The Effects of IPO Herding on the Initial Returns and Subsequent IPO Timing

Sunghwan Kim*

School of Business Administration, Kyungpook National University

Abstract

This study addresses two puzzles in the IPO markets in Korea: whether underpricing in the IPO market is affected by earlier market information, especially the volume and number of IPOs in the prior period, and whether underpricing in the previous period leads to a subsequent hot period in the IPO markets in Korea. Multivariate regressions are conducted using all the IPOs of firms listed on the KOSDAQ and KOSPI exchanges from 2005 to 2016. We also introduce some unique methodologies and models. Most importantly, we apply herding models developed for this study. Our findings can be summarized as follows: First, while that the herding behaviors of IPO firms in the past have a positive effect on the magnitude of IPO returns in the future, the IPO volume itself has a negative effect on the magnitude of IPO returns in the future, consistent with the expectations based on the theoretical viewpoint of the herding theory. Second, the magnitude of weighted herding in IPO markets in the past has a positive effect on the magnitude of IPO returns, while simultaneously reflecting the effects of both time-span and magnitude in returns and volume for most of the information used in Lowry and Schwert (2002)

Keyword: IPO, Herding Behavior, Initial Returns, IPO Timing, Korea

Ⅰ. Introduction

An initial public offering (IPO) is one of the best known, or maybe the most important financing methods in corporate finance (Fang, Shi and Xu, 2012). Firms use IPOs as windows of opportunity to reduce the costs of raising capital, and high IPO initial returns are not a surprising phenomenon for the Chinese stock market (Loughran, Ritter and Rydqvist, 1994), although the phenomenon of extremely high IPO initial returns exists in almost every capital market in the world (Agrawal, 2009). While high underpricing is a common phenomenon in most stock markets, in both developed and emerging economies, it is evidence against market efficiency and can hurt firms trying to raise funds for expansion. Thus, several extensive studies have begun to explore the causes of this apparent anomaly in the IPO market. With a number of theories of IPO underpricing and empirical studies using the data of various stock markets, the anomaly still exists and lasts in most economies.

Most previous studies on the determinants of corporate financial decision-making to go public and the consequences of IPOs in the free capital market report that firms tend to issue equity when stock prices are high during booming periods (Choe et al., 1993; Graham and Harvey, 2001; Schultz, 2003; Kim and Weisbach, 2005), and that in the IPO markets, investors have reportedly enjoyed surprisingly high returns, or an underpricing phenomenon.

Herding behavior in financial markets is well documented in many areas of studies. In the field of financial markets, Christie and Huarig (1995), Belhoula (2011), and Bikkchandani and Sharma all define herding as the investors' tendency to suppress or ignore their own beliefs and base investment decisions on the collective behavior of prior investors. Brunnemeier (2001) states that herding behaviors driven by subjective emotion of investors are sometimes irrational. Birkhchandami et. al. (1992) define herding in terms that in financial markets investors are influenced by others in deciding whether to enter into the market, which stocks to trade, and whether to buy or sell, that such influences may cause investor behavior to converge, that to explain these phenomena various theoretical models has been developed, and that investors decide to ignore their own information and imitate previous investor actions.

Chang et al. (2002) document that in South Korea and Taiwan herding is most pronounced and systematic risk accounts for a relatively large portion of overall security risk, which they claim that the relative scarcity of firm specific information in emerging financial markets may cause investors to rely more on macroeconomic factors. However, they claim that as long as

investors react to any of useful information, firm specific or overall market related, their behavior can be viewed as being rational.

Our studies are focused on the herding decisions in the initial public offering (IPO) market and underpricing in its initial returns. Firms use IPOs as windows of opportunity to reduce the costs of raising capital, and high IPO initial returns are not a surprising phenomenon for a stock market (Loughran, Ritter and Rydqvist, 1994), although the phenomenon of extremely high IPO initial returns exists in almost every capital market in the world (Agrawal, 2009). While high underpricing is a common phenomenon in most stock markets, in both developed and emerging economies, it is evidence against market efficiency and can hurt firms trying to raise funds for expansion. Thus, several extensive studies have begun to explore the causes of this apparent anomaly in the IPO market. With a number of theories of IPO underpricing and empirical studies using the data of various stock markets, the anomaly still exists and lasts in most economies. Most previous studies on the determinants of corporate financial decision-making to go public and the consequences of IPOs in the free capital market report that firms tend to issue equity when stock prices are high during booming periods (Choe et al., 1993; Graham and Harvey, 2001; Schultz, 2003; Kim and Weisbach, 2005), and that in the IPO markets, investors have reportedly enjoyed surprisingly high returns, or an underpricing phenomenon. IPO markets have long provided opportunities firms to finance funds for growth and in most cases lower the cost capital. The surprising underpricing phenomenon in IPO markets still exists as a puzzle. Su and Fleisher (1997) report that the primary purpose for firms going public is to raise capital, not mainly to transfer state ownership to private sectors, that IPO underpricing is the largest at the earliest stage of development of stock markets, and that absurdly huge IPO underpricing is at least partially due to a relatively small aggregate supply of shares. While the lasting and huge IPO underpricing can benefit firms to finance capital with ease from the capital market, abnormally high returns in IPO markets have caused some expected problems. Meanwhile, the opposite phenomenon has been observed in some advanced markets. As a result of a higher supply of stocks, the issuance of new stocks usually leads to decreases in IPO returns. The adverse effect of IPOs on market returns is evidenced in the U.S. (Baker and Wurgler, 2000), in emerging markets (Braun and Larrain, 2009), and internationally (Henderson et al., 2006; Wang, 2011). In addition, in contrast to Lowry and Schwert (2002) and many other studies, we will report some clear conclusions with respect to IPO puzzles: the negative relation between the IPO volume and subsequent initial returns, yet the positive relation between the initial returns and

subsequent IPO volume. However, Chen et al. (2015) report hardly any evidence of such relations in the Chinese IPO markets, unlike those in the IPO market in advanced economies like the U.S., U.K., and Japan. Thus, we focus on whether firms that file IPOs following high initial returns and high volume can themselves also expect to be extremely underpriced. To study the phenomena still under debate in the Korean IPO market specifically to explain the relation between the initial returns and the IPO volume, using most factors known as affecting IPO underpricing and some other factors introduced for this study from 2005 to April 2016, we basically apply Lowry and Schwert(2002) model for initial returns and volume in the IPO market and a new version of herding model of Hwang and Salmon (2009). Our proposed study is different in many aspects from prior ones. First, we develop theoretical models in which firms in consideration of IPO investigates the interaction between density in herding and sentiment on the basis of this idea of density in herding. Second, we develop both parametric and non-parametric models in Hwang and Salmon (2004, 2009) respectively. Third, based on exogenous and endogenous IPO herding density estimated, we study the effects of IPO herding on the returns and their variability of IPOs. In addition, by improving Lowry and Schwert (2002) in our gravity models, we investigate some puzzles still in debate: the negative relation between the IPO volume and subsequent initial returns, yet the positive relation between the initial returns and subsequent IPO volume, while many others like Chen et al. (2015) do not report such evidences.

IPO markets have long provided opportunities firms to finance funds for growth and in most cases lower the cost capital. The surprising underpricing phenomenon in IPO markets still exists as a puzzle. Su and Fleisher (1997) report that the primary purpose for firms going public is to raise owners' capital, not mainly to transfer state ownership to private sectors, that IPO underpricing is the largest at the earliest stage of development of stock markets like China, and that absurdly huge IPO underpricing is at least partially due to a relatively small aggregate supply of shares. While the lasting and huge IPO underpricing can benefit firms to finance capital with ease from the capital market, abnormally high returns in the IPO markets have caused some expected problems. Meanwhile, the opposite phenomenon has been observed in some advanced markets. As a result of a higher supply of stocks, the issuance of new stocks usually leads to decreases in IPO returns. The adverse effect of IPOs on market returns is evidenced in the U.S. (Baker and Wurgler, 2000), in emerging markets (Braun and Larrain, 2009), and internationally (Henderson et al., 2006; Wang, 2011).

This study addresses some of the IPO puzzles in Korea by applying some unique methodologies and models. First, while the magnitude of weighted (equally or value weighted) aggregate information prior IPO volumes in the past have a positive effect on the magnitude of IPO returns in the future, the IPO volume itself has a negative effect on the magnitude of IPO returns in the future. Thus, from the theoretical viewpoint of aggregate information theory, the relative magnitudes of weighted aggregate information prior IPO volumes in the past to the volume of a specific IPO firm has a positive effect on the magnitude of the initial return of an IPO firm in the future. Second, we find that the magnitude of aggregate information in IPO returns in the past has a positive effect on the magnitude of IPO returns. The simultaneous, not separated, effect of both time-span and magnitude in returns and volume, reflecting the lagged information effect of IPOs, can affect the initial returns, or underpricing, of the subsequent issuance, as well as the timing of other IPO firms in consideration. Third, we introduce subsamples to study the differences between a group of firms with the high initial returns and another with the high initial returns in underpricing in IPO and their subsequent long term effects on their stock market performance, a curse in the post-IPO market by some researchers.

