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A Study on Reversals after Stock Price Shock in the Korean Distribution Industry*

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Abstract

Purpose: The purpose of this paper is to confirm whether stocks belonging to the distribution industry in Korea have reversals, following large daily stock price changes accompanied by large trading volumes. **Research design, data, and methodology:** We examined whether there were reversals after the event date when large-scale stock price changes appeared for the entire sample of distribution-related companies listed on the Korea Composite Stock Price Index from January 2004 to July 2022. In addition, we reviewed whether the reversals differed depending on abnormal trading volume on the event date. Using multiple regression analysis, we tested whether high trading volume had a significant effect on the cumulative rate of return after the event date. **Results:** Reversals were confirmed after the stock price shock in the Korean distribution industry and the return after the event date varied depending on the size of the trading volume on the event day. In addition, even after considering both company-specific and event-specific factors, the trading volume on the event day was found to have significant explanatory power on the cumulative rate of return after the event date. **Conclusions:** Reversals identified in this paper can be used as a useful tool for establishing a trading strategy.

Keywords: Reversals, Large-Price Change, Large-Trading Volume, Overreaction, Drifts

JEL Classification Code: G11, G12, G40, C30.

1. Introduction

This paper examines whether there are reversals after large stock price changes of distribution-related stocks in the Korea Composite Stock Price Index (KOSPI) market. We examined the variation in the stock price return after the event date, depending on the trading volume on that day. In addition, through multiple regression analysis, we examined whether abnormal trading volume on the event day had a significant influence on the reversals of stock return. This work is to identify how investors react to the shock of the event day and to find out how the reaction affects stock returns after that day. If the effect of the abnormal trading volume on the rate of return after the event day is confirmed, this has an important meaning in predicting the stock price after the event day. If stock prices can be predicted in this way, the efficient market hypothesis can be rejected. Our study will be able to provide very useful material from the perspective of investment strategy. Large-scale stock price change is an event which can be sufficiently observed *ex*

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post facto. If you only observe the event date, it will be possible to establish an investment strategy using the systematic pattern of stock returns after that date. However, more sophisticated confirmation will be needed later to justify if such an investment strategy provided economically meaningful returns even after deducting transaction costs (Lehmann, 1990).

In this paper, we simply assumed that the degree of investor response to the shock was proportional to the trading volume (Barron et al., 2005). According to this assumption, when investors overreact to a shock, the trading volume is high and if they underreact, the trading volume is low. If the trading volume is abnormally high(low) on the day of the large stock price change, it will be seen as the result of the investors' overreaction (underreaction) (Zarown, 1989).

If an overreaction (underreaction) occurs, the stock price would have changed more(less) than appropriate. As a result, it can be expected that there will be stock price reversals (drifts) in which the stock prices would gradually converge toward an appropriate level after the event date. Accordingly, the short-term cumulative rate of return after the event date will appear in the opposite(same) direction to the stock return on the event date (Bremer & Sweeney, 1997).

In general, large-scale stock price changes are believed to occur due to the disclosure of related information (Kim & Verrecchia, 1997). Existing literature also considers the role of disclosed information important in determining the short-term return patterns after the event date. For example, in the case of Savor (2012), it was reported that the stock price change accompanied by information disclosure mainly showed stock return drifts after the event date, and the stock price change without information disclosure mainly showed stock return reversals after the event date. According to Savor (2012), investors underreacted to the event when information disclosure occurred. Conversely, investors overreact to shocks other than information disclosure, including changes in investor sentiment or general liquidity shocks.

In addition, according to Savor (2012), almost 80% of large-scale price shock events did not involve information disclosure. In Korea's distribution industry, the abnormally large trading volume on the event day has a clear effect on the reversals of the stock returns after the event date. Therefore, high trading volume can be regarded as a kind of overreaction by investors following shocks other than information disclosure. Considering these points, it was noted that the abnormally large trading volume on the day of the event served as a proxy variable for shocks other than information disclosure. However, the abnormally small trading volume on the event date did not have a clear effect on the drifts of the stock returns after the event day. Therefore, it is unreasonable to consider a small transaction volume as a proxy variable for information disclosure. These findings partially explain why significant reversals dominate and drifts are less significant in the case of large-scale price changes of stocks belonging to the distribution industry in Korea.

