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IPO initial returns in China: Underpricing or overvaluation?

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ABSTRACT

This paper separates the amount of IPO underpricing (primary market underpricing) and overvaluation (secondary market overvaluation) from the value of an IPO's initial return to evaluate the relative importance of these two factors and their main determinants. Using data on the IPOs of 948 Chinese firms, we find that average initial returns are 66% and that underpricing and overvaluation are between 14–22% and 44–53%, respectively, depending on the method used to assess firms' intrinsic values. In addition, while both the value of the initial return and the extent of overvaluation are significantly negatively related to post-IPO long-run stock performance, overvaluation can predict post-IPO performance better than the value of the initial return. Value uncertainty in IPOs is positively related to both underpricing and overvaluation, and both the underwriter's reputation and the existence of pricing regulation are positively related to underpricing. Investor sentiment has a positive effect on overvaluation but has no effect or a negative effect on underpricing. Overall, our results suggest that in China overvaluation accounts for a larger proportion of the initial return than underpricing, and that underpricing and overvaluation have different determinants.

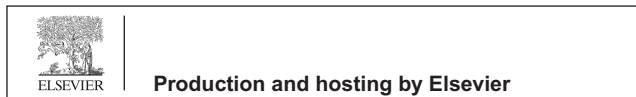
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1. Introduction

On November 5, 2007, PetroChina (601857), the most profitable company in Asia, returned to the A-share market at the peak of a bull market. The initial return (also called the first-day return) of PetroChina peaked

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at 163%, making it the world's most valuable company by market capitalization at that moment. However, the stock price of PetroChina gradually dropped after its IPO, depreciating by 76% over the next three years. Consequently, countless holders of A-shares in PetroChina lost a great deal of money. However, in China's IPO market, stories like that of PetroChina are common. While IPO initial returns are extremely high, the post-IPO stock performance of many companies is very poor. In theory, there are only two cases in which IPOs would experience an abnormally high initial return: the offer price of the IPO is too low, indicating that there is underpricing in the primary market, or the first-day closing price is too high, indicating that there is overvaluation in the secondary market (Han and Wu, 2007).

Therefore, a crucial question is which of these two cases is relatively more important in explaining the phenomena of extremely high initial returns in China: underpricing in the primary market or overvaluation in the secondary market? We believe that the answer to this question is not only vital to studies of IPO pricing but also has important implications for the regulators who must decide whether and how to reform IPO pricing in China. Unfortunately, when discussing initial returns in China, the media seldom distinguish between IPO initial returns and underpricing. Moreover, the literature usually measures IPO underpricing with IPO initial returns and does not differentiate between the extent of underpricing and the extent of overvaluation (e.g., Wang et al., 2009; Zhang and Liao, 2011).

However in the Chinese stock market, first-day closing prices are often significantly overpriced and thus the initial return and the underpricing are two totally different concepts. If the extent of underpricing and overvaluation is not separated from the value of the initial return, we not only cannot evaluate the relative importance of these two parts, but also cannot precisely examine the main determinants of underpricing and overvaluation.

Motivated by this problem and gap in the literature, this paper clarifies the two concepts of IPO initial return and IPO underpricing, separates IPO underpricing and IPO overvaluation from the value of the initial return, investigates the relative importance of these two parts, and then examines their main determinants. Estimating IPO firms' intrinsic values is the key to measuring the extent of underpricing and overvaluation. Two methods for assessing intrinsic value are used and compared in this paper: analyst forecasts and comparisons to similar firms (we explain these two methods in detail in Section 4).

Using data from the IPOs of 948 Chinese firms between 2006 and 2011, our results show that, during the sample period, when a firm's intrinsic value is measured by analyst forecasts, underpricing is about 22.2% and overvaluation is about 44.1% (twice as much as underpricing). However, when intrinsic value is assessed through comparable firms, underpricing is about 13.6% and overpricing is about 52.7% (three times as much as underpricing). These results consistently show that overvaluation accounts for the largest proportion of the value of the IPO initial return, suggesting that the first-day closing price being overvalued by investors is more important in explaining the high initial return of Chinese IPOs than the offer price being underpriced by the issuer.

In addition, both the value of the initial return and the extent of overvaluation are found to be significantly negatively associated with post-IPO long-run stock performance. According to the regression coefficients of the initial return and the overvaluation, the extent of overvaluation, as measured by analyst forecasts, predicts post-IPO long-run stock performance better than the value of the initial return, suggesting that extracting the overvaluation from the initial return has value in terms of forecasting post-IPO stock performance. Additionally, the overvaluation measured by analyst forecasts predicts post-IPO long-run stock performance better than the overvaluation measured by comparison to similar firms, suggesting that analyst forecasts are a more accurate way to measure the extent of overvaluation than using comparable firms.

We also find that the value uncertainty of IPOs is positively related to both underpricing and overvaluation. Both underwriter reputation and pricing regulation are positively related to underpricing. Investor sentiment has a positive effect on overvaluation but has no effect or a negative effect on underpricing. Overall, our results suggest that overvaluation accounts for the largest proportion of the value of initial returns in China, and that underpricing and overvaluation have different determinants.

These findings contribute to the literature in two ways. First, while prior studies imply that IPO initial returns consist of two parts, underpricing and overvaluation (e.g., Cao and Dong, 2006; Han and

Wu, 2007), there has been little empirical work that attempts to quantify the relative importance of these two parts. This paper shows that overvaluation accounts for the majority of an IPO's initial return. This finding contributes to studies of IPO pricing by pointing out which parts of the initial return deserve more attention. It also has implications for regulators who need to consider how to reform IPO pricing structures, by showing that it is more important to control first-day overvaluation than to reduce primary market underpricing. Moreover, decomposing the initial return can also help to evaluate more comprehensively the potential effects of IPO pricing reform.

A second way that this paper contributes to the literature is that we split the initial return into underpricing and overvaluation, and investigate the main determinants of these aspects separately, which can help us further understand the determinants of the value of IPO initial returns and provides a reference for further studies that examine the determinants of these two aspects.

This paper is divided into five sections. In Section 2, we introduce the institutional background of China's IPO market. Section 3 provides a theoretical analysis. Section 4 presents our methodology. Section 5 reports our empirical results and Section 6 concludes the paper.

2. Institutional background

During the process of an IPO, the behavior of listed companies, underwriters and investors are influenced by both the institutional environment and institutional arrangements. Therefore, before we analyze the composition of IPO initial returns and their determinants in China, it is necessary to briefly introduce the institutional environment and institutional arrangements in China's IPO market.

2.1. IPO institutional environment

IPO initial returns can be explained by both rational and non-rational theories. Given that the market efficiency in China is relative low and the primary market is not a competitive one, non-rational explanations may be more appropriate (Han and Wu, 2007). First, the extent of the market efficiency of China's stock market is lower than that of a developed market. While the efficiency of the U.S. stock market has been recognized by both academics and practitioners, Chinese scholars generally believe that China's stock market has not yet reached a level of semi-strong form market efficiency. For example, many studies, such as Lu and Zhou (2007) and Xu et al. (2011) have found evidence against China having semi-strong form market efficiency. China's stock market is an emerging market with a very short history, characterized by inexperienced investors and intense speculation. As Su (2008) and Tian (2010) point out, most participants in China's stock market are individual investors (retail investors), who prefer speculation rather than value investment. This means that stock prices in China's stock market are easily influenced by investor sentiment.

Second, the primary market in China is not yet competitive. In a competitive primary market, underwriters have an incentive to underprice offer prices intentionally to avoid the risk of IPO failure. However, there are very few examples of IPO failures in China because investors in China have a very strong interest in subscribing to new shares (because of the high initial returns in China).¹ Due to the low risk of IPO failure, firms and underwriters have lower incentives to undervalue offer prices compared to those in a developed market. This means that rational theories may be relatively less important in explaining the value of initial returns in Chinese IPOs.

2.2. IPO institutional arrangements

In China, the government regulates many different aspects of IPOs and thus the evolution of IPO institutional arrangements goes hand in hand with changes in laws and regulations. The regulator controls the IPO process in two main ways: IPO qualifications and IPO pricing. In relation to IPO qualifications, the CRSC

¹ In June 2011, Baling Technology (002592) was forced to cease its IPO because the number of book building participants (mostly institutional investors) did not reach the quota of 20. It became the first failed IPO in China (Baling Technology IPO later succeeded in November 2011). The second failed IPO (Longmaster Information & Technology, 300288) did not appear until January 2012. The company succeeded in holding an IPO in February 2012). The fact that there are very few failed IPO cases suggests that there is a low risk of IPO failure in China.

