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HAS THE INTRODUCTION OF BOOKBUILDING INCREASED THE EFFICIENCY OF CHINA'S IPO PRICING?

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SINGAPORE MANAGEMENT UNIVERSITY

2009

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN FINANCE BY RESEARCH

SINGAPORE MANAGEMENT UNIVERSITY
2009

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Abstract

Book-building is commonly adopted in global primary markets and regarded as the most efficient pricing method for accurate IPO pricing by literatures. China has introduced book-building in 2005 to increase IPO pricing accuracy and the capabilities of domestic institutional investors. However, with the current IPO data from China, I find the level of under-pricing has unexpectedly increased after book-building, which is against the empirical studies of a few domestic papers. Secondly, there's some evidence that with better information disclosure from issuer-side through book-building process, the signaling and ex-ante uncertainty effect that previously caused under-pricing has been reduced. But there're unique findings on both Shanghai and Shenzhen Stock Exchange due to the bull market effect, the launch of SME Board and the removal of IPO suspension after mid-2006. Last but not least, large number of institutional investors involved in book-building is likely to be regarded as a signal for herding behavior on China's secondary market and based on the information collected from book-building, underwriters tend to over-adjust final offer price.

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Has the Introduction of Book-building Increased the Efficiency of China's IPO Pricing?

1 Introduction

Initial Public Offerings ("IPO"s) are marketed and priced with different methods in different countries. Ritter (2002) summarized that generally there are three types of IPO pricing methods adopted by new issuers globally: auction, fixed-price and book-building. Before 1990, fixed-price methods were commonly adopted by non-U.S. countries. But after trial and error, book-building gradually become dominant in the last two decades. According to Ljungqvist, Jenkinson and Wilhem (2003), by July 1999, about 80% of non-U.S. offerings were brought to market using book-building method or its hybrids.

Book-building is conducted in the way that the underwriter organizes a price consultation meeting or "road show" where potential institutional buyers are invited to bid at their favorite prices and volumes for new issues, meanwhile the underwriter keeps a "book" of the information collected from the above processes, and sets the ultimate offer price based on the "book" just been built.

Book-building method is considered superior to auction and fixed-price methods in terms of information gathering and pricing accuracy. The "secret" behind is that with book building, the underwriter has full control over share allocation and is likely to base the allocation on either the level of information revealed by institutional investors [Cornelli and Goldreich (2001)] or the long-term relationship between investor and underwriter [Sherman (2000)].

In China, despite frequent changes in IPO pricing regulation, pricing methods before 2005 were pretty close to fixed-price. In 2005, "The Notice of Trial on Book-building Pricing Mechanism for China's Initial Public Offerings" ("The Notice")— a milestone document issued by China Securities Regulatory Commission (CSRC) officially took effect. The Notice regulated that new IPOs on China's A-stock market be priced by conducting book-building process, where qualified institutional investors are invited to consult on appropriate IPO price. The issuing of the Notice is aimed to 1) produce more accurate offer price and resolve the high under-pricing problem most IPOs on China's A-

stock market will suffer on the first trading day; 2) get more institutional investors involved in pricing process and to elevate their pricing abilities.

This paper, therefore, attempts to find out whether the expectations of introducing book-building method have been achieved and whether book-building has made significant changes on China's IPO market. In detail, the paper will explore the answers to the following questions: 1) whether the introduction of book-building has significantly lowered under-pricing in both Shanghai and Shenzhen Stock Exchange; 2) whether the information asymmetry theories that are commonly considered to explain for under-pricing on China's primary equity market become less significant after the introduction of book-building; 3) what is the information contained in China's book-building process, especially the preliminary book-building session where the offer price range and size are first set and whether such information has significantly lowered under-pricing;.

To answer these questions, this paper used a sample of 483 IPOs listed on Shanghai and Shenzhen A-stock market from 2001-2007, among which 187 are IPOs after 2005—the post book-building regulation period. Regression models are conducted to analyze the proxies for factors that are considered significant for under-pricing and compare the result before and after book-building. One of the major contributions of this paper is that the dataset used to compose the variables in the model are mostly hand-collected from either prospectuses or stock-exchange websites and are not readily available in publicly accessible database.

This paper extended the theories from past literatures, which propose book-building as an efficient pricing method, by applying them to specific data from China market. Sherman (2000), Sherman (2005), and Benveniste and Busaba (1997) are the representative among them providing explanations for the mechanisms behind book-building regarding how it has affected under-pricing. Ljungqvist, Jenkinson and Wilhelm (2003) adopted regression models to compare the direct and indirect costs of book-building and fixed-price on non-US IPOs, and reached the conclusion that book-building, though more expensive, produce far less under-pricing. But with samples overseas, these theories or empirical models cannot be simply applied to China's IPOs.

Earlier domestic papers, however, focused on explaining under-pricing problem on China's IPO market and testing established theories such as signaling, winner's curse,

information cascade etc. Since 2005, China's domestic scholars started to conduct studies and discussions on the effect of this new book-building regulation— "the Notice". There are positive results supporting the idea that book-building has increased China's IPO pricing accuracy [(Wang, He and Zhang (2006), Tian and Wang (2007), Yang and Zhao (2006)]. However, given the time of publishing, these studies are only able to include a small sample (about only 15 observations) and therefore the empirical results are not very convincing.

In Section 2, I briefly review the revolution of IPO pricing methods in China, discuss the rationale behind the introduction of book-building mechanism and summarize its major contents. In Section 3, I summarize the literature theories on the effectiveness of book-building and based on them, derive the hypothesis needed to be tested for China's IPOs. The introduction of data is in Section 4 and I will have analysis on the under-pricing before and after book-building method is introduced and the characteristics of the data.

2 A Review of Pricing Mechanism in China's A-stock IPO Market

2.1 The history of China's A-stock IPO pricing regulations

China's IPO pricing regulations have gone through drastic changes in the past. Before Dec.1996, IPO prices were fixed at 15 times of forecasted earnings per share. However, the earnings forecast was very subjective, and therefore there was large casualty in pricing. From Jan.1997, the earnings per share used in P/E ratio were changed to the arithmetic average of the past three years' earnings per share. However opponents held that this method didn't correctly reflect the market demand and in Mar.1998, historical earnings per share in P/E ratio was changed back to forecast earnings and the P/E ratio was still fixed at 15.

In Mar. 1999, the pricing method was open to market, so called "book-building". Nevertheless, only the offer price at that time was open for consultation, while the issue size was still under the "Quota System" by CSRC. So the market reform of IPO pricing was very limited. At the same time, the newly reformed IPO P/E ratios become extremely high, some as high as 40. It was obvious that when the "Quota System" was applied in IPO market, huge demand for new issues had not been matched, causing the IPO's initial

return on first-trading extremely high. Chen et al (2004) observed an average initial return of 178% with a sample of 507 A-shares from 1993 to 1998, and Chi and Padgett (2005) measured a market-adjusted initial return of 129.16% with 668 A-shares from Jan.1st, 1996 to Dec.31st, 2000. Also, there was no incentive for underwriters to bid for a competitively higher offering price as the issue size was restrictedly controlled.

In 2001, the "Quota System" was finally transformed into "Sanction System", under which underwriters could recommend new issuers to CSRC for approval [(Liu Ti (2003)] and the issue size was no longer restricted. The IPO pricing method was then changed again to "book-building". Unfortunately, the offer price was upper-limited to a P/E ratio of 20. Therefore the market-oriented change was still limited and such pricing method was almost equal to fixed-offer method as most IPOs were issued at their P/E ratio ceiling of 20.

It was not until 2005 when the landmark book-building pricing regulation took effect that the real market reform of IPO in China started.

2.2 The background of introducing book-building method

The experiences in mature primary markets show that consulting IPO prices from institutional investors who are experts in securities analysis and valuation is the most efficient way for setting IPO prices. Besides, in China, institutional investors represented by mutual funds are developing fast and they are more capable and willing to be involved in IPO pricing. China's Securities Regulatory Committee decided it was time to push forward the market-oriented revolution of China's IPO market, beginning with the reform on IPO pricing mechanism. "The Notice of the Trial of Book-building Pricing Mechanism on China's Initial Public Offerings" ("The Notice") was issued in such backgrounds.

The Notice has revolutionary meaning in the development of China's securities market. First, by introducing book-building, combining the opinions from issuer, underwriter and investor, IPO pricing becomes less subjective and arbitrary. With the public disclosure of the pricing process, both the investor and underwriter are under market's supervision, which creates a long-term value investment environment. Secondly, it benefits the institutional investors by giving them more power in IPO pricing, which

motivates more diversified capital flowing into primary market, such as trust-investment companies, treasury companies, insurances and pension funds. Thirdly, book-building demands for high standards from the underwriter, from internal management, research, clientele resources, sales channel to IPO pricing and marketing abilities and in the long-run, is helpful in improving the competitiveness of China's underwriter force.

2.3 How does China's book-building process work?

In U.S. and many other countries, the book-building effort follows the registration for IPO and filing of the preliminary prospectus with the security regulatory committee. The preliminary prospectus represents the outcome of investment banker's due diligence effort. After the committee has commented on the registration statement and the preliminary prospectus has been circulated among potential investors, the issuing firm's investment bank organizes a series of road shows designed to generate interest among potential investors. Based on these presentations and the information in the prospectus, including a suggested price range for the offering, participants are asked to provide nonbinding indications of interest in the issue. The "book" is built from these expressions of demand and based on the information in the book, the terms of the offering are finalized shortly before distribution begins [Benveniste and Wilhem (1997)].

The book-building process in China is quite similar to the U.S. version, except that it contains two sessions, the preliminary book-building session and road show session. The issuer and "IPO Sponsor", usually the same as underwriter first file for registration to the China Securities Regulatory Committee (CSRC) and hand in due diligence report. Once the registration gets approved by CSRC, the report will be delivered to institutions who will participate in preliminary book-building (the "Notice"). These institutions are selected by the investment bank from all qualified institutional bidders, no less than 20, and should fall in the qualifications regulated by CSRC. During the preliminary book-building, the price consultation is conducted and the offer price range is settled based on consultation result. The underwriter then organizes road show campaigns, discloses the price range and accumulates bidding volumes from all qualified institutions within the price range, and finally sets the offer price according to the demand. The underwriter will

then allocate the shares according the bid size[1]. After book-building, the rest of stocks will be allocated to public investors online at a uniform price, which is normally the offer price. [Wang, He and Zhang (2006)] The stocks allocated to applicants in book-building session will be locked up to 3 months (the "Notice"). So strictly speaking, the new pricing method in China's A-stock IPO market is book building/fixed-price hybrid based on the definition by Sherman (2000).

3 Literature Review and Hypotheses

3.1 The relationship of book-building and under-pricing

Short-term under-pricing of IPO, usually defined as the increase in the first-trading day closing price from the offer price, is commonly observed in almost all primary markets around the world. Ritter (2002) studied the under-pricing of 38 countries in the past two decades and found that on average, the closing market price on the first day of trading of an IPO is higher than the offer price.

