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ANALYSIS OF IPO UNDERPRICING: A STUDY OF GOVERNMENT-OWNED IPOS IN CHINA

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ABSTRACT

With a growing number of firms getting listed, an interest in the concept of IPO underpricing has also increased. The initial returns, caused by the closing prices being more significant than the offering prices on the first day of trading, have been noticeably higher in China. This has been believed to be caused by the intense government control and ownership of state-owned enterprises. This paper will focus on analysing the effects of different firm-specific and macroeconomic variables on the level of underpricing in government-owned A-share IPOs listed on the Shanghai Stock Exchange. The main model for testing is the ordinary least squares. According to the results, the larger, more profitable and less leveraged a firm is, the less underpricing it will have. In contrast, the higher the inflation in China, the higher will be the level of underpricing.

Key words: State-owned enterprise, partial privatisation, underpricing, government regulation

INTRODUCTION

When an unlisted company decides to grow and raise capital through the sale of its shares to the public, it engages in something known as the Initial Public Offering, or an IPO. With the increasing number of issuing firms, IPOs are attracting growing attention. However, the main problem arises when it comes to pricing the IPOs. If the issue is priced too high, there might be a need to withdraw it, which will result in a failed IPO. On the other hand, if the issue is priced less than its fair market value, the existing shareholders face a risk of losing money from selling shares for less than they are worth. The latter is known as underpricing and is one of the most observed phenomena in the stock markets all over the world. Underpricing helps new shareholders earn a higher interest on the shares they purchase, thus earning a higher initial return, but at the same time it decreases the profit for the existing shareholders, a concept known as “leaving money on the table.” To them, it is an indirect cost of issuing new securities.

IPO underpricing can be quite dramatic once it exceeds 100 per cent. (Gao, 2010) This usually happens at a specific period. He, 2007, suggests that this could be because of the IPO fluctuations, known as the “hot markets" and “cold markets.” Hot markets are characterised by an unusually high volume of offerings and severe underpricing levels, whilst cold markets are the opposite with lower offering volume and lower underpricing.

In that regard, China has seen a tremendous growth of 170 per cent average first-day return during the years 1990-to 2018. (Chi *et al*, 2005) Numerous studies have been conducted to analyse such high initial returns which make the Chinese stock markets stand out from other emerging markets. Increasing attention has been drawn to analysing different factors that could have such an effect on Chinese IPOs. Studies such as Chang et al, 2008 and Jian *et al*, 2008 have found that this is mainly due to the constant and growing market regulations from the Chinese government and the increasing level of information asymmetry between the different parties involved in a public offering. China is home to a lot of state-owned enterprises, most of which are owned by the government. However, during the past 30 years, with the motive of raising capital, the state has undertaken an act known as partial privatisation, under which the government gives up part of its control over the firm and sells the shares to private investors. The problem in such cases is that these shares make up only a small portion of what the government owns. It is also a well-known fact that the Chinese IPOs

are under immense regulations from the Chinese Securities Regulatory Commission, CSRC and the state which gives us a reason to think that the underpricing there could be under the influence of different macroeconomic variables.

As mentioned, there is outgrowing information and research done on the IPO underpricing, specifically in the Chinese markets. In this paper, I will try to combine the provided literature with the quantitative variables assumed to be affecting the Chinese government-owned IPOs listed on the Shanghai Stock Exchange. To analyse the impact of different firm-specific and macroeconomic variables, I will be using an ordinary least squares, OLS regression model for the sample of 558 firms. The independent variables - return on assets, price to earnings ratio, debt to equity ratio, firm size, issue size, gross domestic product growth rate, and inflation will be regressed against the dependent variable, which is underpricing. The model is tested for heteroscedasticity to ensure the p values are not less than they are supposed to be, which will give reasonable support to accept or reject a hypothesis.

This study has found significantly positive and negative relationships between most of the listed variables except the P/E multiple, GDP growth rate, and offer size. A study done by Güçbilmez, 2015 found that the increase in IPO initial returns was characterised by an increase in IPO volume, suggesting the existence of IPO cycles. To analyse that hypothesis, the two variables will be graphed against each other, with an expectation that such a relationship exists in the dataset.

The main research questions addressed in this paper are:

R1: What is the reason for such high initial returns in the Chinese A-share market?

R2: How are the Shanghai Stock Exchange-listed firms affected by different firm-specific and macroeconomic variables?

The first research question will be addressed more thoroughly in the literature review, whilst the second will be used to guide the analytical research. Based on the chosen variables, the following hypothesis is formulated:

Ha: Firm size has a negative effect on the level of underpricing.

Hb: P/E multiple has a positive effect on the level of underpricing.

Hc: ROA has a negative effect on underpricing level.

Hd: D/E has a positive effect on the level of underpricing.

He: Issuing size has a positive effect on the level of underpricing.

Hf: GDP growth rate has a positive effect on the level of underpricing.

Hg: The inflation rate has a positive effect on the level of underpricing.

This paper is organised into four chapters, literature review, methodology, empirical results, and discussion. The first chapter presents a discussion of why IPO companies decide to go public, the literature supporting underpricing existence and the possible reasons for such, information asymmetry, and IPO waves. The review goes on to cover the Chinese IPOs and how they are different from IPOs in other countries, possible IPO waves in China, government control and state-owned enterprises. The second chapter is a methodology, which provides an overview of the used data, the sources of it, the models used and their justification, and sample-specific information. It goes on to the third chapter which covers the actual data testing and results drawn from it. Moving to the fourth chapter which finishes off with the discussion and the detailed analysis of the testing results, including the conclusion.

1. LITERATURE REVIEW

1.1. Initial Public Offering

An initial public offering is a term known to describe when a company first sells its shares to the investors on a stock exchange. This is termed “going public” and indicates a moment in a company's life when it decides to transition from private ownership to a public one. Before the IPO, companies are initially nurtured with private equity capital. However, at some point in time, the owners might see a need for additional capital. This has been stated to be the main reason why firms refer to IPOs. But this does not exactly explain why firms decide to go public. In fact, a famous pecking order theory argues that the managers will issue equity only after they exhaust all their retained earnings and debt capacity. This is mainly because the outside investors take the issuance of external equity as a rather negative signal, assuming that the company is not doing too well. Anticipating such negative investor sentiment, the management will try to do its best to attract potential shareholders by underpricing its securities, a phenomenon representing a cost to the issuing firm. Given these reasons, it would be unlikely to think that equity financing would be a firm’s first choice, so why do firms decide to go public?