Table 1
The evolution of China's IPO system since 2006.

| Time period | September 2006–June 2009 | June 2009–May 2012 | May 2012 onward |
|-------------------------------------|---|---|--|
| Verification system | Approval system and sponsor system | Approval system and sponsor system | Approval system and sponsor system |
| IPO pricing system | Book building approach with “Window Guidance,” IPO firm's PE multiple should not exceed 30 | Book building approach without “Window Guidance” | Book building approach with “Window Guidance,” IPO firm's PE Multiple should not exceed 25% of the average PE of industry peers |
| Book building system | (1) Preliminary Inquiry: institutions must provide at least 20 valid bidders (50 if the firm will issue more than 400 million in shares) (2) All eligible allotment subjects who have participated in the preliminary inquiry can subscribe for new shares off-line and can change their bidding price and bidding number in the subscribing stage | (1) Preliminary Inquiry: institutions must provide at least 20 valid bidders (50 if the firm will issue more than 400 million in shares) (2) Only eligible allotment subjects who have participated in the preliminary inquiry can and must participate in off-line subscription; only valid bidders (with a bidding price no less than the minimum of the range of offering prices) can participate in the subscription | (1) Preliminary Inquiry: institutions must provide at least 20 valid bidders (50 if the firm will issue more than 400 million in shares) (2) Those who did not participate in the preliminary inquiry, or did not provide a valid bid are not eligible to participate in the accumulated bidding inquiry and the off-line allotment |
| Share allocation and lock-in system | (1) The amount of the off-line allotment should not exceed 20% (or 50% for firms issuing more than 400 million in shares) of total issued shares (2) Strategic investors are locked in for 12 months, and investors who obtain shares from off-line allotments are locked in for three months | (1) The amount of the off-line allotment should not exceed 20% (or 50% for firms issuing more than 400 million in shares) of total issued shares (2) Strategic investors are locked in for 12 months, and investors who obtain shares from off-line allotments are locked in for three months | (1) The amount of the off-line allotment should not be less than 50% of the total issued shares (2) Investors who obtain shares from off-line allotments are not subject to lockup |
| Related laws and regulations | “The Measures for the Administrations of Securities Issuance and Underwriting (September 19, 2006)” | “The Guidance for the Further Reform and Improvement of the IPO System (June 11, 2009)” | “The Guidance for the Further Deepening of Reform of the IPO System (April 28, 2012)” and “The Measures for the Administrations of Securities Issuance and Underwriting (May 18, 2012)” |

(China Securities Regulatory Commission) implemented an approval system² in 2001, under which the Issuance Examination Committee of the CSRC examines whether the applicant meets the regulator's listing criteria. Complementing the approval system, a sponsor system was adopted in 2004, under which an underwriter conducts due diligence and verifies the truth, accuracy and completeness of the issuer's materials.

In relation to the second aspect of IPO pricing, China introduced the book building approach in 2005, which is the dominant method of issuing in most countries.³ Under the book building approach, the

² The approval system means that when new stocks are issued, the issuer should not only completely disclose financial and non-financial information but also meet the regulator's listing criteria. The Issuance Examination Committee of the CSRC determines whether the applicant meets the listing criteria. The difference between an approval system and a registration system is whether the regulator judges the value of IPO firms. The sponsor system means that the underwriter and representative of the sponsor is responsible for recommending and guiding the issuer; conducting due diligence; verifying the truth, accuracy and completeness of the issuer's materials; and assisting the issuer in building a strict information disclosure system.

³ The book building approach can be divided into two stages: the preliminary inquiry and the accumulated bidding inquiry. The issuer and the lead underwriter first determine the range of offering prices through a preliminary inquiry and then confirm the offering price through the accumulated bidding inquiry. Whether an accumulated bidding inquiry is required depends on the firm's size and the time of the IPO. Before 2012, small firms could choose whether to conduct an accumulated bidding inquiry and this has been voluntary for all firms since 2012.

underwriter seeks demand information from institutional investors and determines the offer price with the issuer according to the demand information received. IPO pricing reform in June 2009 further improved the book building approach. However, China's regulator has not yet thoroughly adopted the market-based IPO pricing approach used in developed markets and still controls IPO pricing through "Window Guidance."⁴ Although "Window Guidance" was given up in the IPO reform of June 2009, it was restarted under the IPO reforms of May 2012. The history of IPO reform in China shows that the CSRC is still hesitant in deciding whether it is necessary to regulate IPO pricing. Thus research that discusses the pros and cons of IPO pricing regulation is still highly relevant in a Chinese context.

Table 1 summarizes the history of China's IPO system since the split share reform in 2006.

3. Theoretical analysis and predictions

3.1. IPO initial returns: underpricing or overvaluation

Many theories have been proposed to explain the puzzle of IPO initial returns. These theories can be categorized by whether they assume investors are rational or not (Han and Wu, 2007). Although current studies mainly explain IPO initial returns in the United States using theories based on asymmetric information, Ritter and Welch (2002) argue that information asymmetry cannot fully explain initial returns in the United States, which can be as high as 18%, and call for more explanations based on non-rational (or semi-rational) investors or issuers. Purnanandam and Swaminathan (2004) find that the median IPO offer price is overvalued by 14–50% relative to industry peers, depending on the peer-matching criteria, which suggests that initial returns may be a result of optimistic investor sentiment. Other studies such as those of Ljungqvist et al. (2006), Derrien (2005) and Dorn (2009) show that an overvalued first day closing price is a result of irrational investor sentiment.

In China, some studies use information asymmetry theory to explain initial returns (e.g., Guo and Zhao, 2006; Wang et al., 2009; Zhang and Liao, 2011), while others use investor sentiment theory to explain initial returns (e.g., Cao and Dong, 2006; Jiang, 2007; Han and Wu, 2007). We believe that extremely high initial returns in China (up to 66.3% in the period from 2006 to 2011) are unlikely to be able to be explained under the assumption of rational investors. In China, the real question is perhaps not whether the first-day closing price of IPOs is overvalued or not, but the extent of this overvaluation. The extent of the overvaluation is an unanswered question that must be answered with empirical evidence.

Studies have shown that the first-day closing price of IPOs usually reverses after the IPO, which raises the question of post-IPO long-run underperformance (Ritter and Welch, 2002; Jiang, 2007). This question is related to whether the high initial returns of IPOs are due to underpricing or overvaluation. If the initial return mainly results from underpricing, then it would be expected that initial returns would either not be related or positively related to post-IPO long-run performance. Intuitively, IPO underpricing should not be related to the long-run aftermarket performance. However, signaling theory in finance suggests that IPO underpricing is positively related to post-IPO long-run performance. According to the signaling model, high-quality IPO firms are more likely to set a lower offer price in an IPO, which deters lower quality firms from imitating the firm and recoups their up-front sacrifice post-IPO through future issuing activity (Welch, 1989; Grinblatt and Hwang, 1989). The signaling model has received some support from empirical evidence (e.g., Su and Fleisher, 1999). However, if initial returns are mainly a result of the overvaluation of the first-day closing price, we would expect the initial returns to be negatively related to post-IPO long-run performance because the overpriced first-day closing price will be corrected gradually by the secondary market.

In sum, according to this argument, if we split the initial return into underpricing and overvaluation, we predict that underpricing will not be related to or will be positively related to post-IPO long-run performance, and that overvaluation will be negatively related to post-IPO long-run performance.

⁴ "Window Guidance" is a kind of regulation with Chinese characteristics. According to "The Measures for the Administrations of Securities Issuance and Underwriting (September 19, 2006)," the PE multiple used to determine the offering price, generally, cannot exceed 30. In China, the regulator's "Window Guidance" can substantially reduce the offering price.

3.2. Determinants of underpricing and overvaluation

In a developed market, the main participants in an IPO are the issuer, the underwriter and the investors. What is special in China is that the regulator is also an important participant in IPOs. Under the book building approach, the issuer and the underwriter negotiate over the result of the preliminary inquiry and determine the offer price, but the regulator can cap the maximum PE multiple of the offer price. We expect that, in China, a firm's IPO offer price will be mainly determined by the characteristics of the issuer and the underwriter, and whether there is IPO pricing regulation. Additionally, the first-day closing price will be mainly influenced by investor sentiment, and the characteristics of IPO firms may influence the effects of investor sentiment on the first-day closing price. Thus, we expect a firm's first-day closing price to be mainly affected by investor sentiment and the issuing firm's characteristics. Due to space limitations, we only consider the most important characteristics of the issuer and the underwriter, namely, the value uncertainty of IPOs and the underwriter's reputation.