There are a lot of different explanations for under-pricing. Many are based on the information asymmetry between IPO firm and investors. One of the most phenomenal is the signaling theory that high-quality firms often discount on their IPO price as signal of confidence in the firm's sustainable profitability. Another commonly discussed explanation is the winners' curse theory that investors are assumed to hold different level of information about the issuing firm and thus retail investors are often in disadvantage in share allocation. In order to secure the active participation of retail investors, IPO firms will under-price more to compensate for those less-informed investors.

Among all the alternative explanations, the choice of pricing method is also frequently discussed and proved to be helpful in understanding under-pricing, because different pricing methods do cause different level of under-pricing according to some scholars. Many literatures have compared under-pricing of IPOs using fixed-price, auction and book-building pricing methods and found that book-building methods produce lower under-pricing.

[1] According to "the Notice", the number of shares allocated to institutions participating in book-building shall not exceed 20% of the total IPO size, if the IPO size is less than 400 million shares; and shall not exceed 50%, if the IPO size is more than 400 million and including.

Compared with auction or fixed-price methods, the key difference of book-building is its advantage in information collection and the full discretion of share allocation by underwriters. Although in auction, IPO pricing and allocation is also based on market demand information, it fails to put the power of the investment banker's relationships with potential investors to work for the issuing firm and therefore is generally inefficient [Sherman (2000)].

But why the information advantage and discretion of allocation of book-building will lead to lower under-pricing?

Benveniste and Wilhelm (1997) explained this from the information-revealing point of view. They observed that investors have “soft” information, which is their level of demand for the new issue. By building an “order book” through road show, issuers and their underwriters are able to collect the true revelation of IPO valuation from investors. While the incentives of such honesty come from the underwriters’ ability to allocate shares to their favorable investors who they consider have contributed most in information revealing. For investors, it’s the balance between the cost of a higher offer price and favorable share allocation, and normally the latter provides larger benefits.

Sherman (2000) emphasizes on the importance of the long-term relationship between underwriter and investors in book-building, which can be utilized in repeated IPO settings to reduce under-pricing. Discretion in share allocation in book-building allows underwriter to form regular investor groups that will participate in every offering. Such long-term relationship allow the underwriter to lower average under-pricing while still giving investors the incentive to gather and report the optimal level of information. Therefore, underwriters and investors achieve mutual benefits. Other issue methods such as auctions do not allow long term relationship between underwriter and investors, as the allocation mechanism behind them is non-discretionary.

Whether it is because favorable share allocation or long-term benefit to lure investors to reveal true demand interest, book-building pricing is widely considered to have lowered under-pricing due to its information-collection nature. The effect should also be observed in China’s IPO market if the book-building mechanism in China is well implemented. Yang and Zhao (2006) observed a 48.38% market-adjusted return on IPO

first-trading day with 15 samples since 2005. The similar result, about 45% market-adjusted initial return, was observed by Wang, He and Zhang (2006).

Hypothesis 1: Book-building has efficiently lowered under-pricing. On both Shanghai and Shenzhen Stock Exchanges, the under-pricing after 2005 will be significantly lower than under-pricing before 2005.

3.2 Book-building and Information Advantage of Issuing Firms

Ritter and Welch (2002), Benveniste and Spindt (1989) both identified that there are two kinds of information asymmetries existing between IPO issuer and investors: 1) issuing firms are more informed about their own business situation than investors and 2) investors are more informed about factors outside firm than issuers, for example superior information about competitors and market demand information. Hypothesis 1 actually talks about the second type of information asymmetry, the information advantage of investors. The next two hypotheses will be based on the first type of information asymmetry that issuing firms possess inside information over investors.

If issuers hold more inside information, a lemons problem may appear that investors cannot tell the good IPOs from bad. In order to distinguish themselves, high-quality firms attempt to signal by discounting more on the offer price, known as the "Signaling Theory". Investors then will benefit from price appreciation in secondary market. Under-pricing then becomes a cost that low-quality IPOs cannot afford to imitate. [Welch (1989)]

However, with book-building, such information asymmetry should be reduced. During preliminary book-building, investors invited will receive due diligence report on IPO firm, which will contain more information regarding firm quality. While before book-building, such information is not available. Therefore, high-quality firms which intend to send a signal to investors by under-pricing will find this approach less effective after book-building is introduced.

Hypothesis 2: Signaling effect on under-pricing decreased after book-building and firm quality proxies significant in explaining under-pricing before book-building become less significance after book-building.

Rock (1986), Beatty and Ritter (1986) discussed about the "winner's curse" problem associated with IPOs, that the privileged investors will crowd out the disadvantaged investors when IPOs are offered at their expected value, and withdraw from the market when bad issues are offered. Such "winners' curse" problem intensifies especially when investors have ex ante uncertainty regarding the IPO value. In order to guarantee that uninformed investors also participate in IPO market, underwriters have to discount more on the offer price to provide uninformed investors with a reasonable return as compensation for taking the risk of issuer uncertainty and disadvantage share allocation.

Beatty and Ritter (1986) used a sample of 545 IPOs registered with SEC from April, 1981 to December, 1982 to test the ex-ante uncertainty proposition with the proxy of 1) number of uses of proceeds disclosed in prospectus and 2) reciprocal of gross proceeds, and found that there's a significant positive relationship between under-pricing and IPO proceeds, which supported the ex-ante uncertainty explanation for under-pricing.

Moreover, Su (2003) conducted similar empirical test with 587 IPOs from China between January 1994 and December 1999, with more proxies used for ex-ante uncertainty. He found that under-pricing is closely related to the size of offerings, inside ownership, disclosure practices, market conditions and allocation mechanism. Therefore, according to Su, ex-ante uncertainty theory also applies to China's IPOs in the time period when book-building is not adopted.

However, once book-building mechanism is introduced, through thorough due diligence process before filing registration with CSRC for IPO offering and two rounds of marketing campaign, issuers disclose more information to investors, and the speculative risks associated with the IPOs are supposed to be reduced. Though the winners' curse problem may still exist, especially among retail investors, compared to pre-book-building period when only the underwriter and issuer hold the authority of pricing, more institutional investors get involved in the pricing process, the winners' curse problem should have eased.

Hypothesis 3: Ex-ante uncertainty effect on under-pricing decreased after book-building and the ex-ante uncertainty proxies significant in explaining under-pricing before book-building become less significant after book-building.

3.3 Information Value of Book-building and Under-pricing

The book-building process contains valuable information. For example, the number of institutional investors, on one hand, reflects the level of market demand; on the other hand, indicates more accurate IPO pricing and better information collection. Some other form of information includes: the price range settled in preliminary book-building, the final price adjustment from expected offer price, which is the arithmetic average of the high and low end of price range and the final offer size adjustment from the amount disclosed in book-building.

As discussed in Section 2.2, institutional investors are normally considered to have the expertise and resources to come up with more accurate IPO price. One of the reasons of introducing book-building by CSRC is to utilize the strengths of institutional investors and increase the pricing efficiency of China's IPO, at the mean time increase the pricing abilities of China's developing domestic institutional investors. The more institutional investors involved in pricing process of IPOs, the more information they will bring to book-building process. Therefore, the under-pricing should be reduced due to more accurate pricing and better information revealed.

The magnitude of price range, which is determined in preliminary book-building also helps observe the accuracy of pricing. Large price range show that there is large discrepancies among institutional investors on the offer price. Therefore, larger price range relates to larger under-pricing.

Hypothesis 4: More institutional investors participating in IPO pricing process result in lower under-pricing; the magnitude of price range settled in preliminary book-building is positively associated with under-pricing.

4 Data and Description

4.1 The Sample

The sample used in this paper is comprised of 483 companies that issued A-shares and listed on either Shanghai or Shenzhen Stock Exchange, during the period from 1 January 2001 to 31 December 2007. The sample is selected from Tsinghua University China Center for Financial Research and is further divided into two periods for empirical analysis and comparison by the year when book-building pricing method was introduced: the pre-book-building period (2001-2004) and the post-book-building period (2005-2007).

Such time periods are chosen because in 2001, the long-time dominant "Quota System" for selecting new IPOs each year has been transformed into "Sanction System", under which underwriters are able to recommend new issues to CSRC for approval [(Liu Ti (2003)] and there's no quota limits for the number and volume of IPOs each year. Therefore, the year 2001 is recognized as the beginning of market-oriented reform on China's IPO market. On Jan.1 2005, book-building pricing method officially took effect, allowing pricing of IPOs on China's A-stock market open to market forces.

Table [1] summarizes the number of IPOs in the sample from 2001 to 2007 on an annual basis and reveals some interesting results. Before book-building was introduced, from 2001 to 2004, Shanghai Stock Exchange on average had 64 IPOs each year and totally took up 86.82% of all IPOs listed on both stock exchanges during that period. This is because IPO listing was suspended on Shenzhen Stock Exchange in 2001. It was not until 2004 that the suspension was removed and the Small and Medium-sized Enterprises (SME) Board was launched on the Shenzhen Stock Exchange. The SME Board is designed as an exclusive market segment for small- and mid-caps with pronounced core business, high growth potential and intensive technological contents[2].

IPO listing was challenged again from mid-2005 to mid-2006, when IPOs on both stock exchanges were suspended to pave the way for the Non-Outstanding Stock Reform. So there are only 15 IPOs in the sample on both stock exchanges in 2005. With the re-opening of IPO market in mid-2006, the number of IPOs increased dramatically year on year. Interestingly, about 81% of IPOs post-book-building period chose to list on the

[2] Source: Shenzhen Stock Exchange website

Shenzhen Stock Exchange. The reason is probably because the majority if IPOs in that period were small and mid-caps, and SME Board on Shenzhen Stock Exchange have lower entry requirements and more customized systems.

However, through the entire sample period from 2001-2007, Shanghai Stock Exchange still has 50% more IPOs than Shenzhen Stock Exchange, because in the four years pre-book-building period, there were a lot many IPOs in Shanghai.

4.2 Under-pricing before and after book-building

A number of papers have studied the under-pricing problem in China's IPO market since the stock market opening in 1990s. Extreme high under-pricing in early age of China's equity market is often quoted and studied as an emerging-market phenomenon by a lot of scholars. In Ritter (2002)'s 38-country under-pricing table, average initial returns in China from 1990-2000 is the highest, 256.9%. Table [2] summarizes the results of empirical studies on China IPOs' initial returns and market-adjusted initial returns. Under-pricing on B-stock market is generally lower than A-stock market IPOs, around 25% on average. However, under-pricing on A-stock market varies with different time period. Under-pricing before 1990 was extremely high, that's why dataset including early years of IPOs will have dramatically high initial return, such as Su and Fleisher (1999) and Gu (2003). With time progressing, the average initial until 2000 is about 130%. Most recent studies, especially with data after 2005, show even lower under-pricing, less than 100%.

In this paper, I calculated both initial return and market-adjusted initial return of the sample. But I use only market-adjusted initial return as dependent variable in empirical study, because it keeps away the influence of market conditions and therefore is more accurate for detecting the efficiency of IPO pricing.

