M. Narikbayev KAZGUU University

International School of Economics

MASTER'S DISSERTATION (PROJECT)

«*The Long-Run Performance of Initial Public Offerings: South Korea Case*»

Program 7M04124 - «Finance»

«__» _____ 2022

Written by Abilkaiyr Turpanov

Supervisor: Aldambergenova Zhanar

Nur-Sultan, 2022

Table of contents

Abstract

The Long-Run Performance of Initial Public Offerings: South Korea Case

Abilkaiyr Turpanov

ISE KAZGUU University

May 2022

Abstract — In this research, we empirically investigated South Korean initial public offerings (IPOs) to provide one case of the international evidence on the long-run performance of IPOs. Our sample consists of 92 companies listed on the Korea Exchange (KOSDAQ) during the period 2015-2016. Unlike previous international evidence, our results reveal that the Korean IPOs outperform seasoned firms with similar characteristics. The results show that the three year buy-and-hold abnormal returns (BHAR) value is 28.3%. From 92 companies – 59 or 64% were overperformed the market, while 33 or 36% were underperformed. Thus, we can say about overall overperformance trend. Firm's size and financial leverage variables are significant at the 5% level. Our results suggest that the divergence of opinion hypothesis (on the whole) do not apply to the case of Korean IPOs, however one sub-hypothesis (Size) is accepted. Based on multivariate regression model, firms with huge size and low financial leverage seem on average to experience greater long-run overperformance.

I. Introduction

Actually, in simple words IPO (Initial Public Offering) is the “initial public offering” of a company's shares on the stock exchange. Most often, a company places shares to raise funding. The opportunity of capital raise is allowed by public share issuance to a company by public investors. The time of transition from a private to a public company can prove extremely crucial for private investors to completely materialize gains from their investment (Fernando 2021). This, generally, presents share premiums for current private investors. In the meantime, it also enables the public investors to engage and take a part in the offering.

Lee, referring to IPOs, write: “From the researcher’s point of view, IPOs are important as they represent an opportunity to observe strategic choices related to valuation and disclosure” (Lee 2003, p. 1). As a matter of fact, the research on IPOs is extensive which certainly unveiled that the performance and pricing of IPOs is identified by various apparent anomalies. Above all, it is associated with the long-term performance. Specifically, in the first years, the performance is frequently poor by IPOs regardless of remarkable raise in price during initial trading.

Anomalies associated with IPOs have not yet been fully explored. And it is very interesting, why especially in the long-run there are underperformance trend. There are many hypotheses that answer why this phenomenon happens, however sometimes hypotheses are confirmed, sometimes not. There are opinions and calculations that in developed countries there is a presence of long-term underperformance of Initial Public Offerings. Also, there are not much research papers on emerging markets. It can be due to undeveloped markets in some countries or strong government regulation and etc. For example, South Korea became developed country by 2000s. However, there are very few studies on the “long-term underperformance” subject and they are done in 1990s. For example, research conducted in 1995 by Kim *et al*., where IPO firms showed long-term “outperformance” instead of “underperformance”. However, time has changed and now it is possible to do new and additional research on the case of the South Korea.

Korea Exchange (KRX). According to PricewaterhouseCoopers Report (2017): “In 1956, the Korean stock market opened with the start of Korea Stock Exchange. In January 2005, through integration of Korea Stock Exchange and two other domestic markets, the Korea Exchange (KRX) was created. There are four markets in the KRX; Main Board (KOSPI Market), KOSDAQ (Korea Securities Dealers Automated Quotation), KONEX (Korea new exchange) and the derivatives market. The KRX is one of the most liquid stock exchanges. Numerous companies from various industries completed their IPOs successfully on KRX. In 2021, the KRX listed 2,448 companies with a combined market capitalization of $2.6 trillion. Normal trading sessions look the same as those of other major stock markets around the world. Trading opens at 9:00 a.m. and closes at 3:30 p.m. The market is open every day of the week except Saturday, Sunday, and holidays.” (PricewaterhouseCoopers Report 2017, p. 1).

The purpose of the study is to examine whether the long-term IPO underperformance evidenced in the US, UK and other developed markets also can be applied to the South Korean IPOs.

We have stated several tasks to achieve this purpose:

1. conduct a literature review on the concept of the long-run IPO performance;
2. develop a research methodology for empirical research;
3. collect data and analyze descriptive statistics;
4. systematize the results of empirical research

Object of the study are IPOs in South Korea during 2015-2016.

Subject of the study is long-run IPO performance in South Korea during 2015-2016.

Methodology of the study. In this research we used event-time approach (BHAR) in order to measure long-run performance. The study is based on testing divergence of opinion hypothesis in terms of assessing the relationship between stock returns and the age of the firm, the issue size, the industry of the IPO and the financial strength of the firm. Thus, obtained

results are just confirmation of the existing findings, which were tested based on the developed markets. We also used correlation analysis and regression modeling to evaluate the significance of the influence of several key factors on BHAR in South Korea.

Hypotheses of the study. We formulated 5 hypotheses of the study:

1. The long run performance of IPOs is a positive function of the age of the issuing company in South Korea.
2. The long run performance of IPOs is a positive function of issuing size of the company in South Korea.
3. The long run performance of IPOs is dependent on the financial strength of the company in South Korea.
4. The long-run performance is negatively related to the financial leverage of the companies in South Korea.
5. The long-run performance is positively related to the ROA of the companies.

Structure of the work. The study consists of an introduction, a literature review, research methodology, results of the empirical study, conclusion and references.

II. Literature Review

Initially, to test the concept of the long-run underperformance, many researchers did their analysis on the United States stock markets. And then, they focused on other markets of different countries: primarily developed countries such as United Kingdom, Germany, Japan, Spain and other. In general, most of the studies that had been done conclude that this phenomenon of the long run underperformance appears in almost many cases, but of course there are exceptions, but there are also some nuances there. Nonetheless, it is important to note that the amplitude, the scope of the underperformance is contrasting among each stock market and country. Agathee *et al.* write: “Based on the overreaction hypothesis, it is often argued that the initial underpricing of IPOs is affected positively by ex-ante uncertainty, and that a greater degree of underpricing will be followed by worse long-run aftermarket performance” (Agathee *et al*. 2014, p. 3). Buyers are highly positive about the securing IPOs at first, which then, “inflation” occurs and prices become very high. Nonetheless, at the stage where the information is at vast, IPOs will eventually arrive at their fair values. It may occur that the short run underpricing of equities is followed by long run under performance.

In general, Ritter (1991) did one of the first notable studies that set out to measure the performance contingent on stock returns. The matching of issuing firms in the (1975-1984) period was pursued in this study on the basis of industry, indices and size. The study conducted by Ritter (1991) showed the underperformance of IPOs. It suggested that the underperformance stretches beyond trading’s first year. A trial was held having 1,526 IPOs samples through 1975-1984 underperformed same size & industry firms matching the percentage of 29% by the third-year anniversary of their public listing. The calculation of the returns was carried out by employing cumulative average balanced with monthly rebalancing along with buy-and-hold returns over three years. It has been discovered that in the three years subsequent to making the way to become public, issuing firms considerably underperformed. It is explained by Ritter

(1991) as the over optimism of the investors while considering the prospects of firms that issued equity for the first time, and firms availing these "window of opportunities".

However, as already mentioned, the underperformance of IPOs is not confined to the US. According to Miller (2000) on the European studies: “It was discovered by Uhlir (1988) that underperformance matched 7.4% after one year of German issues from 1977-1987. 93 Australian IPO’s that were issued from 1966-1978 were studied by Finn & Higham (1988)” (Miller 2000, p. 3). They determined the earning to be 6.5% below the indices if buying was made at the end of the month of listing and held to the end of the first year. However, loss was not statistically notable. Long-run performance of a sample having 712 UK IPOs was surveyed by Levis (1993) in the UK that was issued during 1980-1988 (Levis 1993). Divergence of opinion and overreaction hypotheses are tested. Contingent on the chosen benchmark, Levis (1993) described the variation of underperformance between 8.3% and 23%. Also, Aggarwal *et al*. (1993) described three-year market-adjusted returns of minus 47%, minus 20% and minus 24% for Brazil, Mexico and Chile, respectively.

