

## An Empirical Assessment of A-Share IPO Under-Pricing in China\*

**CHAN-HYUN SOHN\*\***

*Kangwon National University  
Korea*

**ALBERT K TSUI\*\*\***

*National University of Singapore  
Singapore*

**FENG ZHANG\*\*\*\***

*David Eccles School of Business  
University of Utah, USA*

**ZHAOYONG ZHANG\*\*\*\*\***

*School of Accounting, Finance & Economics  
Edith Cowan University, Australia*

### Abstract

This paper investigates the under-pricing and long-run performance of 230 A-share IPOs issued in the Chinese markets using comparable firm

---

\* The authors wish to thank the journal Editor-in-Chief, Professor Kyung Mook Lee, and three anonymous referees for extremely valuable comments. The last author wishes to acknowledge the financial support of a Strategic Research Grant from ECU.

\*\* Professor, Department of International Trade and Business, Kangwon National University, Korea (chsohn@kangwon.ac.kr).

\*\*\* Associate Professor, Department of Economics, National University of Singapore, Singapore (ecsatsui@nus.edu.sg).

\*\*\*\* Assistant Professor of Finance, David Eccles School of Business, University of Utah, USA (feng.zhang@business.utah.edu).

\*\*\*\*\* (Corresponding author) Associate Professor of Economics, School of Accounting, Finance and Economics, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia. Tel: +61 8 6304 5266; Fax: +61 8 6304 5271 (zhaoyong.zhang@ecu.edu.au)

multiples. We find that A-share IPOs are severely under-valued by issuers and underwriters at the offer, but over-valued by investors on the listing day. Both contribute to the severe under-pricing of IPOs in China. Our findings are robust across stock exchanges, classification of firms, criteria for choosing matching firms; absence of CSRC regulation and B-share market prices, respectively. The results also show that those over-valued IPOs by investors on the listing day under-perform those under-valued IPOs in the long-run.

Keywords: Chinese stock market, A-share IPO, Under-pricing

## INTRODUCTION

Under-pricing of initial public offering (IPO) refers to a phenomenon where the initial market price of a newly listed stock exceeds its issue price. It was first documented by Stoll and Curley (1970), Reilly (1973), Logue (1973), and Ibbotson (1975), respectively. Such a study has become an important research agenda in the past three decades. Among others, Ritter and Welch (2002) give a detailed survey of IPO-related issues. Indeed, empirical evidence of under-pricings has been detected in many financial markets across countries. Loughran et al (1994) provide evidence of under-pricings of IPOs in 25 countries, highlighting lower IPO under-pricing in developed than in developing markets. More recently updated international average initial returns for more than 13 countries including China are available in the Ritter's IPO homepage. Among such evidence of under-pricing, the degree of severe under-pricing of A-shares in China is the most alarming.

Many researchers have reported consistent empirical evidence of under-pricing of A-share IPOs in China. For example, Mok and Hui (1998) find a high initial return of 289% for A-shares in Shanghai Stock Exchange between 1990 and 1993. Su and Fleisher (1999) find that the A-shares average initial return is astonishingly at 948.59% from 1986 to 1996. Chen et al. (2001) find under-pricing of A-shares listed in the period 1991 to 1996 staggering at 335%. Chi and Padgett (2002b) find an average market-adjusted initial return of 129.16% in a sample of 668 IPOs from 1996 and 2000. And Liu and Li (2000) find an average market-adjusted initial return of 139.4% in a sample of 781 IPOs listed from 1991 to 1999. Chan et al. (2001) find the average initial return of A-shares between 1993 and 1998 is 178%. Finally Wu (2001) studies A-share IPOs listed



Note: This chart graphs the index adjusted first-day returns of Chinese A-share IPOs up to 1999. Data source: Wu (2001)

**Figure 1. Initial Returns of Chinese A-Share IPOs by Year.**

between December 1990 and March 2000 and finds an average market adjusted initial return of 218.33%. Figure 1 displays the initial returns of Chinese A-shares IPOs by year in Wu (2001). It can be observed that the initial returns of IPOs listed before 1993 are extremely high. This implies that inclusion of such IPOs contributes to the extraordinarily high initial returns reported by Su and Fleisher (1999), and Chen et al. (2001), respectively.

However, findings on the long-run performance of Chinese A-share IPOs are mixed. For example, Chen et al. (2000) find that A-share IPOs listed from 1992 to 1995 under-perform the market after 3 years of listing. Similarly, Gu (2003) finds that the 68 IPOs went public in 1994 under-perform the market by 53% and 57% after 3 and 5 years of listing respectively. In contrast, other researchers find the opposite. Mok and Hui (1998) find that the under-priced IPOs under-perform the market as a whole in the first 75 trading days, but out-perform the market with a few percent above zero in the rest of the 350 holding days; whereas those over-priced IPOs also under-perform the market in the first 20 trading days, but enjoy high excess returns in the rest of the 350 holding days. In addition, Chi and Padgett (2002a) find that A-share IPOs listed in 1996 and 1997 out-

perform the market by 10.26% after 3 years of listing.

Essentially there are two types of theoretical models used to explain the under-pricing of IPOs in general. One is based on the assumption of asymmetric information, and the other on symmetric information. The former includes (1) signaling model, (2) winner's curse model, and (3) principal-agent model. Allen and Faulhaber (1989), Grinblatt and Hwang (1989), Welch (1989), and Chemmanur (1993) employ signaling models to account for the high initial returns of IPOs, assuming that issuers have superior information on security value than the underwriters or investors. New issues of high quality IPOs are under-priced in order to signal their quality to investors. In the winner's curse model developed by Rock (1986) and Beatty and Ritter (1986), investors are assumed to be more informed than issuers and they are differentially informed among themselves. To induce investors to subscribe shares and thus ensure the launch a success, it is optimal for issuers to under-price IPOs. Baron (1982) constructs the principal-agent model to offer an alternative explanation for IPO under-pricing. He assumes that issuers are less informed than underwriters. The issuers prompt to under-price IPOs so as to induce underwriters to put in the requisite effort to market shares. Recently, Baker and Wurgler (2006, 2007) construct a sentiment index based on six proxies for market sentiment orthogonalized against a set of macroeconomic variables, and find that the sentiment index is significantly positively correlated to stock returns.

These well-established models have been applied to markets for IPOs in China. Many researches have tried to find evidence of severe under-pricing of the Chinese A-share IPOs using asymmetric information models. For instance, nine studies examine the possibly negative relationship between under-pricing and ownership retained by issuers, as hypothesized in the signaling model. Five obtain the expected negative relationship, while four do not (see Chan et al. 2001; Chau et al. 1999; Chen et al. 2001; Chi and Padgett 2002b; Gu 2003; Mok and Hui 1998; Su 1999; Su and Fleisher 1999; Wu 2001). In addition, Chen et al. (2001), Chi and Padgett (2000b), Su and Fleisher (1999), and Wu (2001) examine the relationship between under-pricing and seasoned equity offerings. All the three except Chi and Padgett (2000b) obtain the expected positive relationship.

Moreover, ten studies test the winner's curse model by examining

the relationship between under-pricing and ballot ratio (reciprocal of oversubscription rate), and/or the relationship between under-pricing and ex-ante uncertainty about the value of an issue (in addition, see Liu and Li 2000). If the winner's curse model holds for the IPO markets in China, the former relationship should be negative, and the later positive. The variables used to measure ex-ante uncertainty include firm size, IPO size (proceeds from IPO or number of shares issued), firm age, and market risk around the offering. These studies find a broadly consistent negative relationship between under-pricing and ballot ratio, a negative relationship between under-pricing and IPO size, and a positive relationship between under-pricing and market risk around offering of IPO. However, results concerning the relationship between under-pricing and firm size and firm age are mixed. In short, these ten studies do not provide strong evidence to support the winner's curse model. More recently, Wu (2001) tests the principal-agent model by examining the relationship between under-pricing and reputation of underwriter. His results do not support the principal-agent model either.

