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"THE IPO UNDERPRICING IN THE CHINESE STAR MARKET: AN EXAMINATION OF THE EFFECTS OF THE NEW MARKET-ORIENTED REGULATIONS"

RELATORE:

CH.MO PROF. AMEDEO PUGLIESE

LAUREANDO: JAN VIERSBACH

MATRICOLA N. 1194062

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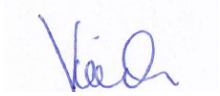

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Abstract

This thesis examines the new Chinese STAR Market in its first year of existence with a main focus on the degree of IPO underpricing. It first illustrates the characteristics of Chinese capital markets and describes its issues. It then introduces the STAR Market and describes how its regulations are supposed to solve these issues. Then it illustrates the phenomenon of IPO underpricing and presents the most important theories which aim to explain it. The thesis then empirically examines IPO underpricing in the STAR Market and compares it to underpricing in the SSE main board and the NASDAQ. It finds that despite of the new regulations IPO underpricing in the STAR Market is significantly higher than in the NASDAQ and only slightly lower than in the SSE main board.

The thesis further finds that firms listed in the STAR Market experience on average extremely high quotations after the first trading day. To understand the reasons for the high IPO underpricing in the STAR Market the thesis examines its drivers by performing a multiple factor regression. It finds that the new regulations have successfully eliminated many of the issues present in other Chinese stock markets, and traditional drivers of IPO underpricing in China are not significant in the STAR Market. Instead it finds that the severe IPO underpricing in the STAR Market is largely caused by sentiment-driven secondary market participants who transferred the pattern of high initial returns to the STAR Market.

Keywords: STAR Market, IPO, Underpricing, Initial return, Chinese stock markets

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1. Introduction

In fall 2020 global stock markets are waiting for the IPO of the Chinese FinTech *Ant Group,* which is expected to compete with Saudi Aramco for the biggest IPO in history (Chen et al. 2020). Ant Group is an affiliate company of the Alibaba Group and operates Alipay, the world's largest mobile payments platform. Similar to other large Chinese firms in the past, Ant Group is aiming to go public in a dual listing simultaneously on two stock exchanges. One of the two stock exchanges will be the Hong Kong Exchange, a stock exchange which seems an obvious choice given its reputation for being one of the most important hubs for large Chinese IPOs. However, the choice of the second stock exchange might have come as a surprise to many investors. In the Chinese mainland Ant Group will get listed on the just one-year old STAR Market. However, especially in Western countries not much is known about this young stock market, which is about to move into the spotlight with the upcoming listing of Ant Group.

This lack of awareness is even more surprising, given that the STAR Market has been planned by president Xi Jinping and is supposed to play an important role in the future of the Chinese economy. In fact, because Xi Jinping announced the foundation of the STAR Market at the end of 2018 himself, the market has been often referred to in the media as the president's *brainchild* (see for example Liu, 2020). The president has an ambitious vision for the STAR Market. This new stock market established in Shanghai should help the city to develop into a global financial center, at par with the financial capitals like New York, London or Hong Kong. Furthermore, the STAR Market is supposed to help facilitate the "Made in China 2025" initiative. With this initiative the Chinese government aims to manage the transition of the Chinese economy from being the "worlds' factory" which is focused on low-end segments, to becoming the global leader in high-tech industries, which will dominate trade in the future. The STAR Market was founded to provide the needed equity financing to young Chinese high-tech companies, in order to help them grow (SSE, 2019a). Additionally, the STAR Market is a Chinese answer to the global trade tensions, especially concerning the Sino-American trade war. The STAR Market should prevent promising Chinese companies to get listed in the U.S. and is supposed to lure home Chinese companies which formerly got listed abroad (Platonov, 2019).

In order to achieve these ambitious goals, the STAR Market is designed very differently from all the other Chinese stock markets. It got equipped with a set of market-oriented regulations, which are supposed to work as an experiment to loosen the strong government grip on the stock markets. Most importantly, the STAR Market is the first Chinese stock market in history, that experiments with a registration-based IPO system. With these regulations the STAR Market is

intended to be a pilot project for all Chinese stock markets. It should be tested whether with this new setting the issues prevailing in the Chinese stock markets can be resolved.

From these issues in the Chinese stock markets the astronomical high IPO underpricing is probably the most striking one. Usually, in the first trading day after an IPO in China the stock prices soar high. This means that the Chinese IPO firms often set their IPO prices too low. While IPOs in the U.S. were underpriced on average by 17%, in Italy by 13% and in Germany by 23% over the last few decades, IPOs in mainland China were underpriced on average by 170% over the last 30 years. No other country with a large stock market comes even close to this number (Ritter, 2020a). This means that the companies which went public in China over the last 30 years missed the opportunity to collect much more money with their IPOs. Because of the severeness of IPO underpricing in China this phenomenon has been examined by many scholars over the last two decades. An overwhelming majority of them assumed that the tight IPO regulations in China were the main cause for this phenomenon.

This thesis builds on the prior work of these scholars. It examines the success of the STAR Market in its first year of existence and evaluates whether the Chinese government could reach its goals with the STAR Market. For this purpose, it evaluates the nature of the firms which got listed on the STAR Market. However, the main focus of the thesis lies on IPO underpricing. It evaluates whether the new regulations were successful in eliminating this issue. The average level of IPO underpricing in the STAR Market is calculated and the most important drivers for IPO underpricing in the STAR Market are aimed to be identified.

The thesis is divided into two parts. The first part (chapter two to four) introduces the existing stock markets in China, describes the STAR Market and its new regulations and presents prior literature about the phenomenon of IPO underpricing. The second part (chapters five and six) then builds on the first part by statistically evaluating IPO underpricing in the STAR Market. It examines the degree of IPO underpricing in the STAR Market and aims to identify its drivers. In the second chapter the functioning of the existing Chinese stock markets is explained in order to get an understanding about the environment in which the STAR Market operates. These stock markets have features which are globally unique and which underwent many changes in the last three decades. To get an understanding of these features and changes, first the history of the Chinese stock markets is explained. Then some of the unique features are pointed out: the different existing share types, the IPO legislation and the different existing stock markets. Finally, the issues prevailing in these stock markets are explained.

In the third chapter the STAR Market is introduced. First, its mission and the reasons for its foundation are presented. Then its regulations are examined, thereby focusing on how they are

designed to solve the above-mentioned issues. Then it is analyzed how the STAR Market developed in its first year of existence.

The fourth chapter is dedicated to the topic of IPO underpricing. It first presents evidence for the different levels of IPO underpricing in different countries around the world. Then it reviews the literature on IPO underpricing. Many highly esteemed scholars have examined this phenomenon and have tried to find an explanation for it. The most influential theories are presented in this chapter.

In the second part of the thesis IPO underpricing in the STAR Market is examined statistically. First, some key indicators of the STAR Market are compared to its peers, the Shanghai Stock Exchange main board and the American NASDAQ. Then, underpricing in the STAR Market is compared statistically to the two other stock markets. To evaluate whether the means of IPO underpricing in these markets are statistically different an independent sample t-test is performed.

In the sixth chapter different factors which might contribute to IPO underpricing are identified and then evaluated statistically. These factors are chosen in line with the underpricing theories mentioned in chapter three and are based on the results of related studies from the past. To check if these factors are valid to explain underpricing in the STAR Market, a regression analysis is performed. Since several factors need to be taken into account, a multiple linear regression model is used. At the end of the thesis, the findings are discussed. It is evaluated whether the STAR Market was successful in executing its vision.

Many researchers have evaluated the degree of IPO underpricing and its drivers in different stock markets. This thesis adds to this literature by evaluating the degree of IPO underpricing and its drivers in the young STAR Market. Additionally, it contributes to the research about the efficiency of the Chinese stock markets overall. In prior literature and in specialist media publications examined the regulations of the STAR Market. However, these publications were exclusively descriptive. This thesis goes beyond this research by evaluating the success of the STAR Market using quantitative methods. By examining the STAR Markets' first-year performance the thesis tries to understand whether the market managed to reach its aims, and whether it became more efficient than the other Chinese stock markets. Given the obvious restrictions of time and space of a master thesis this thesis cannot evaluate stock market efficiency in a broad way. This would require a deeper analysis with more time and more sophisticated models. For this reason, one proxy was chosen to represent market efficiency in this thesis: the IPO underpricing. To the knowledge of the author, this thesis is the first research which quantitively examines stock market efficiency in the STAR Market.

2. Chinese Stock Markets

Traditionally the Chinese economy has relied more on the banking system than on the stock markets to finance its firms. Still in 2017 the amount of new bank loans was nearly 16 times larger than the total equity funding (Qian et al., 2020). However, over the last 20 years the stock markets received increasingly more attention by the Chinese authorities which tried to improve their importance with a series of reforms. The following chapter introduces the Chinese stock markets. It outlines the dynamic development those markets have experienced over the last decades prior to the foundation of the STAR Market.

First, the history of the Chinese stock market is briefly outlined. Then the different available share types are explained, and the existing IPO legislation is illustrated. This is followed by a brief presentation of the different Chinese stock markets, and finally the problems prevailing in these stock markets are highlighted.

2.1. History

It is not widely known that the Chinese capital markets look back on a long history and that the first Chinese stock exchange was founded in the 1920s. In 1921 the Shanghai Huashang Security Exchange was founded and quickly became the most important exchange in East Asia. However, the success of the exchange was hampered by the uncertainties existing in the China of the 1930's and 1940's. Those years were characterized by political instability, changes in the economic system and wars. In 1949 Mao Zedong and the Communist Party of China won the civil war and founded the People's Republic of China. They immediately assigned the task of capital allocation to the central government authorities and the Shanghai Huashang Security Exchange was suspended (Hu et al., 2018).

It took nearly 30 years until the political climate started to change, but in 1976 China started to slowly open up to the rest of the world. The country's economy entered in a transition phase and started to slowly adapt some capitalistic elements in its economy. This process is still ongoing today. In 1990 the Chinese stock markets were officially founded again. First the Shenzhen Stock Exchange (SZSE) and then the Shanghai Stock Exchange (SSE) were established under the strict planning and guidance of the central government (Zhen, 2013). However, these first versions of the stock markets were still very different from its Western counterparts. The new stock markets were founded when China was still a planned economy and their foundation was mainly driven by political, rather than by economical concerns. Mainly, the Chinese government wanted to show its dedication to its *open-door policy* (Fang et

al., 2012). Furthermore, the government wanted to provide its huge state-owned enterprises (SOE) with a new source of funding, besides the bank loans (Zhen, 2013).

Since the young markets were characterized by enormous volatility and sky-high returns, the regulators got concerned and forbad the government officials to participate in these markets. As a consequence, market confidence dropped significantly, and the stock exchanges experienced nine months of recession. On 22 April 1991 the SZSE even experienced a day without any trades at all. This development forced the government to intervene again. A fund was formed with the aim to buy stocks with the intention to raise the stock prices. This intervention brought back the confidence in the markets and a bull market was created (Fang et al., 2012).

These first months can be seen as a blueprint for the development of the newly funded stock exchanges because also the following years were characterized by such cycles of experimentation and intervention. Even today the Chinese regulators are constantly modifying the stock markets in order to make them work more efficiently without giving away control to early. To improve the efficiency in the stock markets, the Chinese government has implemented a series of institutional reforms over the years which were supposed to lead the stock markets slowly away from state control towards a market orientation (Gao et al. 2020). The reforms started in 1990 and are still ongoing today. Its latest example is the foundation of the STAR Market.

2.2. Share Types

One special feature of the Chinese stock markets is the existence of different share-types for different types of investors. To obtain funds on the stock exchanges the Chinese companies have the possibility to issue A-, B- H, or N-shares or can list as red chips. The implications of these different share types are now explained.

2.2.1. A-Shares

The most important shares in China are the A-shares. These are shares which are exclusively traded by domestic investors and thus are denominated in Renminbi (RMB). Foreign investors are not allowed to trade these shares. A-shares are the most traded share type in China and account for approximately 96% of all the trade volume (Hu et al., 2018). Historically the A-shares were a vehicle for state-owned enterprises to obtain funding, and still today the large state-owned companies dominate the A-share market. However, also the A-shares were subject to many reforms and are a good example for how a single reform in the regulations can

substantially change the performance of the whole stock market. In the initial stage the Chinese stock markets were characterized by low liquidity due to a split share structure. Under this structure a company issued both tradable and non-tradable shares. Both share types had the same voting and cash flow rights. Typical holders of non-tradable shares were the central or local government and its affiliates. Typical holders of tradable shares were domestic individual or institutional investors (Li et al., 2011). Before 2004 a majority of almost 70% of all outstanding shares was non-tradable. These circumstances led to conflicts due to different incentives between the two groups of shareholders (Firth et al., 2010). Especially the large portion of government ownership in the listed companies prevented the efficient allocation of capital to its best use because the government authorities often had other objectives than maximizing shareholder's value. Therefore, in 2005 the government intervened with a reform which allowed non-tradable shares to be converted into tradable shares. This led to the privatization of many state-owned enterprises. By 2007 the transition was completed and nearly all non-tradable shares were converted in tradable shares. This reform turned out to be a turning point in the history of Chinese stock markets because it enhanced its liquidity and thus fostered stock-market participation. Shortly after the reform was completed the Chinese stock exchanges entered a bull market in which the Shanghai Composite Index (SHCOMP) nearly doubled (Zhen, 2013). As shown in figure 1, after the reform was successfully completed the SHCOMP reached its historic peak at the end of 2007. However, in the following month the index fell dramatically as a result of the beginning financial crisis. Until today the SHCOMP has never reached its peak of 2007 again.

Figure 1. Historic development of SHCOMP

From Eikon (2020). Shanghai SE Composite Index – Price history.

2.2.2. B-Shares

A unique feature of the Chinese stock exchanges is the availability of B-shares. Those are shares from Chinese companies which are accessible only to foreign investors. They are denominated in foreign currency but are listed in the domestic stock exchanges. Shares listed in Shanghai are denominated in U.S. dollars and shares listed in Shenzhen are denominated in Hong Kong dollars (Chui and Kwok, 1998). When the first B-shares were issued in 1992 the share class was designed to attract foreign investors and to mitigate the foreign currency shortage (Zhen, 2013). Since those shares are created for foreign investors, they are subject to the international accounting standards, which, in the early years of the Chinese stock markets, were way more developed than the Chinese accounting standards. The international accounting standards for example contained much broader disclosure requirements. This made foreign investors better informed about the value of the Chinese firms than the majority of the Chinese investors (Chen et al., 2000). However, in spite of its initial success, at the beginning of this century B-shares trading volume became marginal when the new class of H-shares was created. Today the B-shares market is largely inactive after many companies converted their B-shares to H-shares at the beginning of the century (Zhen, 2013).

2.2.3. H-Shares, Red Chips and N-Shares

H-shares are shares from Chinese companies which are listed on the Hong Kong Exchange (HKEX). These shares are listed in Hong Kong to profit from the mature stock market and thus facilitate the easier access to foreign capital (Sun and Tong, 2000). Starting from a market value of $11 billion in 2001 the popularity of H-shares rose in the following years and reached the market value of $482 billion in 2011 (Zhen, 2013). By July 2020 already 267 H-shares have been listed on the HKEX with a market value of $734 billion. H-shares thereby account for 14,14% of the total market value of the Hong Kong Exchange (HKEX, 2020a) Among the H-shares are many of the biggest Chinese companies. For example, each of the “big four” Chinese banks[1] has issued H-shares (HKEX, 2020b). In 2014 the HKEX and the SSE launched the Shanghai-Hong Kong Stock Connect to increase the accessibility of both markets. With this connection it became possible for foreign investors to trade shares listed on the SSE and for Chinese investors it became possible to trade shares listed on the HKEX (SSE, 2019b).

Another way for Chinese companies to attract foreign capital is through the listing as a red chip. Red chips are companies which are incorporated and traded in Hong Kong, while most of their

[1] Bank of China (BOC), China Construction Bank (CCB), Agricultural Bank of China (ABC), Industrial and Commercial Bank of China (ICBC).

business activity is in mainland China (Zhen, 2013). Red chips are often state-controlled conglomerates with largely diversified business activities which act in the interest of the Chinese authorities. This is a difference to the H-shares which tend to be issued by companies which are more specialized in one specific business area (Sun and Tong, 1999). In total 173 red chips are listed in Hong Kong which have a combined market value of $599 billion (in July 2020) and thus account for 11,53% of the overall market value (HKEX, 2020a). Large red chips are for example the state-owned companies China Mobile and CITIC (HKEX, 2020b).

Finally, many of the large Chinese companies have listed on the New York Stock Exchange or the NASDAQ to obtain foreign capital and profit from the well-developed market environment in the U.S. (FTSE Russell, 2019). Additionally, a listing in New York means a huge boost in prestige for Chinese companies. In July 2020 67 important Chinese tech companies, like Alibaba or JD.com, were listed on the NASDAQ (Liu, 2020). The shares issued in New York are called N-Shares. To be classified as a N-Share a Chinese company must be listed in New York but its origin must be Chinese and the company must derive the majority of its revenues from China (FTSE Russell, 2019).

2.3. IPO Legislation

The IPO legislation in the Chinese stock markets is in some ways very different from that in the western stock markets. It underwent substantial changes over the last 30 years. The most important aspects of the Chinese IPO legislation are illustrated in the next chapter. Additionally, the most important regulatory changes which affected the IPO legislation are outlined.

2.3.1. Quota, Approval and Registration System

Together with the development of the overall domestic stock market, also the legislation regarding initial public offering changed in China over the last 30 years. The development of IPO legislation up to 2019 can be broadly divided in two phases. Starting from 1992 an administrative approval regime was in place, which was also called the *quota system*. Under this system the central government decided how many shares could be issued every year. The government then negotiated with the individual regions the fraction of shares each region received. When a firm wanted to go public under the quota system it had to first get the approval from the local government authority. This local government authority then recommended the company to the central China Securities Regulatory Commission (CSRC), which made the final approval decision (Zhen, 2013). This system was designed to control the size of the domestic stock markets, to maintain a balance among the Chinese regions and to preserve the dominant

position of state ownership in the stock markets. One of the main issues with this system was the overall low quality of the listed firms as firms with excellent political connections were admitted for a listing rather than firms with excellent financial performance and potential. This was due to the approval process involving two government authorities (Du and Xu, 2009). Additionally, since the CSRC only permitted a limited number of IPOs per year, those IPOs were usually largely oversubscribed by the investors, which led to a very high degree of underpricing (Wan and Yuce, 2007).

Being aware of these issues, the CSRC changed the system in 2001 by implementing the qualification approval system. Under this system the government still decided on a quota of IPOs per year but transferred the decision authority from the central authority to renowned underwriters. The CSRC empowered these main underwriters by assigning them a quota from two to nine each year. This quota allowed the underwriters to annually suggest two to nine companies eligible for an IPO. These suggestions were then reviewed by the CSRC. This system was an intermediate step since it remained a quota system but gave the power to select companies to players in the market (Zhen, 2013).

Because the Chinese stock markets were still working very ineffectively, the government adopted a new regulation in 2004, the *Provision Measures on the Sponsorship System for Issuing and Listing of Securities.* This regulation implemented the so-called *approval-based system* which has been in effect ever since. Its aim is to improve the quality of publicly traded firms and protect the interest of the investors (Zhen, 2013). One of the main changes with this new legislation was the replacement of the quota system with a sponsorship IPO system. With this system the sponsor suggests its clients for an IPO, without having to respect any quota. The CSRC then reviews the application in order to decide whether the application is allowed. This system is more market oriented because it gives the sponsors the incentive to evaluate their client extensively in order to only suggest valid firms to CSRC. It thus improved the quality of firms applying for a listing. Additionally, it reduced the structural advantages of state-owned enterprises or companies with strong political connections and thus made it easier for entrepreneurs to apply for an IPO (Liu et al., 2013). Even though this approval-based system is more market-oriented than the previous systems, it has still many differences compared to the registration-based systems which are used in the other major stock markets around the world. Under the registration-based systems, there is usually a minimum threshold for some indicators the IPO companies have to fulfill in order to be allowed to apply for a listing. The regulatory authorities then just make sure that the IPO candidate satisfies all the given disclosure requirements. Instead under the Chinese approval-based system the CSRC significantly

influences the IPO process, for example by selecting the companies to admit or by influencing the IPO price and the filing process (Fang et al., 2012). Because the registration-based system is perceived as superior in terms of market efficiency its implementation has been requested by the Chinese general public and investors. Nevertheless, the Chinese government held on to the approval-based system in order to maintain control over the listing of firms (Zhen, 2013).

During the first 30 years of stock markets in China the CSRC maintained its outstanding position in developing the markets in accordance with the overall economic orientation of the country. The CSRC was founded in 1992 and operates as a sub-unit of the Chinese State Council. Besides developing the domestic capital markets, the commission has the authority to regulate and supervise the Chinese stock markets (CSRC, 2008). In times when the Chinese economy or the stock market performed unsatisfactory the CSRC used its authority to completely suspend all IPO activities. This happened quite frequently, in fact the Chinese IPO market was suspended eight times between 1994 and 2013 (Zhen, 2013) The last suspension happened in 2015, after the burst of a stock market bubble led the Chinese stock markets into a recession. The authorities suspended all IPOs because the creation of the bubble was blamed on the large number of IPOs hitting the already frothy and strongly leveraged market (Zhang and Taplin, 2015).

2.3.2. Allocation System

The change in the legal environment also affected the IPO allocation mechanisms. Since the foundation of the Chinese stock markets in 1990, three main mechanisms have been used: the fixed price, auction and book building mechanism (Azevedo et al., 2018).