The following is the detailed formula for under-pricing measurement:

$$\textit{Initial Return (IR) (\%)} = \frac{P_1 - P_0}{P_0} * 100$$

$$\textit{Market-adjusted Return (MAR) (\%)} = [\frac{P_1}{P_0} - \frac{M_1}{M_0}] * 100$$

P_0 : IPO offer price;

P_1 : IPO first-trading day closing price;

M_0 : Market index closing price on the day of IPO offering;

M_1 : Market index closing price on the day of IPO listing (i.e.IPO first-trading-day).

Table [3] summarizes the average under-pricing of sample IPOs on both stock exchanges from 2001-2007 on an annual basis. I find that there's not much difference between initial return and market-adjusted initial return. This is because the percentage change of market index within a few days is very small. So the analytical results by using market-adjusted initial return will not show much difference from results using initial return. Such uniformity of IR and MAR can also be observed from Figure [1].

In pre-book-building period, the average under-pricing in Shanghai Stock Exchange measured in initial return is 103.09%, while the average under-pricing post book-building has been decreased to 77.59%, and the overall average under-pricing on Shanghai Stock Exchange is 100.04%. For under-pricing on Shanghai Stock Exchange, there are two turning points throughout the whole sample period, which can also be observed from Figure [1] (a). The under-pricing has drastic changes before and after both 2002 and 2006. 2006 is when more IPOs started to list on Shang Stock Exchange since book-building regulation took effect. The under-pricing decreased dramatically to only 37.90%. However, it picked up again in 2007 to 105.20%. This is probably because in 2007, many blue-chip IPOs such as large domestic commercial banks and key-industry State-Owned Enterprises (SOE) got listed on SHSE. They received overwhelming market demand on secondary market.

The under-pricing on Shenzhen Stock Exchange is another story. Before book-building, the average initial return is only 68.28%. However, it increased to 159.27% after book-building. Especially in 2007, the under-pricing on average is amazingly as high as 212.14%. Actually, the maximum initial return in 2007 on Shenzhen Stock Exchange was even more than 500%. From Figure [1] (b), we can see that 2005— the year of book-building regulation is the turning point, and there's steep increase afterwards. This is probably because most IPOs on Shenzhen Stock Exchange post book-

building are small and mid-caps listed on SME Board and such IPOs have relatively high risk. Therefore their offer price is purposefully set lower, on one hand, to guarantee a successful IPO, and on another, to compensate investors for taking high risks.

In conclusion, it's not a good sign to see dramatic increase in under-pricing in 2007 on both stock exchanges, as the first-trading day initial return is supposed to decrease with the introduction of book-building. Later in this paper, I will further analyze the effect of book-building on statistical significance basis.

4.3 The Independent Variables

Historical literatures on China's IPO under-pricing have provided empirical evidences for some explanations of under-pricing. In Section 3, I summarized two representative theories commonly studies on China's data: the signaling effect of high-quality firms [Welch (1989)] and the ex-ante uncertainty of IPO firm value due to limited information disclosure [Beatty and Ritter (1986)].

In the signaling theory, equity retained by the Government or State-owned companies (STATOWN)[3] is often used as proxy for firm quality. Su (2004) considered equity retention as signal of improved earnings. Mok and Hui (1998) argued that in emerging market with high information asymmetry, the high equity retention is normally interpreted by investors as a business guarantee and thus high firm quality. Su (2004) and Chen *et al* (2004) observed significantly positive relation between Government's equity retention and under-pricing. Besides, I also put controlling stock-ownership (CONTROWN) to proxy firm quality in the regression model, because the higher percentage of controlling stockholders' ownership in the firm, they will have stronger incentive to monitor the firm to deliver better profits. In the long-run, high-quality firms will outperform low-quality firms in the aftermarket stock performance. So I used the IPO's cumulative stock return after one-year of offering (LGTMPERF) as proxy for firm quality. The rest independent variables for firm quality include historical earnings per share (EPS), return on equity (ROE) and compounded annual growth rate of net income (NICAGR). All these are fundamental factors that reflect firms' profitability or return to investors.

[3] The bold characteristics in brackets are variables used in this paper, the detailed description of which is in Appendix 1.

Regarding the ex-ante uncertainty theory, almost all literatures agree that the IPO proceeds (IPOSIZE) has significant effect on book-building. Su and Fleisher (2004), Su (2004), Chi and Padgett (2004), Mok and Hui (1998) as well as Chen at al (2004) observed significantly positive effect. IPO offer size is generally used as proxy for uncertainty of the firm value. IPOs of larger size are considered to have lower risk. Besides, Su (2004) used debt-to-total assets ratio (DE) and the age of firm (AGE) as proxies for uncertainty. He argued that a high pre-IPO leverage ratio raises uncertainty about the financial strength of a firm because debt financing imposes a hard budget constraint on management. Besides, old firms have lower risk than new firms. I also put P/E ratio (PE) as proxy for firm uncertainty, because high P/E reflects high growth rate and thus high risk of a firm. So a positive impact of P/E on under-pricing is expected.

Besides variables proxy the above two theories, some variables have also been commonly regarded as significant in explaining under-pricing, thus I added as control variables in the model.

Mok and Hui (1998) found out that a long time-lag between IPO offering and listing (TIMELAG) is one of the key determinants of under-pricing. Su (2004) used cumulative daily returns of Shanghai/Shenzhen stock exchanges index 30-trading days before an IPO as proxy for market condition surrounding a new issue, and found significantly positive relationship with under-pricing. Chi and Padgett (2005) argued that one important reason for high under-pricing of IPOs in China is the inequality between the supply and demand for IPOs. They defined the odds of winning the lottery for IPO allocation (LOTTODD) as proxy for market demand and found that it has significantly negative impact on under-pricing. They also found that firms in high-tech industry (IND) suffered higher under-pricing. Besides, SEO, UNDWRI and EXCH are the other control variables to capture the influences of seasoned equity offering, the underwriter's ranking and the stock exchange on under-pricing.

Moreover, the information contained in book-building process is both unique and critical in understanding under-pricing, because book-building collects the institutional investors' interest and valuation of IPO. For hypothesis 4, the obvious variables are the number of institutional investors participating in book-building where offer price range is

settled. I call them “book-builders” (BKBDER). I use the percentage of price range over the bottom price in the range as proxy for magnitude of price range (PRIRAN).

Benveniste and Spindt (1989) predicted that if it’s not possible to completely compensate truth-telling through increased share allocation, then under-pricing must also be used to compensate investors for revealing good information. Based on this, Hanley (1993) tested the final offer price adjustment from anticipated offer price disclosed in preliminary prospectus against under-pricing and documented a significantly positive relation between offer price adjustment and initial return based on a sample of 1,430 IPOs on U.S.

In China, the final offer price is limited within the price range settled in preliminary book-building. However, I divided IPOs on both stock exchanges into two groups: IPOs with positive price adjustment and IPOs with negative price adjustment and then I calculated the average under-pricing for each group. I found that opposite to the positive relation between price adjustment and under-pricing from Hanley’s paper, IPOs in China have larger under-pricing when offer price is adjusted downward, as shown in Figure [2]. IPOs calculated the under-pricing for IPOs with positive price adjustment and negativedue to the overall large magnitude of price range, the final price greatly deviates from the mid-level price range (arithmetic average of the highest and lowest price in the range), which could have changed the level of under-pricing. So I include the percentage adjustment of offer price from expected price in book-building (PRIADJ) in the model. In Hanley’s paper, she also discussed about the offer size adjustment and therefore, I also add the percentage adjustment of offer size from the size previously disclosed in preliminary book-building (SIZEADJ) to the model.

All the above independent variables as well as the dependent variable are defined in Appendix 1 and the expected signs of independent variable have also been summarized.

4.4 Data Sources and Statistic Descriptions

The data set in this paper comes from various sources and is mostly hand-collected. The four major sources I approached in preparing the data are : 1) Tsinghua University China Center for Financial Research; 2) Shanghai Stock Exchange or Shenzhen Stock Exchange websites; 3) Prospectus or book-building result announcement downloaded

from www.cninfo.com.cn (Ju Chao Zi Xun)— the designated information disclosure website by China Securities Regulatory Commission; 4) RESSET (Rui Si Financial Database). All sources are publicly accessible by investors. Appendix 2 is a summary of the data and their resources.

The statistics description of both dependent and independent variables are summarized in Table [4]. In order to avoid distortion from outliers, except the dummy and integral variables, all variable have been winsorized in 1~99 percentile interval and observations beyond 1 and 99 percentile are set to be equal to the border values.

First, market-adjusted initial return (MAR) has large standard deviation. The lowest value is negative, while the highest value is nearly 500%. After IPO, the average percentage of equity ownership by Government and State-owned enterprise in IPOs on SHSE is much higher than IPOs on SZSE, because most IPOs on Shanghai are blue-chips in key industry, while IPOs on Shenzhen especially since 2005 are SMEs with majority stockownership from private sector. Besides, the stockownership of IPOs on SZSE after offering is more diversified, because the average controlling stockownership (CONTROWN) of SZSE is lower than SHSE.

Generally, IPOs under-perform over the long term, as the average cumulative 1 year market-adjusted stock return after offering (LGTMPERF) is very negative. In the long run, IPOs on SZSE under-perform more than IPOs on SHSE, only -60.10% on average. However, IPOs' long-term performances vary greatly from each other. The worst performance is -248.18%, while the highest performing IPO has almost doubled the first-trading day closing price. The profitability variables of IPOs on SZSE are on average better than IPOs on SHSE, as average EPS, ROE and NICAGR on SZSE are higher. The average IPO size on SHSE is larger than that on SZSE, that is because firms on SZSE are of smaller scales, they are not expected to finance large volume of capital from primary market. The financial leverage (DE) of firms on the two stock exchanges are quite close, with average debt/equity ratio around 55%. And there's not much difference in firm age on the two exchanges. The average P/E on SZSE is higher than that on SHSE, which is reasonable, because IPOs on SZSE are SMEs with high growth potential, yet high risks. Issuers on SHSE seem not care much about the timing for IPO listing, because the average market-index return 30-days before IPO (PREMKTRET) is negative. However,

issuers on SZSE tend to time the market, as PREMKTRET is 24.08%. That could be because for small-size IPOs, a good market condition is very critical to guarantee the success of IPO offering. The time interval from IPO offering to listing is larger in SHSE, which might be due to the procedures of IPO listing on SHSE are more complex and thus require longer time. The odds of winning IPO allocation bidding lottery (LOTTODD) on SZSE is on average much lower than that on SHSE for IPO. Since the IPO size on SZSE is not as big as IPO size on SHSE, it must be because of more market demand for IPOs on SZSE. According to Chi and Padgett (2005), the imbalance of IPO stocks' supply and demand is more serious in SZSE.

