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Determinants of IPO Pricing: A Review of Theories and Evidence

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Abstract. This literature review explores the role of information asymmetry in Initial Public Offering pricing, focusing on how companies impact their informational advantage over investors to underpricing shares. Information asymmetry creates an adverse selection problem, leading firms to underprice IPOs to attract institutional investors and reduce risks. Signaling theory suggests that underpricing can also signal a firm's quality with high-quality firms absorbing short-term losses to gain long-term benefits. Empirical evidence, including studies by Jain and Kini (1994) and Rock (1986), demonstrate how underpricing compensates uninformed investors for higher risk. Additionally, the allocation process is influenced by market sentiment, firm size, and underwriter reputation, with institutional investors often receiving favorable allocations in high-demand IPOs, leading to better outcomes for them.

Keywords: IPO pricing determinants, Information asymmetry, Market sentiment, Institutional allocation, Bookbuilding process

1. Introduction

Initial public offering (IPO) is when a company launches their stocks on the financial market publicly for the first time. IPO pricing determines the initial value of a company going public and signals their potential performance to the market. Either the price being overpriced or underpriced, can have significant long-term consequences on stock performance. This review focuses on empirical findings regarding the factors that influence IPO pricing. By assessing the empirical evidence, this review aims to provide insights into the determinants that guide how companies and their underwriters set IPO prices and the effects these decisions have on the market. Understanding these determinants is crucial for investors since the price of an IPO share could directly influence the risk they are bearing with and as well as the return they are receiving. Investors, especially those uninformed investors, face the challenges of having lesser access to a company's financial health and prospect. On behalf of the companies, the determinants of IPO pricing is important as it may be used as a mechanism for them to signal investors about their quality since they cannot tell their actual value. Underpricing could leave significant capital on the table whereas overpricing can result

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in poor post-IPO performance which damages the companies' reputation and stock valuation. In addition, the review will also be exhibiting the bookbuilding method and other IPO methods that are widely used in various countries and the specific process of allocating shares by their methods, also mentioning the advantages and controversies regarding the book-building method's discretionary power over stock.

2. Overview of theories in IPO pricing

Information asymmetry theory refers to a situation where there is an imbalance in access to information. In an IPO, this imbalance occurs between companies and investors, suggesting that investors may be exploited by purchasing shares that are overpriced at a value that it is not worth. This situation's existence is due to the firms that are going public often have more detailed knowledge of their value whereas on the other side the uninformed investors overpaying the shares of lower-quality companies and missing out on better investments. This is why underpricing is needed to reduce the risk investors are facing.

Investor sentiment and company size are key factors in IPO pricing. Larger companies typically attract institutional investors and receive higher prices, while smaller companies are seen as unstable and more likely to be undervalued [1,2]. In addition, institutional participation and underwriter reputation also significantly affect IPO outcomes [3,4].

Benveniste and Spindt [5] and Benveniste and Wilhelm [6] have examined in the academic literature the process of building a book, which can be described as consisting of three steps. The investment bank first decides which investors to invite to evaluate the offering and purchase it [7]. Next, investors evaluate the offering and provide the investment bank with their initial quantity demanded for the offering [7]. Lastly, the investment bank prices the offering and allocates shares to investors [7].

3. Information asymmetry theory

How do companies hold more information lead to underpricing?

Firms hold a better understanding of their financial health and growth potential than external investors. Therefore, investors who rely on public information such as financial statements are not fully capturing the actual value of a firm. The asymmetry creates an adverse selection problem [8], where investors are not able to tell the differences between a good or bad 'lemon' in other words the difference between firms with good performance or bad, the price of them then tends to be the same. This is when overpriced stock in the IPO is offered to the investors as the value of a bad 'lemon' should be lower in comparison to a good 'lemon'. This leads to the outcome of the investors discounting their bids. The investors might assume that only bad 'lemons' are eager to issue equity. This is when companies cooperate with underwriters to underprice their stock intentionally to attract institutional investors and reduce the risk of IPO failure [9]. This pricing strategy lowers the barrier of entry in the market since it is difficult for outside investors to assess the firm's actual value accurately at the time of the IPO. Hence, firms exploit the information advantage they have over investors to price their IPO shares, this strategy is also known as the signalling theory.

