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Abstract

The large underpricing in the Chinese IPO market has attracted much research attention. Despite many studies on the Chinese IPO underpricing, however, answers concerning the explanation of the underpricing in light of the classical IPO underpricing models, such as asymmetric information models, institutional explanations, and ownership and control, remain elusive. We attempt to shed light on this issue by examining some classical models of IPO underpricing for the Chinese market, especially some hypotheses not examined before. Using data from November 1995 to December 1998, our results show that the winner's curse hypothesis is the main reason for the high IPO underpricing in China. The signaling hypothesis and manager's strategic underpricing model do not stand in the Chinese market during the sample period.

Keywords:

IPO, signaling, strategic underpricing, winner's curse

JEL Classification:

G15, G20

1 Introduction

Much evidence suggests that initial public offerings (IPOs) of common stocks are systematically priced at a discount to their subsequent trading price. The large underpricing magnitude in the Chinese IPO market has attracted much attention. Mok and Hui (1998) report an underpricing of 289% for a sample of 87 Shanghai IPOs listed from 1990 to 1993.[1] Su and Fleisher (1999) find the underpricing level as high as 948.6% for A-share IPOs before January 1, 1996. A more updated report by Tian (2003) finds an average initial return of 267% for the IPOs from 1991 through 2000. These reported underpricing levels in the Chinese market are much higher than the average level of 60% in the emerging markets (Jenkinson and Ljungqvist, 2001). Despite many studies on the Chinese IPO underpricing, few studies have been done to investigate the reasons in light of classical IPO underpricing theories. Although previous studies such as Mok and Hui (1998), Su and Fleisher (1999), and Chau et al. (1999) have explored some reasons for the high IPO underpricing, most of the studies examine specific aspects that may affect IPO underpricing. For many markets, whether developed or emerging, IPO underpricing may be explained in terms of some classical IPO underpricing models such as asymmetric information models, institutional explanations, and ownership and control (see Jenkinson and Ljungqvist, 2001). Tests of the Chinese IPO underpricing against classical IPO underpricing models are, however, far from comprehensive. This paper attempts to shed some light on this and examine the classical models of IPO underpricing for the Chinese market using data from November 1995 to December 1998.

The classical IPO underpricing models examined in this study are the winner's curse model (Rock, 1986), ex ante uncertainty hypothesis (Ritter, 1984; Beatty and Ritter, 1986), signaling model (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989, 1996) and

[1] Underpricing is defined as the pricing of an IPO at less than its market value. A possible measure of the degree of underpricing is $(MV - P_0)/MV$, where P_0 is the offer price and MV is the firm's per-share market value on the offering date. Since MV is unknown on the offering date, many researchers use the initial return, $(P_1 - P_0)/P_0$, where P_1 is the first-day closing price, as a measure of underpricing. We shall adopt this terminology in this paper.

manager's strategic underpricing explanation (Aggarwal, Krigman and Womack, 2001). Among these models, the winner's curse model and the strategic underpricing model have not been examined before. The ex ante uncertainty hypothesis was tested by Mok and Hui (1998), but they tested only one proxy for ex ante uncertainty, i.e., the inverse of new funds raised. We consider 3 proxies–the standard deviation of after-market returns, the offer size and the age of firms, to examine the ex ante uncertainty hypothesis. In examining the signaling model, we test 4 key empirical implications of the signaling model, 3 of which have been examined in Su and Fleisher (1999), but the methodology adopted and the conclusion made are different.

Using data from November 1995 to December 1998, our results show that the winner's curse hypothesis is the main reason for the high IPO underpricing in China. The signaling hypothesis and manager's strategic underpricing model do not stand in the Chinese market during the sample period.

The rest of this paper is organized as follows. Section 2 provides a survey on the Chinese primary market and analyzes possible IPO underpricing models to be examined. Section 3 formulates the hypotheses to be examined and methodology adopted. Section 4 describes the data and reports the empirical results. Section 5 summarizes and concludes.

2 The Chinese Primary Market and Previous Studies

In this section we describe the institutional features of the IPO market in China, and survey research on this area. The hypotheses about IPO underpricing with respect to the China market will be summarized.

2.1 Features of the Chinese Primary Market

The IPO decision in China is made on the basis of political considerations as well as profitability considerations. Every year, the Chinese authorities (the State Planning Committee, the Central Bank, and the China Securities Regulatory Commission) determine the total number

of issues allowed and the firms that can make issues.[2] Next, each province is allocated a sub-quota. Within each regional quota, the local security regulatory authorities invite enterprises to apply for listing and make selections based on some criteria (Yau and Steele, 2000). Once approval for an issue has been obtained an investment syndicate is formed to draw up a detailed plan. Securities companies then perform the standard services of providing advice, underwriting and distributing shares to the public, as well as developing a secondary market.

Going public is also a process of privatization for the state owned enterprises (SOEs) in China. The Chinese government introduces 5 major categories of shares to allow the ownership of the state-owned enterprises to be dispersed among the government itself, state-owned enterprises, firm's own employees, domestic public and foreign investors. These are: (1) State shares, which are owned by the state and its various ministries, bureaus and regional governments. They are not tradable; (2) Legal entity shares, which can only be held by SEOs and/or the foreign partners of a corporatized joint venture. These shares are highly illiquid. They cannot be listed in the two official exchanges (Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE)); (3) Employee shares, which are shares issued by the listed companies and offered to managers and employees prior to offerings to the public; (4) Ordinary domestic shares or *A*-shares designated only for private Chinese citizens and traded on SHSE and SZSE; and (5) Foreign shares, which are designated only for foreign investors and are to be traded on security exchanges in China (B shares), Hong Kong (H shares) or New York (N shares). [3]

The share offering mechanism in China has gone through several stages of reforms. The most commonly used method after 1995, however, is the online fixed price offering method called 'Shang Wang Ding Jia'. This online fixed price offering method was first introduced in 1994, in which investors bid for fixed quantities, with pro-rata allocation in the event of over-subscription. Investors need to pay a full subscription deposit, with repayment for unsuccessful

[2] The quota control policy was changed in 2001 when the local government or the ministries recommend issuing firms to CSRC for approval.
[3] The B-share market has been opened to the domestic residents since 19 February 2001.

applications around 1 week after subscription. It has become the major offering method from 1996 to 2002.

The offer price in the online fixed price offering is chosen according to the formula of taking the after tax profits per share multiplied by a price earning ratio (PE), the latter being set in relation to the price earnings ratios of listed companies in the same locality and industry. However, The PE ratio changes in accordance with the guidance of the CSRC (China Securities Regulatory Commission). The CSRC often imposes a ceiling on the PE ratio, which prevents prices from being set in relation to an individual firm's characteristics and growth potential. Moreover, the ceiling changed over time. Before 1999, the ceiling was fixed at 15. In January 1999, the ceiling restriction was loosened and the PE ratio used in IPO pricing is raised to as high as 50. In 2002 a ceiling of 20 was re-imposed. In case of oversubscription investors are essentially chosen by balloting. The ballot ratio is determined by the number of shares publicly offered and the number of shares investors subscribed.

In China, almost all IPOs are oversubscribed due to an extremely high demand relative to its limited supply of new issues. Before the emergence of stock markets, Chinese households had access to very limited number of investment instruments, mainly savings deposits at relatively low interest rates. At the same time, China's household savings rate, at about 40% of total disposable income, is one of the world's highest. On the other hand, the aggregate value of new shares to be issued is limited by the national investment and credit plan. Therefore, there has been a persistent demand for new shares in China.

It is also noteworthy that seasoned equity offerings (SEOs) are frequently observed among Chinese issuers and that SEOs account for a substantial portion of shares issued. About 91% of the Chinese firms that went public before 1 July 1994 issued seasoned equities before 1 January 1996 (Su and Fleisher, 1999).

Another characteristic of the Chinese stock market related to this study is that the accounting report and market regulatory system in China are relatively primitive and incomplete (Aharony et al., 2000; Xiang, 1998). The auditing standards in the Chinese stock market are generally perceived to be low (Aharony et al., 2000). There is far less corporate disclosure in China than in the developed markets. Private investors' major source of information is the IPO prospectuses, which unfortunately are not reliable under the existing accounting and auditing standard. This causes difficulties for individual investors in evaluating an IPO before investing. Therefore, investors lack information about the true quality of the firm going public and there are big ex ante uncertainties about the issuing firm's value.