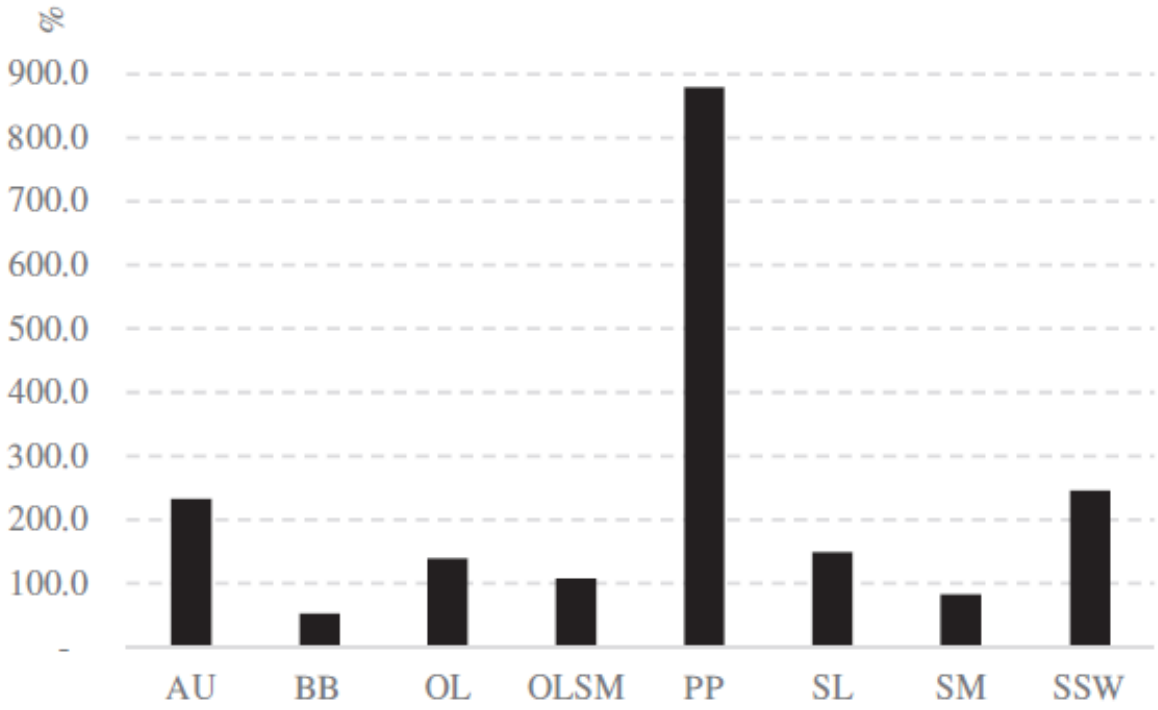
The fixed price mechanism can be further divided into six slightly different procedures. However, all six of them have in common that the issuer and the underwriter already agree on the offering price before contacting the market. Subsequently, after this offering price is disclosed to the market the investors can specify their bids. The different fixed price mechanisms were frequently used from 1990 until 2011 in the Chinese stock markets.

With the auction mechanism each potential investor indicates how many shares he is willing to buy and at which price. The underwriter then ranks all the bids according to the indicated price, and the offering price is set at the bid price of the last share sold. This mechanism was popular in China mainly in the middle of the 1990s.

The third IPO allocation mechanism used in China is the book building mechanism. This mechanism started to be used in China in 2000 but became popular from 2006 on. Today it is

the only mechanism used in China. Therefore it is explained in detail in the following paragraph. The book building mechanism is not only the most popular approach in China, but also worldwide (Iannotta, 2010). It owes its popularity mainly to its capacity to extract private information from the investors at comparably low costs. In addition, book building is the mechanism with the on average lowest level of IPO underpricing in China. Azevedo et al. (2010) examined IPO underpricing in the Chinese stock markets from 1990 to 2015 under the different mechanisms. The results are presented in figure 2.

Figure 2. Average IPO underpricing per price finding mechanism



Average IPO underpricing in China from 1990 until 2015 using different price finding mechanisms. Auction (AU), Book building (BB), Online fixed price (OL), Online fixed price plus Secondary market proportional (OLSM), Private placement (PP), Saving linkage (SL), Secondary market proportional offering (SM) and Selling subscription warrants (SSW). From Azevedo, A., Guney, Y. and Leng, J. (2018). Initial public offerings in China: Underpricing, statistics and developing literature. Research in International Business and Finance, 46, 387-398.

As mentioned before, the book building mechanism, which is nowadays used exclusively in China, is the most effective approach for extracting information about the real value of the offer (Iannotta, 2010). To obtain this information the issuing company is carrying out *roadshows* prior to setting the offer pricing. The underwriter approaches the investors with a range for the offering price. This range represents a set of values that are considered to be reasonable by the underwriter and the issuer. The size of the range itself is a signal for the underwriter's uncertainty about the true value of the offer. In the roadshows the underwriter collects information from the potential investors. The investors place non-binding offers with the underwriter indicating at which price they would be willing to acquire a certain number of

shares. When the roadshow is finished the book is closed and the underwriter and the issuer evaluate the offers and discuss which offering price to set. The shares are then distributed at the chosen price to the investors on discretionary basis. However, in order to make the investors truthfully state their interest during the roadshow the issuer has to offer a reward in return. This topic is discussed in detail in chapter 3.3.

2.3.3. P/E Cap and Window Guidance

Another unique feature of the Chinese stock markets is the so-called *window guidance*. This is basically a policy setting an upper limit for the price to earnings (P/E) ratio at the IPO in order to prevent overpricing. It thus tries to enable the success of the IPOs by guaranteeing that the stocks perform positively after the IPO. In its history the Chinese stock markets have undergone different phases in which the P/E cap was lifted and reinstated multiple times, depending on the development of the market (see table 1).

Table 1. Price restriction regimes in different periods in China

Time Period	Pricing Restrictions
1. 10/1992–06/1999	P/E cap at 20
2. 07/1999–09/2001	No price cap
3. 11/2001–09/2004	P/E cap at 20
4. 02/2005–06/2005	No price cap
5. 06/2006–09/2008	Window guidance P/E cap of 30
6. 07/2009–11/2012	No price cap
7. 01/2014–02/2014	No price cap
8. 06/2014–today	Window guidance P/E cap of 23

From Qian, Y., Ritter, J.R. and Shao, X. (2020). Initial public offerings Chinese style. Working Paper.

The CSRC thereby moved from an official P/E cap in the early stages to the window guidance in the later stages of the market. Under the window guidance written rules which restrict the issuing P/E ratio are eliminated, instead the CSRC communicates the desired P/E cap directly to the investment banks (Qian et al., 2020).

The observation of the above developments since 2009 can help to understand the rationale behind the changes in the P/E cap. Before 2009 the issuing P/E ratio in China was capped at 30 (Guo et al., 2019). This P/E ratio of 30 is in line with the average issuing P/E ratio in mature stock markets like the American ones (Kim and Ritter, 1999). However, this issuing P/E ratio restriction held the offering prices artificially low which led to investors flooding the market to

profit from the enormous first day return. This stage of the Chinese stock markets was therefore characterized by severe IPO underpricing in comparison to the countries with more developed stock markets (see for example Chan et al., 2004).

In 2009 the CSRC issued the *Guidance on the Further Reform and Refinement of the Initial Public Offering Method* which relaxed the existing regulatory constraints. It allowed the market to determine the IPO price and thus ended the window guidance (Qian et al., 2020). Consequently, the Chinese firms going public wanted to seize this opportunity and tried to maximize their offering price. However, this behavior was not well accepted by the market which was used to low offering prices and high first day returns. Therefore, the demand decreased significantly and the stock prices collapsed. The Chinese government understood that the abolishment of the window guidance did not make the markets more rational either and reinstated the policy in 2014 (Guo et al., 2019).

According to Huang et al. (2018) the average industry P/E ratio in the Chinese secondary market is 52. Nevertheless, in 2014 the CSRC set the issuing P/E cap at 23, way below the average P/E ratio in the secondary market. Huang et al. (2018) found that under the reinstated window guidance the average issuing P/E ratio was 21.5. This means that the average P/E ratio in the secondary market is around 250% higher than the average issuing P/E ratio. The reform of 2014 therefore brought back IPO underpricing and high returns in the first trading days.

However, to reduce the variance in the stock markets the CSRC introduced limits in the fluctuations of the share prices. In the first day of trading after an IPO the development of the stock price is subject to a return limit of plus or minus 44%. After this, a daily limit of 10% applies to the stock in every subsequent trading day (Qian et al., 2020).

2.4. The Stock Exchanges

In the following chapter an overview of the existing Chinese stock markets is provided. Each stock market is briefly presented, and its characteristic are outlined. This will later on allow to understand how the STAR Market differs from these stock markets.

2.4.1. Shanghai Stock Exchange

The Shanghai Stock Exchange is the largest stock market in the People's Republic of China in terms of total market capitalization and trading volume (Hu, 2018). Having undergone a fast development in the last 30 years after the reopening of its stock exchange in 1990, Shanghai is now aiming to take the position as the financial center of Asia. A position it already owned in

the 1920s and 1930s, when both domestic and foreign investors were allowed to trade on the Shanghai Chinese Securities Exchange (SSE, 2019c). But this time the Chinese government is aiming for even more: it wants to establish Shanghai as one of the global financial centers (Shen and Goh, 2019). With a market capitalization of 4.67 trillion U.S. dollars the SSE is currently the fourth biggest stock exchange in the world, after the New York Stock Exchange, the NASDAQ and the Japan Exchange Group (Statista, 2020a). By August 2020, 1540 companies were listed on the SSE and most of them are large, and often state-owned, companies (SSE, 2020a). The most important index which tracks the performance of the companies listed on the SSE is the SSE Composite Index. All the 1540 listed companies are included in the SSE Composite Index with their A-, and B-shares (SSE, 2020b). However, the realization of Shanghai's goal to become a worldwide financial center is still hindered by the excessive control the CSRC possesses over the stock market and the limitations of the SSE regarding transparency and accessibility for foreign investors (Shen and Goh, 2019). Being aware of these shortcomings the SSE launched the Shanghai Stock Exchange Science and Technology Innovation Board (also called STAR Market) in July 2019. The STAR Market has more market-oriented regulations than the SSE main board and is supposed to attract Chinas innovative high-growth firms (SSE, 2019c). This new stock market is analyzed in chapter 3.

2.4.2. Shenzhen Stock Exchange

The other major Chinese stock market besides the SSE is the Shenzhen Stock Exchange (SZSE). The SZSE is located in Shenzhen, which is one of the Special Economic Zones which were created in the early stages of the Chinese opening up in order to foster this process. Shenzhen is often called the "Chinese Silicon Valley". The SZSE was founded in 1990 and then quickly emerged from a regional to a nation-wide securities market (Hu, 2018). Nowadays it is the seventh biggest stock exchange in the world with a market capitalization of 3.28 trillion U.S. dollars (Statista, 2020a). At the end of July 2020, 469 companies were listed in the SZSE. A characteristic of the SZSE is that its companies are on average smaller than the companies listed on the SSE main board (SZSE, 2020a).

In 2005 the SZSE took a further step to support smaller enterprises by opening the Small and Medium Enterprises Board (SME Board). On this board small- and medium-size firms can be listed which are typically characterized by high growth and high profitability (Hu, 2018). Small- and medium- size enterprises have a high importance in China and account for around 60% of the GDP and 80% of the employment. Before the foundation of the SME Board these companies often had difficulties in obtaining funds and the SME Board aims to close that gap (Zhen, 2013).

Even though the SME Board aims to attract a different type of companies than the main boards, the listing and maintenance rules in the SME Board do not differ from the ones of the main boards (Platonov, 2019). In August 2020 already 960 companies were listed on the SME Board (SZSE, 2020b).

In 2009 the SZSE launched a further board with the Growth Enterprise Market (also called ChiNext). In terms of vision ChiNext is similar to the STAR Market because it aims to provide funding to small high-tech firms with large growth potential (SZSE, 2020c). The Chinese government published its intention to found ChiNext already in 1998. However, after the burst of the dot.com bubble in America in 2000 and the following crash of the NASDAQ, concerns about ChiNext were raised and the launch was suspended. Nevertheless, in 2004 the State Council decided to establish a different layer market system to be able to provide access to financing for different types of enterprises. This included the foundation of first the SME Board and then ChiNext (Zhen, 2013). In October 2009 ChiNext was officially founded with listing rules which differed from the ones in the other Chinese stock markets (Hu, 2018). For example, the minimum listing requirements on ChiNext were much lower compared to the other boards, which led to a high IPO approval rate (Zhen, 2013). To be approved for a listing firms must have promising growth potential and must fulfill some financial criteria like net assets of at least RMB 20 million[2]. Additionally, firms must have been profitable in the two years prior to the IPO and must have earned combined profits of more than RMB 10 million[3] in those two years. Alternatively, a firm can also get approved if it just has profits of more than RMB 5 million[4] in the year prior to the IPO but fulfills certain revenue and growth criteria (Zhen, 2013). By August 2020 already 833 companies were listed on ChiNext (SZSE, 2020c). ChiNext turned out to be a success and way more capital was raised on this stock exchange than initially expected by the authorities (Zhen, 2013). The above explanations describe the state of the ChiNext at the date the STAR Market was founded. In 2020 the ChiNext adopted many regulations from the STAR Market. This is described later on.

None of these four main exchanges has an investor threshold which reduces the accessibility for certain types of investors. Therefore, nearly every Chinese citizen can trade on these exchanges and consequently these markets are characterized by a high liquidity. However, all four exchanges are heavily regulated and have strict and onerous listing rules. In order to get

[2] RMB 20 million = $ 2.98 million (exchange rate 09.10.2020).
[3] RMB 10 million = $ 1.49 million (exchange rate 09.10.2020).
[4] RMB 5 million = $ 0.74 million (exchange rate 09.10.2020).

listed on one of these exchanges, besides from meeting the standards in company law and security regulation, the firms must obtain the approval from the CSRC (Lu and Ye, 2020).

2.5. Issues

As previously described, the Chinese stock markets have undergone a rapid development over the last 30 years. Many regulatory changes were implemented with the intention to reduce the influence of the government and to make the stock markets more market oriented. However, many issues still existed at the time the SSE was planning the foundation of the STAR Market.

Now the remaining issues of the Chinese stock markets are explained. This serves as a basis to understand which issues the regulators had to tackle when founding the STAR Market.

First of all, the Chinese stock markets have a strong fundraising, but a weak investment function. As seen before, in the early years the stock exchanges were designed to give the Chinese state-owned enterprises access to new sources of funding. Providing an opportunity for the investors to generate returns was only a secondary concern. Especially in the early years of the stock markets, the investors financed the growth of large state-owned enterprises, while generating only low returns on investment or even losing money (Zhen, 2013). Additionally, investor protection was still weak in China. The CRSC tried to improve the protection of minority shareholders in previous years, but the overall level of investor protection remains quite low, especially compared to firms with good political connections (Berkman et al., 2010).

Second

, the reviewing process of the IPO applications is very lengthy in China. The time between the file date and the approval date has been on average 489 days for the 951 IPOs between 2014 and 2017. This is roughly three times longer than this process takes on average in the U.S. (Qian et al., 2019). Before a company can even file for an IPO it must enter a reorganization phase in which the company has to be reorganized according to the criteria set by the CSRC to be eligible for an IPO application. This process is very time consuming and takes on average around three years. Additionally, it is uncertain if the firm will even be able to finish the process successfully (Zhen et al., 2013). Afterwards the firm can file the IPO application, but it then must wait for the approval from the CSRC examination committee. There is normally a long queue of firms waiting to be examined by the CSRC, so it is common that a firm has to wait one or two years until the CSRC examines its application. The timing of the IPOs is therefore in the hands of the CSRC rather than the applying firms (Li et al., 2018).

Additionally, Liu et al. (2013) and Chen et al. (2017) state that firms with good political connections have a higher probability to be approved for an IPO. This largely hinders the allocation of the capital to its best use and makes it especially difficult for young, innovative, companies to get admitted for a listing. Additionally, Fana et al. (2007) show that companies with political connections in China on average experience poorer accounting and stock return performance compared to their peers. This is the case because these firms are more likely to have former or current government bureaucrats in their boards which on average have less professional experience.

Furthermore, there are many issues connected to the approval-based IPO system. For example, the non-transparent issuance system opens the door for corruption (Zhen, 2013). Moreover, the week institutional environment and the low disclosure requirements incentivized many firms to falsify their accounts in order to get a higher valuation (Aharony et al., 2000 and Chen et al., 2011). As mentioned before, also the window guidance policy is an issue. The cap of the issuing P/E ratio makes the issuing companies leave a lot of money on the table. This money goes instead into the pockets of the IPO investors who can realize the tremendous first day returns.

A last important issue in the Chinese stock markets is its volatility. Because of its capital controls the Chinese capital markets are generally separated from the rest of the world and thus the global institutional investors (Shi et al., 2018). The Chinese stock markets are very speculative and retail investors dominate the trading by contributing around 80% of the trading volume (Chen, 2019). Those investors are often young and unexperienced. Among the retail investors 44% are under 40 years old and only 20% hold a bachelor degree or a higher qualification (Han et al., 2017). Due to their large proportion the sentiment of retail investors has a profound effect on the market movements. Their short investment horizon and their tendency to overreact to new information contributes largely to the overall volatility of the market (Chen, 2019). Wu and Wang (2018) compare the Chinese CSI 300 index, which contains the top 300 stocks of the SSE and SZSE, with main indices from mature markets. Three of them are from the United States and one is from Germany (see table 2).

Table 2. Volatility in different stock markets

Index	Country	Standard Deviation
S&P 500	United States	0.001252
NASDAQ	United States	0.001667
DJIA	United States	0.001199
CSI 300	China	0.00331
GDAXI	Germany	0.002488

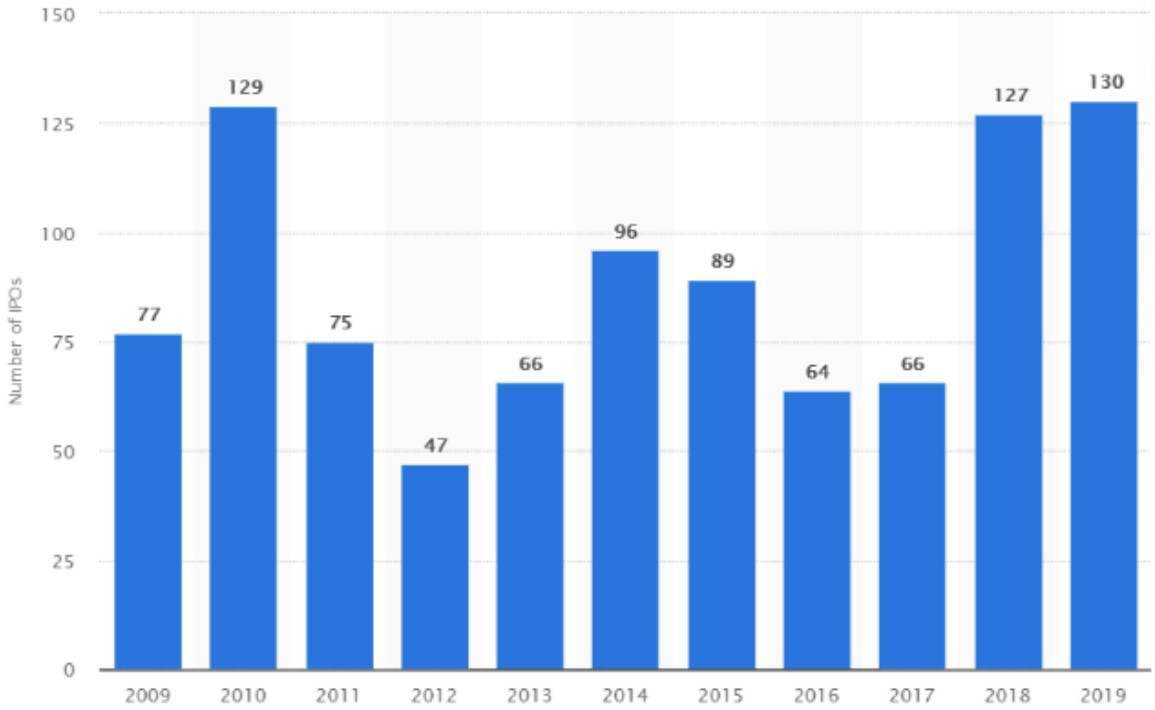
From Wu, M. and Wang, Y. (2018). Risk analysis of world major stock index before and after the 2008 financial crisis. International Journal of Financial Research, 9 (2), 39-54.

Table 2 shows that the standard deviation of the returns is way higher in the CSI 300 than in any of the other indices. The underlying data about the S&P 500, NASDAQ, DJIA and GDAXI stretches from the beginning of 2003 to the end of 2016. The data about the CSI stretches from its foundation on 8 April 2005 to the end of 2016. Additionally, Qian et al. (2020) found very high flipping ratios of institutional investors once they obtained IPO shares. They find that 55% of the investors sell their allocated shares directly in the first week in which they are allowed to sell. Qian et al. therefore state that the interest of these investors is mainly to only take advantage of the common IPO underpricing. This lack of long-term investment interest harms the efficiency of the stock markets because it discourages due diligence and thus hinders price discovery.

A good example for the herd behavior of the Chinese investors is the stock market bubble from 2014. In July 2014 China entered in a strong bull market, driven by the government showing its intention to further deepen economic and social reforms, and the state media repetitively spreading the believe that the rise of the stock prices would continue. As a reaction, people rushed to open trading accounts and investors largely engaged in margin trading and borrowed money to participate in this bull market. Consequently, the SSE Composite Index more than doubled in one year (see figure 1) and value of ChiNext tripled. However, in June 2015 some investors started to realize that most of the shares did not deserve their high quotation and that a bubble has been created due to the excessive liquidity. Following this realization, investors rushed to sell their shares and the bubble suddenly burst. Many investors made great losses and even the global stock market experienced turbulences (Lu and Lu, 2017).