Signalling theory as mentioned in [10] after comparing the models of other papers shows how underpricing can act as a costly signal that only high-quality firms can afford. These high-quality companies are willing to underprice the IPO because they expect to offset this loss through future equity offerings or higher post-IPO stock prices. Also, it is more likely for investors to receive higher returns from them while the risk is lower [11], therefore, high-quality have the capability to

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use underpricing as a method of reflecting their quality. Hence, underpricing builds a positive market reputation, especially for those high-quality companies. Therefore, investors could perceive the companies' significantly underpriced shares but with a high return and growth potential. This reduces their uncertainty which puts investors in a less risky place, allowing them to expect a short-term return. This helps the companies exhibit an image of consideration for the investors and confidence, making them to be eye-catching in the market.

In many studies, authors have shared their perspectives on various theories of information asymmetry. Some conduct data collection and data analysis, while others have developed theoretical models according to their own interpretations.

In the study of Jain and Kini [12], it was claimed that firms tend to experience a significant decline in operating performance post-IPO. While firms take advantage of asymmetric information and inflate the IPO price, investors are often left holding underperforming shares. The study employed tables to compare the effect of different levels of underpricing on a firm's performance. For instance, it compared firms that were underpriced at a level of ≤ 1.17% with those underpriced at a level of > 1.17%. Revealing how these pricing strategies influence their operating returns on assets and operating cash flow. Firms that were underpriced at a level of > 1.17% conducted a medium capital expenditure of 8.79% over their total assets which was higher than the 8.20% of the firms being underpriced at a level of ≤ 1.17%. And a lower cash flow of 11.14% in comparison to the 11.28% of the less underpriced firms in the year -1. However, the firms with more significant underpricing showed a medium operating return of 21.79%, which was 0.76% higher than the 21.03% return of those with lower levels of underpricing in the year prior to the IPO.

In Welch [10], a theoretical model was used to demonstrate how the value of low-quality firms decreases when they attempt to imitate high-quality firms. Asymmetry information prevents investors from distinguishing between high and low-quality firms. As a result, underpricing becomes a mechanism for high-quality firms to signal their value and attract more investors since they cannot effectively convey their quality through biased announcements. In the model, high-quality firms were denoted as 'H' low-quality firms were denoted as 'L'.

Initially, when neither type of firm is operational, both are valued V^L. However, because 'H' is more efficient in their operations, their value increases to V^H, where $V^L < V^H$. On the other hand, 'L' firms know the true value of the 'H' firms and are aware of their value being lower. They will attempt to imitate the operations of 'H' firms. However, this imitation works as an extension of cost for them, which lowers their value to $V^L - C$, where 'C' is the cost of the imitation.

This model illustrates that when investors are deciding which firms to invest in, asymmetric information leads to a scenario where, at the same price, some investors receive shares of a firm valued at V^H, while others receive shares of a firm valued at $V^L - C$.

Rock [13], the study that introduced the concept of the "winner's curse" argued that uninformed investors are less likely to access underpriced shares since informed investors dominate it, lefting overpriced shares for them. Therefore, uninformed investors face more risk for not being able to distinguish underpriced or overpriced IPOs, this is when underpricing plays a role in asymmetric information to compensate the uninformed investors for bearing more risk. Uninformed investors typically get larger allocations in overpriced IPOs, and as a result, they receive lower or even negative returns. A model for calculating the expected return for uninformed investors was presented which was labeled as R_U. The model used the probability of uninformed investors getting an allocation of underpriced shares (denoted as P_U) and the expected return of underpriced (denoted as $R_{underpriced}$) and overpriced (denoted as $R_{overpriced}$) shares to calculate R_U. Assuming that P_U

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is 30% because informed investors have more information and holds on to the 70%, and $R_{underpriced}$ being 15% and $R_{overpriced}$ being -5%. By using the model:

$$R_U = P_U \times R_{underpriced} + (1 - P_U) \times R_{overpriced}$$

By substituting the values in: $0.3 \times 1.5 + (1 - 0.3) \times -0.5 = R_U = 0.1 = 1\%$

This model justifies the need for underpricing to ensure that uninformed investors remain willing to participate, despite the risks they face from information asymmetry.

4. IPO pricing and allocation

Based on the challenges of information asymmetry mentioned above, it is critical to understand how companies and underwriters determine IPO pricing and allocate shares to investors. To address these risks, the design of pricing and allocation strategies will balance attracting more investors and ensuring the long-term success of the IPO. This section will delve into the determinants of IPO pricing and allocation, explore the key factors that influence these decisions, IPO methods such as book-building methods, and the specific process of allocating shares.