2.2 Prior Studies of the Chinese IPO Underpricing

Table 1 presents a summary of some studies on the underpricing of the Chinese IPO market. Using different data sets, these studies report that the mean initial returns range from 127% to 949% and present a number of determinants of underpricing, including time gap, offering size, issuer's fractional ownership, etc. Most of the studies examine only specific determining factors instead of testing the classical IPO underpricing hypotheses in a comprehensive way. Mok and Hui (1998) find that the high equity retention by the state, a long time-lag between offering and listing and ex ante risk of new issues were key determinants of IPO underpricing. Su and Fleisher (1999) examine the signaling model comprehensively and find that the Chinese IPO underpricing is a strategy for firms to signal their value to investors. They also investigate the effects of the offering mechanism on IPO underpricing and find that IPO underpricing is the largest under the lottery system with a fixed number of lottery forms and is the smallest under the auction mechanism. A more recent study by Tian (2003) argues that the listing quota and pricing caps imposed by the government are major determinants of IPO underpricing.

2.3 Possible Explanations for the Chinese *A*-share IPO Underpricing

In trying to explain why firms are floated at too low a price, researchers have produced a large theoretical and empirical literature. Jenkinson and Ljunqvist (2001) sum up most of the

studies on IPO underpricing. The classical IPO underpricing models can be divided into 3 categories: asymmetric information models, institutional explanations, and ownership and control. Different models explain different situations in different countries. Some models are not possible explanations for IPO underpricing in a particular country because of the country's stock market characteristics. The Chinese stock market characteristics determine that some IPO underpricing models do not apply in China, but the characteristics do provide a unique situation where certain models can be examined as well.

As shown above, the major offering mechanism in China does not have any pricing or rationing bias. This suggests that the ownership and control explanation will not apply since these two models need rationing discrimination as means to realize the control ends.

In the Chinese IPO market, there is no book building mechanism until 2001. Therefore, information revelation cannot possibly explain the high level of underpricing, at least not before 2001. The lawsuit idea is a US-centric model. China did not have a complete securities law in force until July 1999; the risk of being sued is not economically significant. Therefore, the lawsuit hypothesis does not apply here. Price support is prohibited in the Chinese stock market; neither can price support underpricing explain the Chinese IPO underpricing.

As to the principal-agent hypothesis, on one hand underwriters do not have much market power to seek the information rent because of the competition in the Chinese underwriting line; on the other hand it is not a problem for underwriters to place all available stocks with investors due to the extremely high demand. Therefore, without rent seeking or moral hazard problems, the principal-agent model cannot possibly explain the Chinese IPO underpricing.

The winner's curse problem is a possible explanation for the Chinese IPO underpricing. There are mainly two types of investors in the Chinese stock market: individual investors and institutional investors. The vast majority of investors in the Chinese market are individuals who can be regarded as uninformed investors, while the small portion of institutional investors may

function as informed investors. Rock's winner's curse model is examined only in countries where there are data on allocation rates (Koh and Walter, 1989; Levis, 1990; Keloharju, 1993; Amihud et al., 2003). In the Chinese market, the allocation-rate data are available. Indeed, in the China market all applications of different sizes have equal probability of being accepted and the probability (ballot ratio) is publicly announced after the IPOs. This feature enables us to examine the adverse selection model in the Chinese market.

Due to weakness in disclosure and auditing standards, investors lack information about the true quality of the firm going public. A relatively high degree of investor uncertainty affects the IPO pricing. The winner's curse model, the signaling model and principal-agent model all suggest a positive correlation between ex ante uncertainty and underpricing. The winner's curse model explains that an investor who decides to engage in information production implicitly invests in a call option on the IPO, which she will exercise if the 'true' price exceeds the strike price, the price at which the shares are offered to the public. The value of this option increases with valuation uncertainty, so more investors will become informed. This raises the required underpricing, since an increase in the number of informed traders aggravates the winner's curse problem. The signaling model says that a noisier environment increases the extent of underpricing that is necessary to achieve separation. The principal-agent model implies the same because the more uncertain the value of the firm, the greater the asymmetry of information between issuer and underwriter, and thus the more valuable the underwriter's services become, resulting in greater underpricing (Jenkinson and Ljunqvist, 2001). Mok and Hui (1998) argue that proxies for ex ante uncertainty explains the pattern of *A*-share IPO returns for a sample of 87 Shanghai firms that went public during the years 1990-1993. Thus ex ante uncertainty could also be one of the main reasons for Chinese IPO underpricing.

The high degree of investor uncertainty means that the information asymmetry between the investors and the issuers is high. This provides incentives for good quality issuers to underprice in order to signal their firm value. Moreover the frequent observation of SEOs among Chinese

issuers also suggests that signaling may be a good explanation for underpricing. Su and Fleisher (1999) find that the signaling hypothesis explains the pattern of underpricing behavior among Chinese issuers rather well. Mok and Hui (1998) also find a positive relationship between the issuer's ownership and IPO underpricing in support of the signaling hypothesis.

Aggarwal et al. (2001) propose underpricing as an agency cost to issuers, where managers strategically underprice new issues to maximize their own expected shareholding value at the lock up expiration. Managers underprice to create an information momentum, which shifts the demand curve for a firm's stock outwards. This generates higher prices at the lockup expiration, when managers have their first opportunity to sell shares. As a result, managers accept substantial underpricing in order to maximize their personal wealth. Manager's strategic underpricing may be an interesting hypothesis to investigate in the Chinese market. However, due to the lack of data for media coverage, only a preliminary test will be performed. Further examination will be a topic for future research.

In this study we focus on examining 4 possible models, namely, the winner's curse model, the ex ante uncertainty explanation, the signaling model and the managers' strategic underpricing explanation. Among these the winner's curse model and the strategic underpricing model have not been tested before for the Chinese market. We shall test the ex ante uncertainty hypothesis using more proxies than in Mok and Hui (1998), and the overlapping implications from the 3 alternative explanations will be investigated. Finally, the signaling model will be examined with a different methodology from that of Su and Fleisher (1999).

3 Hypotheses and Methodology

We now summarize the hypotheses of the IPO underpricing in the China market, and discuss the methodology for testing these hypotheses.

3.1 The Winner's Curse Model

Rock's (1986) asymmetric information model assumes that there are two groups of potential investors in the IPO markets: 'informed' and 'uninformed' investors. Informed investors bid

only for attractively priced IPOs; 'uninformed' investors apply for every new issue coming into the market indiscriminately. Thus, uninformed investors face competition for good shares, but have a higher probability of obtaining bad shares due to the rationing mechanism applied to oversubscribed offerings. Rock argues that the bias in rationing produces an equilibrium offer price with a finite discount sufficient to attract uninformed investors to the issue. Implicit in the winner's curse model is the notion that, if properly adjusted for rationing and risk uninformed investors' initial returns should be on average equal to the riskless rate, which is just enough to ensure their continued participation in the market.

***H*$_1$:** *After ration-adjustment, uninformed investors earn the riskless rate.*

We assume that uninformed investors subscribe a fixed amount of shares for each and every IPO. Thus their allocation-weighted initial return, AWIR, is given by[4]

$$AWIR = \left(\frac{P_1 - P_0}{P_0} \right) BALLOT - \left(\frac{I_1 - I_0}{I_0} \right) \tag{1}$$

where P_1 is the closing price on the first day of trading, P_0 is the IPO offer price, *BALLOT* is the ballot ratio used in lottery, and $(I_1 - I_0)/I_0$ is the *A*-share composite index return from the IPO date to first trading date in the corresponding stock exchange, which is used as the proxy for the riskless rate. I_1 is the closing price of the *A*-share composite index on the first trading date and I_0 is the closing price of the *A*-share composite index on the IPO date. Hypothesis ***H*$_1$** states that *AWIR* is approximately equal to the riskless rate of interest.

Rock's winner's curse model also implies a negative correlation between initial returns and allocations to investors. Since informed investors avoid overpriced IPOs, uninformed investors receive larger allocation of shares on which they earn low or negative returns, and smaller

[4] In the fixed-price offering, unsuccessful parts of application deposit are refunded around one week after the IPO subscription date. However, since the interest rate is extremely low in the Chinese market (average one-week interest rate in the study period is close to zero, 0.039%) and there are few other investment opportunities, we treat the application deposit as frozen until the first trading date.

allocations in underpriced IPOs. Thus, the joint participation by both informed and uninformed investors in underpriced IPOs makes the demand for underpriced IPOs high, and allocation rate low. Our second hypothesis for Rock's model pertains to the relation between underpricing and the allocation rate.

H_2: *IPO initial returns are inversely correlated with allocations to investors.*

This relationship can be examined by the following simple linear regression

$$IR = \beta_0 + \beta_1 BALLOTT + \varepsilon \tag{2}$$

where *IR* is the initial returns and *BALLOTT* is the logistic transformation of the ballot ratio:[5]

$$BALLOTT = \log(BALLOT + \alpha)/(1 - BALLOT + \alpha) \tag{3}$$

The logistic transformation is used here to accommodate the cases where *BALLOT* is practically 0 or 1. We expect β_1 in equation (2) to be negative and significant.