All these issues motivated many Chinese firms to avoid the unstable domestic stock exchanges with its difficult and time-consuming listing process and many Chinese firms applied for a listing on a foreign stock market. In five years during the period between 2002 and 2011 Chinese firms raised more funds in Hong Kong than on the domestic stock exchanges (Zhen, 2013). Especially in the last years 2018 and 2019 the number of foreign IPOs increased significantly, as figure 3 shows.

Figure 3. Number of Chinese firms getting listed abroad per year



From Statista (2020b). Number of IPOs of Chinese companies abroad from 2009 to 2019. https://www.statista.com/statistics/279629/number-of-ipos-of-chinese-companies-abroad/

This issue is painful for the Chinese authorities because especially the most successful Chinese companies tend to list abroad. For example, the three best known Chinese public companies, Baidu, Alibaba and Tencent, all got listed abroad (Qian et al., 2020). Cong et al. (2020) confirm this trend. They found that from 2007-2017 85 Chinese companies went public in the U.S. and 497 in Hong Kong. In the same time 2,087 firms got listed in mainland China. Yet, the total amounts raised in the U.S. and Hong Kong exceeded the amounts raised in the mainland ($66 billion vs. $50 billion). The CSRC knows it is necessary to adjust the stock market regulations in order to prevent the listing of more promising Chinese firms abroad. Therefore, in 2019 the STAR Market was founded. It is equipped with a set of new different regulations which are supposed to tackle the aforementioned issues. With these novelties the STAR Market should serve as a pilot project for the whole Chinese stock market.

3. The STAR Market

In the following chapter the STAR Market is presented. First, the reasons which drove the Chinese authorities to establish this market are explained. Then the novelties in STAR Markets' legislation, which could affect IPO underpricing, are analyzed profoundly. Finally, it is illustrated how the STAR Market developed in its first year of existence, and how it handled issues like the initial euphoria or the Covid-19 crisis.

3.1. Reasons for Foundation

During his keynote speech at the opening ceremony of the first China International Import Expo in Shanghai on 5 November 2018, the president of the People's Republic China, Xi Jinping, explained his vision for the future of international trade and the opening-up of his country (Xinhua, 2018). He described the different measures China was going to implement in order to integrate the country more deeply into the global economy and to make China a global leader in terms of scientific innovation. In this speech Xi Jinping praises Shanghai for its important contribution in the opening of the country and lays out his future plans for the city. He states that Shanghai should cement its position as an international financial center and a hub of science and innovation. Additionally, the fundamental institutions of the capital markets in Shanghai should be improved. To achieve these goals Xi Jinping announced no less than a revolution in the Chinese capital markets: the launch of a science and technology and innovation board on the Shanghai Stock Exchange which will experiment with a registration system for listed companies (Xinhua, 2018).

After this announcement, it took the Chinese authorities less than nine months to launch this science, technology and innovation board. In short, it is called *STAR Market* and on 22 July 2020 the first 25 companies got listed on the new board (SSE, 2019a). In line with the announcements made by Xi Jinping in November 2018, there are three main motives for its foundation:

1. "To support the construction of Shanghai International Financial Center and Innovation Center of Science and Technology, to promote the joint development of the two centers"
2. "To enhance the capability to serve technology innovation, to promote the high-quality development of China's economy"
3. "To promote the market-oriented reform of the capital market, to improve the multi-tiered capital market, and to accumulate experience for the construction of the capital market infrastructure" (SSE, 2019a).

In the following paragraphs these three motives are illustrated in detail. Additionally, a fourth motive is explained, which cannot be found on the official website of the STAR Market. This fourth motive is the creation of a board which prevents domestic companies to list abroad. Moreover, this board should attract Chinese companies which already listed abroad to consider a listing in China. All the four motives are somewhat interconnected.

The Chinese government considers Shanghai as the central pillar for both the countries' trade and finance system. Shanghai has established itself as an important global trade hub and for example has the largest port in the world. However, its financial system is still underdeveloped (Platonov, 2019). One decade ago, the Chinese State Council announced its plan to transform Shanghai into an international financial center by 2020 (Shen and Goh, 2019). Indeed, the stock markets in Shanghai were growing over the past 10 years. In 2018, one year before the foundation of the STAR Market, the Shanghai Stock Exchange experienced an increase in trading volume by 15,2% compared to the previous year and could establish itself in the top five of the biggest stock exchanges in the world. Thanks to its position as the economic center of the well-developed Yangtze Riva Delta region, Shanghai has the ideal prerequisites for further growth of its financial markets (Lu and Ye, 2020). However, in 2019 Shanghai was still far away from its goal to become a financial center at par with London or New York. The American Chamber of Commerce in Shanghai stated in order to reach that goal Shanghai's capital markets must engage in serious regulatory changes. The regulators would have to improve transparency and remove excessive control in the markets and make it currency fully convertible. These are issues which largely hinder Shanghai in achieving its ambition to become a global financial hub (Shen and Goh, 2019). The launch of the STAR Market is therefore of strategic importance for the Chinese government because it tackles many of these issues. By solving these issues the new stock market should facilitate the further growth of the financial center Shanghai (Lu and Ye, 2020).

Second, in recent years the People's Republic China entered in a phase of economic transition and nowadays cannot rely on the old growth drivers anymore. Due to the strong economic growth over the past 30 years the Chinese citizen experienced a strong improvement of their living conditions and wealth. This fact jeopardizes the former advantage of the cheap labor pool and makes the Chinese economy shift away from its focus on low-end segments and its status as the *world's factory* (Platonov, 2019). To manage this transition, China launched the *Made in China 2025* initiative with the aim to upgrade the industry capacities and to produce more high

value-added products and services. In recent years the promotion of technological innovation has become a top priority of the Chinese government and nowadays China has a massive high-tech industry. In 2019 China became the top global patent-filing country (Lu and Ye, 2020). The *Made in China 2025* initiative identifies 10 strategic industries which need substantial funding. For each of these industries the initiative lists goals to achieve till 2020 and goals to achieve till 2030. In addition, it illustrates the strategy in order to achieve these goals. Among those 10 strategic industries are for example "Next Generation Information Technology", "New Materials" and "Biomedicine and high-performance medical devices" (U.S. Chamber of Commerce, 2017).

The STAR Market is designed to smoothen this phase of transition in the Chinese economy by providing funding to the industries of strategic importance. Indeed, the STAR Market states that by serving the global science and technology sectors it aims to "serve the major battlefield of the economy, and […] serve the major needs of the country" (SSE, 2019a). The STAR Market wants to achieve that by serving "enterprises of science and technology innovation that serve the national strategy" (SSE, 2019a). The STAR Market also names the industries it targets. In line with the *Made in China 2025* initiative these are:

- New Generation IT
- High-end Equipment
- New Materials
- New Energy
- Energy Conservation & Environmental Protection
- Biomedicine (SSE, 2019a).

For tech companies it is crucial to raise funds in the earlier stages of their life cycle. In this stage these companies often depend on capital injections to be able to grow largely (Ozmel et al., 2013). Traditionally, it used to be difficult for young Chinese high-tech companies to obtain funding in one of the domestic exchanges due to of their strict rules regarding profitability and share ownership. Therefore, Chinese high-tech companies largely relied on foreign private equity funds or a listing in an overseas capital market to raise the urgently needed funds (Lu and Ye, 2020). The STAR Market therefore was created to offer these countless Chinese tech companies a channel through which they can easily raise funds domestically. The STAR Market fulfills the needs of these companies by offering easy access to a highly liquid market that is equipped with a market-oriented legislation (Lu and Ye, 2020). Like the other Chinese stock exchanges the STAR Market allows only IPOs of domestic firms.

Another reason for the foundation of the STAR Market is the desire of the Chinese government to focus on home grown technology to become independent form other countries. As mentioned before, currently many important Chinese tech companies are listed abroad, mainly in Hong Kong and New York. The STAR Market shows the desire of the Chinese government to prevent further foreign IPOs of successful Chinese businesses by establishing an internationally competitive trading platform. Additionally, the Chinese government hopes to lure back companies which already listed abroad in the past (Platonov, 2019). The foundation of the STAR Market fell in a time when the Chinese relations with the U.S. began to sour and the future of Hong Kong as a global financial center was questioned due to the local political tensions (Harper, 2020). This gives the STAR Market an increased probability to attract companies currently listed in these countries.

Especially after Donald Trump became president of the United States in 2017, the relationship between China and the U.S. worsened dramatically. During his election campaign Donald Trump threatened China with a trade war and the implementation of high tariffs on Chinese imports. Even though Trump did not execute all his threats, the political and economic climate between China and the U.S. changed for good (Li et al., 2018). Furthermore, the probability that the STAR Market will be able to attract more Chinese firms listed in the U.S. was increased by the Luckin Coffee scandal and its consequences. Luckin Coffee was regarded to be one of the most robust Chinese consumer brands. But at the end of January 2020 Luckin got caught inflating earnings by large amounts. With this inflated earnings Lucking Coffee was able to list on the NASDAQ in 2019. The shares traded very successfully and rose from the $17 offering price to $50 shortly before the fraud was discovered. In June 2020 the NASDAQ forced Luckin to delist, but this will not remain the only consequence of the fraud. The U.S. government also implemented a new law to prevent these types of frauds in the future: the *Holding Foreign Companies Accountable Act* (Wang and Campbell, 2020). This act imposes stricter disclosure requirements on foreign companies listed in the U.S. The act could therefore lead to the delisting of many Chinese companies which can't or won't comply with the new legislation (Van der Heijden, 2020). The Chinese companies getting delisted from the NASDAQ then could find shelter in the STAR Market. This would play into the hands of the Chinese government and its plan to lure back the Chinese tech companies.

3.2. Regulations

In the following the new regulations of the STAR Market are illustrated. The focus lays on the regulations that are new, compared to the other stock markets and that could possibly affect the IPO underpricing in the STAR Market.

3.2.1. Establishment

The first stocks started trading on the STAR Market only 220 days after president Xi Jinping announced the foundation of a science and technology innovation board in his speech at the opening ceremony of the 1st China International Import Expo in 2018. In contrast, as seen before, the foundation of ChiNext took 11 years, from the first announcement until the first stocks traded on the board. The fast process on the STAR Market shows that the government is serious with its intention to reform its stock markets. Additionally, it shows that China wants to seize the opportunity with the geopolitical tensions, including the Sino-U.S. trade war and the unstable political situation in Hong Kong, to boost the start of the STAR Market. Figure 4 shows the timeline of the foundation of the STAR Market.

Figure 4. Timeline of creation of STAR Market

From Platonov, I. (2019, September 17). China's 'Star Market': A new engine for the budding tech sector. Equal Ocean. https://equalocean.com/research/2019091711915

3.2.2. Registration System

Article 1 of the Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board (2019) states that a "Pilot Registration-Based IPO System" will be launched at the STAR Market. This is a big novelty in the Chinese stock markets because

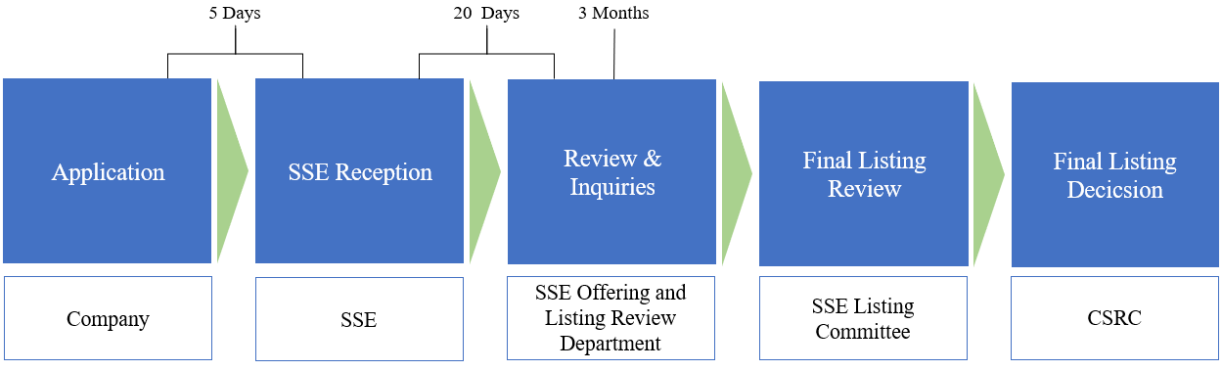
it is the first time a Chinese stock exchange is operating with a registration-based IPO system. With the registration-based system the influence of the CSRC on the STAR Market is limited drastically. As long as the issuers sponsors provide the required documentation the CSRC won't conduct substantial examination over the issuing companies, like it does at the other stock exchanges. (Lu and Ye, 2020). With the new listing method, the STAR Market became conceptually closer to its leading western counterparts, which all use the registration-based IPO system (Platonov, 2019).

Under the old system the IPO application process was very lengthy. The CSRC inquired about all aspects of the firm and made them usually wait for 18 months before making a decision. Under the registration-based system at the STAR Market the waiting time has shrunken significantly. Moreover, the task to examine the applying companies was passed on from the CSRC to the SSE (Platonov, 2019). After having received listing application documents, the SSE must decide if the application is admitted for examination within five working days. If this is the case, the review process starts (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 13). In Chapter V of the same regulation the SSE specifies the application process and sets a maximum duration. At the STAR Market the *offering and listing review department* of the SSE is in charge of reviewing the application. After having received the application it reviews all documents and, within 20 working days, it issues the first review inquiry to the issuer about any unclarities or additional information disclosure required. After the firm receives this review inquiry it has 10 working days to respond to the questions of the SSE and to disclose additional documents. This process of inquiry by the SSE and response by the applicant can take several rounds until the SSE is satisfied with the disclosed information. To make the duration of the process more transparent, the SSE obligates itself to make a final decision whether to approve or terminate the listing review within three months after the acceptance of the application documents from the issuer. However, the time in which the SSE waits for a response from the issuer after it has issued a review inquiry does not count towards these three months. Additionally, the time in which the SSE conducts on-site inspections of the issuer, askes for instruction from the competent authorities or suspends the review does not count towards the three months either.

If the offering and listing review department approves the application, it issues a review report to the SSE listing committee. The listing committee then holds deliberation meetings with five members including at least one accounting and one legal expert. After a panel discussion the committee decides if the application is approved or suspended. If the issue is approved the SSE passes on its review opinion to the CSRC which must give the final approval before the IPO

can take place. In theory, in contrast to the other stock markets, the CSRC does not influence the reviewing process and it just give its approval in the end of the process based on the recommendation of the SSE. Figure 5 summarizes the IPO application process in the STAR Market.

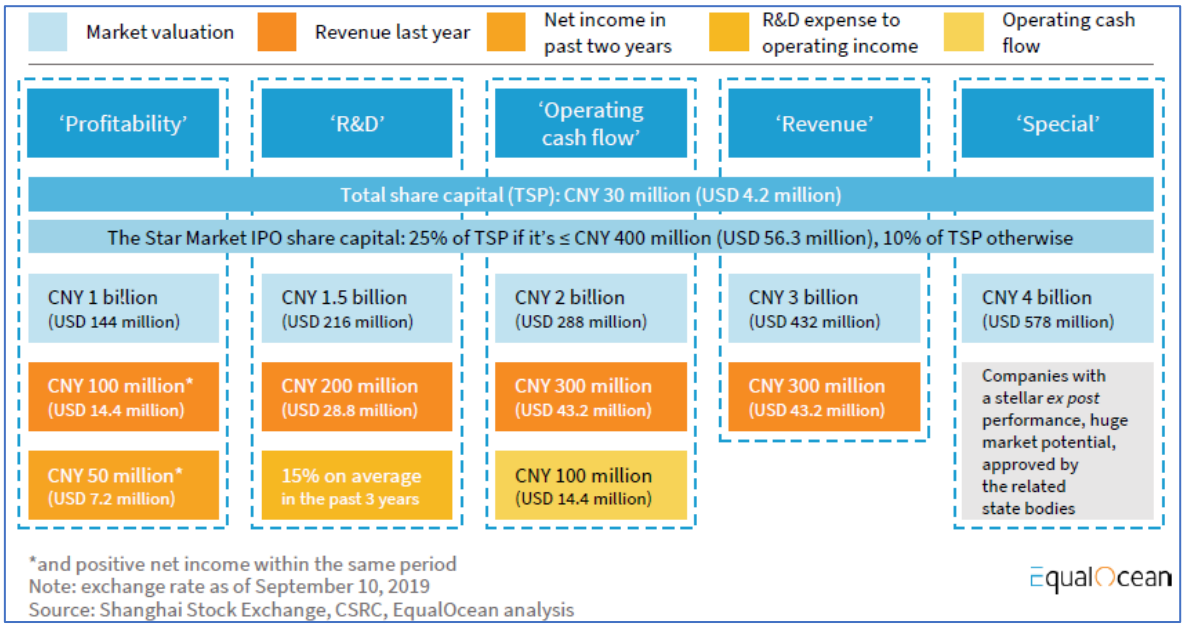
Figure 5. Listing application review process in STAR Market



3.2.3. Listing Standards

Other main novelties in the STAR Market are its diverse listing standards for domestic companies. Those standards are more diverse than on any other Chinese stock exchange (Platonov, 2019). Under article 22 of the Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board (2019) five listing criteria are named. The five criteria and their respective minimum requirements are illustrated in figure 6.

Figure 6. Listing standards in STAR Market



From Platonov, I. (2019, September 17). China's 'Star Market': A new engine for the budding tech sector. Equal Ocean. https://equalocean.com/research/2019091711915

From those five criteria the issuer must fulfill at least one to be eligible for an IPO application on the STAR Market. Each of the five criteria consist of a selection of the indicators market capitalization, net profit, operating revenue, R&D investment and net cash flow from operating activities.

However, besides the criteria which focus on classical performance indicators, the STAR Market has also a criterion which focuses on R&D expenditure. Criterion two contains a minimum percentage of R&D expenses compared to revenue. This should help innovative firms which might not be profitable yet to list on the STAR Market.

Another remarkable feature is criteria five, which consist just of a minimum market capitalization. Additionally, to be eligible to get listed using this criterion the company must obtain an extraordinary approval by the CSRC. According to Article 22 (5) of the Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board (2019) companies can get this approval if it can be expected that in the future they will have a "big market [and] superiority in technology". With this last criterion the CSRC keeps a foot in the door to intervene in the IPO process by admitting firms it selects itself.

Another revolution in the listing criteria of the STAR Market is that the applying firms do not need to be profitable anymore. Just one of the five criterion contains a minimum requirement for net income. The STAR Market therefore breaks with the tradition that all firms getting listed in China have to be profitable (Lu and Ye, 2020). The novelty allows younger tech firms which are in an earlier stage of their business cycle, and thus are not profitable yet, to get listed on the STAR Market. As seen before, especially those firms need external funding in order to be able to grow their business.

Additionally to these listing criteria for domestic companies the regulations also contain criteria for red chip enterprises. Article 23 of the Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board (2019) states that red chip enterprises are welcome to apply for an IPO on the STAR Market. The article further specifies that, in order to apply, the red chip companies must be internationally unlisted and must have "fast growing operating revenue, independently developed and internationally leading technologies, and relative competitive edge over its peers" (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 23). Furthermore, the red chip companies must either have an estimated market capitalization of no less than RMB 10 billion[5] or an estimated market capitalization of no less than RMB 5

[5] RMB 10 billion = $ 1.49 billion (exchange rate 09.10.2020).

billion[6] and an operating revenue of at least RMB 500 million[7] in the year before the IPO. This article supports the intention of the Chinese government of attracting Chinese companies which previously got listed in Hong Kong.

Moreover, the STAR Market aims to attract young high-tech firms by giving them the possibility to issue dual-class shares or shares with weighted voting rights, as the first Chinese stock market in history (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 24). Issuing shares with weighted voting rights is especially popular among young companies because it allows the entrepreneurs to collect money on the capital markets while keeping control over the firm. This setting protects the company from the short-term focus of the markets and allows the management to focus on growth and long-term strategy (Papadopoulos, 2019).

A further difference from the other Chinese stock exchanges is the absence of an issuing price regulation in the STAR Market. As pointed out before in the other Chinese stock markets the CSRC limits the issuing price through the window guidance. An issuing P/E ratio cap depresses the IPO offering price and thus contributes to the high underpricing in China. The STAR Market does not have this limitation anymore and the issuers can set the price freely (Lockett, 2019a).

Last, the STAR Market allows companies to issue a percentage of the IPO shares to their executives, and to subsidiaries of the underwriter. The IPO firm is allowed to issue up to 10% of its IPO shares to its. senior officers and key employees. However, these shares must be held for at least 12 months after the IPO (Implementation Measures for the Offering and Underwriting of Stocks on the Science and Technology Innovation Board, 2019, Art. 19). Similarly, the IPO firm is allowed to let the underwriter participate in the issue by issuing between two to five percent of the IPO shares to a subsidiary of the underwriter. However, also these shares are initially locked up, and the subsidiary must hold the shares for at least 24 months (Guidelines for the Offering and Underwriting of Stocks on the Science and Technology Innovation Board, 2019, Art. 15-19).

3.2.4. Information Disclosure

Obviously, the adoption of the registration-based IPO system requires higher information disclosure by the IPO companies. The stock market authorities won't extensively examine the applying companies anymore as long as the companies' sponsors provide the necessary documentation. Therefore, this documentation is required to be way more extensive compared

[6] RMB 5 billion = $ 0.74 billion (exchange rate 09.10.2020).
[7] RMB 500 million = $ 74,44 million (exchange rate 09.10.2020).

to the documentation required with the approval-based IPO system. For this reason, a large part of the Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board (2019) issued by the SSE, concerns information disclosure. Article 28 states that an issuer must disclose all information which is necessary for investors to assess the value of the company and to make their investment decision. In article 34 the SSE specifies which information must be disclosed to fulfill the latter condition. This includes disclosure of the business, technical, financial, corporate governance and investor protection information of the issuer. Additionally, the issuer has to disclose all factors "which may have a material adverse impact on the issuer's operation and financial position" (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 34).