In the remainder of this thesis, Chapter II discusses related literature and Chapter III explains the hypotheses and empirical models. Chapter IV investigates the data and basic relations between the initial returns and other related factors. Chapter V then investigates the effects of market and other factors on IPO underpricing and the volume of IPOs in the subsequent period, and their effects on the long time performance in the market. Finally, Chapter VI summarizes the results.

Ⅱ. Related Literature

2.1 IPO Underpricing

Theoretically, IPO firms should be relatively overvalued since firms will try to finance by timing their equity issuance: they offer when their IPO costs are the lowest, or when the initial returns are the smallest due to the highest IPO price or low initial price on the listing date. The timing of issuing securities in the U.S. IPO market is explained generally by two theories. First,

the rational market-timing theory or 'the window of opportunity', suggests that due to agency problems between managers and investors, managers have incentives to postpone their IPO when their securities are undervalued, until the bull market arrives for more favorable pricing (Lucas and McDonald, 1990; Graham and Harvey, 2001). Second, the life cycle theory suggests that a firm finds optimal timing in their life cycle to go public after its early life cycle as a private firm (Chemmanur and Fulghieri, 1999; Benninga et al., 2005). In addition to firm-level micro approaches, some prior research on IPO underpricing uses macroeconomic factors, like the stock market and bond market performances for a three month period before the IPO (Bayless and Chaplinsky, 1991), other macroeconomic variables, including the term spread, default spread, and three-month equity market return prior to the IPO (Korajczyk and Levy, 2003), and more recently legal protection and a country's accounting disclosure standards (Wang, 2011).

However, the pattern of IPOs noticed by Ibbotson and Jaffe (1975) is puzzling because theoretically firms do not go public when the initial returns are the lowest. Rather, in reality, firms tend to go public when the initial returns are the highest. It is against the general belief that firms would prefer to raise as much capital as possible in their IPO, especially when the initial returns are at the lowest. Scholes (1972) asserts that an increase in stock supply by a new equity issuance, if it is a small percentage of the assets, should not affect market prices negatively. However, Ritter (1991) provides evidence that over-optimistic investors during certain periods contribute to especially high initial returns, as they tend to bid up the after-market price of the IPO firms. Baker and Wurgler (2000) show that an increase in asset supply by a new equity issuance leads to a decrease in future aggregate equity market returns after periods of active issuance.

Lowry and Schwert (2002) report weak evidence of a negative relation between the IPO volume and future initial returns, yet a significant positive relation between the initial returns and future IPO volume. It appears that increased numbers of companies go public after observing that IPOs are being underpriced by the greatest amount. Loughran and Ritters (2002) report that the initial returns tend to be especially underpriced even though they reflect public information available during the registration period, yet only insufficiently incorporated into the offer price due to overlapping periods, generating cycles in the initial returns. Braun and Larrain (2009) also report that shocks in asset supply have a positive effect on asset prices in emerging markets. Their study also shows that a shock has a more negative effect on those stocks by the issuance of new stock in the same industry, of a similar size, or of a similar book-to-market ratio.

Lowry and Schwert (2002) reported a positive relation between the initial returns and subsequent IPO volume. However, Chen et al. (2015) reported hardly any evidence of lead-lag relations in the Chinese IPO markets, even after controlling for IPO market shutdowns due to the distinct regulatory regime in China. Thus, our study focuses on whether firms that file IPOs following high initial returns and high volume can themselves expect to also be extremely underpriced, leading to a hot period in IPOs in China, an issue still under debate.

We test the lag and lead relation between the IPO volume and average initial returns. We also investigate the effect of firm-specific factors and market factors on high initial returns as in many other prior studies. In the process, we introduce aggregate information models revised for this study to reflect the differences and value-weighted aggregate market forces in time and volume between IPOs.

2.2 Herding in the IPO Market

Herding, in general, refers to the mimicking behavior of investors following others. Herding behavior can be rational when fund managers to maintain their reputation disregard their own assessments and mimic the behavior of others (Scharfstein and Stein, 1990). Many studies have empirically focused on detecting herding behavior among fund managers (Wermers, 1999; Gleason and Lee, 2003; Clement and Tse, 2005), while herding can be detrimental to the efficiency of the market. Investors have different reasons for a profit or utility maximizing and are influenced after observing others. They might know something about the returns on the investment and their actions reveal the information. The information is relevant also for money managers who work for incentives and invest on behalf of others. And some investors may have intrinsic preference for conformity.

The pioneering work of Christie and Huang (1995) measured herding as the dispersion of stock returns with respect to market returns, where decreasing cross sectional standard deviations of stock returns (CSSD) with respect to market returns in a linear parametric model can be interpreted as evidence of herding. Chang et al. (2000) applied the cross sectional absolute dispersion of stock returns (CSAD) in a quadratic parametric regression model as an evidence of herding in the market. Both conventional empirical frameworks rely on particular parametric specifications. In the empirical literature, to test for herd behavior, other alternative approaches have been employed to address the issue of extreme cases. Celik (2013) introduces quintile regression models, applying 1% and 5% criterion.

Similarly, Chiang et al. (2013) introduce a rolling regression technique to improve the methodology. Using a new non-parametric measure of herding, beta herding, by incorporating the interaction between sentiment and herding in standard linear factor models Hwang and Salmon, 2009) find that high beta stocks are priced following adverse herding when high (low) betas are biased higher (lower), although as in Fama and French (1992) beta does not explain cross-sectional asset returns. Mahmud and Tinic (2015) apply a non-parametric approach in kernel regression models without imposing a priori restrictions on the underlying model and subjective criteria to divide the sample into subsamples to analyze the herd behavior in the Chinese stock market.

In the prior studies such as Hwang and Salmon (2009), the basis of herding is based on the interaction between sentiment and herding where they assume herding affects the values of assets in the market. Sentiment, in those studies, is considered a market wide phenomenon that evolves over time. They use dispersion in returns as a factor representing herding. This in fact demonstrates that herding increases with market wide sentiment, and then individual asset returns tend to increase regardless of their systematic risk.

2.3 Post-IPO Stock Performance

While Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) showed that new issues in the United States are followed by abnormally low stock returns for the subsequent five years, a generally accepted explanation for these findings is still in debate. Loughran and Ritter (1995) argued that these results are explained by managers exploiting temporary share overvaluation. On the contrary Spiess and Affleck-Graves (1995) and Jegadeesh (2000) claimed that the IPO underperformance is due to fact that firms take advantage of 'windows of opportunity' and sell overvalued equity to overly optimistic investors. Kang et al. (1999) showed that both convertible debt-issuing firms and equity-issuing firms underperform for at least five years in Japan and the performance of firms issuing equity privately is not different from that of other firms issuing equity publicly. Chen et al. (2000) and Gu (2003) find that IPO firms in China underperform on the market after 3 to 5 years of their IPOs. Mok and Hui (1998) and Niu, Song and Guo (2013) found that in China investors achieve negative abnormal returns, and that IPO firms underperform on the market over one- and three-year periods. Zhang (2005a) and Carlson, Fisher, and Giammarino (2006) suggest mispricing arguments. Lyandres et al. (2008)

showed that real investment is an important driving force behind the new issue puzzle. Balia et al. (2013) find evidence for a significantly negative relation between net share issues and expected returns in the United Kingdom and Japan. However, the results from Germany, France, Italy and Canada indicate that the relation between net share issues and expected returns is positive. Kwark and Jun (2015) show that in Korean IPO markets firms with excessive initial returns are more likely to suffer from price declines in a month after listing.

However, Bai and Zhang (2004) show that using Chinese IPO firms issued on the Shenzhen and Shanghai Stock Exchange between January 1998 and December 2000 the long-run stock performance of IPO firms is better than that of non-IPO firms.

Ⅲ. Hypotheses and Test Models

While Chen et al. (2015) report hardly any clear evidence of lead-lag relations in the Chinese IPO markets, even after controlling for IPO market shutdowns mainly due to a distinct regulatory regime in China, we follow the findings of Loughran and Ritter (1995) and Lowry and Schwert (2002) in the U.S. market to set and test the hypotheses in this study.