Mixed findings are discovered on Asian markets IPOs concerning long-term performance. It was found that IPOs surpasses stock market average in the long run. For, example, there was the quite outdated study on long run performance of IPOs in South Korea made by Kim in 1995. The finding is compatible with the superior average ex post-financial performance of IPOs. Results can be related to the fact that there was some government intervention and regulation. Authors explain that fact. Also, the long run performance was reported positive for Malaysia. For example, Cao and Wen write: “While developed countries report a persistent result of long-run underperformance, emerging countries have mixed results. Dawson (1987) examines the 1-year market-adjusted return for IPOs in Hong Kong, Singapore, and Malaysia during 1978-1984. While the underperformance in Hong Kong and Singapore is insignificant, Malaysia IPOs over-perform significantly 18.2%. The same result of Malaysian IPOs with high long-term return up to 3-year after listing is reported in Jelic *et al*. (2001). Kim *et*

al. (1995) study on 169 IPOs listed on KSE during 1985–1989, revealing that the Korean IPOs outperform seasoned firms with similar characteristics in the first month, quite not statistically different from seasoned firms in the long-run" (Cao and Wen (2013), p. 2). As we can see, these studies informative, however outdated. In Korean 1995 study divergence of opinion and overreaction hypotheses didn't confirm.

In case of India, Bhatia and Singh (2010) analysed the "long-run performance" of 438 IPOs offered during 1992-2001. Bhatia and Singh write: "The cumulative adjusted abnormal returns (excluding initial returns) of Indian IPOs experienced a decline as evidenced in the literature, however, negative returns do not surface before fifteenth month and after thirtieth month such negative returns disappear. The CARs follow an increasing trend from the thirty-first month till the sixtieth month. The CARs at the end of the fifth year is 184.64%" Bhatia and Singh (2010), p. 12. Also, Cao and Wen (2013) discovered performance of 121 IPOs listed on Taiwan Stock Exchange between 2005 and 2007. They found severe underperformance (3-5 years after the issue). In one more recent study that had done by Jewartowski and Lizińska (2012) of performance of Polish Initial Public Offerings between 1998 and 2008 on the Warsaw Stock Exchange, researchers noted "significant long-term underperformance" with mean of minus 23% for the three-year buy-and-hold strategy. Divergence of opinion hypotheses is confirmed. Jewartowski and Lizińska write: "Our study documents some determinants of IPO short- and long-run returns that are consistent with the divergence of opinion hypothesis (Miller 1977)." (Jewartowski and Lizińska 2012, p. 60).

Actually, there are three main hypotheses on the long-run underperformance issue that are mainly tested: divergence of opinion hypothesis, impresario/overreaction hypothesis and windows of opportunity hypothesis. Many clarifications have been given along with models in support of long-term underperformance. But the most well-liked justification for these settles with overreaction hypothesis which argues that the IPOs initial returns are influenced by the before the event uncertainties and that higher initial returns will be trailed by off putting

aftermarket execution. This also shows that at first purchasers are very hopeful about the acquisition of IPOs but with the abundance of information at a later stage these IPOs will eventually reach their fair values, and it might happen that the initial short run returns of equities are accompanied are paired with long-run underperformance. Shiller (1990) built up the impresario theory to anticipate that the IPO market is dependent upon some "crazes-fads" and that speculation financiers, going about as "producers", would just undervalue the "work" since they need to pull in financial backers for new issues. This outcome depends with the understanding that there is a data deviation among financial backers and guarantors, and that all things considered, speculation investors go about as delegates to guarantee the nature of the issue. This intentional undervaluing makes the presence of overabundance interest to make it an occasion, setting off financial backers' positive thinking and eruption towards the stock. Specifically, Shiller (1990) accepts that there are "trends" in the protections markets, steady with the famous clarification of the overreaction hypothesis announced by De Bondt and Thaler (1987). As time passes by, data is revealed to such an extent that organizations with high introductory returns thusly procure low returns. It is interesting note and Agathee et al. write: “As such, the impresario hypothesis and the overreaction hypothesis both predict that the degree of underperformance of IPOs would be positively related to the degree of the underpricing and negatively related to the ex-ante financial strength of an IPO” (Agathee *et al.*2014, p. 13).

In addition to that, Miller (1977) have suggested the "Divergence of Opinion" hypothesis in which the long-term performance is identified with the variety of opinions like the costs would change downwards in the longer run with the boost in information flow along with cutback on opinions and suggestions. Be that as it may, the dissimilarity of assessment will be more noteworthy when the ex-ante vulnerability in regards to the IPO is higher. Taking all points into consideration, the "divergence of opinion hypothesis" predicts a negative connection between ex-ante uncertainty and aftermarket performance. Furthermore, various investigations have also advocated by giving reasons that managers or administrators exploit the investors’ good faith.

Ritter writes: “If high volume periods are associated with poor long-run performance, this would indicate that issuers are successfully timing new issues to take advantage of windows of opportunity” (Ritter 1991, p. 4).

Simultaneously a reason given for the underperformance of IPOs is that there is an inclination for firms to attempt to seem appealing prior to opening up to the world. Teoh *et al.* (1998) contend that organizations will attempt “aggressive earnings management” exercise to build investors good faith in the IPO year. So, IPOs will window dress their bookkeeping numbers with the end goal that financial bankers are excessively hopeful about their stocks. With this impact, Jain and Kini (1994) guarantee that it will bring about pre-IPO performance being exaggerated and post-IPO performance being downplayed (Jain and Kini 1994).

To evaluate the long-run IPO performance, researchers use different approaches. The calculation of buy-and-hold abnormal return (BHAR) is the most common approach. A fairly large number of studies based on this method are devoted to developed capital markets. For example, Fathi and Simonsson (2018) conducted an analysis of long-run IPO performance for Swedish companies based on BHAR. Merikas *et al.* (2010) conducted a similar analysis for the USA. Fotiadou (2015) assessed the factors that affect BHAR for companies in the UK.

Although a large number of studies are devoted to developed markets, there are studies that have evaluated long-run IPO performance based on BHAR for emerging markets. Agathee, *et al.* (2014) analyzed long-run IPO performance for companies in Mauritius. Arora N. and Singh B. (2020) conducted such an analysis for Indian companies. Jamaani and Alidarous (2021) studied the specifics of long-run IPO performance for companies in Saudi Arabia.

Researchers also use other methods to evaluate long-run IPO performance. In particular, Kuantan *et al.* (2019) calculated cumulative abnormal returns (CAR) to identify underperformed and overperformed companies. This method is usually used to analyze the reaction of the stock market to news (event study). This method is also applicable to the evaluation of long-run IPO

performance. However, BHAR is more relevant because this method is focused on analyzing the long-term effects of an IPO, while CAR is more relevant for analyzing short-term effects. Singh and Jain (2018) used a modified cumulative market-adjusted return method to analyze the long-run IPO performance. This method is also more relevant for the analysis of short and medium term IPO performance.

Thus, based on previous research findings, it can be concluded that less research has been made to discover the relationship between stock returns and the long run IPO performance in South Korean market and the existing studies are outdated.

III. Research Methodology

i. Hypotheses development

The methodology will be generally conducted according to Agathee, *et al.* (2014) research. It will be tested 4 hypotheses on divergence of opinion hypothesis. Divergence of opinion hypothesis: actually, there are a lot of investors that are very optimistic, when IPO in beginning stage. Also, in initial stage of IPO, there is a high level of uncertainty and scarce of information, however optimistic investors will overestimate IPOs. Nevertheless, after some time, information becomes more and more and there are a more pessimists, thus the price corrects and falls. As such, the hypothesis predicts that if it is high ex-ante uncertainty, then the aftermarket performance will down. For instance, a young, small company with short operating history, low sales and low capitalization in high tech industry probably will have huge underperformance. Four variables for ex-ante uncertainty are used to test this relationship. These are the age of the firm, the issue size, the industry of the IPO and the financial strength of the firm.

