Literature Review

Yanwei Pan

panyw@uchicago.edu

IPO underpricing ("New issues Puzzle") has become one of the most famous market anomalies since Ibbotson (1975) documented in their research. Ibbotson used the data of new issue companies in the US from 1960 to 1969 and built up a time-series model to test the dependency of new issue premia, which is the first empirical analysis that justifies the IPO underpricing phenomenon in the US capital market. Ibbotson's research shows that the average underpricing rate is 11.4% among the sample data, which triggered researchers to explore the factors that cause this "puzzle".

Much work has been done in this exploration. As an IPO is associated with three groups of people: issuers, underwriters (usually are the investment banks), investors (including institutional investors and individual investors), most of the research that relates to IPO underpricing focus on these three perspectives. The most common one is focus on the underwriters' perspectives. That is to say, the majority of researchers considered the underpricing was caused by the low pricing. Logue firstly took this perspective. He built a linear regression model to explore the relationship between new issue performance (underpricing level relative to the market index) and competing issues variable, market ebullience variable, etc., as he considered the investment banker would underprice a new issue due to the consideration of minimizing his own cost, risks and gaining favors from issuers. Then, Baron utilized principal-agent theory to explain the IPO underpricing in 1982, which built a more generalized theory model in this perspective. His model indicated that, as the underwriters had more advantages in gathering information and resources in the stock markets, and they had more experience in issuing shares, they would underprice the new issues in order to ensure the success of issuing. As a result, the underpricing rate would be positively related to the risks of the new issue. Johnson and Miller (1988) specifically took Logue's consideration of investment banker's prestige to explore the impact of investment banker prestige on the IPO underpricing. They used two methodologies to measure the prestige level of each investment bank in their sample with a size of 196, including binary measurement and a four-point ranking scale. The empirical result shows that, the

underpricing level is positively related to the prestige of investment banker, using the OLS regression. In 1989, Welch proposed to use a signaling model to explain the underpricing, which is one of the most well-known theory in explaining the "New Issue Puzzle". He assumed that there are two kinds of firms in the stock market, including low-quality firms and high-quality firms. As the low-quality firms tended to imitate the high-quality firms in their issuing process, they would invest in imitation expenses. However, it was possible that their imitations would be discovered by the high-quality firms between offerings. In order to give sufficient signals to let the investors identify the high-quality firms, the high-quality firms would underprice at the IPO. Welch also used data to support his assumption. He used 1028 IPO firms in the 1977-1982 period as his sample, comparing the IPO data with the SO data and found that the empirical result was consistent with the implications of signaling model. Hanley (1993) also used signaling model to explore the IPO underpricing phenomenon. She considered the rate of final offer price to the range of anticipated offer prices that the firms disclosed in the preliminary prospectus as an efficient signal, which could affect the initial returns. She used the IPO data of 1,430 firms from January 1983 to September 1987, which were compiled from Investment Dealer's Digest Corporate Database, and built a regression model to examine the relationship. The result shows that the prices only partially adjust to new information, and the underwriters would like to increase the underpricing rate to compensate the ones who reveal the real information. Those researches only focused on the game between the issuers and underwriters, but not consider the investors. Among the research that stand on the underwriters' point of view, which considers that the underpricing was generated in the pricing process, a few of scholars also take the investors into account. The most famous theory in this perspective is known as the "Winner's curse", which was proposed by Rock in 1986. He built up an adverse selection model and assumed that there were two kinds of investors in the stock market, one is the informed investors who have more information of stocks, the other is the uninformed investors who were lack of information. If the stocks were overpriced, the uninformed investors, who played important roles in new issue process, wouldn't actively invest in the stocks. Therefore, in order to ensure the success of IPO, the underwriters would underprice the new issues. As Rock started to consider the impact of investors in the pricing process, Welch followed his step. In 1992, Welch established a herd behavior model to explain the underpricing. In the aspect of social psychology, individual behavior would be greatly affected by the collective behavior. Welch's theory