3.1. Hypotheses

3.1.1 Effects of Market Information on Initial Returns

Lowry and Schwert (2002) showed a positive effect of market returns on initial returns, without a strong statistical significance, whereas Loughran and Ritter (2002) showed that initial returns are significantly related to market returns during the periods prior to the offering, with a strong statistical significance. Following Loughran and Ritter (2002), we set the following hypothesis.

Hypothesis 1: The market returns of IPOs offered prior to an IPO have a negative effect on the initial return of the subsequent IPO.

Basically, a higher IPO price leads to a larger IPO volume, given that the issuance number is fixed. Therefore, the initial returns will be smaller, even with the same first trading day price, leading to a negative relation between them. Hanley (1993) showed a negative relation between initial returns and the proceeds of IPOs. Meanwhile, Braun and Larrain (2009) showed that a supply shock by another firm in the same industry, of a similar size or with a similar book-to-market ratio, has a more negative effect on initial returns. Thus, the larger the size of an IPO is, the lower the initial returns of the IPO will be. We then hypothesize as follows.

Hypothesis 2: The volume of an IPO has a negative effect on the initial return of the IPO.

To test the effect of spillover information in our study, we introduce the number of IPOs, as in Lowry and Schwert (2002). They showed a strong negative relation between current initial returns and past numbers of IPOs. Ritter (1991) provided evidence of investors' over-reaction during certain periods leading to underpricing in a subsequent IPO. However, following Lowry and Schwert (2002), we set the following hypotheses for the number of IPOs in the current period and in the previous period as follows.

Hypothesis 3: The number of IPOs in the current period has a negative effect on the initial return of a subsequent IPO.

Baker and Wurgler (2000) posited that an increase in asset supply by a new equity issuance leads to a decrease in future aggregate equity market returns after periods of active issuance. While Fang, Shi, and Xu (2012) found no evidence of decline in subsequent market returns after more IPOs in China, we follow Ritter (1991), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995, 1999), Lowry and Schwert (2002), and Lyandres et al. (2008) who reported a negative relation on the initial returns of a subsequent IPO. Thus, we set the following hypothesis.

Hypothesis 4: The volume in proceeds of IPOs has a negative effect on the initial return of a subsequent IPO.

Loughran and Ritter (1995), Spiess and Affleck-Graves (1995) Kang et al. (1999) showed that IPO firms underperform for some years afterwards in countries like the United States and Japan. Mok and Hui (1998) Chen et al. (2000) and Gu (2003), Niu, Song and Guo (2013) and Kwark and Jun (2015) showed underperformance in post IPO stock markets. Thus, we set the following hypothesis to study the effect of the magnitude of IPOs as follows.

Hypothesis 5: IPO stocks in China experience abnormally low returns afterward.

3.1.2 Effects of Market Information on Number of IPOs

We next examine the effects of market and firm-specific information on initial returns on the number of firms filing IPOs following periods of high average underpricing. Lowry and Schwert (2002) reported a positive relation between initial returns and the subsequent IPO volume, although Chen et al. (2015) who reported hardly any evidence of such relations in the Chinese IPO markets. Thus, we set the following hypothesis following Lowry and Schwert (2002) with respect to the effect of aggregate market information on the market timing of other IPO firms in the subsequent period as follows.

Hypothesis 6: The market returns of the prior IPO period have a positive relation with the number of IPOs in the subsequent period.

Lowry and Schwert (2002) also suggested a positive relation between the volume of IPOs and subsequent IPO volume using SDC data on aggregate IPO activity in the U.S., 1985 to 1997. Thus, we set the following hypothesis to study the effect of distance in time as follows.

Hypothesis 7: The aggregate volume in proceeds of IPOs has a positive effect on the number of IPOs in the subsequent period.

3.2. Empirical Models

Out study is focused on two issues still under debate; whether firms that file IPOs following high initial returns and a high volume can themselves also expect to be extremely underpriced, and whether underpricing in the previous period leads to a hot period subsequently in IPO markets in China. Basically, we follow two models for the empirical study; Lowry and Schwert (2002) in finance and Frankel, and revised Stein, and Wei (1993)'s models to reflect the aggregate market information.

3.2.1 Aggregate Information Models for IPO Underpricing

To test whether firms that file IPOs following high initial returns and a high volume can themselves also expect to be extremely underpriced, leading to a hot period in IPOs in China, we also developed the empirical models below. We use the initial returns (IR) defined as the difference between the first-day market opening price minus the IPO price, divided by the IPO price. Here, we assume that using the first-day market closing price, as by Lowry and Schwert (2002), to calculate the initial returns can cause a significant distortion for the following reasons. First, based on the beliefs of investors, known as prospect theory, IPO investors, after realizing huge initial margins, do not hold onto IPO stocks, but rather sell at least some of them to avoid downside risks in price. Second, according to market segmentation theory, there can be a separate market for IPO investors and post-IPO investors. Thus, we use the open price on the listing date as the selling price in the market for IPO underpricing and as the purchasing price in the following study with respect to IPO firms' overvaluation after underpricing.

We use the basic regression models, the ordinary least squares (OLS) multiple regression models in Lowry and Schwert (2002).We skip this for simplicity while we explain them later in the sections for empirical tests.

Ⅳ. Data and Descriptive Statistics

4.1. Data

The data used in this study is a merged dataset obtained from two sources, FnGuide, a firm-level financial database in Korea, and IPO stock data base for IPO information from DART (Data Analysis, Retrieval and Transfer system) of Korea Financial Supervisory Service (http://www.fss.or.kr/fss/kr/main.html). Basically, we use all the firms as long as they have data used in this study. The number of firms is subject to change due to lack of information for the variables used in the model. We use 744 firms for data analysis and regression models.

Table 1. Number of IPOs and High and Low Initial Returns by Exchange

Year	Full Sample			Low IR Firms		High IR Firms	
	All	KOSPI	KOSDAQ	KOSPI	KOSDAQ	KOSPI	KOSDAQ
2005	70	12	58	8	32	4	26
2006	62	8	54	1	23	7	31
2007	72	11	61	4	28	7	33
2008	44	6	38	5	20	1	18
2009	67	13	54	7	19	6	35
2010	92	23	69	12	44	11	25
2011	69	15	54	6	22	9	32
2012	28	7	21	6	7	1	14
2013	39	3	36	0	16	3	20
2014	71	6	65	2	37	4	28
2015	118	16	102	11	58	5	44
2016	12	1	11	0	4	1	7
Total	744	121	623	62	310	59	313

Note: 1. High and low initial return firms are classified by the median in initial returns.

2. The number of IPOs in 2016 is for the period until April 2016.

Table 1 shows that the numbers of firms going public in Korea exhibit some cycles, peaked in 2005, 2010, and 2015 in our sample period. The numbers were 70 in 2005, 62 in 2005, and 72 in 2007 followed by much fewer 44 IPOs in 2008. Then, it increased to 67 in 2009 and then 92 in 2010, followed by much fewer 69 and 28 IPOs in 2011 and 2012, respectively. Another big boom in IPOs was in 2015 with 118 IPOs after 39 in 2012 and 71 in 2014, and then followed by

a relatively cool year in 2016, although the number of IPOs in 2016 includes IPO firms that went public until April 2016. While the number of firms, classified high and low initial return firms according to the median in initial returns, is more or less distributed in balance between KOSPI and KOSDAQ exchanged, we can notice that most of IPO firms chose to go public through KOSDAQ exchange. The seemingly cyclical patterns are repeated many times over the 12-year period, which is very similar to the phenomena in the U.S. markets, as reported in Lowry and Schwert (2002). The cyclical patterns and distribution between exchanges are also very similar those in China, as reported in Tan and Kim (2016).

Table 2. Number of NIPO, Initial Returns, and Proceeds by Year

Year	NIPO	IR	Proceeds	Avg. Proc
2005	70	25.79%	8,127.0	112.9
2006	62	33.31%	11,394.0	183.8
2007	72	33.81%	25,213.0	350.2
2008	44	18.46%	8,073.0	175.5
2009	67	42.90%	33,750.0	503.7
2010	92	20.79%	102,351.0	1,077.4
2011	69	29.74%	39,949.0	570.7
2012	28	27.54%	10,095.0	315.5
2013	39	33.12%	13,098.0	311.9
2014	71	30.92%	46,605.0	647.3
2015	118	26.04%	45,298.0	368.3
2016	12	29.08%	7,429.6	353.8

Table 2 shows that the numbers of firms going public in Korea and average initial returns, total proceeds from IPOs, and average proceeds from IPOs by year from 2005 till 2006. Considering many factors, the average returns from IPO investment seem to be fluctuating around 30%, which might be very profitable in a short period of time.