Furthermore, several studies are conducted to investigate the high initial returns of A-shares using fundamental characteristics of the IPO markets in China. For example, Chan et al. (2001), Chen et al. (2001), Mok and Hui (1998), and Wu (2001) find a positive relationship between the under-pricing and the time lag from offering to listing. And Chi and Padgett (2002b), Gu (2003), and Liu and Li (2000) attribute the severe under-pricing to the high demand for IPOs and limited investment opportunities of the investors in China. However, Gu (2003) does not provide empirical support for his conclusion. Nevertheless, Liu and Li (2000) and Chi and Padgett (2002b) find evidence of a negative relationship between under-pricing and ballot ratio, thereby supporting the winner's curse model. Moreover, Gu (2003) also claims that the bribery hypothesis contributes to the high initial returns of A-share IPOs. This is because managers and employees of the issuing companies are eligible to buy a portion of the initial offerings. As such, they have incentives to under-price the new issue for personal gains at the expense of the government. But Su and Fleisher (1999) argue that bribery may be a by-product of under-pricing.

As it is clear that the asymmetric information models seem do not provide convincing explanations for the severe under-pricing of A-share IPOs in China, the purpose of this study is to find some

alternative measures to investigate whether A-share IPOs are really under-valued at offering. As a matter of fact, Ritter and Welch (2002) deem it unlikely that asymmetric information theory is able to explain more than a few percent of IPO under-pricing. In particular, we adopt in this paper the methodology of comparable firm multiples proposed by Kim and Ritter (1999) and Purnanandam and Swaminathan (2004) to assess the role played by China Securities Regulatory Commission (CSRC) in under-valuing Chinese A-share IPOs at offering, and investigate the factors that contributed to the under-pricing of IPOs in China. The results show that the A-share IPOs in China are severely under-valued by issuers and underwriters, and that these IPOs are over-valued by investors on the listing day. Hence, both under-valuation by issuers and underwriters, and over-valuation by investors contribute to the severe under-pricing of IPOs.

The rest of the paper is organized as follows. The next section highlights some institutional background of the IPO market in China. Section 3 describes the data and the IPO valuation methodology. Section 4 presents empirical findings under the benchmark case and ranks performance of price multiples in valuating IPOs. It also performs sensitivity analysis of the benchmark findings across different exchanges, classification of firms, criteria for choosing matching firms, CSRC regulations and B-share market prices. Section 5 reports results on initial returns and long-run performance of IPOs. Section 6 provides some concluding remarks.

## **CHARACTERISTICS OF CHINESE IPO MARKET**

In what follows we highlight some unique features of the emerging securities market in China pertaining to the under-pricing of IPOs.

### **Share Types**

Since their inception in early 1990's, Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE) are the two national exchanges established to absorb and control capital for state owned enterprises (SOE), thereby improving their management and profitability. In the last decade, the Chinese government has introduced

5 different types of shares SHSE and SZSE to raise money and to retain control over listed companies. These include government shares, legal entity shares, employee shares, A-shares, and B-shares. Government shares are owned by the State Assets Management Bureau (SAMB) and are non-tradable; Legal entity shares can only be held by other SOEs or the foreign partners of a Sino-foreign joint venture and are also non-tradable; Employee shares are issued to employees of IPO companies and prevented from being traded for a certain period of time (usually one year), and once employee shares are listed, they become the same as A-shares; A-shares are tradable common shares that can be held only by Chinese citizens; B shares are tradable only to foreign investors. From 1993, the China Securities Regulatory Committee (CSRC) allows companies that satisfy certain requirements to issue shares on Hong Kong Stock Exchange and other foreign exchanges. These shares are called H-shares and N-shares, respectively.

### **Listing Procedure**

One notable characteristic of the Chinese IPO market is the unique selection process of listing companies. Based on economic development plans and other (even political and military) factors, the State Council Securities Committee (SCSC), the State Planning Commission (SPC), and the People's Bank of China (PBOC) jointly determine the total IPO quotas annually. The quotas are then allocated to individual provinces, municipalities, ministries in consideration of regional needs, regional development goals and provincial differences in production structure. Within each regional quota, the local securities authorities invite enterprises to request listings and then make a selection based on factors including perceived financing needs, previous operating performance, regional and national development objectives, societal concerns, and even personal relationships of enterprise management with government officials. However, the annual IPO-quota practice was cancelled by the CSRC on March 17, 2001. Since then any firm that satisfies the requirements stipulated in the Company Law and Securities Law may apply for listing. These requirements include: (a) The firm must make profits in the past three years; (b) capital stock must exceed 50 million RMB; (c) at least 25% of capital stock (15% for firms whose capital stock exceed 400 million RMB) should be sold to the

public; and (d) no manipulation of accounts in the past 3 years.

### **Long Time Lag Between Offering and Listing of IPO**

The usual time lag between offering and listing of A-share IPOs has been alarmingly long. After making public offerings, the firms need wait in a queue to be floated. The average time lag reported by Wu (2001) is 350.76 days, which is much longer than the short duration ranging from a few days to a few weeks in the developed stock markets. Before 1993, the time lag could even be more than 3 years (See Chen, Firth, and Kim 2001; Mok and Hui 1998). The listing time lag during this study period is with an average of 305 days and the median of 34 days.

### **High Demand for A-Share IPO**

The high demand for A-share IPOs may be caused by two major factors. One is due to the limited aggregate supply of IPOs as it is controlled by the government through the annual quota of IPO. The other can be explained by the shortage of alternative investment choices. It is common knowledge that before 1990, the Chinese investors can only invest in bank deposits and Treasury bond since the domestic financial markets are poorly developed and they are refrained from investing overseas due to capital control of the government. Muirin and Sommariva (1993) find that for the Chinese investors, the real returns on saving and Treasury bonds are actually negative because of the relatively high inflation rate. Hence, it is not surprising that many investors shift to holding securities for the expected higher returns after the establishment of Shanghai Stock and Shenzhen Stock Exchanges in the early 1990's.

### **Allocation Methods**

In what follows we provide detailed information on the allocation methods of A-share IPOs since they are very different from those used in the developed markets and have undergone many changes since the early 1990's.

Basically a fixed pricing system was used to determine the offer prices of most A-share IPOs. Under the fixed price mechanism, issuers and underwriters decide a fixed offer price months before



the listing and there is no feedback mechanism to adjust the offer price. As required by the China Securities Regulatory Committee (CSRC), the offer price should be based on the following formula:

$$\text{Offer price} = \text{EPS} * \text{P/E},$$

where P/E refers to the price-to-earnings ratio, and EPS is earnings per share. Note that the P/E ratios of most IPOs are usually set between 13 and 15 times according to regulations of the CSRC, with some exceptions specially approved by the CSRC.

There were substantial changes in methods of computing EPS. Before 1996, EPS was based on forecasted earnings per share. On December 26, 1996, the CSRC published a notice which changed EPS to be based on the realized arithmetic average EPS in the past three years, that is  $\text{EPS}_t = (\text{EPS}_{t-1} + \text{EPS}_{t-2} + \text{EPS}_{t-3})/3$ . On September 10, 1997, the CSRC changed the EPS calculation formula to:  $\text{EPS} = (0.7 * \text{EPS in the year before the IPO} + 0.3 * \text{Forecasted EPS during the IPO year})$ . In addition, on March 17, 1998, the CSRC further changed the EPS calculation formula to:  $\text{EPS} = \text{Forecasted Earnings}/(\text{Total number of shares before IPO} + \text{Number of IPO shares} * (12\text{-month})/12)$ , where 'month' is the month when IPO is offered.