3.2 Ex ante Uncertainty

Another key empirical implication of the winner's curse model, pointed out by Ritter (1984) and formalized in Beatty and Ritter (1986), is that underpricing should increase in the ex ante uncertainty surrounding an issue. The underpinning is that higher uncertainty leads to proportionally more informed investors, which deteriorates the winner's curse problem. Other testable implications of the winner's curse model are basically elicited from this relation between ex ante uncertainty and underpricing. For example, Carter and Manaster (1990), Johnson and Miller (1988), James and Wier (1990) and many other researchers tested the relation between the underwriter's reputation and initial returns as evidence of adverse selection. It is argued that more prestigious underwriters can reduce the informational asymmetry and thereby cut the underpricing cost. Another explanation is that hot issue periods are characterized by a higher level of ex ante uncertainty, necessitating higher underpricing (Ritter, 1984). However, these relationships are not unique to the winner's curse model. As discussed in

[5] We use the same transformation as Amihud et al. (2003), where α = 0.5/T with *T* being the sample size.

section 2, the principal-agent and signaling models imply similar results. Therefore, we will test the ex ante uncertainty explanation separately.

Researchers have used the variance of the after-market returns of IPOs (Ritter, 1984, 1987; Clarkson and Merkley,1994), the age of the firm at the time of offering (Ritter, 1984, 1991; Megginson and Weiss, 1991), the offer size (Beatty and Ritter, 1986; McGuinness, 1992) and the underwriter's reputation (Carter and Manaster, 1990; Johnson and Miller, 1988; James and Wier, 1990) as proxies for measuring the ex ante uncertainty of the IPOs. We are not going to use underwriter's reputation as a proxy in this study because the Chinese *A*-share issues are underwritten by domestic state-owned security companies and there are no prestigious financial institutions with international reputations involved. The other 3 proxies for ex ante uncertainties predict that the larger the variance of the after-market returns of the IPOs, the younger the age of the issuing firms and the smaller the offering size, the higher the uncertainty about the value of IPO firms and therefore the more underpriced the corresponding IPOs. Thus we expect:

H_3: *The standard deviation of the after-market returns of the IPOs is positively related to IPO underpricing.*

H_4: *The offer size of the firm is inversely related to IPO underpricing*.

H_5: *The age of the firm is inversely related to IPO underpricing*.

We use multiple linear regression model to examine the explanatory power of ex ante uncertainty and control for other well-known determinants of IPO underpricing. The dependent variable is the market-adjusted initial return. The proxies for ex ante uncertainty are SD, AGE and IPOSZ, where SD is the standard deviation of returns over days 1 to 100 after IPO, AGE is the age of a firm in years from the establishment date to the date of IPO, and IPOSZ is the number of shares offered at the IPO times the IPO offer price.

Other variables that may affect the level of ex ante uncertainty are also controlled for. The first one is the market return before IPO. There has been overwhelming evidence that

underpricing is higher in buoyant stock markets (Davis and Yeomans, 1976 (UK), Reilly, 1977 (USA), and McGuiness, 1992 (Hong Kong)). To test if the Chinese IPOs are more heavily underpriced when the market is performing well, we use BFMARTN, the percentage change in the *A*-share composite index 3 months prior to the issue, as one of the explanatory variables. Another control variable is the issuers' fractional ownership. In an emerging market with high information asymmetry, the domestic investors interpret a high percentage of equity retention by the state as government confidence and business guaranty. That is, high equity retention by the state lowers the ex ante uncertainty (Mok and Hui, 1998). OWNSHP is the proportion of shares owned by the government, legal entities and employees after the IPOs. The time gap elapsed between the IPO date and the first trading date can also affect the level of ex ante uncertainty. Chowdry and Sherman (1996) demonstrate that an increasing lag between the fixing of the offer price and the beginning of trading results in bigger ex ante uncertainty and more IPO underpricing. Mok and Hui (1998) and Su and Fleisher (1999) report a very large time gap between offering and listing in the Chinese market. Therefore, we add time lag from IPO date to the first trading date, LAG, as one of the independent variables. Other control variables include year dummies, industry dummies and the exchange dummy. Thus, we consider the following regression:

$$IR = \beta_0 + \beta_1 SD + \beta_2 \ln AGE + \beta_3 \ln IPOSZ + \beta_4 BFMARTN + \beta_5 OWNSHP + \beta_6 LAG + \beta_7 Y96 + \beta_8 Y97 + \beta_9 IN2 + \beta_{10} IN3 + \beta_{11} IN4 + \beta_{12} IN6 + \beta_{13} STKCDSH + \varepsilon \quad (4)$$

where the last 7 explanatory variables are dummy variables defined as below:

Year: *Y*96 equals to 1 for IPOs in 1996 (including 1 IPO in November and 1 in December 1995), *Y97* are IPOs in 1997, and *Y98* are IPOs in 1998.

Industry: *IN*2 utilities, *IN*3 properties, *IN*4 conglomerates, *IN*5 industry, *IN*6 commerce

Exchange: *STKCDSH* is a dummy for IPOs listed on the SHSE

STKCDSZ is a dummy for IPOs listed on the SZSE.

If $\boldsymbol{H_3}$, $\boldsymbol{H_4}$ and $\boldsymbol{H_5}$ hold, we expect β_1 to be positive, and β_2 and β_3 to be negative. If the ex ante uncertainty hypothesis stands, we expect β_4, β_5 and β_6 to be positive.

3.3 Manager's Strategic Underpricing

In China, the lockup periods for employee shares are typically 6 months or 3 years. If managers were to use information momentum to maximize the stock price upon expiration of lockups, the lockup period cannot be too long. As there would be too much uncertainty for managers during the 3-year lockup period, the information momentum strategy would not work. We assume that only managers of issuing firms with a 6-month lockup period are likely to adopt this strategy. Therefore, if managers' strategic underpricing exists, we would expect a higher underpricing for IPOs with a 6-month lockup period than those with 3 years. Two more dummy variables, *LCK6MON* and *NOLCK*, are added to equation (4) to examine preliminarily the strategic underpricing.

$$\begin{aligned} IR = {} & \beta_0 + \beta_1 SD + \beta_2 \ln AGE + \beta_3 \ln IPOSZ + \beta_4 BFMARTN + \beta_5 OWNSHP \\ & + \beta_6 LAG + \beta_7 y96 + \beta_8 y97 + \beta_9 IN2 + \beta_{10} IN3 + \beta_{11} IN4 + \beta_{12} IN6 \\ & + \beta_{13} STKCDSH + \beta_{14} LCK6MON + \beta_{15} NOLCK + \varepsilon \end{aligned} \tag{5}$$

where *LCK6MON* equals to 1 if the employee share lockup period is 6 months and zero otherwise; *NOLCK* equals to 1 if no data available for employee share lockup period and zero otherwise. If managers in China do underprice to maximize their personal wealth upon the lock-up expiration, we expect a positive β_{14}.

3.3 The Signaling Model

The signaling model assumes that the issuer has better information on securities value than the underwriters or investors. If the issuing firm is better informed about the present value and the risk of its future cash flows than the investors or underwriters, underpricing may become a means of convincing potential buyers of the "true" high value of the firm, i.e., underpricing is a signal for firm quality. Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989, 1996) contribute theories of this underpricing signaling model. They hypothesize that

underpricing allows "good" firms to distinguish themselves from "bad" firms and to improve the terms of future external financing. Under this assumption, good quality issuers are assumed to maximize the expected proceeds of a two-stage sale: they sell a fraction of the firm at flotation and the remainder in a SEO. In the words of Ibbotson (1975), issuers underprice in order to "leave a good taste in investors' mouths". With a positive probability, a firm's true type is revealed before the post-IPO financing stage, introducing the risk to low-quality issuers that any cheating on their part will be detected before they can reap the benefit from the signal. This makes separation possible. Signaling true value is beneficial to a high-value company as it allows a higher price to be fetched at the second-stage sale if separation is achieved. Therefore, the signaling model leads to the empirical predictions:

***H_6**: Firms with more underpriced IPOs are more likely to issue seasoned equity than firms with less underpriced IPOs*

A direct implication of the signaling model is that, in their eagerness to capitalize on the favorable news, high-quality firms will return to the capital market as soon as the opportunity comes, and to maximize the benefit. Thus, high-quality firms are more likely to reissue.

***H_7**: Firms with more underpriced IPOs are likely to issue seasoned equity more promptly than firms with less underpriced IPOs*

The intuition behind is that it is more costly for high quality firms to defer their investments in new projects than for firms of low quality.