3.2.1. The value uncertainty of IPOs

The value uncertainty of IPOs contributes to underpricing because there is asymmetric information between the issuer and the investors in that the true value of the IPO firm is known by the issuer but not by the investors. Therefore, investors require a lower offer price to compensate for their information uncertainty risk and the issuer needs to set a lower offer price to attract these uninformed investors (Beatty and Ritter, 1986). According to this argument, we predict that a higher value uncertainty of IPOs will be associated with greater IPO underpricing.

The value uncertainty of IPOs can also affect overvaluation. Existing studies suggest that the stock prices of firms with a higher value uncertainty are more likely to be affected by investor sentiment and speculative behavior (e.g., Baker and Wurgler, 2007). According to Miller (1977), under the assumption of a short-sale constraint and heterogeneous expectations, stock prices only reflect the most optimistic investors' expectations. Given that a higher value uncertainty is often related to higher heterogeneous expectations, the stock prices of firms with a higher value uncertainty are more susceptible to optimistic investor sentiment. Additionally, higher value uncertainty is also related to speculative behavior, and thus can lead to the overvaluation of stock prices. Given that investor sentiment and speculative behavior are common in China's stock market, we predict that a higher value uncertainty for IPO firms is positively related to the overpricing of the first-day closing price.

3.2.2. The underwriter's reputation

To reduce the risk of value uncertainty facing outside investors, the issuer can signal its fundamental value in many ways, including by increasing the retained proportion of outstanding shares (Brealey et al., 1977) and employing a reputed underwriter (Beatty and Ritter, 1986). Researchers in China have found evidence that the reputation of the auditor and venture capital companies have an effect on the extent of IPO underpricing (Wang et al., 2009; Zhang and Liao, 2011), but these studies fail to find evidence that the underwriter's reputation affects underpricing (Guo and Zhao, 2006; Song et al., 2011).

Theoretically, the reputation of the underwriter could either increase or decrease the extent of underpricing. On the one hand, according to the signaling hypothesis, underwriters with a higher reputation could send a positive signal to outside investors and mitigate the value uncertainty of IPOs, thus reducing underpricing (Beatty and Ritter, 1986). On the other hand, according to the conflict of interest hypothesis, there is a conflict of interest between the underwriter and the issuer. Underwriters have an incentive to set a lower offer price to reduce the risk of IPO failure and to cater to their customers (institutional investors) (Beatty and Welch, 1996; Guo and Zhao, 2006). Compared with underwriters with a low reputation, those with high reputations have stronger bargaining power in setting the offer price and are thus more capable of increasing IPO underpricing. Furthermore, compared with large firms, small firms have weaker bargaining power in setting the offer price and thus their shares are more likely to be underpriced by their underwriters. According to this analysis, we therefore do not have a clear prediction of the direction of the effect of an underwriter's reputation on the extent of underpricing.

3.2.3. IPO pricing regulation

As mentioned in the institutional background section, during some periods in our sample, the regulator stipulated that the offer prices of IPO firms were not allowed to exceed a certain PE multiple (for example, 30). In this situation, IPO pricing regulation would have decreased the offer price and thus increased IPO underpricing. Liu et al. (2011) have shown that deregulating IPO pricing indeed reduces the level of underpricing (as measured by IPO initial returns). We therefore predict that IPO pricing regulation is positively related to underpricing.

3.2.4. Investor sentiment

Investor sentiment affects underpricing. The puzzle of the hot market is well documented in academia. The initial returns and issue volume of IPOs fluctuate periodically. The initial returns of IPOs during some periods are much higher than the average level and there are more firms going public in some periods than in others (e.g., Ritter, 1984). The puzzle of the hot market suggests that IPO firms take advantage of investors' optimistic sentiment. Under the charge mode of underwriting in China,⁵ we believe that underwriters have an incentive to exploit the optimistic sentiment of investors to increase an IPO firm's offer price, thus increasing their underwriting fee. Therefore, we predict that there will be a negative relationship between investor sentiment and underpricing.

Investor sentiment also affects overvaluation. According to the hypothesis of heterogeneous expectations proposed by Miller (1977), in a market without short-selling, when investors have divergent opinions about a firm's fundamental value, the stock price of this stock will only reflect the expectations of the most optimistic investors, leading to an overvalued stock price. Past studies, such as those by Ritter and Welch (2002) and Ljungqvist et al. (2006), have shown that investor sentiment can explain the high initial returns of IPOs in the United States. In China, short-selling is not available, and there is often a very high divergence of opinions among investors (as shown by the high turnover in the first-day trading of IPOs). So the closing prices of Chinese IPO firms are very likely to be subject to optimistic investor sentiment. Studies from China, such as Jiang (2007) and Han and Wu (2007), have also found evidence that investor sentiment is related to the overvaluation of first-day closing prices. We thus predict that investor sentiment will be positively related to overvaluation. Additionally, according to the previous analysis, we predict that the higher the value uncertainty of IPOs, the larger the effect of investor sentiment on the overvaluation.

Overall, we predict that the value uncertainty of IPOs will be positively related to both underpricing and overvaluation, the underwriter's reputation will be either be positively or negatively related to underpricing, IPO pricing regulation will have a positive influence on underpricing, investor sentiment will be positively related to overvaluation, and the value uncertainty of IPOs and investor sentiment will have an interactive effect on overvaluation. Table 2 summarizes these predictions.

4. Sample and methodology

4.1. Sample and data sources

To test our predictions, we initially collected data from the IPOs of 994 firms for the period from September 19, 2006 to December 31, 2011. We selected September 19, 2006 as the start time because this was the date when the CSRC enacted the "Measures for the Administrations of Securities Issuance and Underwriting." It was also at this time that the split share reform ended. By selecting IPOs that occurred after the new regulations were enacted in September 2006, we avoid potential discrepancies in the data caused by changes to regulations and institutions. Our sample period ends on December 31, 2011 because we want to ensure that there was at least one year of post-IPO stock performance data for each examined firm. Based on the initial sample, we exclude firms without sufficient data on analyst forecasts, stock prices and other firm characteristics, which left a sample of 948 IPO firms. The process of sample selection is reported in Table 3.

⁵ It is reported that underwriters generally charge underwriting by segment. Within the range of the issuer's expected financing amount, the underwriter can usually obtain an underwriting fee of about 3% (which is rather low) but for the part exceeding the expected amount of financing the underwriting can charge as much as 10%.

Table 2
Predictions of the determinants of IPO underpricing and overvaluation.

| | Value uncertainty | Underwriter reputation | IPO pricing regulation | Investor sentiment |
|-------------------|---|------------------------|------------------------|--|
| IPO underpricing | Positive | Positive/negative | Positive | Negative |
| IPO overvaluation | Positive, interactive with investor sentiment | No prediction | No prediction | Positive, interactive with value uncertainty |

Table 3
Sample selection process.

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Total |
|---|------|------|------|------|------|------|-------|
| Initial sample | 65 | 125 | 76 | 99 | 347 | 282 | 994 |
| (Exclude: observations without sufficient data) | (5) | (16) | (3) | (4) | (11) | (7) | (46) |
| Final sample | 60 | 109 | 73 | 95 | 336 | 275 | 948 |

Analyst forecast data was collected from the WIND and CSMAR (China Securities Market and Accounting Research) databases, and all other data, including IPO initial returns, post-IPO stock performance and firm characteristics, were obtained from the CSMAR database. It is important to note that WIND collects analyst forecasts from many securities companies but not all of them, so we collected additional data on analyst forecasts from CSMAR to complement the omission of some of these forecasts in the WIND database.

4.2. Model construction and variable definitions

4.2.1. Model construction

We use the following models to examine the effects of IPO initial returns, IPO underpricing and IPO overvaluation on post-IPO long-run stock performance:

$$BHAR = a + \beta_1 \times IR + \beta_2 \times Underwriter + \beta_3 \times Topone + \beta_4 \times EPS + \beta_5 \times Age + \beta_6 \times Size + I.Board + I.Indu + I.Year + \varepsilon \quad (1)$$

$$BHAR = a + \beta_1 \times IRUP + \beta_2 \times IROP + \beta_3 \times Underwriter + \beta_4 \times Topone + \beta_5 \times EPS + \beta_6 \times Age + \beta_7 \times Size + I.Board + I.Indu + I.Year + \varepsilon \quad (2)$$

In Model 1, the dependent variable is *BHAR* (Buy and Hold Abnormal Return), which represents the post-IPO long-run stock performance. This can be expressed as *BHAR240*, *BHAR480* and *BHAR720*, representing the one-year, two-year, and three-year post-IPO *BHAR*, respectively. The main independent variable is *IR*, which is a proxy for IPO initial returns. In addition, drawing on the literature (e.g., Zhang and Liao, 2011; Song et al., 2011), we include *Underwriter* (underwriter reputation), *Topone* (shareholding proportion of the largest shareholder), *EPS* (earnings per share), *Age* (firm age), *Size* (firm size), *I.Board* (dummy variables for listing board effects), *I.Year* (dummy variables for year effects) and *I.Indu* (dummy variables for industry effects) as control variables in our model. Based on our theoretical analysis, we predict that *IR* is negatively related to *BHAR*. The variables used in Model 1 are defined in detail in Table 4.