As regards the allocation mechanism, the lottery and *pro rata* mechanisms have been adopted. Conceivably the former allocates shares issued by lot and the latter allocates shares by *pro rata*. The difference lies in how shares are allocated in case of over-subscription. But different lottery systems were adopted during different periods. For example, in 1991 and 1992, a lottery system based on fixed number of application forms was used. Under this arrangement, each investor was allowed to purchase a limited number of lottery forms, and the lottery winners were entitled to a certain number of shares per winning form. On August 18, 1993 CSRC introduced two other lottery systems, one based on unlimited number of application forms and the other on unlimited number of special savings deposit certificates. Unlimited number of application forms and special savings deposit certificates were supplied, respectively, to investors to subscribe, and shares were allocated by lot. Moreover, the CSRC's October 20, 1995 notice recommended a lottery system based on quantity bids, where investors were required to open and save enough money in special saving accounts and could

bid for shares at affordable amount backed up by the saving deposits. This system has been widely used since 1995.

Owing to the lucrative returns, investors were eager to subscribe to IPOs. In order to direct investors to the secondary securities market, the CSRC published a notice on February 13, 2000, allowing issuers and underwriters to allocate half of the issued shares to current secondary securities market investors. This was under a fixed price lottery mechanism and shares were allocated by drawing lots in case of over-subscription. 35 out of 137 A-share IPOs adopted this allocation mechanism during year 2000. But it ceased operation after year 2000 for technical problems. On 20 May 2002, the CSRC resumed this mechanism and adjusted the percentage that could be allocated to the secondary securities market investors from 50% to 100%. In practice, almost all issuers may allocate all their issued shares to the secondary securities market.

Furthermore, two *pro rata* mechanisms were introduced by the CSRC on 16 December 1996. Investors were required to save enough money to subscribe to shares in special accounts. And IPO shares were allocated *pro rata* in case of over-subscription. These two *pro rata* mechanisms were widely adopted in 1996 and 1997, but were not used after 1998.

Alternatively several auctions were experimented in 1994 and 1995. Issuers and underwriters set an initial price and investors were required to bid for both price and quantity. The final offer price was set at the level where the accumulative quantities demanded by investors were equal to the total number of new shares available. However, only four IPOs listed between June 1994 and January 1995 adopted this auction mechanism and all of the first closing market prices fell below the offer prices.

Regarding the book-building system, it was first introduced on 28 July 1999 with a view to allowing issuers and underwriters to set an initial offer price range and to decide the final price after receiving feedback from investors. However, the final offer price must fall in the price range approved by the CSRC. Exceptional cases were to be specially approved by the CSRC. 31 (3 in 1999 and 28 in 2000) issuers adopted the book-building system since September 21, 1999. This book-building system ceased operation in late 2000. Since its restoration on November 6, 2001, the book-building approach was used by almost all IPOs issued in 2001 and the first 5 months in 2002 until the CSRC required issuers to allocate shares to the sec-

ondary market investors in May 2002.

Notwithstanding the cancellation of annual IPO quota and re-adoption of the book-building, the year 2001 witnessed another fundamental change in the Chinese IPO market: namely the introduction of the over-allotment option for up to 15% of the shares offered on September 3, 2001. Such an option has been commonly used in many mature securities markets. Apparently the Chinese IPO markets have become more homogeneous with those practices in developed markets.

## DATA AND METHODOLOGY

In this section, we first describe the source and characteristics of sample data, then summarize the steps in choosing matching firms and finally the IPO valuations based on comparable firm multiples.

### **The Data**

The period under study is from January 1997 to December 1998. The reasons for choosing this period in this study are two. First, since its establishment in the early 1990s, the Chinese stock market had experienced several changes in regard to the share offering mechanism, and moved to the online fixed price offering method in 1994 which became the major offering method since 1996. And since 1999, the CSRC implemented several new regulations including imposing a ceiling on the PE ratio and adopting the book-building system. Therefore, the chosen study period would be more appropriate for us to assess the role played by the CSRC in under-valuing Chinese A-share IPOs at offering and investigate the factors that contributed to the under-pricing of IPOs in China. This is supported by our exercise when examining those IPOs that are launched in the period from March 2000 to August 2001 when CSRC cancelled the offering price regulation. Second, our choice of the study period is also to ensure proper selection of matching firms and to spare enough duration to gauge the after-listing performance of IPOs of A-shares listed on SHSE and SZSE, respectively. To be included in the study sample, an IPO must satisfy the following criteria slightly adopted from those used by Kim and Ritter (1999) and Purnanandam and Swaminathan (2004) to suit the market

environment in China:

1. The IPO should have an offer price higher than 1 RMB;
2. The IPO should be a non-financial company;
3. The IPO should have information on underwriter, allocation method, ballot ratio, and P/E ratio in the prospectus;
4. The IPO should have information on revenue from main operation, operating profit, and net profit for the prior fiscal year; and
5. The IPO should have an appropriate matching firm in the same industry that was listed prior to the year when the IPO was offered.

There are 312 A-share IPOs listed on the Shanghai and Shenzhen Stock Exchanges during the period of study. We collect matching firms' revenue from main operation, operating profit, net profit, earnings per share and state and legal entity ownership data from the China Stock Market & Accounting Research (CSMAR) database and from offer prospectus and listing prospectus of IPOs, respectively. However, we drop 43 samples as their P/E ratios and/or ballot ratios are not available.

### **Choosing Matching Firms**

We adopt the matching approach of Purnanandam and Swaminathan (2004) with adjustments according to the context of IPOs in China. Like these researchers, we select the reasonably comparable firms subjectively from the pool of industry peers based on their closeness with the IPOs in terms of revenue from main operation and net profit. Revenue from main operation and net profit are used to ensure that the IPOs and matching firms have similar size and profitability, respectively. Besides these benchmark criteria, we also pick the comparable firms by industry, price-to-earning (P/E) ratio and state and legal entity ownership as alternative matching criteria. This is because earnings per share and government ownership play important roles in valuing Chinese stocks. Both the benchmark and the alternative matching criteria yield similar IPO valuations. Details are provided in Section 4.2. However, we do not match the price-to-forecasted earnings multiple for two reasons. First, Chen and Firth (1999) show that profits forecast in the offer

**Table 1. Descriptive Statistics for the 230 A-share IPOs****Panel A: Descriptive Statistics of IPOs**

Variable	Mean	Median	Max	Min	Std. Dev.
Offer Price (RMB)	6.05	6.00	15.00	3.00	1.68
Proceeds (Millions of RMB)	336.98	256.79	2625.00	14.00	330.77
Ballot Ratio (%)	1.59	0.75	18.66	0.0084	2.53
P/E Ratio	14.66	14.50	23.83	10.00	1.39

**Panel B: Characteristics of IPO Firms and Matching Firms**

	IPO Firms					Matching Firms				
	Mean	Median	Max	Min	Std. Dev.	Mean	Median	Max	Min	Std. Dev.
Revenue from Main Operation (Millions of RMB)	666.90	331.08	8513.20	16.25	1137.70	636.78	300.43	12127.00	51.72	1361.60
Operating Profit (Millions of RMB)	85.72	50.79	920.16	9.81	119.79	62.38	40.62	885.93	2.98	90.41
Net Profit (Millions of RMB)	71.12	44.75	614.54	2.38	87.51	59.40	45.08	726.47	8.56	73.57
State and Legal Entity Ownership (%)	65.16	66.67	84.99	30.47	9.68	64.34	64.73	90.00	30.82	9.85

Note: Panel A provides descriptive statistics of IPOs. P/E ratio stands for offer price/earnings per share. Ballot ratio is number of shares issued/number of shares subscribed. Offer price and proceeds numbers are collected from CSMAR database, and most of ballot ratio and P/E ratio numbers are collected from the offer prospectus and listing prospectus of IPOs, with few from <http://www.cninfo.com.cn/>. Panel B compares IPO firms and matching firms. Revenue from main operation, operating profit, and net profit numbers of matching firms are collected from the CSMAR database, and those of IPO firms from offer prospectus and listing prospectus of IPOs. State and legal entity ownership is collected from the CSMAR database.

prospectuses are only moderately accurate although better than time series extrapolations of historical profits. Second, the forecasted profits are not available in the CSMAR database.