A special provision the SSE has implemented is the need that the issuer and its sponsors must follow the public media coverage and market rumors during the time before the issue, to prevent that wrong information affects the issue on the STAR Market. The firm must intervene if it detects that public misinterpretation of the disclosed documentation could materially affect the issue. The company is then required to disclose relevant additional information for a verification of the matter (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 68).

In addition to the stricter disclosure requirements the STAR Market imposes strict penalties in case of non-compliance with these rules. The SSE can take disciplinary actions in case an IPO company issues application documents which have material defects, are not truthful, accurate, and complete or fails to report or disclose any material matters. Depending on the severity of the circumstances the SSE can take different actions, up to a suspension of the IPO application (Rules Governing the Review of Offering and Listing of Stocks on the Science and Technology Innovation Board, 2019, Art. 74-77).

3.2.5. Trading Rules

Moreover, also in the market trading the STAR Market reduces the degree of control. In the first five days after a listing the price development is not restricted and the price can fluctuate freely. After these first five days the daily price fluctuation is limited to 20% (Special Rules Governing the Trading of Stocks on the Science and Technology Innovation Board, 2019, Art. 18). On the SSE and SZSE main board instead the price is allowed to fluctuate only 44% on the first day of trading, and 10% the days after. Moreover, Article 14 of the same regulation allows margin trading and short selling from the first day of trading. This measure is supposed to

support the efficiency on the STAR Market. From day one the STAR Market investors can bet against a stock if they think it is overvalued.

Additionally, the over-allotment option is reinstated in the STAR Market. This gives the underwriter the option to purchase additional shares from the issuer in during the secondary market trading, in case the demand is high and the price rises after an IPO. (Guidelines for the Offering and Underwriting of Stocks on the Science and Technology Innovation Board, 2019, Art. 33). If this option is adopted, the underwriter has the right to purchase additionally up to 15% of the shares offered in the IPO at the offering price. In the main boards, the over-allotment option is forbidden since 2014.

3.2.6. Investor Participation

Finally, in contrast to the two main boards in Shanghai and Shenzhen not every Chinese citizen can trade in the STAR Market. To fight the common volatility in the Chinese stock markets, the STAR Market established some restrictions on investor participation. In order to be eligible for trading on the STAR Market an investor must have possessed on average at least RMB 500,000[8] in the 20 trading days before the investors applies for trading STAR stocks. Additionally, the investor must have participated in stock trading for at least 24 months before the application (Special Rules Governing the Trading of Stocks on the Science and Technology Innovation Board, 2019, Art.4). This should prevent that many unexperienced retail investors trade on the STAR Market.

In the IPO process the SSE implemented some restrictions to avoid the participation of uninformed investors as well. Article 28 of the Implementation Measures for the Offering and Underwriting of Stocks on the Science and Technology Innovation Board (2019) states that issuers and their underwriters are not allowed to include uninformed investors in the price inquiry process and are not allowed to distribute their IPO shares to unqualified investors. A violation of this article leads to disciplinary actions against the agents involved. Additionally, during the IPO allocation institutional investors are treated preferential compared to retail investors. Article 12 (3) of the Implementation Measures for the Offering and Underwriting of Stocks on the Science and Technology Innovation Board (2019) states that at least 50% of the newly offered stocks have to be distributed to institutional investors like social security funds, pension funds, corporate annuity funds or insurance funds.

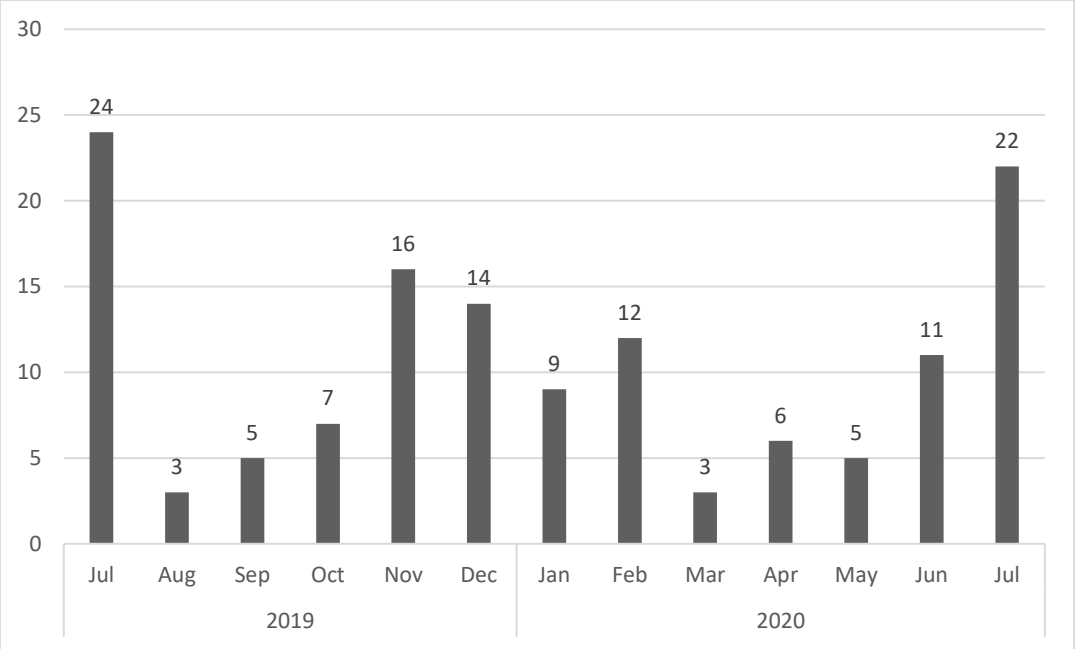
[8] RMB 500,000 = $ 7444 (exchange rate 09.10.2020).

3.3 Fist Year IPO Activity

On 22 July 2020 the SSE held a ceremony on its trading floor in the Shanghai Securities Exchange Building in Pudong in the heart of Shanghai. The occasion was the celebration of the first anniversary of the STAR Market. During this ceremony the SSE declared that it is satisfied with the development of the STAR Market because it achieved the basic objectives of reform and managed to attract many tech firms (SSE, 2020c). In the following the IPO activity in the STAR Market is examined more closely.

After the foundation of the STAR Market was announced and its characteristics were disclosed a run for a listing started. Initially more than 140 companies applied for a listing on the STAR Market (Lockett, 2019b). In the first month of trading 26 of these companies got listed (see figure 7) and it was expected that more than 100 companies would be listed by the end of the year. However, instead of going through the roof the number of IPOs decreased significantly in the following months. The new market experienced some teething problems and the regulators were more careful admitting companies for a listing than expected beforehand (Lockett, 2019b).

Figure 7. Number of listing on STAR Market per month



At the end of 2019, the number of IPOs in the STAR Market increased, but in January China got hit by the Covid-19 outbreak which slowed down all activity on the stock exchanges. From the reopening of the Chinese stock markets after lunar new year on 2 February until mid-April not much IPO activity happened on the markets. Shenzhen had only six successful listing worth $504 million. The SSE completed eight IPOs which raised $1.06 billion. And while the stock exchange in Hong Kong completed 15 IPOs, it only raised $658 million. The STAR Market

instead completed 15 IPOs in which $3.4 billion were raised, more than three times the amount raised on the SSE main board in that time (Euromoney, 2020). After this success the STAR Markets reputation improved and in July 2020 for the first time since the first month more than 20 firms got listed. Among those was the biggest IPO in China in the last decade, completed by China's top chipmaker SMIC which raised $6.6 billion (Kharpal, 2020). The company previously delisted in New York and then got relisted on the STAR Market. The IPO of SMIC received a lot of attention due to its size, its delisting in New York and its importance to the country's ambition to become more self-dependent in developing core technologies. The Chinese government hopes that the listing of SMIC becomes the blueprint for many important companies listed abroad (CGTN, 2020). Additionally, STAR Market enthusiasm gets fueled further by the announcement of Chinese tech giant Ant Group to get listed on the STAR Market. Ant Group is parent of Chinas largest mobile payment company *Alipay* and aims to get listed this fall in a dual listing simultaneously on the STAR Market and the Hong Kong Stock Exchange. The listing is followed with excitement because it is expected to become the biggest IPO in years globally and might even surpass the listing of Saudi Aramco for the biggest IPO in history (Chen et al., 2020).

4. IPO Underpricing

IPO underpricing is a robust and persistent phenomenon across countries and over time. The existence of underpricing is one of the most surprising phenomena in corporate finance, and up to today its cause is not fully decrypted. Therefore, IPO underpricing has received a lot of attention in academic research over the last decades. This research is presented in the following chapter.

4.1. Global Evidence on IPO Underpricing

The website for financial education *Investopedia* defined IPO underpricing in 2019 as the "practice of listing an initial public offering (IPO) at a price below its real value in the stock market". *Investopedia* further explained that "when a new stock closes its first day of trading above the set IPO price, the stock is considered to have been underpriced". This definition is in line with the one from Ritter and Welch (2002), who defined IPO underpricing as the difference between the offering price and the first day closing price. Ritter and Welch further stated that in academics the terms *first day returns* and *initial returns* are used as synonyms for IPO underpricing. In this thesis these terms are used interchangeably as well.

The first studies on IPO underpricing were published in the early 1970s. In 1970, Stoll and Curley found a remarkable price appreciation between the initial offering date and the 1st day closing price for small businesses. They stated that this appreciation appeared to be systematic and suggested that its causes must be evaluated more closely. In 1975 Ibbotson confirmed the existence of positive initial returns on basis of the American IPOs between 1960 and 1969. He presented some theories to explain this phenomenon, but he concluded that they are not sufficient to explain the severe underpricing. However, this study by Ibbotson set the ground for a long series of research that followed and aimed to discover the reasons for IPO underpricing. This research is presented later in this chapter.

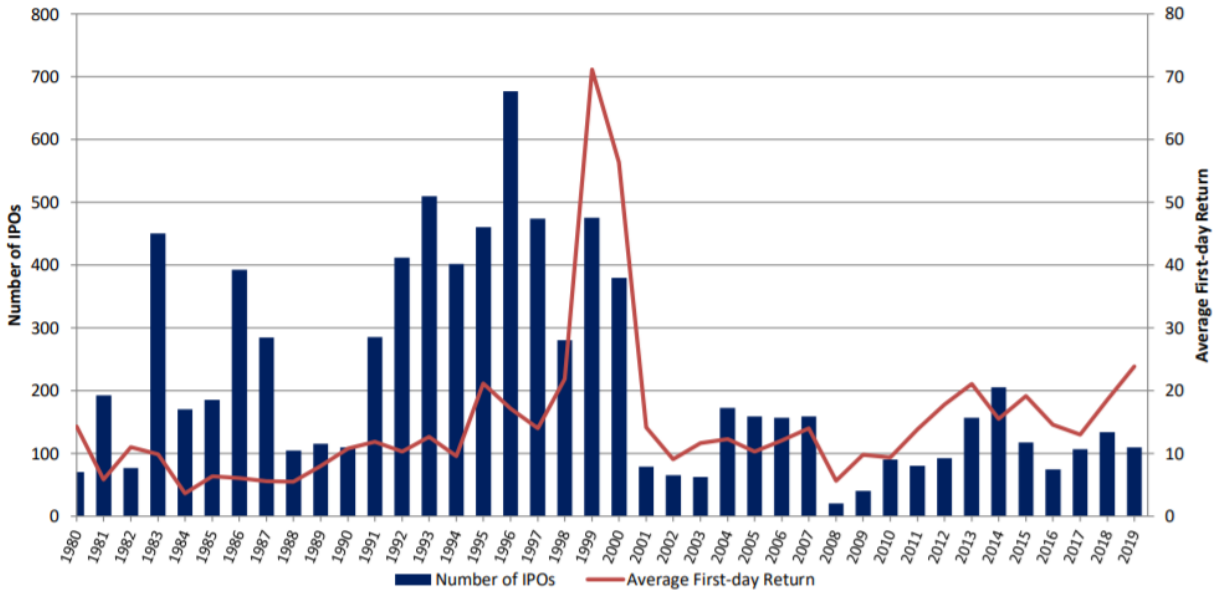
One of the most influential researchers in the field of IPOs and IPO underpricing is Professor Jay R. Ritter from the University of Florida. On his website he summarized the level of underpricing over the last 30-50 years for all countries with a relevant stock exchange. The level of IPO underpricing ranges from 3.3% in Russia to 270.1% in the United Arabic Emirates (Ritter, 2020a). However, with just 64 and 24 IPOs the sample size is small in both countries. Generally, the data from Ritter shows that some degree of IPO underpricing is present in every country in the world. Furthermore, mature Western stock markets tend to have a lower level of underpricing, while younger, especially Asian, stock markets tend to have a higher level. By

far the most companies have gone public in the U.S., where from 1960 to 2019 13.244 companies have gone public with an average level of underpricing of 16.9%. In Italy underpricing has been 13.1% between 1985 and 2018.

Banerjee et al. (2011) examined IPO underpricing around the world as well. They studied IPO underpricing in 36 countries around the world from 2000 to 2006 and found significant underpricing in each of these countries. However, similar to the results from Ritter (2020a), Banerjee et al. found that the level of underpricing varies strongly between the different countries. Banerjee et al. stated that these large differences result from the different characteristics and regulatory environments among those countries.

However, the level of IPO underpricing within a country is not constant every year. Instead underpricing varies strongly between the years. Figure 8 shows the level of underpricing in the American stock exchanges in every year since 1980. Especially the 1990s were characterized by a very high degree of IPO underpricing. After the burst of the dot.com bubble in 2000 underpricing in the U.S. has been significantly lower.

Figure 8. Number of offerings and average first-day returns of US IPOs



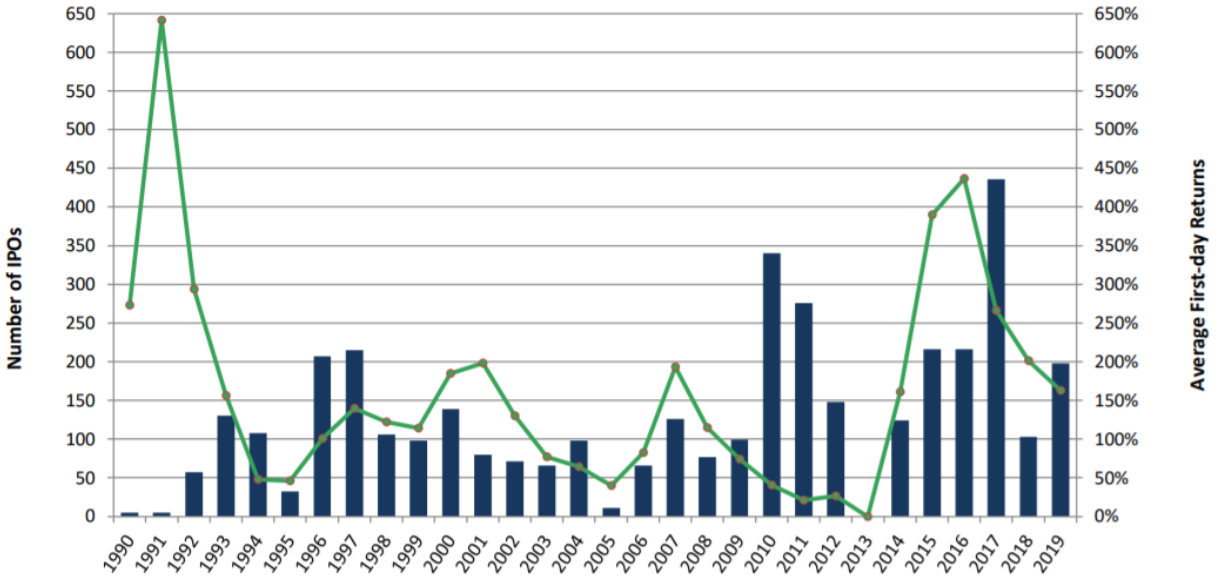
From Ritter, J.R. (2020b). IPO statistics for 2019 and earlier years. https://site.warrington.ufl.edu/ritter/files/IPOs2019Statistics.pdf

Compared to other countries, the magnitude of IPO underpricing is especially large in mainland China. In Jay R. Ritter's data the average underpricing in the Chinese stock markets amounts to an astonishing 169.5%. This value is calculated from the opening of the first stock exchanges in 1990 until 2019. In this period only Saudi Arabia and the United Arab Emirates have a higher level of average underpricing, but way less companies got listed in these countries. Underpricing in mainland China is 10-times larger than in the U.S., and nearly four-times larger

than in Hong Kong[9]. However, as figure 9 shows, also in China underpricing varied substantially over the last 30 years. In China the fluctuations were largely driven by the regulatory changes imposed by the CSRC. In chapter 1.3 those changes have already been examined. Further it can be seen that the Chinese IPO market was nearly inactive in the three years from 2010 to 2012 and got completely suspended in 2013. After the implementation of new regulations, including the reinstatement of the window guidance, the number of IPOs again increased significantly, starting from 2014.

Nevertheless, the high level of underpricing corresponds only to the Chinese A-shares. Chen et al. (2003) evaluated underpricing in China from 1992 to 1997, a period in which B-shares were still largely traded. Chen et al. found a median initial return of A-shares of 145%, while the median initial return of B-shares was just 10%.

Figure 9. Number of offerings and average first-day returns of Chinese IPOs



From Ritter, J.R. (2020c). China, 1990-2019. https://site.warrington.ufl.edu/ritter/files/China-1990-2019.pdf

In combination with the growing economic importance of China and its capital markets, the astonishing high level of IPO underpricing has provoked much research about this phenomenon in China. Especially in the last 20 years researchers have increasingly turned their attention to the Chinese capital markets.

[9] Average IPO underpricing in Hong Kong is 44.5%.

4.2. IPO Underpricing Theory

As seen before, the phenomenon of IPO underpricing is a significant issue all over the global stock markets and over all periods of time. This seems puzzling because companies on average leave money on the table when going public. This issue was therefore studied extensively in financial research. Many theories were published in renowned papers to discuss the reasons for IPO underpricing. In general, most scholars agree that there is not one theory which is sufficient to explain the globally high degree of underpricing. Many theories exist which claim to explain a percentage of the overall underpricing. Most of these theories can coexist with other theories. The following paragraphs outline the most widely accepted theories which explain the reasons for IPO underpricing. In later chapters the relevance of these is evaluated in the STAR Market.

4.2.1. Information Asymmetry Theories

The majority of the studies on IPO underpricing identified information asymmetry as its main cause. These theories assume that if a market would work perfectly and would not be subject to information asymmetry, IPO underpricing would not exist. In the literature different forms of information asymmetry have been analyzed. Information asymmetry can exist between the issuer and the investors, between different types of investors or between the issuer and its underwriter. The studies which examine these different forms of information asymmetry are presented in the following.

First, information asymmetry between the issuer and the investors might exist. To simplify, this theory assumes that the issuer and the underwriter can be regarded as one entity. As mentioned in chapter 1.3.2, prior to the IPO the issuer does not know the demand of the investors. The issuer therefore uses the book building mechanism to obtain this information. During the roadshow the issuer askes the investors to disclose their demand in order to understand the value of the firm's stock. But the investors have no interest to truthfully disclose this information. It would be rational for the investors to indicate a price well below the real value, in order to be able to buy the shares at a discount later. To make sure the investors truthfully reveal their information they therefore need to be incentivized by the issuer. Benveniste and Spind (1989), Benveniste and Wilhelm (1990) and Spatt and Srivastav (1991) were the first to examine that phenomenon. They stated that IPO underpricing is a natural consequence of the use of the book building mechanism. According to them underpricing is used as a tool to incentivize the investors to indicate the real value of the offering. They further stated that investors get compensated in two ways for their information revelation. First, they get a favorable treatment when the shares are allocated. This is done by assigning more shares to them. Second, they

profit because the issuer usually sets an offering price which is below the real value of the share. Usually, investors get compensated by a combination of these two methods. However, Ritter and Welch (2002) stated that this theory can only explain a small percentage of underpricing. They stated that the issuer can ask hundreds of potential investors and thus the information of one single investor is not very valuable. Hence, the issuer does not need to compensate these investors with large underpricing of the stocks.

Second, many influential theories focus on the information asymmetry among the different classes of investors. The first, and still very influential theory, in this field was published by Miller in 1977. In his theory Miller presumed that in the market no, or very little, short selling activity exists and that investors have heterogenous expectations about the value of the firm. Directly after the IPO the demand is therefore driven by the investors with the most optimistic assessment of the firms' value. This drives up the returns during the first day of trading, hence the IPO seems to be underpriced. However, Miller stated that over time the variance in opinions among investors disappears as the investors get better informed about the real value of the firm. Therefore, the price will fall towards the mean valuation eventually.

Another important theory in this field is the *winner's course hypothesis,* which was published by Kevin Rock in 1986. The *winner's course hypothesis* is regarded to be one of the most influential theories to explain IPO underpricing and received a lot of attention in the related literature. Rock assumed that in a market two different types of investors exist: informed and uniformed investors. Even though information about a new issue is available for every investor, obtaining this information is difficult and expensive. Not all investors are able or willing to bear the cost connected to obtaining this information and therefore remain uninformed. To simplify it can be assumed that institutional investors represent informed investors and that retail investors represent uninformed investors. Rock assumes that the informed investors have perfect knowledge about the real value of the shares offered. They therefore only bid if the value of a share exceeds its offering price. Uninformed investors instead don't know the real value of the offering, hence they bid "blindly" for every IPO. This leads to the effect that if the offering price is below its real value, both informed and uninformed investors bid. The demand for the IPO share is high and the underwriters must decide to whom they allocate the shares. Rock stated that if the underwriters have discretion in the allocation decision, they usually favor their established customers, who tend to be informed investors. If however the offering price is above the real value of the shares, the informed investors will be aware of that and therefore renounce to bid. The uninformed investors instead bid because they don't know the real value of the shares. They therefore get allocated all the shares.