In Model 2, the main independent variables are *IRUP* (IPO underpricing) and *IROP* (IPO overvaluation), instead of *IR*. The control variables are the same as those in Model 1. According to our theoretical analysis, we predict that *IROP* will have a negative relationship with *BHAR*, and that *IRUP* will not be related to or will be positively related to *BHAR*.

We use the following model to investigate the determinants of IPO initial returns, IPO underpricing and IPO overvaluation:

$$IR \setminus IRUP \setminus IROP = a + \beta_1 \times Uncer + \beta_2 \times Underwriter + \beta_3 \times PEcontrol + \beta_4 \times Sent + \beta_5 \times Topone + \beta_6 \times EPS + \beta_7 \times Age + \beta_8 \times Size + I.Board + I.Indu + I.Year + \varepsilon \quad (3)$$

In Model 3, the dependent variable can either be *IR* (IPO initial return), *IRUP* (IPO underpricing) or *IROP* (IPO overvaluation). Based on our theoretical analysis, we include the following four variables as the main independent variables: *Uncer* (value uncertainty of the IPO), *Underwriter* (underwriter reputation), *PEcontrol* (whether IPO pricing is regulated) and *Sent* (investor sentiment). Referring to the literature, such as Zhang and Liao (2011) and Song et al. (2011), we control for the following variables in Model 3: *Topone* (shareholding proportion of the largest shareholder), *EPS* (earnings per share), *Age* (firm age), *Size* (firm size), *I.Board* (dummy variables for listing board effects), *I.Year* (dummy variables for year effects) and *I.Indu* (dummy variables for industry effects). We predict that *Uncer*, *Sent* and *PEcontrol* are positively related to *IR*; that *Uncer* and *PEcontrol* are positively related to *IRUP*; that *Uncer* and *Sent* are positively related to *IROP*; and that *Underwriter* is either positively or negatively related to *IRUP*.

4.2.2. Variable definitions

4.2.2.1. *IPO underpricing and IPO overvaluation.* Estimating an IPO firm's intrinsic value (or fundamental value) is the key to measuring IPO underpricing and overvaluation. Two methods for estimating intrinsic value are used and compared in our study: the method of analyst forecasts and the method of comparison to similar firms.

4.2.2.1.1. *The method of analyst forecasts.* Taking advantage of unique data from analyst forecasts, we measure the intrinsic value of IPO firms based on analyst forecast prices.⁶ We first compute the mean of each analyst's forecast prices (analysts usually forecast a range of intrinsic values for each IPO firm), and then calculate the mean of all analyst forecast prices that were released before the IPO.⁷ We exclude observations in which forecast prices are provided by analysts affiliated to the underwriters and observations that are not the analyst's last forecast price released before the IPO.⁸ In our dataset, 92% of IPO firms have at least three analysts providing forecast prices and 74% of IPO firms have at least five analysts providing forecast prices. Given this large number of analyst forecasts, we can avoid the subjectivity and randomness that would result if forecast prices from a single analyst were used.

4.2.2.1.2. *The method of comparable firms.* Following Purnanandam and Swaminathan (2004), we use the product of the IPO firm's industry peers' PEs and the IPO firm's EPS to measure the firm's intrinsic value. For each IPO in our sample, we find a non-IPO industry peer with comparable sales and net income that did not go public in the previous three years. Specifically, we select comparable firms using three steps: (1) to obtain appropriate comparable firms, we first consider all firms in the CSMAR database for the fiscal year before the IPO and then exclude firms with negative PE ratios or with PE ratios exceeding 100⁹ and firms that went public in the previous three years; (2) we group firms in each industry into 4 (2 * 2) portfolios based on sales and net income, and also group the IPO firms (our sample firms) into 4 (2 * 2) portfolios in the same way; (3) each IPO firm is then matched to the appropriate industry-sales-income bracket. Using this portfolio, we select a comparable firm that is closest in sales size to the IPO firm.

We believe that compared with this method of selecting comparable firms, using analyst forecasts may have some advantages in predicting an IPO firm's intrinsic value. First, given that analysts are experts in their industry, they may be able to choose more appropriate comparable firms (most of the analysts use comparable firms' PEs to estimate an IPO firm's PE). Additionally, analysts generally adjust the estimated PE of IPO firms according to firm-specific information, such as the extent of industry competition and growth potential, so their estimation of an IPO firm's PE ratio may be more accurate.

4.2.2.2. Post-IPO long-run stock performance

⁶ By reading the abstracts of analyst reports, we find that analysts forecast the intrinsic value (reasonable price) of an IPO firm rather than the first-day closing price. Therefore, it makes sense to use analyst forecast prices to measure intrinsic value.

⁷ For instance, an IPO firm receives a price forecast from three analysts, and their forecast prices are 11–13, 12–14 and 13–15, respectively. The mean forecast prices for each analyst are 12 ((11 + 13)/2), 13 and 14 respectively, and the overall mean forecast price is 13 ((12 + 13 + 14)/3). We would then use this mean forecast price (13) to measure the intrinsic value of the firm.

⁸ During the entire process of sample selection, we obtained 11,471 analyst forecasts. After deleting 136 forecasts from analysts who were affiliated with underwriters and 532 repeated forecasts, we had a final total of 10,957 analyst forecasts for all of the sample firms.

⁹ Generally, firms with a PE of more than 100 are rare and are thus not suitable as matching firms.

Table 4
Definition of variables.

| Variable name | Definition of variables |
|-----------------------|--|
| Dependent variables | |
| <i>IR</i> | IPO initial return = (first-day closing price – offer price)/offer price |
| <i>IRUP1</i> | IPO underpricing = (intrinsic value – offer price)/offer price; intrinsic value = the mean of analyst forecast prices |
| <i>IROP1</i> | IPO overvaluation = (first-day closing price – intrinsic value)/offer price; intrinsic value = the mean of analyst forecast prices |
| <i>IRUP2</i> | IPO underpricing = (intrinsic value – offer price)/offer price; intrinsic value = the comparable firm's PE * the IPO firm's EPS |
| <i>IROP2</i> | IPO overvaluation = (first-day closing price – intrinsic value)/offer price; intrinsic value = the comparable firm's PE * the IPO firm's EPS |
| <i>BHAR240</i> | Post-IPO long-run stock performance = the 240-day (approximately one year) buy and hold abnormal return following the IPO |
| <i>BHAR480</i> | Post-IPO long-run stock performance = the 480 days (approximately two years) buy and hold abnormal return following the IPO |
| <i>BHAR720</i> | Post-IPO long-run stock performance = the 720 days (approximately three years) buy and hold abnormal return following the IPO |
| Independent variables | |
| <i>Uncer</i> | Value Uncertainty for the IPO as measured by the divergence of analyst forecast prices (variance of analyst forecast prices/mean of analyst forecast prices) |
| <i>PEcontrol</i> | Whether the CSRC regulated IPO pricing (dummy variable) at the time of the IPO, 1 for yes and 0 for no; during our sample period from 2006 to 2011, offer prices were regulated by the CSRC before June 2009 |
| <i>Sent</i> | Index of investor sentiment, computed using principle component analysis of four sentiment related variables |
| <i>Underwriter</i> | Underwriter reputation, equal to 1 for the top 10 underwriters, and 0 otherwise |
| <i>Topone</i> | Shareholding proportion of the largest shareholder |
| <i>EPS</i> | Earnings per share = net income/total equity |
| <i>Age</i> | Firm age = the year of IPO – the year of firm establishment |
| <i>Size</i> | Natural logarithm of issuance size = Ln(number of issued shares * offer price) |
| <i>I.Board</i> | Dummy variables for listing board effects. We have the main board, SME board and GEM board, and thus create two dummy variables to control for board effects |
| <i>I.Indu</i> | Dummy variables for industry effects. We have 13 industries, according to the classification of industries by the CSRC, and thus create 12 dummy variables to control for industry effects |
| <i>I.Year</i> | Dummy variables for year effects. We have six years in our sample period and thus create five dummy variables to control for year effects |

$$BHAR(2, n) = \prod_{1}^n (1 + R_{it}) - \prod_{1}^n (1 + R_{mt})$$

Post-IPO long-run stock performance is measured by BHAR. In the above formula, BHAR (2, n) is the buy and hold abnormal return of IPO firms from the second day to the n th day after the IPO (this does not include the first day of the IPO); R_{mt} is the market return for day t , where t belongs to the range from 2 to n . According to the requirements of different stock performance periods, we set n to be equal to 240 days, 480 days and 720 days, which results in measurements for *BHAR240*, *BHAR480* and *BHAR720*, as reported in Table 4.¹⁰