Steps in choosing a matching firm for each IPO in our sample

under the benchmark case are briefly described as follows. First, we collect information on industry, revenue from main operation and net profit of the IPO from its offer prospectus and the CSMAR database. Then we locate the corresponding industry peers listed before the year when the IPO was offered from the CSMAR database. The CSMAR adopts the CSRC's industry classification in 2001. Finally, we collect information on revenue from main operation and net profit for all the industry peers and select an appropriate matching firm based on its closeness with the IPO in terms of these three criteria. When two or more matching firms are possible, we select the one that has similar net profit as the IPO in question. Nevertheless, we are unable to identify reasonably satisfactory matching firms for 39 IPOs. Consequently, 230 out of these identified 312 IPOs are selected as the resultant sample in our study.

Panel A of Table 1 presents the summary statistics of IPOs under offer price, proceeds, ballot ratio and P/E ratio, respectively. As can be observed, the mean and median ballot ratios are 1.59% and 0.75%, implying a high demand for IPOs. In addition, the mean, median, and standard deviation of P/E ratios are 14.66, 14.50, and 1.39 respectively. Apparently most issuers gauge the P/E ratios by the upper limit of the P/E ratio set by CSRC. Panel B of Table 1 displays the characteristics of individual IPO firms and their corresponding matching firms. As expected, individual firms and their matching firms have similar mean and median revenue from main operation, net profit, and state and legal entity ownership since the matching firms are selected according to features similar to the individual firms.

### **IPO Valuation Using Price Multiples**

For each IPO firm, we obtain three price-to-value (P/V) ratios based on the offer price (P) and fair value (V) computed from the matching firm's market multiples and the IPO firm's revenue from main operation, operating profit, and net profit, respectively. These ratios are obtained by dividing the IPO offer price multiples by the matching firm's market multiples. That is:

$$\left[ \frac{P}{V} \right]_{RMO} = \frac{(P/RMO)_{IPO}}{(P/RMO)_{Match}} \quad (1)$$

$$\left[ \frac{P}{V} \right]_{OP} = \frac{(P/OP)_{IPO}}{(P/OP)_{Match}} \quad (2)$$

$$\left[ \frac{P}{V} \right]_{NP} = \frac{(P/NP)_{IPO}}{(P/NP)_{Match}} \quad (3)$$

where *RMO* refers to revenue from main operation. *OP* refers to operating profit and *NP* refers to net profit. Offer price multiples for IPOs are computed as follows:

$$\left[ \frac{P}{RMO} \right]_{IPO} = \frac{\text{Offer Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year RMO}}$$

$$\left[ \frac{P}{OP} \right]_{IPO} = \frac{\text{Offer Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year OP}}$$

$$\left[ \frac{P}{NP} \right]_{IPO} = \frac{\text{Offer Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year NP}}$$

where *Shares Outstanding* refers to shares outstanding after the issuance of IPO and *Prior Fiscal Year* refers to the year before the offer year of IPO. The price multiples for matching firms are computed as below:

$$\left[ \frac{P}{RMO} \right]_{Match} = \frac{\text{Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year RMO}}$$

$$\left[ \frac{P}{OP} \right]_{Match} = \frac{\text{Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year OP}}$$

$$\left[ \frac{P}{NP} \right]_{Match} = \frac{\text{Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year NP}}$$

where *Market Price* and *Shares Outstanding* refer to closing price and shares outstanding of the matching firm on the day before the offer date of the IPO.

## IPO VALUATION ADEQUACY AND ROBUSTNESS

In what follows we highlight special features of IPO valuations, including hypothesis testing of P/V ratios. Then we compare valuation adequacy of the price multiples under the offer price and the first closing market price, respectively. Finally we conduct sensitivity analysis of findings in the benchmark case using different stock exchanges location, classification of firms, matching criteria, absence of CSRC regulation and presence of B-share market price, respectively.

Panel A of Table 2 presents the descriptive statistics of offer price-to-value (P/V) ratios of 230 IPOs based on price multiples. As can be observed, the mean (median) P/V ratios based on P/RMO, P/OP, and P/NP multiples are 0.56 (0.49), 0.45 (0.43), and 0.52 (0.48),

**Table 2. IPO Valuation based on Price Multiples**

**Panel A: P/V Ratios Based on Price Multiples**

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Wilcoxon p-value
P/RMO	0.56	0.49	3.77	0.11	0.39	3.72	25.33	0.0000
P/OP	0.45	0.43	1.33	0.06	0.20	0.80	4.18	0.0000
P/NP	0.52	0.48	4.75	0.09	0.35	8.06	96.80	0.0000

**Panel B: Correlation among P/V Ratios**

	RMO	OP	NP
RMO	1	0.28	0.13
OP	0.28	1	0.32
NP	0.13	0.32	1

Note: This table reports offer price-to-value (P/V) ratios, computed based on market price-to-revenue from main operation (P/RMO), market price-to-operating profit (P/OP), and market price-to-net profit (P/NP) of a matching firm. An appropriate matching firm is selected based on its closeness with the IPO in terms of revenue from main operation, operating profit, and net profit. Panel A presents descriptive statistics of P/V ratios based on P/RMO, P/OP, and P/NP multiples. The Wilcoxon p-value corresponds to the Wilcoxon signed rank test for the null hypothesis that the median is equal to 1. Panel B presents the correlation coefficients among the P/V ratios based on P/RMO, P/OP, and P/NP multiples.



respectively. The standard deviation, skewness and kurtosis of P/V ratios based on P/OP multiple are much smaller than those based on P/RMO and P/NP multiples.

We also compute p-values for the Wilcoxon signed rank test that under the null hypothesis the median P/V ratio is equal to 1. As can be seen from the last column of Panel A, these p-values are all less than 0.001, thereby implying that based on the sample data, the null hypothesis is rejected for all three price multiples even at the 1% level of significance. Overall, our results indicate that A-share IPOs in the Chinese markets are severely under-valued at the offer.

Moreover, Panel B of Table 2 displays the pair-wise sample correlation coefficients among P/V ratios between P/RMO, P/OP, and P/NP multiples. As can be gleaned, all the correlation coefficients are positive but relatively weak, with magnitudes less than 0.33. In particular, correlation between P/V ratios based on P/RMO and P/NP multiples (0.13) is much lower than their correlations with P/V ratios based on P/OP multiple (0.28 and 0.32 respectively). A valid concern is whether P/OP multiple perform better than the other two multiples in IPO valuation? We address this issue in the next section.

### Valuation Adequacy

To compare valuation adequacy of the price multiples under the benchmark case, we compute similar price-to-value ratios (P/V) for each IPO based on its first closing market price. These 3 ratios are same as those computed based on offer price described in equations (1)-(3). The first closing market price multiples for IPOs are computed as follows:

$$\left[ \frac{P}{RMO} \right]_{IPO} = \frac{\text{First Closing Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year RMO}}$$

$$\left[ \frac{P}{OP} \right]_{IPO} = \frac{\text{First Closing Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year OP}}$$

$$\left[ \frac{P}{NP} \right]_{IPO} = \frac{\text{First Closing Market Price} \times \text{Shares Outstanding}}{\text{Prior Fiscal Year NP}}$$

where *Shares Outstanding* refers to shares outstanding on the

**Table 3. Valuation Errors****Panel A: Valuation Errors**

	Mean	Median	Max	Min	Std. Dev.	T-test p-value	Wilcoxon p-value
P/RMO	-0.10	-0.10	1.31	-2.82	0.56	0.0076	0.0129
P/OP	0.09	0.05	2.07	-2.32	0.55	0.0102	0.0356
P/NP	-0.06	-0.11	2.05	-2.38	0.46	0.0352	0.0048

**Panel B: Absolute Valuation Errors**

	Mean	Median	Max	Min	Std. Dev.	Percentage of Valuation Errors within 15%
P/RMO	0.43	0.35	2.82	0.0002	0.37	20.43
P/OP	0.40	0.30	2.32	0.0037	0.38	27.83
P/NP	0.35	0.27	2.38	0.0090	0.32	24.78

Note: This table presents valuation errors, measured as the natural logarithm of the inverse of P/V ratios. We also report the absolute valuation errors and the percentage of prediction errors within 15%. The percentage of valuation errors within 15% is computed as  $|\log(V/P)| \leq 15\%$ . T-test p-value corresponds to test for mean equal to 0. Wilcoxon p-value corresponds to the Wilcoxon signed rank test for the null hypothesis that the median is equal to 0.

listing day of IPO and *Prior Fiscal Year* refers to the year before the year when IPO is listed. The price multiples for matching firm can be computed accordingly as described in Section 3.2.