To summarize, uninformed investors only get allocated a small portion of shares when the offer is underpriced but get allocated all the shares when the offer is overpriced. They therefore always loose on average compared to the informed investors. This realization would discourage the uninformed investors to bid. However, it is very important for the issuer to attract all investors to guarantee that the issue gets fully subscribed (Katti and Phani, 2016). Therefore, Rock concluded that the equilibrium offering price must include a finite discount to attract all investors. Rock's theory has become very popular in the literature on IPO underpricing. Michaely and Shaw (1994) tested the hypothesis with a sample of IPOs in the years 1984-1988 and confirmed the findings from Rock.

In 1992 Ivo Welch enriched the literature on IPO underpricing concerning information asymmetry between the investors with his theory about *informational cascades.* He stated that investors tend to ignore their own assessment and instead follow the decisions other investors made earlier. This behavior creates a bandwagon effect and many attractive issues are largely oversubscribed. On the other hand, if an issuer just slightly overprices its shares, he could start a negative cascade which leads to nearly no investors bidding for the shares. By just slightly overpricing its shares the issuer thus takes the risk of a complete failure. Therefore, issuers tend to underprice their offerings to mitigate this risk. Amihud et al. (2003) supported this hypothesis. They tested the *informational cascades* theory empirically in a sample of Israelian IPOs and found that IPOs are either undersubscribed or largely oversubscribed, with only very few IPOs being slightly oversubscribed.

Other important theories focus on the conflict of interest between the issuer and its underwriter. These theories assume that the underwriter is better informed about the market demand than the issuer. At first glance, it should be assumed that underwriters try to maximize the offering price in order to obtain a higher compensation. The underwriters get compensated through the percentage gross spread[10], which is negotiated before the final offering price is set. Therefore a higher offering price implies higher revenues for the underwriter (Loughran and Ritter, 2002). Nevertheless, Baron and Holmström (1980) and Baron (1982) found that underwriters often choose to set the offering price below the real value of the shares to minimize their distribution efforts. Habib and Ljungqvist (2001) examined this phenomenon empirically and found that underpricing is a nearly perfect substitute for marketing expenditures. They found that one dollar spent less in marketing can be offset by losing one dollar through underpricing. The

[10] The percentage gross spread is a percentage of the total offering size which the underwriter receives as compensation.

issuers are forced to accept this underpricing because of their informational disadvantage (Baron, 1982).

Additionally, because the underwriter is better informed about the market demand, the issuer often gives discretion to the underwriter in the share allocation to the investors. However, according to Loughran and Ritter (2002) this allocation might not always be performed in the best interest of the issuer. Instead underwriters might intentionally underprice IPOs and then allocate the shares to their favored long-term clients. In return for receiving shares of hot IPOs at a discount, these clients then offer quid pro quos to the underwriters. These quid pro quos are a further form of compensation for the underwriter.

4.2.2. Signaling Theory

In prior literature the signaling theories are among the most cited theories to explain IPO underpricing. Actually, also the signaling theories presume asymmetric information in the markets. Those theories assume that the issuers are better informed about the real value of the issue than the investors. Welch (1989) argued that high-quality firms underprice their IPOs to signal their quality to the market. He stated that low-quality IPO firms have to use many resources to imitate good quality IPO firms in order to cover up their inferior quality. If those low-quality firms additionally have to underprice their IPOs in order to signal their quality, the costs of imitating become too high and low-quality firms instead prefer to reveal their real, inferior, quality. In line with Ibbotson (1975), Welch stated that the high-quality firms are content to leave money on the table because they aim to “leave a good taste in investors' mouths” so that future underwritings from the same issuer could be sold at attractive price (Ibbotson, 1975, p.264). Using a dataset from firms that went public between 1977 and 1982, Welch found that high-quality firms which underpriced their shares at the IPO could raise on average 3.4 times higher proceeds in seasoned equity offerings. Allen and Faulhaber (1988) confirmed the hypothesis by testing it empirically. They categorized firms in good- and bad-quality firms and found that good-quality firms tend to underprice their IPOs. They stated that with the underpricing they signal a future favorable dividend yield, which the good-quality firms are more likely to pay because of their higher probability of generating high future cash flows.

However, further research did not always favor the signaling theory. Michaely and Shaw (1994) tested the theory published by Welch from 1989, but found no evidence that firms underprice because they want to return to the market in the future. Instead they found that firms which underprice more tend to return less frequent to the market for a seasoned equity offering.

Moreover, in conflict with the theory by Allen and Faulhaber from 1988, Michaely and Shaw found that firms which underprice more have weaker earnings performance and pay smaller dividends in the years after the IPO.

4.2.3. Further Theories

Besides the popular information asymmetry and signaling theories scholars came up with many more theories to explain IPO underpricing. This paragraph outlines three more important theories.

First, a high level of IPO underpricing might be regarded as a marketing tool by some firms, because high initial returns generate high attention in the media. Demers and Lewellen (2003) evaluated this hypothesis by analyzing a sample of internet firms. They found that underpricing is positively related to post-IPO growth in web traffic, which is a direct measure of performance for internet firms. Additionally, Demers and Lewellen analyzed the firms' media mentions in the month of the IPO, as an indirect measure of marketing benefits. They found that also media exposure is positively associated with IPO underpricing. Overall, Demers and Lewellen argued that marketing benefits arise from underpricing, which also extend beyond the internet sector. Stoughton et al. (2001) came to the same conclusion. They found that firms which experienced high IPO underpricing gain larger market shares after the IPO than firms with low underpricing.

Another reason for the general IPO underpricing might be the aim of the issuers to reduce the possibility of the investors to monitor the firm. Stoughton and Zechner (1998) stated that investors are not homogeneous in their ability to monitor a firm. Instead large investors can better monitor firms they invested in, because they possess the needed institutional mechanisms. The issuing firms therefore prefer to have smaller shareholders which have less abilities to monitor the firm. Brennan and Franks (1997) examined 69 IPOs in the UK and found that underpricing leads to oversubscribed offerings, and an oversubscribed IPO gives the issuer the possibility to choose whom to allocate the shares to. The firms usually use this possibility and discriminate large investors. Brennan and Franks found that a high level of underpricing is negatively related to the existence of large block-holders after the IPO. Additionally, Smart and Zutter (2003) compared underpricing in dual-class IPOs to single-class IPOs. With dual-class shares the firm's owners manage to retain control over the firm, even if they sell many shares. They therefore do not have to worry that much about the influence of the investors. Smart and Zutter found that single-class IPOs are more underpriced than dual-class IPOs. Based on the two previous mentioned papers Smart and Zutter concluded that firms underprice their IPOs in order to have a more fragmented shareholder base and thus retain control over the firm.

Last, some important papers reasoned that underpricing is used as a form of insurance against legal liabilities. Hughes and Thakor (1992) argued that firms which significantly underprice their IPO shares are less likely to be sued. They stated that this is the case because the probability that the share price in the secondary market will fall below the offering price is reduced. This result confirmed the findings published by Tinic in 1988. Tinic stated that IPO underpricing is higher if the legal environment imposes high legal liabilities. Lowry and Shu (2003) confirmed these findings as well. They stated that potential litigation costs can be quite significant for firms that just went public. Lowry and Shu found that firms with higher litigation risk tend to underprice their IPOs by larger amounts. However, also this theory has been criticized. Ritter and Welch (2002) stated that underpricing is a cost ineffective way to avoid lawsuits.

4.2.4. Theories Concerning Chinese Stock Markets

All the above-mentioned theories are valid in mature stock markets without strong regulatory constraints like the American or major European stock markets. In China however, the stock markets function differently, and regulatory constraints play a crucial role in pricing IPOs. The IPO pricing in China is not solely decided rationally by the market but instead is affected largely by the regulations (Ge et al., 2019). As seen before, the CSRC controlled IPO pricing in China for a long time through the so-called *window guidance*. Cheung et al. (2009) found that the regulatory framework in China significantly contributed to the IPO underpricing They found that underpricing was reduced when the regulations changed towards more market-oriented listing requirements, which gave the issuer and its underwriter more discretion in setting the issue price. According to Qian et al. (2020) the regulatory restrictions regarding the offering price are the most important driving forces of IPO underpricing in China. They found that the average issuing P/E ratio is way higher during unrestricted periods compared to restricted periods (40.8 vs. 20.3), which is the main cause for high initial returns in the second case.

Tian (2011) stated that the huge underpricing in China is related to the long time the IPO firms must wait, from issuing their shares to the IPO investors to the actual trading of the shares. After having issued the shares and collected the money from the investors the IPO firms have to wait for another approval by the CSRC to actually list on the stock exchange and start the trading. Tian states that this waiting time induces lockup risks. The IPO subscribers are worried about tunneling risks during this lock up period and therefore require a discount on their IPO shares. Chen et al. (2003) confirmed this analysis. They found that the listing lag in China drives

IPO underpricing because the investors require a return to compensate them for the uncertainty which is connected to the long waiting time.

Additionally, Chen et al. (2003) tested the hypothesis from Welch (1989) in China, that firms which want to return to the market in the future underprice their IPOs more. Chen et al. found evidence for this phenomenon in the early years of the stock markets in China.

Tian (2011) tested if the risk to be sued after the IPO could be a driver of IPO underpricing in China. Tian found that no lawsuits regarding IPOs have taken place in China and thus rejected the theory by Hughes and Thakor (1992) for the Chinese stock markets.

Last, in one of the first theories about the reasons for IPO underpricing Miller (1977) stated that if in a capital market no or very little short selling exists, post IPO prices are driven by the most optimistic investors. Liu and Galbraith (2020) stated that short selling has very low impact on the Chinese stock markets due to its relatively small size compared with the overall market. The necessary condition of the theory by Miller is therefore fulfilled. Additionally, Shi et al. (2018) supported the theory of Miller by finding that many investors in China are very optimistic about the performance of Chinese IPOs. They found that some investors even sell some of their existing shares in order to obtain the necessary liquidity for purchasing IPO shares.

5. Univariate Analysis of IPO Underpricing in the STAR Market

The following chapter statistically examines the degree of IPO underpricing in the STAR Market. In order to understand if the degree of underpricing in the STAR Market is different from its foreign peer markets, it is compared to the SSE main board and the NASDAQ. In the first part of the chapter the hypotheses are derived and in the second part these hypotheses are tested statistically.

5.1. Hypotheses and Methodology

This chapter starts with the derivation of the hypotheses which are evaluated later on. These hypotheses are formulated based on findings from the previous chapters. Then, the methodology is presented, which is used to evaluate the hypotheses statistically.

5.1.1. Hypotheses Formulation

It is interesting to compare the two Chinese main boards in Shanghai and in Shenzhen to the STAR Market because these two stock markets have different regulations compared to the STAR Market. As seen in chapter 2, the main boards still operate with an approval-based registration system and are tightly controlled by the CSRC. The STAR Market instead operates with a registration-based system and some, for the Chinese stock markets, revolutionary market-oriented regulations (see chapter 2). The simultaneous existence of stock markets in the same country with different sets of regulations allows to observe the effect that the regulations have on IPO underpricing. However, in the evaluated time frame no companies got listed in the Shenzhen main board. Therefore, the sample of Chinese firms which is used in this thesis includes only firms that got listed in Shanghai, in the STAR Market and in the SSE main board.

The reason why IPO underpricing is expected to be different in the STAR Market and in the SSE main board is the difference in their regulations. Most importantly, the pricing process in the STAR Market is not guided by the CSRC through the window guidance policy. In the STAR Market the CSRC does not recommend a maximum issuing P/E ratio and thus the issuer can price the shares without restrictions. In prior literature, the window guidance policy was identified as the main driver of IPO underpricing in China (see for example Cheung et al., 2009), which largely explains the astonishing initial returns. It can therefore be expected that

the elimination of this policy leads to lower IPO underpricing in the STAR Market compared to the IPO underpricing in the SSE main board.

Moreover, with its regulations the STAR Market explicitly invites investors to engage in short selling. This is a further difference to the Chinese main boards where short selling is basically non-existent. The more frequent use of short selling would make the underpricing theory by Miller (1977) become meaningless. Hence, the existence of shorts selling can be expected to reduce the initial returns because investors can bet against the stocks if they presume it is overvalued. When this happens during the first trading day the short selling reduces the initial returns.

Additionally, the regulations in the STAR Market emphasize information disclosure and impose strong penalties on companies which do not comply. This reduces the probability of corruption and earnings management before the IPO. In general, these increased disclosure requirements contribute to a reduction in the information asymmetry between the issuer and the investors before the IPO. In the STAR Market investors can now perform an in-depth due diligence, instead of blindly gambling on high initial returns. According to the theories by Rock (1986) and Welch (1992) the reduction in information asymmetry should lead to a reduction in underpricing.

Moreover, the time needed to proceed from the first IPO application to the issuing of the shares is way shorter in the STAR Market compared to the SSE main board. Following the theory of Tian (2011) this should reduce the risk for the investors and thus reduce the price-discount the issuers have to offer in exchange to the investors.

The possibility to execute the over-allotment option is supposed to reduce underpricing as well. If the price rises directly after the IPO, the initial demand can be satisfied by executing the over-allotment option. By this option further shares get issued which then stabilize the stock price by satisfying the high demand. This over-allotment option is only available in the STAR Market and not in the SSE main board.

Additionally, all types of Chinese investors can participate in the conventional Chinese stock exchanges. Instead the STAR Market imposes an investor threshold to keep unexperienced investors away from the market. This might hamper herd behavior and might reduce the number of investors which blindly buy IPO stocks, regardless of their value. Additionally, the STAR Market explicitly penalizes issuers who include uninformed investors in the price inquiry

process. By letting only institutional investors and qualified retail investors participate in the trading on the STAR Market the CSRC aims to bring prudence and reason in the market.

All previous arguments were in favor of a lower IPO underpricing on the STAR Market compared to the SSE main board. However, the literature also shows that high-tech stocks are on average more underpriced than stocks from other industries (see for example Butler et al., 2014 and Lowry et al., 2010). These high-tech firms are often smaller and harder to value because their value largely depends on growth options. The IPOs of high-tech firms are therefore often characterized by higher information asymmetry and thus are on average more underpriced (Lowry et al., 2010). While the STAR Market aims to attract mainly high-tech firms, the SSE main board attracts larger, more mature firms. It can therefore be expected that this factor promotes higher IPO underpricing in the STAR Market compared to the SSE main board.

Nevertheless, considering all the arguments, it becomes obvious that the arguments in favor of a lower IPO underpricing in the STAR Market prevail. Especially the abolishment of the window guidance policy is a key argument for it. Hence, it can be expected that the IPO underpricing is lower in the STAR Market than in the SSE main board.

Hypothesis 1: IPO underpricing is lower in the STAR Market than in the SSE main board.

Next, IPO underpricing in the STAR Market will be compared to underpricing in the American NASDAQ. The NASDAQ is chosen for comparison because it has similar characteristics and a similar vision to the STAR Market. After being founded in 1971 the NASDAQ could establish itself as a growth-company exchange which welcomes technology firms (Ernst & Young, 2009). Its vision is to provide high-tech companies and entrepreneurs with the possibility to obtain funds, in order to help these companies grow (NASDAQ, 2020). The past of the NASDAQ has been a success story and up to now the NASDAQ was able to attract many of the most important tech-companies from all over the world. For example, the big five American tech companies (Alphabet, Amazon, Apple, Facebook and Microsoft) are listed at the NASDAQ. Moreover, many important non-American tech-companies are listed on the NASDAQ. With Baidu and JD.com two of the most important Chinese internet firms are listed on the NASDAQ. As outlined in chapter 2.1. the vision of the STAR Market is nearly identical to the one of the NASDAQ. In fact, the STAR Market is often called “the Chinese NASDAQ” in the media because of the similar vision.

Second the STAR Market uses the NASDAQ as orientation for its regulatory setting (see for example Lockett, 2019a and Harper, 2020). This is the second reason which makes the comparison of the two stock markets interesting in the area of underpricing. Generally, the U.S. stock markets are known to function very efficiently. Over most periods of time they functioned more efficiently than most of the other global stock markets (Lim, 2007). Eugene Fama (1970) defined that markets are efficient if the security prices always fully reflect the available information. Thus, according to the theory by Fama, IPO underpricing should not occur in a completely efficient market. Indeed, it could be observed that the American capital markets experienced a low level of underpricing, compared to other countries (see Ritter, 2020a). However, since more high-tech firms got listed in the NASDAQ than in the other American stock exchanges, the initial returns in the NASDAQ are usually slightly over the average initial returns in America (Lowry et al., 2010).

With its well-developed regulations and broad investor base the NASDAQ is able to attract the most promising high-tech firms from all over the world. The STAR Market aims to copy the success of the NASDAQ on the Chinese market and therefore tried to implement regulations which to some extend are comparable to the NASDAQ. One example for this are the disclosure requirements. In the NASDAQ the disclosure requirements have been among the most stringent in the world for a long time (Shi et al., 2012). These stringent disclosure requirements lead to a low level of information asymmetry, which reduces IPO underpricing according to Rock (1986) and Welch (1992). In China however, the STAR Market is the first stock market which imposes stiff disclosure requirements on the applying firms.

However, it can be expected that the IPO underpricing in the NASDAQ is still significantly lower than in the STAR Market. This is especially due to the fact that the NASDAQ has a long history of moderate underpricing, which is driven by the factors explained previously. The STAR Market instead operates in a market environment where astronomical initial returns are common. The STAR Market aims to enhance its efficiency and thus to reduce IPO underpricing by implementing regulations which increase information disclosure requirements, foster short selling and keep away uninformed investors. However, these actions are just the first step of the Chinese authorities to make the STAR Market work more efficiently. These regulations do not achieve the level of sophistication of the NASDAQ's regulations yet and it is therefore unlikely that they trigger a reduction of IPO underpricing up to the level in the NASDAQ.

Additionally, IPO underpricing is still fostered by the fact that only Chinese investors can trade shares on the STAR Market. The STAR Market aims to attract mainly experienced Chinese

investors but since to a large extent the Chinese investors are retail investors with a low level of professionalism, also the STAR Market is exposed to their trading behavior. These investors are used to see the IPO stocks soar the first day of trading. It can be expected that these investors transfer their behavior, of bidding blindly on IPOs to generate quick returns from the other Chinese stock exchanges, to the STAR Market. It is therefore anticipated that the initial return will be kept on a high level in the STAR Market, above the level of initial returns in the NASDAQ.

Hypothesis 2: IPO underpricing is lower in the NASDAQ than in the STAR Market.

5.1.2. Methodology

In the literature almost all authors agree about the way to measure IPO underpricing. They calculate the percentage change from the offering price to the closing price after the first day of trading. This approach is used in nearly all the important papers on IPO underpricing[11]. Only very few scholars use a different method and calculate IPO underpricing as the difference between the offering price and the opening price on the first day of trading (see for example Barry and Jennings, 1993).

This thesis follows the general way to measure IPO underpricing. In line with the general understanding of IPO underpricing it is defined as the return on the first day of trading relative to the offering price. To calculate IPO underpricing of a stock in this thesis the following formula is used:

$$UP_{i,1} = \frac{P_{i,1}}{P_{i,O}} - 1 \qquad (1)$$

where $UP_{i,1}$ is the initial return, or the IPO underpricing, of IPO stock i on the first day of trading (day 1). $P_{i,1}$ is the closing price of stock i on the first day of trading, and $P_{i,O}$ is the offering price of stock i.

However, a change in the stock price is not necessarily caused by dynamics related to the issuing firm. Instead the stock price could possibly change in line with a general trend in the stock market which affects all stocks simultaneously. Therefore, the initial return must be adjusted by the price development in a for the IPO stock representative stock market on the first trading day. The final calculation of IPO underpricing for an IPO firm is therefore the following:

[11] See for example Loughran and Ritter (2002), Chan et al. (2004) or Lowry et al. (2010).

$$AdjUP_{i,1} = \frac{P_{i,1}}{P_{i,O}} - \frac{P_{i,m,1}}{P_{i,m,O}} \quad (2)$$

where $AdjUP_{i,1}$ is the market-adjusted return of stock i on the first trading day. $P_{i,m,1}$ is the closing value of the for stock i relevant market index at the first day of trading of stock i, and $P_{i,m,O}$ is the closing value of this market index on the offering day of the new issue i.

In this thesis initial returns from stock in the STAR Market, the SSE main board and in the NASDAQ are examined. Hence, for each of these markets a relevant market index has been chosen. For the NASDAQ the NASDAQ Composite index is chosen. This index tracks the performance of nearly all stocks which are listed on the NASDAQ and is therefore a good approximation for the overall development of the market. As a proxy for the development of the stocks from the SSE main board the SSE Composite Index is chosen. Similar to the NASDAQ Composite this index includes all the shares which are traded on the main board of the SSE. However, for the STAR Market such an index did not exist during the analyzed time frame. The first STAR Market index, the SSE STAR Market 50 Index, was launched in July 2020, one year after the first companies got listed on the board (SSE, 2020d). Therefore, a different approach had to be found to come up with a related market return for the STAR Market. One option would have been to calculate the average return of all the stocks listed in the STAR Market. However, this approach was not chosen because, especially in the first month after the founding of the STAR Market, just very few stocks were listed in the market. The average price development of these few stocks would not have been an accurate proxy for the overall development of the stock markets. A better approximation is the SHCOMP, which displays the price movement of all the stocks listed in the SSE main board and thus can be used as an indicator for the overall development of the Chinese stock markets. For this reason, the SHCOMP is used in this thesis to adjust the initial returns in the STAR Market.

Last, this thesis does not only aim to calculate the initial returns of the individual stocks but instead aims to calculate the average initial returns in each of the three stock markets. Formula (2) is therefore extended to the following formula, to measure IPO underpricing for a whole stock market:

$$AdjUP_1 = \frac{1}{n}\sum_{i=1}^{n} \left(\frac{P_{i,1}}{P_{i,O}} - \frac{P_{i,m,1}}{P_{i,m,O}}\right) \quad (3)$$

where $AdjUP_1$ is the market-adjusted initial return of n IPOs which took place in the respective market within the relevant time frame.