According to Brau, 2012, all private firms that see growth prospects do eventually go public. This mainly concerns the investment-intensive firms that do not generate sufficient internal cash flows. Based on the post-IPO data, Brau, 2012 suggests that newly public firms face cheaper and more available credit than before. These firms would rather have a low intervention with financial intermediaries such as banks or venture capitalists. (Pope *et al*, 2004) This reasoning however seems to be rather biassed because it fails to provide sufficient explanation to a fairly noticeable number of governmental and non-governmental private companies that have seen enormous growth numbers over the years. A study done by Jain and Kini, 1999, suggests that firms go public not to finance growth but rather to rebalance their accounts after a long period of high investments and financial expansion. In line with this finding, in his study about the Italian IPOs, Pagano *et al*, 1999, finds a reduction in financial leverage in the post-IPO firms. As companies pursue long duration of current and future investments, mostly financed by debt, after listing this number would decrease resulting in lower leverage as firms are able to repay their payables. A third rather prevailing reason explaining the IPO is that the owners are interested in establishing a market price for their

firms. This is well documented in a study done by Jain *et al*, 1999, and Brau, 2012, who suggest that by obtaining a market value for their assets, the firms first attempt to cash out, meaning sell their shares in exchange for cash, and then sell out at a hopefully higher market value than initially offered. In other words, firms try to facilitate the sale of their firms through a reduction in ownership which in the end, results in a capital raised.

After the IPO, firms either survive as independent firms, are acquired by an existing company or fail outright. Firms that fail are for practical purposes in a terminal state. Maintaining the status of an independent company would be a logical outcome of this case and would also be a target for many firms. However, Pagano *et al*, 1999, found that two years after the IPO, independent firms experience a negative impact on capital expenditures, with a reduction of 7% in capital stock. This leads us to believe that there is a high chance a newly listed company will experience an acquisition soon after the IPO, either by an existing public company, private company or converted into a private entity through a leveraged buyout. If a firm is acquired right after listing, that would serve as a primary motivation for going public. (Pope *et al*, 2004) The suggesting explanation for this is that as entrepreneurs see their growth prospects levelling off, they seek to divest their holdings before failure. To ensure that the losses are reduced in terms of their holdings in the company, the owners try to diversify the risk and make a joint decision to list their shares.

Going public is a choice, characterised by the loss of confidentiality and complex procedure before that. The firms going public are required by the disclosure rules of stock exchanges to unveil the information about their future earnings, strategies, and R & D projects. All this information is crucial and quite enclosed to the company insiders for confidentiality and partly market competitive advantage reasons. These firms are also exposed to scrutiny from the tax authorities which decreases their chances of tax elusion relative to the private companies who have a larger scope of tax evasion. (Pagano *et al*, 1999) Some firms see such strict requirements for disclosure as an opportunity. Usually, the owners of these companies would want their firms to go public to increase the publicity or the reputation of their companies. IPOs may serve as strategic moves and this is especially the case if the company is listed on a major exchange which further increases the investor recognition as well as the interest in that firm.

1.2. IPO process

When a company wishes to make a public offering, the first step for it would be to select an underwriter, which normally takes the form of a large investment bank or commercial bank that in practice conducts the issuing process on behalf of the issuer. Usually, there are two types of underwriters, reputable and non-reputable. The first group has more knowledge about the market, is better known and has a lot more experience in the field than the latter. In their study, Jain and Kini, 1999, found a positive relationship between the investment banker prestige and IPO performance. They concluded that being taken public by a reputable banker results in a higher probability of survival as an independent firm due to valuable post-issue monitoring services provided to the issuing firm. In that sense, Jamaani *et al*, 2019, also suggest the same outcome, stating that non-reputable companies have limited business connections and tend to charge cheaper underwriting fees.

The selection process of an underwriter relies on the bank's general reputation and expertise in the field, as well as the quality of research coverage on the industry the issuer operates in. After the underwriter is selected, a whole series of processes before and after listing takes place. One investment bank is usually selected as the 'lead manager' who is then responsible for all the primary responsibilities including the due diligence process, pricing, distribution of stock, and assembling a group of underwriters known as the syndicate to assist in the sale of the shares. The most common type of arrangement is known as the "firm commitment" underwriting and it requires the underwriter to purchase the entire floating stake from the issuer and then attempt to resell the securities back to the public. The difference between the price at which the underwriter buys and later sells the issue is called the gross spread. The lead underwriter typically receives 20% of the gross spread simply for its involvement in the offering process. 60% then goes to the underwriter and syndicate members for actually selling the securities. The remaining 20% is used to cover underwriting expenses which also includes the marketing process serving to promote the IPO. The latter is known as the road show and usually lasts for 3-4 weeks with two or more meetings a day with both retail and institutional investors. If anything remains from the gross spread after deducting all costs, it will be divided proportionately between the underwriter and the syndicate members depending on how many securities each underwrote. (Jain *et al*, 1999)

After the issuer-underwriter relationship is bonded, a registration statement is filed with the agency. In China, this agency is known as the CSRC, and it decides which firms are eligible for listing. The purpose of this statement is to ensure that the public has adequate and concise information regarding the securities offered to them. This does not include the price of the offering. In the United States, the Securities and Exchange Commission, SEC has no authority to prevent a public offering based on the quality of the securities involved. However, according to Sun *et al*, 2009, it is different in China. The CSRC requires companies to disclose all the information including the issuance price of the shares and it also has the authority to prevent a company from going public. Regardless, since the overall IPO process is relatively the same, I will continue with this discussion. The stage at which the registration statement has already been filed is known as the "Red Herring" and serves as a preliminary prospectus which usually lasts for 20 days. The government agency during this period responds to the initial filing and declares the issue effective. This marks an end to the red herring. A road show takes place only after the latter is completed and the registration statement is approved and transformed into the official offering document. (Ellis *et al*, 1999)

Once the issue is brought to market, the underwriter engages in the stabilisation activities, which essentially means that if an order imbalance arises, the underwriter will be required to support the stock and guarantee liquidity to the investors by buying the shares at or above the offering price. The final stage of the IPO comes 25 calendar days after the IPO when the so-called "quiet period" ends. This marks the transition period to a public company and the end of the prospectus and disclosure process. Underwriters after this point take on the role of an advisor. (Jain *et al*, 1999) The IPO process thus involves a rather complex list of tasks by the company, the lead underwriter, and the syndicate members. This process also requires a high level of trust and reliability as throughout the whole process, the issuer firm is relying on the underwriter's expertise to market, price, distribute, further stabilise, and support the issue.