Explanation why these variables have been chosen. According to Miller (2000), when “divergence of opinion” lowers, the price of the stock also lowers. It is direct dependency. Obviously, when a firm is new, there is also a lot of uncertainty around its future. It usually happens that there are more optimists than pessimists, and as a result, optimistic speculators dictate (influence) the pricing of stocks. Miller writes: “As a result, the divergence of opinion will be greater for an initial public offering than for the typical seasoned stock. The effect of this greater divergence of opinion is to raise the stock price and lower the return. In addition, as the company develops an operating history, it becomes easier to forecast its future earnings and dividends. The divergence of opinion shrinks. This lowers the price relative to well-seasoned stocks given the same mean valuations by investors” (Miller 2000, p. 7). It is obvious that the more speculative our security, if we look in the framework of our “divergence of opinion” theory,

the worse our long run performance will be in the future. Miller (1977) claimed that uncertainty and risk are correlated with “divergence of opinion”, so the “divergence of opinion” itself can be measured by the uncertainty about the returns from a security. However, we have not a measure of uncertainty. Miller writes: “Since there are no direct measures of uncertainty about the value at the time of the initial offering, it is necessary to find variables that proxy for the degree of initial uncertainty” (Miller 2000, p. 9-10). Size, firm age, industry and financial strength are some of the surrogates of uncertainty, that could shed light to the issue.

Size and underperformance. Small companies (low market value, small sales, small investments) will be the most speculative ones, the ones with the greatest “divergence of opinion”, and the ones expected to underperform the most.

Firm age. The age of the company can be used as one of the proxies too. Actually, new young firms are the most uncertain and risky. However, many investors believe that these start-ups will achieve success in future. However, according to Ritter (1991), mature companies outperform new start-ups.

Industry. According to Miller (2000), usually all industries have the same “low performance” trend, except three special groups: financial institutions, insurance and restaurant chains.

Financial strength. As it was already mentioned, there is a negative relationship between ex-ante uncertainty and aftermarket performance. Agathee *et al.* write: “To this effect, companies with lower ex-ante financial strength are associated with higher ex-ante uncertainty and as such, should experience greater underperformance.” (Agathee *et al.* 2014, p. 22). In order to know the financial strength of companies, Altman Z-scores will be calculated. According to Investopedia: “The Altman Z-score is the output of a credit-strength test that gauges a publicly traded manufacturing company's likelihood of bankruptcy. The formula takes into account

profitability, leverage, liquidity, solvency, and activity ratios." (Investopedia 2021). Therefore, this indicator comprehensively assesses the financial position of the company.

Based on these arguments, the following hypotheses are considered:

Hypothesis 1 (H1): The long run performance of IPOs is a positive function of the age of the issuing company in South Korea.

Hypothesis 2 (H2): The long run performance of IPOs is a positive function of issuing size of the company in South Korea.

Hypothesis 3 (H3): The long run performance of IPOs is dependent on the financial strength of the company in South Korea.

We will also analyze several other important factors that can have a significant impact on long-run IPO performance.

Financial risks can have a significant impact on long-run IPO performance. Kumar and Sahoo (2021) proved that risk exposure is a significant factor that affects long-run IPO performance. Companies that use a riskier financial strategy perform worse on average. Investors perceive such companies as insufficiently reliable. On the other hand, higher risk must be offset by higher returns, so financial risk can have a positive impact on long-run IPO performance. To analyze financial risk, we will use financial leverage. Financial leverage is calculated as the ratio of debt to equity of the company. The higher the financial leverage, the more aggressive the financial policy pursued by the company. Financial leverage is used as an independent variable for the analysis of long-run performance. In particular, Aslam and Ullah (2017) revealed a negative and significant impact of financial leverage on long-run IPO performance. We also assume that financial leverage will have a negative impact on long-run IPO performance. We have identified the following hypothesis:

Hypothesis 4 (H4): The long-run performance is negatively related to the financial leverage of the companies in South Korea.

Business performance can also be an important factor. Companies that have efficient business processes, on average, have higher profitability. Companies that have more profitable and efficient businesses have, on average, more successful long-run IPO performance, according to an empirical study by Singh and Jain (2018). The researchers built a regression model and proved that ROA, which was used as a proxy for business performance, had a statistically significant impact on long-run IPO performance. However, some studies refute this conclusion. Mutai (2020) also conducted an empirical study and showed that ROA and ROE are not reliable predictors of long-run IPO performance. ROA before the IPO is quite different from ROA after the IPO. Therefore, the author recommends that investors do not focus on ROA as an important indicator when deciding whether to invest in a company during an IPO. Consequently, there are different approaches to understanding the effect of ROA on long-run IPO performance. We will test this hypothesis using regression analysis:

Hypothesis 5 (H5): The long-run performance is positively related to the ROA of the companies in South Korea.

The specification of the regression equation is shown below:

Multivariate Regression: $BHAR_{i36} = \alpha + \beta_{1\,i} SIZE_i + \beta_2 AGE_i + \beta_3 ZSCORE_i + \beta_4 Leverage_i + \beta_5 ROA_i + u_i$

The dependent variable will be 36 months buy and hold abnormal returns (BHARs) of companies where as the independent variables are defined: SIZE = log of firm's book value, AGE =company's age in years, where age is calculated from the year of incorporation to the year of listing, ZSCORE = Ex-ante Financial Strength, Financial leverage= The logarithm of

financial leverage, ROA= Net income divided by total assets , INDUSTRY = extra dummy variable takes a value one if firms are in the non-financial sector and zero otherwise.

ii. Sample and data collection

Actually, South Korean Stock Exchange consists of three parts: Main Board (KOSPI Market), KOSDAQ and KONEX (New exchange). The sample of IPO companies had been taken from KOSDAQ exchange, because of the search criteria, more than 90 percent of companies are listed on this exchange. We got a sample of 92 companies, which have been gone public from January 1, 2015 to May 5, 2016.

We have defined the following criteria for data collection:

1. companies are public;
2. head office of the companies is located in Korea;
3. companies made an IPO in 2015-2016;
4. companies belong to non-financial industries.

Data collection process has conducted through Bloomberg Terminal, Korea Exchange site, Google search and other databases. Industry classification for IPO sample firms have been held. There are different data sources for the independent variables:

- Size. The log of firm's book value. Data from Bloomberg terminal.
- Age. Age is calculated from the year of incorporation to the year of listing. Data from Korea Exchange website.
- Z-SCORE= ex-ante financial strength. An Altman Z score is calculated based on figures prior to the year of listing to proxy the ex-ante financial strength. Data from Bloomberg terminal.
- Financial leverage= The logarithm of financial leverage. Data from Bloomberg terminal.
- ROA= Net income divided by total assets. Data from Bloomberg terminal.

- Industry (dummy). This dummy variable takes a value one if firms are in the non-financial sector. Data from Korea Exchange website.

Furthermore, only non-financial companies were taken due to fundamentally different economic mechanisms. Other researchers (for example, Agathee *et al.* 2014) also did not include financial companies in the sample. In particular, Z-Altman is quite different for such companies, but these changes are related to the specifics of the business model of organizations in the financial industry.