In addition, we compute valuation errors for each IPOs in order to rank the performance of their price multiples. We follow Kaplan and Ruback (1995) and Kim and Ritter (1999) to define valuation errors as the natural logarithm of the inverse of P/V ratios. For example, valuation error of the P/OP multiple is  $\log(V/P)_{OP}$ , which is the difference between  $\log(P/OP)_{Match}$  and  $\log(P/OP)_{IPO}$ . Panel A of Table 3 displays valuation errors of the price multiples. Both mean and median valuation errors for the P/RMO, P/OP, and P/NP multiples are significantly different from zero at the 5% level. Panel B of Table 3 reports the absolute prediction errors and the percentage of valuation errors within 15%. The percentage of valuation errors within 15% is computed as  $|\log(V/P)| \leq 15\%$ . As can be observed, the mean absolute valuation error for the P/NP price multiple is only 35%, the lowest among three multiples. The percentage of valuation

errors within 15% for the P/OP price multiple is about the same order of magnitude as that for P/NP, and both are considerably higher than that for P/RMO. Such a battery of evidence indicates that the P/NP multiple performs the best, followed by P/OP and P/RMO consecutively. Our findings are consistent with Liu et al. (1999). One possible reason for the worst performance of the P/RMO multiple may be that RMO is a measurement of sales, rather than earnings which are often used by practitioners as a popular valuation indicator.

### **Robustness of P/V Ratios**

In order to check the sensitivity of our findings under the benchmark case, we compute the P/V ratios based on P/RMO, P/OP and P/NP multiples across: (a) two classification of firms, namely: technology and non-technology; (b) two exchanges, including SHSE and SZSE stock exchanges; (c) alternative criteria for choosing matching firms; (d) absence of CSRC regulation; and (e) B-share market prices, respectively.

We divide our sample IPOs into technology firms and non-technology firms. We classify technology firms as those belong to *Electronics Manufacturing, Medicine and Biological Products Manufacturing, Information Technology, Motion Picture and Sound Recording, Radio, Film, and Television*, and *Information Services* in the CSRC's industry classifications (2001). The rest are regarded as non-technology. As can be observed from Table 4, out of the 230 IPOs under study, 27 IPOs are grouped as technology and 203 as non-technology. The computed mean P/V ratios based on P/RMO, P/OP, and P/NP multiples are: 0.57, 0.45 and 0.45 for technology firms; and they are 0.56, 0.45 and 0.53 for non-technology firms, respectively. The corresponding small p-values warrant rejection of the null hypothesis that the mean price to value ratio is equal to 1. This implies that IPOs are under-priced in different classification of technology.

As regards IPOs listed in various exchanges, we decompose the 230 IPOs under study into 110 IPOs issued in SHSE and 120 issued in SZSE. As can be seen from Table 4, the computed mean P/V ratios based on P/RMO, P/OP, and P/NP multiples are: 0.56, 0.43 and 0.49 for IPOs listed on SHSE; and they are 0.57, 0.46 and 0.55 for those listed on SZSE, respectively. Similarly, the small p-values indicate rejection of the null hypothesis that the mean price to value

**Table 4. Mean P/V Ratios in SHSE and SZSE Exchanges and in Technology and Non-Technology firms**

No. of Issues	SHSE	P-value	SZSE	P-value	Tech	P-value	Non-Tech	P-value
	110		120		27		203	
P/RMO	0.56	0.0000	0.57	0.0000	0.57	0.0000	0.56	0.0000
P/OP	0.43	0.0000	0.46	0.0000	0.45	0.0000	0.45	0.0000
P/NP	0.49	0.0000	0.55	0.0000	0.45	0.0000	0.53	0.0000

Note: This table reports the mean offer price-to-value (P/V) ratios in different exchanges and in firms. Technology firms refer to *Electronics Manufacturing, Medicine and Biological Products Manufacturing, Information Technology, Motion Picture and Sound Recording, Radio, Film, and Television*, and *Information Services* in the CSRC's industry classifications. P-value corresponds to the t-test for the null hypothesis that the mean is equal to 1.

ratio is equal to 1. This provides some support for under-pricing of IPOs under-priced in different stock exchanges.

Turning to alternative matching criteria, we select matching firms based on industry, earnings per share and state and legal entity ownership. Earnings per share rather than net profit are used here because price-to-earning ratio is often regarded as a popular indicator by investors in China. As can be observed from Table 5, the computed mean P/V ratios under the alternative criteria are higher than those under the benchmark as displayed in Table 2. In addition, the median P/V ratios based on P/RMO, P/OP, and P/NP multiples are very similar. For example, they are 0.49, 0.44 and 0.53 under the alternative criteria and are 0.49, 0.43 and 0.48 under the benchmark. Like the benchmark case, the very small Wilcoxon p-values indicate that the null hypotheses that the median P/V ratios are equal to 1 are all rejected at the 1% level of significance. This implies that under-pricing of IPOs is reasonably robust to the choice of matching firms by industry, earnings per share and state and legal entity ownership.

Moreover, it has often been argued that undervaluation of IPOs may be influenced by the CSRC regulation which stipulates that the offer price should not exceed 15 times of earning per share of the issuing firm. In other words, issuers and underwriters may be prompted to undervalue the IPOs. We address this issue by examining those IPOs that are launched in the period from

**Table 5. IPO Valuation Using Matching Criteria of Industry, Earnings per Share, and State and Legal Entity Ownership****Panel A: P/V Ratios Based on Price Multiples**

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Wilcoxon p-value
P/RMO	0.76	0.49	6.47	0.06	0.83	3.37	18.93	0.0000
P/OP	0.52	0.44	4.75	0.03	0.46	5.50	42.71	0.0000
P/NP	0.61	0.53	5.30	0.15	0.53	6.26	48.02	0.0000

**Panel B: Correlation among P/V Ratios**

	RMO	OP	NP
RMO	1	0.30	0.22
OP	0.30	1	0.69
NP	0.22	0.69	1

Note: This table reports offer price-to-value (P/V) ratios under the matching criteria of industry, earnings per share, and state and legal entity ownership. These ratios are computed based on market price-to-revenue from main operation (P/RMO), market price-to-operating profit (P/OP), and market price-to-net profit (P/NP) of a matching firm. A matching firm is selected based on its closeness with the IPO in terms of industry, earnings per share, and state and legal entity ownership. Wilcoxon p-value corresponds to the Wilcoxon signed rank test for the null hypothesis that the median is equal to 1.

March 2000 to August 2001 when CSRC cancelled the offering price regulation. In the absence of CSRC regulation, 190 A-share IPOs were issued during this period. We are able to identify the appropriate matching firms for 167 IPOs based on industry, net profit, and state and legal entity ownership. The mean and median P/E ratios of these 167 IPOs are 34.26 and 33.29 respectively, which are much higher than those of IPOs listed in 1997 and 1998. As can be observed from Table 6, these IPOs are also undervalued. The median P/V ratios are 0.46, 0.45, and 0.51 respectively, and p-values for the Wilcoxon signed rank test are low enough to warrant rejection of the null hypothesis that P/V ratios are equal to 1 at the 1% level of significance. Hence, we find evidence that in the absence of CSRC regulation, IPOs are still undervalued by the issuers and underwriters.