1.3. Pricing the IPOs

On the day before the marketing, the firm and the lead underwriters meet to discuss two final and very important topics: the offer price and the exact number of shares to be sold. When deciding on the number of shares to offer, the issuing firm distinguishes between two types, primary and secondary shares. Kim *et al*, 2008, in their study, demonstrated that 41 per cent

of the time, firms sell primary shares and 41 per cent of the time, they sell secondary shares. However, they also suggest that the motivation between which shares to issue varies. Firms selling primary shares illustrate a greater demand for new capital and increased investment. Regardless, the company has to decide on the offering price of the new shares. This serves as one of the most complex processes in the issuing process. Busaba *et al*, 2013, refer to valuing IPOs more as an art than science, especially for young firms in the market that don't have a large supporting or operating history. Investment bankers usually indicate their perception that an offer should be two to three times oversubscribed to create a good IPO. Whilst this benefits the initial offering process, in terms of investor demand, it also leads to an adverse relationship with the pricing, resulting in IPOs being undervalued. This is when the price rises on the first offer day, resulting in the offering price being lower than the closing price at the end of the first-day trading.

Underwriters undertake several different approaches to pricing the IPOs. The main problem is that the offering price depends on the demand for the floating shares. When a company first goes public, it does not know what the demand will be for its securities. One approach for knowing this is when a syndicate comes together to take allocations from the investment banks and mutual funds. After calculating the average of the bid price and the shares stated by the latter two, the firm then sets the offering price accordingly. (Kim *et al*, 2008) Another method is when investment bankers value shares by comparison to similar firms in the same industry. If there is a higher number of comparable firms in the market, pricing becomes easier and more accurate. Such IPOs are characterised by the lower variance between the initial price range set by the issuer/banker. On the other hand, issuing firms for whom the availability of comparable companies is lower because of their presence in a rather nascent industry (such as the Motion Picture or Video Exhibition industry) the price spreads would be larger. (Chemmanur *et al*, 2012) Underwriters are usually motivated to obtain the valuations for the IPO firm mainly for two reasons. The first reason is that the revenue the lead underwriters receive from the gross spread is proportional to the IPO offer price. The second reason has to do more with the underwriter's reputation. Successful IPOs typically lead to increased reputation with subsequent issuers.

1.4. IPOs in China

Chinese IPOs are quite significant and distinguished due to their history and current government intervention. It is important to note that China's financing system has always relied more on banks rather than securities markets. In fact, the country did not have a stock market until the beginning of the 1990s. (Wang, 2015) After the transition from a centrally planned economy to a market economy, China has pursued major economic reforms which lead to remarkable growth and productivity. (Shen, 2009) A centrally planned economy means that almost all enterprises are entirely owned and controlled by the government. Over the years, this has been changing and the country has been trying to move towards a less state-centric economy. But the financial crisis of 2008 marked an end to whatever motivation was left for reforming the SOEs. The main challenge arose when the SOEs started facing bankruptcy risks whilst the Chinese markets rigorously pursued becoming more and more competitive. Scholars from China and foreign countries started suggesting privatising SOEs, arguing that the guaranteed government support can lead to low efficiency and careless money spending. Following this, the state has adopted the partial privatisation scheme, also known as the Share Issue Privatisation. Through this method, the common shares of a firm are publicly offered whilst still being under state ownership. Although, it is worth noting that this concerns only a small number of SOEs, as the government is pursuing a 'zhuada fangxiao' (grasp the big, release the small) agenda according to which, the state maintains control over the larger SOEs, allowing the smaller ones to be partially privatised, restructured, or just shut down. (Jiang, 2009) Chi and Padgett, 2005, suggest yet another reason for rigid government control of the IPO market and it consists of a statement that in privatisation, the government cannot afford any possible failure as the IPO success affects the state's credibility.

Because of the above-listed characteristics, the underpricing levels are enormous in China. For simple statistics, a study conducted by Loughran *et al*, 1994, suggested that advanced countries such as Japan have an average underpricing of 44.7%, the United Kingdom, and Denmark, 7.4% and 25.9%, respectively, whilst the first day returns reach up to 170% in China. Much of this depends on pricing the IPOs which in this country is heavily controlled by the CSRC.

The pricing of the offerings has changed from annual quotas imposed by the government to the famous book building method which was first introduced in 1999 and was finally

implemented in 2005. However, in China, this method is quite discrete from the book-building in other countries such as the U.S. and Europe. Much of this has to do with the 'Window Guidance' set by the CSRC. According to this guidance, there is a limit to an IPO firm's P/E multiples. (Gao, 2010) Between 2006 and 2009, this number could not exceed 30. Since 2009, it has been narrowed down to 25% of the average P/E of similar companies in the industry. (Qian *et al*, 2021) This detail would not have been so important had the offering price not been based on the (P/E * EPS) formula. When P/E is confined to a narrow margin, the offering price also naturally comes down to the range set by the CSRC, which is in most cases lower than the issuing firms would like it to be. Because of this, many issuers and underwriters are prompted to set an issue price close to the capped P/E ratios. In their study, Hu *et al*, 2019 concluded that the underpricing levels would have been lower and rather consistent with the levels found in developed markets if the regulations were lifted. Moreover, the CSRC usually takes a long time to review and approve the IPOs, thus increasing the time gap from the IPO date to the listing date. This adds uncertainty to IPO pricing, making the market more volatile, and thus resulting in a higher underpricing.

1.5. IPO cycles

Prior studies distinguished between the hot and cold markets, also known as the IPO cycles. Loughran *et al*, 1994, Agathee *et al*, 2012, Shen *et al*, 2009, Brau, 2012, Chemmanur *et al*, 2011, and Ritter, 1984, all suggest that there seem to exist periods of IPO cycles in terms of the IPO volume, measured by the number of firms going public, and the IPO underpricing. It appears there is a time, termed a hot issue period, when there is a noticeably high IPO volume associated with the high underpricing. Firms getting listed during this period tend to raise more capital but also according to Agathee *et al*, 2012, are riskier. Thus the simple conclusion is that a hot market issue occurs when a large proportion of firms going public have a high risk. Because riskier firms are harder to value, the probability of them being underpriced also increases due to the increased uncertainty from uninformed investors. This period is known as the IPO wave. Chemmanur *et al*, 2011, suggest that IPO waves occur when many entrepreneurs exercise their options of going public due to favourable market conditions. Nguyen, 2020, argues that the quality of the IPOs deteriorates over time in a hot market cycle, resulting in an end to a hot and the start of a cold market. After the hot market comes to an end, a phenomenon known as a cold market develops. The latter is typified by unusually low

initial returns and higher post-IPO productivity. These firms also tend to decrease their leverage in the coming years after a cold IPO due to better investment opportunities, suggesting interesting long-term productivity compared to the firms in hot IPO. (Nguyen, 2020) According to Ritter, 1984, a cold issue market occurs if a large proportion of firms have low risk. To document this transition, the author reports unusually high initial returns of 48.4% for the period 1980-1981 in the US, followed by an average return of only 16.3% in 1977-1982.