4.1. Determinants of IPO pricing and allocation

The allocation of shares between institutional and individual investors has always been a topic of interest. The pricing and allocation methods of IPOs and the way shares are traded are affected by a variety of factors, including market conditions, company characteristics, and investor demand.

Market sentiment plays an important role in determining IPO pricing and performance, particularly in bullish markets where investor excitement is high. According to Ljungqvist, Nanda, and Singh [14], investor sentiment and limited rationality significantly impact the behavior of IPO stock prices. As investor excitement fades over time, long-term underperformance of IPOs can be caused by it [14]. Similarly, Lee, Shleifer, and Thaler's [15] study highlights the changes in investor sentiment affecting the pricing of closed-end funds, which can also be applied to IPOs .In bullish markets, IPOs are often priced higher due to positive investor sentiment, while in bearish markets, they tend to be priced lower. Reilly [16] supports this, showing that short-term returns are strongly affected by market conditions, with investors usually seeing higher gains during periods of market optimism.Interestingly, Ljungqvist, Nanda, and Singh's [14] model suggests that when underwriters allocate IPO shares to regular (institutional) investors and gradually sell them to sentiment-driven investors, the issuer's value is maximized. Underpricing becomes a necessary compensation to institutional investors for the potential risk of holding shares as sentiment-driven demand might dissipate over time, but it is offset by higher offer prices later on.

Company size and age are other key factors in IPO pricing. Smaller firms are often seen as riskier and often have difficulty attracting institutional investors, which results in lower share prices during IPOs, so institutional investors often favor larger, more stable companies [1]. Furthermore, there might be notable differences in the profitability changes from pre-IPO to post-IPO periods between small and large companies. Lizińska and Czapiewski [2] discovered that the size of a company's size before its IPO affects the extent of underpricing, with smaller firms typically experiencing higher returns. They also found that larger firms typically showed better profitability growth before their IPOs and slower profit margin declines after their IPOs than smaller companies. Growth potential is another important factor. IPOs in high-growth sectors such as technology and media are

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generally priced higher because they attract investors seeking high-risk, high-reward opportunities [17]. Investor demand has increased, and underwriters can feel confident about increasing IPO pricing.

Plenty of investors have been encouraged to engage in the final stages of the offer period by the transparency of institutional and retail investors' participation in IPOs [3].This encouragement is especially strong for retail investors. Neupane and Poshakwale [3] found that the early participation of institutional investors significantly affects the participation of retail investors. However, due to the strong early participation of non-institutional investors, concerns have been raised about investor welfare when retail investors follow dubious offerings [3].On the other hand,they noted that the participation of institutional investors seems to be influenced by recent market returns, offer size and underwriter reputation.The regression results from them show that underwriters with good reputations are more likely to set more conservative prices than underwriters with poor reputations. In fact, Table 1 of Aggarwal, Prabhala, and Puri [4] 's study suggests that underwriters with better reputations are more likely to balance pricing with demand, ensuring a more successful IPO. Additionally, Aggarwal, Prabhala, and Puri [4] show that because institutions receive favorable allocations to IPOs with strong premarket demand, institutions do tend to focus more on better-performing IPOs . The study from Neupane [3] therefore recommends possible regulatory reforms to better protect retail investors in the IPO market.

Table 1. Institutional allocation and underpricing [4]

	Panel A: Ordinary Least Squares		Panel B: Ordered Probit	
	Dependent Variable: Day One Return		Dependent Variable: 0 if R ' 0%, 1 if 0 < R 20%, 2 if R > 20%	
	Model 1	Model 2	Model 3	Model 4
Intercept	-1.69 (-0.19)	108.97* (2.91)	-0.27 (-1.72)	2.06 (0.74)
INST	0.30* (3.05)	0.31* (2.62)	0.02* (2.46)	0.02* (2.46)
LOGSHARES		- 7.54* (-3.06)		-0.16 (-0.90)
UPDATE		0.75* (4.45)		0.05* (6.37)
REPUTED		12.09* (3.09)		0.57* (2.08)
DAYS		0.01 (0.02)		0.003 (0.10)
Pseudo R ^2(ordered probit)or Adj. R^2(OLS)	6.53%	30.13%	5.21%	20.51%

* Significant at the five percent level using a two-tailed test.

4.2. Book-building process

The above section mentioned the various factors that determine the pricing and allocation of an IPO, this section will then take a deeper look at the various methods used for IPOs and the specific process, as well as the utility and controversy of the various methods, the most controversial of which is the bookbuilding Method. The next section describes how the bookbuilding Method works.