model demonstrates that during the new issue process, the potential investors would pay attention to other investors' behavior, which would then affect their investment behaviors. In order to attract those potential investors to get involved and trigger the herd effect, the underwriters would underprice the new issues. Those researches, which focus on the underwriters' perspectives, give me lots of inspiration. As they only consider the pricing process, it is possible that the underpricing is generated from the trading process. In addition, from their theories and models, I found it essential to take the IPO competing issues (the total number of issues in the specific issuing month) and the underwriters' prestige (the market share of the investment bank) into consideration while exploring the causes of the IPO underpricing. Thus, I use similar data as them to form these variables.

A relatively novel perspective that the researchers take in this area is standing on the side of investors, which is the point of view I would like to focus on. As behavioral finance came into our sight, more and more researchers utilize relevant theories to explore the underpricing phenomenon. Jaggia and Thosar (2004) referred to the DHS theory (Daniel et al, 1998) to build up an ordered logit regression model and analyzed the high-tech IPO underpricing. Their sample included all IPOs from January 1, 1998, through October 30, 1999, in the specific sectors. They also used the Day 1 open price for each firm, which were collected from yahoo finance, as I will use in my own research. Their result shows that investors' overconfidence and biased self-attribution contributed to the underpricing in high-tech companies. However, they didn't provide much evidence that this model could apply to other sectors and how to generalize this model. In 2003, Ljungqvist, Nanda, and Singh did a simulation, which shows how could the sentiment investors behavior influence the IPO's first-day return. They modeled a firm that is going public in a "hot" IPO market and two types of investors: sentiment investors and rational investors, which then justify the underpricing phenomenon was triggered by those sentiment investors. Their research gives strong theory support to my research.

In addition to the theory models provided by the above research, some scholars focus on using OLS to explore the factors that could explain and predict the underpricing. Tian (2011) used some explicit variables to find the determinants of Chinese extreme IPO returns. She utilized the data of Chinese IPO to examine the factors that are significant in the regression model and found that although the asymmetric information about the quality of firms would cause the IPO underpricing, the effects of financial regulations played an important role in

this phenomenon. Similar to Tian, Butler, Keefe, and Kieschnick did a research about robust determinants of IPO underpricing in the US IPO market in 2014. They examined the variables (more than 40) from previous studies and found that half of these variables were significant in the regression model. They gathered all the IPO data and the stock price data from 1981 to 2007. Their results inspired me to use the total share volume of the specific month as one of the variables in my research. Furthermore, their examinations also help me scale down the range of variables, which contributes to my research a lot.

In recent years, many researchers begin to pay more attention to the impact of the IPO prospectus. They regard it as a significant factor that could influence investors' sentiment, which could indirectly cause the underpricing. Loughran and McDonald (2013) studied the relationship between the first day returns of the IPO and the sentiments of the prospectus. They used the word lists they established in their previous research in 2011 to classify each prospectus in his sample (1,887 IPOs in the US with an offer price higher than $5 per share during 1997-2010) into uncertain, weak modal, negative, etc. And the result shows that the IPOs with uncertain text in their prospectus have higher first-day returns, which means as the uncertainty of the text increased, the underpricing is more severe. Their research gives me strong evidence that the prospectus could be a factor that causes the underpricing phenomenon and there could be a significant correlation between these two aspects. Then, Ly and Nguyen furtherly studied this relationship in 2020. They used different models, including the OLS regression model, random forest, decision tree, naïve Bayes, etc., to examine the impact of prospectus sentiments on IPO performance. They used similar sample data as Loughran and McDonald, which were both from the Electronic Data Gathering, Analysis, and Retrieval system. However, they used a wider sample, including all the IPOs in the US from 1975 – 2019. In addition, they not only considered the sentiments of the prospectus as the independent variables but also took the complexity of the text, count of characters, and other factors into account. Their result shows that the models they trained can predict the first-day price with an accuracy of up to 9.6% higher than chance. These two pieces of research only focus on the sentiments of the text in the prospectus but didn’t explore the contents of the prospectus. As I would like to explore the contents, which could also influence the investor sentiments, I decided to use a deep learning model - the LSTM model. This is a brand-new attempt in studying the causes of the IPO underpricing, basically, no researcher has used this model in this area. In the realm of sales forecasting, Liu and Liu