It is very difficult for investors to predict changes in investor sentiment or general liquidity shocks in advance. Therefore, it is almost impossible to predict the large stock price change caused by these shocks in advance. However, it is easy to check whether the large stock price changes that have already occurred are accompanied by abnormal trading volume. Based on this information, an investment strategy that takes advantage of the systematic pattern of stock returns since the event date can be formulated. In that case, you will be able to achieve excess returns which will beat the market.

Stock prices and trading volume data of distribution-related companies listed on the KOSPI market from January 2004 to July 2022 were used in this paper. Significant reversals of the returns were found when examining the cumulative returns 5 and 20 days after the event date. A significant negative(positive) cumulative return appeared after a large-scale rise(fall) in stock price. When high trading volume occurred on a day when the stock price rose on a large scale, a significant negative rate of return was shown for 5 days after the event date. Strong reversals were demonstrated. On the other hand, when the high trading volume occurred on the day when the stock price declined on a large scale, insignificant drifts were found. Finally, the estimated coefficient of the abnormal trading volume on the event day showed a significant value. It was found that the abnormal trading volume on the event date had a significant explanatory power for the *ex-post* returns even after considering the company-specific and event-specific factors. Combining all these test results, it was found that the trading volume had overall significant explanatory power for the cumulative returns after the event date.

Kudryavtsev (2019) can be cited as an example of a study since he applied a methodology similar to this paper. Through a sample of individual stocks within the S&P500 index, he uncovered the effect of trading volume on the event day on stock returns after the event day. In his study, both the stock price drifts and reversals were found to be consistent and significant. This paper is different from his research since the stock price reversals were found to be consistent.

Section 2 of this paper reviews the literature on stock trading volume and literature dealing with large-scale stock price change and subsequent stock return patterns. Section 3 defines the research hypothesis. Section 4 presents the data and research methodology. Section 5 presents the results of the empirical analysis. Section 6 summarizes the results and presents a brief discussion.

2. Literature Review

Studies have been conducted in three major directions regarding the predictability of stock prices after large-scale stock price changes. These include the efficient market hypothesis, the overreaction hypothesis, and the underreaction hypothesis. First, Lehmann (1990) and Cox and Peterson (1994) presented findings on efficient market hypothesis. They concluded that once bid-ask spreads and transaction costs are taken into account, the profitability of the strategies based on price reversals is unlikely to beat the market. Studies supporting the overreaction hypothesis are based on the availability heuristics of Tversky and Kahneman (1973) and consider that the profitability of the strategies based on price reversals exists. Related studies include Zarowin (1989) and Bremer and Sweeney (1997). They reported that the abnormal returns of the strategies based on price reversals do not disappear even when transaction costs or bid-ask spreads are taken into account. Next, there is a perspective that stock price drifts mainly occur after the event date due to investors' underactivity. Schnusenberg and Madura (2001) and Lasfer et al. (2003) represented this position. They demonstrated significant drifts mainly by using the stock index. Regarding the predictability of stock prices after large-scale stock price changes, empirical analyses suggested various outcomes. Therefore, so far, there is no consensus regarding the predictability of stock prices after large-scale stock price changes.

On the other hand, in this paper, the main analysis target is the trading volume on the event day when large-scale daily stock price changes occurred. We suggested that there was a possibility that the trading volume on the date of the event could contain information about the stock price after the date of the event. Kim and Verrecchia (1997), through a theoretical model, showed the increase in trading volume due to information asymmetry. Barron et al. (2005) empirically showed the increase in trading volume due to information asymmetry. In addition, Harris and Raviv (1993), Kandel and Pearson (1995) suggested a model in which trading volume increased when there was a difference in interpretation even if investors had the same information. Against this background, Kudryavtsev (2019) particularly emphasized the information effect of the trading volume that occurred simultaneously with large-scale stock price changes. He empirically demonstrated, using individual stock data included in the S&P500 index, that an abnormally high trading volume on the event day caused reversals. He also showed that abnormally low trading volume on the event day created drifts after the event day. This paper also applied his analysis to stocks related to Korea's distribution industry.