In order to test the hypotheses from 4.1.1 the average initial returns in the three stock markets have to be calculated. To measure IPO underpricing usually the percentage change from offering price to the closing price at the first trading day is used (see formula 1). However, in order to measure IPO underpricing in the SSE main board this method cannot be applied. This is due to the unique regulatory environment in the Chinese stock markets which limits the daily price fluctuations of its stocks. After an IPO the price fluctuation is limited to 44% on the first day of trading. IPOs in the Chinese main boards can therefore never have higher initial returns than 44% if the classical way to measure IPO underpricing is used. In fact, 51 of the 52 IPOs at the SSE main board analyzed in this thesis reached this cap at their first day of trading. Just the company Beijing-Shanghai High Speed Railway stayed with an initial return of 38.73% below this cap. Furthermore, in the days after the first day of trading the share price return is limited even more to a maximal range of +/- 10%. For this reason, an alternative way has to be used to capture the full dimension of IPO underpricing in the SSE main board. Hence, Qian et al. (2020) define the initial return of stocks listed in the Chinese main boards as the percentage difference between the offering price and the closing price on the first day on which the regulatory return limit is not reached. This can be either the first trading day if the limit of 44% is not reached, or it can be the first day on which the limit of +/- 10% is not reached afterwards. This approach is used in this thesis as well for the stocks which got listed in the SSE main board. Since the STAR Market does not impose any limits on the first five days of trading, the standard way of measuring underpricing proposed by Chan et al. (2004) can be applied for this market.

After having obtained the mean IPO underpricing of each market, a t-test is performed to evaluate if the differences are statistically significant. This test was carried out by using the statistical software STATA. Because the samples from the two stock markets are not related to each other an independent t-test (also called two sample t-test) was chosen. Since the two sample sets do not have the same size and their variance is different[12], an unequal variance independent t-test was carried out, and the common significance level of $\propto = 0.05$ was used.

5.2. Empirical Results

After the two hypotheses have been formulated and the methodology has been explained above, this chapter examines IPO underpricing in the three stock markets statistically. The chapter starts with a short summary on the performed data collection. Then it points out some of the

[12] Variance in the STAR Market sample: 1.64; Variance in the SSE main board sample: 8.05; Variance in the NASDAQ sample: 0.17.

characteristics of the three stock markets, which could be observed in the sample. Finally, the hypotheses, which were previously formulated, are evaluated statistically.

5.2.1. Data Collection

The data collection in this thesis was mainly done using the *Eikon* database from Thompson Reuters, a database which contains a wide range of economic data from all over the world. Eikon contains data about IPOs from all three stock markets covered in this thesis (STAR Market, SSE main board and NASDAQ). To obtain data about the IPOs in these markets the *screener app* was used within Eikon. This app enables to search for data concerning different types of firm financing. To obtain the relevant data the asset class *equity* was selected, and the following filters were used:

- Issue Type: *IPO*
- Stock Exchange: *Nasdaq, Shanghai, Shenzhen, Sci tech Inv*
- Transaction Status: *Live*
- Listing Date: *21.07.2019-21.07.2020*

The selection of transaction status *live* guarantees that only the IPOs which have been executed are included in the data. IPOs which have just been announced or those that have been postponed were excluded. Since the scope of this thesis is the first year of the existence of the STAR Market, all IPOs that do not fall into this time range are excluded from the data. Furthermore, to allow for a comparison across all three markets all financial data are reported in US Dollar. The data from the Chinese stock markets are directly converted into US Dollar within Eikon, at the exchange rate of the relevant date. This common currency makes it possible to compare data among the different stock exchanges and countries.

The generated report from Eikon contained most of the data needed to perform the statistical analysis. However, data about firms which were previously listed abroad and then got listed on the STAR Market were not included in this database (Eikon labeled them as *follow on* offerings). These firms were therefore added manually to the dataset by the author of this thesis. Also, for some firms listed on the NASDAQ the founding date was missing and therefore was obtained manually from the Bloomberg website. Additionally, the Eikon database does not contain all the data needed to perform a profound analysis of the Chinese capital markets. Data about the first day closing price, the issuing P/E ratio and the earnings in the year before the IPO were incomplete for the Chinese IPO firms. These missing data were obtained using the Chinese *Wind Database* which contains a wider range of data about Chinese IPOs. This

database, operated by Wind Data Service, is the leading financial data provider in China and includes a broad set of data on Chinese listed companies (Wind, 2020). Last, to identify on which day the IPOs stocks in the SSE main board did not reach the daily return limit for the first time each stocks price history was checked in the Eikon database. This price information was added manually.

By merging the data from Eikon and Wind a comprehensive set of data was created. This dataset served as the basis for the following statistical analysis.

5.2.2. Key Indicators of the Analyzed Stock Markets

In its first year of existence 137 companies went public on the STAR Market. These were just slightly fewer listings than in the NASDAQ during the same period but were over 2.6 times more IPOs than on the SSE main board.[13] This edge over the traditional SSE main board shows that Chinese firms embraced the new market with its trial-regulations. Judged by the number of IPOs the first year of the STAR Market can be regarded as a success. The STAR Market could prove that the initial euphoria did not fade quickly but is maintained. It managed to fight back early skepticism and experienced a stable number of IPOs per month starting from October 2019. This trend was just interrupted in the months of March, April and May 2020, when China had to deal with the economic effects of the global crisis caused by Covid-19. Table 3 displays some of the key characteristics of the three stock markets for the period 21.07.2019-21.07.2020.

Table 3. Comparison of indicators from STAR Market, SSE Main Board and NASDAQ

	STAR Market	SSE Main Board	NASDAQ
Listings	137	52	156
Average Issue Size (in USD Mio)	220.45	335.89	243.02
High-Tech Firms (in %)	64.96	27.27	53.21
Average Age at IPO (in years)	14.41	17.62	8.91
Profitable Firms (in %)	94.16	100.00	30.11 (103 observations)
Average Issuing P/E Ratio	67.09	21.84	8.64 (103 observations)

[13] On the NASDAQ 156 companies got listed in this period and on the SSE main board 52 companies got listed (see also table 3).

It is interesting to see that the issuing size in the STAR Market was very close to that in its American role model, the NASDAQ. The offering size is calculated by multiplying the offering share price with the number of shares issued. The numbers also show that the listings on the SSE main board on average raised significantly more capital than the listings on the other two stock markets. This is not surprising given the orientation of the stock exchanges. The SSE main board is mainly focused on large stock issues while the other two stock markets are more specialized on medium-size offerings.

To calculate the percentage of high-tech firms the industry classification from Thompson Reuters was used. It can be seen that the STAR Market achieves its goal to fund mostly high-tech companies, with nearly 2/3 of its listings being high-tech firms. The tech-focus of the NASDAQ is also evident, with more than half of its listings in the chosen time frame being high-tech firms. Nevertheless, it is interesting to see that even the number of high-tech listings in the SSE main board is quite high, accounting for more than 1/4 of the listings in the given time frame. This could be an indicator for a change in the composition of the SSE main board, away from its traditional focus on conventional, large state-owned enterprises.

The average age at the IPO of the companies getting listed the STAR Market lies between the values of the SSE main board and the NASDAQ. However, the average age of 14.41 years is quite high in the STAR Market, and close to the value of the SSE main board. In its first year of existence no companies that were less than four years old got listed on the STAR Market. Moreover, roughly just 1/5 of the IPO companies were less than 10 years old. This is a big difference to the NASDAQ where nearly half of the listed companies (43,59%) were less than four years old. This shows that the STAR Market could not yet achieve its goal to assist young companies with financing in the early stages of their business cycle.

Additionally, regarding the number of listings of firms with negative earnings in the year prior to the IPO the STAR Market is closer to the values of the SSE main board than to the ones of the NASDAQ. Even though for the first time in China it was possible for firms with negative earnings to get listed in a stock exchange, not that many firms made use of this opportunity. One reason for this phenomenon could be that firms with negative earnings have to fulfill more thresholds in order to be eligible for a listing. These thresholds might be too challenging. In the NASDAQ instead the vast majority of the IPO companies (nearly 70%) went public with negative earnings before the listing. This was especially driven by the young firms which were less than four years old at the time of the IPO. Less than 15% of these firms had positive earnings in the year prior to the IPO. For the NASDAQ this indicator has fewer observations

than the other indicators because not for every company the earnings data was available in Eikon.

Perhaps the most interesting reviewed indicator is the average issuing P/E ratio. On the SSE main board the CSRC restricts the issuing P/E ratio to 25 through the window guidance policy. With Zhongtai Securities just one company did not respect this cap and priced its shares above the threshold of 25. All the other companies from the sample respected the guidance and priced their shares at a P/E ratio below 25. On the STAR Market however, the window guidance was abolished and the companies could determine their issuing P/E ratio freely. It is therefore interesting to see that the IPO companies on the STAR board seized this opportunity and priced their shares at an average issuing P/E ratio of 67.09. This is way above the P/E cap of 25 which is common in the other Chinese stock markets.

Compared to that the low average P/E ratio in the NASDAQ is striking as it is significantly lower than the average values of the STAR Market and the SSE main board. However, this value is largely driven by the large number of firms that went public with negative earnings. All these companies were included in the calculations with a P/E ratio of zero. Since nearly 70% of the firms had negative earnings the year before the IPO, they largely depress the average issuing P/E ratio. To address this issue the P/E ratio was calculated again, this time including only firms with positive earnings. Within the sample 21 firms had positive earnings and they had an average issuing P/E ratio of 43.18. Accordingly, when the eight firms with negative earnings are eliminated from the sample of the STAR Market, its average issuing P/E ratio increases slightly to 71.25. It can therefore be summarized that the STAR Market has significantly higher issuing P/E ratios than the other two stock markets.

To put the high P/E ratio in the STAR Market into perspective the price to earnings differential was calculated for each IPO stock. For this the percentage difference between the issuing P/E ratio of the STAR Market's IPO stock and the average P/E ratio of the firms' industry in China in the month of the IPO was taken. The average price to earnings differential in the STAR Market was 0.4672. In other words, the STAR Market companies set their IPO price on average 46.72% higher than the respective industry average in China. Hence, this thesis shows that the offering prices are very high on the STAR Market. The average issuing P/E ratio on the STAR Market is way above that of the SSE main board, and even of the NASDAQ. Additionally, the calculated price to earnings differential shows that the STAR Market companies priced their shares way above the average P/E ratios in the industries.

5.2.3. Test of Hypothesis 1

In this chapter the two hypotheses from chapter 4.1.1 are evaluated and the degree of IPO underpricing in the three stock markets is compared. First, underpricing in the STAR Market is compared to that in the SSE main board, to test hypothesis 1. Then, underpricing in the STAR Market is compared to that in the NASDAQ to test hypothesis 2.

The results of the comparison of IPO underpricing in the STAR Market and the SSE main board are presented in table 4.

Table 4. Unequal variance independent t-test for SSE main board and STAR Market

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
SSE	52	2.36085	.4077532	2.94035	1.542251	3.179449
STAR Mar	137	1.627333	.109833	1.285562	1.410132	1.844535
combined	189	1.829147	.1389452	1.91018	1.555055	2.103239
diff		.7335167	.4222865		-.1116116	1.578645

diff = mean(SSE) - mean(STAR Mar) t = 1.7370
Ho: diff = 0 Satterthwaite's degrees of freedom = 58.5536

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.9562 Pr(|T| > |t|) = 0.0876 Pr(T > t) = 0.0438

The average initial return in the SSE main board amounts to 236.08% (SSE mean value). This astronomically high return continues the trend of very high initial returns in the Chinese stock markets, after they were reopened in 2014 (see chapter 3.1). The STAR Market experienced very high initial returns as well in its first year, which amount to 162.73% on average. Just one company experienced negative initial returns[14]. All the other firms saw their shares soaring in the first day of trading. The information security firm QuantumCTek even broke the record for the highest ever initial return in the history of the Chinese stock markets. The shares of this company soared by 924% in the first day of trading.

The high average initial return in the STAR Market is especially surprising when it is regarded in context of the high average issuing P/E ratio on the STAR Market. The average issuing P/E ratio is already more than three times higher than the one on the SSE main board. Given this

[14] Luoyang Jianlong Micronano New Material Co Ltd got listed on 04.12.2019 in the STAR Market and experienced an initial return of -2.15 %.

combination of high issuing P/E ratios and high initial returns, the stocks in the STAR Markets are priced at astronomically high P/E ratios after the first day of trading.

Moreover, the standard deviation of the sample from the stocks in the SSE main board is way larger than the one from the STAR Market. Hence, the dispersion of the individual initial returns compared to the sample mean is higher in the SSE main board than in the STAR Market. This observation is supported by the median IPO underpricing in the two samples, which is calculated additionally to table 3. This median is quite similar in both markets (128.25% in STAR Market vs. 140.07% in SSE main board). For both markets the average initial return is significantly higher than the median initial return. This means that the majority of the firms experienced less than average underpricing. Especially in the SSE main board the difference between average and median is very large. This signifies that the high mean is driven by few IPOs which experienced especially high initial returns.

The t-value is calculated in order to test the results from the two samples for statistical significance. The t-value amounts to 1.737 and the degrees of freedom are 58.55. Therefore, the corresponding p-value is 0.0876. This p-value is quite close to the chosen significance level of 0.05. But since it exceeds the significance level the performed t-test fails to reject the null hypothesis. The null hypothesis states that the means in the two stock markets are equal. Therefore, it cannot be stated that the average initial returns in the STAR Market and the SSE main board are significantly different because it cannot be excluded that the difference in the two means is solely a result of chance. Hypothesis 1 is therefore rejected.

5.2.4. Test of Hypothesis 2

The same t-test was performed as well to compare underpricing in the STAR Market to the NASDAQ. The results of the test can be found in table 5. The average initial return in the given period in the NASDAQ is 20.29%. This value lies just slightly above the historic average underpricing in the American stock markets of 16.9% observed by Ritter (2020a). However, the average initial return in the NASDAQ lies well below the one from the STAR Market (162.73%).

Table 5. Unequal variance independent t-test for NASDAQ and STAR Market

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Nasdaq	156	.2029077	.033538	.4188901	.1366571	.2691583
STAR Mar	137	1.627333	.109833	1.285562	1.410132	1.844535
combined	293	.868936	.0683727	1.170352	.7343703	1.003502
diff		-1.424425	.1148394		-1.651208	-1.197643

diff = mean(Nasdaq) - mean(STAR Mar) t = -12.4036

Ho: diff = 0 Satterthwaite's degrees of freedom = 161.314

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Furthermore, the variability of the individual returns is lower in the NASDAQ than in the STAR Market (standard deviation of 0.42 compared to 1.29).

In this model the mean and standard error from the two samples lead to a t-value of -12.4. The degrees of freedom are 161.31. Therefore, the corresponding p-value is 0, which implies a high statistical significance of the results. Hence, the null hypothesis could be rejected for all significance levels. This proofs that the average initial return in the NASDAQ is significantly lower than the average initial return in the STAR Market. Hence, hypothesis 2 can be accepted.

5.3. Results

The Chinese authorities implemented many regulatory novelties in the STAR Market in order to improve its efficiency. These new regulations, like the increase in disclosure requirements or the promotion of short selling, were expected to lead to a low level of IPO underpricing in the STAR Market. Most importantly, the elimination of the window guidance was expected to increase the issuing P/E ratios and thus reduce the initial returns. It therefore seems very surprising that hypothesis 1 had to be rejected as it could not be proved that IPO underpricing is significantly lower in the STAR Market compared to the SSE main board. Instead the average underpricing in the STAR Market was very similar to the historical 169.5% of average IPO underpricing in China (Ritter, 2020a). In the SSE main board underpricing was even well above the historical average in the given time frame.

Moreover, it could be observed that the abolishment of the window guidance policy in the STAR Market was only partially effective. As expected, the average issuing P/E ratio increased significantly. However, the average initial returns remained high.

Instead the statistical comparison of the STAR Market with the NASDAQ showed the expected results. Because of the investor sentiment-driven Chinese capital markets and the more sophisticated regulatory environment in the NASDAQ it was expected that IPO underpricing is significantly lower in the NASDAQ than in the STAR Market. This could be proofed and hypothesis 2 could be accepted.

This analysis has shown that the issue of severe underpricing in the Chinese stock markets was transferred to the STAR Market. This result seems puzzling given the regulatory novelties implemented in this new stock market. Building on these findings, the question arises why IPO underpricing was still that high in the STAR Market. Based on above findings it can only be speculated if the new regulations did not have the desired effects or if other factors contributed to the large underpricing. In the next chapter a more in-depth analysis of the STAR Market is carried out with the aim to statistically identify the factors which contribute to its large IPO underpricing.

6. Multivariate Analysis of IPO Underpricing in STAR Market

The following chapter further elaborates the analysis from chapter 5. Even though a lot of regulations were implemented which were supposed to decrease IPO underpricing, it was still found to be a significant issue in the STAR Market. Therefore, this chapter digs deeper and aims to discover the factors which can explain the high underpricing. In this chapter first the factors and the methodology are presented. Then these factors are tested statistically and at the end the results are discussed.

6.1. Hypotheses and Methodology

First, all the factors which are tested statistically are illustrated. For each variable a hypothesis is formulated, regarding how it is expected to affect underpricing in the STAR Market. Then the methodology of the statistical analysis is explained. Then, the characteristics of the factors are analyzed using the descriptive statistics.

6.1.1. Variables and Hypotheses

a. Hot Market

In line with the theory about informational cascades by Welch (1992), Ibbotson and Jaffe (1975) first documented the phenomenon of hot market phases in which IPOs have higher than average initial returns. Ritter confirmed these findings in 1984 and stated that a high degree of correlation in monthly average initial returns exists. Furthermore, Ritter (1984) found that average initial returns are higher in hot market periods. In later research Bradley and Jordan (2002) calculated a moving average of initial returns from firms going public in the previous 30 days. They found that this moving average has significant predictive power for future IPOs. Furthermore, Ljungqvist et al. (2006) found that issuers underprice their IPO shares in hot market phases in order to compensate investors for their expected losses when the stock market crashes in the future.

As seen in chapter 2.5, the Chinese stock markets are characterized by many sentiment driven retail investors. For this reason, the analysis of the relation between prior IPOs returns and IPO underpricing has received a lot of attention in the literature about Chinese stock markets. In line with the research about western stock markets, Chen et al. (2015) found that this relation is significantly positive, which means that underpricing is higher when the market is *hot*. In a

recent study Han and Li (2017) have confirmed this analysis using a sample of purely Chinese firms.

In prior research the effect of a hot market is usually evaluated for by using an average of the most recent initial returns before the listing date in the same market (see Bradley and Jordan, 2002, Ljungqvist et al., 2006 and Chen et al., 2015). This approach is followed in this thesis as well. The effect of a hot market is evaluated by calculating the average market-adjusted initial returns of all the IPOs in the STAR Market in the 30 days prior to the new issue. However, for the first bunch of firms that went public in the STAR Market in July 2019 this method cannot be applied due to the lack of prior IPOs. Therefore, for these firms the average initial returns of the IPOs in the SSE main board in the previous 30 days are used. It can be assumed that if the average prior initial returns are high, and the market is *hot*, investors are confident to ride on this wave and bid more for the shares.

Hypothesis 3: A *hot* market is positively related to IPO underpricing in the STAR Market.

b. Offering Price

In contrast to the signaling theory by Welch from 1989, Tinic (1988) found that low-priced shares are mainly issued by highly speculative firms. He stated that the offering price contains information about the riskiness of the issuing firm. Blume and Husic (1973) came up with similar findings and stated that low-priced shares are more volatile than high-priced shares. Albring et al. (2007) related these findings to the phenomenon of IPO underpricing and assumed that the offering price can be regarded as an indicator of quality of the firm. They therefore predicted a positive relationship between offering price and IPO underpricing. Albring et al. tested this hypothesis in a sample of American IPOs in the time from 1990 to 1998 and found that the assumed relationship is highly significant. Quintana et al. (2017) tested the same factor in a sample of American IPOs in the time frame from 1999 to 2010. They confirm that the offering price is a key value to predict IPO underpricing because it serves as a quality indicator. Quintana et al. (2017) also found that the offering price is significant positively related to IPO underpricing.

In this thesis the relationship between offering price and IPO underpricing is evaluated in the sample from the STAR Market. To obtain a normal distribution of the data the natural logarithm of the offering prices is taken. In line with the findings in prior literature, it is expected that the relation between offering price and IPO underpricing is positive in the STAR Market.

Hypothesis 4: The offering price is positively related to IPO underpricing in the STAR Market.

c. Offering Size

The factor offering size received much attention in prior literature due to its connection to the information asymmetry theories, for example by Rock (1986) and Welch (1992). The effect of the offering size on IPO underpricing was tested for the first time by Beatty and Ritter in 1986. They state that a negative relation between offering size and information asymmetry exists. Smaller offerings, ceteris paribus, have substantially higher initial returns because they are more speculative. Beatty and Ritter tested this assumption in a sample of American IPOs and found significant evidence for a negative relation between offering size and IPO underpricing. Banerjee et al. (2011) tested the factor in a sample from 36 countries around the globe and confirmed the assessment from Beatty and Ritter.

Cheung et al. (2009) tested the effect of offering size on IPO underpricing in a sample of Chinese IPOs for the period 1992-2006. They confirmed the prior findings and stated that also in China the capital raised in an IPO is significant negatively related to IPO underpricing. In addition to the classical theory from Beatty and Ritter (1986), Cheung et al. came up with another explanation for this relation. They stated that the larger the offering size, the more relative bargaining power the issuer has in negotiations with the underwriter. The issuer can therefore reach a higher offering price for its issue.

In line with the previous findings this thesis includes a proxy for offering size in the model. This thesis follows the approach by Smart and Zutter (2003). By taking the natural logarithm of the proceeds raised they aim to normalize the data and thus make it more suitable for the regression model. This approach is similar to the approach used by Beatty and Ritter (1986) and Banerjee et al. (2011), which included a similar proxy for offering size in their models.