The signaling model implies empirically a positive association between underpricing and the success of the SEO. The success of SEO can be measured in terms of the SEO size relative to its IPO size and the market reaction to the seasoned issue. This leads to our hypotheses 8 and 9.

***H_8**: Firms with more underpriced IPOs are likely to issue larger amount of seasoned equity than firms with less underpriced IPOs*

H_9: *Firms with more underpriced IPOs are likely to experience a less unfavorable price reaction to SEO announcement than firms with less underpriced IPOs*

Hypothesis ***H_9*** follows from the notion that firms with higher IPO underpricing are more likely to return with seasoned equity issue and hence investors are more prepared for or less surprised by their SEOs.

There is, however, an alternative explanation for the existence of the above relations between IPO underpricing and SEO activity. In fact, the market feedback hypothesis posits that the market is better informed than the issuer and hence a high return on the IPO date implies that the issuer has underestimated the marginal return to the project. The issuer uses this information and increases the scale of the project by raising additional capital through seasoned offerings. The abnormal share price changes during the after-market period should have the same effect on future equity issues as price changes on the issue date. The issuers can adjust their seasoned equity offering strategies by looking at the after-market stock performance. To explore whether the relations between IPO underpricing and SEO activity can be explained by market feedback hypotheses, we examine whether the returns in 400 trading days after the IPOs, *AFTRTN*, are related to subsequent offerings. We choose a 400-day post-IPO window to measure the after-market returns because the cross-sectional standard deviation of the after-market returns in the 400-day window is about the same as the cross-sectional standard deviation of the IPO date returns, which suggests that the same amount of information is revealed to the market during these two periods. This follows the suggestions by Jegadeesh (1993), whereas Su and Fleisher (1999) use only 10-day after-market returns to test the market feedback hypothesis. As there is comparatively too little information revealed in such a short time than that revealed on the initial trading date, it is not appropriate to compare the effect of the two variables on SEO activities. Following Jegadeesh et al. (1993), we test ***H_6*** using a logit model:

$$\ln\left[P^{seo}/(1-p^{seo})\right] = \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon \quad (6)$$

where P^{seo} is the probability that a firm issues seasoned equity after the initial offering. The first two independent variables are market-adjusted initial return (underpricing) and the after-market abnormal return over the period from trading day 1 to trading day 400 after the IPO date. The after-market abnormal return equals to market-adjusted return over the same period. Since firms with a small IPO size are more likely to come to seasoned equity offering, we include the natural logarithm of the IPO size as an additional explanatory variable. Finally, we also control for potential differences in SEO activity across years, industries and exchanges. We expect a positive β_1 if $\boldsymbol{H_6}$ is true and a positive β_2 if market feedback hypothesis is true.

To examine the relationship between the time elapsed between IPO and SEO, *TIMESEO*, and IPO underpricing, we use a tobit model with right censoring. For firms with no SEOs over the years from 1996 through 2001, we assume that the time it takes for their re-issuance is infinity. For firms that issue their first SEOs during that period, the maximum time elapsed between IPO and SEO in our sample is 1394 days. Therefore, we take ln(1400) as the right censoring value. The explanatory variables are the same as those in the previous logit model. Su and Fleisher also use a tobit model to test the same hypothesis. But for IPOs with no seasoned equity offerings, they take *TIMESEO* value as zero and use a left censoring test, which is inaccurate. We consider the model

$$\ln TIMESEO = \begin{cases} \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \\ \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon & if \quad RHS < \ln 1400 \\ \infty & otherwise \end{cases} \quad (7)$$

We expect a negative β_1 if $\boldsymbol{H_7}$ is true and a negative β_2 if market feedback hypothesis is true.

To test $\boldsymbol{H_8}$ we use a tobit model similar to Jegadeesh et al. (1993). The tobit model specifies the relation between the relative size of seasoned offering and the explanatory variables as follows:

$$SEOSZ / IPOSZ = \begin{cases} \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 + \beta_7 IN3 + \\ \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \varepsilon & if \quad RHS > 0 \\ 0 & otherwise \end{cases} \tag{8}$$

where *SEOSZ* is the number of shares offered at the first SEO times the SEO price, and *SEOSZ/IPOSZ* is the relative size of the SEO. The independent variables are the same as those in the logit model. Similarly, we expect a positive β_1 if $\boldsymbol{H_6}$ is true and a positive β_2 if the market feedback hypothesis holds.

To examine the excess return around the date when the firm announces its SEO, we estimate the excess return, *REACT*, over the event days −1 through +4, where day 0 is the SEO announcement date. *REACT* equals to $[(P_4 - P_{-1})/P_{-1}] - [(I_4 - I_{-1})/I_{-1}]$, where P_4 is the 4th day closing price of the stock and I_4 is the 4th day closing price of the corresponding exchange *A*-share composite index after the SEO announcement (the SEO announcement date is taken as the publishing date of the SEO prospectus). P_{-1} and I_{-1} are the stock price and index price 1 day before the SEO announcement.

Moreover we include a variable *TIMESEO*, which measures the number of days between the IPO date and the SEO date. The longer the time between these events, the greater the volume of public information released about the firm, thus reducing the uncertainty about the firm value. Additional independent variables are *SEOSZ/MKT*, which is the SEO size over the stock market value 1 day before the SEO announcement and *SEOPRC/TRDPRC*, which is the SEO price over the closing price 1 day before the SEO announcement. These variables are included to control for possible differences in the extent to which the market is surprised by the SEO announcements that are not related to the initial returns of their IPOs or their after-market returns. For firms with SEOs, we do the following regression to examine $\boldsymbol{H_9}$:

$$\begin{aligned} REACT = {} & \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 \\ & + \beta_6 IN2 + \beta_7 IN3 + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \beta_{11} \ln TIMESEO \\ & + \beta_{12} \ln SEOSZ + \beta_{13} SEOSZ / MKT + \beta_{14} SEOPRC / TRDPRC + \varepsilon \end{aligned} \tag{9}$$

Similarly, we expect a positive β_1 if **H9** is true and a positive β_2 if the market feedback hypothesis is true.

4 Data and Empirical Results

4.1 Data

To pursue the objectives of this study, we examine all online fixed price and firm commitment *A*-Share IPOs over the period November 1995 - December 1998. Financial institutions and close-end funds are excluded. Online fixed price offering is the most commonly used offering method in Chinese *A*-share IPOs. The study of the online fixed price IPOs can represent the general IPO market in China. We exclude the IPOs after 1999 to obtain sufficient after-market data for testing the signaling model. To do this, we need at least 3 years' time for the listed firms to issue their first seasoned equity offerings. The sample period ends in 1998, which also helps control for government intervention in the pricing of IPOs since after 1998 there was a policy change in the ceiling for the PE ratio. The data come from several sources, including the trading database from GTA (Guo Tai An Information Technology Co.), the IPO database from Haitong Securities and the panorama network website (www.p5w.net). Finally a sample of 343 IPOs are collected, representing a broad spectrum of industries such as utilities, properties, conglomerates, industry and commerce. Descriptive statistics are reported in panel A of table 2. The mean and median offering sizes of the IPOs (i.e., gross proceeds) are RMB 304 million and RMB 220 million, respectively. The average proportion of shares retained by the state, legal entities and employees is 71.04%, indicating that the majority of shareholding of equities are non-negotiable government shares and legal entities shares. The average age of IPO firms is 3 years. The mean PE ratio used in IPO pricing and the average offer price are 14.85 and 6.19, respectively.

215 out of the 343 IPOs issue their first SEOs in the period 1996 to 2001. In other words, over 60% of the sample of IPOs issue SEOs. All the 215 SEOs included in our study are rights offers (SEOs to the existing shareholders). Public seasoned offering (SEOs to the general public

investors) are rarely seen in China because public seasoned offerings are not permitted until 1997. Even after the restriction was lifted, very few firms use public offerings in their re-issuances. Some characteristics of the SEO data are reported in panel B of table 2. The average SEO price is RMB 8.79 and the average SEO size is RMB 248.27 million. The mean and minimum time it takes from IPO to SEO is 805 days and 441 days, respectively.

To measure the level of IPO underpricing, we use the market-adjusted initial return, i.e., the raw initial return after taking into account the overall market effect. The raw initial return *RAWIR* is calculated as:

$$RAWIR = (P_1 - P_0) / P_0$$

Market adjusted initial return equals to *RAWIR* minus the *A*-share composite index return from the IPO date to its first trading date.

$$IR = RAWIR - (I_1 - I_0) / I_0$$

where I_1 is the closing price of the SHSE *A*-share composite index or SZSE *A*-share composite index on the first trading day of the new issue, and I_0 is the closing price of the SHSE *A*-share composite index or SZSE *A*-share composite index on the IPO date.