Although IPOs are commonly undervalued with respect to their

**Table 6. Valuation of IPOs Issued without the CSRC Offering Price Regulation**

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Wilcoxon p-value
P/RMO	0.57	0.46	2.37	0.13	0.39	1.75	6.74	0.0000
P/OP	0.61	0.45	3.85	0.05	0.53	3.07	15.60	0.0000
P/NP	0.62	0.51	3.74	0.10	0.43	3.89	25.26	0.0000

Note: This table reports the offer price-to-value (P/V) ratios of IPOs issued without the CSRC offering price regulation. These ratios are computed based on market price-to-revenue from main operation (P/RMO), market price-to-operating profit (P/OP), and market price-to-net profit (P/NP) of a matching firm. A matching firm is selected based on its closeness with the IPO in terms of industry, net profit, and state and legal entity ownership. Wilcoxon p-value corresponds to the Wilcoxon signed rank test for the null hypothesis that the median is equal to 1.

A-share peers, it is interesting to see whether the same applies when they are compared to their B-share market prices. The main idea is to select a sub-sample of IPOs that also issue B-shares and see whether the conclusions are still valid. In our sample of 230 IPOs, 6 firms issue B-shares prior to the A-share IPOs. The mean and median P/V ratios for these 6 IPOs are 1.34 and 1.27 respectively. Indeed, 5 out of these 6 IPOs are overvalued and only one is slightly undervalued with respect to their B-share price. This is not surprising as it is well-known that A-share stocks in China are characterized with high speculation and there is a large difference between A- and B-share market valuations. With some preliminary study, we find support for undervaluation of A-share IPOs based on their A-share market, but overvaluation of A-shares IPOs with respect to the B-share peers.

Furthermore, we investigate the possible relationship of P/V ratios with P/E ratios and the relationship of P/V ratios with ballot ratios based on three types of IPO portfolios: high P/V portfolio, medium P/V portfolio, and low P/V portfolio. We first sort IPOs by P/V ratios and allot the first 77 IPOs with the highest P/V ratios to the group of high P/V portfolio, the last 77 IPOs with the lowest P/V ratios to the group of low P/V portfolio, and the rest to the group of medium P/V portfolio. Table 7 reports P/E ratios and ballot ratios for these three groups of P/V portfolios. We omit results for the P/V portfolios computed by the P/RMO price multiple because it provides the

**Table 7. IPO Portfolios Based on P/V Ratio, P/E Ratio, Ballot Ratio and Initial Return**

IPO Portfolio	No. of Issues	Based on P/OP					Based on P/NP				
		Median P/V Ratio	Median P/E Ratio	Median Ballot Ratio (%)	Median IR (%)	Mean IR (%)	Median P/V Ratio	Median P/E Ratio	Median Ballot Ratio (%)	Median IR (%)	Mean IR (%)
Low P/V	77	0.26	14.50	0.79	146.51	163.82	0.32	14.50	0.80	144.16	166.42
Medium P/V	76	0.43	14.74	0.73	126.23	145.07	0.48	14.65	0.62	135.76	146.15
High P/V	77	0.62	14.50	0.70	108.76	108.91	0.69	14.50	0.79	100.19	105.24
Low P/V – High P/V			0 (0.3483)	0.09 (0.6206)	37.75 (0.0000)	54.91 (0.0000)		0 (0.1191)	0.01 (0.3729)	43.98 (0.0000)	61.18 (0.0000)
All IPOs	230	0.43	14.50	0.75	125.80	139.24	0.48	14.50	0.75	125.80	139.24

Note: This table reports P/E ratios, ballot ratios and initial returns for the three IPO portfolios based on P/V ratios. We only tabulate P/V ratios based on the P/OP and P/NP multiples, but omitting those based on P/RMO. P/E ratios are available in the prospectuses. Initial return (IR) is the first-day return of IPO relative to SHSE/SZSE index. The numbers in parentheses for differences in median of Low and High P/Vs are those p-values corresponding to the Wilcoxon signed rank test for the null hypothesis that the difference is equal to 0. Similarly, those for testing the null hypothesis that the difference in mean is equal to 0 are p-values corresponding to the t-test.

worst performance among the P/OP and P/NP price multiples. As can be gleaned from Table 7, all the medium P/V ratios, P/E ratios, ballot ratios and IR (initial return) ratios based on the P/OP multiple are very close to those under the P/NP multiple for low, medium and high P/V portfolios, respectively. In addition, P/V ratios are expected to be positively correlated with P/E ratios in the prospectuses since the P/E ratio is a commonly used valuation indicator. Also, P/V ratios are expected to be positively correlated with ballot ratios as investors tend to pick severely under-valued IPOs for higher returns. Surprisingly, we find small difference in P/E ratios and ballot ratios between the low P/V portfolio and high P/V portfolio. However, p-values for the Wilcoxon signed rank test are very high, with magnitudes larger than 0.10. Apparently we do not find evidence to support that P/V ratios are positively correlated with P/E ratios and with ballot ratios, respectively.

## UNDER-PRICING AND LONG-RUN PERFORMANCE

As discussed in Section 4, we have found consistent evidence that A-share IPOs are severely under-priced on the listing day. In addition, the mean offer price-to-value ratios based on P/RMO, P/OP and P/NP multiples are significantly less than 1. Hence, such under-pricing may be caused by the under-valuation of IPOs. If it is the case, those IPOs that are most under-valued should earn the highest first-day returns. In other words, the lower the offer price-to-value ratios, the higher the first-day returns. In what follows we shall test this hypothesis by studying the relationship between P/V ratios and the first-day returns.

### PV Ratios and Initial Returns

The first-day returns of IPOs (or initial return, IR) relative to the SHSE/SZSE A-share prices and market indices can be computed by the following:

$$IR = \frac{P_{Market} - P_{Offer}}{P_{Offer}} - \frac{I_{Market} - I_{Offer}}{I_{Offer}} \quad (7)$$



where  $P_{Market}$  and  $P_{Offer}$  are the first day closing market price and offer price of IPO, respectively.  $I_{Market}$  is the A-share index of the exchange market where the IPO is listed on the listing day of IPO.  $I_{Offer}$  is the A-share index prior to the offer date of IPO. The Wilcoxon signed rank test is used to test the null hypothesis of equality of medians and the t-test is used to check whether the low P/V portfolio and the high P/V portfolio have the same mean.

As can be observed from the last row of Table 7, the median and mean initial returns of the 230 IPOs under study are 125.8% and 139.24%, respectively. This under-pricing is consistent with those reported by Chan, Wei, and Wang (2001), Wu (2001), and Chi and Padgett (2002b). In addition, differences between the median initial returns for the low P/V portfolio and high P/V portfolio based on the P/OP and P/NP multiples are 37.75% and 43.98%, respectively, which are significantly greater than zero by the Wilcoxon signed rank test. Indeed, differences between the mean initial returns are even larger and significantly greater than zero. As such, our findings provide support that undervaluation may contribute to under-pricing.

Moreover, high demand may lead to the severe under-pricing of A-share IPOs, which is regarded as a source of under-pricing of IPO in Chi and Padgett (2002b) and Gu (2003). We investigate this conjecture using the first closing market price-to-value ratios of IPOs. If investors over-value IPOs, the first closing market price-to-value ratios should be greater than 1. Table 8 presents the results for P/V ratios on the listing day of IPOs. The t-test is used to check the null hypothesis that the mean is equal to 1 and the Wilcoxon signed rank test to check whether the median is equal to 1, respectively.