While we do not see clear the relationship between them, we may notice that the average yearly initial returns are high 42.9% for 67 IPOs in 2009, and relatively low 25.79% for 70 IPOs in 2005, 18.5% for 44 IPOs in 2008, 20.8% for 92 IPOs in 2010, and 26.0% for 118 IPOs in 2010 respectively. that the numbers of firms going public in Korea exhibit some cycles, peaked in 2005, 2010, and 2015 in our sample period. The proceeds were about 0.8 trillion won in 2005, peaked in 2010 about 10.2 trillion won. The market was relatively cool in 2005, 2006, 2008, 2012, 2013 and maybe 2016 by May 2016, while it was hot in 2010, 2014, and 2015. It seems

that the numbers of firms going public in Korea and average initial returns are negatively related, as are the numbers of IPO firms with total proceeds from IPOs, as well as average proceeds.

Cyclical patterns are also observed in the Korean IPO market, as reported by Lowry and Schwert (2002) for the US markets. However we observe some interesting facts. First, when compared with the U.S. markets, the relation between the number of IPOs and initial returns is not so clear in the Korean market, if it is not opposite. Second, the lags and leads also seem not so clear in the Korean market. Third, the cyclical patterns show larger and more volatile variations in the Korean market than in the U.S. markets.

Figure 1 shows the numbers of IPOs by month and monthly average in initial returns between 2005 and 2015 for firms going public on both the KOSPI and KOSDAQ. The initial returns are limited up to 100% as for so many IPO firms in 2000s. From statistical analyses using correlation for the past 12 months, the number of IPOs and initial returns showed negative relations except for some short periods in early 2005, from April 2009 till March 2010, from June 2011 till February 2012, and from May 2015 till November 2015.

Figure 1. Monthly Average Initial Returns (IR) and Number of IPOs (NIPOs)

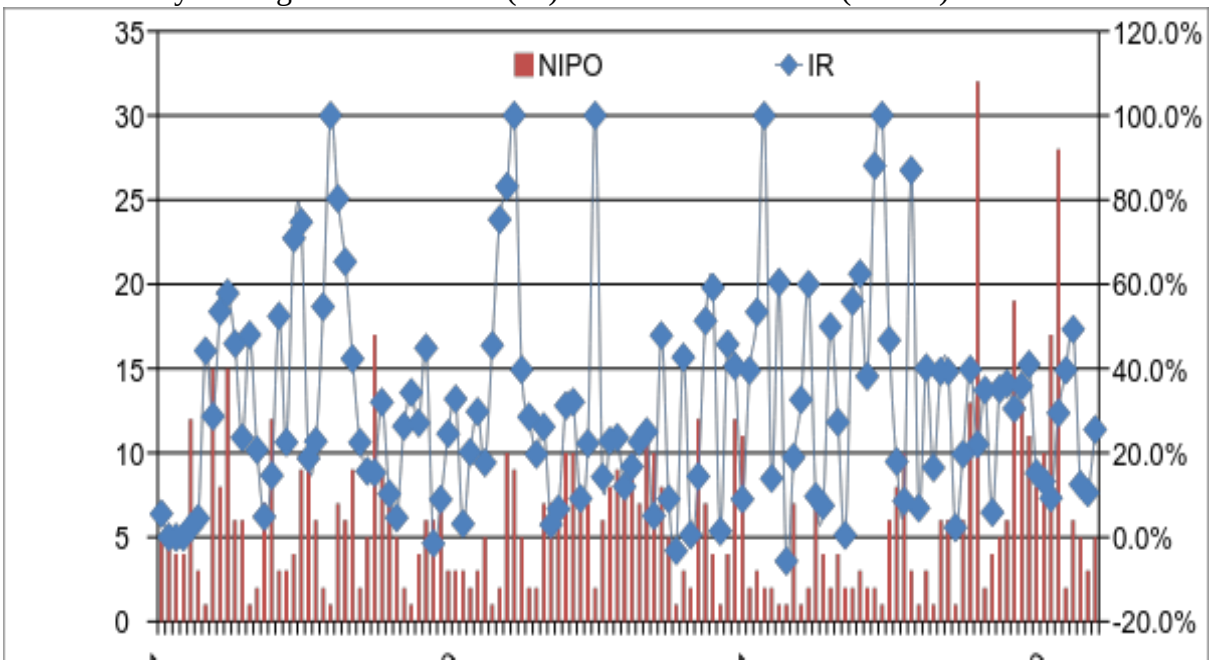

Figure 2. Monthly Average Initial Returns (IR) and Proceeds from IPOs (Proceeds: in ₩10^8)

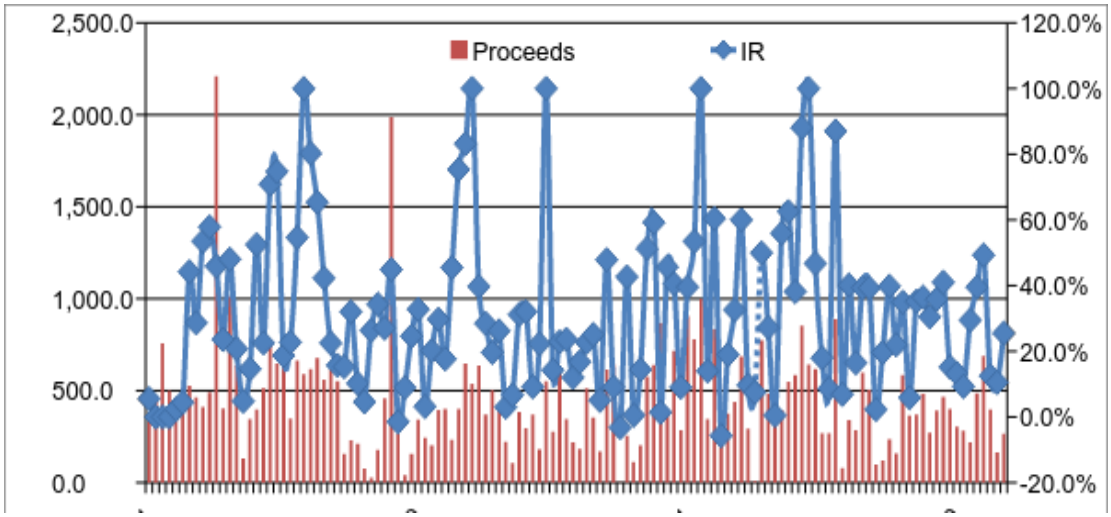

Table 3 shows the mean, standard deviation, minimum, maximum and median of the most variables used in this paper. While the total number of IPOs used in this table is 744, some firms are excluded from the full sample mostly due to lack of financial information used in regression.

Table 3. Descriptive Statistics

Variables	**Firms**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**	**Median**
IR	744	0.319	0.396	-0.844	1.000	0.200
MIR	744	0.296	0.218	-0.057	1.000	0.236
Ln_Proc	744	5.171	1.164	2.639	10.797	5.011
NIPO	744	9.385	6.397	1.000	32.000	8.000
MProc	744	0.261	0.385	-0.057	8.833	0.208
HPR_12M	744	0.010	0.380	-0.980	9.855	0.001
HPR_60M	744	0.009	0.108	-0.790	1.014	0.002
KSDQ_1M	744	0.007	0.083	-0.317	0.291	-0.002
KOSPI_1M	744	0.003	0.047	-0.303	0.181	0.004
KOSDAQ	744	0.822	0.383	0.000	1.000	1.000
Big5_D	744	0.441	0.497	0.000	1.000	0.000
Span_R	744	0.201	0.081	0.046	0.833	0.184
Sub_R	744	450.2	640.5	0.230	10159.0	381.0

Here, we focus on a few variables of interest, such as initial returns (IR), initial return of the IPO market (MIR), measured by those of other IPOs that went public in the month, volume (Ln_Proc) of the IPO measured using a natural logarithm, equally-weighted average of, aggregate volume (MProc) in 100 million won of proceeds and the number of IPOs (NIPO) during a specific month. The initial return (IR) on average is 31.8% for the selected sample of 744 IPOs, the median 20.0%, the minimum -84.4%, and the maximum 100.0%. The equally-weighted average initial return (MIR) of other IPOs in the month is about 29.1% on average, the median 23.6%, the minimum -5.7%, and the maximum 100.0%. The volume of IPOs (Ln_Proc) measured using a natural logarithm of 100 million won is about 5.17, the median 5.01, the minimum 2.63, and the maximum 10.80. Aggregate volume (MProc) of the IPO market, measured by the amount of proceeds of IPOs in the month is about 26.1 million won, the median 20.8 million won, the minimum 5.7 million won, and the maximum 883.3 million won. The number of IPO firms in a month (NIPO) is about 9.385 on average, the median 8, the minimum 1, and the maximum 32.