To examine a longer-term IPO after-market performance, we calculate initial returns over 10 and 100 trading days after the IPO as

$$IR10 = (P_{10} - P_0) / P_0 - (I_{10} - I_0) / I_0$$

and

$$IR100 = (P_{100} - P_0) / P_0 - (I_{100} - I_0) / I_0$$

Some summary statistics for the initial excess returns are presented in table 3 and the distribution of *IR* is depicted in figure 1. The average *IR* is positive and significant: the mean is 123.59% with $t = 27.00$. Only 7 out of 343 IPOs have negative initial returns. Nearly 98% of the IPOs have positive initial returns. The average 10-day and 100-day initial excess returns, *IR*10 and *IR*100, are 119.27% and 123.79%, respectively. This is much lower than what was reported in previous studies, showing that the Chinese new issue market has indeed improved its

efficiency. *IR*10 is slightly lower than *IR*, and *IR*100 is slightly higher than *IR*. Notably, the mean initial return from day +1 to day +100 is not significantly different from zero (mean = −1.72%, $t = -0.93$). If the price of a new issue at the opening of trade represents an overreaction or speculative bubble rather than the true economic or fundamental price, we should witness a significant decline in the stock return in the after-market. However, we do not see a statistical difference between *IR* and *IR*100, which suggests that there is no momentum effect in pricing. The correlation between *IR* and the subsequent initial returns from day +1 to day +100 is 0.114, indicating that the price of the IPO stocks adjusts efficiently after the IPO. All 3 initial return distributions are positively skewed, reflecting the very high returns obtained in a few cases (see figure 1).

Table 4 presents the summary statistics of the initial returns and the PE ratios used in IPO pricing by year and by stock exchange. There are only 2 observations in 1995 and we include these into the data for 1996. The average initial returns in 1996, 1997 and 1998 are 95.87%, 144.96% and 130.57%, respectively. The significant difference in underpricing across years is mainly caused by the changes in the IPO pricing policy over time. As discussed before, the offer price in the Chinese fixed price offering is determined by the multiplication of PE ratio of the same industry and the issuing firm's after-tax profit per share. A ceiling was imposed by the supervisory authorities and the ceiling changed over time. Table 4 shows that the PE ratios used in 1996 are significantly higher than that in 1997 and 1998. We will not analyze in detail why the initial return in 1996 is lower than that of 1997 and 1998 or why the IPOs in 1997 are more underpriced than IPOs in 1998 since the policy changes are complicated. There is not much difference in the initial returns and PE ratios across the two stock exchanges.

4.2 Allocation and Adverse Selection

The pro rata allocation rate in China is the ballot ratio used in the lottery and equals to the ratio of the number of shares publicly offered in the IPO to the number of shares subscribed by investors. There is no under-subscription in the sample. *BALLOT* denotes the ballot ratio

(allocation rate). Some summary statistics of *BALLOT* are presented in table 5, and the pattern of its distribution is depicted in figure 2.

The ballot ratio in most IPOs is extremely small due to the overwhelming oversubscription. The overwhelming oversubscription is mainly caused by surplus demand for the limited supply of negotiable shares. Moreover, the vast majority of the primary market investors are relatively unsophisticated private individual investors. The characteristics of Chinese individual investors and the weakness in information disclosure result in a very big proportion of uninformed investors in the Chinese market. The distribution shows that the allocation rate in most IPOs (95%) is below 5% and there are only a few cases with ballot ratio greater than that. The mean for *BALLOT* in our sample is 2.18% and the median is much lower, 0.65%. The average allocation rate for overpriced IPOs is 34%, which is much higher than that of the underpriced IPOs (1.51%). This is consistent with the winner's curse theory that the uninformed investors have a higher probability of obtaining overpriced IPOs. However, this is weak evidence of the presence of winner's curse problem since we have only 7 overpriced IPOs.

If $\boldsymbol{H_1}$ is true, the allocation-weighted initial returns minus the riskless rate should be approximately zero. The statistics for *AWIR* are presented in table 3. The mean of *AWIR* is negative (−0.33%), and is not statistically different from zero (t = −0.63). This suggests that, despite the seemingly high initial returns, uninformed IPO investors essentially break even.

The OLS regression result for equation (2) is as follows:

$$IR = -0.67 \; - \; 0.41 BALLOTT$$
$$(-2.74) \quad (-7.94) \qquad R^2 = 0.1535$$

The estimated coefficient for *BALLOTT* is −0.41, with t = −7.94. The strong inverse relationship between initial returns and allocations to investors is again consistent with Rock's hypothesis of adverse selection.

The above two empirical results confirm the major empirical implications of Rock's theory. We conclude that individual investors in China face the winner's curse problem. However, without

data on application sizes and other details, it is not clear who the informed investors in the Chinese IPO market are.

4.3 Ex ante Uncertainty and Manager's Strategic Underpricing

Model 1 of table 6 presents the regression results for equation (4). Consistent with $\boldsymbol{H_3}$, the coefficient for the standard deviation of the after-market returns is positive and strongly significant. The coefficients for ln*AGE* and ln*IPOSZ* are both negative and significant, which supports the ex ante uncertainty hypotheses $\boldsymbol{H_4}$ and $\boldsymbol{H_5}$, namely, the age and offer size of the issuing firm are inversely related to IPO underpricing in the Chinese IPO market.

The coefficient of *BFMARTN* is positive and significant at the 5% level, which means that the IPOs are more underpriced in hot market. This is consistent with previous studies (Davis and Yeomans, 1976 (UK), Reilly, 1977 (USA), and McGuiness, 1992 (Hong Kong)). The coefficient of *OWNSHP* is negative and significant, consistent with Mok and Hui (1998). This shows that Chinese investors interpret high state and legal entity retention as government support and business guaranty. That is, high equity retention lowers the ex ante uncertainty about firm value, thereby lowers the required level of underpricing. The time lag between the IPO date and the first trading date is insignificant in explaining IPO underpricing in the regression. Different from Mok and Hui (1998) and Su and Fleisher (1999)'s sample, the time lag after 1996 has been dramatically shortened, which removes previous uncertain factors caused by the extreme long time lag.[6]

The positive and significant coefficient for the dummy variable *Y*96 shows that the IPOs made in 1996 are less underpriced than the IPOs in 1998. This might be affected by the changes of the PE ratio used in IPO pricing. There is no statistical difference in underpricing across industries. The IPO underpricing in SHSE is significantly higher than that in SZSE. As we have seen in table 4, there is not much difference in the PE ratio used in IPO pricing across the two

[6] The average lag time in our sample is only 32 days, which is much shorter than the average of 260 days reported in Su and Fleisher's (1999) study. The much shorter lag time from the IPO date to the first listing date in our sample shows that the online fixed pricing offering method is more efficient than previously used offering methods.

exchanges. Thus, this cannot be caused by the difference in the PEs. One explanation is that many firms at SZSE are joint ventures, while those listed at SHSE are mostly SOEs. There are relatively more disclosure and less uncertainty in joint venture firms. That is why IPOs listed on SZSE are less underpriced. The model explains 96.7% of the variability in initial returns of the sample of *A*-share IPOs, which shows the strong explanatory power of ex ante uncertainty. This supports our hypothesis that the high ex ante uncertainty in IPO value is the main reason for the high level of IPO underpricing observed in the Chinese market.

Model 2 in table 6 reports our preliminary results for the strategic underpricing model. The positive sign for *LCK6MON* is as expected but it is not statistically significant, suggesting that there is no statistical difference in the underpricing level between IPOs with 6-month lockup period and those with 3-year lockup period. Therefore, manager's strategic underpricing may not be a good explanation for Chinese IPO underpricing.

4.4 The Signaling Model

Table 7 presents the logit regression test for the relation between IPO underpricing and the probability of seasoned equity issue (equation (6)). The slope coefficient (*t*-statistics) on the variable *IR* is −0.07 (−0.40). The slope coefficient for *AFTRTN* (*t*-statistics) is 0.86 (3.97). For $\boldsymbol{H_6}$, the signaling hypothesis expects a positive and significant role of IPO initial return in explaining the likelihood of issuing subsequent equity offerings. However, we find a negative and insignificant coefficient for the initial returns. This suggests that the signaling model does not stand. At the same time, the estimates show a strong relation between the after-market price appreciation and the likelihood of SEOs. In other words, the coefficient for *AFTRTN* suggests that the higher the after-market returns, the more likely the listed firm re-issue. This is consistent with the market feedback hypothesis. Other two significant variables are *Y*96 and *Y*97, which means that IPOs in 1996 and 1997 are more likely to issue SEOs than those in 1998. This is probably because IPOs in 1996 and 1997 have longer time for SEOs than those in 1998. The rest of the dummy variables are insignificant and their coefficients are jointly not different from zero.