During preliminary book-building, there are more institutional investors participating in price consultation in SHSE than SZSE. It's also reasonable because the IPO size and firm scale on SHSE are larger than SZSE and therefore the underwriter for IPOs on SHSE will invite more investors for book-building and stock allocation. The average price range on SZSE is larger than that on SHSE, that is because underwriters for IPOs on SZSE are of lower ranks and their pricing ability is relatively less strong or because IPOs on SZSE are of higher uncertainty (average higher P/E ratio and lower IPO size), the larger price range thus reflects the uncertainty implied in valuation. The average price adjustment for IPOs on both stock exchanges is negative, probably because underwriters in China tend to lower the final offer price before listing to obtain oversubscription, cause a buzz and therefore guarantee stock premium on first trading day. IPOs on SZSE are discounted more from average price range in book-building than IPOs on SHSE, which could be because IPOs on SZSE are of more uncertainty and require much lower offer price to secure a successful listing. None of the IPO finally adjusts the offer size upward after book-building, which also indicates that underwriters are more comfortable with less aggressive equity financing, as lower volume more easily gain oversubscription.

Table [5] shows the correlation among variables from 2001 to 2007, combining IPOs on both stock exchanges. The high correlations recorded are EPS and ROE, IPOSIZE and LOTTODD. The first pair's relation is easy to understand, both reflect the profitability to stockholders. The positive relation between IPO proceed and odds of winning online bidding lottery is also not difficult to explain, because large IPO size offer large volume of supply and LOTTODD is supposed to be higher, reflecting that the imbalance of IPO

supply and demand becomes less serious. STATOWN and CONTROWN also have higher correlation because higher level controlling stockownership is normally by government or state-owned enterprises, while private sectors often hold lower controlling stake once the company gets listed. There's 0.31 correlations co-efficient between PREMKTPERF and MAR, which indicates that the under-pricing of IPO follows the market conditions, higher under-pricing associated with bull market and vice versa. IPOs on SHSE tend to have more SEOs, as the correlations co-efficient between SEO and EXCH is 0.22. There's also 0.22 correlation between LOTTODD and STATOWN, because stated-controlled IPO size is larger and imbalance of supply and demand is less serious. PE has 0.29 correlations with MAR, which is consistent with hypothesis 3 that high-uncertain IPOs have higher under-pricing. The relation between UNDWRI and IPOSIZE is -0.48, which makes sense because larger volume IPO normally invites underwriter of higher rank, in this case smaller integral value (0 is the highest rank and 2 is the lowest rank). Therefore the correlation between UNDWRI and LOTTODD is -0.37, higher-ranking underwriter is associated with higher odds of lottery success. High-tech industry normally have more diversified stock-ownership, therefore the correlation between IND and STATOWN as well CONTROWN is both negative. The correlation between IND and PE is slightly positive 0.08, which is consistent the assumption that high-tech industry has higher P/E ratio. PE has relatively high correlation with BKBD 0.29, showing that P/E ratios of IPOs post book-building become higher, either because since 2005, the stock market in China was booming and investors are confident of IPO firms' fundamental performance or because the offer price compared to fixed-pricing period has been adjusted upwards to reflect more accurate market valuation. Market conditions post book-building also turn better, with 0.43 correlations with BKBD, which could be the reason that MAR become higher after book-building and the increase of under-pricing is driven by market conditions neglecting the effect of book-building. Based on -0.71 between EXCH and BKBD. Correlation between LOTTODD and BKBD is 0.19, which shows that with the introduction of book-building, the imbalance of supply and demand of IPO is eased.

5 Empirical Analysis on the Effect of China's Book-building

5.1 Hypothesis 1—The effectiveness of book-building on under-pricing

Model 1 is used test Hypothesis 1— whether the introduction of book-building to China's IPO market has significantly reduced under-pricing.

Model 1

$$MAR_i = \beta_0 + \beta_1 STATOWN_i + \beta_2 CONTROWN_i + \beta_3 LGTMPERF_i + \beta_4 EPS_i + \beta_5 ROE_i$$
$$+\beta_6 NICAGR_i + \beta_7 IPOSIZE_i + \beta_8 DE_i + \beta_9 AGE_i + \beta_{10} PE_i + \beta_{11} PREMKTRET_i + \beta_{12} TIMELAG_i$$
$$+\beta_{13} LOTTODD_i + \beta_{14} SEO_i + \beta_{15} UNDWRI_i + \beta_{16} IND_i + \beta_{17} EXCH_i + \beta_{18} BKBD_i + \varepsilon_i$$

In the model, BKBD is a period dummy variable. It equals to 1 when the IPO is listed after January 1, 2005. The independent variables used in the model are mainly chosen based on past empirical studies on China's IPOs and are proved significant in explaining under-pricing. The detailed discussion on independent variables is in Section 4.3 and their definitions are listed in Appendix 1. STATOWN, CONTROWN, LGTMPERF, EPS, ROE and NICAGR are proxies for firm quality; IPOSIZE, DE, AGE and PE are proxies for ex-ante uncertainty. Besides, I included control variables PREMKTRET, TIMELAG, LOTTODD, SEO, UNDWRI, IND and EXCH to capture the effect of market conditions before IPO, time interval between IPO offering and listing date, odds of winning online bidding lottery, seasoned-equity offering, underwriter's ranking, industry as well as the stock exchange where IPO gets listed. The result has been adjusted by White Heteroskedasticity-Consistent Standard Errors & Covariance, and is displayed in Table [6].

The co-efficient of BKBD dummy for all three groups is positive and they are significant on 5% level for the full sample and SHSE sub-sample. On average, the under-pricing increased 41.815% after book-building for IPOs on Shanghai Stock Exchange and increased 33.2% for IPOs on both stock exchanges as a whole, which is quite significant increase. The finding is obviously against Hypothesis 1 that with the introduction of book-building, IPO under-pricing on China's A-stock market should have decreased.

The result is also inconsistent with empirical findings in past literatures. Ljungqvist, Jenkinson and Wilhelm (2003) found the sign of book-building dummy co-efficient negative though not significant. The same result from papers with China IPO data [Wang, He and Zhang (2006), Yang and Zhao (2006)]. In Yang and Zhao (2006), the coefficient of book-building dummy is even significantly positive.

The possible explanations for the unexpected result could be: 1) IPOs listed on Shanghai Stock Exchange since 2005 are mostly large blue-chip stocks in key industries. Because of their better quality (higher equity retained by government and controlling stockholders), they are well-received by public investors and there is overwhelming demand on the first-day of trading on secondary market; 2) In mid-2005, IPO listing was suspended in order to pave the way for stock-reform. Once the suspension was removed in mid-2006, the long-waited capitals for IPO on secondary market increase the under-pricing on Shanghai Stock Exchange. We can find evidence from Figure [1] that on SHSE, in 2005 when book-building was first introduced, the under-pricing was much lower. However, it dramatically increased from 2006; 3) In Table [5], the correlation between PREMKTRET and BKBD is 0.43, which indicates that after book-building, the market conditions shortly before IPO offering become higher. Therefore, such bull-market effect could have caused high under-pricing.

To prove the authenticity of my data and justify the above finding, I then reconducted the test on IPO sample until 2005 only, excluding data in 2006 and 2007. The co-efficient of book-building dummy now became significantly negative (not shown here), which is consistent with Hypothesis 1 and the past literatures with China's data.

Besides, I find some interesting results in Table [6] about the influence of other independent variables, which overall support the signaling and ex-ante uncertainty theory in Hypothesis 2 & 3 throughout the whole data period.

Firm quality proxies: STATOWN, LGTMPERF and NICAGR find some evidence of impact on under-pricing. More equity retained by government, higher aftermarket IPO return and net income growth rate are associated with higher market-adjusted initial return. For IPOs on Shenzhen Stock Exchange, equity ownership by government is not significant, probably because the majority of IPOs on SZSE are SMEs and are dominantly owned by private sectors, such effect on under-pricing is not obvious.

Among ex-ante uncertainty proxies, there's some evidence of impact from IPOSIZE and PE. Firms with smaller IPO proceeds and higher P/E ratio are considered to more speculative and associated with higher under-pricing. The significance of IPO proceeds on SZSE not significant however, probably because referring to Table [4] and Table [5], the proceeds of IPOs on SZSE are on average smaller and less volatile, and therefore has smaller explanation power.

Besides, some controlling variables like PREMKTRET, TIMELAG, LOTTODD as well as UNDWRI also show some significance for under-pricing. Strong market conditions pre-IPO offering, short time interval between IPO offer and list, lower lottery winning odds and more reputable underwriter lead to higher under-pricing. Industry and stock exchange factors are not significant.

5.2 Hypothesis 2—The signaling effect of high-quality firms

To test Hypothesis 2 and 3, I compare the significance of theory proxies before and after book-building. Table [7] displays the results on three groups: full sample, SHSE sub-sample and SZSE sub-sample. Results for pre-book-building include sample IPOs from 2001-2004 and results for post-book-building include IPOs from 2005-2007.

Hypothesis 2 assumes that the significance of signaling theory proxies significantly decrease post-book-building. Taking a look at the top-1/3 of Table [7], the significance of STATOWN for all three groups has decreased after book-building, though the change is not significant, which provides limited support for Hypothesis 2. Similar result has been reached by NICAGR, the net income growth rate of IPOs, except that its significance unexpectedly increased for SZSE sub-sample post-book-building. But such change however is also non-significant.

Perhaps the most controversial result comes from LGTMPERF, the long-term IPO stock performance after offering. For full sample and SZSE sub-sample, it becomes more significantly positive, while for SHSE sub-sample, its sign changes in just the opposite direction, becomes more significantly negative. This indicates that for IPOs on Shenzhen Stock Exchange, high IPO's long-term performance is significantly associated with high under-pricing, i.e. the signaling effect from high-quality firm becomes even stronger post-book-building, For IPOs on Shanghai Stock Exchange, the relationship could be the

other way around, high under-pricing IPOs causes low long-term stock return, a phenomenon that has received recognitions by numerous papers that IPOs with high initial return tend to under-perform in the long run [Beatty and Ritter (1986)]. From Table [6] we can find that the correlation between long-term stock performance and book-building dummy is -0.40, which further justify the above finding. Furthermore, in Table [6], correlation between market-adjusted initial return and book-building dummy is 0.22, and from Section 5.1 we learned that the under-pricing on SHSE significantly increases after book-building, which provides reasonable explanation for stock price of IPOs on SHSE to under-perform in the long run in post-book-building period.

Overall, I received limited support for Hypothesis 2 from the empirical study. The proxy of state-ownership and net income growth rate provides insignificant decrease in the significance of co-efficients. For IPOs on SZSE, the signaling effect becomes stronger post-book-building, based on the observation that the significance of LGTMPERF and NICAGR increases, which is against Hypothesis 2. The result also shows that on SHSE, IPOs after book-building that receive high first-day premium tend to under-perform in the long run.

5.3 Hypothesis 3—Ex-ante uncertainty effect of issuing firms

Hypothesis 3 assumes that ex-ante uncertainty effect will significantly decease after book-building. The result for Hypothesis 3 is displayed in the middle part of Table [7]. IPO proceeds (IPOSIZE) present itself as good proxy for ex-ante uncertainty, because its significance decreases for all three groups, especially significant for full sample and SHSE sub-sample. This provides strong support for Hypothesis 3 that firms with smaller IPO proceeds are perceived more risky and have significantly lead to high under-pricing, but such explanation power significantly decreases after book-building is introduced.