Dummy variable for KOSDAQ listed firms (KOSDAQ_D) is 82.2%, implying that most IPO firms went public through KOSDAQ market. Dummy variable for big 5 underwriters (Big5_D) in Korea measured based on their total IPO volume during the sample period is 44.1%, implying that 44.1% of IPO firms went public with the help of big five underwriters. The ratio of difference between high and low offer(estimated) prices to actual offer price (Span_R) is 20.1% on average, the median 18.4%, the minimum 4.6%, and the maximum 83.3%. The competition or subscription rate (Sub_R) in IPO is 450.2 times on average, the median 381 times, the minimum 0.23 times, and the maximum 10,159 times. The 12 month holding period return (HPR_12M) for IPO firms after listing is 1.0% on average, the median 0.1%, the minimum -98.0%, and the maximum 985.5%. The 60 month holding period return (HPR_60M) for IPO firms after listing is 0.9% on average, the median 0.2%, the minimum -79.0%, and the maximum 101.4%. We can recognize that long term performance (HPR_12M, HPR_36M) of IPO firms is significantly lower than their initial returns. The results might imply that the IPO firms underperform not only their initial returns but the market return.

Table 4. Pearson Correlation Coefficient between Main Variables Used

Variables	IR	MIR	HPR_1M	HPR_12M	HPR_60M	High_D	KOSDAQ	NIPO	MProc	KSDQ_1M	KOSPI_1M	B
IR	1											
MIR	0.576***	1										
HPR_1M	0.051	0.273***	1									
HPR_12M	-0.013	0.005	0.024	1								
HPR_60M	0.011	0.053	0.074**	-0.023	1							
High_D	0.794***	0.218***	-0.132***	-0.040	0.041	1						
KOSDAQ	0.077**	0.038	-0.008	0.004	0.037	0.055	1					
NIPO	-0.018	-0.063*	0.090**	-0.068**	0.009	-0.060**	-0.003	1				
MProc	0.576***	0.580***	0.134***	0.002	0.030	0.155***	0.037	-0.054	1			
KSDQ_1M	0.010	0.065*	0.102***	0.024	0.098**	-0.015	0.002	0.017	0.039	1		
KOSPI_1M	-0.034	0.014	-0.009	0.069**	0.095***	-0.033	-0.035	-0.157***	0.024	0.532***	1	
Big5_D	-0.021	-0.001	0.050	0.049	0.031	-0.004	0.093***	-0.013	-0.026	0.015	-0.004	1
Span_R	-0.011	0.035	-0.111***	-0.014	-0.018	0.006	-0.008	0.004	0.035	0.013	0.035	-0.
Sub_R	0.298***	0.207***	0.081**	-0.020	0.047	0.284***	0.150***	-0.117***	0.207***	-0.058	-0.025	-0.
Ln_Proc	-0.167***	-0.134***	-0.021	-0.043	-0.059	-0.177***	-0.585***	0.069**	-0.134***	-0.069**	-0.016	-0.

Note. *, **, and *** denote statistical significance at 10%, 5%, and 1% level, respectively.

Table 4 shows the Pearson correlations between two variables in pairs used in this study.

Basically, we focus on the correlation between the dependent variable (IR) and other major independent variables of concern. The correlation between the dependent variable and the equally-weighted IPO market return (MIR) is 57.6%, also positive at a significance level of 1%. However, the 1 month, 12 month and 60 month holding period returns (HPR_1M, HPR_12M, and HPR_60M) do not show any evidence of statistical relationship with the initial returns, at any significance level. The correlation between the high IR firms (High_D) and 1 month holding period (HPR_1M) is positive at a significance level of 1%. KOSDAQ dummy (KOSDAQ_D) shows a significantly strong relationship with the initial returns at 5% level. The number of IPOs (NIPO) shows a slightly negative relationship with the initial returns, without any statistical significance. The correlation between the dependent variable and the aggregate volume of other IPOs (MProc) is 57.6%, positive at a significance level of 1%. The correlation between the initial returns (IR) and dummy variable for big 5 underwriters (Big5_D) is negative without any statistical significance as in the case of the ratio of difference between high and low offer(estimated) prices to actual offer price (Span_R), while the one with subscription rate

(Sub_R) in IPO is positive at a significance level of 1%. Lastly, the correlation between the initial returns (IR) and the size of the IPO (Ln_Proc), measured by the amount of proceeds from the IPO is -16.7%, negative at a significance level of 1%. However, those negative or positive correlations among other variables in tandem with the initial returns (IR) do not guarantee our conclusion, since a multi-lateral correlation can cause multicollinearity in multivariate regression analyses with many factors introduced simultaneously. For these in consideration, we perform the VIF tests to measure the seriousness of multicollinearity among independent variables.

Table 5. Group Mean Tests between Low and High IR Firms

Variables	Low IR Firms (A)	High IR Firms (B)	Difference(A-B)	t-stat
IR	-0.014	0.597	-0.611 ***	-36.221
MIR	0.195	0.388	-0.193 ***	-13.498
HPR_1M	0.643	0.507	0.136 ***	3.773
HPR_12M	0.030	-0.002	0.031	0.886
HPR_36M	-0.011	-0.009	-0.002	-0.228
HPR_60M	0.003	0.013	-0.009	-1.240
NIPO	9.887	9.094	0.793 *	1.703
MProc	0.182	0.306	-0.124 ***	-5.501
Big5_D	0.443	0.439	0.004	0.114
Span_R	0.200	0.201	-0.001	-0.163
Sub_R	248.9	613.8	-365.1 ***	-8.135
Ln_Proc	5.410	4.994	0.416 ***	4.481

Note 1. *** and * denote statistical significance at 1% and 10% level, respectively.
2. Tests are performed assuming the variances of the two groups are unequal.

Table 5 presents the results of group mean tests for differences between the means of two groups, high and low IR firms classified using the median of 20.0% in initial return, a dummy variable for high IR variables (High_D), for most major variables used in the study. Each t statistic shows the statistical significance with respect to difference in means between the groups. We perform the t tests and find significant differences, assuming unequal variances between the two groups. The initial returns (IR) of firms and the IPO market IRs (MIR) are higher by 61.1%p and 19.3%p on average at a significance level of 1% for the high IR firm group.

However, the means for the two groups for the 1 month, 12 month and 60 month holding period returns (HPR_1M, HPR_12M, and HPR_60M) are not statistically different at any

significance level. The number of IPOs (NIPO) is higher at 10% significance level for low IR firms. This might imply that relatively less promising firms show herding behaviors in taking into consideration of their market entry timing. The aggregate amount of proceeds for the whole market (MProc) is higher for high IR firms, which might also be a plausible evidence of herding behaviors in market timing, while the amount of proceeds for the IPO firms (Ln_Proc) is higher for low IR firms. The likelihood of selecting big 5 underwriters (Big5_D) are not significantly different for the two groups as in the case of the ratio of difference between high and low offer(estimated) prices to actual offer price (Span_R). However, subscription rate (Sub_R) in IPO is higher for high IR firms than for high IR firms, statistically significant at a level of 1%. It is noticeable that the higher demand for IPO stocks, as evidenced by high subscription rate (Sub_R) and more IPO proceeds for the whole market (MProc) might have caused higher initial returns, and that the higher demand for IPO stocks, as evidenced by high subscription rate (Sub_R) while more supply of IPO stocks or higher price by an IPO firm, as evidenced by its IPO proceeds, could have lowered the corresponding initial returns.

Ⅴ. Regression Analysis

5.1 Effects of Market Returns on Initial Returns

Table 6 presents the regression results mainly for the market returns of IPOs on the initial returns on a current period IPO. Here, we empirically test whether initial returns are affected, as shown in Lowry and Schwert (2002). We test whether there are differences in the effects of the market returns of IPOs between two groups, high and low IR firms. For the t-statistics, we use White's (1980) heteroskedasticity-consistent standard error in regressions. There are significant differences in effects of factors on initial returns between high IR firms and low IR firms. High IR firms (High_D) have about 57.1% higher intercept than for low IR firms.

The initial returns (IR) from IPOs for KOSDAQ listed firms (KOSDAQ_D) are lower but not significant for high IR firms, higher at a significance level of 5% for low IR firms, and higher but not significant for high IR firms. The equally weighted prior month initial returns of the IPO (MIR_L) market affects positively on initial returns at a significance level of 5% for high IR

firms, positively but not significant for low IR firms, and positively at a significance level of 1% for all IPO firms. Similarly, the current month KOSDAQ market returns of the IPO (KOSDAQ_1M) market affects positively on initial returns at a significance level of 1% both for high IR firms and for the full sample, while negatively at a significance level of 1% for low IR firms. We skip interpretations on the effects of other control variables. The result is consistent with Loughran and Ritter (2002) in that initial returns are significantly related to market returns in the prior periods, and partly consistent with Lowry and Schwert (2002) in that there is a positive effect of market returns on initial returns although without very strong statistical significance.