As can be observed from Table 8, the mean and median P/V ratios based on the P/OP multiple are (1.06, 0.95), respectively, thereby failing to reject the null hypotheses that these ratios are equal to 1. In contrast, the mean and median P/V ratios based on the P/RMO and P/NP multiples are (1.33, 1.11) and (1.20, 1.12), respectively, thereby rejecting the null hypotheses that mean and median P/V ratios are equal to 1 at the 1% level of significance. Moreover, we note that the percentages of P/V ratios that are greater than 1 for the P/RMO and P/NP multiples are roughly 60%, but that for the P/OP price multiple is only 45%. As such, these three price multiples do not agree on whether investors over-react on the listing

**Table 8. P/V Ratios on the Listing Day of IPOs**

	Mean	Median	Max	Min	Std. Dev.	Percentage of P/V Ratios $\geq$ 1	T-test p-value	Wilcoxon p-value
P/RMO	1.33	1.11	16.85	0.27	1.28	0.57	0.0001	0.0001
P/OP	1.06	0.95	10.17	0.13	0.78	0.45	0.2559	0.5378
P/NP	1.20	1.12	10.78	0.13	0.80	0.60	0.0003	0.0000

Note: This table reports the first closing market price-to-value (P/V) ratios computed based on market price-to-revenue from main operation (P/RMO), market price-to-operating profit (P/OP), and market price-to-net profit (P/NP) of a matching firm, respectively. A matching firm is selected based on its closeness with the IPO in terms of revenue from main operation, operating profit, and net profit. T-test p-value corresponds to the t-test for the null hypothesis that the mean is equal to 1. Wilcoxon p-value corresponds to the Wilcoxon signed rank test for the null hypothesis that the median is equal to 1.

day of IPO. On balance, we prefer findings based on the P/NP price multiple since it provides the best performance in IPO valuation. As such, we are more inclined to report that both under-valuation by issuers and underwriters and over-valuation by investors contribute to the severe under-pricing of A-share IPOs.

### Long-run Performance

While investors overvalue A-share IPOs on the listing day, they may become rational enough to value IPOs based on the fundamentals in the long-run. We test this rationality hypothesis by looking at the relationship between the first closing market price-to-value ratios and the cumulative buy-and-hold abnormal returns (CARs) of IPOs with respect to two benchmarks: the SHSE/SZSE A-share market and their matching firms. The cumulative buy-and-hold returns for IPO firm  $i$  and its benchmark  $m$  are computed using the conventional formulas:

$$R_{iT} = \prod_{t=1}^T (1 + r_{it}) - 1$$

$$R_{mT} = \prod_{t=1}^T (1 + r_{mt}) - 1 \quad (8)$$

where  $T$  is the holding month,  $r_{it}$  is the monthly buy-and-hold return of IPO, and  $r_{mt}$  is the monthly return of benchmark market (value-weighted) or matching firm.  $r_{it}$  and  $r_{mt}$  are adjusted for stock dividends, stock splits, and rights offerings. We assume there are 20 trading days for one month.  $CAR$  is the difference between the cumulative buy-and-hold returns of IPO and the benchmark, i.e.,

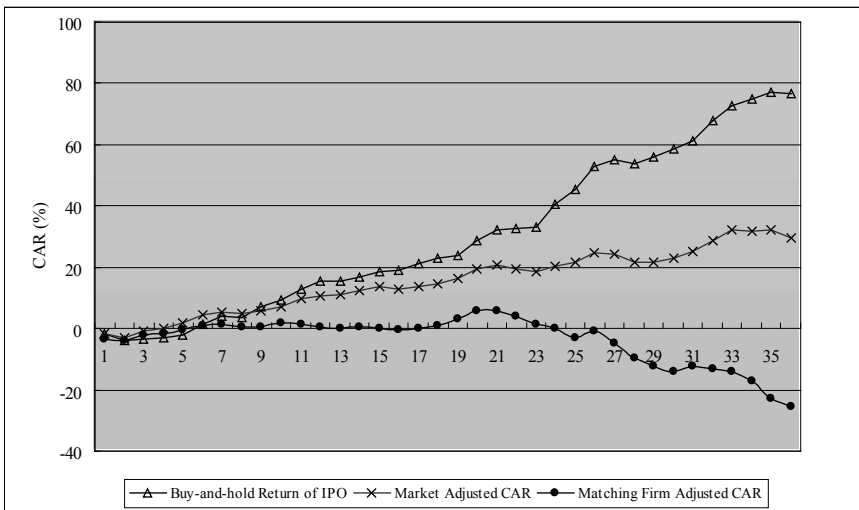
$$CAR_{iT} = R_{iT} - R_{mT}.$$

$CAR$  up to month  $T$  is computed as the mean  $CAR$  of all IPOs up to month  $T$ :

$$CAR_T = \frac{1}{N} \sum_{i=1}^N CAR_{iT},$$

where  $N$  is the number of IPOs in our sample. All the daily and monthly returns are collected from the CSMAR database.

Table 9 reports the CARs of IPOs up to 36 months with respect to their matching firms and SHSE/SZSE A-share markets. Both



Note: The chart graphs the cumulative buy-and-hold returns of IPOs and buy-and-hold abnormal returns of IPOs with respect to the market and their matching firms.

**Figure 2. Long-run Cumulative Buy-and-hold Abnormal Returns (CARs) of IPOs**

**Table 9. The Long-run Performance of Chinese A-share IPOs**

Months	Ret	Mktret	Matret	Cumret	Mkt Adjret	Mat Adjret
1	-1.899	-0.241	1.582*	-1.899	-1.658	-3.482**
2	-1.768**	-0.882*	-1.622**	-3.883**	-2.812**	-3.818**
3	0.549	-1.181**	-0.796	-3.251*	-0.982	-2.270
4	0.913	-0.208	0.216	-2.907	0.037	-1.764
5	1.614*	-0.352	-0.127	-1.925	1.811	-0.390
6	3.211**	1.001*	1.702**	1.378	4.394**	1.058
7	2.934**	1.760**	2.347**	3.997*	5.507**	1.256
8	0.193	0.543	0.909	3.659	4.734**	0.471
9	3.488**	2.404**	3.247**	7.079**	5.970**	0.658
10	2.343**	1.707**	1.274*	9.492**	7.017**	1.637
11	2.766**	1.050**	3.371**	12.851**	9.578**	1.463
12	3.486**	1.925**	4.157**	15.486**	10.728**	0.493
13	0.920	0.090	0.982	15.541**	11.286**	0.024
14	1.871**	0.140	1.110	16.782**	12.559**	0.627
15	1.549*	0.693	1.720*	18.454**	13.581**	0.061
16	0.777	1.162**	1.447*	18.970**	12.835**	-0.449
17	1.874**	1.341**	1.427*	21.169**	13.833**	0.150
18	1.632**	0.603	1.289*	22.744**	14.767**	0.889
19	0.741	-0.453	-0.328	24.053**	16.489**	3.042
20	3.171**	1.383**	1.516*	28.626**	19.404**	5.638
21	2.851**	2.408**	2.839**	32.315**	20.551**	5.933
22	1.230	1.495**	2.314**	32.662**	19.267**	3.883
23	0.891	1.300**	2.679**	33.181**	18.497**	1.545
24	5.582**	5.565**	6.051**	40.417**	20.395**	0.193
25	4.466**	4.223**	5.615**	45.600**	21.758**	-3.156
26	4.559**	4.301**	4.914**	52.720**	24.755**	-0.904
27	2.869**	2.968**	4.141**	55.187**	24.166**	-4.706
28	0.777	1.303**	3.223**	53.783**	21.715**	-9.838
29	1.859**	1.998**	3.093**	56.152**	21.647**	-12.165
30	1.731**	0.406	1.700**	58.406**	23.081**	-14.171
31	1.608**	0.525	0.689**	61.398**	25.278**	-12.479
32	3.292**	2.587**	2.799**	67.852**	28.893**	-13.362
33	3.263**	1.758**	3.017**	72.705**	32.016**	-14.194
34	2.740**	2.450**	3.350**	74.829**	31.833**	-17.007*
35	2.124**	1.646**	3.246**	76.968**	32.285**	-22.842**
36	1.228**	1.955**	2.525**	76.592**	29.673**	-25.500**

Note: This table presents the long-run performance of Chinese A-share IPOs after listing. We assume that there are 20 trading days in one month. *Ret* is the monthly return of IPOs; *Mktret* is the monthly return of A-share stock market; *Matret* is the monthly return of matching firm; *Cumret* is the cumulative return of IPO; *Mkt Adjret* is the market adjusted cumulative return of IPO; *Mat Adjret* is the matching firm adjusted cumulative return of IPO. \* and \*\* represent the significance level at 10% and 5%, respectively.

