Individual Investor Sentiment and IPO Stock Returns: Evidence from the Korean Stock Market

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Abstract

This paper examines the impact of individual investors' pre-market and aftermarket sentiment on initial public offering (IPO) stock returns, based on 382 IPO firms in the Korean stock market from 2007 to 2014. The results indicate that individual investors' pre-market sentiment is significantly and positively related to the initial returns initial returns, as measured by the difference between the offer price and the first-day opening price. The findings also indicate that individual investors' pre-market sentiment is positively associated with their aftermarket sentiment, implying a spillover effect from pre-market to aftermarket sentiment. However, after high initial returns in IPO firms with individual investors' high pre-market sentiment, we find subsequent underperformance; this is more pronounced in firms with high pre-market and aftermarket sentiment. Overall, our results imply that individual investors' pre-market sentiment can largely explain IPO stocks' high initial returns. Additionally, pre-market sentiment followed by aftermarket sentiment can account for IPO stocks' underperformance. Nevertheless, the impact of individual investor sentiment on IPO stock returns seems to be a short-term phenomenon, as high initial returns and subsequent underperformance are more pronounced within the first month from the IPO.

Keywords: Individual Investor; Pre-market Sentiment; Aftermarket Sentiment; IPO Stock Returns; Korean Stock Market

JEL Classification: G14, G15, G30

1. Introduction

Substantial literature documents high initial returns on IPO stocks. Studies have attempted to explain IPOs' initial returns based on the asymmetry information and reputation hypotheses. The former hypothesis is based on asymmetric information between the issuer and investors, and posits that the IPO firm's true value is known by the issuer, but not by the investors; thus, investors require a lower offering price to compensate for information uncertainty risk, and the issuer must set a lower offering price to attract these uninformed investors (Beatty and Ritter, 1986). Additionally, the reputation hypothesis argues that a conflict of interest exists between the underwriter and issuer, and thus, underwriters have an incentive to set a lower offering price, to reduce the risk of IPO failure and satisfy their clients (Beatty and Welch, 1996).

In contrast, some studies argue that IPO stocks' high initial returns can be explained by overvaluation in the secondary market, or the particularly high stock price immediately after the IPO. The overvaluation story in particular is largely related to investor sentiment.[1] For example, Miller (1977) proposes that the short-sale constrained IPO stock prices could only reflect optimistic investors' expectations, and thus, lead to overpriced IPO stocks. Ritter and Welch (2002) and Ljungqvist et al. (2006) show that the information asymmetry hypothesis cannot fully explain IPOs' high initial returns, and investor sentiment may be related to this phenomenon. Purnanandam and Swaminathan (2004), Derrien (2005), and Dorn (2009) also suggest that high initial returns could be a result of irrational investor sentiment.

Related studies also suggest that overvalued IPO stock prices would revert to their fundamental values eventually, and this could lead to long-term IPO underperformance. For

[1] Baker and Wurgler (2007) suggest that investor sentiment and speculative behavior are more pronounced in the stock prices of firms with high information uncertainty.

example, Aggarwal and Rivoli (1990), Ritter (1991), and Ritter and Welch (2002) argue that fads stemming from investors' irrational behaviors could drive excess demand for and high initial returns on IPO stocks, and this implies long-term IPO underperformance as the excess demand clears over time. However, these studies are limited as they fail to indicate a direct association between investors' fads and long-term IPO underperformance.

Recent studies have employed proxy variables for individual investor sentiment, and have linked them to high initial returns on IPO stocks in order to investigate an association between IPO stock returns and investors' irrational behaviors more directly. Derrien (2005) finds that book-building demand by individual investors in the French market results in significant IPO stock price increases on the first trading day, and is subsequently negatively related to long-term IPO performance. Cornelli et al. (2006) also find that high grey market prices lead to high first-day closing prices, based on data from 486 IPOs in 12 European countries.[2] Dorn (2009) documents that individual retail investors' sentiment temporarily pushes aftermarket prices above fundamental levels, and IPOs substantially purchased by individual investors in the German grey market exhibit high first-day returns. Chan (2010) documents that in the U.S. IPO market, hot IPOs' aftermarket prices are largely related to trading by individual investors, who are more likely to be influenced by sentiment than institutional investors. Da et al. (2011) use the abnormal search volume index (ASVI) in Google as a direct measure of investor attention to IPO stocks and show that increased investor attention leads to high initial returns and subsequent long-term underperformance of IPO stocks. Agarwal et al. (2008) document that emerging markets' investor sentiment is associated with IPO firms' aftermarket performance in the Hong Kong stock market; Jiang

[2] In addition to the IPO book-building process, individual investors in Germany and Italy can trade IPO shares in "grey" markets on an "as-if"/"when-issued" basis before the start of secondary trading. Issuers in the French IPO market can choose to reserve a fraction of the offered shares for individual investors during the book-building process. Hence, individual investors' IPO share demands in pre-IPO markets could reflect their optimism.

and Li (2013) further prove that individual investor sentiment plays an important role in Hong Kong's IPO pricing during both pre-market and aftermarket stages. Additionally, Song et al. (2014) find that overvaluation accounts for a substantial proportion of high IPO initial returns in China, and is highly associated with investors' market sentiment.

Appropriate proxies are critical to measure the extent of individual investor sentiment, and analyze the impact of overvaluation from this sentiment on IPO stocks' initial returns. Nevertheless, existing studies do not adequately measure individual investor sentiment. For example, Derrien (2005), Cornelli et al. (2006), and Jiang and Li (2013) proxy individual investors' demand for IPO stocks as the individual investor sentiment before IPO offer prices are determined. Hence, high initial returns on IPO stocks can be affected not only by individual investors' fads in the pre-market but also by intentionally underpriced IPO stocks. Additionally, individual investors' demand is assessed in the pre-market, and thus, could already be reflected, at least partially, in the IPO's offer prices. Accordingly, these studies are limited in that the association between pre-market sentiment, as proxied by individual investors' demand, and the high initial returns on IPO stocks is clouded by the IPOs' offer prices.

In order to overcome the compound effect of both individual investor sentiment and low offer prices in the pre-market on high initial IPO stock returns, it is worth measuring individual investor sentiment after the offer prices are determined, and linking this to high initial returns on IPO stocks and subsequent reversions. In that sense, the Korean stock market provides a unique environment in which individual investors do not participate in the IPO book-building process, and thus, the offer price does not necessarily incorporate individual investors' demand. In the Korean IPO market, after institutional investors' book-building process is complete and the offer price is determined, 20% of IPO stocks are allocated to individual investors with the determined offer price, and the individual investors'

IPO stock subscription rates are determined based on their demand. Hence, we consider that an IPO stock's high subscription rate can imply individual investors' high demand for the stock and the extent of their sentiment, which is not reflected in the offer price.

Individual investor sentiment could affect stock prices both before and after the IPO, and prior studies heavily rely on examining individual investor trading to gauge their aftermarket sentiment. Although individual investors' trading patterns can be useful in measuring the extent of their sentiment, prior studies on individual investor trading are highly limited because individual investors' short-term trading and ownership data are often limited or unavailable. Hence, they indirectly infer individual trading from a small trade size (Chan and Meidan, 2005; Chan, 2010; Jiang and Li, 2013). This methodology sometimes misclassifies institutional trading as an individual one because institutions have incentives to avoid detection by intermediaries and instead, use order-splitting techniques to disguise their trades (Campbell et al., 2009). Since the Korea Exchange (KRX) provides the daily buy and sell trading volumes of each type of investor classified as 'individuals', 'institutions' and 'foreigners' for all firms listed on the KRX, this paper directly utilizes individual investors' daily trading volumes to measure their aftermarket sentiment.

In particular, this study is based on the IPOs of 382 firms in the Korean stock market from 2007 to 2014, and specifically examines the impact of individual investors' sentiment on IPOs' return patterns. A focus on individual investor sentiment in the Korean IPO market provides a useful empirical setting, as individual investors' trading volume in Korea's stock market is globally one of the highest, and information asymmetry among investors is relatively high compared to the developed markets.[3] Various studies document that individual investors' trading behavior and performance tends to be worse than those of

[3] According to the Korea Exchange (KRX), individual investors' trading volume accounted for almost 90% of total market activities during our sample period from 2007 to 2014. As later reported in detail, the market participation rate of individual investors is even higher in the trading of IPO stocks.

institutional or foreign investors (e.g., Nofsinger and Sias, 1999; Grinblatt and Keloharju, 2000; Barber and Odean, 2000; Gibson et al., 2004; Amihud and Li, 2006; Choi and Sias, 2012). Hence, studying the informational disadvantages of individual investors can be more fruitful in the Korean IPO market.