In theory, Agathee, 2012, suggests that there is a lead-lag relationship between the IPO volumes and underpricing. This means that there is a time aspect which defines the success of the IPOs in different periods. Normally, a firm will go public in periods when the shares are overvalued. Chemmanur, *et al*, 2011, further suggests that this happens during a period when there is low expected market return, high price uncertainty, and high expected aggregate profitability associated with the market. If however, investors are irrationally optimistic, it will lead to an increase in investor sentiment and more companies will have an incentive to go public, increasing offer sizes. Since the IPO offer prices are based on investor interest, significant issue underpricing will signal important pricing information, reducing information asymmetry which in turn reduces valuation uncertainty for future issuers, triggering an IPO wave. (Aggarwal, 2022)

1.6. Information asymmetry

The discussion regarding the IPO pricing mechanisms, the investor perception of the issuing firm and their incentive to buy the floating shares, all sum up to an information asymmetry. It suggests that there is a high level of difference between the information each party (issuers, underwriters, investors) possesses, which leads them to act accordingly.

The asymmetry between investors is known as the “winner’s curse” and implies that the informed investors are in a much better position than the uninformed investors due to their immense financial knowledge and capability. Because they are financially more sophisticated, informed investors can better identify the profitable shares, after which they decide to subscribe to them, crowding out the uninformed investors. (Xu, 2013) This leads to uninformed investors having to receive full allocations in overpriced offerings. Henceforth, to

ensure the continued participation of uninformed investors in the market, the issuing firms provide compensation for them through underpricing. (Jamaani *et al*, 2019) This leads us to believe that if the number of informed investors dominates the market, the firm will finish the issuing process soon enough and underpricing will not be necessary. But if there are more uninformed investors left with all the overvalued shares, issuers will have to spend more time underpricing the securities to attract them. This phenomenon is more complicated when it comes to China where most issuing companies are state-owned which also means that the government owns part of the floating shares. The government then, who knows the company and the market, serves as the most informed investor as compared to the rest of the market. Since IPO success affects the state's credibility, it cannot afford any possible IPO failure. (Xu, 2013)

Underwriters can be classified as reputable and non-reputable underwriters, with the former having a superior advisory team and an established connection with institutional investors and the latter having a much smaller market presentation. According to the principal-agent theory, underwriters underprice the IPO firms by employing their extensive market knowledge to benefit their preferred clients through "spinning." The latter implies that reputable underwriters who have mutual business relationships with institutional investors tend to provide them with more information about the issuing firm and underwrite shares for them. This is usually the case when the issuing firms are unsure about the present value of their firms and rely solely on the decision of the underwriters. (Jian *et al*, 2008) The case of Credit Suisse First Boston from 2002 serves as a great example of such an agency problem, where the company was fined $100 million for receiving side payments and causing deliberate underpricing of underwritten offerings. According to Su *et al*, 1999, high-quality issuers also intend to impress institutional investors by having their IPOs underwritten by prestigious underwriters.

Because investors rely on the reported earnings of the issuer to make a decision, the firm has to bear considerable discretion in releasing any kind of good or bad news that will provide a vision of the firm's future and manipulate the earnings. (Chen *et al*, 2013) This is called signalling which assumes that the issuer can have a superior knowledge of the firm's intrinsic value whilst the investors will have a better understanding of the aggregate demand in the market. (Chan *et a*l, 2004) The information released highly depends on the quality of the issuing firm. Usually, the type of issuer is revealed after an IPO. Jaamani *et al*, 2019, argue

that high-quality issuers are more knowledgeable about their firms' performance and the company's future earnings. In that sense, they know the exact value of their shares and in practice, they don't need to appoint an underwriter to price the stock and so they take on the pricing themselves. However, quality issuers, expecting to obtain the highest possible offer price, may well be reluctant to communicate positive information regarding their future earnings directly to the market because of the market competition.

1.7. Hypothesis development

There are numerous ways and sufficient amounts of research done on testing IPO underpricing. In theory, as discussed in the literature review, companies have a higher reputation if they are bigger in size. Small firms have a limited operational history, are harder to value and have rather uncertain growth rates, leading managers to underprice the securities more just to incentivise investors in buying their shares. In that sense, we would expect a negative, adverse relationship between the IPO underpricing and firm size. (Mezhoud *et al*, 2011)

Ha: Firm size has a negative effect on the level of underpricing.

As mentioned in China, setting the offering price highly depends on the CSRC regulations, which sets a limit for the P/E ratios for the issuing firms. Since the formula for offering price is the multiple of P/E and EPS, we would expect that:

Hb: P/E multiple has a positive effect on the level of underpricing.

A study done by Xu and Zhao, 2014, found that the Chinese SOEs, due to their state monopolisation and immense government support, are usually more profitable. In theory, Packer *et al*, 2020, suggest that a more solvent company will have less need to underprice its shares because of its market performance and reputation.

Hc: ROA has a negative effect on the level of underpricing.

According to Li *et al*, 2008 the more debt a company has, the more it will try to underprice its shares, to attract inventors and sell its securities. Because of the partial or full government control, it suggests that the SOEs in China have been major borrowers from the government, increasing their leverage. Based on these two studies is the following assumption:

Hd: D/E has a positive effect on the level of underpricing.

Offering size could be one variable that would need more discussion. In concept, a larger issue size, measured in the number of shares issued, would indicate lower ownership retention for the existing shareholders. According to Bannenberg *et al*, 2019, this would signal less confidence about the expected cash flows and increase IPO underpricing due to intensified information asymmetry.

He: Issuing size has a positive effect on underpricing.