Hypothesis 5: The offering size is negatively related to IPO underpricing in the STAR Market.

d. Listing Lag

A special feature concerning Chinese IPOs is the long-time span between the issuing of the shares to the investors and the first day the shares trade on the stock exchanges. In 1998 Mok and Hui were the first to find that this listing lag between the offering and listing date is a predictor of IPO underpricing in China. They analyzed a sample of IPOs on the SSE. Following the work of Mok and Hui many researchers included the listing lag in their models when examining the reasons for underpricing in China. Tian (2011) found that the period between issuing and listing date lasts on average 54 days in China, ranging from a minimum of three days to a maximum of nine years. According to Tian this listing lag is used by the Chinese

authorities as a further lever to control the domestic stock market. Chen et al. (2003) stated that this long listing lag only exists in the Chinese stock markets. All three mentioned papers found a positive relationship between the listing lag and IPO underpricing. Chan et al. (2004) stated that IPO firms which are expecting a long listing lag price their shares cheaper. That way they aim to compensate the IPO investors for the uncertainty attached to a long waiting time. Chen et al. made the same conclusion.

Following the approach of Chen et al. (2003), this thesis calculates the listing lag as the number of days between the offering date and the listing date. In line with prior findings, the time lag is predicted to be positively related to IPO underpricing. However, because the SSE tried to speed up the listing process on the STAR Market it will be interesting to see if this relation is also significant in the STAR Market.

Hypothesis 6: The listing lag is positively related to IPO underpricing in the STAR Market.

e. P/E Differential

As explained in the previous chapters, the regulatory environment is one of the main reasons for the large underpricing in China. The issuing P/E ratio used to be a decisive predictor of IPO underpricing in the Chinese stock markets, especially in periods in which the stock market was controlled tightly by the authorities[15]. Already in 2003 Chen et al. found that if an IPO is priced at a low P/E ratio the issues experience high initial returns. Cheung et al. (2009) studied a sample of Chinese IPOs from 1992 to 2006 and found that the issuing P/E ratio contributes significantly to IPO underpricing in times in which this ratio is controlled. They further found that this effect vanishes when more market-oriented regulations are implemented, and the issuing P/E ratio cap is abolished. Zhou and Lao (2012) examined this relation for the ChiNext board. As seen in chapter 2.4.2, this market has more market-oriented regulations compared to the other Chinese stock exchanges but is still controlled through the window guidance policy. Zhou and Lao (2012) found that in the ChiNext a negative correlation between underpricing and the offering P/E ratio exists as well.

In the prior literature usually the approach from Purnanandam and Swaminathan (2004) is followed, which included the P/E differential in their model. This differential is the percentage difference between the issuing P/E ratio and the average domestic P/E ratio of the public companies operating in the same industry. This approach is used in this thesis as well. The data

[15] See chapter 2.3.3: *P/E Cap and Window Guidance*.

about the average industry P/E ratio was retrieved from the CEIC website. This website contains data about the average P/E ratio per industry in China. The data is available for every month in the relevant period of time.

In line with the prior literature, this thesis assumes a negative relation between the P/E differential and IPO underpricing. It is expected that underpricing is lower if the issuing P/E ratio is high compared to the industry P/E ratio. However, since the CSRC lifted the window guidance policy in the STAR Market it can be expected that this relation will not be significant.

Hypothesis 7: The price-to-earnings differential is negatively related to IPO underpricing in the STAR Market.

f. Auditor Reputation

In line with the information asymmetry theories Beatty (1989) found a negative relation between the reputation of the underwriter and IPO underpricing. He stated that the presence of a high-quality auditor reduces the ex-ante uncertainty for the investors. These findings were later confirmed by Michaely and Shaw (1994) and Smart and Zutter (2003) who found the same relation. Michaely and Shaw (1994) stated that the auditing by firms with high prestige signal lower uncertainty to the investors.

In line with the prior literature Li et al. (2019) found a negative relation between auditor reputation and IPO underpricing in the Chinese stock markets Moreover, Chen et al. (2013) found that in a stock market with less government intervention firms are more likely to choose a high quality auditor.

In China the auditing market is dominated by five companies[16]. These companies could maintain their edge over the competition over the last two decades through their superior quality of service. Following the approach of Li et al. (2019) this thesis uses a dummy variable as a proxy for auditor reputation. This dummy variable is equal to one if the chosen auditor is among the top five auditors, and otherwise equal to zero.

Hypothesis 8: The selection of an auditor with a high reputation is negatively related to IPO underpricing in the STAR Market.

[16] PricewaterhouseCoopers Zhong Tian, Deloitte Huayong, BDO China Shu Lun Pan, Ernst & Young Hua Ming and KPMG Huazhen.

g. High-Tech

Industry classification is used frequently when controlling for the drivers of IPO underpricing because many scholars found that IPOs of high-tech firms are on average more underpriced. This is mainly due to the fact that their value is harder to estimate (Lowry and Murphy, 2007). These high-tech firms getting listed are often young firms whose value largely depends on future growth, instead of on past earnings performance (Lowry et al., 2010).

Lit et al. (2019) tested this correlation in a sample of Chinese A-share-IPOs from 2001 to 2016. They found empirical evidence that also in China the issues from high-tech firms are on average more underpriced than the issues of non-high-tech firms. This is in line with the theories about information asymmetry mentioned in chapter 4.

In prior literature scholars usually relied on the American Standard Industrial Classification (SIC) system to identify high-tech firms. Usually a dummy variable was used to differentiate between high-tech firms and non-high-tech firms (see for example Lowry and Murphy, 2007, Butler et al., 2014 and Lin et al., 2019). This approach is used in this thesis per as well. However, to classify the firms the distinction from Thompson Reuters is used, which is more detailed than the one of the SIC. Since prior literature uniformly is in favor of a positive relation between high-tech issues and IPO underpricing, this relation is assumed in the STAR Market as well.

Hypothesis 9: High-tech issues are positively related to IPO underpricing in the STAR Market.

h. Underwriter Reputation

In line with the theories about information asymmetry initial research about the impact of the reputation of the underwriter on IPO underpricing assumed a negative relation. Beatty and Ritter (1986) stated that underwriters with a higher reputation send a positive signal to the potential investors and mitigate the value uncertainty. They stated that the reduced value uncertainty consequently reduces underpricing. Carter and Manaster (1990) found empirical evidence for the negative relation between underwriter reputation and IPO underpricing. They explained this relation with the assumption that that prestigious underwriters only choose low dispersion firms in order to maintain their reputation. On the other hand, Beatty and Welch (1996) and Smart and Zutter (2003) found a positive relation between underwriter reputation and underpricing, and thus conflicting results to prior research. Smart and Zutter (2003) stated that the relationship between underwriter reputation and underpricing changed in the 1990s. Beatty and Welch (1996) explain this change with the behavior change of prestigious

underwriters. These underwriters started to underprice their issues in order to reduce the risk of failure and to cater to their customers. This is in line with the theory from Loughran and Ritter (2002, mentioned in chapter 4.3.1), who formalized this theory later on.

Being aware of this mixed evidence, Su and Brookfield (2013) tested the impact of underwriter reputation on underpricing in the Chinese stock markets. They found that in the early years of Chinese stock markets no significant relation can be found at all. Instead after the reforms in the beginning of the 21st century a significant negative relation between underwriter reputation and IPO underpricing could be found.

As a proxy for underwriter reputation this thesis follows the approach by Li et al. (2019). They used a dummy variable which is equal one if the issuer engaged a top underwriter and equal zero if the issuer did not engage a top underwriter. To filter out the top underwriters in the Chinese stock markets, the 2020 investment bank ranking issued by the CSRC is used. In this thesis underwriters are categorized as top when they received the AA score from the CSRC. All investment banks with a lower score than AA are not regarded as top underwriters. In Appendix A all the companies which were involved in an IPO in the STAR Market as lead underwriter are listed in combination with their CSRC score.

Given the mixed evidence it is not clear which relation can be expected between underwriter reputation and underpricing in the STAR Market. But since Su and Brookfield (2013) found a negative relation in the Chinese stock markets, the same relation is expected in the STAR Market as well.

Hypothesis 10: The involvement of a high reputation lead underwriter is negatively related to IPO underpricing in the STAR Market.

6.1.2. Methodology

In the previous chapter eight variables have been presented which could potentially have an influence on IPO underpricing in the STAR Market. These variables serve as independent variables in the statistical model used in this thesis. The market-adjusted initial return serves as the dependent variable. To analyze the effect of multiple independent variables on one dependent variable this thesis uses a multiple linear regression. To design the regression model and to perform the analysis the approach from Backhaus et al. (2016) is used as an orientation.

The data needed for the regression analysis was obtained in nearly the same way as the data needed to perform the univariate analysis in chapter 5. Hence, the data collection process is

explained just briefly here. The data used in the regression analysis is obtained from two sources: from the Thomson Reuters Eikon database and from the Chinese Wind database. The information about the initial return, offering price, offering size, auditor, underwriter and industry is obtained from the Eikon database. Instead the information about the listing lag and the issuing P/E ratio is obtained from the Wind database.

The level of underpricing for each company is calculated following the approach presented in chapter 5.1.2. The degree of underpricing is calculated using formula (2) as the difference between the first day returns of the IPO stock and the return of the SHCOMP the same day.

Based on the previously presented variables the following equation is used in this thesis:

$$lnreturn = \alpha + \beta_1\, hot + \beta_2\, lnprice + \beta_3\, lnsize + \beta_4\, lag + \beta_5\, pedif + \beta_6\, auditor + \beta_7\, tech + \beta_8\, underwriter + \varepsilon \quad (4)$$

In this model the dependent variable *lnreturn* is the natural logarithm of the market-adjusted initial return; α is the intercept; *hot* is the average initial return of the IPOs in the STAR Market in the 30 days before the listing; *lnprice* is the natural logarithm of the offering price; *lnsize* is the natural logarithm of the proceeds raised in the IPO; *lag* is the time difference between the offering date and the listing date in days; *pedif* is the price to earnings differential; *auditor* is a dummy variable for the reputation of the auditor; *tech* is a dummy variable for operating in a high-tech industry; *underwriter* is a dummy variable for the reputation of the underwriter and ε is the error term. The exact calculation of the variables and the prediction of the effect on underpricing is summarized in Appendix B. In order to avoid interference from several large observations the data of *lnsize* is winsorized at the 1% level. To perform the regression analysis the statistical software *STATA* is used.

After the regression model has been formulated, it needs to be tested whether the data is compliant with the assumptions underlying linear regression models. Only if these assumptions are fulfilled, the results are valid and can be interpreted appropriately. According to Backhaus et al. (2016), it can be distinguished between six assumptions: (1) the relationship between dependent and independent variables is linear, (2) the error terms have a mean of zero, (3) there is no correlation between the independent variables and the error term (exogeneity) (4) the variance of the error terms is constant (homoscedasticity), (5) the error terms are uncorrelated with each other (no autocorrelation), (6) the independent variables are uncorrelated with each other (no multicollinearity) and (7) the error terms are normally distributed.

For this thesis (1) is tested by observing the scatter plots of each of the variables (according to von Auer, 2006). (2) can be neglected since a violation only influences the constant intercept which does not need to be interpreted here (Backhaus et al., 2016). (3) is tested by calculating bivariate correlations between the independent variables and the error terms (Wooldridge, 2010). (4) is tested by utilizing the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity (Johnston and DiNardo, 2000). (5) can be neglected as a violation is insignificant when analyzing cross-sectional data (Backhaus et al., 2016). (6) is examined by determining bivariate correlations between the independent variables as well as variance inflation factors. (Tabachnick and Fidell, 2019). (7) is negligible if the data set is sufficiently large (n<40), which is the case in this thesis (Brooks, 2008). The exact testing of the assumptions can be found in Appendix C. After having tested all seven assumptions, it can be concluded that the data set fulfills all the assumptions to a sufficient degree.

6.1.3. Descriptive Statistics

The descriptive statistics of the independent variables are presented in table 6. The model includes observations from 137 firms that went public in the STAR Market in the first year of its existence.

Table 6. Descriptive statistics of independent variables

Variable	Obs	Mean	Std. Dev.	Min	Max
hot	137	1.710072	.7555236	.5307	3.2794
lnprice	137	1.293876	.6444442	-.5935967	3.659226
lnsize	137	4.881773	.6657599	3.897536	7.333249
lag	137	14.56934	2.899786	10	27
pedif	137	.8429414	4.460527	-1	50.72641
auditor	137	.2846715	.4529139	0	1
tech	137	.649635	.478835	0	1
underwriter	137	.6058394	.4904629	0	1

The market-adjusted initial returns in the 30 days prior to the IPO range from 53.07% to 327.94%. It can be observed that for every firm the prior 30 days initial returns were significantly larger than zero.

It is also interesting to see that the average listing lag is 14.57 days. The span from longest to shortest listing lag ranges from 10 to 27 days. It can therefore be concluded that the time period in which the firms have to wait for the approval of the CSRC before the shares are traded publicly has reduced significantly. Moreover, no extreme cases occurred in which the CSRC let the companies wait for a many months before giving its final approval. Instead all the

companies listed in the STAR Market are within a small corridor, which shows that the CSRC aimed to keep the listing lag on a uniformly low level.

The average P/E differential of 0.84 shows that the IPO companies on the STAR Market price their IPOs above the average industry P/E ratio. This finding might be explained by the fact that many small firms are listed in the STAR Market which are less mature than their industry peers. Therefore, their high P/E ratio might reflect expectations about future earnings performance. In addition, it can be seen that a wide range of variation exists in setting the issuing P/E ratio. Nevertheless, since the STAR Market companies on average price their IPOs above the industry P/E ratio, it can be concluded that these companies fully utilize their discretion to freely set the issuing P/E ratio. Hence, the abolishment of the window guidance in the STAR Market had an immediate effect on the issuing P/E ratios.

Last, the dummy variables show that most of the IPO companies did not choose one of the top five auditors. However, the majority of the companies chose a highly reputational underwriter which got assigned the *AA* ranking by the CSRC. Furthermore, as seen in chapter 5.2.2, the majority of the STAR Market companies are operating in high-tech industries.

6.2. Statistical Analysis

Finally, the hypotheses formulated in chapter 6.1.2 are tested in a multiple linear regression model. It is tested which factor has a significant impact on IPO underpricing in the STAR Market. The results of this regression are presented in table 7.

The model has 137 observations and a F-statistic of 12.82. The null hypothesis states that all the coefficients in the model are equal to zero. Given the value of the F-Statistic the null hypothesis can be rejected for all the commonly used significance levels. In other words, the probability that all the independent variables from this model do not help to predict the dependent variable *lnreturn* is extremely small and can therefore be neglected.

Table 7. Results multiple linear regression

Source	SS	df	MS	Number of obs	=	137
				F(8, 128)	=	12.82
Model	51.3268728	8	6.41585909	Prob > F	=	0.0000
Residual	64.0365076	128	.500285216	R-squared	=	0.4449
				Adj R-squared	=	0.4102
Total	115.36338	136	.84826015	Root MSE	=	.70731

lnreturn	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
hot	.6216126	.0836604	7.43	0.000	.4560762	.7871491
lnprice	-.4368477	.1000224	-4.37	0.000	-.634759	-.2389363
lnsize	-.2693377	.102885	-2.62	0.010	-.4729133	-.0657622
lag	.0282346	.0215525	1.31	0.193	-.0144107	.0708799
pedif	-.0258413	.0144077	-1.79	0.075	-.0543495	.0026668
auditor	.2725095	.1416065	1.92	0.057	-.007683	.5527021
tech	.2241314	.1319319	1.70	0.092	-.0369184	.4851812
underwriter	.362137	.1286998	2.81	0.006	.1074826	.6167915
_cons	.1563559	.5960131	0.26	0.793	-1.022958	1.33567

The model has an R-squared value of 0.4449. R-squared is used to measure the proportion of variation in the dependent variable which is explained through the model (Backhaus et al., 2016). Hence, R-squared is an indicator for the overall quality of the model. However, the R-squared value can be inflated by adding more independent variables to the model. If these added variables do not have much explanatory power, the model has a high R-squared value without being able to predict the dependent variable accurately. As a protection against this noise usually the adjusted R-squared is calculated in addition to the R-squared value. The adjusted R-squared considers the number of degrees of freedom as well. Therefore, its value decreases when variables are added which do not have any explanatory power. Because of the correction for the degrees of freedom the adjusted R-squared value can be used to compare the explanatory power of different models (Backhaus et al., 2016). The adjusted R-squared value in this model is 0.4102. This value is similar to the adjusted R-squared values from other models which tested IPO underpricing in the Chinese stock markets (see for example Tian, 2011, Chen et al., 2015, Cheung et al., 2019 and Li et al. 2019).

The calculated coefficients of the independent variables allow to understand how these variables affect the dependent variable. This way the hypotheses formulated in chapter 6.1.1 can be tested. However, to understand the relevance of each individual variable the t-values have to be considered as well. If the t-value of variable i is high, it can be assumed that its influence on the dependent variable is significant and the true value of β_i is different from zero.

Table 8 lists all the coefficients from the model as well as their significance, using the common significance levels of 0.05, 0.01 and 0.001.

Table 8. Significance of variables' coefficients

Variable	active
hot	.62161265***
lnprice	-.43684766***
lnsize	-.26933774**
lag	.02823462
pedif	-.02584134
auditor	.27250954
tech	.22413142
underwriter	.36213705**
_cons	.15635586

legend: * p<.05; ** p<.01; *** p<.001

It can be seen that the variable *hot* has a positive coefficient. Its corresponding t-value is 7.43 and thus the relation is highly significant at the 0.01 significance level. This implies that hypothesis 3 can be confirmed, that the initial returns of the IPOs in the STAR Market the 30 days before an issue are positively related to IPO underpricing. In other words, if the IPO market has been *hot* in the 30 days before an issue, it can be expected that the initial return is high for the following issue as well.

The coefficient of the variable *lnprice* seems surprising. The coefficient is negative, and with a t-value of -4.37 the variable is highly significant at the 0.001 significance level. This is in conflict with prior literature, which found that a positive relation between offering price and IPO underpricing exists because the price serves as an indicator for the quality of the issuing firm. Since in this model the coefficient is negative, hypothesis 4 has to be rejected.

The variable *lnsize* has a negative coefficient and a t-value of -2.62. Given this t-value the variable is significant at the 0.01 significance level. This confirms the findings from prior literature that the offering size is negatively related to IPO underpricing. In the literature the lower information asymmetry and the higher bargaining power for the issuer to set the price were identified as the reasons for this relation. Given the findings from this model, hypothesis 5 can be accepted.

Prior literature about the Chinese stock markets found a positive relation between the listing lag and the IPO underpricing because of the risk attached to a long waiting time. In line with these findings, in this model the variable *lag* has a positive coefficient. Therefore, hypothesis 6

can be accepted. However, with a t-value of 1.31 the relation is statistically not significant. It cannot be excluded that the result was obtained purely because of chance. This confirms the assumption that, in contrast to the other Chinese stock markets, the listing lag does not play an important role in the STAR Market when predicting IPO underpricing.

The second variable concerning the unique regulatory environment of the Chinese stock markets is the issuing P/E ratio differential. Prior literature found that there is a significant negative relation between a firms issuing P/E ratio and the price to earnings differential. In this model regarding the STAR Market the coefficient is negative as well, hence hypothesis 7 can be accepted. However, with a t-value of -1.79 the relationship is not significant. This confirms the assumption that due to the regulatory novelties the influence of the issuing P/E ratio on IPO underpricing in the STAR Market is neglectable.

The coefficient of the variable *auditor* is positive. This seems surprising since prior literature found a positive relation stating that an auditor with a high reputation is supposed to decrease information asymmetry. Due to the positive coefficient hypothesis 8 has to be rejected. However, the t-value of 1.92 lies a bit over the common significance level of 0.05. Hence, the coefficient is not significant, and it cannot be ruled out that the result was just obtained because of chance.

The variable *tech* has a positive coefficient as well and therefore hypothesis 9 can be accepted. Prior literature explained this relation with the high value uncertainty in high-tech firms. The high initial returns can be considered to be a compensation for this risk. However, in this model the t-value of the variable *tech* is 1.70. Hence, its p-value lies just slightly over the common significance level of 0.05. The relation is therefore not statistically significant.

Last, the variable *underwriter* was tested. The coefficient of this variable is negative, hence hypothesis 10 has to be rejected because it predicted a negative relationship between underwriter reputation and IPO underpricing. However, as seen in chapter 6.1.1, the literature about the relation between underwriter reputation and IPO underpricing comes to different conclusions. Early research found a positive relation due to reduced information asymmetry through the involvement of underwriters with a high reputation (see for example Beatty and Ritter, 1986). Instead the findings in this thesis correspond with the later research which found a positive relation between the two variables (see for example Loughran and Ritter, 2002). The t-value of the variable *underwriter* is 2.81. Hence, this coefficient is significant at the 0.01 significance level.

6.3. Discussion of Results

The previous findings showed that not all hypotheses formulated in chapter 6.1.1 could be accepted. These hypotheses were built on the findings in the most relevant literature from the previous 45 years of research on IPO underpricing. It can therefore be concluded that the STAR Market provides a unique market environment, which does not entirely follow the patterns of the other stock markets from around the world.

Now the findings related to the STAR Market are compared to the underpricing theories from chapter 4.2. Furthermore, the conclusions which can be drawn from the regression model are stated.