Defining IPO stocks' initial returns is also vital for this study. Related literature typically measures initial returns based on the difference between the offer price and the first-day closing price. However, when IPO stocks' first-day opening prices substantially reflect pre-market sentiment, it is necessary to investigate the relationship between pre-market sentiment and initial returns as measured by the difference between the offer price and first-day opening price (Bradley et al., 2009; Jiang and Li, 2013). The Korean IPO market is an instance in which IPO stocks' first-day opening prices are meaningful. The Korea Exchange's opening stock prices are determined based on the call auction method, under which significant buy and sell orders are accumulated for an hour before the market opens, and are simultaneously executed at a single price by equating the supply and demand quantities. Hence, initial returns after the first-day opening price has been settled can relate to aftermarket sentiment. The decomposition between the initial returns as related to both pre-market and aftermarket sentiment provides a useful setting to examine the spillover effect from pre-market to aftermarket sentiment in the Korean IPO market.

Our results indicate that individual investors' pre-market sentiment is significantly and positively associated with initial returns, as measured by the difference between the offering price and first-day opening price. Moreover, we find that the measurement of individual investors' pre-market sentiment is positively associated with that of individual investors' aftermarket sentiment. Additionally, IPO stock returns are found to be significantly negative from the third to the twentieth day after the IPO, as they seem to revert. Overall, our results suggest that individual investors' pre-market sentiment accounts for a substantial

proportion of IPO stocks' high initial returns, as this transfers to individual investors' aftermarket sentiment and influences post-IPO long-term stock performance. Nevertheless, this sentiment and its impact on stock returns seem to be a short-term phenomenon, as they are the most pronounced within the first month after the IPO.

The remainder of this paper is organized as follows: Section 2 presents the data and research methodology. Section 3 discusses variables and descriptive statistics. Section 4 reports the empirical results, and Section 5 provides a conclusion.

2. Data and Methodology

We select 382 IPO firms, 59 Korea Composite Stock Price Index (KOSPI) firms and 323 Korea Securities Dealers Automate Quotation (KOSDAQ) firms, from July 2007 to December 2014.[4] We restrict the July 2007 sample in particular, due to a regulatory change for IPOs in the Korean stock market. Prior to July 2007, individual investors who were given a put-back provision on their IPO stocks could resell their holdings to an underwriter at 90% of the offer price during the month immediately after the stocks were listed. However, in June 2007 the Financial Supervisory Service (FSS), the Korean financial market's regulatory agency, abolished the put-back option to parallel global standards toward financial market deregulation. Hence, we do not consider IPO sample firms before July 2007, as individual IPO investors' influence may be distorted by the regulation.

Sample IPO firms are selected from the KRX database, and their detailed information is compiled using information from the FSS' Data Analysis Retrieval and Transfer system. Additionally, we obtain sample firms' stock returns and financial data from

[4] The Korean stock market is divided into two categories: the KOSPI and KOSDAQ. The KOSDAQ opened in 1996 to make funds more readily available for small- to mid-sized firms and venture firms. The KOSDAQ's listing requirements are more relaxed than that of the KOSPI; therefore, more small- to mid-sized firms and venture firms are listed on the former.

Data Guide Pro, provided by FnGuide, a Korean financial data provider.

We employ buy-and-hold abnormal returns (BHARs) to measure IPO stocks' abnormal performance, as follows:

$$\mathrm{BHAR}[T_1, T_2] = \prod_{t=T_1}^{T_2}(1 + R_{i,t}) - \prod_{t=T_1}^{T_2}(1 + R_{m,t})$$

where $R_{i,t}$ is the return on IPO stock *i* at time *t*, and $R_{m,t}$ is the firms' average return in the industry in which the IPO firms are included at time *t*. Specifically, we consider four classified BHARs: BHAR[F,O], in which the IPO stock return is computed based on the difference between the offer price and the first-day opening price; BHAR[O,D3], in which the IPO stock returns for three days are computed based on the closing price on the third trading day after IPO relative to the first-day opening price; BHAR[D4,D20], in which the IPO stock returns are computed based on the closing price on the twentieth trading day after IPO relative to the third trading day after IPO; and BHAR[M1,M13], in which the IPO stock returns are computed for the one-year period a month after the IPO. We utilize these BHARs to analyze the relationships between individual investors' sentiment and IPO stocks' abnormal performance.

3. Variables and Descriptive Statistics

3.1. Variables

In this paper, individual investors' pre-market sentiment is proxied by individual investors' IPO stock subscription rates (IDV_SUB). Individual investors in the Korean stock market are separated from the book-building process by institutional investors; therefore, the IPO's offering price does not necessarily incorporate individual investors' demand. Twenty percent of IPO stocks are instead randomly allocated to individual investors, with the

determined offering price and randomly selected IPO stocks' subscription rates completely determined by individual investors' demand. Therefore, a high subscription rate could imply individual investors' high demand, driven by their sentiment about IPO stocks. We use the log of the subscription rate in multivariate regression analyses to mirror the sentiment's nonlinear nature. Additionally, we use individual investors' turnover ratio (IDV_TURN) to measure their aftermarket sentiment. The turnover ratio is specifically defined as individual investors' three-day average trading volume relative to the number of IPO firm stocks immune from the lock-up restriction.[5] We observe that a high turnover ratio for individual investors could be associated with high sentiment. Existing studies often utilize such variables as the net buy or turnover ratios, based on individual investors' trading volumes, to capture the extent of their sentiment (Chan and Meidan, 2005; Chan, 2010; Jiang and Li, 2013). However, these studies are limited, as they indirectly infer individual trading from a small trade size. This paper constructs the turnover ratio by using individual investors' unbiased daily trading volumes to measure individual investors' aftermarket sentiment.

Although we focus on individual investor sentiment's roles in the IPO market, our empirical analyses also consider other explanatory factors that may affect IPOs' characteristics. Loughran and Ritter (2002) particularly find that both IPO stocks' high initial returns and post-IPO long-term underperformance are more pronounced in hot issue markets. Bradley and Jordan (2002) also find that more than 35% of IPO stocks' initial returns can be predicted by stock market conditions during the "dot-com bubble" period. Hence, we consider the IPO market conditions (MARKET), which are measured by average stock return in the IPO firm's industry for the three months preceding the individual investors'

[5] We only consider the quantities of tradable IPO shares immune from the lock-up restriction because approximately 50% of IPO shares are held by large shareholders. Further, institutional investors who have held the shares for a short period are restricted for the lock-up period in the Korean stock market. Hence, trading volumes of individual investors relative to the tradable shares would more accurately reflect the relative impact of individual investor trading.

subscription. Additionally, Beatty and Ritter (1986) and Ritter (1991) document that the IPO firms' age and offer size reflect their level of uncertainty and influence on the IPO stock returns, both in the short- and long-term. Thus, we also consider the number of months before IPO since the firm's establishment (AGE), and the offer size, as measured by the number of IPO stocks issued multiplied by the offering price (OFFER).

Moreover, Hong et al. (2006) argue that investors' optimism is reflected in IPO stock prices, as the number of tradable stocks is restricted due to the IPO stocks' lock-up provision. Hence, our analyses consider the ratio of tradable IPO stocks (TRADABLE), or the number of tradable stocks divided by the number of shares outstanding. Additionally, Carter and Manaster (1990) and Brav and Gompers (1997) document that both venture capital investment in IPO firms and the IPO underwriters' reputation are important in IPO stock pricing. We use a dummy variable for venture capital investment in IPO firms, coded as 1 if the firm was funded by venture capital prior to its IPO, and 0 otherwise (D_VC). The dummy variable for the IPO underwriters' reputation is coded as 1 if the primary underwriter has had an IPO market share of more than 4% for the last two years, and 0 otherwise (D_REPU). In addition, the dummy variable is coded as 1 if the IPO stock is listed on the KOSDAQ, and 0 if it is listed on the KOSPI (D_KOSDAQ) in order to incorporate the firm's diverse characteristics in the analyses' different exchanges.

