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Large changes in stock prices: Market, liquidity, and momentum effect

Shwu-Jane Shieh[a], Chih-Yung Lin[b,*], Po-Hsin Ho[c]

[a] Dept. of International Business, National Chengchi University, Taiwan
[b] Department of Finance, National Taichung University of Science and Technology, Taiwan
[c] Department of Finance, National United University, Taiwan

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ABSTRACT

This article investigates the determinants of large changes in stock prices. Empirical evidences suggest that the asymmetry phenomenon in determinants of large changes in stock prices is found in three stock exchanges. In the New York Stock Exchange (NYSE), momentum effect accounts for most of the likelihood of big gains in stock prices, while liquidity characteristics account for sharp declines of stock prices. An interesting finding is that the opposite is true for stocks traded in Amex and NASDAQ. The possible explanations of the different results in different stock exchanges may attribute to the characteristics of firms listed in these stock exchanges are different.

1. Introduction

Patterns of large changes in stock prices provide information on big movements in stock returns, which can then be used to identify risk factors that affect extreme expected returns of stocks. Occasionally, stock prices may be volatile, gaining or losing more than 10% on a daily basis. Large changes in returns convey information on the force that drives stock prices up or pulls it down. The probability of stock prices to move upward or downward in large percentages in the next period could help identify the risk factors explaining such expected return, but this topic has not received much attention in existing literature. Hence, we investigate the recurrence of the event wherein volatility of a stock price reaches more than 10% in a given trading day using five characteristics suggested in existing works. In doing so, we examine whether these variables are the determinants of large price changes.[1]

The determinants of expected returns of stocks have been well established in the field of finance research. Using empirical studies, as documented in extensive literature, scholars have already proven that many determinants well explain stock returns. In particular, starting with the pioneering work of Fama and French (1993), who constructed a three-factor model to explain expected returns, other risk factors were similarly documented in existing work, notably, on market returns by Sharpe (1964), Lintner (1965), Black (1972), and Fama and French (1993); size of a firm by Banz (1981), Roll (1981), Chan and Chen (1991), and Fama and French (1993); book-to-market ratios by Rosenberg, Kenneth, & Ronald (1985), Lakonishok, Andrei, & Robert (1994), and Fama and French (1993, 2008); past short-term returns by Jegadeesh and Titman (1993), Chan, Jegadeesh, & Lakonishok (1996); and turnover rates by Datar, Naik, & Radcliffe (1998). However, contrary to the risk-based factor model of Fama and French (1993), Daniel and Titman (1997) provide evidence that characteristics rather than factor loadings appear to determine the cross-sectional variation in stock returns. Furthermore, Avramov and Chorida (2006) argue that the predictive power of size, book-to-market ratio, turnover, and past returns are unexplained by the Fama–French model with constant risk and expected returns. Therefore, following this line of literature, we use five characteristics (one market-level and four firm-level variables), including market return, size, book-to-market ratio, lagged returns, and turnover, to explain large changes in stock returns.

* Corresponding author at: Department of Finance, National Taichung University of Science and Technology, Taichung, Taiwan, ROC.
E-mail addresses: sjshie@nccu.edu.tw (S.-J. Shieh), d95723009@ntu.edu.tw (C.-Y. Lin), d95723002@ntu.edu.tw (P.-H. Ho).

[1] We focus on this topic not because a change in stock price of more than 10% provides more information on expected returns than a change of less than 10% does, but because the large changes provide more information on extreme expected returns.

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Most traditional empirical studies in the field of finance generally utilize the Logit or Probit regression to explore the determinants of financial events (i.e., IPO, SEO, share repurchase). However, these methods cannot handle the event-correlated dependence problem. The occurrence of prior events thus may influence the likelihood of events in latter periods. If the data are subjected to event-correlated dependence, traditional Logit or Probit regression models may yield biased results. Hence, we take another approach that has been used in many other fields of research[2], namely, recurrent-event data analysis. This technique has some advantages. First, when analyzing why a stock price of a firm is volatile by more than 10%, recurrent-event data analysis incorporates historical data from numerous events rather than from a single event alone. Next, recurrent-event data analysis deals with event-correlated dependence (nonlinear dependence) and heterogeneity among individual firms via the frailty effect or robust variance. Finally, recurrent-event data analysis allows the study of collective market effects by examining hazard rates estimated from explanatory variables of individual firms.

This study investigates the entire sample of firms in NYSE, Amex, and NASDAQ whose stock prices rose or dropped by more than 10%, 15%, 17.5%, and 20%[3] in a trading day during the past 13 years, and uses five variables as covariates. Since empirical results are profound in many aspects, we first present the results involving big gains in stock prices. While we examine sharp increases in stock prices, we observe that all five characteristics are significantly related to the likelihood of the events of price gains of over 10%, 15%, 17.5%, and 20%. Among these characteristics, market characteristic is the most important variable explaining the probability of a stock price to rise by more than 10%. However, for stock price increases of more than 15%, 17.5%, and 20%, we find liquidity characteristic to become the most important variable, implying that it is a good strategy for investors to chase a stock whose price rises by more than 15% a day if the big gain in stock price is accompanied by an increase in turnover rate.