The information asymmetry between different agents involved in the IPO process was identified as the most important reasons for IPO underpricing in most of the prior IPO literature. A common assumption of these theories is that if no information asymmetry exists, no IPO underpricing exists. Rock (1986) established the winner's course hypothesis which states that IPO underpricing is a result of the existence of two different classes of investors who are not equally well informed. In order to also attract the less informed investors the issuing company has to underprice its shares. In this thesis the variables *lnsize*, *auditor* and *tech* where used to test this theory. These variables can be seen as a proxy for information asymmetry, because smaller firms, firms with less reputational auditors and high-tech firms usually have more information uncertainty. The issues from these firms are therefore supposed to be more underpriced. Using a regression model this thesis found that *lnsize* and *tech* both confirm the relevance of the winner's course hypothesis in the STAR Market. Surprisingly, the variable *auditor* does not support the expected relation. Instead firms with high-class auditors experienced higher IPO underpricing. Two reasons for this relation come to mind. First, following the findings by many researchers that the Chinese capital markets are largely driven by uninformed retail investors (see chapter 2.5), it could be assumed that investors regard the auditing by a top-five auditor as a signal for quality. These investors could assume that firms that hire a top auditor are willing to disclose more information because of their superior firm quality. Therefore, these shares are more attractive. Second, it could be assumed that the distinction of high-class auditors might not have been accurate. Perhaps the STAR Market investors do not regard the top five auditors as more trustworthy, just because they control a large share of the market. An indicator in support of this hypothesis could be the fact that out of the ten biggest IPOs in the STAR Market, in terms of offering size, just four companies selected one of the top five auditors. Nevertheless, among these three variables the only significant variable is *ln size*. It can therefore be stated that the winner's course hypothesis is

valid also in the STAR Market and it can be expected that also in the future firms with a large offering size generally experience higher IPO underpricing.

Another important theory concerning information asymmetry is the theory about informational cascades by Welch (1992). He states that investors tend to follow the decision made before by other investors and thus create a type of *bandwagon effect*. In a slightly adjusted form this theory can be applied to the STAR Market. The variable *hot* was used as a proxy for the investor sentiment. This variable was found to be highly significant, hence it confirms the theory from Welch. This finding might not be surprising, given the characteristics of the Chinese investors mentioned in chapter 2.5. However, the SSE implemented an investor threshold in the STAR Market in order to hinder unexperienced investors to participate. Given the findings from this thesis this regulation can be regarded as insufficient to fight sentiment-driven behavior by the domestic investors.

Additionally, the theory by Baron (1982) about underwriters and information asymmetry could be confirmed for the STAR Market. Baron states that underwriters try to underprice shares intentionally. In this thesis the proxy *underwriter* was used to control for the involvement of a lead underwriter with a high reputation. It was found that firms which engaged high quality underwriters experienced higher underpricing. This relation was found to be significant. This can be explained by Barons theory from 1982, that underwriters with a good reputation have more power to negotiate lower offering prices with the issuer.

The significant negative relation in the STAR Market between the variable *lnprice* and IPO underpricing supports the signaling theory by Welch from 1989. Welch stated that high value firms intentionally underprice their shares to signal their value. However, as seen before, many of the investors trading in the Chinese stock markets are often not very sophisticated in their trading behavior. The negative relation between offering price and underpricing in the STAR Market must therefore not necessarily be a confirmation of the signaling theory. Instead it could be assumed that investors favor low price stocks because it is less costly to speculate with them and the low prices leave more room for price appreciation.

Last, the theories were tested which are related to the unique characteristics of the Chinese stock markets. In the other Chinese stock markets the issuing P/E ratio and the listing lag contributed significantly to the strong underpricing. The issuing P/E cap held the offering prices artificially low, and the long waiting time between offering and listing date evoked risk for the IPO investors. In the regression model in this thesis the two variables *pedif* and *lag* were used as proxy for these issues. The correlation of both variables with underpricing is in line with the findings about other Chinese stock markets. The P/E differential is negatively related to

underpricing and for the listing lag a positive relation was found. However, in contrast to prior research about other Chinese stock markets both variables are not significant in the analyzed STAR Market sample. The regulations of the STAR Market emphasize the distinction regarding the price setting, and the acceleration of the IPO process. Given that the two variables *pedif* and *lag* are not significant, the implementation and execution of these new regulations can be regarded to be a success.

7. Conclusion

As the *brainchild* of president Xi Jinping, the STAR Market has been established with the intention to play an important role in the overall economic strategy of China. The STAR Market got equipped with modernized regulations which were supposed to solve the issues which existed in the other Chinese stock markets. In this thesis the influence of these regulations on IPO understanding was evaluated for the STAR Market during its first year of existence.

The thesis started with an explanation of the functioning of the Chinese capital markets. It became evident that since the foundation of the Chinese stock markets in 1990 they have been in a constant period of transition towards more open markets. Many regulations have been tested in the stock markets using the trial and error principle. Up to today the characteristics of the Chinese stock markets are quite unique globally, for example concerning the existence of different share types and the tight government control, for example regarding the IPO process. The tight control of the IPO process led to many issues which were explained in detail in this thesis. These issues are for example the long and uncertain listing process, the strong IPO price control or the importance of political connections. It is very difficult for young tech-companies to get listed on the domestic stock exchanges. Moreover, many of the Chinese investors are largely sentiment driven and short term oriented, which leads to high flipping ratios in the first days after an IPO. All these issues drove many of the most promising young Chinese companies to list in a foreign country, where the stock markets work more efficiently.

The STAR Market is aimed to function as an experiment to solve the prevailing issues in the Chinese stock markets. It has four main goals which are 1) to help facilitate the transition of the Chinese industry towards a focus on high-tech industries, 2) experiment with a modernization and improvement of the stock market regulations in China, 3) establish Shanghai as a global financial center, and 4) attract firms that got listed abroad or prevent further listings of promising young Chinese firms abroad. For this purpose, the STAR Market got equipped with new, and for the Chinese stock markets, very innovative regulations. For the first time a registration-based IPO system was implemented in a Chinese stock market. To support this system the STAR Market regulations emphasize information disclosure instead of intensive control by the authorities. The listing process was shortened and standardized. Moreover, the *window guidance* policy was lifted, and the stock prices were allowed to fluctuate freely in the first five days of trading. Additionally, for the first time in the history of Chinese capital markets firms with negative earnings were permitted to get listed. Last, an investor threshold was implemented to prevent unexperienced investors to trade on the exchange.

In the fourth chapter IPO underpricing was identified to be one of the most striking issues in the Chinese stock markets. Evidence was presented for the fact that IPO underpricing in China is significantly higher than in all other major stock exchanges around the world. Then the most important theories which aim to explain the reasons for IPO underpricing were presented. These included theories which are valid globally, but also theories which are only valid in the Chinese stock markets because of its unique market environment.

In the fifth chapter the IPO underpricing in the STAR Market was evaluated statistically. Moreover, it was compared to two of its peers, the SSE main board and the NASDAQ. First, it could be observed that in the chosen time frame way more companies got listed on the STAR Market than on the SSE main board, but slightly less than on the NASDAQ (137 vs. 52 vs. 156). The average offering size in the STAR Market was similar to the one of the NASDAQ but far below the one of the SSE main board. It is further interesting to see that 65% of newly listed companies in the STAR Market were high-tech firms, and that seven companies did not generate profits yet. Probably most interesting to see is that the STAR Market companies used the opportunity to freely set the offering price. This resulted in the average issuing P/E ratio being three times higher than the one on the SSE main board, and also significantly above the ratio from the NASDAQ. The preliminary analysis of these indicators suggests a success of the new regulations in the STAR Market.

Additionally, given the modified regulations in the STAR Market, it was expected that it experiences lower IPO underpricing than the SSE main board. Examples of these regulations are the tighter disclosure requirements or the abolished issuing P/E cap. Additionally, given the better developed market environment and the more sophisticated investors in the NASDAQ, it was expected that IPO underpricing in the NASDAQ is lower than in the STAR Market, where market-oriented regulations are a novelty and investors are less experienced.

The average degree of underpricing was calculated for the STAR Market, the SSE main board and the NASDAQ in the time period of the first year of existence of the STAR Market. Then their means were compared using an independent t-test to check for statistical significance. In line with the expectation, IPO underpricing in the SSE main board was higher than in the STAR Market (236% vs. 163%). However, the difference is not statistically significant, hence it cannot be excluded that the result was simply obtained due to chance. This result seems puzzling, given the new regulations and the high level of the issuing P/E ratio in the STAR Market. In a second step IPO underpricing in the STAR Market was compared to underpricing in the American NASDAQ. As expected, it was found that IPO underpricing in the STAR Market is higher than in the NASDAQ (163% vs. 20%). The result was found to be statistically

significant. The formulated hypothesis that IPO underpricing in the STAR Market is higher than on the NASDAQ could therefore be accepted.

Given the surprising results from the statistical comparison of underpricing levels in China, this matter was examined in more detail in the following chapters. Different drivers which were identified to be relevant by prior research were evaluated for the STAR Market. A total of eight factors were tested in a multiple linear regression model. In this model four out of the eight factors were found to be significant in the STAR Market. These are:

1. the prior IPO returns,
2. the issuing price,
3. the size of the issue and
4. the underwriter's reputation.

A positive significant relation could be found between underpricing and the reputation of the underwriter. In line with the theory by Loughran and Ritter (2002) it can be expected that the top underwriters used their power to keep the issuing price on a low level. This might have been easier, given the characteristics of the STAR Market firms, which are on average smaller and younger than the ones from the SSE main board.

A highly significant factor was the average initial return in the STAR Market in the 30 days before the listing date of the IPO firm. If these average initial returns were high also the respective IPO on average experienced high returns. This finding supports the theory of hot markets and is not surprising in the light of the behavior of Chinese investors, who often seek quick profit without having a long-term investment orientation.

The same reasoning can be applied regarding the findings concerning the issuing price. Contrary to common theories a negative relation between this variable and underpricing was found in the STAR Market. In light of the prior findings about hot stock markets it can be assumed that Chinese investors gamble with the low-priced shares because they contain much appreciation potential, given the low initial price.

The negative relation between the offering size and IPO underpricing can be interpreted similarly. As seen in chapter 2.5, many Chinese investors do not engage in a profound due diligence. Therefore, it could be assumed that these investors might regard the admission of a firm to the STAR Market as a sign of quality, since the stock market's mission is to list firms which could become important in the country's future economic development. Therefore, especially regarding the small firms for which not much information is available publicly, investors might hope that the firm could become the next star and therefore bet on a share price

appreciation. Besides, the negative relation between offering size and underpricing could also be an indicator that the information asymmetry theories are also valid for the STAR Market.

A further very important finding was that the listing lag and the P/E differential did not have a significant influence on IPO underpricing in the STAR Market. This is an indicator for the success of the experimental regulations in the STAR Market.

Combining the analyses from chapter 5 and 6, it can be observed that the STAR Market was very successful in implementing its vision. In its first year this young stock market was embraced by many Chinese companies which applied for a listing on it. Among these were important companies like the Semiconductor Manufacturing International Corporation which got delisted on the NASDAQ to then list on the STAR Market. In addition, with the upcoming listing of the Ant Group the STAR Market is preparing for what is expected to be one of the largest IPOs in history. In line with the market's vision, the companies getting listed on the STAR Market were mostly high-tech companies which on average were younger than the ones getting listed on the SSE main board. Moreover, the IPO process was speeded up significantly which reduces the risk for all participants. Most importantly, IPO pricing worked more efficiently and the issuing P/E ratios were set close to the industry averages. All these factors are indicators for the success, the STAR Market achieved with its adjusted regulations.

However, the issue of IPO underpricing did not vanish in the STAR Market. The level of underpricing was still way higher than in the NASDAQ and not significantly different from the level in the SSE main board. This is especially surprising given the high issuing P/E ratios in the STAR Market. Considering the high issuing P/E ratios and the high IPO underpricing, it can be concluded that the companies listed in the STAR Market experienced highly inflated valuations after their first trading days, which were way above the valuations of their industry peers.

The analysis of individual factors influencing underpricing supports the prior findings. IPO underpricing on the STAR Market was not driven anymore by the factors traditionally affecting IPO underpricing in China. This indicates that the reform of the regulations was a success. However, the analysis in this thesis moved another factor in the spotlight: the investors sentiment. It could be observed that a large portion of the underpricing in the STAR Market was caused by very optimistic investors. These investors transferred the pattern of high underpricing to the new market, probably with the mindset that each company listed in the STAR Market could potentially be the next star in China. Additionally, these investors were driven by the desire to not miss the opportunity to participate in a *hot* IPO market in order to

generate quick returns. The implemented investor threshold did not prevent this behavior in the STAR Market.

To solve or smoothen this issue, the Chinese authorities could engage in additional measures. An obvious measure could be to increase the investor threshold. The SSE could require more market experience in order to be eligible to participate in the STAR Market trading. However, this would decrease the investor base of the STAR Market and therefore would harm the liquidity in the market. Another measure could be to educate those investors who might not be familiar yet with the new possibilities the stricter disclosure requirements offer. Last, another possibility could be the opening up to foreign investors. Especially the opening up to foreign institutional investors could bring more rationality to the market, while simultaneously providing more liquidity. This opening up to foreign investors, and potentially also to foreign companies, could be the SSE's challenge for the next decade.

However, the competitors of the STAR Market observed its success with great interest and are now trying to fight back with their own adjustments. The Shenzhen-based technology board ChiNext copied many of the STAR Market regulations in order to keep up. In August 2020 the first companies got listed under the new registration-based system on the ChiNext board (Caiping and Jia, 2020). While this behavior is an undeniable sign for the success of the STAR Market, it created a valid competitor in the race for the listing of the most promising Chinese high-tech firms. Additionally, also the stock exchange in Hong Kong tries to fight back in order to keep attracting promising Chinese high-tech firms. For this purpose, the HKEX relaxed its listing standards and launched its new Hang Seng Tech Index, just two days after the launch of the STAR 50 Index (Tan and Somasundaram, 2020). With these moves ChiNext and HKEX have increased their competitiveness compared to the STAR Market. two new potent competitors for the STAR Market have been created. The listing of Ant Group on the STAR Market is a good sign for this market, but in the future it must be observed carefully if the STAR Market continues to attract the most attractive Chinese high-tech firms.

As the STAR Market had just one year of trading activity at the time this thesis was written, only a small number of 137 IPOs could be analyzed. In subsequent analyses it should be observed if the findings from this thesis are robust over a longer time horizon, or if underpricing in the STAR Market was perhaps just driven by first-year euphoria. Additionally, the factors included in the regression model where chosen based on the findings in prior literature. However, it cannot be ruled out that an important factor which explains IPO underpricing in the STAR Market has not been considered in the model. Furthermore, given the high valuations

after the first trading day, additional research should examine whether these price levels are sustainable.

To sum up, this thesis provides a first insight into the functioning of the STAR Market after its first year of trading. During this time period the STAR Market could largely meet its expectations and can be regarded to be a success. However, the issue of severe IPO underpricing seen in other Chinese markets could not be sufficiently addressed in the STAR Market. This thesis shows that while regulations could be changed quickly, investor behavior did not. To further reduce IPO underpricing it will therefore be a future challenge for the Chinese authorities to make the domestic investors more familiar with long-term investment strategies and the new opportunities arising from the stronger disclosure requirements. Also opening up the market to experienced foreign investors should be considered.

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Appendix

Appendix A: Underwriter Table

lead underwriter	CSRC rating	frequency in sample
China International Capital Corp	AA	14
China Securities Co Ltd	AA	12
CITIC Securities Co Ltd	AA	12
Huatai United Securities Co Ltd	AA	11
Guosen Securities Co Ltd	AA	7
Everbright Securities Co Ltd	AA	5
Guotai Junan Securities	AA	5
China Merchants Securities Co Ltd	AA	4
Essence Securities Co Ltd	AA	4
Haitong Securities Co Ltd	AA	4
Zhongtai Securities Co Ltd	AA	2
China Galaxy Securities Co	AA	1
Ping An Securities Ltd	AA	1
Shenwan Hongyuan Securities	AA	1
Dongxing Securities	A	3
Industrial Securities Co Ltd	A	3
Tianfeng Securities Co Ltd	A	3
Changjiang Financing Services Co Ltd	A	2
Citi Orient Securities Co Ltd	A	2
Zheshang Securities Co Ltd	A	2
Zhong De Securities Co Ltd	A	2
China Minzu Securities Co Ltd	A	1
Cinda Securities	A	1
Dongguan Securities Co Ltd	A	1
Founder Financing Services Co Ltd	A	1
Huachuang Securities Co Ltd	A	1
Huajing Securities Co Ltd	A	1
Morgan Stanley Huaxin Securities Co Ltd	A	1
Soochow Securities Co Ltd	A	1
UBS Securities Co Ltd	A	1
Western Securities	A	1
Zhongtian Guofu Securities Co Ltd	A	1
GF Securities	BBB	6
Huaan Securities	BBB	2
Shengang Securities Co Ltd	BBB	2
Guoyuan Securities Co Ltd	BBB	1
Minsheng Securities Co Ltd	BB	4
Yingda Securities Co Ltd	BB	1
Pacific Securities	CCC	1
Zhongshan Securities	CCC	1
Sinolink Securities Co Ltd	no rating	4
Capital Securities Co Ltd	no rating	1
China Dragon Securities Co Ltd	no rating	1
Chinalion Securities Co Ltd	no rating	1
Tebon Securities Co Ltd	no rating	1

Data from 137 IPOs in STAR Market from 21.07.2019-21.07.2020.

Appendix B: Calculation of the Independent Variables

variable	prediction	calculation
hot	+	Average inital returns in STAR Market in 30 days before IPO
lnprice	+	Ln(offer price)
lnsize	-	Ln(offering price price x number of shares issued)
lag	+	Offering date - listing date
pedif	-	(Issuing PE ratio / average Chinese industry PE ratio in issue month) - 1
auditor	-	Dummy variable: 1=big5 auditor; 0=not big5 auditor
tech	+	Dummy variable: 1=high-tech firm; 0=not high-tech firm
underwriter	-	Dummy variable: 1=AA-rated underwriter; 0=not AA-rated underwriter

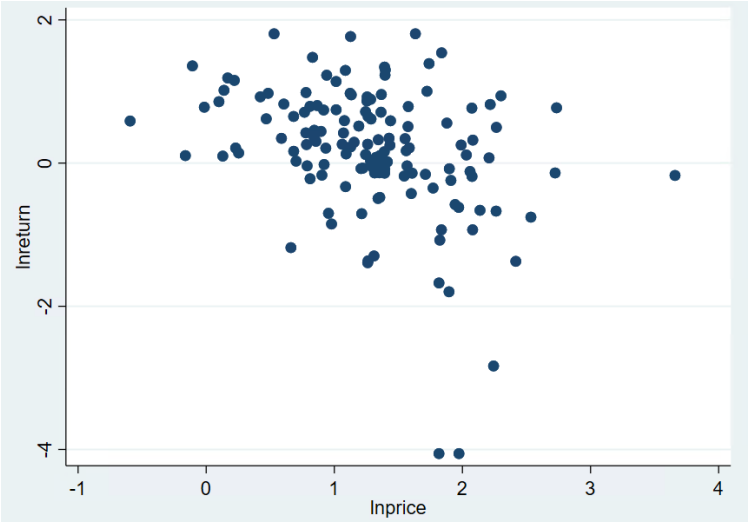
Legend: Prediction "+" means positive relation expected; Prediction "-" means negative relation expected.

Appendix C: Assumption Testing of Linear Regression Model

In this thesis per a multiple linear regression analysis was performed. For this regression to produce valid results the underlying data needs to fulfill seven assumptions (Backhaus et al., 2016). As a supplement to the explanations in chapter 6.1.2 the testing of the assumptions is outlined here. For illustration purposes screenshots from *Stata* are used. For each assumption the source is mentioned which explains the execution and the rational of the test.

(1) Linear Relationship

By observing different scatter plots (here: *lnreturn* and *lnprice*), visual inspection gives no suggestion of non-linear relationships (von Auer, 2016):



(2) Zero Mean of Error Terms

The assumption can be neglected as the violation only influences the intercept which does not need to be interpreted here (Backhaus et al., 2016).

(3) Exogeneity

To test that no correlation exists between independent variables and the error term, the bivariate correlations between them are determined. The test results in coefficients of zero for all variables (here: correlation *residuals* and *hot* and correlation *residuals* and *lag*). Therefore, no indication for endogeneity is ascertained (Wooldridge, 2010):

	residu~s	hot
residuals	1.0000	
hot	0.0000	1.0000

	residu~s	lag
residuals	1.0000	
lag	-0.0000	1.0000

(4) Homoscedasticity

In order for the model to be valid homoscedasticity needs to be present. To obtain homoscedasticity the natural logarithm of the dependent variable is taken. In order to test if the variance of the error terms is constant the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity is used. The resulting F-statistic is 0.1095, which exceeds $p < 0.05$. Therefore, no indication for heteroscedasticity and a violation of the assumption of homoscedasticity could be found (Johnston and DiNardo, 1996).

(5) No Autocorrelation

The assumption can be neglected as a violation is insignificant when analyzing cross-sectional data (Backhaus et al., 2016).

(6) No Multicollinearity

To test that the independent variables are uncorrelated with each other, the correlation matrix between the independent variables as well as the variance inflation factors (VIF) are determined. As the correlation coefficients are low and VIF < 10, no indication for multicollinearity is ascertained (Tabachnick and Fidell, 2019):

	hot	lnprice	lnsize	lag	pedif
hot	1.0000				
lnprice	0.0351	1.0000			
lnsize	0.1824	0.2696	1.0000		
lag	0.0064	-0.1603	-0.1486	1.0000	
pedif	0.1507	-0.0564	0.1683	-0.0030	1.0000

Variable	VIF	1/VIF
lnsize	1.28	0.784042
lnprice	1.13	0.885347
pedif	1.12	0.890667
auditor	1.12	0.894296
hot	1.09	0.920752
tech	1.08	0.921738
underwriter	1.08	0.923232
lag	1.06	0.941786
Mean VIF	1.12	

(7) Normal Distribution of Error Terms

The assumption is negligible since the data set is sufficiently large in this thesis ($n > 40$) (Brooks, 2008).

After having tested all seven assumptions it can be concluded that the dataset fulfills all the assumptions underlying linear regression models.