Next there were check for availability of stock price for a 36-month period after IPO event month and financial data (annual reports) for period thirty-six month after and IPO event. We have chosen this period of time because it is the most optimal for analyzing long-term IPO performance. On the one hand, 36 months is a long enough period of time for investors to get enough information about the company's future prospects. On the other hand, such a period of time is not too long, the company's business model is likely to remain the same. Longer time periods may involve fundamental transformations of the company's business model, so IPO performance analysis becomes less relevant in this case.

iii. Methods of the study

Long Run Return Measurement. The Event-time Approach

There are different methods to estimate “abnormal” returns. The BHAR method will be used, because it conceptually better for long-time horizons. Several studies criticize CAR method, when estimating long-run “abnormal” returns. For instance, Barber and Lyon (1997) find that CARs are the “biased predictors” of BHARs. It leads to measurement bias and incorrect results may appear in a greater extent. Furthermore, Barber and Lyon write: “Second, even if the inference based on cumulative abnormal returns is correct, the documented magnitude does not correspond to the value of investing in the average or median sample firm relative to an

appropriate benchmark over the horizon of interest. Yet this is precisely the objective of long-run event studies of stock returns." (Barber and Lyon 1997, p. 370). Agathee *et al.* (2014) according to Ritter (1991), as an alternative measure to CAR, the buy and hold abnormal return, which is defined as a strategy where a stock is purchased at the first closing market price after going public and held until its T anniversary, is defined as:

$$R_{iT} = \prod_{t=1}^{T}(1 + r_{iT}) - 1 \quad (1)$$

where T is number of months and r_{iT} is the raw return on firm *i* in event month *t*, T is 36 months here since we consider the 3-year total return. The holding period return on the benchmark during the corresponding period for firm *i*, r_{mT}, is also calculated in the same manner.

Agathee, U.S. et al. (2014) according to Kooli and Suret (2004), take the buy-and-hold abnormal return (BHAR) as:

$$BHAR_{iT} = [\prod_{t=1}^{T}(1 + r_{iT}) - 1] - [\prod_{t=1}^{T}(1 + r_{mT}) - 1] \quad (2)$$

where r_{mT} is the return on the benchmark during the corresponding time period.

The mean buy-and-hold abnormal returns for a period t are defined as:

$$BHAR_t = \sum_{i=1}^{nt} x_{it}\, BHAR_{it} \quad (3)$$

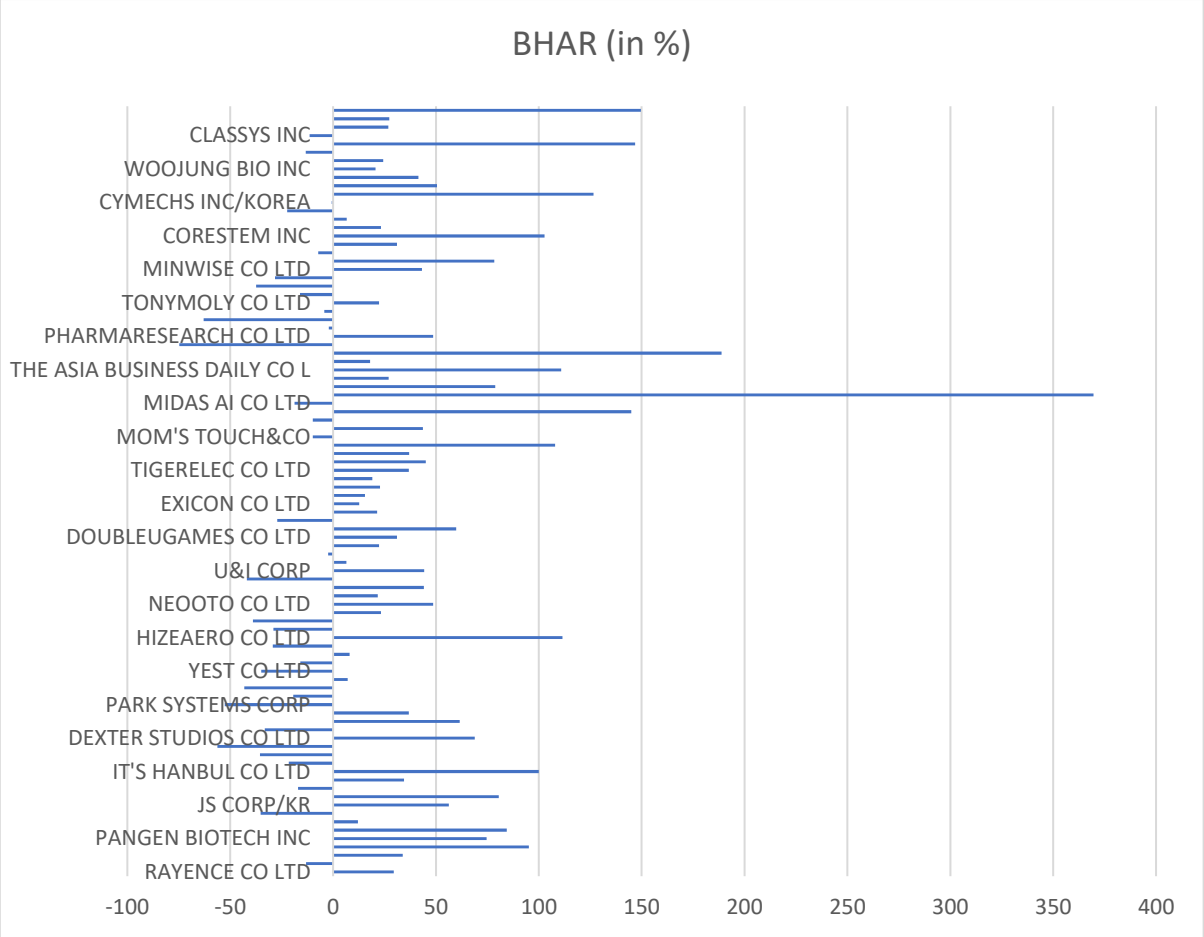
Multicollinearity, heteroscedasticity tests will be applied, also t-statistics will be used. We will use a correlation matrix and a Variance inflation factor (VIF) to test models for multicollinearity. VIF is the most relevant test for multicollinearity analysis, so we will draw final conclusions about multicollinearity based on this test. We will use White's test to test the model for heteroscedasticity. This test puts the null hypothesis of homoscedasticity. If we reject this hypothesis, then we will conclude that the residuals are heteroscedastic. The model in this case is not suitable for interpretation because the coefficient estimates are biased. We will calculate White's test for each regression model. Models will be constructed in statistical software program STATA MP 16.

IV. Results of the empirical study

According to the methodology we reviewed earlier, we calculated BHAR for the 92 companies that are part of KOSDAQ. Average BHAR value is 28.3%. From 92 companies – 59 or 64% were overperformed the market, while 33 or 36% were underperformed. Thus, we can say about overall overperformance trend.

The results are presented in the figure below.

Figure 1. BHAR calculation results



We concluded that most companies showed fairly good results in terms of increasing capitalization in the long run. Some companies posted extremely high BHARs - for example, Hyungkuk B&B posted a BHAR of 369%. Chemtros Co showed the worst results - this company

showed BHAR, which is equal to -74.8%. However, the mean BHAR is positive at 28.3%. Consequently, companies outperformed the market by 28.3% on average over the long run. The IPOs that were implemented in 2015-2016 in Korea were quite successful.

The conclusions obtained are quite typical for empirical studies. For example, Ahmad-Zaluki (2018) identified the importance of overperformance for Malaysian companies. Arora and Singh (2020) also made this finding for Indian companies. But there are also studies that reveal significant underperformance. For example, Gregory *et al.* (2010) identified a fairly large proportion (over 40%) of underperformed IPOs.

We analyzed the factors that affect BHAR. We used regression equations to test our hypotheses.