4.2.2.3. *Investor sentiment.* There is no standard way in academia to measure investor sentiment, and scholars usually use principle component analysis to integrate several variables into a comprehensive factor for investor sentiment. In the spirit of Baker and Wurgler (2007) and Wu et al. (2012), we use the following four variables to create an overall investor sentiment index: (1) market turnover (monthly data); (2) discounts of closed-end funds (monthly data); (3) the number of shareholders that open new stock accounts (monthly data); (4) and the three-month stock return of the Shanghai Composite Index.

4.2.2.4. *Value uncertainty and underwriter reputation.* In previous studies, the divergence of analyst earnings forecasts is often used to measure a firm's information uncertainty (e.g., Barron et al., 1998; Zhang, 2006).

¹⁰ Because of the limitations of the dataset, the number of observations for *BHAR720* and *BHAR480* is smaller than for *BHAR240* and thus when we use *BHAR720* and *BHAR480* as dependent variables the sample is smaller than when the full sample is used.

Table 5
Descriptive statistics.

| | <i>N</i> | Mean | p50 | Max. | Min. | SD |
|--------------------|----------|--------|--------|--------|--------|-------|
| <i>IR</i> | 948 | 0.663 | 0.405 | 5.381 | −0.232 | 0.806 |
| <i>IRUP1</i> | 948 | 0.222 | 0.122 | 2.663 | −0.233 | 0.346 |
| <i>IROP1</i> | 948 | 0.441 | 0.311 | 4.668 | −0.517 | 0.600 |
| <i>IRUP2</i> | 948 | 0.136 | −0.031 | 3.147 | −0.778 | 0.597 |
| <i>IROP2</i> | 948 | 0.527 | 0.448 | 4.403 | −2.542 | 0.663 |
| <i>BHAR240</i> | 948 | −0.144 | −0.142 | 4.041 | −3.216 | 0.533 |
| <i>BHAR480</i> | 782 | −0.073 | −0.177 | 3.975 | −2.979 | 0.520 |
| <i>BHAR720</i> | 439 | 0.041 | −0.079 | 5.984 | −5.389 | 0.861 |
| <i>Uncer</i> | 948 | 0.167 | 0.160 | 0.572 | 0.025 | 0.068 |
| <i>PEcontrol</i> | 948 | 0.745 | 1.000 | 1.000 | 0.000 | 0.436 |
| <i>Sent</i> | 948 | −0.143 | −0.230 | 1.939 | −1.093 | 0.412 |
| <i>Underwriter</i> | 948 | 0.399 | 0.000 | 1.000 | 0.000 | 0.490 |
| <i>Topone</i> | 948 | 0.391 | 0.382 | 0.865 | 0.052 | 0.151 |
| <i>EPS</i> | 948 | 0.554 | 0.498 | 3.158 | 0.058 | 0.301 |
| <i>Age</i> | 948 | 1.715 | 1.946 | 3.258 | 0.000 | 0.777 |
| <i>Size</i> | 948 | 11.115 | 11.035 | 15.715 | 9.110 | 0.878 |

Note: The variables are defined in Table 4.

Thus, we use the divergence of analyst forecast prices to measure an IPO firm's value uncertainty. Intuitively, the reputation of the underwriter will also be associated with their underwriting income (e.g., Megginson and Weiss, 1991; Liu et al., 2011), thus we use the rank of underwriting income to measure underwriter reputation and create a variable that equals 1 if the underwriter is in the top 10, and 0 otherwise.¹¹

4.3. Descriptive statistics and correlation analysis

Table 5 presents the descriptive statistics for the main variables. The results in Table 5 show that (1) during our sample period (2006–2011), the mean IPO initial returns in China were 66.3%; (2) when intrinsic value was measured using analyst forecast prices, the mean IPO underpricing and overvaluation were 22.2% and 44.1%, respectively, but when the intrinsic value was measured using a comparable firm's PE and the IPO firm's EPS, the mean underpricing and overvaluation were 13.6% and 52.7%, respectively; (3) compared with those estimated using analyst forecasts, the underpricing and overvaluation estimated using comparable firms have larger minimums, maximums and standard errors, suggesting that using analyst forecasts is a more precise way to predict intrinsic value (because it is less likely to produce extreme values); (4) the mean BHAR 240 days, 480 days and 720 days after the IPO were −14.4%, −7.3% and 4.1%, respectively, and the medians were −14.2%, −17.7% and −7.9%, respectively, suggesting that more than half of IPO firms underperform the market and confirming that there is a phenomenon of post-IPO long-run underperformance in China.

Table 6 reports the correlation analysis of the main variables. The results in Table 6 show that (1) the correlation coefficient between *IR* (IPO initial returns) and *IROP* (IPO overvaluation) is larger than the coefficient between *IR* and *IRUP* (IPO underpricing), which indicates that the size of the initial return is more related to overvaluation than overpricing (we thus conclude that overvaluation accounts for a larger part of the initial return); (2) *IRUP1* and *IRUP2*, and *IROP1* and *IROP2* are positively and significantly related, suggesting that the two methods we use to estimate intrinsic value are at least somewhat consistent; (3) *IR*, *IROP1* and *IRUP2* are negatively and significantly related to *BHAR240* (the one year post-IPO abnormal return), suggesting that higher initial returns, higher overvaluation (as estimated by analyst forecasts) and higher underpricing (as estimated using comparable firms) are associated with poorer post-IPO long-run stock performance; (4) *IR*, *IRUP1*, *IRUP2*, *IROP1* and *IROP2* are positively and significantly correlated with *Uncer* (the value uncertainty of the IPO), *Sent* (investor sentiment) and *PEcontrol* (whether there is regulation of IPO pricing); (5) *IRUP1* is positively and significantly related to *Underwriter* (underwriter reputation); (6) and

¹¹ Using the top 10 as the cut-off point is common in the literature. Our empirical results are not affected if the top eight is used as the cut-off instead of the top 10.

Table 6
Correlation analysis.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-----------------------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|--------|--------|--------|-------|
| 1. <i>IR</i> | 1.000 | | | | | | | | | | | | | |
| 2. <i>IRUP1</i> | 0.734* | 1.000 | | | | | | | | | | | | |
| 3. <i>IROP1</i> | 0.920* | 0.410* | 1.000 | | | | | | | | | | | |
| 4. <i>IRUP2</i> | 0.589* | 0.645* | 0.419* | 1.000 | | | | | | | | | | |
| 5. <i>IROP2</i> | 0.686* | 0.311* | 0.742* | -0.185* | 1.000 | | | | | | | | | |
| 6. <i>BHAR240</i> | -0.121* | 0.031 | -0.180* | -0.145* | -0.017 | 1.000 | | | | | | | | |
| 7. <i>Uncer</i> | 0.332* | 0.329* | 0.256* | 0.193* | 0.230* | 0.037 | 1.000 | | | | | | | |
| 8. <i>Underwriter</i> | 0.044 | 0.147* | -0.026 | -0.006 | 0.058 | 0.108* | 0.013 | 1.000 | | | | | | |
| 9. <i>PEcontrol</i> | -0.601* | -0.688* | -0.411* | -0.641* | -0.154* | 0.211* | -0.213* | -0.081 | 1.000 | | | | | |
| 10. <i>Sent</i> | 0.412* | 0.248* | 0.410* | 0.340* | 0.194* | -0.275* | 0.167* | -0.017 | -0.414* | 1.000 | | | | |
| 11. <i>Topone</i> | 0.026 | 0.058 | 0.001 | 0.012 | 0.021 | 0.015 | -0.035 | 0.045 | -0.112* | 0.066 | 1.000 | | | |
| 12. <i>EPS</i> | -0.251* | -0.096* | -0.282* | -0.077 | -0.236* | 0.130* | -0.098* | 0.029 | 0.192* | -0.175* | -0.047 | 1.000 | | |
| 13. <i>Age</i> | -0.152* | -0.147* | -0.119* | -0.087* | -0.106* | -0.028 | -0.040 | -0.009 | 0.193* | -0.017 | -0.083 | 0.121* | 1.000 | |
| 14. <i>Size</i> | -0.402* | -0.309* | -0.362* | -0.543* | 0.001 | 0.157* | -0.138* | 0.048 | 0.298* | -0.128* | 0.230* | 0.255* | -0.066 | 1.000 |

Note: The variables are defined in Table 4.