Therefore, we report a second logit regression excluding those insignificant dummy variables in Model 2 of table 7. Model 2 reflect almost the same result as that of model 1 except that the significance level for dummy variable *Y*96 decreases.

The right censoring tobit regression examining $\boldsymbol{H_7}$ is presented in table 8. The slope coefficient estimate for *IR* is 0.04, with $t = 0.83$. The sign of *IR* is opposite to our expectation and the *t*-statistics is insignificant. This again shows that the signaling model does not stand in the Chinese market. The coefficient for *AFTRTN* is negative (−0.17) and statistically different from zero at the 1% level ($t = -4.42$). This result indicates that firms that experience large price appreciation after the IPOs are likely to raise larger amounts of capital through seasoned equity issues. This is again consistent with the market feedback hypothesis.

Model 1 of table 9 reports the tobit regression estimates examining the relation between the size of the seasoned offerings and the explanatory variables (equation (8)). The estimate (*t*-statistic) of the slope coefficient for the variable *IR* is 0.02 (0.15), which indicates that the excess initial returns in the IPOs are weak in explaining the relative SEO size and $\boldsymbol{H_8}$ is rejected. Same as the previous logit regression, we find a positive (0.46) and significant ($t = 4.84$) coefficient for *AFTRTN*. Consistent with our previous findings, the market feedback hypothesis is verified for the Chinese *A*-share market. The tobit regression also shows that *IPOSZ* is negative (−0.37) and significant ($t = -2.85$) in explaining the relative SEO size. The coefficients (*t*-statistics) for year dummy variables *Y*96 and *Y*97 are 0.6 (2.67) and 0.72 (3.97), respectively, indicating that the IPOs in 1996 and 1997 raise higher amount of capital through seasoned equity issues than the IPOs in the year 1998. Another significant dummy variable is *IN*6 suggesting that commercial firms raise smaller amount of capital in SEOs than industrial firms. There is no statistical difference in the two stock exchanges. Therefore we report a second tobit regression excluding *STKCDSH* in model 2 of table 9, which shows almost the same results as those of model 1.

To examine the relation among the stock-price response to the announcement of seasoned equity offerings, underpricing and after-market returns, we first use a sub-sample of 215 IPOs with subsequent offerings to run the OLS regression. The results are presented in model 1 of table 10. The estimated coefficient for *IR* is positive, as expected, but statistically insignificant (t = 1.69). This indicates that underpricing the IPO does not significantly mitigate the negative share-price response to a first seasoned equity offering. The estimate of the coefficient for the variable *AFTRTN* is also not significantly different from zero. The rest of the explanatory variables are insignificant. The adjusted R^2 is 0.0089, which shows that the regression has very weak explanatory power. This is not surprising in the Chinese market because the seasoned equity offering news is normally leaked out long time before the publication of the SEO announcement. Usually months before a re-issuance, a board meeting is held to discuss the re-issuance decision and the meeting resolution is published the next day after the meeting. Therefore, by the time of SEO prospectus publication, the SEO news is not new and the stock price has already adjusted.

Model 1 of table 10 examines only 215 firms with their first SEOs within 3 years of IPO. This is only a subset of our larger population. The decision to make subsequent offerings is endogenous, which is not reflected in the cross-sectional estimates of model 1. Therefore the estimator may be inconsistent as a result of truncation bias. Eckbo et al. (1990) derive consistent estimators using a latent variable model. These estimators account for the presence of the potential truncation bias. Michaley and Shaw (1994) use this method to detect the dividend announcement effect. We also adopt the same model to further examine $\boldsymbol{H_9}$.

Firstly, a probit regression is estimated as followings:

$$SEOD = Z\gamma + \varepsilon$$

where Z denotes the independent variables, which are *IR, AFTRTN,* Ln*(IPOSZ), Y*96 and *Y*97. They are related to the likelihood that a SEO will be issued. Then we calculate the Mill's ratio

MILLSRATIO as $\varphi(Z\gamma)/\Phi(Z\gamma)$, where φ is the normal density function and Φ is the normal cumulative distribution function.

By adding *MILLSRATIO* as one more explanatory variable into equation (9), consistent parameters can be obtained:

$$\begin{aligned} REACT = {} & \beta_0 + \beta_1 IR + \beta_2 AFTRTN + \beta_3 \ln IPOSZ + \beta_4 Y96 + \beta_5 Y97 + \beta_6 IN2 \\ & + \beta_7 IN3 + \beta_8 IN4 + \beta_9 IN6 + \beta_{10} STKCDSH + \beta_{11} \ln TIMESEO + \beta_{12} \ln SEOSZ \\ & + \beta_{13} SEOSZ / MKT + \beta_{14} SEOPRC / TRDPRC + \beta_{15} MILLSRATIO + \varepsilon \end{aligned} \tag{10}$$

The estimation result of equation (10) is presented in model 2 of table 10. Same as our regression in model 1, the slope coefficient for *IR* and *AFTRTN* are still insignificant. This verifies the fact that more underpriced IPOs do not experience a less unfavorable price reaction to SEO announcement than firms with less underpriced IPOs. Thus $\boldsymbol{H_9}$ is rejected.

In summary, the relations between IPOs and SEOs activities in the Chinese market are mainly caused by the after-market performances of stocks instead of the issuer's signaling behavior. The signaling hypothesis does not stand in the Chinese *A*-share market, while the market feedback hypothesis is supported.

5 Conclusions

This study examines the degree of underpricing for 343 online fixed price offerings from November 1995 to December 1998. The initial return is on average 123.59%, much lower than the level in early 1990s reported in previous studies. This indicates that the efficiency in the primary market has improved. However, it is still larger than what is found in most emerging markets.

We investigate possible explanations for the level of underpricing. We analyze possible explanations for the Chinese market according to the characteristics of the Chinese market and examine all major models, i.e., the winner's curse model, the ex ante uncertainty explanation, the signaling model, and manager's strategic underpricing model.

Consistent with the winner's curse model, after adjusting for rationing, uninformed investors in the Chinese market essentially break even. The negative relation between the initial returns and the allocation rates to investors also suggest that Chinese individual investors face the winner's curse problem. Using several proxies for ex ante uncertainty, we find ex ante uncertainty has very high explanatory power in explaining the Chinese IPO underpricing. This is consistent with Mok and Hui (1998)'s assertion. A preliminary test of the manager's strategic underpricing model suggests that there is no significant difference in IPO underpricing between firms with a lockup period of 6 months and 3 years, which indicates that managers' behavior of maximizing their value upon the expiration of the lock-up period does not exist in China.

After an extensive examination of 4 hypotheses of the signaling model, we conclude that the signaling model does not stand in the Chinese market. Evidence shows that the relations between IPO underpricing and SEO activities are caused by the market feedback information. This is contrary to Su and Fleisher (1999)'s findings.

In all, the main reasons for the Chinese *A*-share IPO underpricing are investor's high level of ex ante uncertainty about IPO value and the winner's curse problem. As we have eliminated the possibility of the principal-agent and the signaling explanation, we conclude that the positive relation between ex ante uncertainty and underpricing is evidence in support of the winner's curse problem. This suggests that reducing issuing firms' ex ante uncertainty, such as through more information disclosure from IPO firms, will help to ameliorate the winner's curse problem and thereby lower the level of underpricing.

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Table 1: Prior studies of the Chinese IPO underpricing

Papers	Sample size	Sample period	Average Initial Return (%)	Findings pertaining to the explanations of the IPO underpricing
Mok and Hui (1998)	87	1990-1993	289	The high equity retention by the state, a long time-lag between offering and listing and ex ante risk of new issues were the key-determinants of the underpricing.
Kim et al (1998)	45	1993	594	IPOs for which a larger percentage of total shares are sold to individual investors are more underpriced and IPOs of firms that are expected to have larger increases in profitability are less underpriced , which is consistent with the political persuasion hypothesis.
Su and Fleisher (1999)	101	1987-1995	949	The signaling hypothesis explains the pattern of underpricing behavior rather well. In examining the effect of the offering mechanism on IPO underpricing they find the underpricing to be the largest under the lottery with a fixed number of lottery-forms and is the smallest under the auction mechanism.
Chau et al (1999)	102	1990-1993	546	Investors in previously centrally planned economies view agency costs as a consideration in investment; Initial returns are smaller when the government retains a large proportion of ownership and initial returns are negatively related to firm size. Investors rely on insider ownership to reduce agency costs.
Chen et al (2000)	277	1992-1995	350	The state underprices to ensure future seasoned equity issues to be successful; The long-time lag from the offering date to the first trading date explain the high underpricing; A-share IPOs that subsequently make rights issues are significantly more underpriced.
Chi and Padgett (2002)	340	1996-1997	127	The quota system for new issues is the main reason for the underpricing
Tian (2003)	1124	1991-2000	267	The listing quota and pricing caps imposed by the government account for more than half of the severe underpricing. Information on the quality of the firm causes IPO underpricing, but it is not a major determinant. Besides the effects of the financial regulations, Chinese-specific investment risks also contribute to severe underpricing. The long time lag from the IPO date to the first trading date causes the underpricing.