Specification of the model:

$$BHAR_i = \alpha + \beta_1 * Size_i + \beta_2 * LN\_leverage_i + \beta_3 * Altman\_Z\_Score_i + \beta_4 * Age_i + \beta_5 * ROA_i + u_i$$

Descriptive statistics are shown in table 1.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
BHAR	92	.2827034	.6306191	-.7475539	3.696602
Size	92	11.0957	1.165526	8.631334	14.33137
LN_leverage	92	.4444628	.3719901	.024595	1.947666
ALTMAN_Z_Score	92	13.46053	22.82462	.1456	124.7684
Age	92	13.73913	8.158956	2	50
ROA	92	.017652	.08671	-.4015389	.1508231

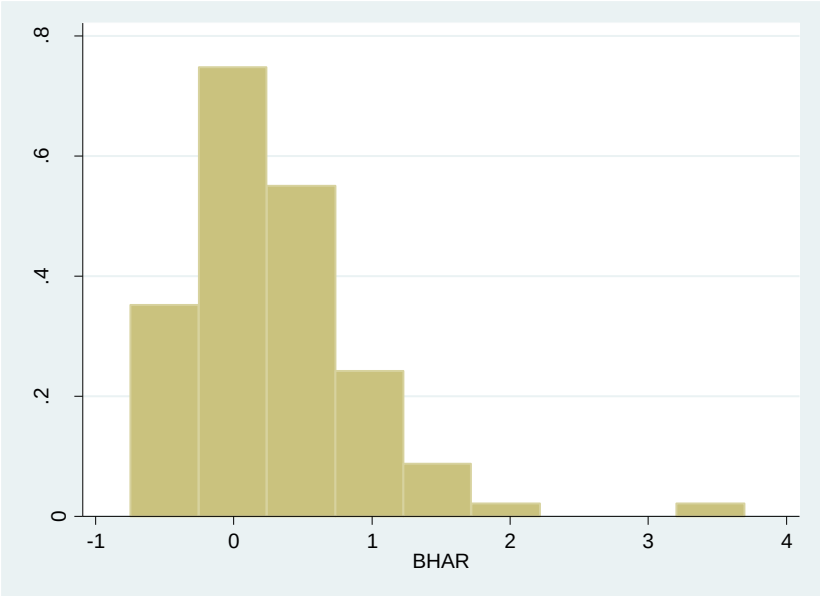
The sample size is 92 companies. The average age of companies that went public with an IPO was 14 years old at the time of the IPO. Consequently, the company was mature enough when they made the decision to go public. The oldest company was founded 50 years before going public. ROA averages 1.8% for the sample. Hence, the company is on average profitable. 15.1% is the highest ROA in the sample. This value is not extremely high. The lowest ROA value is -40%. We will check if ROA affects BHAR for this sample.

Altman Z-Score averages 13.5. This value is far enough from zero, so we can conclude that the financial condition of the companies is generally favorable. However, some companies have a very low Altman Z-Score. 0.15 is the minimum value in the sample.

Size and leverage were taken logarithmically to minimize the risks of heteroscedasticity. Such a method is relevant for spatial sampling in order to achieve a uniform scale for all companies.

Density diagram for the dependent variable (BHAR) is shown in the figure below.

Figure 2. Density diagram for BHAR



We built a correlation matrix to preliminarily assess the relationships and assess the risks of multicollinearity:

Table 2. Correlation matrix

	BHAR	Size	LN_leverage	ALTMAN_Z_SCORE	Age	ROA
BHAR	1.0000					
Size	0.1493	1.0000				
LN_leverage	-0.1228	0.3524	1.0000			
ALTMAN_Z_SCORE	-0.0390	-0.0137	-0.3983	1.0000		
Age	-0.0823	0.1114	0.0500	-0.1092	1.0000	
ROA	0.0662	0.3043	-0.0693	-0.1737	0.1268	1.0000

BHAR has rather weak correlations with independent variables. BHAR and Size have the closest correlation. The Pearson correlation coefficient is 0.15 for these variables. This coefficient is positive. Therefore, we can assume that company size is the growth driver of BHAR. However, we must use regression analysis to confirm this finding, because multivariate regression will allow us to analyze the combined effect of various factors on the dependent variable.

BHAR and Leverage are also relatively highly correlated compared to other variables. Pearson's correlation coefficient is -0.12 for these variables. A negative value of the correlation coefficient indicates that there may be a negative relationship between the variables. The higher the company's leverage, the lower the BHAR. We may assume that this relationship is statistically significant, but we will use regression analysis to confirm this finding.

There is no strong correlation between the independent variables. Leverage and Altman Z-Score have the closest correlation. Pearson's correlation coefficient is -0.3983. Therefore, there is a weak negative relationship between a company's financial position and leverage.

However, this relationship is not strong enough to pose a significant risk of multicollinearity. Therefore, we are able to include all factors in the regression model.

We conducted a VIF test for a more advanced multicollinearity risk analysis. This test quantifies the risk of multicollinearity. If the VIF is greater than 10, then there are high risks of multicollinearity. The results of the VIF test are shown in table 3. According to the results obtained, the VIF averaged 1.31; this is a fairly low value. VIF for all variables does not exceed 10, so we concluded that the risk of multicollinearity is low and we can include all independent variables in the model.

Table 3. VIF test for the basic regression

Variable	VIF	1/VIF
LN_leverage	1.53	0.653540
Size	1.40	0.716218
ALTMAN_Z_Score	1.34	0.746174
ROA	1.26	0.792437
Age	1.03	0.969471
Mean VIF	1.31	

The results of the VIF test for the model with industry variables also show that the risk of multicollinearity is low.

Table 4. VIF test for the regression with industry variables

Variable	VIF	1/VIF
Manufacture	2.81	0.355758
Software	1.93	0.517886
LN_leverage	1.83	0.544980
ALTMAN_Z_SCORE	1.65	0.607134
Wholesale	1.55	0.644695
Size	1.53	0.653446
Retail	1.52	0.656079
ROA	1.49	0.672594
RD	1.46	0.685083
Electronics	1.33	0.753335
Construction	1.17	0.855704

Media	1.14	0.878819
Age	1.07	0.931438
Mean VIF	1.58	

Next, we will present the results of the regression analysis

Firstly, we checked each hypothesis factor separately.

The results of the regression analysis for the Size variable are shown in table 5. We can conclude that this factor does not have a significant effect on BHAR at the 10% level.

Table 5. Size

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Size	.0807659	.0563937	1.43	0.156	-.0312699	.1928018
_cons	-.613451	.6291324	-0.98	0.332	-1.863332	.6364303
F(1, 90)	2.05					
Prob > F	0.1556					
R-squared	0.0223					
Number of obs	92					

The results of White's test, which tests for heteroscedasticity, are shown in table 6. The null hypothesis of homoscedasticity is confirmed. Therefore, the problem of heteroscedasticity is not relevant.

Table 6. White test results

chi2(2)	=	1.22
Prob > chi2	=	0.5447

The regression where Altman Z-Score is the independent variable is shown in table 7. According to the results of this model, Altman Z-Score has no significant effect on BHAR at the 10% level.

Table 7. Altman_Z_Score

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
ALTMAN_Z_SCORE	-.0010771	.0029101	-0.37	0.712	-.0068586	.0047044

_cons	.2972015	.0768013	3.87	0.000	.1446224	.4497806
F(1, 90)	0.14					
Prob > F	0.7122					
R-squared	0.0015					
Number of obs	92					

The results of White's test are shown in table 8. The model is not characterized by heteroscedasticity of residuals.

Table 8. White test results

chi2(2)	=	0.27
Prob > chi2	=	0.8727

The results of the regression calculation, where Leverage is the independent variable, are shown in table 9. This variable is not significant at the 10% level, according to the results of the t-test.

Table 9. Financial leverage

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
LN_leverage	-.2082441	.1773425	-1.17	0.243	-.560566	.1440778
_cons	.3752602	.1025555	3.66	0.000	.1715158	.5790046
F(1, 90)	1.38					
Prob > F	0.2434					
R-squared	0.0151					
Number of obs	92					

The results of White's test are shown in table 10. The model is not characterized by heteroscedasticity of residuals.