* $P < 0.01$.

PEcontrol and *Sent* are positively and significantly related because a period of bullish investor sentiment coincided with a period of IPO pricing regulation. However, it is important to note that the results from the correlation coefficients only provide preliminary conclusions and further regression analysis based on theory is needed.

5. Empirical results

5.1. IPO initial returns: underpricing or overvaluation

Fig. 1 plots IPO underpricing and overvaluation as measured by analyst forecast prices for the sample firms from 2006 to 2011. It shows that, from 2006 to 2011, although the value of initial returns first increases and then decreases substantially, overvaluation consistently accounts for a larger proportion of the initial return than underpricing. We believe that the huge fluctuation in the value of initial returns is the result of variation in the firm characteristics, changes in the IPO pricing regulation and the stock market environment during the sample period. We thus categorize our sample into groups by listing board, market environment and IPO pricing regulation, and then compare the initial return, underpricing and overvaluation within these different groups. We also compare the difference between the underpricing and the overvaluation in each group.

Table 7 presents the results based on this group comparison. The results in the first row of Table 7 show that the average initial return was 66% during the sample period. When intrinsic value is measured by analyst forecasts, underpricing is about 22% and overvaluation is about 44% (twice as large as underpricing). When intrinsic value is measured using comparable firms, underpricing is about 14% and overvaluation is about 53% (more than three times as large as underpricing). The results for the grouping by listing board show that, when intrinsic value is measured by analyst forecasts, the initial return, underpricing and overvaluation in the main board are lower than those in the SME board and GEM board. When intrinsic value is measured using comparable firms, underpricing in the main board is lower than in the other boards, but overvaluation in the main board is almost the same as in the other boards. Third, the results for the grouping by investor sentiment show that, in periods of high investor investment, the initial return, underpricing and overvaluation are significantly higher than during periods with weak investor sentiment. The difference between underpricing and overvaluation is also larger in periods with strong investor sentiment. Fourth, the results for the grouping by IPO pricing regulation show that, compared with the period in which the CSRC regulated IPO pricing, the initial return, underpricing and overvaluation are significantly lower in the period when the CSRC deregulated IPO pricing. In summary, the results from both the full sample and the sub-samples show that overvaluation accounts for a significantly larger part

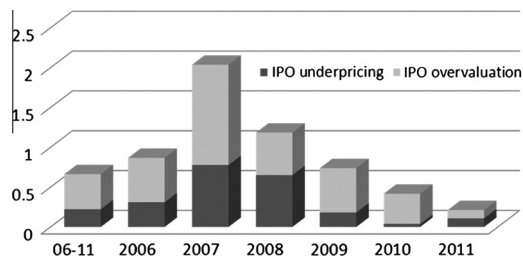


Figure 1. IPO underpricing and IPO overvaluation from 2006 to 2011.

of the initial return than underpricing and is thus more important than underpricing in explaining the value of initial returns in China.

It is worth mentioning that the IPO firms' intrinsic values estimated both by analyst forecasts and using comparable firms are likely to be affected by investor sentiment. However, we find that overvaluation is significantly larger than underpricing both in periods of high and low investor sentiment, suggesting that measurement bias resulting from investor sentiment does not affect our conclusion. Furthermore, because China's stock market lacks a short-selling mechanism, stock prices are more often overvalued rather than undervalued, which leads to the possibility that our methods may overestimate the intrinsic value of IPO firms. Therefore, if it were possible to remove this kind of positive deviation in estimating intrinsic value, overvaluation would be likely to account for an even larger part of the initial return, supporting the conclusion that IPO overvaluation accounts for a larger part of the IPO initial return than underpricing. Therefore, we can confidently conclude that an overvalued first closing price is a much more important issue than the underpricing of offers in China's IPO market.

5.2. IPO initial return and post-IPO long-run stock performance

In this subsection, we further investigate the effects of IPO initial returns, underpricing and overvaluation on the post-IPO long-run stock performance. This subsection has two main purposes: to examine the relationship between these variables and to evaluate and compare the two methods we used to measure underpricing and overvaluation.

The results in Table 8 show that (1) controlling for other variables, *IR* (IPO initial return) is significantly negatively related to *BHAR* (post-IPO long-run stock performance), suggesting that the initial return contains at least some component of overvaluation; (2) *IROP* (IPO overvaluation) is significantly negatively related to *BHAR*, which is consistent with our prediction that the overvalued first-day closing price of IPO firms reverts to its intrinsic value; (3) when intrinsic value is measured by analyst forecasts, underpricing (*IRUPI*) is positively related to post-IPO long-run performance, whereas when intrinsic value is measured using comparable firms, underpricing (*IRUP2*) is negatively related to post-IPO long-run performance. Our theoretical analysis predicts that underpricing would either not be related to or would be positively related to post-IPO long-run performance. We thus believe that the method of analyst forecasts measures underpricing and overvaluation better than the method of using comparable firms.

We can also compare the difference in the coefficients of *IR* and *IROP1*, *IR* and *IROP2*, *IROP1* and *IROP2* using the SUEST test. The results in Table 8 show that, no matter whether *BHAR240*, *BHAR480* or *BHAR720* is used as the dependent variable, the coefficients of *IROP1* are significantly larger in their absolute value than those of *IR* and *IROP2*, and the coefficients of *IR* and *IROP2* are not significantly different. These results imply that overvaluation estimated by using analyst forecasts is better at predicting post-IPO long-run performance than overvaluation estimated using comparable firms. This result further supports the conclusion that the method of using analyst forecasts is better at measuring underpricing and overvaluation.

In addition, the results in Table 8 show that the regression coefficients of *IR*, *IROP1* and *IROP2* increase as the timescale of the dependent variables increases from *BHAR240* to *BHAR480* and *BHAR720*. This suggests that the first-day closing price of IPO firms reverts gradually to its intrinsic value. Lastly, the results in Table 8 show that firm performance (*EPS*) is positively related to post-IPO long-run stock performance, and firm size

Table 7
 IPO underpricing and overvaluation: group comparison.

| <i>N</i> | <i>IR</i> | <i>IRUP1</i> | <i>IROP1</i> | Diff1 ^{sig} | <i>IRUP2</i> | <i>IROP2</i> | Diff2 ^{sig} |
|--|-----------|--------------|--------------|----------------------|--------------|--------------|----------------------|
| Full sample (<i>N</i> = 948) | 0.66 | 0.22 | 0.44 | -0.22*** | 0.14 | 0.53 | -0.39*** |
| <i>Group by listing board: 1 for main board, 0 for others</i> | | | | | | | |
| 0 (<i>N</i> = 855) | 0.68 | 0.23 | 0.46 | -0.23*** | 0.15 | 0.53 | -0.37*** |
| 1 (<i>N</i> = 93) | 0.49 | 0.19 | 0.30 | -0.11 | -0.03 | 0.52 | -0.55*** |
| Diff2 ^{sig} | 0.20** | 0.04 | 0.16** | | 0.19*** | 0.01 | |
| <i>Group by investor sentiment: 1 for high sentiment, 0 for others</i> | | | | | | | |
| 0 (<i>N</i> = 474) | 0.49 | 0.21 | 0.28 | -0.08*** | 0.09 | 0.40 | -0.31*** |
| 1 (<i>N</i> = 474) | 0.84 | 0.24 | 0.60 | -0.36*** | 0.18 | 0.65 | -0.47*** |
| Diff2 ^{sig} | -0.35*** | -0.03 | -0.32*** | | -0.10*** | -0.25*** | |
| <i>Group by IPO pricing regulation: 1 for yes, 0 for others</i> | | | | | | | |
| 0 (<i>N</i> = 430) | 0.38 | 0.07 | 0.31 | -0.24*** | -0.10 | 0.48 | -0.58*** |
| 1 (<i>N</i> = 242) | 1.49 | 0.63 | 0.86 | -0.23*** | 0.79 | 0.70 | 0.09 |
| Diff2 ^{sig} | -1.11*** | -0.56*** | -0.55*** | | -0.89*** | -0.22*** | |

Note: *IR*, *IRUP* and *IROP* are proxies for the IPO initial return, IPO underpricing and IPO overvaluation, respectively. *IRUP1* and *IROP1* are the underpricing and overvaluation as estimated by analyst forecasts. *IRUP2* and *IROP2* are the underpricing and overvaluation as estimated from comparable firms. Diff1 is the difference of *IRUP* and *IROP* within the group and Diff2 is the difference of *IRUP* and *IROP* between groups.