Table 6. Effects of Market Returns on Initial Returns (Basic Models)

Variable		**Full Sample**	**Low IR Firms**	**High IR Firms**
Observations		696	339	357
F-value		159.50	5.96	5.58
R-squared		0.650	0.488	0.101
VIF		1.02~1.63	1.02~1.73	1.01~1.57
Variable IR_t	**Coefficient**	**Coefficient (t-value)**	**Coefficient (t-value)**	**Coefficient (t-value)**
High_D	β_1	0.571 *** (30.43)		
KOSDAQ	β_2	0.021 (0.73)	0.039 ** (2.02)	-0.010 (-0.18)
MIR_L	β_3	0.117 *** (2.92)	0.025 (0.81)	0.147 ** (2.18)
KSDQ_1M	β_4	0.430 *** (2.66)	-0.208 * (-1.78)	0.837 *** (2.98)
Big5_D	β_5	-0.045 ** (-2.28)	0.000007 (0.00)	-0.085 ** (-2.38)
Span_R	β_6	0.006 (0.09)	-0.197 *** (-4.56)	0.274 * (1.81)
Sub_R	β_7	0.00004 *** (2.83)	0.00009 *** (3.47)	0.00004 ** (2.22)
Ln_Proc	β_8	-0.007 (-0.72)	0.001 (0.13)	-0.014 (-0.82)
Constant	B_0	-0.023 (-0.33)	-0.045 (-0.93)	0.552 *** (4.25)

Note 1. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.
2. The estimates are the Huber White sandwich estimators.

5.2 Effects of IPO Volume on Initial Returns

In this section, we empirically test whether initial returns are affected by the magnitude of the market factors in IPOs, specifically the number (NIPO) and aggregate amount (MProc) of proceeds of IPOs that went public in the prior months on initial returns. For simplicity, we introduce such market information of the current month and up to 3 months in the empirical study. The lags of 3 months are determined in that such effects exist up to only 2 periods in our sample data. The number of lags, 3 months, is same as that in Lowry and Schwert (2002) who studied the effect of market information from the prior IPO periods on the initial returns on the initial returns and volume of subsequent IPOs.

For the full sample, High IR firm dummy (High_D) shows about 52.6% higher initial returns than low IR firms. The aggregate amount (MProc) of proceeds of IPOs that went public in the prior months has a positive effect on initial return. This positive effect is significant for both low IR firm samples and high IR firm samples but the latter sample shows a larger effect. The KOSDAQ market returns for the past 1month of the IPO (KOSDAQ_1ML) market affects positively on initial returns at a significance level of 5% for high IR firms, while not significant for the full sample and low IR firms. On the contrary, the KOSDAQ market return for the past 3 months of the IPO (KOSDAQ_3ML) market affects negatively for high IR firms and positively for the full sample but not significant, while it affects positively at a significant level of 1% for low IR firms. The number of IPOs in the same month (NIPO) as the initial public equity issuance has a positive effect on the initial returns of IPO, for the full sample at a statistical significance of 10% and the subsample for the high IR firms (High_D) at a statistical significance of 1%. While the number of IPOs in the previous month (NIPO_L) has a negative effect on the initial return, yet without any statistical significance, that of two months earlier (NIPO_L) shows a significantly negative effect on the initial return for the full sample and the subsample for the high IR firms at a statistical significance of 10%. The changing effect of prior IPO volumes with different signs is a strong evidence of cyclical patterns of IPOs in the Korean market.

Table 7. Effects of Number and Volume of Prior IPOs on Initial Returns

Variable		**Full Sample**	**Low IR Firms**	**High IR Firms**
Observations		598	300	298
F-value		67.46	3.37	5.90
R-squared		0.711	0.194	0.299
VIF		1.03~3.16	1.05~3.03	1.05~3.79
Variable	**Coefficient**	**Coefficient (t-value)**	**Coefficient (t-value)**	**Coefficient (t-value)**
High_D	β_1	0.526 *** (25.88)		
KOSDAQ	β_2	0.020 (0.70)	0.062 *** (3.18)	-0.030 (-0.58)
NIPO	β_3	0.002 * (1.60)	-0.001 (-0.80)	0.008 *** (2.87)
NIPO_L	β_4	0.001 (0.57)	-0.0004 (-0.25)	-0.001 (-0.12)
NIPO_L2	β_5	-0.004 * (-1.80)	0.002 (1.13)	-0.006 * (-1.86)
NIPO_L3	β_6	0.002 (1.01)	0.0004 (0.25)	0.003 (0.76)
MProc	β_7	0.442 *** (8.19)	0.118 ** (2.52)	0.601 *** (6.86)
MProc_L	β_8	-0.030 (0.62)	-0.029 (-0.86)	-0.093 (-1.08)
MProc_L2	β_9	0.035 (0.79)	0.037 (1.12)	0.039 (0.51)
MProc_L3	β_{10}	-0.017 (-0.42)	-0.021 (-0.74)	0.033 (0.44)
KSDQ_M1	β_{11}	-0.145 (-1.01)	0.006 (0.06)	-0.158 (-0.61)
KSDQ_M1L_	β_{12}	0.394 (1.46)	-0.301 (-1.58)	0.984 ** (2.01)
KSDQ_M2L_	β_{13}	0.346 (1.25)	-0.187 (-0.92)	0.887 * (1.88)
KSDQ_M3L_	β_{14}	0.228 (1.30)	0.469 *** (3.64)	-0.029 (-0.10)
KOSPI_1M	β_{15}	-0.067 (-0.26)	-0.309 (-1.52)	-0.177 (-0.41)
KOSPI_1ML	β_{16}	-0.259 (-0.76)	0.177 (0.71)	-0.831 (-1.37)
KOSPI_2ML	β_{17}	-0.461 (-1.46)	-0.041 (-0.18)	-1.042 * (-1.89)
KOSPI_3ML	β_{18}			
Big5_D	β_{19}	-0.015 (-0.84)	0.007 (0.58)	-0.035 (-1.09)
Span_R	β_{20}	0.033 (0.47)	-0.157 *** (-3.61)	0.270 * (1.84)
Sub_R	β_{21}	0.00004 ** (2.13)	0.001 *** (2.66)	0.00005 * (1.87)
Ln_Proc	β_{22}	0.002 (0.16)	0.004 (0.61)	-0.002 (-0.10)
Constant	B_0	-0.156 ** (-2.04)	-0.104 ** (-1.96)	0.294 ** (2.09)

Note 1. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.
2. The estimates are the Huber White sandwich estimators.

5.3 Determinants of Provisions on Number and volume of IPOs

Table 8 shows the regression results for the number of IPOs (NIPO) in the following month in relation with the volume of IPOs, the initial returns of the overall IPO market, and other gravity and market information factors. Here, we basically test the effect of the initial returns and numbers of IPOs in the prior periods on the number of IPOs ($NIPO_{t+1}$) in the following period.

The effect of the number of IPO firm in the month (NIPO) and 3 months earlier and last 3 periods (NIPO_L3) on the number of IPOs ($NIPO_{t+1}$) in the following period are all significantly positive for all samples at 1% significance level. However for the previous month and 2 months earlier IPO firms (NIPO_L and NIPO_L2), the effect is negative for all samples at 1% significance level. Although the equally weighted initial returns of the IPO (MIR) market in the month of issuance does not significantly effects on the number of IPOs ($NIPO_{t+1}$) in the following period for all samples, the equally weighted initial returns of other firms during the past 2 months (MIR_L, MIR_L2) negatively affects volume in IPO firms of IPOs in the subsequent month, while it affects positively on the number of IPOs ($NIPO_{t+1}$) in the following period. The effects of KOSDAQ market returns from past 3 month IPOs on the number of IPOs ($NIPO_{t+1}$) in the following period are significant and positive for all samples, except the low IR firms without statistical significance while those in the same month are significant and negative for all samples, except the low IR firms without statistical significance.

Interestingly, The effects of KOSPI market returns from past 3 month IPOs on the number of IPOs ($NIPO_{t+1}$) in the following period are significant and negative for all samples, except the low IR firms without statistical significance while those is the same month are significant and positive for all samples, except the low IR firms without statistical significance. The results might imply that IPO market timing is in general positively correlated with KOSPI market movements for the same period and lagged effects in an opposite ways, vice versa for the case of KOSDAQ market movements. However, considering the fact that most IPO firms go on public through KOSDAQ market, we might conclude that new IPO firms consider the KOSDAQ market returns in past 1 to 3 months in their IPO market timing, unfortunately ending up with lower initial returns due to herding effects. Table 9 shows similar regression results for the volume of IPOs ($MProc_{t+1}$) in the following month in relation with the volume of IPOs, the initial returns of the overall IPO market, and other gravity and market information factors. We skip explanations for simplicity.