As aforementioned, 20% of IPO stocks are randomly allocated to individual investors with a set offering price, after the book-building process is complete and the offering price is set. Hence, an individual investor subscription rate, which is our measurement of pre-market sentiment, is likely to be affected by information from the IPO stocks' previous book-building process. We define the revision in the offering price, as the price relative to a median value in the offer range (REVISION), and control for this to explain individual investors' subscription rates. Benveniste and Spindt (1989) argue that individual investors interpret an

unexpectedly high revision in the offering price to imply that information related to the IPO is not fully reflected in the offering price; this revision could affect individual investors' subscription rates. Additionally, Hanley (1993) documents that the percentage width of an offer range measures an issue's ex ante risk, as underwriters who are unsure of an issue's price are likely to set wider offer ranges to provide greater flexibility in setting the final offer price. Thus, an offer range's percentage width may reflect information related to the issue's risk, and this can also affect individual investors' subscription rates. We control for this by specifically defining an offer range's percentage width as the difference between the offer range's highest and lowest values, divided by the offer range's median value (RANGE). Moreover, institutional investors' high IPO stock subscription rates may reflect their excess demand, which can also affect individual investors' subscription rates. Therefore, we control for institutional investors' subscription rates (IST_SUB) in analyzing pre-market sentiment. We also control for the average return on the five latest IPOs (RCT_IPO), as individual investors could be more sentimental in a recent hot IPO market. The stock return is computed as the first-day opening price relative to each IPO stock's offer price.

3.2. Descriptive Statistics

Table 1 reports the descriptive statistics for our study's key variables, BHARs and individual investors' subscription rates, turnover, and net buy ratios. The table also provides turnover and net buy ratios of institutional investors in order to compare them to those of individual investors.[6] The IPO stocks' initial returns (BHAR[F,O]), measured based on the

[6] We compute the investors' NB for stock *i* in day *t* as

$$\mathrm{NB}_{i,t} = \frac{\text{Buy Volume}_{i,t} - \text{Sell Volume}_{i,t}}{\text{Total Tradable Volume}_{i,t}}$$

where Buy Volume and Sell Volume are the numbers of shares bought and sold by individual or institutional investors, respectively. Total Tradable Volume is the total number of IPO firm stocks immune from lock-up

first-day opening price relative to the offer price, display a mean and median of 31.20% and 21.19%, respectively. Korean IPO stocks' high initial returns are consistent with those in foreign IPO markets. However, the first three-day BHAR (BHAR[O,D3]), measured based on the closing price on the third trading day after IPO relative to the first-day opening price, displays a mean of -2.41% and median of -8.41%.[7] The subsequent 17-day BHAR (BHAR[D4,D20]), measured based on the closing price on the twentieth trading day after IPO relative to the third trading day after IPO, indicates a mean of -5.15% and median of -8.94%. Additionally, the long-term BHAR (BHAR[M1,M13]), measured for 1-year period from 1 month after IPO, displays a mean of 1.66% and median of -4.91%. This implies that a high variation exists in IPO firms' long-term BHAR.

[Insert Table 1 about here]

The individual investors' subscription rate, which is the measure for pre-market sentiment, notes a mean of 410 and median of 360. A subscription rate of 410, for example, means that for every newly issued IPO stock, there are 409 excess demands by individual investors. This implies that individual investors' demand for IPO stocks is substantially high, and may be affected by their sentiment toward an IPO stock. Individual investors' IPO stock turnover for 20 trading days after the IPO is significantly higher than that for institutional investors. Particularly, individual investors' turnover ratio mean is 99.23% for the first day after IPO. This means that average individual investors' trading volume for the first trading day are almost the same as the number of tradable stocks, and this is approximately twice the

restrictions. Specifically, the individual net buy (IDV_NB) and institutional net buy (IST_NB) are the three-day average net buy after the IPO.

[7] First-day returns, measured based on the difference between IPO firms' first-day opening and closing prices, display a mean of -1.05% in the Korean stock market. However, Bradley et al. (2009) document that first-day returns in the U.S. market have a mean of 2.3%. The different phenomenon in the Korean market may rely on the Korea Exchange's opening stock prices' being determined by the call auction method, under which significant buy and sell orders are accumulated for one hour before the market is actually open, and are simultaneously executed at a single price, equating the supply and demand quantities. Hence, the Korean stock market's opening price substantially reflects price information, and it is more suitable in this study to compute initial returns based on the first-day opening price instead of the closing price.

newly issued IPO stocks. Individual investors' abnormally high turnover ratios last for three days after the IPO, and tend to decrease afterward. We find that, in contrast, the average institutional investors' turnover ratio for the first three trading days is only 4.87%, which is significantly lower than that for individual investors. This substantially high turnover ratio for individual investors seems abnormal considering that only 20% of IPO stocks are allocated to them in the Korean IPO market. Jiang and Li (2013) argue that divergences of opinion, as captured by trading volume in conjunction with short-sale constraints, cause IPO investment fads. Hence, we view individual investors' three-day turnover ratio as the proxy for aftermarket sentiment.

Additionally, Table 1 indicates that individual investors are net buyers, and institutional investors are net sellers for the 20 trading days after IPO. Particularly, the average individual investors' net buy ratio is 17.78% of the total tradable volume on the first trading day. Further, their average cumulative net buy ratio is 21.38% for the first three trading days, while institutional investors' corresponding average cumulative net buy ratio is -16.94%. However, institutional investors' average cumulative net buy ratio for 20 trading days does not seem to materially differ after the 3 trading days, suggesting that their net sales is primarily intensified for the first three trading days. This result is consistent with the finding that institutional investors' net sell is more pronounced immediately after the IPO in the U.S. market (Krigman, Shaw, and Womack, 1999).

Table 2 reports summary statistics for the other variables used in the multivariate regression analyses. The mean of MARKET, as measured by average stock return in the IPO firm's industry for the three months preceding the individual investors' subscription, is 0.27%. The number of months between a firm's establishment and its IPO (AGE) has an average of 166, and a high variation in sample firms. The average offering price (OFFER) is KRW 60.1 billion, with a maximum of KRW 4.9 trillion, and a minimum of KRW 140 million. We use

log values in the multivariate analyses in order to incorporate the high, nonlinear variations of AGE and OFFER. The tradable IPO stocks' average ratio (TRADABLE), or the number of tradable stocks divided by the number of shares outstanding, is 42.72%. This implies that over half the IPO stocks are under a lock-up restriction at the time of IPO. The average dummy variable for venture capital investment in IPO firms (D_VC) suggests that 44.50% of IPO firms are funded by venture capital. Additionally, the average dummy variable for IPO underwriters' reputation (D_REPU) indicates that 25.13% of IPOs are executed by reputable underwriters, and the average dummy variable for market indication (D_KOSDAQ) implies that 84.55% of IPO firms are listed on the KOSDAQ.

Further, the average institutional investors' subscription rate (IST_SUB) is 129, implying that for every newly issued IPO stock, 128 excess demands are made by institutional investors on average. We use the log value of institutional investors' subscription rates in the multivariate analyses in order to consider their nonlinearity. The set offer price's relevant distance from its offer range, or revision in offer price (REVISION), is 1.01 on average, implying that the offer price is determined at approximately its expected ranges. The average percentage width of the offer range, defined as the difference between the offer range's highest and lowest values divided by its median value (RANGE), is 17.19%, with a high variation. Moreover, the average return on the five latest IPOs (RCT_IPO) is 31.24%.

[Insert Table 2 about here]

4. Empirical Results

4.1. Univariate Analysis

We first examine the univariate relationship between individual investors' subscription rates, and short- and long-term IPO stock performances, by sorting stocks by

individual investors' subscription rates and allocating them into three portfolios. Portfolios 1, 2, and 3 include stocks with high, medium, and low subscription rates, respectively. We then obtain the corresponding mean and median values for the four classified BHARs, i.e., BHAR[F,O], BHAR[O,D3], BHAR[D4,D20], and BHAR[M1,M13]. Table 3 reports the results.

[Insert Table 3 about here]

We observe a positive relationship between individual investors' subscription rates and the mean and median values of IPO stocks' initial returns (BHAR[F,O]). Specifically, the mean and median values of BHAR[F,O] in portfolio 1 are 54.79% and 54.08% while those in portfolio 3 are 6.64% and -0.62%. The differences in the mean and median values of BHAR[F,O] between portfolios 1 and 3 are both statistically significant at 1% level. The significantly positive relationship between individual investors' subscription rates and IPO stocks' initial returns cannot be explained by the intentional IPO underpricing hypothesis, which argues that high initial returns on IPO stocks stem from low offering prices. Notably, individual investors' subscription rates should not affect offering prices, as the offering prices are determined before individual investors' subscription to IPO stocks in the Korean market. Alternatively, individual investors' expected demand of IPO stocks can be partially considered when determining the offering prices. However, if so, we should find a negative relationship between individual investors' subscription rates and the initial returns on IPO stocks because high expected demand should increase the offering prices and decrease initial returns. Therefore, this positive relationship suggests that individual investors' pre-market sentiment, as measured by their subscription rate, may be reflected in IPO stocks' high initial returns.