Table 10. White test results

chi2(2)	=	0.28
Prob > chi2	=	0.8695

The results of the regression calculation, where ROA is the independent variable, are shown in table 11. ROA had no significant effect on BHAR at the 10% level, according to the results of this model.

Table 11. ROA

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
ROA	.4815599	.7649317	0.63	0.531	-1.03811	2.00123
_cons	.274203	.0673335	4.07	0.000	.1404332	.4079727
F(1, 90)	0.40					
Prob > F	0.5306					
R-squared	0.0044					
Number of obs	92					

The results of White's test are shown in table 12. The model is not characterized by heteroscedasticity of residuals.

Table 12. White test results

chi2(2)	=	0.44
Prob > chi2	=	0.8027

The results of the regression calculation, where Age is the independent variable, are shown in table 13. The results of the model show that Age did not have a statistically significant effect on BHAR.

Table 13. Age

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Age	-.0063575	.0081196	-0.78	0.436	-.0224886	.0097736
_cons	.3700496	.1295608	2.86	0.005	.1126544	.6274449
F(1, 90)	0.61					
Prob > F	0.4357					
R-squared	0.0068					
Number of obs	92					

The results of White's test are shown in table 14. The model is not characterized by heteroscedasticity of residuals.

Table 14. White test results

chi2(2)	=	0.41
Prob > chi2	=	0.8163

We can see that each variable is not significant, when is checked separately.

Next, we calculated the regression, which included all independent variables. The results of this regression are shown in table 15.

Table 15. Regression results

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Size	.1495429	.0658137	2.27	0.026	.0187095	.2803762
LN_leverage	-.4854199	.2158708	-2.25	0.027	-.9145568	-.0562829
ALTMAN_Z_SCORE	-.0047132	.0032926	-1.43	0.156	-.0112586	.0018323
Age	-.0085476	.0080809	-1.06	0.293	-.0246119	.0075167
ROA	-.387845	.8410269	-0.46	0.646	-2.059751	1.284061
_cons	-.9731026	.6830163	-1.42	0.158	-2.330894	.3846888
F(5, 86)	1.67					
Prob > F	0.1497					
R-squared	0.0886					
Number of obs	92					

The results of White's test are shown in table 16. The model is not characterized by heteroscedasticity of residuals.

Table 16. White test results

chi2(20)	5.42
Prob > chi2	0.9995

This regression model shows the following results. Firstly, company size has a statistically significant effect on BHAR (5% significance level). We made this conclusion based on the t-test. The coefficient is positive (0.15), so there is a positive effect of Size on BHAR. Secondly, leverage also has a significant effect on BHAR (5% significance level). However, leverage has a negative impact on BHAR. The higher the leverage, the lower the BHAR. This confirms our hypothesis. Thirdly, Altman Z-Score, age and ROA had no significant effect on

BHAR. All of these factors had a negative impact on BHAR, but we cannot confirm the statistical significance of these results at the 10% level.

We can conclude that there are 2 significant factors: company size (positive impact) and financial leverage (negative impact). These variables are significant at the 5% level.

We also removed the least significant variable (marginality - ROA), the results were stable:

Table 17. Main Regression results

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Size	.1376898	.0603124	2.28	0.025	.0178124	.2575672
LN_leverage	-.4551829	.2047395	-2.22	0.029	-.8621248	-.048241
ALTMAN_Z_SCORE	-.0042798	.0031413	-1.36	0.177	-.0105236	.0019639
Age	-.0088181	.008023	-1.10	0.275	-.0247647	.0071286
_cons	-.8639874	.6378172	-1.35	0.179	-2.131718	.4037433
F(4, 87)	2.06					
Prob > F	0.0934					
R-squared	0.0864					
Number of obs	92					

The results of the White test for heteroscedasticity show that the null hypothesis of homoscedasticity is confirmed. Therefore, the model is not characterized by the heteroscedaticity problem, so the results obtained are not distorted.

Table 18. White test result

chi2(14)	3.49
Prob > chi2	0.9978

Many variations were made and thus this model was obtained. It is the final and most stable model. P-value is 0.09, we can say that our model is significant at the 10% level. Adjusted R-squared value is 4.4%. It is a low value, however many scientists argue that in finance and especially, for instance, in predicting stock returns using regression models, it is normal practice getting models that yield R-squared values in the range of 5% to 10%.

Size and financial leverage variables are significant at the 5% level. These two hypotheses are confirmed.

Regression equation results are the following:

BHAR = -0,864 + 0,138*Size – 0,455*LN_leverage – 0,004*Altman_Z_Score-0,0088*Age

We can conclude that models that assessed the significance of independent variables separately showed different results compared to a model that included all independent variables at the same time. This can be justified by the fact that the model becomes better with the advent of new variables, because we reduce the proportion of the random factor. It turns out that if we include few variables, then this so-called "random factor" begins to settle in a constant. And the R-squared goes down. The better variables we set, the definite the model becomes. (We also take into account the simultaneous influence of several variables). In contrast, if we do not take into account that something else can influence this “variable”, then this simplifies the model too much. As a result, it may be of bad quality. Again, a lot of random factors. And we say that several factors simultaneously influence (and here they are Size, Age, Financial strength and etc.), then the share of random factors becomes smaller. The model is already better oriented in these dependencies. And the quality will go up.

Thus, when we include several variables, then we reduce the proportion of the random factor, for example, this can be seen from the R-squared. Also, we improve the quality of the model by taking into account the simultaneous influence of several factors. That is, it is not an isolated model (simplified), but more realistic. And in econometrics, multiple models are commonly used.

We added dummy variables for various industries to explore the impact of the industry factor:

Table 19. Regression with industry dummies results

BHAR	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Size	.1384288	.0638451	2.17	0.033	.0113482	.2655094
LN_leverage	-.5139576	.2235637	-2.30	0.024	-.95895	-.0689653
ALTMAN_Z_SCORE	-.0060488	.0035187	-1.72	0.090	-.0130526	.0009549
Age	-.0078061	.0082192	-0.95	0.345	-.024166	.0085537
Wholesale	.2010256	.3901336	0.52	0.608	-.5755159	.9775671
Software	.5977383	.361382	1.65	0.102	-.1215747	1.317051
Retail	.5577736	.4454694	1.25	0.214	-.3289111	1.444458
RD	-.15573	.4341834	-0.36	0.721	-1.019951	.7084905
Media	-.4223349	.6578545	-0.64	0.523	-1.731761	.8870917
Manufacture	.3081094	.2343221	1.31	0.192	-.1582972	.7745159
Construction	.044159	.6703725	0.07	0.948	-1.290184	1.378502
Electronics	.7327454	.4915314	1.49	0.140	-.2456234	1.711114
_cons	-1.123144	.6930302	-1.62	0.109	-2.502587	.2562976
F(12. 79)	1.32					
Prob > F	0.2231					
R-squared	0.1672					
Number of obs	92					

The results of White's test are shown in table 20. The model is not characterized by heteroscedasticity of residuals.

Table 20. White test results

chi2(14)	3.49
Prob > chi2	0.9978

Size and leverage remained significant at the 5% level. Altman-Z is also significant at the 10% level. But we cannot accept this model, because p-value shows that this regression is not significant in the 10% level. There are no significant industrial variables.

The results of the empirical analysis are systematized in table 21.

Table 21. Conclusions on hypothesis testing

Hypothesis	Outcome
Hypothesis 1. Size is significant and has a positive effect on BHAR.	The variable «Size» is significant and positive at the 5% level. Hypothesis accepted.
Hypothesis 2. Age is significant and has a positive effect on BHAR.	The variable «Age» is not significant at the 10% level. Hypothesis rejected.
Hypothesis 3. Altman Z-Score is significant and has a positive effect on BHAR.	The variable «Altman_Z_Score» is not significant at the 10% level. Hypothesis rejected.
Hypothesis 4. Financial Leverage (level of financial risk) is significant and negatively affects BHAR.	The variable «LN_leverage» is significant and negative at the 5% level. Hypothesis accepted.
Hypothesis 5. ROA is significant and has a positive effect on BHAR.	The variable «ROA» is not significant at the 10% level. Hypothesis rejected.