Macroeconomic variables are important affecting factors on IPOs especially when it comes to a company's shares. When GDP increases, people's income also increases. As investment becomes more encouraged in a thriving economy, companies will face higher demand for their shares. Usually, in a demand-supply regulated market, an increase for securities would increase their price to balance out the two, however, since in China there is a cap on the offering price, the firms will not be able to do so. In such a situation, issuing firms will face higher money left on the table due to the absence of proper market regulations. (Nakamura *et al*, 2003)

Hf: GDP growth rate has a positive effect on underpricing.

Nasution *et al*, 2021, found in their study that when inflation increases, the price of goods increases, affecting the level of domestic production. Since it also leads to a rise in interest rates, investors are incentivised to save more in banks. Seeing this, managers will try to underprice securities more to bring investors back to capital markets.

Hg: The inflation rate has a positive effect on the level of underpricing.

2. DATA AND METHODOLOGY

2.1. Data

This study takes into account different variable metrics, and thus for the sake of their implementation, a quantitative study will be conducted. The aim is to analyse IPO underpricing in China based on different firm-specific and macroeconomic variables, and try

to detect any possible IPO cycles in the dataset. The study focuses purely on the Chinese market and uses firms listed on the Shanghai Stock Exchange.

The sample consists of Chinese A-shares. These are shares limited only to domestic investors and traded in domestic currency, the Chinese Yen. Because of the government regulations, foreign investors have difficulty accessing these securities. For the sake of this study, I will be using the data only from these shares. Further, the sample size is limited to the Shanghai Stock Exchange, the biggest exchange in China. The latter is run by the CSRC which makes it easier to test the companies based on the regulations. After removing all non-A share firms and deleting the outliers using the interquartile range, the final sample size came to be 558 companies from 2001 to 2022. Important to note that all data variables are in the Chinese Renminbi.

For quantitative research, an OLS model has been implemented. All the firm-specific and macro variables are regressed against the dependent variable which is the underpricing. Return on assets, price to equity and debt to equity ratio, firm size and the offer size, inflation, and the GDP growth rate are the independent variables. These variables are all taken from before the offering period and have been collected from the EIKON database. ROA is calculated as pre-IPO net income/total assets. Firm size is measured as the natural logarithm of the total assets (Mikkelson *et al*, 1997), and the offer size is the number of shares offered to the market. (Pagano *et al*, 1999) GDP growth rate and inflation are taken from the National Bureau of Statistics of China.

For the IPO cycles, the IPO volume and underpricing are purely based on the used data. Volume is taken as the sum of the firms going public annually from 2001-to 2022, whereas underpricing is calculated as an average of all the listed firms during that year.

2.2. Descriptive statistics

Table 1. Descriptive Statistics

	Observations	Mean	Median	St. Dev	Min	Max
Model	558	-	-	-	-	-
Underpricing	-	107.31%	44.38%	111.72%	12.90%	1242.99 %

ROA	-	0.12	0.09	0.05	0.0085	0.36
P/E	-	22.21	20.46	7.87	9.61	43.86
D/E	-	0.65	0.34	0.76	0.03	36
Firm size	-	7.44M	7.35	0.89	5.03	11.79
Issue size	-	14.33M	8.11	12.22	2	44.19
GDP growth rate	-	12.97%	11.91	7.91	1	28.74
Inflation	-	2.33%	0.39	1.75	-0.73	5.93

Based on the descriptive statistics from Table 1, it has been observed that the average market-adjusted underpricing level of Chinese state-owned IPOs from 2001 to 2022 for an average of 14.33 million shares offered to the market is 107.31%. This is quite close to the level found by Xu *et al*, 2013 who documented this number to be 110.33% from 1990 to 2010. For a better understanding and comparison, referring to table 2, average underpricing is 11.9% in Australia and 5.4% in Canada which further prove how high the initial returns on the first IPO days are in China. (Xu *et al*, 2014) This could well indicate the presence of government regulations in the market. If the offering prices and the overall market were purely functioned based on the market itself and the supply-demand caused by it, the underpricing levels would have been much lower. As seen the Chinese firms experienced a ROA of an average of 0.12 which is quite profitable. The average pre-IPO P/E is 22.21 with some firms having a maximum level of 44 and a minimum of 9.6. It can also be observed that the multiple does deviate by 0.7 points and this is very much supported by the literature review that the Chinese Commission keeps changing the P/E margins to make sure that the firms getting listed don't have too high P/E multiple. This is done to make sure that the offering price is low so that investors can get high initial returns. It can further be observed that for average GDP growth of 12.97%, the maximum level of underpricing reaches a maximum of 1242.99%, which is very high.

Table 2: IPO underpricing level of main countries in the world

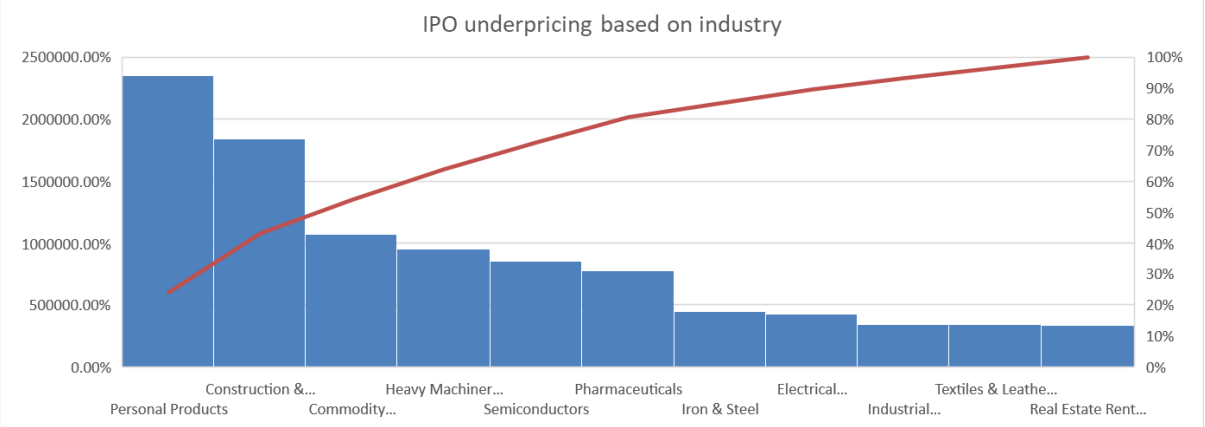
Country	**IPO underpricing level**
Australia	11.9%
Canada	5.4%
China	338.0%

Germany	10.9%
India	35.3%
United Kingdom	12.0%
United States	15.8%

Source: Xu *et al*, 2014

The data has been controlled for the industry. The initial data contained firms from a total of 90 industries. However, companies from 53 productions whose IPO underpricing was 0 have been eliminated from the data. The rest of the 33 industries have been included in the data. Graph 1 displays a few industries with high and lower underpricing levels for visualisation.