However, short-term BHARs subsequent to high first-day opening prices tend to be negatively associated with investors' subscription rates. The mean and median values of

BHAR[O,D3] and BHAR[D4,D20] in portfolio 1 are negative, and significantly lower than those in portfolio 3. Hence, high first-day opening prices, related to high individual investors' subscription rates, tend to revert in the short-term. Moreover, this reversal is most pronounced in portfolio 1. This reversal patter persists in the long-term. The mean and median values of BHAR[M1,M13] in portfolios 1 and 2 tend to be negative while those in portfolio 3 are positive, showing a significant difference. However, this long-term relationship seems to be weaker than that in the short-term. Overall, these results imply that high initial returns and the subsequent return reversals are linked, and could be substantially related to overvaluation driven by individual investors' pre-market sentiment.[8]

The pre-market sentiment, as measured by individual investors' subscription rates, could amplify investors' sentiment toward IPO stocks after investors begin to trade the stocks in the secondary market. Hence, we additionally investigate the spillover effect from pre-market to aftermarket sentiment. We sort stocks by individual investors' subscription rates and allocate them into three portfolios, as noted in Table 3. We then obtain the corresponding mean and median values for the individual investors' three-day average turnover and net buy ratios. Table 4 reports the results.

[Insert Table 4 about here]

We find a positive relationship between the individual investors' subscription rates and the mean and median values of individual investors' three-day average turnover (IDV_TURN). The result notes the mean (79.01%) and median (63.81%) values of the individual investors' three-day average turnover in portfolio 1, and the mean (49.87%) and

[8] We also consider the initial return, based on the difference between the offer and the first-day closing prices and the subsequent 13-month BHAR, as compatible with prior literature. Consistent with this literature, we find higher (or lower) initial returns (or 13-month BHAR) in portfolio 1 than in portfolio 3. However, our focus is on IPO stock return behaviors specifically related to individual investors' pre-market and aftermarket sentiment. The first-day opening price is beneficial to compute initial returns in the Korean stock market because the opening price sufficiently reflects investors' demand for IPO stocks. More importantly, the initial return can directly match individual investors' subscription rates, or the pre-market sentiment, and thus, is not confounded by aftermarket sentiment. Furthermore, by decomposing the IPO stocks' performance measurement windows into four, we can observe whether sentiment-driven return behaviors are primarily a short-term phenomenon.

median (36.12%) in portfolio 3; their differences are both statistically significant at the 1% level. This implies that individual investors' pre-market sentiment tends to transfer to their aftermarket sentiment, and this spillover effect is more pronounced when pre-market sentiment is higher.

We expect that individual investors' net buy immediately after an IPO would also be high, as this is affected by high pre-market sentiment, in conjunction with the fact that only 20% of IPO stocks are allocated to individual investors in the Korean pre-market. Table 4 shows positive mean and median values for individual investors' three-day average net buy ratio (IDV_NB) in all portfolios, consistent with this expectation. However, we do not observe a significant relationship between individual investors' subscription rates and the mean and median values of the individual investors' three-day average net buy ratio. We conjecture that these results would stem from individual investors' trading behavior. Nofsinger and Sias (1999), Choe et al. (1999), and Grinblatt and Keloharju (2000) document that individual investors tend be contrarian traders. As documented in Table 3, first-day opening prices are significantly higher than their offering prices, especially when pre-market sentiment is high. Hence, individual investors as contrarian traders are more likely to hesitate to buy shares when IPO stocks' initial returns are high, which is also related to pre-market sentiment. This behavior may explain insignificant variations in the individual investors' three-day average net buy ratio among the portfolios.

Table 4 also reports results based on the institutional investors' three-day average turnover and net buy ratio, according to individual investors' subscription rate. We find that the mean and median values of the institutional investors' three-day average turnover (IST_TURN) are positive for all portfolios, but their values are much lower than those of the individual investors' three-day average turnover. This suggests that institutional investors' sentiment level is not as significant as that of individual investors. We also find that the mean

and median values of the institutional investors' three-day average net buy ratio (IST_NB) are negative for all portfolios, meaning that institutional investors are net sellers after an IPO, in contrast to individual investors as net buyers. More importantly, we do not find a material relationship between individual investors' subscription rates and the mean and median values of the institutional investors' three-day average turnover and net buy ratio, suggesting that individual investors' pre-market sentiment is not transferred to institutional investors.

Table 5 presents the univariate relationships between the individual investors' three-day average turnover and short- and long-term abnormal return on IPO stocks in order to examine the effects of aftermarket sentiment on IPO stock performances. Specifically, we sort stocks by individual investors' IPO stock turnover ratio, and allocate them to three portfolios. Portfolios 1, 2, and 3 include stocks with high, medium, and low turnover ratios, respectively. We then obtain the corresponding mean and median values for the three classified BHARs after IPO, i.e., BHAR[O,D3], BHAR[D4,D20], and BHAR[M1,M13]. The table also reports corresponding mean and median values for institutional investors' average net buy ratio for the first three trading days (IST_NB[O,D3]), and for 17 trading days from the fourth trading day (IST_NB[D4,D20]) after the IPO, respectively.

[Insert Table 5 about here]

We expect a positive association between aftermarket sentiment, measured by the individual investors' turnover, and short-term IPO stock performance, as aftermarket sentiment may cause a stock price increase. However, we do not find a significant relationship between the individual investors' three-day average turnover (IDV_TURN) and BHAR[O,D3], as we observe a negative BHAR[O,D3] for all portfolios. This result can be explained by institutional investor trading after the IPO. Table 5 displays the mean values of IST_NB[O,D3] in portfolios 1 and 3 as -9.13% and -2.33%, respectively, and their difference is statistically significant. This implies, in conjunction with Table 4's results, that institutional

investors tend to sell IPO stocks to individual investors, and this tendency seems stronger when aftermarket sentiment is high. Consistent with this result, Ofek and Richardson (2003) document that IPO stocks' high initial returns are accompanied by institutional investors' selling stocks to retail investors. Derrien (2005) additionally argues that institutional investors attempt to gain a short-term profit by flipping their overpriced IPO shares. Hence, the negative BHAR[O,D3] and its insignificant association with the individual investors' three-day average turnover seem to be affected by institutional investors' opportunistic trading behavior in exploiting high initial returns. This is also consistent with existing literature, which documents that institutional investors have sophisticated trading skills and/or are more informed than individual investors, and thus engage in more profitable trades (Nofsinger and Sias, 1999; Grinblatt and Keloharju, 2000; Barber and Odean, 2000; Gibson et al., 2004; Amihud and Li, 2006; Choi and Sias, 2012).

However, we find a negative relationship between individual investors' three-day average turnover (IDV_TURN) and BHAR[D4,D20]. The mean (and median) values of BHAR[D4,D20] in portfolios 1 and 3 are -11.53% (-16.13%) and -1.62% (-3.64%), respectively, and their differences are statistically significant. This result is associated with a greater return reversal after higher aftermarket sentiment, and is consistent with the negative relationship between pre-market sentiment and BHAR[D4,D20] documented in Table 3. This reversal pattern tends to be persistent yet weaker after the first 20 trading days. We only find a weak, negative relationship between individual investors' three-day average turnover (IDV_TURN) and long-term BHAR, based on the median values of BHAR[M1,M13]. Overall, this result suggests that the effect of individual investors' aftermarket sentiment on short-term IPO stock returns seems to be offset by institutional investors' trading. However, once institutional investors' net selling behavior weakens, long-term IPO stock underperformance seems to be more pronounced in stocks with higher aftermarket sentiment.

4.2. Multivariate Analysis

4.2.1. Individual Investors' Pre-Market and Aftermarket Sentiment and IPO Stock Performance

This subsection extends the previous univariate analyses by considering other factors that may affect IPO stocks' short- and long-term performance, in addition to individual investors' sentiment variables: subscription rate (INV_SUB) and turnover ratio (INV_TRUN). Specifically, additional explanatory variables to be incorporated in the multivariate regression analyses are as follows: the IPO market conditions (MARKET), the firm's business history (AGE), the offer size (OFFER), the ratio of tradable IPO stocks (TRADABLE), the dummy variable for venture capital investment (D_VC), the dummy variable for IPO underwriters' reputation (D_REPU), and the dummy variable for KOSDAQ listing. As already shown in Table 4, individual investors' subscription rates affect their turnover ratios after IPO. Hence, Models 1 and 2 exclude individual investors' turnover ratios and individual investors' subscription rates, respectively. However, as a robustness check for the multicollinearity issue, both variables are included in Model 3. Table 6 reports the estimation results.

[Insert Table 6 about here]

First, we find a positive, significant relationship between individual investors' subscription rates (INV_SUB) and IPO stocks' initial returns (BHAR[F,O]), implying that individual investors' pre-market sentiment may result in an overvaluation of IPO stocks and high initial returns.[9] We also find that the IPO market conditions (MARKET) and offer size (OFFER) are positively and negatively related to BHAR[F,O], respectively, and these relationships are statistically significant. These results are consistent with related literature.