3. Research Hypothesis

As demonstrated in previous studies, there is a close correlation between stock price and trading volume. This paper simplifies these relationships while considering the case where trading volume increased excessively in response to the shock of the event day. Such high trading volume could be used to indicate that a company-specific shock was completely or excessively reflected in the stock price. If there was an excessive increase in the trading volume on the day of the event, the extent to which investors reflected information about the shock in the stock price would be excessive, this is referred to as overreaction. After investors overreacted, the stock price would have a reversal. A reversal refers to the process by which the price of a stock that has moved away from its basic value converges back to its basic value after the event date.

Conversely, considering that large daily price changes were accompanied by unusually low trading volumes. Such low volume would be a sign that information about the shock was insufficiently reflected in the stock price. If the trading volume was very small on the day of the event, the extent to which investors reflected the information in the stock price would be seen as too low. This is called an underreaction. Following investors' underreaction, drift would have appeared. Drift refers to the process by which a stock price continues to converge to its basic value after the event date. Based on the discussion so far, the research hypothesis of this paper was set as follows:

H1: Abnormally high trading volume on the event day will significantly explain the cumulative return that moves in the opposite direction to the stock price on the event day (reversals) after the event day.

H2: Abnormally low trading volume on the event day will significantly explain the cumulative return that moves in the same direction as the stock price on the event day.

4. Data Description and Research Design

The research data used in this paper is the price and trading volume of distribution industry-related stocks registered in the KOSPI market from January 2004 to July 2022. These data were obtained from the FnGuide database. Daily simple returns and daily abnormal returns were used as proxy variables for large-scale daily stock price changes. Concrete definitions of these proxy variables are described below.

Table 1: Descriptive Statistics for the Firms Making up the Sample and Their Stocks

Proxy/ Threshold	Number of large price moves	Market capitalization, (100 million KRW)		Cumulative return over one year preceding the large price move, %		St.Dev.of historical stock returns, %	
		Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.
DSR : $\mid SR0_i \mid > 10\%$	10,692						
Price increases	7,317	42,700	138,000	30.28	58.62	3.84	1.32
Price decreases	3,375	45,100	167,200	15.86	65.61	3.97	1.36
DAR : $\mid AR0_i \mid > 10\%$	10,455						
Price increases	7,173	42,073	137,000	23.87	58.41	3.84	1.32
Price decreases	3,282	44,600	167,000	21.87	65.18	3.98	1.36

Daily Simple Return (DSR): $|DSR0_0| > 10\%$. A daily simple return with an absolute value greater than 10%. $DSR0_0$ represents the stock return on the event day (day 0) of the i-th event. For reference, the 10% threshold is considered to reflect significant changes, such as, substantial changes in fundamentals or investor sentiment. Price changes due to other insignificant shocks are considered to be within 10% of price changes.

Daily Abnormal Return (DAR): $|DAR0_0| > 10\%$. A daily abnormal return with an absolute value greater than 10%. $DAR0_0$ represents the market model adjusted return (MMAR) on the event day of the i-th event. In this case, beta is measured with data from 250 days prior to the event date.

In order to calculate the abnormal return DAR on the event day of the i-th event, an equation that regresses the stock return for 250 days preceding the event date to the market return for the same period must be estimated. The regression equation is in the form of ($SR = \alpha_i + \beta_i MR + \epsilon_i$), and the regression coefficients to be estimated in this equation are $\hat{\alpha}$ and $\hat{\beta}$. Using this regression coefficient and the stock return and market return on the event date of the i-th event, $DAR0_0$ can be calculated as follows:

$$DAR0_i = DSR0_i - [\hat{\alpha} + \hat{\beta} MR0_i] \quad (1).$$

The cumulative return after the event date, CAR_i, is calculated by accumulating the rate of return for each day after the event date according to the size of the window. We will use CAR_i, as an explanatory variable in multiple regression analysis.

Meanwhile, the principle of event sampling was described as follows:

Firstly, 250 trading days prior to the incident date must be secured and a margin of 20 days after the event date must remain.

Secondly, market capitalization information should be available for each stock.

Table 1 shows the number of samples and basic statistics for each proxy variable constructed according to these sampling principles.