Meanwhile, P/E ratio provides limited support to Hypothesis 3. For full sample and SHSE sub-sample, PE is significantly positive to under-pricing, indicating that firms with high-P/E is regarded as more speculative and require higher under-pricing. The significance decreases post-book-building, though still strongly significant. Such change in significance, however, is not significant.

P/E ratio for IPOs on SZSE has a different story. Before book-building, the co-efficient is negative, but it changes to significantly positive post-book-building, and the change is significant. This means that ex-ante uncertainty effect for IPOs on SZSE represented by P/E ratio significantly increases, which is against Hypothesis 3. This could be because after book-building, SME Board is launched on SZSE and firms filing for IPO on SZSE are of high-P/E afterwards, the discount required by investors therefore is higher as compensation for running higher uncertain risks and intensified winners' curse problem.

In conclusion, Hypothesis 3 receives mixed approval. IPO proceeds provide strong support for Hypothesis 3 that the ex-ante uncertainty effect on under-pricing significantly dropped post-book-building, especially for IPOs on SHSE. P/E ratio provides limited support as the decrease in significance is not obvious. Ex-ante uncertainty effect for IPOs on SZSE presented by P/E actually increases significantly, which is against Hypothesis 3.

There's also significant change in control variables for the three groups before and after book-building. 1) TIMELAG, the time interval between offer day and listing day, become significantly more negative after book-building. This is probably because longer time interval from listing provides investors with more sufficient time to conduct analysis on the coming IPO and the secondary market initial return therefore decreases due to more rational investment strategy. 2) The impact of LOTTODD, proxy for imbalance of market demand and supply for IPO, significantly changed from positive to negative. From Table [5], I find that the correlation between odds of lottery and book-building dummy is 0.19, meaning that the odds increase after book-building, and the imbalance of supply and demand is eased after book-building. The increase of 1% in lottery odds significantly decreases under-pricing by 54.723% initial return in full sample. 3) The co-efficient of SEO integral variable becomes significantly negative after book-building for all three groups. Observing from Table [5], I find that correlation between SEO and BKBD dummy is 0.26, indicating that IPOs are more likely to issue seasoned-equity offering after book-building, probably because of the bull market conditions, and from the correlation of SEO and EXCH, I know that IPOs on SHSE are more likely to issue SEO than IPOs on SZSE. With more knowledge on issuing firms post-book-building and

knowing that these IPOs will probably have later equity offering, investors decide not to chase the initial offering and save for later investment.

5.4 Hypothesis 4—The effect of book-building information variables

To test Hypothesis 4, I added two more representative proxies to Model 1: the number of qualified institutional investors invited to conduct price consultation in book-building process (BKBDER) and the percentage range of IPO price bid by investors participating in price consultation (PRIRAN). I also added the percentage adjustment of offer price from the expected price implied in price range (PRIADJ) and the percentage adjustment of IPO size from the offer size disclosed in book-building (SIZEADJ). All the above variables are considered to have valuable information regarding book-building in China.

Model 2

$$MAR_i = \beta_0 + \beta_1 STATOWN_i + \beta_2 CONTROWN_i + \beta_3 LGTMPERF_i + \beta_4 EPS_i + \beta_5 ROE_i + \beta_6 NICAGR_i$$
$$+\beta_7 IPOSIZE_i + \beta_8 DE_i + \beta_9 AGE_i + \beta_{10} PE_i + \beta_{11} PREMKTRET_i + \beta_{12} TIMELAG_i + \beta_{13} LOTTODD_i$$
$$+\beta_{14} SEO_i + \beta_{15} UNDWRI_i + \beta_{16} BKBDER_i + \beta_{17} PRIRAN_i + \beta_{18} PRIADJ_i + \beta_{19} SIZEADJ_i + \varepsilon_i$$

The regression result of Model 2 is displayed in Table [8]. In all three groups, BKBDER has significant effect on under-pricing, but with opposite sign against Hypothesis 4 that more institutional investors involved in book-building should have increased the pricing accuracy and lowered under-pricing. The possible explanation could be that more institutional investors actually caused “information cascade” on the secondary market, which is a common phenomenon in China’s security markets. Public investors in China tend to observe the action taken by institutional investors, more institutions interested in book-building indicates the IPO is a “hot issue”. They then buy from the secondary market once the IPO get listed and drive up initial return. So the “herding behavior” dominate the information collection advantage of book-building,.

PRIRAN, however is not significant for all three groups, but the positive co-efficient in full sample and SZSE sub-sample shows limited support for Hypothesis 4 that large price range bid by institutional investors in preliminary book-building reflects

discrepancy among investors on the appropriate IPO value and high uncertainty regarding the issuing firm as well, so under-pricing should be higher.

PRIADJ has negative co-efficient for all three groups, and is significant for full sample and SZSE sub-sample, which is against the assumption that price adjustment is positively associated with under-pricing, based on Hanley (1993). From Figure [2], I observe the same trend on both stock exchanges that, on average, the under-pricing of negative price adjustment is higher than that of positive adjustment. The negative effect could be attributed to the over-reaction of underwriters in determining IPO price after book-building. Favorable bidding interests from investors in book-building may be regarded by underwriters as heated demand and they adjust the offer price higher than the expected level of preliminary price range. The buy-force on secondary market once the IPO gets listed, however, is not as high as expected, thus the under-pricing decreases. On the other hand, if negative demand information is received from book-building, the underwriters may worry that IPOs will not get enough demand from secondary market, and therefore adjust the price lower than expected. Public investors may consider the offer price cheap and under-pricing on first-trading day rises up.

SIZEADJ is only significantly positive for IPOs on SZSE, probably because on Shenzhen Stock Exchange, investors perceive negative adjustment in offer size (SIZEADJ only has non-positive values) as a signal of less confident in IPO from the issuer and underwriter. The interest of investment becomes lower and initial return of the IPO is low.

Therefore, Table [8] provides limited support for Hypothesis 4 from the price range in book-building. Large number of institutional investors may become a signal of “hot issue” to public investors and cause “herding behavior” that drives up the initial return on first-day of trading. Besides, underwriters tend to over-adjust on offer price after information collection from book-building. Offer size adjustment is a more sentiment factor to investors on SZSE, who may consider this as negative signal for bad-quality IPO and bid lower on first-trading day.

6 Conclusion

Book-building is regarded as an effective pricing method that causes lower under-pricing according to literatures and is adopted by the majority of world's primary markets. China therefore introduced book-building in IPO pricing process in January 1, 2005 in order to 1) increase the accuracy of pricing 2) increase the pricing capabilities of institutional investors. Whether or not the original objectives have been achieved, due to the limitation of data (IPO list was suspended from mid-2005 to mid-2006 to pave the way for stock-reform), there are not many empirical studies conducted so far to test the effectiveness of book-building in China. However, based on data until the end of 2005, domestic papers all agreed that book-building has reduced under-pricing and increased the pricing accuracy. This paper included more data since 2005 to find out if book-building has significantly decreased the extremely-high initial return of China's IPOs and apart from that, to further discover what change has book-building brought to factors that caused under-pricing before.

In this paper, there are 483 IPO samples collected from Tsinghua Financial Research Center from 2001 to 2007. The empirical test include three steps: 1) to test the significance of book-building period dummy on under-pricing 2) to compare the significance of variables on under-pricing before and after book-building 3) to find the effectiveness of information variables in book-building process on under-pricing.

The result shows that though under-pricing post book-building significantly decreased in 2005, it significantly increased in 2006 and 2007, probably because 1) since book-building, SHSE has more blue-chip IPOs that attract overwhelming bid from public investors; 2) demand for IPO certainly increased upon the removal of IPO suspension in 2006; 3) the year 2006 and 2007 have bull market conditions.

Then I tested the theories proved to have significantly explained under-pricing by literatures with China's IPO data: the signaling theory and ex-ante uncertainty theory. After comparing, there's limited support for the hypothesis that the signaling effect on under-pricing has been reduced after book-building from data of full sample and Shanghai Stock Exchange sub-sample. Another finding is that on Shanghai Stock Exchange, IPOs after book-building with high under-pricing will under-perform more in the long run. For the hypothesis that ex-ante uncertain effect on under-pricing has

significantly decreased after book-building, I received strong support from IPO proceeds proxy, limited support from P/E ratio. However, P/E ratio for Shenzhen Stock Exchange sub-sample indicates that the ex-ante effect significantly increases after book-building. This is probably because SME Board on Shenzhen Stock Exchange has been launched since book-building took effect and SME IPOs are of higher P/E and higher uncertainty.

Furthermore, I compiled four variables as proxy for the information value of book-building in China: the number of institutional investors involved in pricing consultation, the price range determined in preliminary book-building, the adjustment on offer price and offer size from the expected price and size disclosed in book-building. The result is against our hypothesis that more institutional investors increase pricing accuracy and reduce under-pricing. More institutional investors invited in book-building could be considered as signal of "hot issue" and leads to "herding behavior" on secondary market. Price range shows limited support for the hypothesis that larger range is evidence of higher under-pricing, because the positive co-efficient is not significant. Finally, another interesting finding is that underwriters tend to over-adjust IPO price after demand information is collected in book-building. Such over-adjustment caused under-pricing to increase when negative information is received in book-building and under-pricing to decrease when positive information is received.

In summary, I have received the following implications from the empirical studies in this paper:

1) Book-building pricing method introduced into China's primary market has not reduced under-pricing as expected; on the other hand, the under-pricing has significantly increased possibly due to other external effects.
2) Book-building has to some extent reduced the signaling and ex-ante uncertainty effect on under-pricing. That is probably because through the delivery of due diligence report to investors and two rounds of book-building, more information has been disclosed from the issuer-side that reduced the unnecessary price discount.
3) IPOs on Shanghai Stock Exchange after book-building that have higher initial return will significantly under-perform more than IPOs with lower initial returns. This is probably due to the overwhelming demand for blue-chip stocks and the removal of IPO listing suspension that drive up under-pricing dramatically in 2006

and 2007. In the long-run, those high-under-pricing stocks will return to its normal level.

4) Ex-ante uncertainty effect proxied by P/E ratio for IPOs on Shenzhen Stock Exchange significantly increase, probably because with the launch of SME Board, the majority of IPOs on SZSE are of small and medium-sized and from high-tech industry with higher P/E ratio. Investors consider them of high uncertainty that will intensify winner's curse problem, therefore require higher price discount.

5) Large number of institutional investors involved in book-building will easily be distorted as signal of "hot issue" and cause "herding behavior" that sarcastically increase under-pricing, as public investors on secondary market in China closely observe the actions from institutions. Besides, under-writers tend to over-adjust offer price based on the information collected from book-building.