[9] As following related studies defining the initial return on IPO stocks as the first-day closing prices relative to the offering princes, instead of using the opening prices, we also re-estimate our regression analyses. However, we find that the results do not alter materially. The results are available upon request.

Derrien (2005) documents that IPOs' market conditions positively influence IPO stocks' initial returns. Beatty and Ritter (1986) and Ritter (1991) suggest that IPO firms' offer size reflects their level of uncertainty, and this can affect IPO stocks' returns in both the short- and long-term. However, we do not find a significant effect of other control variables on BHAR[F,O].

Model 1 relates individual investors' subscription rates (INV_SUB) to BHAR[O,D3], BHAR[D4,D20], and BHAR[M1,M13]. We observe significantly negative associations between INV_SUB and BHAR[D4,D20], and BHAR[M1,M13]. This suggests that IPO stocks with high initial returns, driven by individual investors' pre-market sentiment, underperform from the fourth trading day after IPO. However, we do not find a significant relationship between INV_SUB and BHAR[O,D3]. This insignificant finding, considering the results of Tables 4 and 5, could be explained by institutional investors' opportunistic trading behavior in exploiting individual investors' aftermarket sentiment immediately post the IPO.

Model 2 examines the relationship between individual investors' turnover (INV_TURN) and BHAR[O,D3], BHAR[D4,D20], and BHAR[M1,M13]. We find an insignificant relationship between INV_TURN and BHAR[O,D3]. However, we find significantly negative associations between INV_TURN and BHAR[D4,D20], and BHAR[M1,M13], implying that individual investors' aftermarket sentiment, influenced by pre-market sentiment, negatively affects stock performance. Additionally, we find that in Model 3, which includes both INV_SUB and INV_TURN as explanatory variables, INV_TURN is still significantly and negatively related to BHAR[D4,D20] and BHAR[M1,M13], but a significant association only exists between INV_SUB and BHAR[M1,M13]. This finding implies that IPO stocks' long-term performance is negatively influenced by both pre-market and aftermarket sentiment. This result also suggests that

BHAR[D4,D20] is more influenced by aftermarket sentiment than by pre-market sentiment, as pre-market sentiment materially spills over to the aftermarket sentiment.

4.2.2. Determinants of Individual Investors' Pre-Market and Aftermarket Sentiment

Our primary findings in the previous subsection suggest that individual investors' pre-market and aftermarket sentiment could be materially associated with short- and long-term IPO stock performance. As these results rely on our measurements of individual investors' pre-market and aftermarket sentiment, it would be appropriate to investigate factors that may affect individual investors' subscription rates and turnover ratios for IPO stocks.

Table 7 reports the results based on the five multivariate models, in which the dependent variable is the individual investors' subscription rates (IDV_SUB), or pre-market sentiment. We consider the explanatory variables that characterize IPOs in Table 6, and additionally control for institutional investors' subscription rates (IST_SUB), offer price revisions (REVISION), percentage width of the offer range (RANGE), and the five latest IPOs' average return (RCT_IPO). The IST_SUB, REVISION, and RANGE variables are related to institutional investors' book-building process information. They reflect the institutional investors' demand, and subsequently affect individual investors' demand. The RCT_IPO variable is related to current market sentiment, and is likely to affect the investors' sentiment regarding new IPOs. We specifically consider five multivariate models: Model 1 without REVISION; Model 2 without IST_SUB; Model 3 without RCT_IPO; Model 4 without MARKET; and Model 5, which fully incorporates all explanatory variables. Models 1 and 2 do not include REVISION and IST_SUB, respectively, because a revision in offer price is affected by institutional investors' subscription rate, and thus, REVISION and

IST_SUB are highly correlated.[10] Hanley (1993) also documents that a revision in offer price is positively related to institutional investors' subscription rate. Additionally, Models 3 and 4 do not include RCT_IPO and MARKET, respectively. As the average return on five latest IPOs is likely to be associated with the same industry's recent average stock return, RCT_IPO and MARKET can be highly correlated.[11]

[Insert Table 7 about here]

We find that the institutional investors' subscription rate (IST_SUB) and the offer price revisions (REVISION) are positively and significantly related to individual investors' subscription rates (INV_SUB) in Models 1 and 2, respectively. However, the estimation results in Models 3, 4, and 5, which include both IST_SUB and REVISION, indicate that the coefficient for IST_SUB is only positive at a 1% significance level. However, REVISION does not significantly affect INV_SUB, implying that REVISION is largely reflected in IST_SUB. We also find that RANGE is not significantly associated with INV_SUB. These findings suggest that the information related to institutional investors' demand in the book-building process affect the pre-market sentiment, as measured by individual investors' subscription rates.

We also find that the three-month average stock return in the IPO firm's industry (MARKET) and the five latest IPOs' average return (RCT_IPO) are positively and significantly related to individual investors' subscription rates (IDV_SUB) in Models 3 and 4, respectively. However, we only find a positive relationship between IDV_SUB and RCT_IPO in Models 1, 2, and 5, which include both MARKET and RCT_IPO. This result reflects the

[10] The correlation matrix of explanatory variables is unreported for brevity. The results are available upon request.

[11] Market conditions around an IPO are frequently used in literature in order to explain returns on IPO stocks. Specifically, returns in the stock market for a certain period before an IPO, a return on the IPO firm's industry, or the average initial return for recent IPO stocks are used. For example, Derrien (2006) uses a three-month average return from the stock market, and Jiang and Li (2013) utilize initial returns on the five latest IPOs.

high correlation between MARKET and RCT_IPO, and suggests that RCT_IPO could be a more important factor to explain IDV_SUB. This result also implies that pre-market sentiment, as measured by individual investors' subscription rates, could be amplified by a high stock return in the recent IPO market.

Table 7 also notes that the offer size (OFFER) is negatively related to individual investors' subscription rates (IDV_SUB), implying that pre-market sentiment is more pronounced in small size IPOs. This result reflects that as individual investors in the Korean IPO market should provide 50% of the subscription amount as a margin requirement, small individual investors are less likely to subscribe to IPO stocks with large offer size. We also find that the dummy variables for both IPO underwriters' reputation (D_REPU) and venture capital investment (D_VC) tend to be positively and negatively related to individual investors' subscription rates (IDV_SUB), respectively. This result suggests that the IPO underwriter's reputation and venture capital investment in an IPO firm positively and negatively influence the individual investors' pre-market sentiment, respectively.

Similarly, Table 8 presents the estimation results for the five multivariate models, in which the dependent variable is the individual investors' three-day average turnover (IDV_TURN), or aftermarket sentiment. We consider the individual investors' subscription rates (INV_SUB) as an additional explanatory variable in all models in Table 8, in order to reflect the spillover effect from individual investors' pre-market to aftermarket sentiment. The results illustrate that individual investors' turnover (IDV_TURN) is positively and significantly related to individual investors' subscription rates (IDV_SUB), even after controlling for other explanatory variables. Hence, the result is robust, and consistent with our findings in Table 4, which indicate that pre-market sentiment is transferred to aftermarket sentiment. However, institutional investors' subscription rates (IST_SUB), offer price revisions (REVISION), percentage width of offer range (RANGE), and the five latest IPOs'

average return (RCT_IPO) do not seem to explain individual investors' turnover (IDV_TURN). These results suggest that information related to these variables is already incorporated in pre-market sentiment, as measured by individual investors' subscription rates.

[Insert Table 8 about here]

Table 8 also notes that the offer size (OFFER) is negatively and significantly related to individual investors' turnover (IDV_TURN), indicating that individual investors tend to focus on small stocks in the market. We also find that individual investors' aftermarket trading activities are more pronounced in firms with a longer business history and without venture capital investment.

5. Conclusion

This study examines the impact of individual investors' sentiment on IPOs' initial and subsequent returns by analyzing 382 firms in the Korean stock market from 2007 to 2014. We specifically decompose individual investor sentiment into two categories: pre-market sentiment, as measured by individual investors' subscription rates before the IPO, and aftermarket sentiment, as measured by their stock turnover ratio after the IPO. We not only investigate the relationship between pre-market sentiment and short- and long-term IPO stock performance, but also the relationship between aftermarket sentiment and short- and long-term IPO stock performance. We also consider the relationship between pre-market and aftermarket sentiment in order to analyze individual investor sentiment's spillover effect and its association with IPO stock returns.