We have received results that show the features of long-run performance of IPO in South Korea. We can draw several main conclusions from these results.

Firstly, company size has a significant and positive effect on BHAR. Therefore, the larger the company, the higher the probability of a successful long-run performance after an IPO. Other studies also show this result (Agathee, *et al.* 2014). Larger companies have more opportunities to invest and secure long-term growth. Such companies may pursue an aggressive M&A strategy to achieve economies of scale. In particular, companies from technology industries often use this strategy. In addition, large companies are more ready for significant business scaling compared to small companies. An IPO is a tool for scaling a business because companies can raise significant amounts of money to implement investment projects. Small companies do not have enough resources to effectively use the IPO as a funding channel. This is one of the reasons why company size has a positive effect on long-run performance.

However, company age is not a significant variable in the model. Therefore, the time factor is not important compared to the company size factor. Even if the company is old, but this company is relatively small, such a company is likely to have a weaker long-run IPO performance compared to a large and young company. These results confirm the findings that were made by Arora and Singh (2020). Age is not an important predictor in the regression equation that these researchers built to analyze long-run IPO performance. Que and Zhang (2019) came to similar conclusions based on the results of the BHAR model. However, the results obtained do not correspond to those obtained by Malhotra and Premkumar (2017). These researchers found a positive effect of company age on long-run IPO performance. Such differences may be related to the specifics of the Korean market. The Korean market is characterized by a high role of technology, companies are in intense technological competition. The age of the company in such conditions is not an important factor. Company size, as we noted earlier, is a more important factor.

Secondly, financial leverage has a significant impact on long-run IPO performance. Consequently, companies that have high financial risk have, on average, weaker long-run IPO performance. Financial leverage shows the balance between debt and capital of the company. If the financial leverage is high, the company has restrictions on raising funds. Banks and other financial institutions offer less favorable terms for companies that have a high debt load. In addition, the financial stability of such companies is lower. This creates negative conditions for the long-term growth of the company. On the one hand, the high level of financial risk is a consequence of the company's aggressive investment policy. This policy created favorable conditions for growth and IPOs. On the other hand, companies with high financial risk are more limited in their investment compared to companies with low financial risk. On average, financial leverage has a negative impact on long-run IPO performance, as the results of the regression analysis show. These results are in line with the findings made by Aslam and Ullah (2017). The researchers also identified the impact of this factor on the IPO market in Pakistan.

At the same time, Altman Z-Score is not a significant factor that affects long-run IPO performance. The financial strength of the company is not the basis for the growth of the company's value in the long term. Such conclusions do not correspond to the results that were obtained by Agathee *et al.* (2014). These researchers found a positive effect of this factor on long-run performance. Kuantan *et al.* (2019) also came to these conclusions as a result of regression analysis. Some studies have shown no such effect, which is consistent with our findings. In particular, Badru and Ahmad-Zaluki (2018) did not find a significant effect of Altman Z-Score on long-run IPO performance for the entire sample. We also came to these conclusions. This may be due to the more important role of financial leverage. In addition, a company's long-term success is more related to the company's investment strategy than to its financial strength.

Thirdly, ROA is not a statistically significant predictor of long-run IPO performance. These conclusions contradict the results that were obtained by Singh and Jain (2018). The researchers conducted an empirical study and identified a significant impact of this factor on long-run IPO performance. Our study shows that ROA is not a reliable predictor of long-run IPO performance. ROA is a dynamic indicator that is characterized by high volatility. Therefore, a high ROA before the IPO will not necessarily be maintained for 3 years after the IPO. In addition, business profitability is not fundamentally important for capitalization growth. Companies can use different investment strategies. In particular, the company may pursue an aggressive M&A strategy. Such transactions will not be profitable for the company in the short term, but they significantly increase the company's long-term prospects. Therefore, the growth of the company's capitalization can be based on aggressive expansion, which does not imply high profitability. Our research is consistent with the results that were obtained by Mutai (2020). The researcher does not recommend using ROA and ROE as a predictor of long-run IPO performance because these factors are not statistically significant in the model.

Fourthly, the industry factor was not significant in our models. These findings are consistent with the results of a study by Agathee *et al.* (2014). The researchers also did not

reveal a strong influence of the industry factor on long-run IPO performance. We can conclude that the industry is not a predictor for long-run IPO performance.

We have formed several recommendations for investors based on the results obtained. Firstly, we recommend that investors analyze the size of a company before an IPO. Larger companies have more potential to sustain long-term growth. This indicator is a reliable predictor for long-run IPO performance. Secondly, we recommend analyzing financial leverage to evaluate long-run IPO performance. Companies that have high financial leverage have limited potential for long-term business development. This factor is unfavorable in terms of long-run IPO performance.

At the same time, it is important to consider the limitations of the study. We used data for South Korea. Studies that have been done for other financial markets sometimes show different results. For example, Malhotra and Premkumar (2017) built a model for India and concluded that company age is a significant factor that affects long-run IPO performance. This factor should be taken into account when making investment decisions. Size selection is another important factor that must be considered. The sample size is 92 companies, which is a relatively small sample. Expanding the sample to include new years can improve the quality of the model. However, we did not include 2020-2021 to avoid distorting the model results due to the powerful impact of the coronavirus on the stock market. Accounting for this factor in future models is a promising area of research. We also do not analyze financial companies because such companies have a specific business model; many indicators of the model are not relevant for financial companies. However, analyzing the factors that affect BHAR for financial companies is a promising research direction.

V. Conclusion

According to the results of the study, we examined whether the long-term IPO underperformance evidenced in the US, UK and other developed markets also can be applied to the South Korean IPOs.

We made the following conclusions:

Firstly, the researchers analyzed long-run IPO performance for various countries. Most of the findings were made for developed countries, including the US and UK. There are three main hypotheses on the long-run underperformance issue in the empirical studies: divergence of opinion hypothesis, impresario/overreaction hypothesis and windows of opportunity hypothesis. We concluded, that less research has been made to discover the relationship between stock returns and the long run IPO performance in South Korean market and the existing studies are outdated.

Secondly, based on the empirical studies we stated 5 hypotheses for our study. These hypotheses concern the impact of 5 factors on long-run IPO performance: age, size, Altman Z-Score, financial leverage, ROA. To estimate long-run IPO performance we used buy-and-hold abnormal return (BHAR) method. This method is conceptually better for long-time horizons. We chose 36-month time period because it is the most optimal for analyzing long-term IPO performance. We collected a sample of 92 companies, which have been gone public from January 1, 2015 to May 5, 2016. Data collection process has conducted through Bloomberg Terminal, Korea Exchange site, Google search and other databases. Industry classification for IPO sample firms have been held.

Thirdly, results of the BHAR calculations showed, that 64% of the companies were overperformed the market, while 33 or 36% were underperformed. We highlighted overall

overperformance trend. Most companies showed fairly good results in terms of increasing capitalization in the long run.

Fourthly, we tested 5 hypotheses. We revealed that the company's size is significant and positive at the 5% level. Hypothesis 1 was accepted. The company's age is not significant at the 10% level. So, hypothesis 2 was rejected. We concluded that the Altman Z-Score is not significant at the 10% level. Hypothesis 3 was rejected. We revealed that the variable leverage is significant and negative at the 5% level. So, hypothesis 4 accepted. Finally, results showed that the variable «ROA» is not significant at the 10% level. Hypothesis 5 was rejected.