Appendix 1 Definition of Variables

Variables	Definition	Sign
Dependent Variable:		
MAR	The percentage increase of IPO's first-trading day closing price from its offer price, adjusted by market index return in this same period.	
Independent Variables:		
STATOWN	Percentage of government or state-owned enterprise (SOE) ownership of IPO post offering	+
CONTROWN	Percentage of controlling stockholder ownership post offering	+
LGTMPERF	Market-adjusted cumulative return of IPO stock one year post offering	+
EPS	Historical weighted-average* earnings per share in last three years before IPO offering	+
ROE	Historical weighted-average return on equity in last three years before IPO offering	+
NICAGR	Compound Annual Growth Rate of Net income ** in last three years before offering	+
IPOSIZE	Logarithm of IPO proceeds	-
DE	Historical weighted-average D/E	+
AGE	Time between the date of IPO firm filing registration with China's Commerce Bureau and listing	-
PE	Offer Price/earnings per share before offering	+
PREMKTRET	Market index's cumulated return 30 days before offering	
TIMELAG	Lag of time between the date of IPO offering and listing	
LOTTODD	Odd of winning the lottery of online IPO allocation, equal to reciprocal of oversubscription ratio	
SEO	Dummy variable for seasoned equity offering post IPO offering	
UNDWRI	Underwriters' ranking in 2007	
IND	High-tech industry dummy: if IPO belongs to high-tech industry, IND=1; otherwise IND=0.	
EXCH	Exchange dummy: EXCH=1 if IPO is listed on Shanghai Stock Exchange, EXCH=0 if IPO is listed on Shenzhen Stock Exchange.	
BKBD	Book-building period dummy: if IPO listed before 2005, BKBD=0; otherwise, BKBD=1;	
BKBDER	Number of institutional investors participating in preliminary book-building where offer price range is settled.	
PRIRAN	Percentage of offer price range settled in preliminary book-building process.	
PRIADJ	Percentage adjustment of final offer price from the expected offer price (arithmetic average of high-end and low-end prices in price range) implied in preliminary book-building.	
SIZEADJ	Percentage adjustment of offer size from initial offer size disclosed before book-building.	

* The weight is determined by proportion of one-year. For example, the weight for half-year earnings data is 0.5.

** CAGR= $\left[\left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\frac{1}{\text{\# of years}}} \right]-1$

Appendix 2 Data Sources

Data	Components	Sources			
		Tsinghua Financial Research Center	SHSE/SZSE Exchange Websites	Prospectus/Book-building Result Announcement from www.cninfo.com.cn	RESSET
MAR	IPO offer price	√			
	IPO's closing price on first-trading day		√		
	Market-index closing price on IPO offer day				√
	Market-index closing price on IPO's first-trading day				√
STATOWN	Government or state-owned enterprises' equity ownership post-IPO			√	
CONTROWN	Controlling stockownership post-IPO			√	
LGTMPERF	IPO's stock closing price one year after offer		√		
	Market-index closing price one year after offer				√
EPS	Historical earnings per share for last three years before IPO			√	
ROE	Historical return on earnings for last three years before IPO			√	
NICAGR	Historical net earnings for last three years before IPO			√	
IPOSIZE	IPO proceeds	√			
DE	Historical debt and net equity for last three years before IPO			√	
AGE	The day of registration with the Commercial Bureau of China			√	
PE	Offer price over last-year earnings per share before IPO			√	
TIMELAG	IPO offer date and listing date	√			
PREMKTRET	Market-index closing price 30 days before IPO				√
	Market-index closing price the day before IPO				√
LOTTODD	Successful online lottery bidding rate			√	
SEO	Number of SEOs post-IPO		√		
UNDWRI*					
IND	Industry category	√			

* The source of underwriter ranking comes from Appendix 3

Appendix 3 Table of Underwriter Ranking

The table is downloaded from 2007 IPO and SEO Underwriter Ranking, www.confol.com (Zhong Jin Zai Xian). Because either the number of IPO underwritten or the capital raised in 2007 alone is too narrow to reflect the reputation of underwriter. So I multiplied their values in the last column and the category variable UNDWRI is determined by the multipliers. The top 5 underwriters have multiple values above 1000, and the next 12 underwriters' multiple value is above 100.

UNDWRI	No.	Underwriters	No. of IPOs	Total Capital Raised (RMB100 million)	No. of IPO × Total Capital Raised
0	1	中金公司	8	1256.23	10049.84
0	2	中信证券	10	747.44	7474.4
0	3	瑞银证券	5	539.04	2695.2
0	4	银河证券	3	546.49	1639.47
0	5	中银国际	5	310.72	1553.6
1	6	国信证券	16	60.45	967.2
1	7	海通证券	7	122.4	856.8
1	8	光大证券	10	56.44	564.4
1	9	中信建投	6	88.26	529.56
1	10	平安证券	12	39.82	477.84
1	11	高盛高华	2	150.27	300.54
1	12	广发证券	8	32.58	260.64
1	13	信达证券	1	193.5	193.5
1	14	国泰君安	2	59.37	118.74
1	15	华泰证券	5	23.7	118.5
1	16	招商证券	4	25.65	102.6
2	17	齐鲁证券	1	38.67	38.67
2	18	国金证券	4	9.5	38
2	19	联合证券	2	18.96	37.92
2	20	山西证券	3	10.76	32.28
2	21	第一创业	3	8.94	26.82
2	22	兴业证券	2	12.53	25.06
2	23	长城证券	1	23.1	23.1
2	24	南京证券	1	23.1	23.1
2	25	东吴证券	3	7.03	21.09
2	26	建银证券	3	6.74	20.22
2	27	国元证券	3	6.63	19.89
2	28	东方证券	2	8.12	16.24
2	29	西南证券	2	4.15	8.3
2	30	民族证券	2	3.83	7.66
2	31	信达资产	2	3.54	7.08
2	32	方正证券	2	3.44	6.88
2	33	东北证券	2	3.14	6.28
2	34	东莞证券	1	5.04	5.04
2	35	财富证券	1	3.45	3.45
2	36	渤海证券	1	2.91	2.91
2	37	宏源证券	1	2.74	2.74
2	38	东海证券	1	2.58	2.58
2	39	国海证券	1	2.49	2.49
2	40	广州证券	1	2.34	2.34
2	41	民生证券	1	1.64	1.64
2	42	新时代证券	1	1.41	1.41
2	43	首创证券	1	0.84	0.84
2	44	长江证券			0
2	45	申银万国			0
2	46	浙商证券			0
2	47	济南证券			0
2	48	恒泰证券			0
2	49	安信证券			0
2	50	太平洋证券			0
2	51	华龙证券			0
2	52	华欧国际			0
2	53	上海远东			0

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Table [1] Number of IPOs in China by Year of Issuing, 2001-2007

Table 1 is a summary of the number of IPOs used in the sample from 2001 to 2007. There are 483 sample IPOs on both Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE). The entire time period is further divided into two by the introduction of book-building pricing method: 1) the pre-book-building period: 2001-2004 2) the post-book-building period 2005-2007.

	Number of Sample IPOs		
	SHSE	**SZSE**	**Total**
2001	63		63
2002	69		69
2003	66		66
2004	59	39	98
Total Pre-Book-building	**257**	**39**	**296**
Percentage (%)	**86.82**	**13.18**	**100**
2005	3	12	15
2006	13	52	65
2007	19	88	107
Total Post-Book-building	**35**	**152**	**187**
Percentage (%)	**18.72**	**81.28**	**100**
Total	**292**	**192**	**483**
Percentage (%)	**60.33**	**39.67**	**100**

Table [2] Summary of Empirical Studies on China's IPO Under-pricing

Table 2 summarizes the empirical studies on China's under-pricing. There're normally two ways to measure under-pricing by the authors: initial return and market-adjusted initial return. Some empirical studies also cover B-stock market, where only foreign capitals are allowed to trade.

Author(s)	Time Period	Dataset	Under-pricing	
			Initial Return	Market-adjusted Initial Return
Mok and Hui (1998)	19 December, 1990 to 31 December, 1993	87 A-stock (SHSE) 22 B-stock (SHSE)		289% 26%
Su and Fleisher (1999)	1 January, 1987 to 31 December, 1995	308 A-stock	948.59%	
Liu (2003)	1 January, 1999 to 31 December, 2002	354 A-stock	135.01%	132.49%
Gu (2003)	1984-2000	478 A-stock (SHSE)	398%	
Chen et al. (2004)	1992-1997	734 A-stock 117 B-stock		298% 25%
Chan et al.(2004)	1993-1998	570 A-stock	178%	
	1995-1998	39 B-stock	11.6%	
Su (2004a)	1 January, 1994 to 31 December, 1999	348 A-stock	124.2%	
Su (2004b)	January, 1994 to December, 1999	587 A-stock	128.2%	
Chi and Padgett (2005)	1 January, 1996 to 31 December, 2000	668 A-stock		129.16%
Wang, He and Zhang (2006)	2004	97 A-stock	70.04%	70.28%
	2005	15 A-stock	45.12%	45.47%
Yang and Zhao (2006)	2005	15 A-stock		48.38%
Tian and Wang (2007)	November, 2001 to December, 2004	243 A-stock	90.68%	
	2005	15 A-stock	45.12%	
Deng and Dorfleitner (2008)	2002-2004	237 A-stock	88.67%	89.61%

Table [3] Average Initial Return and Market-adjusted Initial Return of China's IPOs by Year of Issuing and by Stock Exchange, 2001-2007

Table 3 displays the average under-pricing measured in both initial returns (IR): $\frac{P_1 - P_0}{P_0}$ and market-adjusted initial returns (MAR): $\frac{P_1}{P_0} - \frac{M_1}{M_0}$ on an annual basis. The time period is divided into pre-book-building (2001-2004) and post-book-building (2005-2007) on each stock exchange.

Shanghai Stock Exchange

		IR(%)				MAR(%)			
	No.	Mean	Median	Max.	Min.	Mean	Median	Max.	Min.
2001	63	140.60	123.33	413.79	0.74	140.58	122.49	416.22	0.18
2002	69	125.65	110.99	428.25	11.33	125.91	109.77	435.37	10.10
2003	66	71.84	64.00	227.99	10.73	71.89	64.35	226.81	10.78
2004	59	71.62	68.44	269.78	-5.24	72.02	67.10	269.78	-6.59
2001-2004	257	103.09	87.63	428.25	-5.24	103.87	88.29	430.15	-1.57
2005	3	74.75	78.97	133.86	11.43	76.30	80.43	134.27	14.22
2006	13	37.90	37.23	71.70	0.00	38.30	37.81	71.48	0.33
2007	19	105.20	93.16	214.59	32.25	105.60	91.59	214.18	33.69
2005-2007	35	77.59	70.81	214.59	0.00	71.24	67.25	206.37	-1.23
Total	292	100.04	86.41	428.25	-5.24	100.40	86.54	430.15	-1.57

Shenzhen Stock Exchange

		IR(%)				MAR(%)			
	No.	Mean	Median	Max.	Min.	Mean	Median	Max	Min.
2001-2004	39	68.28	52.22	324.89	-9.00	71.24	56.13	329.72	-5.54
2005	12	37.72	44.81	74.12	2.79	38.15	44.00	74.21	2.83
2006	52	97.85	86.74	345.71	-13.72	97.19	86.05	347.68	-12.60
2007	88	212.14	194.85	538.12	-2.95	211.56	194.01	540.23	-5.65
2005-2007	152	159.27	123.52	538.12	-13.72	156.14	123.16	488.88	-5.54
Total	191	140.69	104.93	538.12	-13.72	138.8	106.98	488.88	-5.54
Total	483	116.11	89.27	538.12	-13.72	115.52	90.18	488.88	-5.54

Table [4] Descriptive Statistics of Variables for IPOs in China's A-stock Market, 2001-2007

Table [4] compiles the descriptive statistics of variables used in the models of this paper, excluding those dummy and integral variables. The variables have been winsorized before compiling and are described respectively for IPOs on Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE).