In order to test the research hypothesis, in addition to the large-scale daily price change proxy variables, additional proxy variable for the abnormal trading volume on the event day were needed for each event. $ATV0_i$ is defined as a proxy variable for abnormal trading volume. $ATV0_i$ is a value standardized by dividing the difference between the trading volume on day-0 and the average trading volume for the previous 250 days by the standard deviation of the trading volume during the same period.

$$ATV0_i = \frac{Vol0_i - AvVol(-250,-1)}{StDevVol(-250,-1)} \quad (2).$$

Table 2: The Basic Descriptive Statistics of ATV0 Measurements.

Statistical measure	Value
Mean	4.73
Median	1.96
Standard deviation	20.23
Maximum	1378.33
Minimum	-21.18
1st decile	-0.388
1st quintile	-0.166
5th quintile	16.99
10th decile	26.35

In equation (2), $ATV0_i$ represents the abnormal stock trading volume on the event day of the i-th event. $AvVol(-250,-1)$ represents the average trading volume for 250 days prior to the event date, and $StDevVol(-250,-1)$ represents the standard deviation of the trading volume during the same period. Table 2 shows the basic statistics of $ATV0_i$

As it might be expected, the abnormal stock trading volume on the event day was positively greater than the average. The average value of $ATV0_i$ was 4.73. Also, the range of abnormal trading volume was widely distributed. The minimum and maximum values were -21.18 and

1378.33, respectively, highlighting that the degree of immediate reaction of investors to company-specific events was very different from underreaction to overreaction.

5. Results and Discussion

5.1. *Ex Post* Stock Returns: Total Sample

First, let's look at the stock return after the event date for the entire sample in which a large price change occurred. According to the thresholds of the two proxy variables defined above, the cumulative returns after the event date of the two samples and their statistical significance are shown in Table 3. The window of cumulative excess return was set on the 1st day, 1st to 2nd day, 1st to 5th day, and 1st to 20th day after the event date.

Drifts in the stock price appeared in the abnormal return of the 1st day and cumulative return on the 1st to 2nd day after the event date when the large stock price increased. However, it was confirmed that there was a significant price reversal phenomenon from the 1st to the 5th day and from 1st day to the 20th day. On the 1st day after the event date of the large-scale price decline, stock price drifts occurred. However, from the 1st day to the 5th day, there was a significant price reversal phenomenon. From the 1st to the 20th, stock price drifts appeared again. These results are similar to those of Kudryavtsev (2019) but show some differences. He used the S&P500 data to show stock price reversals. According to his research results, an average stock price decline occurred after a large stock price rise and an average stock price rise occurred after a large stock price decline. Although there are small differences, these results are generally similar to those in the distribution industry sample in Korea.

Table 3: Abnormal Stock Returns Following Large Stock Price Increases and Decreases: Total Sample.

Panel A:Large stock price increases		
Days relative to event	Average AR/Cumulative ARs following initial price changes	
	|SR0i|>10%	|AR0i|>10%
	(7,317 events)	(7,173 events)
1	0.916***	0.953***
	(0.0955)	(0.0967)
2	0.0344	0.0248
	(0.0816)	(0.0829)
1 to 5	-0.372***	-0.374***
	(0.0995)	(0.101)
1 to 20	-0.227***	-0.217***
	(0.0777)	(0.0789)

Panel B:Large stock price decreases		
Days relative to event	Average AR/Cumulative ARs following initial price changes	
	|SR0i|>10%	|AR0i|>10%
	(3,375 events)	(3,282 events)
1	-0.716***	-0.717***
	(0.121)	(0.123)
2	0.0181	0.0379
	(0.106)	(0.108)
1 to 5	0.779***	0.762***
	(0.141)	(0.143)
1 to 20	-0.339***	-0.341***
	(0.109)	(0.111)

Robust standard errors in parentheses ***p<0.01, **p<0.05, *p<0.1

5.2. Effect of Abnormal Trading Volume

In order to confirm the effect of abnormal trading volume on the event day on large-scale price fluctuations, a subsample of events with 1st and 5th quintile trading volume was set. As a result of sampling for each proxy variable, there was no significant difference in the effect of abnormal trading volume on the cumulative returns after a large-scale price change event. Therefore, in this section, we analyzed only the event samples made with Proxy B as a proxy variable representing the impact on large-scale price changes.