Graph 1: IPO underpricing based on industry data



Based on Graph 1, it can be observed that the level of underpricing is highest in the Personal Products industry, with an average of almost 95% underpricing level, followed by the Construction & Engineering, Commodity Chemicals and Heave Machinery & Vehicles industries with an average underpricing of 73%, 42%, and 38% respectively.

2.3. Methodology

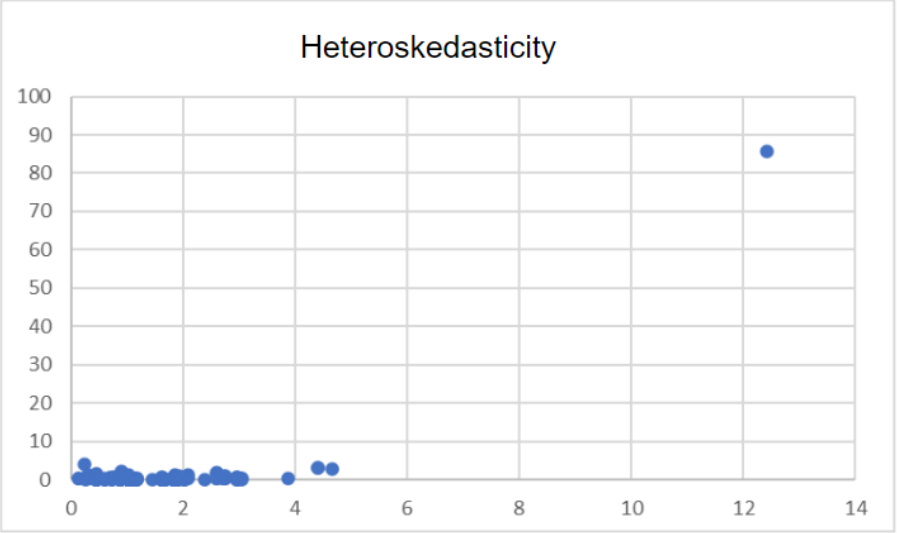
As per the above discussion, the main model used for this research is the Ordinary Least Squares model. The aim is to identify how underpricing in Chinese firms is affected by profitability, leverage, issuing variables and macroeconomic variables and see whether the literature about Chinese government regulations is supported by the regression model. To test

the prior discussion regarding the IPO cycles, graphical visualisation of the behaviour between the IPO volume and underpricing will be presented.

To control that the data is not affected by heteroskedasticity, I ran the regression and plotted the squared residuals against the fitted values, in this case, the IPO underpricing in Graph 2 below. The model has also been tested with the Breusch-Pagan Test in Excel to further make sure the results are reliable to use as the underpricing is the single dependent variable used which increases the chance of inconsistency between the response and explanatory variables.

From Graph 2 below, it is visible that the heteroskedasticity in the used dataset does not exist. This means the p-values are rather acceptable which lets us reject the null hypothesis with confidence.

Graph 2: Heteroskedasticity for firm-specific and macroeconomic variables



As stated, the underpricing serves as the dependent variable. Li *et al*, 2018, Xu *et al*, 2014, Chi *et al*, 2005, Chang *et al*, 2008, all suggest the same way of calculating the return on IPO. There are mainly two approaches for this purpose. The first is the IPO underpricing without the market-adjusted return, calculated as the difference between the IPO closing price and the IPO opening price divided by the opening price:

$$\text{IPO underpricing} = \frac{(IPO\ underpricing\ Closing\ price - IPO\ underpricing\ Offer\ price)}{IPO\ underpricing\ Offer\ price} * 100\%$$

For the other measure of IPO underpricing, the market adjusted values are used and is calculated with the following formula:

$$\text{IPO underpricing} = \frac{(IPO\ Close\ price - Ipo\ Offer\ price)}{IPO\ Offer\ price} - \frac{(Close\ price\ of\ market\ index\ on\ IPO\ day - Open\ price\ of\ market\ index\ on\ IPO\ day)}{Opening\ \ price\ of\ market\ index\ on\ IPO\ day} * 100\%$$

Chi and Padgett, 2005, Li and Liu, 2018, Xu and Zhao, 2014, Jian and Leger, 2008, Xu, 2013, all argue that the second method, which excludes the factor of market price, is a rather more accurate indicator of the IPO underpricing. Thus, for the sake of this research, the second method will be implemented.

The analytical tool used in this research is the multiple regression model. Data is processed through the Excel program. The regression model is as follows:

$$Y = \beta 1\ X1 + \beta 2\ X2 + \beta 3\ X3 + \beta 4\ X4 + \beta 5\ X5 + \beta 6\ X6 + \beta 7\ X7 + \varepsilon$$

Where:

Y = Underpricing (Initial return)

$\beta 1\ X1$ = Firm size

$\beta 2\ X2$ = P/E ratio

$\beta 3\ X3$ = ROA

$\beta 4\ X4$ = D/E ratio

$\beta 5\ X5$ = Issuing size

$\beta 6\ X6$ = GDP growth rate

$\beta 7\ X7$ = Inflation

ε = error term

3. EMPIRICAL ANALYSIS

3.1. Regression model

This paper aims to identify factors influencing the level of underpricing of SSE listed government-owned IPOs in the Chinese A-share market. Regression analysis of initial returns for firm-specific variables was restricted to the IPO sample of 558 companies from the period 2001 to 2022. The regression results are presented in Table 3. Adjusted R Square is 0.35 for the model which is slightly higher than the results reported by Li *et al*, 2008 and Chi *et al*, 2005. Multiple R is 0.59 and the F statistic is 1.41E-36 which suggests a certain level of reliability of the used model.