(2009) used an LSTM model to train the users' behavioral data, which led to a great prediction. He took out the variables he got from the hidden layer of the training model to make the prediction. And this approach was then developed in Li and Shao's research in 2018. They combined the LSTM model with the random forest model to catch both static variables and dynamic variables, which I found useful in doing my research. Therefore, I would like to use this new approach to explore the relationship between investor sentiments and IPO underpricing.

References:

- Ibbotson, R. G., & Jaffe, J. F. (2012, April 30). "HOT ISSUE" MARKETS. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.1975.tb01019.x
- Logue, D. E. (1973). On the Pricing of Unseasoned Equity Issues: 1965-1969. The Journal of Financial and Quantitative Analysis, 8(1), 91. doi: 10.2307/2329751
- Baron, D. P. (1982). A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues. The Journal of Finance, 37(4), 955–976. doi: 10.1111/j.1540-6261.1982.tb03591.x
- Welch, I. (1989). Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings. The Journal of Finance, 44(2), 421–449. doi: 10.1111/j.1540-6261.1989.tb05064.x
- Hanley, K. W. (1993). The underpricing of initial public offerings and the partial adjustment phenomenon. Journal of Financial Economics, 34(2), 231–250. doi: 10.1016/0304-405x(93)90019-8
- Johnson, J. M., & Miller, R. E. (1988). Investment Banker Prestige and the Underpricing of Initial Public Offerings. Financial Management, 17(2), 19. doi: 10.2307/3665523
- Rock, K. (1986). Why new issues are underpriced. Journal of Financial Economics, 15(1-2), 187–212. doi: 10.1016/0304-405x(86)90054-1
- Welch, I. (1992). Sequential Sales, Learning, and Cascades. The Journal of Finance, 47(2), 695–732. doi: 10.1111/j.1540-6261.1992.tb04406.x
- Jaggia, S., & Thosar, S. (2004). The medium-term aftermarket in high-tech IPOs: Patterns and implications. Journal of Banking & Finance, 28(5), 931–950. doi: 10.1016/s0378-4266(03)00040-2

- Ljungqvist, A., Nanda, V. K., & Singh, R. (2003). Hot Markets, Investor Sentiment, and IPO Pricing. SSRN Electronic Journal. doi: 10.2139/ssrn.282293
- Tian, L. (2011). Regulatory underpricing: Determinants of Chinese extreme IPO returns. Journal of Empirical Finance, 18(1), 78–90. doi: 10.1016/j.jempfin.2010.10.004
- Butler, A. W., Keefe, M. O., & Kieschnick, R. (2014). Robust determinants of IPO underpricing and their implications for IPO research. Journal of Corporate Finance, 27, 367–383. doi: 10.1016/j.jcorpfin.2014.06.002
- Loughran, T., & Mcdonald, B. (2013). IPO first-day returns, offer price revisions, volatility, and form S-1 language. Journal of Financial Economics, 109(2), 307–326. doi: 10.1016/j.jfineco.2013.02.017
- Ly, T. H., & Nguyen, K. (2020). Do Words Matter: Predicting IPO Performance from Prospectus Sentiment. 2020 IEEE 14th International Conference on Semantic Computing (ICSC). doi: 10.1109/icsc.2020.00061
- Liu, Y., & Liu, L. (2009). Sales Forecasting through Fuzzy Neural Networks. 2009 International Conference on Electronic Computer Technology. doi: 10.1109/icect.2009.65