Our findings indicate that individual investors' pre-market sentiment is significantly and positively related to initial returns, as measured by the difference between the offer price and the first-day opening price. We also find that individual investors' pre-market sentiment is positively associated with their aftermarket sentiment, implying a spillover effect from pre-

market to aftermarket sentiment. Additionally, we find that immediately after experiencing high initial returns, IPO stocks' underperformance is more evident in firms with high individual investor sentiment, both pre-market and aftermarket.

Overall, this study documents that individual investors' pre-market sentiment accounts for a large proportion of IPO stocks' high initial returns in the Korean IPO market. Although pre-market sentiment is transferred to the aftermarket, this is insufficient to maintain high initial returns afterward. Moreover, individual investor sentiment's impact on IPO stock returns seems to be a short-term phenomenon, as the high initial returns and subsequent underperformance are the most pronounced within the first month after the IPO.

References

Agarwal, S., C. Liu, and S. G. Rhee. "Investor Demand for IPOs and Aftermarket Performance: Evidence from the Hong Kong Stock Market." *International Financial Markets, Institutions and Money*, 18 (2008), 176–190.

Aggarwal, R., and P. Rivoli. "Fads in the initial public offering market?" *Financial Management*, 19 (1990), 45-57.

Amihud, Y., and K. Li. "The Declining Information Content of Dividend Announcements and the Effects of Institutional Holdings." *Journal of Financial and Quantitative Analysis*, 41 (2006), 637–660.

Baker, M., and J. Wurgler. "Investor Sentiment in the Stock Market." *Journal of Economic Perspectives*, 21 (2007), 129–151.

Barber, B. M., and T. Odean. "Trading is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors." *Journal of Finance*, 55 (2000), 773–806.

Beatty, R. P., and J. R. Ritter. "Investment Banking, Reputation, and Underpricing of Initial Public Offerings." *Journal of Financial Economics*, 15 (1986), 213–232.

Beatty, R. P., and I. Welch. "Issuer Expenses and Legal Liability in Initial Public Offerings." *Journal of Law and Economics*, 39 (1996), 545.

Benveniste, L. M., and P. A. Spindt. "How Investment Bankers Determine the Offer Price and Allocation of New Issues." *Journal of Financial Economics*, 24 (1989), 343–361.

Bradley, D. J., and B. D. Jordan. "Partial Adjustment to Public Information and IPO Underpricing." *Journal of Financial and Quantitative Analysis*, 37 (2002), 595–616.

Bradley, D. J., J. S. Gonas, M. J. Highfield, and K. D. Roskelley. "An Examination of IPO Secondary Market Returns." *Journal of Corporate Finance*, 15 (2009), 316–330.

Brav, A., and P. A. Gompers. "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies." *Journal of Finance*, 52 (1997), 1791–1821.

Campbell, J. Y., T. Ramadorai, and A. Schwartz. "Caught on Tape: Institutional Trading, Stock Returns, and Earnings Announcements." *Journal of Financial Economics*, 92 (2009), 66–91.

Carter, R. B., and S. Manaster. "Initial Public Offerings and Underwriter Reputation." *Journal of Finance*, 45 (1990), 1045–1067.

Chan, Y. C. “Retail Trading and IPO Returns in the Aftermarket.” *Financial Management*, 39 (2010), 1475–1495.

Chan, Y. C., and D. Meidan. “Individual Investor Sentiment and Long-Run Performance of IPOs.” (2005), Working Paper.

Choe, H., B. B. Kho, and R. M. Stulz. “Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997.” *Journal of Financial Economics*, 54 (1999), 227–264.

Choi, N. Y., and R. W. Sias. “Why Does Financial Strength Forecast Stock Returns? Evidence from Subsequent Demand by Institutional Investors.” *Review of Financial Studies*, 25 (2012), 1550–1587.

Cornelli, F., D. Goldreich, and A. Ljungqvist. “Investor Sentiment and Pre-IPO Markets.” *Journal of Finance*, 61 (2006), 1187–1216.

Da, Z., J. Engelberg, and P. Gao. “In search of attention.” *Journal of Finance*, 66 (2011), 1461-1499.

Derrien, F. “IPO Pricing in ‘Hot’ Market Conditions: Who Leaves Money on the Table?” *Journal of Finance*, 60 (2005), 487–521.

Dorn, D. “Does Sentiment Drive the Retail Demand for IPOs?” *Journal of Financial and Quantitative Analysis*, 44 (2009), 85–108.

Gibson, S., A. Safieddine, and R. Sonti. “Smart Investments by Smart Money: Evidence from Seasoned Equity Offerings.” *Journal of Financial Economics*, 72 (2004), 581–604.

Grinblatt, M., and M. Keloharju. “The Investment Behavior and Performance of Various Investor Types: A Study of Finland’s Unique Data Set.” *Journal of Financial Economics*, 55 (2000), 43–67.

Hanley, K. W. “The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomenon.” *Journal of Financial Economics*, 34 (1993), 231–250.

Hong, H., J. Scheinkman, and W. Xiong. “Asset Float and Speculative Bubbles.” *Journal of Finance*, 61 (2006), 1073–1117.

Jiang, L., and G. Li. “Investor Sentiment and IPO Pricing during Pre-Market and Aftermarket Periods: Evidence from Hong Kong.” *Pacific-Basin Finance Journal*, 23 (2013), 65–82.

Krigman, L., W. H. Shaw, and K. L. Womack. “The Persistence of IPO Mispricing and the Predictive Power of Flipping.” *Journal of Finance*, 54 (1999), 1015–1044.

Ljungqvist, A., V. Nanda, and R. Singh. “Hot Markets, Investor Sentiment, and IPO Pricing.” *Journal of Business*, 79 (2006), 1667–1702.

Loughran, T., and J. R. Ritter. “Why Don’t Issuers Get Upset About Leaving Money on the Table in IPOs?” *Review of Financial Studies*, 15 (2002), 413–444.

Miller, E. M. “Risk, Uncertainty, and Divergence of Opinion.” *Journal of Finance*, 32 (1977), 1151–1168.

Nofsinger, J. R., and R. W. Sias. “Herding and Feedback Trading by Institutional and Individual Investors.” *Journal of Finance*, 54 (1999), 2263–2295.

Ofek, E., and M. Richardson. “DotCom Mania: The Rise and Fall of Internet Stock Prices.” *Journal of Finance*, 58 (2003), 1113–1138.

Purnanandam, A. K., and B. Swaminathan. “Are IPOs Really Underpriced?” *Review of Financial Studies*, 17 (2004), 811–848.

Ritter, J. “The Long-Run Performance of Initial Public Offerings.” *Journal of Finance*, 46 (1991), 3–27.

Ritter, J., and I. Welch. “A Review of IPO Activity, Pricing, and Allocations.” *Journal of Finance*, 57 (2002), 1795–1828.

Song, S., J. Tan, and Y. Yi. “IPO Initial Returns in China: Underpricing or Overvaluation?” *China Journal of Accounting Research*, 7 (2014), 31–49.

Table 1. Descriptive statistics for key variables

Table 1 presents descriptive statistics for the key variables, such as the buy-and-hold abnormal return (BHAR) and individual investors' subscription rate, turnover, and net buy ratio, as well as institutional investors' turnover and net buy ratio. BHAR[F,O] is computed based on the difference between the offer price and the first-day opening price. BHAR[O,D3] is computed based on the closing price on the third trading day after the IPO relative to the first-day opening price. BHAR[D4,D20] is computed based on the closing price on the twentieth trading day after the IPO relative to third trading day after IPO. BHAR[M1,M13] is computed for the one-year period from one month after the IPO. IDV_SUB denotes the IPO stocks' subscription rates by individual investors. IDV_TURN and IST_TURN are the turnover ratios of individual and institutional investors, respectively. The turnover ratio is defined as investors' three-day average trading volumes, relative to the total number of IPO firm stocks, which are immune from lock-up restrictions. IDV_NB and IST_NB are individual and institutional investors' net buy ratios, respectively. The net buy ratio is defined as the numbers of shares bought minus the numbers of shares sold by investors, divided by the total number of IPO firm stocks that are immune from lock-up restrictions.