* $P < 0.1$.

** $P < 0.05$.

*** $P < 0.01$.

(*Size*) is negatively related to post-IPO long-run stock performance. This suggests that more profitable firms and smaller firms have better post-IPO long-run performance.

5.3. Determinants of IPO initial returns, underpricing and overvaluation

The results for the determinants of IPO initial returns, overpricing and overvaluation are presented in Table 9. In the foregoing subsection, we show that the method of using analyst forecasts is better at measuring underpricing and overvaluation than that of using comparable firms. In this subsection, we thus only report the results for the determinants of underpricing and overvaluation as measured by analyst forecasts.

The results in Column 1 of Table 9 show that after controlling for other factors, the value uncertainty of IPOs (*Uncer*), investor sentiment (*Sent*) and whether IPO pricing is regulated (*PEcontrol*) are significantly positively related to IPO initial returns (*IR*). This suggests that firms with high value uncertainty and firms with IPOs in periods of high investor sentiment have higher initial returns. IPO pricing regulation by the CSRC significantly increases initial returns. The results in Column 2 shows that the value uncertainty of IPOs, whether IPO pricing is regulated, and the underwriter's reputation (*Underwriter*) are all significantly positively related to IPO underpricing (*IRUP1*). The results in Column 3 show that the value uncertainty of IPOs (*Uncer*), investor sentiment (*Sent*) and whether IPO pricing is regulated (*PEcontrol*) are significantly positively related to IPO overvaluation (*IROP1*). Additionally, the results in Columns 1 to 3 show that firm performance (EPS) is positively related to underpricing but negatively related to overvaluation, and that firm age (*Age*) is significantly negatively related to overvaluation but insignificantly related to underpricing. This suggests that firm characteristics may have different impacts on underpricing and overvaluation. Given that most of these results are consistent with our predictions, we do not further elaborate on them in this section.

These results show that *Uncer* and *PEcontrol* affect both *IRUP1* and *IROP1*. We thus further examine the difference in the effects of these two variables on *IRUP1* and *IROP1*. The results in Table 9 show that the coefficients of *Uncer* do not differ between Column 2 and Column 3 (SUEST test: $\chi^2(1) = 0.28$). However, the coefficients of *PEcontrol* differ significantly between Column 2 and Column 3 ($\chi^2(1) = 51.25$), suggesting that whether the CSRC regulates IPO pricing has different impacts on underpricing and overvaluation. We use the sample period adjacent to the IPO pricing regulation (2008 and 2009) to further examine the effects

Table 8
 IPO Initial return, IPO underpricing, IPO overvaluation and post-IPO long run stock performance.

| Dependent variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|--|--|--|---------------------------------|--|---|---------------------------------|--|---|---------------------------------|
| | BHAR240 | BHAR240 | BHAR240 | BHAR480 | BHAR480 | BHAR480 | BHAR720 | BHAR720 | BHAR720 |
| <i>IR</i> | -0.088 ^{***} (-2.89) | | | -0.17 ^{***} (-5.30) | | | -0.20 ^{***} (-4.12) | | |
| <i>IROP1</i> | | -0.19 ^{***} (-5.71) | | | -0.24 ^{***} (-6.27) | | | -0.34 ^{***} (-4.87) | |
| <i>IRUP1</i> | | 0.30 ^{***} (4.15) | | | 0.089 (1.12) | | | 0.24 ^{**} (1.97) | |
| <i>IROP2</i> | | | -0.083 ^{**} (-2.58) | | | -0.16 ^{***} (-5.30) | | | -0.18 ^{***} (-3.58) |
| <i>IRUP2</i> | | | -0.12 ^{**} (-2.43) | | | -0.22 ^{***} (-3.31) | | | -0.37 ^{***} (-3.38) |
| <i>Underwriter</i> | 0.043 (1.43) | 0.030 (1.01) | 0.044 (1.44) | -0.0013 (-0.04) | -0.014 (-0.43) | -0.0018 (-0.06) | -0.032 (-0.44) | -0.072 (-0.97) | -0.033 (-0.46) |
| <i>Topone</i> | 0.039 (0.42) | 0.029 (0.32) | 0.043 (0.46) | 0.062 (0.65) | 0.058 (0.62) | 0.066 (0.69) | 0.049 (0.21) | 0.048 (0.20) | 0.034 (0.14) |
| <i>EPS</i> | 0.14 ^{**} (2.07) | 0.097 (1.44) | 0.16 ^{**} (1.97) | 0.24 ^{***} (3.15) | 0.22 ^{***} (2.92) | 0.26 ^{***} (3.27) | 0.65 ^{***} (3.29) | 0.61 ^{***} (3.25) | 0.73 ^{***} (3.67) |
| <i>Age</i> | -0.0094 (-0.61) | -0.0072 (-0.47) | -0.011 (-0.68) | -0.026 (-1.11) | -0.025 (-1.08) | -0.027 (-1.18) | -0.066 (-1.26) | -0.067 (-1.30) | -0.077 (-1.47) |
| <i>Size</i> | -0.033 (-1.20) | -0.036 (-1.32) | -0.049 (-1.35) | -0.13 ^{***} (-4.76) | -0.14 ^{***} (-5.05) | -0.15 ^{***} (-4.22) | -0.32 ^{***} (-4.69) | -0.34 ^{***} (-4.91) | -0.39 ^{***} (-4.38) |
| <i>_cons</i> | -0.68 (-1.61) | -0.72 [*] (-1.71) | -0.48 (-0.90) | 1.07 ^{***} (2.78) | 1.12 ^{***} (2.91) | 1.32 ^{***} (2.74) | 3.37 ^{***} (3.46) | 3.46 ^{***} (3.55) | 4.34 ^{***} (3.43) |
| <i>I.Board</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>I.Year</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>I.Indu</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Coefficients difference test (SUEST test) | <i>IR = IROP1</i> (28.39 ^{***}) | <i>IROP1 = IROP2</i> (29.03 ^{**}) | <i>IR = IROP2</i> (0.39) | <i>IR = IROP1</i> (10.52 ^{***}) | <i>IROP1 = IROP2</i> (12.58 ^{***}) | <i>IR = IROP2</i> (0.59) | <i>IR = IROP1</i> (10.09 ^{***}) | <i>IROP1 = IROP2</i> (12.79 ^{***}) | <i>IR = IROP2</i> (2.43) |
| Adj. <i>R</i> ² | 0.286 | 0.316 | 0.286 | 0.220 | 0.235 | 0.220 | 0.196 | 0.224 | 0.204 |
| <i>N</i> | 948 | 948 | 948 | 782 | 782 | 782 | 439 | 439 | 439 |

Notes: *BHAR* (the dependent variable) is a proxy for the post-IPO long run stock performance. *IR*, *IRUP* and *IROP* are proxies for IPO initial returns, IPO underpricing and IPO overvaluation, respectively. The variables are defined in Table 4. The numbers in parentheses are heteroskedasticity consistent *t*-statistics.

* $P < 0.1$.

** $P < 0.05$.

*** $P < 0.01$.

of IPO pricing regulations on underpricing and overvaluation. Because the market environment changes quickly in China, limiting our sample to a narrower window will help us to evaluate more precisely the consequence of the deregulation of IPO pricing. The results in Columns 4 and 5 show that, during the sample period of 2008–2009 (there are 73 observations before and 95 observations after the regulation), *PEcontrol* is significantly positively related to *IRUPI* but not significantly related to *IROPI*. This indicates that deregulating IPO pricing reduces underpricing but not overvaluation, which is consistent with our predictions.

The results in Column 2 show that the underwriter's reputation is positively related to underpricing, supporting the conflict of interest hypothesis but not the signaling hypothesis. To further provide evidence for the conflict of interest hypothesis, we classify the full sample into two groups by firm size (issuance size) and find that a positive relationship between the underwriter's reputation and underpricing only exists in the IPOs of smaller firms (these results are reported in Columns 6 and 7). According to our theoretical analysis, these results are consistent with the conflict of interest hypothesis. The results in Columns 6 and 7 also show that investor sentiment (*Sent*) is significantly negatively related to underpricing in small firms, suggesting that underwriters take advantage of investor sentiment toward small firms to benefit themselves.