Fifthly, we have formed several recommendations for investors based on the results obtained. We recommend that investors analyze the size of a company before an IPO. This indicator is a reliable predictor for long-run IPO performance. Small companies (low market value, small sales, small investments) generally are the most speculative ones, the ones with the greatest "divergence of opinion", and the ones expected to underperform the most. We also recommend analyzing financial leverage to evaluate long-run IPO performance. Companies that have high financial leverage have limited potential for long-term business development.

There are some imitations of the study. We used data only for South Korea. We did not include 2020-2021 to avoid distorting the model results due to the powerful impact of the coronavirus on the stock market. We also did not analyze financial companies because such companies have a specific business model. Some directions are relevant for the future research. Including COVID-19 factor in future models is a promising area of research. Analyzing the factors that affect BHAR for financial companies is a relevant research direction as well.

References

1. Agathee, U.S. *et al*. (2014) “The Long Run performance of IPOs: The case of the Stock Exchange of Mauritius”, *Applied Financial Economics*, Vol. 24, No. 17, pp. 1123-1145.
2. Aggarwal, R. *et al*. (1993) “The Aftermarket Performance of Initial Public Offerings in Latin America”, *Financial Management*, Vol. 22, No. 1, pp. 42-53.
3. Arora, N., & Singh, B. (2020). “The long-run performance of SME IPOs in India: Empirical evidence from Indian stock market”, *Journal of Asia Business Studies*.
4. Aslam, U., & Ullah, S. (2017). “Determinants of IPO short run and long run performance: a case study on the listed firm of Pakistan stock exchange”, *Paradigms*, 11(2), 165-172.
5. Badru, B. O., & Ahmad-Zaluki, N. A. (2018). Explaining IPO initial returns in Malaysia: ex ante uncertainty vs signalling. *Asian Review of Accounting*.
6. Barber, B.M. and Lyon, J.D. (1997) “Detecting long-run abnormal stock returns: The empirical power and specification of test statistics”, *Journal of Financial Economics*, Vol. 43, pp. 341-372.
7. Bhatia, S. and Singh, B. (2010) “A Study on the Long-Run Performance of Initial Public Offerings in India”, *Journal of Managerial Finance and Research*, Vol. 6, No. 2, pp. 1-23.
8. Cao, M.H. and Wen, Y.F. (2013) “Short-Run and Long-Run Performance of IPOs: Evidence from Taiwan Stock Market”, *Journal of Finance and Accounting*, Vol. 1, No. 2, pp. 32-40.
9. De Bondt, W.F.M. and Thaler, R.H. (1987) “Further Evidence On Investor Overreaction and Stock Market Seasonality”, *Journal of Finance*, Vol. 42, No. 3, pp. 557-581.
10. Fathi, S., & Simonsson, J. (2018). Long-run IPO performance on the Swedish equity market between 2004-2014-Compared with Private Equity backed IPOs.
11. Fernando, J. (2021) “Initial Public Offering (IPO)” Available from: https://www.investopedia.com/terms/i/ipo.asp [Accessed: 29 Mar 2021].
12. Fotiadou, I. (2015). Long-run IPOs performance: the case of Germany, UK and France.

13. Gregory, A., Guermat, C., & Al-Shawawreh, F. (2010). UK IPOs: Long run returns, behavioural timing and pseudo timing. *Journal of Business Finance & Accounting*, *37*(5-6), 612-647.
14. Jain, B.A. and Kini, O. (1994) “The Post-Issue Operating Performance of IPO Firms”, *The Journal of Finance*, Vol. 49, No. 5, pp. 1699-1726.
15. Jamaani, F., & Alidarous, M. (2021). The short-and long-lived effects of IFRS mandate on IPO firms in emerging market economies. *Journal of Financial Reporting and Accounting*.
16. Jewartowski, T. and Lizińska, J. (2012) “Short- and Long-Term Performance of Polish IPOs”, *Emerging Markets Finance & Trade*, Vol. 48, No. 2, pp. 59-75.
17. Kenton, W. (2021) “Altman Z-Score”, Available from: https://www.investopedia.com/terms/a/altman.asp [Accessed: 25 Nov 2021].
18. Khan, S. *et al.* (2017) “Determinants of IPO’s Long-run Performance: Case of Pakistan Stock Exchange”, *Economics, Business and Management*, Vol. 11, No. 3, pp. 13-45.
19. Kim, J. *et al.* (1995) “The aftermarket performance of initial public offerings in Korea”, *Pacific-Basin Finance Journal*, Vol. 3, No. 4, pp. 429-448.
20. Kuantan, D. P., Siregar, H., & Juhro, S. M. (2019). Long Term under Performance IPO and Financial Distress (Empirical Study of Indonesia Stock Exchange). *DLSU Business & Economics Review*, *29*(1), 200-206.
21. Kumar, A., & Sahoo, S. (2021). “Do anchor investors affect long run performance? Evidence from Indian IPO markets”, *Pacific Accounting Review*.
22. Lee, P.J. (2003) “Initial Public Offers in a Multiple Framework: the impact of Subsequent Equity Issues on Signalling by Underpricing and Retained Ownership” Available from: http://philiplee.id.au/research/PhD%20P.J.%20Lee.pdf [Accessed: 6 Apr 2021].
23. Levis, M. (1993) “The Long-Run Performance of Initial Public Offerings: The UK Experience 1980-1988”, *Financial Management*, Vol. 22, No. 1, pp. 28-41.

24. Malhotra, M., & Premkumar, N. (2017). “Long run performance of initial public offerings in India”, *The Business and Management Review*, *9*(1), 206-214.
25. Merikas, A., Gounopoulos, D., & Karli, C. (2010). Market performance of US-listed Shipping IPOs. *Maritime Economics & Logistics*, *12*(1), 36-64.
26. Miller, E.M. (1977) “Risk, Uncertainty, and Divergence of Opinion”, *The Journal of Finance*, Vol. 32, No. 4, pp. 1151-1168.
27. Miller, E.M. (2000) “Long run underperformance of initial public offerings: an explanation”, *Department of Economics and Finance Working Papers*, 1991-2006, Paper 16. Available from: https://scholarworks.uno.edu/econ_wp/16/ [Accessed: 5 Apr 2021].
28. Mutai, J. K. (2020). “Can a Company’s Pre-IPO return on Assets (ROA), Return on Equity (ROA) and Initial Returns Predict Post-IPO Performance?”, *Journal of Finance and Economics*, *8*(3), 93-99.
29. Perera, K. (2014) “Evaluation of Market Performance of Initial Public Offerings (IPOs) and Its Determinants: Evidence from Australian IPOs” Available from: https://vuir.vu.edu.au/25676/1/Kotalawala%20Liyanage%20Wasantha%20Perera.pdf [Accessed: 03 Apr 2021].
30. PricewaterhouseCoopers Report (2017) “Listing in Korea A Guide to Listing on the Korean Exchange”, Available from: https://www.pwc.com/kr/en/tax/samilpwc_2017k-ipo_en.pdf [Accessed: 25 Nov 2021].
31. Que, J., & Zhang, X. (2019). “Pre-IPO growth, venture capital, and the long-run performance of IPOs”, *Economic Modelling*, *81*, 205-216.
32. Ritter, J.R. (1991) “The Long-Run Performance of Initial Public Offerings”, *The Journal of Finance*, Vol. 46, No. 1, pp. 3-27.
33. Ritter, J.R. (1998) “Initial Public Offerings”, *Contemporary Finance Digest*, Vol. 2, No. 1, pp. 5-30.

34. Shiller, R.J. (1990) “Market Volatility and Investor Behavior”, *American Economic Review*, Vol. 80, No. 2, pp. 58-62.
35. Singh, A. K., & Jain, M. S. (2018). “Relationship between long-run market performances of IPO’s and operating performance of IPO issuing companies: an analysis”, *Message from the Chief Editor*, 50, 37.
36. Teoh, S.H. *et al.* (1998) “Earnings Management and the Long-Run Market Performance of Initial Public Offerings”, *Journal of Finance*, Vol. 53, No. 6, pp. 1935-1974.