Note: This table describes only studies on the Chinese IPO underpricing. Research on other aspects of the Chinese stock market such as the long term IPO after-market performance, the development of China's privatization program, the price behavior of listed companies, or the relationships between company value and accounting earnings and book values is not included. Among the papers listed, only findings of relevant points are summarized.

Table 2: Descriptive statistics on 343 IPOs in the 1996-1998 period and 215 SEOs in the period 1996-2001

Variable	No. Obs.	Mean	Median	Maximum	Minimum	Std. dev.	Skewness
Panel A IPO characteristics							
IPOSZ (million RMB)	343	304.00	220.50	2625.00	33.00	310.00	3.60
OWNSHP	343	0.7104	0.7353	0.8649	0.3670	0.0721	-1.2751
AGE (years)	343	3.06	2.03	40.99	0.10	3.27	6.08
PE	343	14.85	14.57	32.52	8.80	2.51	0.76
LAG (days)	343	32.43	21.00	377.00	9.00	35.09	6.02
P_0	343	6.19	5.99	15.70	2.45	1.83	1.38
P_1	343	13.71	12.74	53.57	4.41	6.01	1.90
BFMARRTN	343	0.1583	0.1076	0.8649	-0.2859	0.2407	0.6655
AFTRTN	343	0.1482	-0.0210	3.9045	-3.0145	0.7575	1.3241
Panel B SEO characteristics							
SEOSZ (million RMB)	215	248.27	188.10	1395.00	2.08	206.07	2.49
SEOPRC	215	8.79	8.00	26.00	3.30	3.50	1.60
TIMESEO (days)	215	805	805	1394	441	219.44	0.55
REACT	215	-0.0109	-0.0144	0.2672	-0.1308	0.0472	1.2076

Table 3: Initial returns in IPOs, with adjustment for allocation

	Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness
Initial return (underpricing)							
1	***IR***	1.2359 (27.00)	1.1123	8.2050	-0.1211	0.8479	2.4129
2	***IR10***	1.1927 (26.38)	1.0619	5.6548	-0.1886	0.8372	1.5264
3	***IR100***	1.2379 (25.07)	1.0192	5.4331	-0.8410	0.9145	1.1342
Allocation-weighted initial return							
4	***AWIR***	-0.0033 (-0.63)	-0.0050	0.3652	-0.3621	0.0955	-0.1360

The figures in the parentheses are the *t*-statistics.

Table 4: Statistics of initial returns and PE ratios by year and by stock exchange

	Years	Mean	Median	Maximum	Minimum	Skewness
1996 (121)						
	IR	0.96	0.95	3.37	-0.12	0.90
	PE	15.34	14.90	32.52	9.70	0.26
1997 (125)						
	IR	1.45	1.29	4.64	0.01	1.46
	PE	14.67	14.90	18.00	10.00	-0.16
1998 (97)						
	IR	1.31	1.13	8.20	-0.05	3.25
	PE	14.48	14.50	18.00	8.80	0.20
Shanghai (170)						
	IR	1.20	1.11	4.31	-0.12	1.05
	PE	14.86	14.57	32.52	8.80	3.13
Shenzhen (173)						
	IR	1.27	1.13	8.20	-0.11	2.86
	PE	14.84	14.57	27.96	11.35	-0.59

The figures in the parentheses are the number of IPOs in that year or in that stock exchange.

Table 5: Statistics of allocations in sample IPOs

	Mean	Median	Maximum	Minimum	Obs.
BALLOT	0.0218	0.0065	0.9540	0.0013	343
Ballot classified by initial return					
For IR < 0; Ballot	0.3432	0.0851	0.954	0.0057	7
For IR > 0; Ballot	0.0151	0.0065	0.7315	0.0013	336

Table 6: OLS regression Analysis Investigating ex ante Uncertainty and Other Significant Explanatory Variables of IPO Underpricing

Dependent Variable:	**IR**	**Model 1**			**Model 2**		
Explanatory Variables:		**Coeff.**	***t* stat.**		**Coeff.**	***t* stat.**	
	Constant	0.8331	2.64	***	0.8631	2.70	***
	SD	9.9021	78.61	***	9.8944	78.12	***
	LNAGE	-0.0312	-3.23	***	0.0952	2.35	***
	LNIPOSZ	-0.0340	-2.23	**	-0.0251	-2.09	**
	BFMARRTN	0.0985	2.45	**	-0.0358	-2.32	**
	OWNSHP	-0.2875	-2.44	**	-0.3005	-2.48	**
	LAG	0.0003	0.90		0.0003	0.99	
	Y96	-0.1937	-6.56	***	-0.1904	-6.19	***
	Y97	-0.0091	-0.39		-0.0096	-0.39	
	IN2	-0.0031	-0.09		-0.0023	-0.07	
	IN3	0.0029	0.03		0.0065	0.07	
	IN4	0.0109	0.47		0.0123	0.53	
	IN6	-0.0546	-1.71		-0.0517	-1.59	
	STKCDSH	0.0517	2.93	***	0.0501	2.80	***
	LCK6MON				0.0194	0.73	
	NOLCK				-0.0039	-0.14	
Adjusted R^2			0.9671			0.9670	

** Significant *t* statistics at the 5% level
*** Significant *t* statistics at the 1% level

Table 7: Logit Model to Test the Relation between Underpricing and the Likelihood of SEO

Dependent Variable:	**SEOD**	**Model 1**			**Model 2**		
Explanatory Variables:		**Coeff.**	***t* stat.**		**Coeff.**	***t* stat.**	
	Constant	4.05	0.88		3.02	0.67	
	IR	-0.07	-0.40		-0.07	-0.40	
	AFTRTN	0.86	3.97	***	0.81	3.89	***
	LOG(IPOSZ)	-0.23	-1.00		-0.17	-0.77	
	Y96	1.02	2.61	***	0.98	2.53	**
	Y97	1.46	4.78	***	1.39	4.69	***
	IN2	-0.12	-0.25				
	IN3	1.52	1.20				
	IN4	0.16	0.45				
	IN6	-0.90	-1.95				
	STKCDSH	0.16	0.67				

215 observations with Dep = 1, the total number of observations is 343.
** Significant *t* statistics at the 5% level
*** Significant *t* statistics at the 1% level

Table 8: Tobit Regression to Examine the Relation between Time to SEO and IPO Underpricing

Dependent Variable:	***LNTIMESEO***			
Explanatory Variables:		**Coeff.**	***t* stat.**	
	Constant	7.44	6.98	***
	IR	0.04	0.83	
	AFTRTN	-0.17	-4.42	***
	LOG(IPOSZ)	-0.01	-0.21	
	Y96	-0.38	-4.18	***
	Y97	-0.35	-4.85	***
	IN2	0.09	0.83	
	IN3	-0.40	-1.34	
	IN4	-0.05	-0.62	
	IN6	0.28	2.49	**
	STKCDSH	0.00	0.07	
Adjusted R^2		0.1248		

Total observations are 343 and right-censored observations are 128.
** Significant *t* statistics at the 5% level
*** Significant *t* statistics at the 1% level

Table 9: Tobit Regression to Examine the Relationship between SEO Size and IPO Underpricing

Dependent Variable:	**SEOSZ/IPOSZ**	**Model 1**			**Model 2**		
Explanatory Variables:		**Coeff.**	***t* stat.**		**Coeff.**	***t* stat.**	
	Constant	7.05	2.68	***	7.08	2.69	***
	IR	0.02	0.15		0.02	0.15	
	AFTRTN	0.46	4.84	***	0.46	4.82	***
	LOG(IPOSZ)	-0.37	-2.85	***	-0.38	-2.87	***
	Y96	0.60	2.67	***	0.60	2.67	***
	Y97	0.72	3.97	***	0.72	4.01	***
	IN2	0.25	0.88		0.23	0.83	
	IN3	1.04	1.41		1.06	1.43	
	IN4	-0.05	-0.25		-0.06	-0.32	
	IN6	-0.54	-2.00	**	-0.54	-1.99	**
	STKCDSH	-0.07	-0.49				
Adjusted R^2			0.1440			0.1434	