	Full Sample						**Subsample_SHSE**						**Subsample_SZSE**					
	No.	Mean	Median	Max.	Min.	Std.	No.	Mean	Median	Maxi.	Min.	Std.	No.	Mean	Median	Maxi.	Min.	Std.
MAR	483	115.52	90.18	488.88	-5.54	92.54	292	100.40	86.54	430.15	-1.57	73.20	191	138.8	106.98	488.88	-5.54	112.17
STATOWN	483	32.47	34.45	82.29	0.00	28.78	292	43.08	53.36	84.65	0.00	26.45	191	16.24	0.00	79.08	0.00	24.30
CONTROWN	483	44.90	43.19	86.29	6.14	15.79	292	45.49	46.96	79.59	9.31	16.28	191	39.40	39.00	73.87	9.31	14.08
LGTMPERF	483	-32.05	-22.04	104.97	-248.18	53.89	292	-13.71	-18.37	99.44	-69.46	24.15	191	-60.10	-32.59	104.97	-248.18	71.87
EPS	467	0.36	0.36	14.25	0.02	0.77	286	0.37	0.31	2.62	0.08	0.31	181	0.51	0.45	1.39	0.15	0.22
ROE	470	19.72	20.06	60.81	1.22	9.01	287	19.51	17.84	58.21	4.71	9.69	183	23.42	22.78	49.67	6.81	7.10
NICAGR	482	30.04	22.31	269.52	-50.06	39.08	291	29.92	21.38	269.52	-50.06	43.27	191	30.24	25.35	162.73	-50.06	31.62
IPOSIZE	483	19.84	19.59	24.92	16.99	1.09	292	20.16	19.80	24.78	18.42	1.22	191	19.42	19.33	22.14	18.42	0.55
DE	482	55.56	57.72	104.37	10.11	13.79	292	56.84	57.98	98.19	14.08	14.45	190	55.64	57.01	93.96	14.08	13.29
AGE	483	4.35	3.78	104.32	0.08	3.33	292	4.65	3.47	18.96	0.22	3.25	191	5.22	4.70	17.96	0.08	3.29
PE	483	21.71	20.00	98.67	2.63	8.67	292	22.55	20.00	76.18	7.66	9.82	191	24.08	24.80	36.39	7.66	5.91
PREMKTRET	483	1.66	-0.54	29.20	-15.61	9.77	292	-0.45	-1.17	29.20	-15.61	6.67	191	4.88	3.97	29.20	-15.61	12.52
TIMELAG	483	18.61	15.00	87	7	6.72	292	17.98	15.00	56.00	7.00	7.71	191	14.72	15.00	24.00	7.00	3.35
LOTTODD	482	0.20	0.10	5.33	0.02	0.45	292	0.31	0.09	3.28	0.03	0.55	190	0.19	0.12	1.16	0.02	0.20
BKBDER	187	91.19	94	176	24	35.92	35	111.43	111	175	40	42.24	152	86.14	93	159	28	32.92
PRIRAN	187	107.09	100.73	299.11	33.33	41.45	35	6.35	4.06	22.81	0.90	5.56	152	7.90	6.95	26.98	1.70	4.86
PRIADJ	187	-7.27	-6.93	16.00	-35.12	11.53	35	-2.85	-1.69	16.00	-27.14	10.10	152	-8.04	-7.48	57.85	-38.74	12.71
SIZEADJ	187	-3.73	0.00	0.00	-41.00	8.96	35	-7.66	0.00	0.00	-39.39	13.37	152	-2.83	0.00	0.00	-41.00	7.37

Table [5] Correlation among Independent Variables, 2001-2007

Table [5] shows the correlations co-efficient of variables used in the models. MAR is the independent variable that represents market-adjusted initial return of IPO on its first day of listing. The rest are independent variables. All variables have been winsorized into 1-99 percentiles for more accuracy.

	MAR	STATOWN	CONTROWN	LGTMPERF	EPS	ROE	NICAGR	IPOSIZE	DE	AGE	PE	PREMKTRET	TIMELAG	LOTTODD	SEO	UNDWRI	IND	EXCH	BKBD
MAR	1.00	-0.08	-0.02	-0.03	-0.07	-0.07	0.05	-0.30	-0.06	0.02	0.29	0.31	-0.08	-0.20	-0.07	0.03	0.05	-0.21	0.22
STATOWN		1.00	0.50	0.20	-0.18	-0.35	-0.06	0.31	-0.01	-0.20	-0.06	-0.14	0.10	0.22	0.00	-0.13	-0.22	0.44	-0.21
CONTROWN			1.00	0.12	0.01	-0.07	0.01	0.20	-0.04	-0.30	-0.03	-0.03	0.11	0.14	0.07	-0.02	-0.17	0.18	-0.04
LGTMPERF				1.00	-0.08	-0.03	0.09	0.24	-0.04	-0.14	-0.02	-0.19	0.13	0.10	0.16	-0.12	-0.08	0.43	-0.40
EPS					1.00	0.62	0.03	-0.02	0.04	0.05	-0.13	0.06	-0.04	-0.07	-0.09	0.01	0.16	-0.24	0.20
ROE						1.00	0.05	-0.06	0.07	-0.15	-0.14	0.07	-0.02	-0.14	-0.02	0.04	0.24	-0.21	0.07
NICAGR							1.00	0.21	0.17	-0.04	0.01	0.07	-0.01	0.23	0.05	-0.13	0.03	-0.02	0.06
IPOSIZE								1.00	0.23	0.08	0.20	0.00	-0.01	0.72	-0.06	-0.48	-0.13	0.32	0.10
DE									1.00	0.07	0.09	0.05	-0.02	0.17	0.08	-0.12	-0.18	0.01	0.09
AGE										1.00	0.06	0.16	-0.10	0.04	-0.11	-0.13	-0.07	-0.10	0.21
PE											1.00	0.15	0.17	0.25	-0.11	-0.15	0.08	-0.10	0.29
PREMKTRET												1.00	-0.13	0.07	-0.14	-0.07	-0.02	-0.29	0.43
TIMELAG													1.00	0.08	0.03	0.03	0.01	0.24	-0.33
LOTTODD														1.00	-0.12	-0.37	-0.08	0.11	0.19
SEO															1.00	0.07	-0.05	0.22	-0.26
UNDWRI																1.00	0.01	-0.07	-0.20
IND																	1.00	-0.05	-0.03
EXCH																		1.00	-0.71
BKBD																			1.00

Table [6] Regression Result for the Effectiveness of Book-building

Table 6 shows the results of test on Hypothesis 1: under-pricing on China's A-stock IPO market should have decreased after the introduction of book-building. The regression is conducted on three groups: the full sample, sub-sample on SHSE and sub-sample on SZSE. The number of observations for each group has been adjusted for missing-value. T-statistic of each co-efficient is in parentheses. * represents 10% significance level, and ** represents 5% significant level. Adjusted-R Square is also provided.

Independent Variables	Full Sample	Subsample_SHSE	Subsample_SZSE
C	887.192** (6.846)	1023.858** (6.906)	101.648 (0.313)
STATOWN	0.311* (1.791)	0.364* (1.921)	0.265 (0.852)
CONTROWN	0.330 (1.226)	0.091 (0.311)	0.332 (0.668)
LGTMPERF	0.251** (2.791)	-0.179 (-1.079)	0.213* (1.954)
EPS	-16.430 (-1.166)	-14.440 (-1.045)	-20.119 (-0.400)
ROE	-0.033 (-0.063)	-0.519 (-1.172)	0.394 (0.196)
NICAGR	0.314** (3.315)	0.227** (2.735)	0.480* (1.925)
IPOSIZE	-43.014** (-6.293)	-47.846** (-6.401)	-5.987 (-0.349)
DE	-0.116 (-0.407)	-0.236 (-0.770)	-0.030 (-0.049)
AGE	-0.625 (0.505)	-0.743 (-0.596)	1.476 (0.644)
PE	3.628** (6.815)	2.673** (5.696)	7.217** (4.911)
PREMKTRET	2.175** (4.217)	1.856** (2.752)	2.330** (3.201)
TIMELAG	-1.315** (-2.179)	-0.378 (-0.669)	-2.532 (-1.206)
LOTTODD	-18.284* (-1.690)	6.670 (0.613)	-120.959** (-3.062)
SEO	-10.537 (-1.085)	0.253 (0.024)	-28.208 (-1.135)
UNDWRI	-10.634* (-1.789)	-11.536** (-2.084)	-4.980 (-0.332)
IND	-2.780 (0.269)	2.447 (0.221)	11.079 (0.545)
EXCH	17.160 (1.341)		
BKBD	33.200** (2.432)	41.815** (2.422)	11.640 (0.507)
No. of observations	462	285	177
Adjusted-R Square	0.34	0.34	0.35

Table [7] Comparison of the Significance of Explanatory Variables before and after Book-building

Table 7 displayed comparison results of theory proxies for Hypothesis 2 &3 on the group of full sample, SHSE sub-sample and SZSE sub-sample. Pre-book-building data include IPOs from 2001-2004. Post-book-building include IPOs from 2005-2007. The result of comparison is represented by P-value columns. Low level of P-value indicates significant change in the effect of coefficient after book-building is introduced. Because all IPOs on SHSE after book-building are from non-high-tech industry, I excluded IND to avoid multi-linearity. T-statistics are in parentheses under each co-efficient value. * represents 10% level of significance and ** represents 5% level of significance. Adjusted R-square is also provided for each regression.