As shown in Table 4, when the price increased, most of the price drifts were showing low abnormal trading volumes, except for the price reversals of the 20-day window. Similarly, for high abnormal transaction volumes, most of the price drifts were shown, except for the price reversals of the 5-day window. In case of a decrease in price, the price reversals appeared although they were not significant in all windows, except for the 1st day for the low abnormal trading volume. In addition, for high trading volume, the price drifts appeared in all windows.

In the case of Korea's distribution industry, unlike Kudryavtsev (2019), it was observed that there were no consistent reversals for high transaction volumes. However, the reversals appeared only in some windows when the price increased. When an abnormally high trading volume occurred on the day of a large-scale price change, investors in the distribution industry in Korea did not consistently overreact. As a result, the price reversals did not appear dominant in all windows. However, it was confirmed that strong price reversals appeared in some windows. Therefore, Hypothesis 1 was generally rejected, but only limitedly accepted for some windows.

In addition, when an abnormally low trading volume occurred on the day of a large-scale price change, investors in the distribution industry in Korea did not consistently underreact. Accordingly, the price drifts did not appear dominant in this case. However, the price drifts were found to be significant for some windows. Based on this, Hypothesis 2 was generally rejected, but it was limitedly adopted for some windows.

Table 4: Abnormal Stock Returns Following Large Stock Price Moves Accompanied by Low and High ATV0: Proxy B for Defining Large Price Moves.

Panel A: Large stock price increases			
Days relative to event	Average AR/Cumulative ARs following initial price changes		
	|AR0i|>10%		
	Low ATV0	High ATV0	Difference
1	2.137***	0.444*	1.69
	(0.219)	(0.234)	
2	0.460**	0.0326	0.43
	(0.187)	(0.203)	
1 to 5	0.255	-0.643***	0.90
	(0.242)	(0.223)	
1 to 20	-0.320*	0.126	-0.45
	(0.180)	(0.169)	
Panel B: Large stock price decreases			
Days relative to event	Average AR/Cumulative ARs following initial price changes		
	|AR0i|>10%		
	Low ATV0	High ATV0	Difference
1	-0.508*	-1.203***	0.70
	(0.291)	(0.274)	
2	0.399*	-0.682***	1.08
	(0.238)	(0.246)	
1 to 5	0.747**	-0.0652	0.81
	(0.326)	(0.312)	
1 to 20	0.00916	-0.185	0.19
	(0.260)	(0.221)	

Robust standard errors in parentheses ***p<0.01, **p<0.05, *p<0.1

5.3. Multifactor Analysis

In the previous section, we looked at the effect of abnormal trading volume on the event date on the average cumulative return after the event date. In this section, we tested whether the cumulative rate of return after the event date showed a significant abnormal rate of return even after considering company-specific and event-specific factors. The explanatory variable in this section is the cumulative abnormal rate of return from the 1st to the 5th day after the event date. The regression analysis equation to test the stock price reversals with trading volume is as follows:

$$CAR = \beta_0 + \beta_1 ATV0_i + \beta_2 MCap_i + \beta_3 Mbeta_i + \beta_4 SRVolat_i + \beta_5 |SR0|_i + \varepsilon_i \qquad (3).$$

In this equation, CAR represents the abnormal cumulative rate of return from the 1st to the 5th day after the event date. $ATV0$ is the abnormal stock trading volume calculated by Equation (2). $Mcap_i$ is the natural logarithm of the market capitalization of the company in the i-th event. $Mbeta_i$ is the CAPM beta of the company corresponding to the i-th event, and is the normalized value in the cross-section of the beta value calculated for the period of one year prior to the event date. $SRVolat_i$ is the normalized value in the cross-section of the standard deviation of the stock return for the year before the event date corresponding to the i-th event. $|SR0|_i$ is the absolute value of the stock return corresponding to the i-th event.

As presented in Table 5, when the stock price increased on the event day, both Proxy A and Proxy B showed coefficient estimates with very high statistical significance. The value represented a negative value, supporting the reversals of the trading volume. On the other hand, when the stock price decreased on the event day, the statistical significance of the coefficient estimate of $ATV0$ was somewhat lower, but the value showed a positive value. This also supported the reversal effect of trading volume.