Total number of observations is 343,the number of left censored observations is 128.
** Significant *t* statistics at the 5% level
*** Significant *t* statistics at the 1% level

Table 10: OLS Regression to Test the Price Reaction at the Announcement of SEO

Dependent Variable*:*	**REACT**	**Model 1**			**Model 2**		
Explanatory Variables:		Coeff.	*t* stat.		Coeff.	*t* stat.	
	Constant	-0.35	-1.98	**	-0.09	-1.04	
	IR	0.01	1.69		0.00	1.59	
	AFTRTN	0.00	0.12		0.00	0.41	
	LNIPOSZ	0.00	0.51		0.00	0.94	
	Y96	0.02	1.61		0.01	0.82	
	Y97	0.00	-0.08		0.00	0.08	
	IN2	-0.01	-0.76		0.00	-0.40	
	IN3	0.04	1.14		0.03	1.12	
	IN4	-0.01	-1.06		-0.01	-0.99	
	IN6	-0.01	-1.03		-0.01	-0.86	
	STKCDSH	0.00	-0.19		0.00	-0.37	
	LNTIMESEO	0.02	0.81		0.00	-0.03	
	LNSEOSZ	0.02	1.54		0.00	0.44	
	SEOSZ/MKT	-0.03	-1.25		-0.01	-0.85	
	SEOPRC/TRDPRC	-0.04	-1.71		-0.04	-2.29	**
	MILLS RATIO				0.00	0.22	
Adjusted R^2			0.0089			0.0177	

The number of observations is 215 for model A and 343 for model B.
** Significant *t* statistics at the 5% level

Figure 1: The distribution of the initial excess return in IPOs

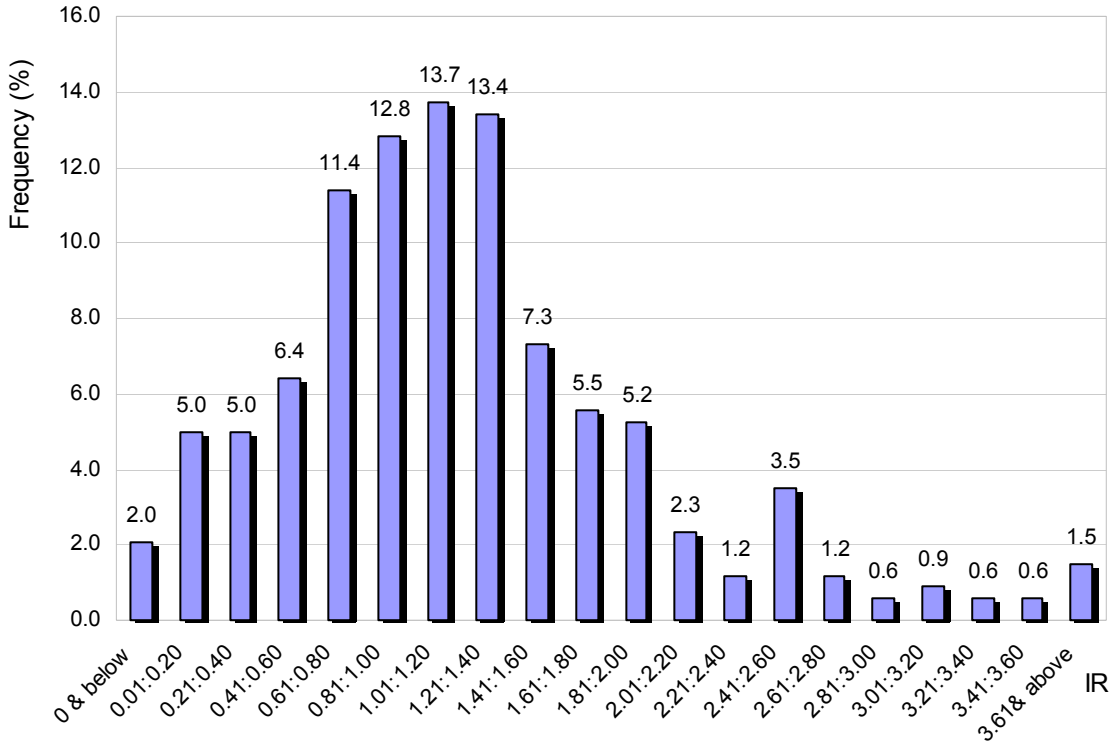
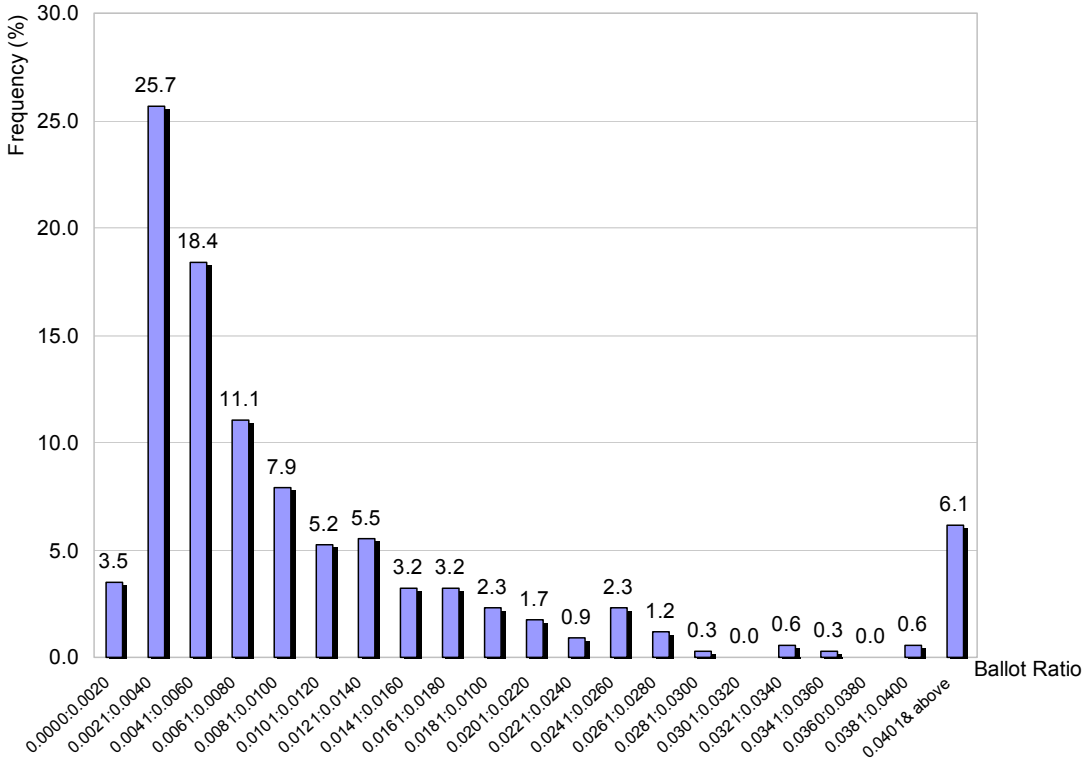


Figure 2: The Distribution of Allocations to Investors in IPOs



Appendix A: Correlation Matrix

Table a*:* Correlation matrix of continuous explanatory variables in equation (4)

	IR	*SD*	*LNAGE*	*LNIPOSZ*	*BFMARRTN*	*OWNSHP*	*LAG*
IR	1.00						
SD	0.98	1.00					
LNAGE	0.01	0.07	1.00				
LNIPOSZ	-0.28	-0.33	-0.28	1.00			
BFMARRTN	0.11	0.13	0.14	-0.30	1.00		
OWNSHP	0.00	0.03	-0.07	0.03	-0.07	1.00	
LAG	0.20	0.18	-0.12	0.09	-0.23	0.02	1.00

Table b: Correlation matrix of continuous explanatory variables in equation (6)

	IR	*AFTRTN*	*LNIPOSZ*
IR	1.00		
AFTRTN	-0.09	1.00	
LNIPOSZ	-0.28	-0.19	1.00

Table c: Correlation matrix of continuous explanatory variables in equation (9)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
(1) IR	1.00						
(2) AFTRTN	-0.14	1.00					
(3) LNIPOSZ	-0.22	-0.23	1.00				
(4) LNTIMESEO	0.26	-0.08	-0.06	1.00			
(5) LNSEOSZ	-0.18	0.05	0.51	-0.01	1.00		
(6) SEOSZ/MKT	-0.19	-0.17	-0.03	-0.15	0.48	1.00	
(7) SEOPRC/TRDPRC	-0.04	-0.32	0.37	0.19	0.21	0.13	1.00