Table 8. Effects of IPO Market Herding on Subsequent Herding (in Number of IPO Firms)

Variable		**Full Sample**	**Low IR Firms**	**High IR Firms**
Observations		579	292	287
F-value		9.33	6.97	4.18
R-squared		0.260	0.340	0.240
VIF		1.03~3.33	1.07~3.17	1.07~3.90
Variable $NIPO_{t+1}$	**Coefficient**	**Coefficient (t-value)**	**Coefficient (t-value)**	**Coefficient (t-value)**
High_D	β_1	-0.725 (1.30)		
KOSDAQ	β_2	0.806 (1.02)	0.767 (0.65)	0.305 (0.29)
NIPO	β_3	0.287 *** (7.04)	0.335 *** (5.72)	0.212 *** (3.65)
NIPO_L	β_4	-0.298 *** (4.49)	-0.352 *** (-3.32)	-0.261 *** (-3.07)
NIPO_L2	β_5	-0.292 *** (-4.89)	-0.233 ** (-2.19)	-0.337 *** (-4.85)
NIPO_L3	β_6	0.423 *** (6.80)	0.551 *** (5.96)	0.267 *** (3.18)
MIR	β_7	0.428 (0.28)	2.617 (0.92)	-1.102 (-0.62)
MIR_L	β_8	-4.161 *** (-3.19)	-6.550 *** (-3.21)	-3.321 ** (-1.96)
MIR_L2	β_9	-4.510 *** (3.66)	-4.397 ** (-2.16)	-4.131 *** (-2.69)
MIR_L3	β_{10}	7.561 *** (6.26)	10.650 *** (5.55)	4.717 *** (3.07)
KSDQ_1M	β_{11}	-9.048 ** (-2.23)	-4.640 (-0.72)	-10.954 ** (-2.11)
KSDQ_1ML_	β_{12}	16.613 ** (2.23)	6.735 (0.59)	21.509 ** (2.17)
KSDQ_2ML_	β_{13}	26.919 *** (3.47)	10.874 (0.87)	39.039 *** (4.07)
KSDQ_2ML_	β_{14}	17.084 *** (3.48)	27.953 *** (3.49)	10.938 * (1.78)
KOSPI_1M	β_{15}	10.507 (1.48)	-10.494 (-0.84)	20.969 ** (2.44)
KOSPI_1ML	β_{16}	-24.673 *** (-2.64)	-19.038 (-1.27)	-30.354 ** (-2.49)
KOSPI_2ML	β_{17}	-16.291 * (-1.83)	11.133 (0.79)	-36.913 *** (-3.26)
KOSPI_3ML	β_{18}			
Big5_D	β_{19}	0.278 (0.57)	0.475 (0.65)	-0.147 (-0.23)
Span_R	β_{20}	-5.153 *** (-2.69)	-6.776 *** (-2.56)	-3.860 (-1.32)
Sub_R	β_{21}	0.0004 (0.73)	0.004 *** (2.56)	-0.0001 (-0.12)
Ln_Proc	β_{22}	0.576 ** (2.16)	0.704 * (1.70)	0.411 (1.18)
Constant	B_0	4.268 ** (2.01)	0.961 (0.30)	7.638 *** (2.67)

Note 1. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.
2. The estimates are the Huber White sandwich estimators.

Table 9. Effects of IPO Market Herding on Subsequent Herding (in Volume of IPOs)

Variable		**Full Sample**	**Low IR Firms**	**High IR Firms**
Observations		579	292	287
F-value		9.33	5.43	7.93
R-squared		0.260	0.240	0.320
VIF		1.03~3.23	1.05~2.01	1.04~3.03
Variable $MProc_{t+1}$	**Coefficient**	**Coefficient (t-value)**	**Coefficient (t-value)**	**Coefficient (t-value)**
High_D	β_1	-0.007 (-0.38)		
KOSDAQ	β_2	-0.050 (-1.95)	-0.069 ** (-2.10)	-0.027 (-0.66)
MProc	β_3	0.299 *** (6.20)	0.273 *** (3.47)	0.302 *** (4.61)
MProc_L	β_4	-0.203 *** (-4.86)	-0.199 *** (-3.52)	-0.218 *** (-3.40)
MProc_L2	β_5	0.090 ** (2.30)	0.076 (1.37)	0.097 * (1.67)
MProc_L3	β_6	-0.144 *** (-3.71)	-0.124 ** (-2.33)	-0.145 ** (-2.50)
KSDQ_1M	β_7	0.697 *** (5.45)	0.658 *** (3.84)	0.768 *** (3.93)
KSDQ_1ML	β_8	0.190 (0.81)	0.080 (0.25)	0.325 (0.89)
KSDQ_2ML	β_9	0.739 *** (3.00)	0.477 (1.40)	0.846 ** (2.34)
KSDQ_3ML	β_{10}	0.548 *** (3.53)	0.661 *** (3.00)	0.396 * (1.73)
KOSPI_1M	β_{11}	-0.126 (-0.57)	-0.283 (-0.89)	-0.075 (-0.23)
KOSPI_1ML	β_{12}	0.520 * (1.81)	0.198 (0.48)	0.671 (1.52)
KOSPI_2ML	β_{13}	-1.227 *** -(4.28)	-1.046 *** (-2.69)	-1.240 *** (-2.85)
KOSPI_3ML	β_{14}			
Big5_D	β_{15}	-0.006 (-0.36)	-0.017 (-0.85)	-0.0001 (0.00)
Span_R	β_{16}	0.202 *** (3.26)	0.148 ** (2.04)	0.233 ** (2.06)
Sub_R	β_{17}	-0.00002 (-1.50)	-0.000004 (-0.08)	-0.00003 (-1.47)
Ln_Proc	β_{18}	-0.008 (-0.89)	0.003 (0.29)	-0.015 (-1.11)
Constant	B_0	0.354 *** (5.46)	0.324 *** (3.78)	0.357 *** (3.45)

Note 1. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.
2. The estimates are the Huber White sandwich estimators.

Table 10. **Effects** of Prior Returns on Post-IPO Underperformance

Category		**1 Month** (HPR_1M)	**12 Month** (HPR_12M)	**36 Month** (HPR_36M)
Observations		745	688	287
F-value		2.79	121.56	7.93
R-squared		0.040	0.671	0.320
VIF		1.01~1.42	1.02~5.23	1.03~6.79
Variable $HPR_{t+1, 12, 36mo}$	**Coefficient**	**Coefficient (t-value)**	**Coefficient (t-value)**	**Coefficient (t-value)**
Hign_D	β1	0.060 ***		
		(2.59)		
Risk_1M	β2	-1.040 ***	-0.664	-1.130 *
		(-2.74)	(-1.62)	(-1.87)
Risk_2M	β3	0.247 ***	0.014	0.312 ***
		(8.43)	(0.24)	(6.30)
IR	β4	-0.075 **	-0.094	-0.073 *
		(-2.34)	(-1.56)	(-1.71)
HPR_2M	β5	-0.013	0.026	-0.029
		(-0.59)	(0.79)	(-0.92)
HPR_3M	β6	-0.111 ***	-0.034	-0.094 ***
		(-5.12)	(-0.83)	(-2.72)
HPR_4M	β7	-0.026	0.045	-0.015
		(-0.87)	(1.07)	(-0.31)
HPR_5M	B8	-0.098 ***	-0.001	-0.104 **
		(-3.23)	(-0.02)	(-2.11)
Risk_P_60M	B9	0.186 ***	0.199 **	0.214 *
		(2.60)	(2.53)	(1.93)
Risk_Q_60M	β10	-0.005	-0.102	0.109
		(-0.04)	(-0.85)	(0.56)
KOSDAQ	β11	0.012	0.019	0.012
		(0.64)	(1.03)	(0.35)
Big5_D	β12	0.015	0.010	0.016
		(1.04)	(0.72)	(0.69)
Constant	B0	-0.042	0.019	-0.022
		(-1.25)	(0.45)	(-0.41)

Note 1. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.
2. The estimates are the Huber White sandwich estimators.

5.4 Long term Effects of IPO Underpricing

While most prior studies showed that IPO firms underperform for some years afterwards in countries as in Korea by Kwark and Jun (2015), we study the curse again with different models and methodologies. Table 10 shows that there higher initial returns (IR) affect negatively for 1 month, 12 month, and 60 month holding period after IPOs. The high IR firms (High_D) show higher holding period return after IPOs.