Table 3. Regression analysis of the relationship between the Initial Adjusted Return and Explanatory variables of A-share IPOs

	Coefficient	St. Error	P-value
Intercept	3.91	1.58	0.01
ROA	1.7	0.046	0.022***
P/E	0.07	0.005	1.99
D/E	0.61	0.006	0.04***
Firm Size	-0.5	0.17	0.001***
Offer size	29.7	0.0004	0.39
GDP growth rate	-0.09	0.14	0.76
Inflation	0.02	0.05	0.048***

3.2. Discussion

Drawn from the results, it can be seen that most of the variables are statistically significant. When regressed against underpricing, return on assets turned out to have a substantial impact on the underpricing. This happens because when the firms are more profitable, they have a better reputation and overall perception from investors. This reduces information asymmetry as the latter consider them less risky. The result is supported by different research from Shen, 2009, Chang *et al*, 2008, Gao 2010, and Chen *et al*, 2013. Li *et al*, 2008, suggest that larger firms represent less uncertainty, making it

easier for potential investors to make an investment decision. The opposite applies to smaller firms. This is better justified when it comes to the Shanghai Stock Exchange as compared to the Shenzhen stock exchange, the second-largest in China. According to Xu *et al*, 2014, this happens because there is a larger number of technology firms in the Shenzhen market. These firms are usually considered riskier, thus increasing the level of underpricing.

From Table 3, it appears that the P/E multiple has an insignificantly positive relationship with underpricing. The ratio is calculated as the market issue price of a share to the projected earnings per share. (Li *et al*, 2008) This lets us reject our hypothesis and conclude that there is no expected sign of a relationship between the P/E ratio and IPO returns. Albeit the argument regarding the CSRC control of the offer price, one of the reasons for such a result is because the high P/E ratio appears to indicate high growth opportunities for the issuing firm. Seeing this, the management will have more confidence and investors will be more motivated to pay a higher price per Chinese Yen of current earnings. This is also an explanation provided by Chan *et al*, 2004 who found the same result in their study.

A significantly positive relationship has been found between the underpricing and debt to equity multiple which lets us accept our hypothesis and conclude that higher debt ratio increases underpricing. Traditionally, a higher proportion of D/E implies greater financial risk. As the company acquires a high level of leverage, investors will receive negative signalling and become sceptical to buy shares. As a result, the issuing firm will try to underprice more to attract investors and raise capital. For this reason, Pagano *et al*, 1999, suggested that newly listed companies should increase their investment or reduce their debt exposure after the IPO. SOEs in China, because of their huge government support, have been viewed as more creditworthy and profitable. According to Packer et al, 2020, they also enjoy preferential access to borrowing from state-owned banks. Thus, it is only logical to think that the SOEs in the current dataset have more leverage and thus are more vulnerable to competition leading them to underprice their securities.

Firm size, which in this study is measured by the natural logarithm of total assets, has been ascertained to have a negatively significant effect on underpricing level. This is in line with the studies done by Pagano *et al*, 1998, and Pope, 2004. In practice, younger and smaller firms, which are more seriously affected by adverse selection, have lower visibility and rather inadequate history records. These firms are either less likely to go public, or if they do, they're more likely to underprice their stocks to attract a sufficient inverter base. The prior literature review in previous sections assessed a study done by Jiang, 2009, who suggests that in China the government tries to hold on to the larger firms whilst letting the smaller ones be acquired or privatised. This gives us rather ample confidence to believe that the majority of SOEs listed on the SSE are indeed small companies and because of their novelty to the market and no solid tracked history record, they’re more heavily underpriced.

The offering size, measured by the number of shares offered to the market on IPO day, has shown to have an insignificantly positive effect on the underpricing. Traditionally, a larger offer size means more shares being traded. Issuance of more securities results in lower levels of ownership retention for the existing shareholders. (Bannenberg *et al*, 2019) in this study, it was expected to find a significant relationship between the two variables, however, the opposite is shown in Table 3 which assumes no correlation. One of the supporting results for such a result could be that in China, where state influence is so significant, it does not matter how many shares the issuing firm offers to the market. Pagano *et al*, 1999, found a different outcome in their study for Italian IPOs for example. However, the circumstances and environment are also different in Italian markets.

Shifting to macroeconomic variables, it has been observed that the GDP growth rate is negatively insignificantly related to the underpricing. The absence of predictability between the two variables is supported by the study carried out by Gunturkun *et al*, 2012, and Nasution, 2021, who also found no such relationship. Typically, a high GDP would result in a higher income, encouraging people to invest more in stock markets. Since in China there is a limit to offering prices, it would be expected for the initial returns to increase with increasing underpricing because firms cannot price their securities at the necessary supply-demand price. However, from the regression model, it can be seen that from 2001 to 2022, in SSE listed A-shares such a relationship is missing.

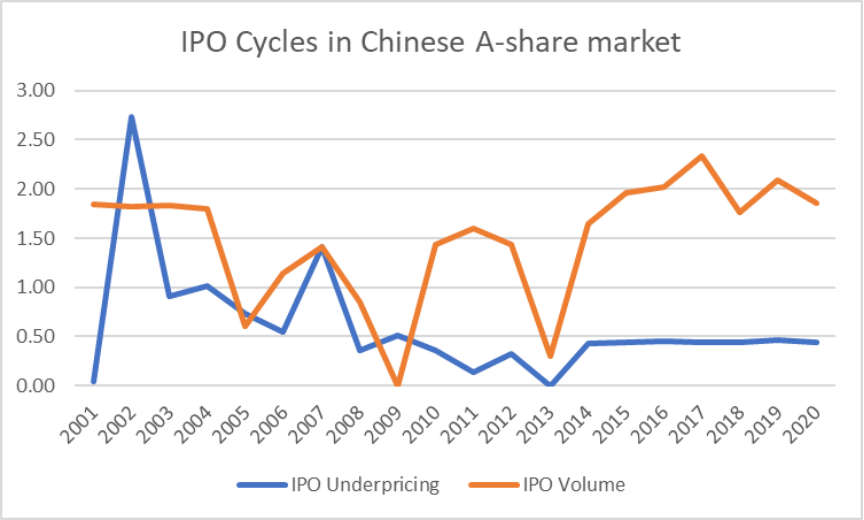
Inflation is significantly positively related to underpricing. Inflation serves as an increase in the price of the product as a whole which further causes a surge in interest rates. As the latter grows, the future potential returns on lower-risk investments like bonds improve, making higher-risk investments like stocks less attractive causing people to save more in banks, rather than in capital markets. Such an outcome is in line with the set hypothesis and also with different studies conducted by Pagano *et al*, 1998 and Brau, 2012.