Furthermore, size characteristic is positively related to the possibility of price increases of over 10%. To our surprise, estimates for the size characteristic are no longer positively related to the likelihood that prices will rise by more than 15%, 17.5%, and 20%. Moreover, size characteristic is significantly negatively related to the possibility of events in such cases, indicating that it is more unlikely for a stock price of a large firm to move upward by more than 15%, 17.5%, and 20% daily, with or without frailty effects.[4] The momentum effect for large changes in stock prices holds until the stock prices rise by more than 15% on a daily basis. The momentum effect is relieved when stock prices rise by more than 17.5%, and this also is true for a price increase of 20%, without the frailty effect. This finding implies that the probability of a stock price to keep rising in a trading day after a 17.5% gain is low. We do observe, however, that the momentum effect stays for all levels of stock price changes if frailty effects are taken into account. The book-to-market characteristic, which can be seen as a value/growth indicator, is always positively related to the probability of the occurring events, indicating significant but minor effects.

The empirical evidence obtained for the events of collapse of stock prices gives us a totally different story. First, the most important characteristic switches from the liquidity variable to the momentum effect. The probability of a firm's stock price to drop by more than 10%, 15%, 17.5%, and 20% is positively related to momentum effect, with or without frailty effect, indicating the higher likelihood of a sharp decline in stock prices if stock returns from the previous trading day is positive; that is, a sharp decline in stock prices is likely to happen as a surprise to investors since returns in the preceding day are positive.

Without considering the frailty effect, book-to-market ratio no longer has an effect on the probability of big declines in stock prices. Similarly, even when frailty effect is considered, signs for the estimates for the book-to-market ratio are always negative, in contrast to the case of increasing stock prices. Market characteristics only affect stock prices that drop by more than 17.5% and 20%, but not those that drop by 10% and 15%. This implies that the market characteristic is likely to affect stock price of a firm while it declines by more than 17.5% and 20%.

The asymmetry effects arising from the likelihood of stock prices moving up or down are very important in identifying firms' risk, which affects the likelihood of a large change in stock prices at different aspects. To disentangle the effects across different trading markets, we provide estimates for the stocks in three different stock exchanges, namely, NYSE, Amex, and NASDAQ. It is interesting to compare the results from NYSE with those from NASDAQ since most of the NYSE constituents are large firms in traditional industries, but most of the firms in NASDAQ are middle or small firms in high-tech industries. The most important variable explaining the likelihood of a firm's stock price in NYSE to increase sharply is the momentum effect, rather than market characteristic and liquidity that mostly influence big gains in stock prices for firms in NASDAQ. Such results shed some light on the fact that it is likely for the high-tech firms to drop with the market at 10% and keep declining if its turnover rate gets higher. As for NYSE firms, if stock returns from the preceding day are positive, the stock prices for the next day are likely to have a big gain. Our empirical results are similar to those of Nguyen, Fetherston, and Batten (2004) only in certain aspects. They confirm the difference of the relationship between size, book-to-market ratio, beta, and stock returns in information technology stocks versus other non-financial stocks.

Finally, evidence of estimations on hazard functions reveals that a sharp increase in stock prices is more likely to happen near the end of a bear market, and a sharp decline in stock prices is more likely to occur in a bull market. This phenomenon is usually observed in practice: During the bear market, the trend of the stock price gradually decreases with some occasionally big gains in stock prices.

The remainder of this article is organized as follows. Section 2 describes the methodology; Section 3 presents the empirical results; and Section 4 provides the conclusions.

2. Methodology

In the article, we utilize the recurrent event data analysis as an estimating tool for our empirical study. Research interests in this type of data often include studying whether these recurrent events are affected by covariates measured for each firm during follow-up, and when estimating the possibility of event recurrences. Originally, this class of models is applied extensively in biomedicine, public health, and clinical trials settings, and for the estimation of survival probabilities based on historical data. Financial researchers likewise utilize this model in predicting financial distress.

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[3] We only present these percentages because of representativeness and completeness. The observations of large changes of more than 20% are rare in our sample. For example, there are only 2574 and 1745 events wherein the stock price increased and declined by more than 25%. These account for only 0.0496% and 0.0336% of all our observations (1586 firms × 3273 days = 5,190,978 observations). Therefore, we adopt 10%, 15%, 17.5%, and 20% changes as the cutoff points.

[4] The frailty effect is regarded as the effect that comes from unobservable variables. The model with frailty effect is defined later.