As a result, in the case of Korea's distribution industry-related stocks, there was consistency in the trading volume reversal effect for the cumulative returns for 5 days after the event date. Clues to this trading volume reversal effect have already been partially presented in Table 4. In the case of a large price increase accompanied by a high abnormal increase in trading volume on the event date, a stock price reversal effect has been observed in some windows after the event date. However, even after considering company-specific ($Mcap, Mbeta, SRVolat$) and event-specific factors ($|SR0|$), it was confirmed that the additional explanation of the abnormal transaction volume for the abnormal cumulative rate of return appeared clearly. As a result, Hypothesis 1 was adopted in the case of sticks related to the Korean distribution industry as in the US market.

Table 5: Multifactor Regression Analysis of ARs/CARs Following Large Stock Price Increases and Decreases: Dependent Variable – Stock AR for Day 1 to 5 Following the Event and ATV0 Includes Lowest and Highest Quintile Classes.

Panel A: Large stock price increases		
Explanatory variables	Coefficient estimates, %(2-tailed p-values)	
	|SR0i|>10% (3,157events)	|AR0i|>10% (3,057events)
Intercept	0.00916	-0.185
	(0.260)	(0.221)
ATV0	-0.0134***	-0.0138***
	(0.00239)	(0.00248)
MCap	-0.186**	-0.195***
	(0.0742)	(0.0758)

Beta	0.695***	0.668**
	(0.268)	(0.273)
SRVolat	-0.322***	-0.334***
	(0.0879)	(0.0888)
|SR0|	-0.0609**	-0.0476*
	(0.0252)	(0.0257)
Panel B:Large stock price decreases		
Explanatory variables	**Coefficie nt estimates, %(2-tailed p-values)**	
	|SR0i|>10% (1,817events)	**|AR0i|>10% (1,820events)**
Intercept	-2.231**	-2.247**
	(0.971)	(0.965)
ATV0	0.0122*	0.0118*
	(0.0216)	(0.0214)
MCap	-4.530***	-4.642***
	(1.004)	(0.998)
Beta	6.632***	6.108***
	(1.151)	(1.091)
SRVolat	-6.642***	-6.412***
	(0.933)	(0.942)
|SR0|	0.245***	0.278***
	(0.0581)	(0.0596)

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6. Conclusions

In this study, we intensively examined whether the abnormal trading volume accompanying a large-scale stock price change event brought about stock price reversal, targeting distribution-related stocks in the Korean stock market. According to previous studies, it is known that the abnormal trading volume on the event day can serve as an indicator of the degree of stock price response to fundamental company-specific shocks. According to this discussion, rapid stock price changes accompanied by relatively large abnormal trading volumes were interpreted as stock prices overreacting to the shocks of each company, and accordingly, stock price reversals were expected to appear after the event date. Conversely, changes in stock prices accompanied by relatively small trading volume were interpreted as an underreaction of stock prices to company-specific shocks, and accordingly, stock price drifts were expected to appear after the event date.

Firstly, this paper reported whether there is a reversal effect on the stock price after the event date of large-scale stock price fluctuations for the entire sample and further confirmed a significant reversal effect. Next, this paper examines whether there was a reversal effect after the event date for abnormally high trading volume on the event date. As a result, a significant and strong reversal effect was confirmed in the cumulative return for 5 days after the stock price rise event. However, after the stock price fell, the residual effect was more dominant than the reversal effect. Finally, this paper confirmed that a significant reversal effect appeared on the coefficient estimate of abnormal trading volume in the multiple regression analysis considering company-specific and event-specific factors. Combining all these findings, it was observed that the trading volume had a significant influence on the cumulative return of a specific window (5-day cumulative return) after the event date to have a reversal effect.

Based on the stock price reversal effect of the trading volume confirmed in this paper, it is possible to establish a kind of reversal effect trading strategy in the case of large stocks related to the Korean distribution industry. As a future research direction, it is necessary to expand the analysis target to include small-cap stocks among distribution industry-related stocks. In addition, it is necessary to confirm whether the trading strategy using the trading volume on the event day is profitable, considering the bid-ask bounce, market liquidity, and transaction costs.

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