	Full Sample			**Subsample_SHSE**			**Subsample_SZSE**		
	Pre-book-building	**Post-book-building**		**Pre-book-building**	**Post-book-building**		**Pre-book-building**	**Post-book-building**	
	Coefficient	Coefficient	P-value	Coefficient	Coefficient	P-value	Coefficient	Coefficient	P-value
C	1332.074** (8.013)	460.234* (1.947)	0.003	1428.311** (7.944)	216.359 (1.234)	0.000	845.656 (0.916)	144.385 (0.417)	0.354
STATOWN	0.323* (1.817)	0.196 (0.585)	0.737	0.390** (1.989)	0.272 (0.724)	0.738	-0.410 (-0.941)	0.289 (0.792)	0.159
CONTROWN	0.093 (0.347)	0.580 (1.194)	0.376	0.034 (0.116)	0.609 (0.845)	0.367	-0.242 (-0.170)	0.405 (0.708)	0.584
LGTMPERF	-0.091 (-0.542)	0.278** (2.682)	0.062	0.116 (0.586)	-0.500** (-3.690)	0.009	-0.365 (-0.736)	0.205* (1.782)	0.130
EPS	-1.143 (-0.080)	-41.605 (-1.041)	0.336	-5.204 (-0.342)	-18.542 (-0.726)	0.595	113.256 (0.821)	-20.786 (-0.393)	0.238
ROE	-0.954** (-2.262)	1.637 (0.822)	0.199	-0.697 (-1.536)	1.298 (0.946)	0.086	-2.329 (-0.704)	0.906 (0.371)	0.355
NICAGR	0.282** (3.057)	0.312* (1.705)	0.881	0.311** (3.223)	0.245* (1.970)	0.631	0.297 (0.423)	0.489* (1.884)	0.736
IPOSIZE	-65.487** (-7.606)	-16.651 (-1.350)	0.001	-68.770** (-7.637)	-6.140 (-0.706)	0.000	-43.532 (-0.912)	-7.741 (-0.424)	0.362
DE	0.035 (0.105)	-0.515 (-1.203)	0.312	-0.113 (-0.298)	-0.744* (-1.881)	0.207	-0.379 (-0.418)	-0.251 (-0.373)	0.894
AGE	-1.465 (-0.984)	1.862 (0.912)	0.187	-0.948 (-0.630)	1.046 (0.341)	0.481	-9.749 (-0.801)	1.775 (0.731)	0.206
PE	2.665** (4.955)	3.695** (4.427)	0.298	2.878** (5.248)	2.013** (3.401)	0.222	-2.365 (-0.613)	7.776** (4.823)	0.002
PREMKTRET	2.893** (4.180)	1.692** (2.671)	0.201	2.880** (4.033)	-0.846 (-1.034)	0..000	-2.986 (-0.590)	2.239** (3.008)	0.161
TIMELAG	-0.081 (-0.142)	-5.783** (-3.031)	0.004	-0.326 (-0.567)	-4.061 (-1.651)	0.062	9.816 (1.442)	-3.333 (-1.481)	0.016
LOTTODD	27.762* (1.896)	-54.723** (-3.108)	0.000	25.788* (1.845)	-31.245** (-3.100)	0.001	67.103 (0.715)	-154.871** (-4.105)	0.005
SEO	-0.075 (-0.008)	-114.258** (-6.780)	0.000	-2.031 (-0.203)	-54.773** (-2.781)	0.004	19.088 (0.418)	-85.278** (-4.042)	0.009
UNDWRI	-11.033** (-2.069)	-4.977 (-0.339)	0.696	-10.551* (-1.906)	0.305 (0.024)	0.340	-15.868 (-0.563)	-1.228 (-0.072)	0.588
IND	1.422 (0.147)	12.709 (0.610)	0.621	0.339 (0.033)			-7.308 (-0.217)	9.317 (0.415)	0.622
EXCH	26.183** (2.062)	-29.286 (-0.985)	0.084						
No. of obs.	280	182	462	251	34	285	29	148	177
Adj-R2	0.41	0.33	0.40	0.42	0.40	0.42	-0.24	0.34	0.35

Table [8] Regression Result on Information Variables in Book-building Process

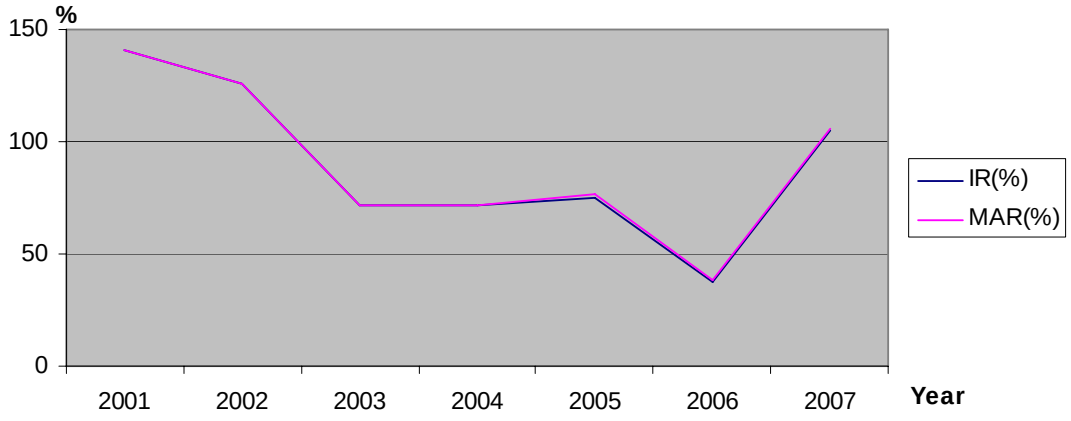
Table 8 has four more variables that reflect information value of book-building in China. The data period is post-book-building from 2005-2007 for better observation. Again, the high-tech industry dummy for SHSE sub-sample is excluded from the model. T-statistics are in parentheses and Adjusted R-square is provided for each regression.

Independent Variables	Full Sample	Subsample_SHSE	Subsample_SZSE
C	777.668** (3.166)	769.217** (3.164)	484.368 (1.271)
STATOWN	0.128 (0.429)	0.072 (0.127)	0.192 (0.579)
CONTROWN	0.738* (1.812)	1.642** (2.163)	0.537 (1.106)
LGTMPERF	-0.024 (-0.236)	-0.330* (-1.980)	-0.059 (-0.485)
EPS	-42.726 (-1.325)	-30.330 (-0.737)	-40.039 (-0.903)
ROE	1.347 (0.742)	1.063 (0.646)	1.608 (0.736)
NICAGR	0.054 (0.355)	0.234* (1.951)	0.033 (0.145)
IPOSIZE	-38.815** (-2.950)	-39.343** (-2.494)	-27.339 (-1.364)
DE	-0.136 (-0.335)	-0.434 (-1.648)	0.244 (0.389)
AGE	1.171 (0.620)	4.136 (1.256)	1.625 (0.683)
PE	1.510** (2.293)	1.310** (3.161)	2.953* (1.710)
PREIPORET	0.972 (1.626)	-1.036 (-1.399)	1.510** (2.100)
TIMELAG	-3.439** (-2.080)	-3.299 (-1.168)	-2.393 (-1.234)
LOTTODD	-20.835 (-1.258)	-5.821 (-0.283)	-113.373** (-3.624)
SEO	-43.575** (-2.155)	-28.685 (-0.791)	-39.525 (-1.602)
UNDWRI	-8.692 (-0.644)	-6.735 (-0.628)	-2.504 (-0.151)
IND	2.062 (0.099)		3.763 (0.171)
EXCH	24.256 (0.880)		
BKBDER	0.945** (3.192)	1.099** (3.481)	0.808** (2.042)
PRIRAN	0.098 (0.436)	-0.146 (-0.543)	0.214 (0.921)
PRIADJ	-2.604** (-3.454)	-0.223 (-0.316)	-2.556** (-3.609)
SIZEADJ	0.743 (1.450)	0.202 (0.302)	1.731** (2.128)
No. of observations	182	34	148
Adjusted-R Square	0.46	0.62	0.44

Figure [1] Average Initial Return and Market-adjusted Initial Return of IPOs

Figure 1(a) and (b) respectively compare average initial returns (IR) and market-adjusted initial returns (MAR) of sample IPOs on Shanghai Stock Exchange and Shenzhen Stock Exchange through 2001-2007. The values in the figures can be traced in Table [3].

(a) Shanghai Stock Exchange



(b) Shenzhen Stock Exchange

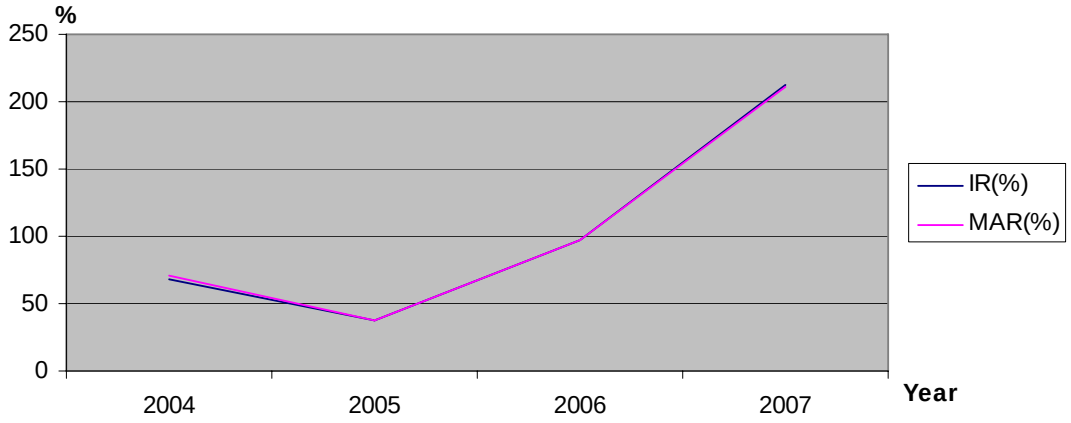


Figure [2] Average Initial Return of IPOs with Positive and Negative Offer Price Adjustment on Shanghai and Shenzhen Stock Exchanges

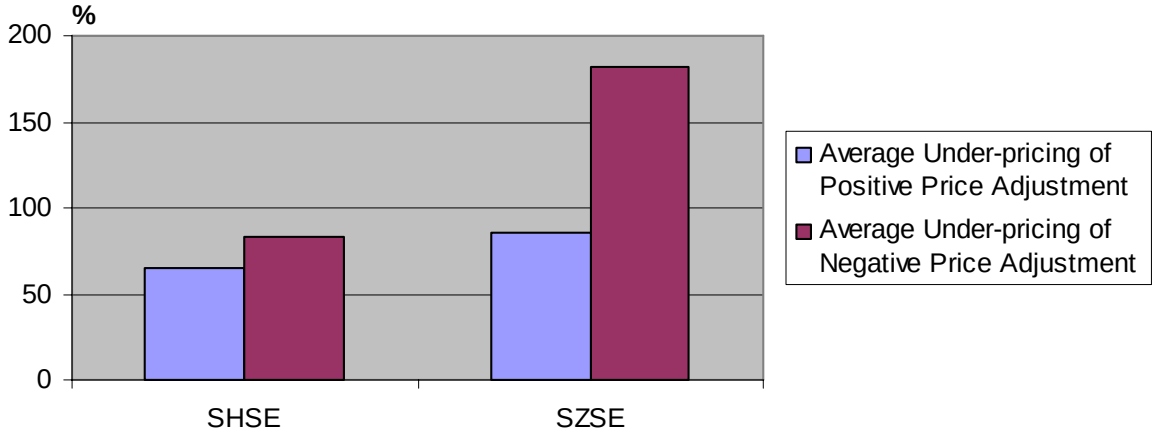



Figure 2 shows a rough relationship of price adjustment and under-pricing. Opposite to Hanley (2003)'s finding that initial return is significantly positively correlated with price adjustment, IPOs in China have lower average initial return when offer price is adjusted downward from preliminary expected price, the mid-value of highest and lowest price institutional investors bid in preliminary book-building.