		Mean	Median	SD	Max	Min
Buy-and-Hold Abnormal Return (BHAR)	BHAR[F,O]	31.20%	21.19%	36.65%	110.11%	-19.68%
	BHAR[O,D3]	-2.41%	-8.41%	21.99%	55.91%	-39.42%
	BHAR[D4,D20]	-5.15%	-8.94%	26.14%	229.19%	-56.71%
	BHAR[M1,M13]	1.66%	-4.91%	49.16%	209.99%	-119.76%
Individual Investor Subscription Rate (IDV_SUB)		410.1	359.0	363.1	1,719.7	0.2
Individual Investor Turnover (IDV_TURN)	Day 1	99.23%	68.51%	91.25%	515.81%	0.10%
	Day 2	57.65%	38.99%	57.62%	373.16%	0.13%
	Day 3	44.17%	26.20%	58.48%	553.83%	0.34%
	Avg. (Day 1 to 3)	67.02%	52.34%	53.56%	450.67%	0.50%
	Avg. (Day 4 to 20)	16.96%	10.88%	19.41%	147.27%	0.31%
Institutional Investor Turnover (IST_TURN)	Day 1	10.70%	9.10%	7.61%	38.52%	0.07%
	Day 2	2.49%	1.61%	3.11%	31.31%	0.00%
	Day 3	1.42%	0.77%	2.13%	23.18%	0.00%
	Avg. (Day 1 to 3)	4.87%	4.09%	3.15%	16.54%	0.22%
	Avg. (Day 4 to 20)	0.57%	0.41%	0.54%	3.18%	0.00%
Individual Investor Net-Buy Ratio (IDV_NB)	Day 1	17.78%	14.77%	14.64%	73.44%	-13.95%
	Day 2	2.36%	1.17%	4.34%	23.33%	-12.73%
	Day 3	1.24%	0.41%	3.78%	34.95%	-7.91%
	Avg. (Day 1 to 3)	7.13%	6.30%	5.48%	24.28%	-5.56%
	Avg. (Day 4 to 20)	0.22%	0.13%	0.53%	5.03%	-1.13%
Institutional Investor Net-Buy Ratio (IST_NB)	Day 1	-14.37%	-11.82%	13.08%	15.84%	-69.90%
	Day 2	-1.68%	-0.98%	4.01%	13.36%	-25.82%
	Day 3	-0.89%	-0.21%	3.15%	8.08%	-31.08%
	Avg. (Day 1 to 3)	-5.65%	-4.99%	5.02%	10.23%	-23.48%
	Avg. (Day 4 to 20)	-0.12%	-0.07%	0.45%	1.37%	-3.87%

Table 2. Summary statistics for sample firm characteristics

Table 2 reports summary statistics for other control variables used in the multivariate regression analyses. MARKET is the average stock returns for three months in the IPO firm's industry. AGE and OFFER are the number of months before IPO since the firm's establishment, and the number of IPO stocks issued multiplied by the offer price, respectively. TRADABLE is the number of tradable stocks divided by the number of shares outstanding. D_VC is a dummy variable for venture capital investment in IPO firms, and is coded as 1 if the firm is funded by venture capital before IPO, and 0 otherwise. D_REPU is the dummy variable for IPO underwriters' reputation, and is coded as 1 if the primary underwriter has had an IPO market share of more than 4% for the last two years, and 0 otherwise. D_KOSDAQ is a dummy variable, coded as 1 if the IPO stock is listed on the KOSDAQ, and 0 if it is listed on the KOSPI. IST_SUB is the institutional investors' subscription rates, and REVISION is an offer price relative to a median value in the offer range. RANGE is the difference between the offer range's highest and lowest values, divided by its median value. RCT_IPO is the average return on the five latest IPOs.

Variables	Mean	Median	SD	Max	Min
MARKET	0.27%	-1.23%	15.55%	80.35%	-41.19%
AGE (month)	166	130	119	762	3
OFFER (mil KRW)	60,213	14,909	291,036	4,888,116	1,358
TRADABLE	42.72%	41.97%	15.00%	95.00%	10.43%
D_VC	0.45%	0	0.50	1	0
D_REPU	0.25	0.00%	0.43	1	0
D_KOSDAQ	0.85	1	0.36	1	0
IST_SUB	128.7	72.1	145.9	688.8	0.7
REVISION	1.01	1.06	0.17	1.36	0.42
RANGE	17.19%	16.22%	5.77%	47.62%	4.49%
RCT_IPO	31.24%	27.26%	23.66%	100.00%	-7.92%

Table 3. Individual investors' subscription rate and BHARs: Portfolio-sorting approach

Table 3 reports the mean and median values for the BHARs of portfolios sorted by individual investors' subscription rates. Portfolios 1, 2, and 3 include stocks with high, medium, and low subscription rates, respectively. BHAR[F,O] is computed based on the difference between the offer price and the first-day opening price. BHAR[O,D3] is computed based on the closing price on the third trading day after the IPO, relative to the first-day opening price. BHAR[D4,D20] is computed based on the closing price on the twentieth trading day after the IPO, relative to third trading day after the IPO. BHAR[M1,M13] is computed for the one-year period from one month after the IPO. The differences in the mean and median values of individual investors' subscription rates are tested based on the Wilcoxon-Mann-Whitney test, and the corresponding *t*-statistics are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	IDV_SUB		BHAR[F,O]		BHAR[O,D3]		BHAR[D4,D20]		BHAR[M1,M13]	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1 (High)	833	782	54.79%	54.08%	-5.18%	-14.18%	-9.65%	-10.97%	-0.32%	-9.60%
2	357	359	32.17%	26.23%	-2.44%	-7.34%	-6.67%	-8.43%	-7.10%	-11.84%
3 (Low)	41	18	6.64%	-0.62%	0.36%	-5.75%	0.89%	-5.69%	12.47%	6.23%
Equality Test	35.275***	13.774***	12.709***	10.390***	-2.157**	-2.227**	-3.198***	-3.148***	-1.950*	-2.755***

Table 4. Individual investors' subscription rate and trading behavior by individual and institutional investors: Portfolio-sorting approach

Table 4 reports the mean and median values for IDV_TURN (IDV_NB) and IST_TURN (IST_NB) from portfolios sorted by individual investors' subscription rates. Portfolios 1, 2, and 3 include stocks with high, medium, and low subscription rates, respectively. IDV_SUB denotes IPO stocks' subscription rates by individual investors. IDV_TURN and IST_TURN are the turnover ratios for individual and institutional investors, respectively. The turnover ratio is defined as investors' three-day average trading volumes, relative to the total number of IPO firm stocks that are immune from lock-up restrictions. IDV_NB and IST_NB are the net buy ratios of individual and institutional investors, respectively. The net buy ratio is defined as the numbers of shares bought minus the numbers of shares sold by investors, divided by the total number of IPO firm stocks that are immune from lock-up restrictions. The differences in the mean and median values of individual investors' subscription rates are tested based on the Wilcoxon-Mann-Whitney test, and the corresponding *t*-statistics are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	IDV_SUB		IDV_TURN		IST_TURN		IDV_NB		IST_NB	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1 (High)	833	782	79.01%	63.81%	4.73%	3.95%	7.32%	6.31%	-5.66%	-4.75%
2	357	359	72.13%	55.33%	5.05%	4.08%	7.26%	6.52%	-5.68%	-5.28%
3 (Low)	41	18	49.87%	36.12%	4.83%	4.25%	6.79%	6.01%	-5.60%	-4.97%
Equality Test	35.275***	13.774***	4.534***	5.355***	-0.271	0.417	0.777	0.875	-0.105	0.068

Table 5. Individual Investors' turnover ratios, BHARs, and institutional investors' net buy ratios: Portfolio-sorting approach

Table 5 reports the mean and median values for the BHARs and IST_NBs of portfolios sorted by individual investors' turnover ratios. Portfolios 1, 2, and 3 include stocks with high, medium, and low IDV_TURN values, respectively. IDV_TURN is defined as individual investors' three-day average trading volumes, relative to the total number of IPO firm stocks that are immune from lock-up restrictions. BHAR[O,D3] is computed based on the closing price on the third trading day after the IPO, relative to the first-day opening price. BHAR[D4,D20] is computed based on the closing price on the twentieth trading day after the IPO, relative to third trading day after the IPO. BHAR[M1,M13] is computed for the one-year period from one month after the IPO. IST_NB[O,D3] and IST_NB[D4,D20]) are institutional investors' average net buy ratios for the first three trading days, and for seventeen trading days from the fourth trading day after IPO, respectively. The differences in the mean and median values of individual investors' subscription rates are tested based on the Wilcoxon-Mann-Whitney test, and corresponding *t*-statistics are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	IDV_TURN		BHAR[O,D3]		BHAR[D4,D20]		BHAR[M1,M13]		IST_NB[O,D3]		IST_NB[D4,D20]	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1 (High)	125.23%	106.97%	-1.87%	-7.36%	-11.39%	-16.13%	-5.19%	-12.59%	-9.13%	-8.69%	-0.15%	-0.05%
2	53.27%	52.34%	-3.46%	-11.51%	-3.19%	-8.62%	4.86%	-2.57%	-5.47%	-5.42%	-0.13%	-0.08%
3 (Low)	22.66%	23.02%	-1.90%	-5.69%	-0.89%	-3.64%	5.29%	-1.83%	-2.33%	-1.98%	-0.07%	-0.06%
Equality Test	20.825***	13.801***	-0.035	0.205	-3.717***	4.789***	-0.512	1.684*	-12.358***	10.364***	-1.299	0.133