Ⅵ. Conclusion

This study addresses two puzzles in the IPO markets in Korea: whether underpricing in the IPO market is affected by earlier market information, especially the volume and number of IPOs in the prior period, and whether underpricing in the previous period leads to a subsequent hot period in the IPO markets in Korea. Multivariate regressions are conducted using all the IPOs of firms listed on the KOSPI and KOSDAQ exchanges from 2006 to May 2016. We also introduce some unique methodologies and models. Most importantly, we apply revised gravity models to reflect the market information introduced in Lowry and Schwert (2002). Our findings can be summarized as follows:

First, while that the magnitudes of weighted (equally or value weighted) gravity IPO volumes in the past have a positive effect on the magnitude of IPO returns in the future, the IPO volume itself has a negative effect on the magnitude of IPO returns in the future, consistent with the expectations.

Second, the magnitude of weighted IPO market returns in the past has a positive effect on the magnitude of IPO returns.

Third, the effects of market information in our study are only partially consistent with Loughran and Ritter (2002) and Lowry and Schwert (2002), as higher market returns and larger numbers of IPOs only result in more IPOs in the subsequent.

Fourth, as most prior studies showed that IPO firms underperform for some years afterwards in countries as in Korea by Kwark and Jun (2015), we find that higher initial returns affect negatively for 1 month, 12 month, and 60 month holding period after IPOs. The high IR firms show higher holding period return after IPOs.

References

Agrawal, D. (2009), "IPO Underpricing: A Literature Review," Electronic copy available at SSRN: http://ssrn.com/abstract=1724762 (accessed 2 August 2012).

Anderson, J. A. (1979), "A Theoretical Foundation for the Gravity Equation," *American Economic Review*, 69(1), 106-116.

Baker, M., and J. Wurgler (2000), "The Equity Shares in New Issues and Aggregate Stock Returns," *Journal of Finance*, 55, 2219-2257.

Baker, M. and J. Wurgler (2002), "Market Timing and Capital Structure," *The Journal of Finance*, 57 (1), 1-32.

Bayless, S. and M. Chaplinsky (1991), "Expectations of Security Type and the Information Content of Debt and Equity Offers," *Journal of Financial Intermediation*, 1, 195-214.

Bayless, S. and M. Chaplinsky (1996), "Is there a Window of Opportunity for Seasoned Equity Issuance?" *Journal of Finance*, 51, 253-278.

Benninga, S., M. Helmantel and O. Sarig (2005), "The Timing of Initial Public Openings," *Journal of Financial Economics*, 75 (1), 115-132.

Benveniste, L. M., W. Y. Busaba and W. J. Wilhelm (2002), "Information Externalities and the Role of Underwriters in Primary Equity Markets," *Journal of Financial Intermediation*, 11 (1), 6-86.

Bustamante, M. C. (2012), "The Dynamics of Going Public," *Review of Finance*, 16 (2), 577-618.

Chemmanur, T. J. and P. Fulghieri (1999), "A Theory of the Going-public Decision," *Review of Financial Studies*, 12, 249-279.

Chen, G. and M. J. Firth (2000), "The Post-Issue Market Performance of Initial Public Offerings in China`s New Stock Markets," *Review of Quantitative Finance and Accounting*, 14, 319-339.

Chen, X. Y, J. Huang and L. Xu (2015), "Corporate Governance and Resource Allocation Efficiency: Evidence from IPO Regulation in China", Electronic copy available at: http://ssrn.com/abstract=2708571

Choe, H., R. W. Masulis and V. Nanda (1993), "Common Stock Offerings across the Business Cycle: Theory and Evidence," *Journal of Empirical Finance*, 1, 3-31.

Daniel, K. and S. Titman (1997), "Evidence on the Characteristics of Cross Sectional Variation in Stock Returns," *Journal of Finance,* 52:1–33.

Fang, J. X., H. N. Shi and H. P. Xu (2012), "The Determinants and Consequences of IPOs in a Regulated Economy: Evidence from China," Electronic copy available at: http://ssrn.com/abstract=2184705

Frankel, J. A., E. Stein and S. J. Wei (1993), "Continental Trading Blocs: Are They Natural or Supernatural?" *The Regionalization of the World Economy,* 91-120.

Gu, A.Y. (2003), "State Ownership, Firm Size, and IPO Performance: Evidence from Chinese 'A' Share Issues," *American Business Review,* 101-108.

Gucbilmez, U. (2015), "IPO Waves in China and Hong Kong," *International Review of Financial Analysis,* 40, 14-26.

Hanley, K. W. (1993), "The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomenon," *Journal of Financial Economics,* 34 (2), 231-250.

Head, K. (2003), "Gravity for Beginners," *Mimeo,* University of British Columbia.

Head, K. and T. Mayer (2013), "Gravity Equations: Workhorse, Toolkit, and Cookbook," *CEPII Working Paper,* 2013-2027.

Ibbotson, R. G. and J. F. Jaffe (1975), "Hot Issue Markets," *Journal of Finance,* 30 (4), 1027-1042.

Kim, W. and M. Weisbach (2008), "Motivations for Public Equity Offers: An International Perspective," *Journal of Financial Economics,* 87 (2), 281-307.

Korajczyk, R. A. and A. Levy (2003), "Capital Structure Choice, Macroeconomic Conditions and Financial Constraints," *Journal of Financial Economics,* 68, 75-109.

Krugman, P. (1991), "The Move Toward Free Trade Zones," in *Policy Implications of Trade and Currency Zones,* Federal Reserve Bank of Kansas City, (August): 7-42.

Kwark, N. K. and S. G. Jun (2015), "Curse of IPO Underpricing: Stock Price Behavior of IPO Shares," *The Korean Journal of Financial Management,* 32(2), 143-169.

Leung, J. and K. Menyah (2006), "Issuer-oriented Underpricing Costs in Initial Public Offers: Evidence from Hong Kong," *Journal of Corporate Finance,* 12 (5), 897-905.

Lee, C., S. Andrei and T. Richard (1991), "Investor Sentiment and the Closed-end Fund Puzzle," *Journal of Finance,* 46, 75-110.

Loughran, T. and J. R. Ritter (1997), "The Operating Performance of Firms Conducting Seasoned Equity Offerings," *Journal of Finance,* 52:1823–50.

Loughran, T. and J. R. Ritter (2000), "Uniformly Least Powerful Tests of Market Efficiency," *Journal of Financial Economics,* 55:361–89.

Loughran, T and J. R. Ritter (2002), "Why Don't Issuers Get Upset about Leaving Money on the Table in IPOs?" *Review of Financial Studies,* 15, 413-443.

Loughran, T. and J. R. Ritter (2004), "Why Has IPO Underpricing Changed Over Time?" *Financial Management,* 33:5–37.

Lucas, D. J. and R. L. McDonald (1990), "Equity Issues and Stock Price Dynamics," *Journal of Finance,* 45, 1019-1043.

Lyandres, E., S. Le and L. Zhang (2008), "The New Issues Puzzle: Testing the Investment-Based Explanation," *The Review of Financial Studies,* 21 (6), 2825-2855.

Mok, H. M. K. and Y. V. Hui (1998), "Underpricing and After-Market Performance of IPOs in Shanghai, China," *Pacific-Basin Finance Journal,* 6, 453–74.

Pastor, L. S. and P. Veronesi (2005), "Rational IPO waves," *The Journal of Finance,* 60 (4), 1713-1757.

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

Ritter, J. R. (2003), "Investment Banking and Security Issuance," in George Constantinides, Milton H. and S. Ren´e (eds.), *Handbook of Economics and Finance,* Amsterdam: North Holland.

Scholes, M. (1972), "The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices," *Journal of Business,* 45, 179-211.

Schultz, P. (2003), "Pseudo Market Timing and the Long-run Underperformance of IPOs," *Journal of Finance,* 58, 483-517.

Su, C. and D. Brookfield (2013), "An Evaluation of the Impact of Stock Market Reforms on IPO Under-pricing in China: The Certification Role of Underwriters," *International Review of Financial Analysis,* 28, 20-33.

Su, D. W. and B. M. Fleisher (1997), "An Empirical Investigation of Underpricing in Chinese IPO," *Pacific-Basin Finance Journal,* 7 (2), 173-202.

Yung, C., G. Colak and W. Wang (2008), "Cycles in the IPO Market," *Journal of Financial Economics,* 89 (1), 192-208.

Wang, C. (2011), "Why Can Managers Time the Market in Issuing New Equity? The Global Evidence," *Journal of Multinational Financial Management,* 21 (3), 151-164.