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Book-building [14] is a process that allows initial public offering (IPO) firms and their underwriters to distinguish between different bidders and allocate shares at their discretion. As [18] mentioned the process of the book-building method, firstly, the issuer of the IPO company will let an investment banker to manage the initial public offering process. Prior to the IPO, the investment banker surveys the needs of institutional investors and gathers a great deal of information about the subject [18]. This information will be used to determine the price of the stock offering. For example, in the US IPO market, the upper limit of the price range is usually 10 percent of the reserve price [18]. Once the price range is set, bids are made for the shares to be offered, which means that retail and institutional investors begin to bid, with a valid bid being one that is at or above the final offering price [18]. Once the bidding is over, the book-builder will determine the final issue price. After the bidding phase is over, the process of allocation of shares begins. All individuals, whether they are retail investors or high bidders, will be allocated the final shares by the underwriters, who have discretionary authority over the shares [18].

And because of the allocation discretion given to the underwriters by the book-building method, this allows the underwriters to build strong, long-term relationships with investors [19]. In the study of Benveniste and Spindt, the importance of long term relationships for IPO book-building is mentioned. But the use of book-building has been hugely controversial precisely just because of the absolute discretion over the stock that the underwriters have. This can appear to the situation that underwriters favour some investors, using their power to give some 'special' care to a few at the expense of others. So this method is unfair to other investors. So the method adopted in many countries is hybrid offerings, i.e. book building for institutional investors and public offerings for local retail investors [19].

4.3. IPO other allocation process

And in Bubna and Prabhala [18] they also proposed another method of initial public offering. That is Fixed Price Initial Public Offering. As the name suggests, the underwriters are fixing the price of the offering and then inviting the public to bid, and this method allocates the shares in proportion to the bids. Compared to 'book building', Bubna and Prabhala [18] think this method loses rights and flexibility over both the final price and the allocation of shares. Of course these are not the only two methods of initial public offerings, there are also auctions and public offerings. Sherman [19] mentions that an auction entails the allocation of shares based on bids, regardless of any relationship between certain bidders and the auctioneer. Similarly, public offerings are subject to the 'rule of fairness', which only allows for differentiation based on the size of the order. But as Sherman [19] mentions the main difference between the book-building method and the other methods of IPOs is that the book-building method gives the underwriters complete discretion in allocating shares. The above mentioned are the main widely used methods of IPOs in various countries and the process of allocating shares.

5. Conclusion

In conclusion, companies that hold more information than investors create information asymmetry. This leads to adverse selection, where investors struggle to distinguish between high and low-quality firms, as highlighted by Akerlof [8] as the "lemon" problem. To counter this, firms cooperate with underwriters to underprice their stock, in order to attract investors and reduce the risk of IPO failure [9]. This underprice also works as a signal of quality, such as high-quality firms are more likely to underprice to show confidence in their long-term value [10]. Additionally, market sentiment plays a

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significant role in determining IPO pricing and performance, particularly in bullish markets where investor excitement is high. Regulatory reforms may be necessary to protect retail investors, especially given institutional investors' push for increased participation [3]. Empirically, Jain and Kini [12] showed how different levels of underpricing impact a firm's operating performance. And the concept of winner's curse that was introduced in Rock [13] demonstrated how uninformed investors face higher risks when they are not able to distinguish between under and over priced shares. The book-building method mentioned by Sherman [19], which gives the underwriters complete discretion in allocating shares, can also lead to situations where there is some favouritism towards some investors and 'special' care given to a few. Therefore, it is recommended that the IPO method used in many countries is a hybrid offering, with a mix of book building and public offering.

6. Contribution

Hanxuan Zhu: Topic idea, structure planning, search and summary of relevant literature on the topic, abstract, information asymmetry part of introduction, information asymmetry part of overview of theory, analysis of theory: information asymmetry, information asymmetry part of conclusion.

Yike Liu: Conducted a search and summary of relevant literature on the topic in the initial stage, IPO pricing and allocation part of introduction, IPO pricing and allocation part of overview of theory, Part of IPO pricing and allocation. IPO pricing and allocation part of conclusion.

Chengcheng Yang: The literature related to the topic was searched and summarised,IPO pricing and allocation part of introduction, IPO pricing and allocation part of overview of theory, Part of IPO pricing and allocation. IPO pricing and allocation part of conclusion.

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Hanxuan Zhu,Yike Liu,and Chengcheng Yang contributed equally to this work and should be considered co-first authors.

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