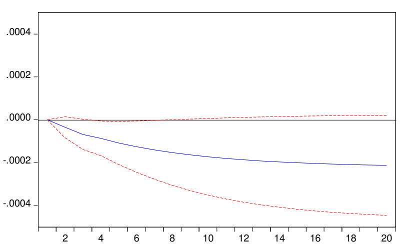
B. Response of illiquidity to short sale shock in lag4



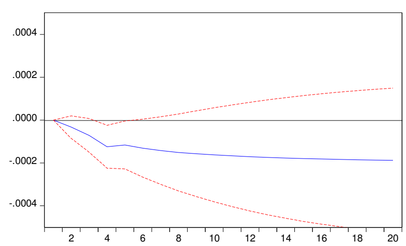
C. Response of illiquidity to short sale shock in lag5



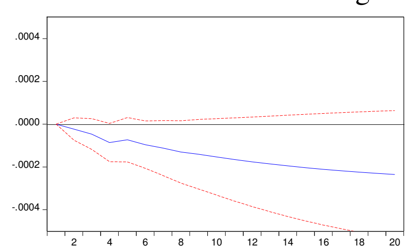
D. Response of volatility to short sale shock in lag3



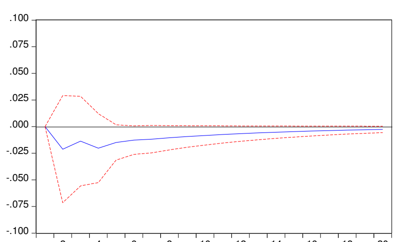
E. Response of volatility to short sale shock in lag4



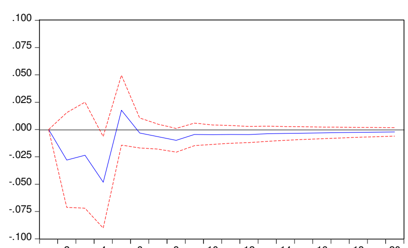
F. Response of volatility to short sale shock in lag5



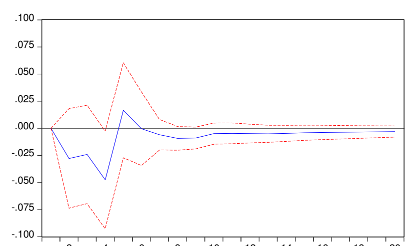
G. Response of return to short sale shock in lag3



H. Response of return to short sale shock in lag4



I. Response of return to short sale shock in lag5



This implies that short selling does not have a dynamic impact on price fundamentals, while it adds efficiency to the price discovery process. To sum up, short selling contributes to an improvement in market efficiency without a negative effect on volatility and price.

Table 4 Variance decomposition

This table presents the results of the variance decomposition of Equation (2).

	illiquidity		volatility		return	
day	short selling	illiquidity	short selling	volatility	short selling	return
1	0.760	99.240	0.924	99.076	0.000	100.000
2	0.894	99.106	0.689	99.311	0.034	99.966
3	0.877	99.123	0.514	99.486	0.048	99.952
4	1.145	98.855	0.410	99.590	0.080	99.920
5	1.332	98.668	0.333	99.667	0.097	99.903
6	1.489	98.511	0.275	99.725	0.109	99.891
7	1.675	98.325	0.231	99.769	0.119	99.881
8	1.819	98.181	0.198	99.802	0.128	99.872
9	1.940	98.060	0.174	99.826	0.134	99.866
10	2.043	97.957	0.155	99.845	0.140	99.860

Table 4 shows the results of variance decomposition as evidence of how illiquidity, volatility, and return can be explained by short sales. This analysis determines the relative importance of short sale shocks for market efficiency, volatility, and price movements. According to Table 4, the relative importance of short sales for market efficiency is 2.04% after 10 days. On the other hand, in the case of volatility and price, the relative importance of short selling after 10 days is 0.155% and 0.140%, respectively. This indicates that the relative importance of short selling for volatility and price change is not as large as for market efficiency.

4. Discussion and Conclusion

This study analyzes the effect of short sales on market efficiency, volatility, and price using a time series analysis from the dynamic point of view. Short selling is crucial for achieving market efficiency as negative information can be quickly reflected in prices through transactions. Nevertheless, there has been some criticism of the system because short selling is claimed to increase market volatility and increase the risk of price falls. The information asymmetry between institutional investors and private investors makes this more serious. In order to verify the effect of short selling on market efficiency, volatility, and price, this study employs the Granger's causality test, impulse response analysis, and variance decomposition using a vector autoregressive model. According to the empirical tests, short selling improves market efficiency by decreasing trading costs. On the other hand, short sales do not have a statistically significant effect on volatility and prices. This study verifies that short selling activities have a positive role in improving market quality without increasing volatility or decreasing prices on average.

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