3.3. Analysis of IPO cycles

As previously discussed there are numerous reasons a firm will choose to go public. Some of them are due to risk diversification and some are due to the need for capital. When the number of firms going public increases, the competition in the market rises accordingly. As Jiang, 2009, argues, pursuing the economic restructure, Chinese companies have become more and more competitive over the past few years. To survive the rivalry, firms have been incentivised to underprice more to sell more. Thus, we are led to believe that as IPO volume increases, IPO underpricing also increases.

This relationship is true and more intense during the so-called 'hot market' periods. This is a time when shares are "overvalued" as suggested by Pastor *et al*, 2005. Such an argument assumes that the periodic market mispricing can somehow be detected by the owners, who then aim for the perfect timing to issue securities and leave less money on the table. The below-shown Graph 3 attempts to find such a timing relationship in the used dataset from 2001 to 2022. As previously mentioned, the IPO volume is taken as a sum of all issuing firms annually and underpricing is taken as an average of these firms.

Graph 3: IPO Cycles in the Chinese A-share market on SSE



According to Graph 2, IPO volume and underpricing move collaterally most of the time. In 2004, as there was a spike in the number of firms getting listed, the underpricing also went up. Another hot market was detected in 2007, 2012, 2014, and slightly in 2019 supporting studies by He, 2007, and Pastor *et al*, 2005. The interesting observation, which further substantiates the literature review in prior chapters, is the observation of cold markets that instantly follow the hot period. For example, right after the surge in issuing firms and underpricing in 2014, a downfall is seen in both variables until a bottom out in 2005. Albeit a slight growth of IPO volume, both variables still follow a downward trend in 2008, then in 2013, and again a slight downturn in underpricing in 2020, coinciding with IPO volume. This supports our initial statement that an increase in IPO volume leads to an increase in IPO initial returns.

The IPO cycles are not detected every year, however. For instance, in 2011 it is visible that whilst the number of issuing firms increased, the underpricing levels decreased substantially. The same happened

in 2009 and partially between the years 2005-2006. The best explanation for such a finding is the government control and the state ownership of the firms in the used dataset. Chinese regulators continue to have a strong influence on IPO activity in China. According to Güçbilmez, 2015, and Shen *et al*, 2009, the CSRC not only decides which firms can go public and when but also exercises power to shut down the IPO market when it deems necessary. This is when the prices start going up, decreasing the initial returns for the investors as in the years 2010-2011 for example. The absence of such a relationship in 2009 is believed to be caused by the global financial crisis of 2008. As the stock markets crashed, the number of firms going public drastically plummeted and the underpricing increased to avoid the IPO failures. This is well reflected in Graph 3.

4. CONCLUSION

The initial public offering has marked a historic moment in a private firm's life ever since it was first documented. Even though IPO has served as a relatively less expensive way of raising capital, it challenges the main question as to why the firms decide to go public. Numerous researches have been conducted trying to analyse this occurrence, marking some of the well-supported reasonings. A study done by Jain and Kini, 1999, suggests that firms, instead of raising money, go public to rebalance their accounts after a long period of investment and financial expansion. Pope *et al*, 2004, argues that as entrepreneurs see their growth levels levelling off, they jointly decide to sell their holdings for a primary motive of diversifying the latter and having a company acquired by another existing private or public company. On the other hand, Maksimovic *et al*, 1998, propose that firms see the disclosure of firm-sensitive information, such as R&D projects and future earnings, as an opportunity to increase company reputation and publicity in the market.

Going public is no easy job and it requires a lot of attention and dedication from the managers and underwriters, who work together to achieve one main goal, get the company public with the least cost acquired by the end of the day. This cost comes from underpricing, which is the difference between the offering price and the closing price. In that manner, the Chinese government has been known for being defiant in setting the maximum offering price limits. Because of this, securities in the country are not priced at their true market value resulting in shares being overly undervalued and by the end of the first trading day, the 'money left on the table' spikes up. Chinese IPOs in that sense are quite significant with an average initial return found to be 107.31%. (Table 1)

In this paper, I have tried analysing the underpricing levels in government-controlled IPOs in China using a sample of 558 companies. The data used is purely based on the Chinese market and the companies listed on the Shanghai Stock Exchange between the period 2001-2022. Specifics have further been limited to 'A' shares which are domestic shares limited to the domestic investors and trading in Chinese Yen. It is worth mentioning that the data has been controlled for heteroskedasticity using the Breusch-Pagan Test. The methods used include two OLS regressions with the first one testing the effect of firm-specific variables on underpricing level and the second one testing the impact of macroeconomic variables on the same, underpricing level. Further, this study has attempted to identify any IPO cycle existence within the data.

The results showed a significantly positive relationship between the debt to equity ratio and inflation. Significantly negative relationships have been detected with return on assets and firm size when regressed against underpricing. The results are supported by different research done on the topic but they also suggest a presence of government control and regulations in the market. In line with other studies, it has been concluded that more profitable, and larger firms have less need to underprice their securities as they are better known and more reputable within the market. These firms also have a well-supported operational history, which makes them more trustworthy for investors. On the other hand, firms with more leverage would be better incentivised to underprice as they lack reputation in the market and are not much attractive. The same happens with firms that issue a lot of shares, signalling to investors low share retention, indicating a problem within a company.

GDP growth rate was concluded to have no significant effect on underpricing. Typically increase in GDP increases demand for investment which should in practice increase offering prices, but since in China they are controlled and capped, we would expect an increase in underpricing. This was observed however in inflation, which was shown to have a positive effect on underpricing.

IPO cycles have been observed during most years in China between 2001 and 2022, with hot markets being followed by immediate cold markets. In other years, however, this correlation was absent due to the effect of the financial crisis of 2008 and the Chinese government having the capacity to exercise power or shut down the market when deemed necessary.

A few shortcomings associated with this research was the data availability. Chinese databases are scarcely accessed only by a few universities in the world. The initial database planned to be used, the China Stock Market & Accounting Research Database (or CSMAR) was in no or extremely limited availability in Estonia and mainland European countries. Thus, the EIKON

database was used, which provided sufficient data for a study, however, with fewer variables offered. A few measurements that would be interesting to observe are the underwriter's reputation, firm history and age. The provided literature review discusses their effect on underpricing but since in China such matters work under very close observation of the government, it would be interesting to see what kind of effect they could have on underpricing. Another factor is the IPO cycles which in this research only considers the short number of firms used in the initial dataset for consistency purposes. Nevertheless, if the data took into consideration a lot more firms over a long period, more patterns would have been detected, especially the transition from the 1990s to the 2000s, which marked a slow reformation of the Chinese government.

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