Our theoretical analysis suggests that value uncertainty in IPOs and investor sentiment may have an interaction effect in overvaluation, but our regressions in Columns 1 to 3 only examine the main effect. In view of this consideration, we further add an interaction term *Uncer * Sent* in Columns 8 and 9. The results in Col-

Table 9
Determinants of IPO initial return, IPO underpricing and IPO overvaluation.

| Dependent variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|--------------------|----------------------|---------------------|
| Sample | All | All | All | Year = 2008/ 2009 | Year = 2008/ 2009 | Small Size | Large Size | All | All |
| <i>Uncer</i> | 2.21*** (7.10) | 0.98*** (5.51) | 1.23*** (4.16) | 1.36*** (3.27) | 0.73 (0.95) | 1.11*** (5.43) | 0.45*** (4.04) | 0.074*** (4.03) | 0.11*** (2.78) |
| <i>Underwriter</i> | 0.027 (0.68) | 0.038** (2.19) | -0.011 (-0.36) | 0.047 (0.75) | -0.10 (-1.53) | 0.066** (2.52) | 0.0065 (0.47) | 0.032** (1.98) | -0.0052 (-0.18) |
| <i>PEcontrol</i> | 0.62*** (9.93) | 0.50*** (17.69) | 0.13** (2.54) | 0.35*** (4.13) | 0.080 (0.57) | 0.22*** (3.28) | 0.14*** (2.92) | 0.16*** (5.43) | -0.30*** (-3.50) |
| <i>Sent</i> | 0.35*** (4.73) | -0.042 (-1.38) | 0.39*** (6.71) | -0.13 (-1.21) | 0.35* (1.97) | -0.088** (-2.22) | -0.025 (-0.86) | -0.079*** (-2.85) | 0.28*** (4.93) |
| <i>Topone</i> | 0.032 (0.26) | 0.047 (0.81) | -0.014 (-0.14) | 0.14 (0.76) | -0.072 (-0.29) | 0.062 (0.65) | 0.0084 (0.19) | 0.028 (0.53) | -0.0029 (-0.03) |
| <i>EPS</i> | -0.11** (-2.22) | 0.094*** (3.02) | -0.21*** (-4.41) | 0.034 (0.41) | -0.12 (-1.56) | 0.11* (1.86) | 0.057*** (2.64) | 0.078*** (2.82) | -0.16*** (-3.35) |
| <i>Age</i> | -0.085*** (-3.30) | -0.016 (-1.53) | -0.069*** (-3.08) | -0.00071 (-0.02) | -0.036 (-0.70) | -0.025 (-1.45) | -0.0028 (-0.30) | -0.017* (-1.72) | -0.026 (-1.21) |
| <i>Size</i> | -0.27*** (-8.05) | -0.060*** (-3.73) | -0.21*** (-7.76) | -0.11* (-1.69) | -0.29*** (-5.12) | -0.13*** (-3.21) | 0.014 (1.09) | -0.051*** (-3.26) | -0.23*** (-9.09) |
| <i>Sent * Uncer</i> | | | | | | | | 0.078 (1.41) | 0.23** (2.24) |
| <i>_cons</i> | 3.62*** (8.41) | 0.66*** (3.23) | 2.96*** (8.25) | 1.55* (1.91) | 4.38*** (5.59) | 1.24** (2.53) | -0.041 (-0.24) | 0.77*** (3.97) | 3.39*** (10.32) |
| <i>I.Board</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>I.Year</i> | | | | | | Yes | Yes | Yes | Yes |
| <i>I.Indu</i> | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. R ² | 0.492 | 0.529 | 0.344 | 0.356 | 0.238 | 0.578 | 0.560 | 0.592 | 0.446 |
| N | 948 | 948 | 948 | 168 | 168 | 474 | 474 | 948 | 948 |

Notes: *IR*, *IRUP* and *IROP* (the dependent variables) are proxies for IPO initial returns, IPO underpricing and IPO overvaluation, respectively. *Uncer*, *Underwriter*, *PEcontrol* and *Sent* are proxies for value uncertainty of IPOs, underwriter reputation, whether IPO pricing is regulated and investor sentiment. The variables are defined in Table 4. The numbers in parentheses are heteroskedasticity consistent *t*-statistics.

* $P < 0.1$.

** $P < 0.05$.

*** $P < 0.01$.

umns 8 and 9 show that the coefficient of *Uncer * Sent* in Columns 9 is significantly positive, suggesting that the higher the value uncertainty of IPOs, the larger the effect of investor sentiment on overvaluation.

Overall, the results in this subsection are consistent with our theoretical analysis, indicating that distinguishing between underpricing and overvaluation is vital when investigating their determinants.

5.4. Robustness tests

To check the robustness of our results, we conducted a series of sensitivity analyses related to aspects of sample selection, model construction and variable measurement. Due to space limitations, the results of these tests are not reported but are available on request.

5.4.1. Sensitivity analysis on sample selection

- (1) During the sample period, there was an important reform in IPO pricing. The CSRC deregulated IPO pricing in June 2009. As a robustness check, we divided the full sample into two sub-samples before and after this reform and then repeat our regressions. The results show that the main conclusions from the full sample apply to these sub-samples.
- (2) According to the definitions of IPO underpricing and overvaluation, underpricing and overvaluation should, in general, be positive. Therefore, we exclude observations with negative underpricing or negative overvaluation (346 observations) and repeat our analysis. The results from this reduced sample do not change our main conclusions.
- (3) Firm characteristics may differ between listing boards, so we divide the sample into two sub-samples: main boards and other boards (SMEs board and GEM board) and repeat our results. Again, the main conclusions from the full sample apply to these sub-samples.

5.4.2. Sensitivity analysis on model construction and variable measurement

- (1) We measure IPO firms' intrinsic values by using analyst forecasts and comparison to similar firms. To reduce the optimistic bias of analyst forecasts, we used the median and minimum instead of the mean of analyst forecast prices to measure intrinsic value and repeat our analysis. We also use all of the firm's industry peers as comparable firms rather than selecting a comparable firm to measure intrinsic value and repeat our analysis. We also use the rank of underwriter size (by total asset) instead of underwriter income to measure underwriter reputation and repeat our analysis. Overall, the results show that these changes in variable measurement do not affect our main results.
- (2) In the analysis in Table 8, we include the variables *IRUP1* and *IROP1*, and *IRUP2* and *IROP2* into the regression model at the same time. As a sensitivity test, we add *IRUP1*, *IROP1*, *IRUP2* and *IROP2*, one by one into the model. The results show that, although the size and significance of the coefficient of *IRUP2* decrease somewhat, the main conclusions of our analysis remain the same.

6. Conclusions and implications

Our main results can be summarized as follows. First, average IPO initial returns are 66%, with underpricing and overvaluation between 14–22% and 44–53%, respectively, depending on the measure used. Second, while both the initial return and overvaluation are significantly and negatively related to post-IPO long-run stock performance, overvaluation predicts post-IPO performance better than the initial return. Third, the value uncertainty of IPOs is positively related to both underpricing and overvaluation. Both underwriter reputation and pricing regulation are positively related to underpricing. Investor sentiment has a positive effect on overvaluation but has no effect or a negative effect on underpricing. Overall, our results suggest that the main reason for extremely high IPO initial returns in China is that first-day closing prices are overvalued, and that underpricing and overvaluation have different determinants.

Our findings have important implications for both academics and regulators. First, as we have shown that overvaluation is more important than underpricing, future studies should pay more attention to the causes of overvaluation and to measures to control overvaluation in IPOs. When deciding the path of IPO reform, regulators should consider not only how to reduce underpricing and increase pricing efficiency in the primary market, but also how to reduce overvaluation in the secondary market. Second, as we show that separating underpricing and overvaluation from the initial return is necessary, future studies could use the methods described here to measure underpricing and overvaluation, and then investigate their determinants more precisely and explore the potential effects of IPO reform more comprehensively. Finally, our results also serve as a reminder for scholars that using IPO initial returns to measure IPO underpricing in China is likely to be inaccurate.

This study is subject to some limitations. The most important is that the intrinsic value of IPO firms is hard to measure. Although the methods used here have some advantages, bias remains. We expect that improved measures could be put forward to evaluate more precisely the relative importance of IPO underpricing and overvaluation, investigate their determinants more accurately, and evaluate the consequences of IPO pricing reform more efficiently.

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