Table 6. Individual investors' pre-market and aftermarket sentiment and IPO stock performance: Multivariate regression approach

Table 6 reports the multivariate regression models' estimation results, to examine the impact of individual investors' pre-market and aftermarket sentiment and IPO stock performance. IDV_SUB denotes the IPO stocks' subscription rates by individual investors. IDV_TURN is defined as individual investors' three-day average trading volumes, relative to the total number of IPO firm stocks that are immune from lock-up restrictions. MARKET is the average stock returns for three months in the IPO firm's industry. AGE and OFFER are the number of months before IPO since the firm's establishment, and the number of IPO stocks issued multiplied by the offer price, respectively. TRADABLE is the number of tradable stocks divided by the number of shares outstanding. D_VC is a dummy variable for venture capital investment in IPO firms, and is coded as 1 if the firm was funded by venture capital before IPO, and 0 otherwise. D_REPU is the dummy variable for IPO underwriters' reputation, and is coded as 1 if the primary underwriter has had an IPO market share of more than 4% for the last 2 years, and 0 otherwise. D_KOSDAQ is a dummy variable, coded as 1 if the IPO stock is listed on the KOSDAQ, and 0 if it is listed on the KOSPI. BHAR[F,O] is computed based on the difference between the offer price and the first-day opening price. BHAR[O,D3] is computed based on the closing price on the third trading day after the IPO, relative to the first-day opening price. BHAR[D4,D20] is computed based on the closing price on the twentieth trading day after IPO relative to third trading day after IPO. BHAR[M1,M13] is computed for the one-year period from one month after the IPO. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variable	Model 1	Model 2			Model 3			Model 4		
	BHAR [F,O]	BHAR [O,D3]	BHAR [D4,D20]	BHAR [M1,M13]	BHAR [O,D3]	BHAR [D4,D20]	BHAR [M1,M13]	BHAR [O,D3]	BHAR [D4,D20]	BHAR [M1,M13]
Constant	0.1833	0.2644	-0.4173*	0.1406	0.2532	-0.3737*	-0.0147	0.2798	-0.2795	0.3500
LOG(IDV_SUB)	0.0898***	-0.0035	-0.0142**	-0.0475***				-0.0031	-0.0110	-0.0427***
IDV_TURN					-0.0103	-0.0803***	-0.1401**	-0.0081	-0.0726**	-0.1103**
MARKET	0.4375***	0.1731**	-0.2026**	-0.1651	0.1630**	-0.2446***	-0.3029*	0.1719**	-0.2131**	-0.1812
TRADABLE	-0.1604	-0.0621	0.0602	-0.1314	-0.0727	-0.0363	-0.2751	-0.0731	-0.0375	-0.2799
LOG(OFFER)	-0.0428**	-0.0089	0.0356**	-0.0328	-0.0088	0.0298**	-0.0310	-0.0101	0.0252*	-0.0486*
LOG(AGE)	0.0452	-0.0188	0.0131	0.0848**	-0.0180	0.0198	0.0964**	-0.0181	0.0192	0.0942**
D_VC	-0.0360	-0.0227	-0.0228	0.1090**	-0.0240	-0.0343	0.0909*	-0.0239	-0.0341	0.0919*
D_REPU	0.0224	-0.0100	-0.0403	0.0752	-0.0110	-0.0444	0.0621	-0.0101	-0.0414	0.0736
D_KOSDAQ	-0.0639	-0.0631	0.0262	0.0103	-0.0625	0.0373	0.0183	-0.0615	0.0410	0.0329
Adjusted-R^2	0.332	0.011	0.044	0.043	0.011	0.054	0.028	0.009	0.058	0.051

Table 7. Determinants of individual investors' pre-market sentiment

Table 7 reports the multivariate regression models' estimation results, to examine the determinants of individual investors' pre-market sentiment. IDV_SUB denotes IPO stocks' subscription rates by individual investors. IST_SUB is the institutional investors' subscription rates. MARKET is the average stock returns for three months in the IPO firm's industry. AGE and OFFER are the number of months before IPO since the firm's establishment, and the number of IPO stocks issued multiplied by the offer price, respectively. TRADABLE is the number of tradable stocks divided by the number of shares outstanding. D_VC is a dummy variable for venture capital investment in IPO firms, and is coded as 1 if the firm was funded by venture capital before IPO, and 0 otherwise. D_REPU is the dummy variable for IPO underwriters' reputation, and is coded as 1 if the primary underwriter has had an IPO market share of more than 4% for the last 2 years, and 0 otherwise. D_KOSDAQ is a dummy variable, coded as 1 if the IPO stock is listed on the KOSDAQ, and 0 if it is listed on the KOSPI. REVISION is an offer price relative to a median value in the offer range. RANGE is the difference between the offer range's highest and lowest values, divided by its median value. RCT_IPO is the average return on the five latest IPOs. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	7.0876***	6.3690***	7.4872***	6.6984***	7.0381***
LOG(IST_SUB)	0.7368***		0.7470***	0.6970***	0.7238***
REVISION		5.0174***	0.4848	0.5366	0.1610
RANGE	-0.1104	-2.2176	0.0776	-0.2803	-0.1515
MARKET	0.8891	-0.0647	1.5726***		0.8497
RCT_IPO	1.4659***	1.6624***		1.6253***	1.4580***
TRADABLE	-0.0079	-0.6445	-0.1519	0.0001	-0.0173
LOG(OFFER)	-0.5382***	-0.6731***	-0.5600***	-0.5454***	-0.5433***
LOG(AGE)	-0.0150	0.0728	-0.0672	0.0036	-0.0138
D_VC	-0.3033*	-0.0106	-0.2691	-0.2717*	-0.2969*
D_REPU	0.3597**	0.3007*	0.3433*	0.3558**	0.3591**
D_KOSDAQ	-0.1316	-0.1231	-0.1213	-0.1854	-0.1383
Adjusted-R^2	0.462	0.348	0.437	0.459	0.461

Table 8. Determinants of individual investors' aftermarket sentiment

Table 8 reports the multivariate regression models' estimation results, to examine the determinants of individual investors' aftermarket sentiment. IDV_TURN is defined as individual investors' three-day average trading volumes relative to the total number of IPO firm stocks that are immune from lock-up restrictions. IDV_SUB denotes the IPO stocks' subscription rates by individual investors. IST_SUB is the institutional investors' subscription rates. MARKET is the average stock returns for three months in the IPO firm's industry. AGE and OFFER are the number of months before IPO since the firm's establishment, and the number of IPO stocks issued multiplied by the offer price, respectively. TRADABLE is the number of tradable stocks divided by the number of shares outstanding. D_VC is a dummy variable for venture capital investment in IPO firms, and is coded as 1 if the firm was funded by venture capital before IPO, and 0 otherwise. D_REPU is the dummy variable for IPO underwriters' reputation, and is coded as 1 if the primary underwriter has had an IPO market share of more than 4% for the last 2 years, and 0 otherwise. D_KOSDAQ is a dummy variable, coded as 1 if the IPO stock is listed on the KOSDAQ, and 0 if it is listed on the KOSPI. REVISION is an offer price relative to a median value in the offer range. RANGE is the difference between the offer range's highest and lowest values, divided by its median value. RCT_IPO is the average return on the five latest IPOs. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	1.8510***	1.9275***	1.7788***	1.8859***	1.7755***
LOG(IDV_SUB)	0.0523***	0.0417***	0.0534***	0.0503***	0.0521***
LOG(IST_SUB)	-0.0291		-0.0493	-0.0400	-0.0490
REVISION		-0.0112	0.2591	0.1426	0.2503
RANGE	-0.2922	-0.2098	-0.3495	-0.3193	-0.3561
MARKET	-0.1845	-0.1613	-0.2265		-0.2456
RCT_IPO	0.0546	0.0408		-0.0028	0.0426
TRADABLE	-1.3578***	-1.3391***	-1.3762***	-1.3775***	-1.3724***
LOG(OFFER)	-0.1336***	-0.1426***	-0.1413***	-0.1420***	-0.1416***
LOG(AGE)	0.0957**	0.0869**	0.0960**	0.0925**	0.0975**
D_VC	-0.1528***	-0.1573***	-0.1418***	-0.1508***	-0.1430***
D_REPU	-0.0210	-0.0140	-0.0228	-0.0203	-0.0219
D_KOSDAQ	0.2257***	0.2036**	0.2160**	0.2286***	0.2153**
Adjusted-R^2	0.285	0.283	0.287	0.283	0.285