**Table 10. CARs for IPO Portfolios Based on P/V Ratios on the Listing Day**

IPO Portfolio	No. of Issues	Median P/V Ratio	Mean Unadjusted CAR of IPO (%)			Mean CAR with respect to Matching Firm (%)			Mean CAR with respect to the market (%)		
			12 month	24-month	36-month	12 month	24-month	36-month	12 month	24-month	36-month
Low P/V	77	0.74	19.13	43.50	84.49	7.99	18.74	-2.66	14.80	26.00	34.54
Medium P/V	76	1.12	12.14	37.02	81.59	-1.84	-12.45	-39.34	6.82	14.46	34.17
High P/V	77	1.50	15.14	40.69	63.76	-4.70	-5.87	-34.67	10.51	20.64	20.36
Low P/V – High P/V			3.99 (0.2957)	2.81 (0.4113)	20.73 (0.1094)	12.69 (0.0789)	24.62 (0.0479)	32.01 (0.1024)	4.29 (0.2578)	5.36 (0.3145)	14.18 (0.1939)
All IPOs	230	1.12	15.49	40.42	76.59	0.49	0.19	-25.50	10.73	20.39	29.67

Note: This table reports the mean unadjusted and adjusted cumulative buy-and-hold abnormal returns (CARs) for IPO portfolios on the listing day. IPOs are allotted into three portfolios based on P/V ratios that are computed using the P/ NP price multiple. Results for 12, 24, and 36 months CARs are reported. The numbers in parentheses for differences in mean under the low and high P/V case are p-values corresponding to the t-test for the null hypothesis that means for the low and high P/V portfolios are equal.

CARs are slightly below zero in the first five month after listing. The market-adjusted CAR increases steadily after the 5<sup>th</sup> month and reaches around 30% at the end of the 3-year holding period. See Figure 2. Our results are consistent with Chan et al. (2001) who also find 25% out-performance of IPOs with respect to the market after 36 months of listing.

However, the CARs with respect to matching firms are slightly above zero after the 5<sup>th</sup> month and less than zero since the 25<sup>th</sup> month. At the end of the 3-year holding period, IPOs under-perform their matching firms by 25%. These findings imply that our matching firms also out-perform the market as a whole. The main reason may be that IPOs have good accounting records before their listings as required by the CSRC and we match IPOs on the accounting items. Hence, our matching firms have better profitability and outperform the market as a whole.

Table 10 reports the mean values of unadjusted and adjusted CARs up to 12, 24, and 36 holding months for IPO portfolios based on P/V ratios using the P/NP multiple on the listing day of IPO. The t-test is used to test the null hypothesis that means of the low and high P/V portfolios are equal; whereas the alternative hypothesis is that the mean of the low P/V portfolio is greater than that of the high P/V portfolio. As can be observed, differences between the mean values of CARs for the low and high P/V portfolios are all positive. In particular, the 12 and 24 months CARs with respect to matching firm are significant at the 10% and 5% levels, respectively. It is not surprising since the P/V ratios are computed using values based on matching firms. The positive difference between mean values of CARs for the low and high P/V portfolios provides evidence that under-valued IPOs with low P/V ratios on the listing day outperform those over-valued IPOs with high P/V ratios in the long-run.

## CONCLUDING REMARKS

In this paper, we have examined the pricing of 230 A-share IPOs in the Shanghai and Shenzhen stock markets from 1997 to 1998 using comparative firm multiples. We find some evidence of under-valuation of IPOs by issuers and underwriters, but over-valuation of such IPOs by investors on the listing day. Our findings are

consistent with previous studies based on characteristics of the Chinese A-share IPO markets. In addition, our results are robust across stock exchanges, classification of firms, alternative criteria for choosing matching firms; absence of CSRC regulation and B-share market prices, respectively.

We also rank the performance of price multiples using valuation errors. We find that the P/NP multiple performs the best, followed by P/OP and P/RMO consecutively. It is unexpected that the P/NP multiple performs better than the P/OP multiple since the operating profit is a more reliable measurement of profitability than the net profit. One possible caveat is that we do not use the price-to-forecasted profits multiple in valuating IPOs as the forecasted accounting profits data for matching firms are not available.

Turning to the long-run performance, we detect a 30% out-performance of IPOs with respect to the market after 36 months of listing. But IPOs under-perform their matching firms by 25% after 36 months of listing. It implies that the matching firms also out-perform the market, partly due to the selection criteria for matching firms. We also find evidence that those IPOs over-valued by investors on the listing day under-perform those under-valued IPOs in the long-run.

## REFERENCES

- Allen, F. and G.R. Faulhaber (1989), "Signalling by Underpricing in the IPO market," *Journal of Financial Economics*, 23, 303-323.
- Baron, D.P. (1982), "A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues," *Journal of Finance*, 37, 955-976.
- Baker, Malcolm and Jeffrey Wurgler (2006), "Investor Sentiment and the Cross-Section of Stock Returns," *Journal of Finance*, 61(4), 1645-1680.
- Baker, Malcolm and Jeffrey Wurgler (2007), "Investor Sentiment in the Stock Market," *Journal of Economic Perspectives*, 21(2), 129-151.
- Beatty, R.P. and J.R. Ritter (1986), "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings," *Journal of Financial Economics*, 15, 213-232.
- Chan, K.L., K.J. Wei, and J.B. Wang (2001), "Under-pricing and Long-term Performance of IPOs in China," *Journal of Corporate Finance*. 10(3), 409-430.
- Chang, E., C. Chen, J. Chi and M. Young (2008), "IPO Underpricing in Chi-

- na: New Evidence from the Primary and Secondary Markets," *Emerging Markets Review*, 9(1), 1-16.
- Chau, C.T, C.S. Ciccotello, and C.T. Grant (1999), "Role of Ownership in Chinese Privatization," *Advances in Financial Economics*, 4, 51-78.
- Chemmanur, T.J. (1993), "The Pricing of Initial Public Offerings: a dynamic model with information production," *Journal of Finance*, 48, 285-304.
- Chen, G.M. and M. Firth (1999), "The Accuracy of Profits Forecasts and their Roles and Associations with IPO Firm Valuation," *Journal of International Financial Management and Accounting*, 10(3), 202-226.
- Chen, G.M., M. Firth and J.B. Kim (2000), "The Post-issue Market Performance of Initial Public Offerings in China's New Stock Markets," *Review of Quantitative Finance and Accounting*, 14, 319-339.
- Chen, G.M., M. Firth and J.B. Kim (2001), "IPO Underpricing in China's New Stock markets," working paper, the Hong Kong Polytechnic University.
- Chi, J. and C. Padgett (2002a), "The Performance and Long-run Characteristics of the Chinese IPO market," working paper, the University of Reading.
- \_\_\_\_\_(2002b), "Short-run Underpricing and its Characteristics in Chinese IPO market, working paper," the University of Reading.
- Gao Y. and Y.K. Tse (2004), "Market Segmentation and Information Values of Earnings Announcements: Some Empirical Evidence from an Event Study on the Chinese Stock Market," *International Review of Economics and Finance*, 13(4), 455-474.
- Grinblatt, M. and C.Y. Hwang (1989), "Signalling and the Pricing of New Issues," *Journal of Finance* 44, 393-420.
- Gu, A.Y. (2003), "State Ownership, Firm Size, and IPO Performance: Evidence from Chinese 'A' share issues," *American Business Review*, 21(2), 101-108.
- Guo, H.F. and R. Brooks (2008), "Underpricing of Chinese A-share IPOs and short-run Underperformance under the Approval System from 2001 to 2005," *International Review of Financial Analysis*, 17(5), 984-997.
- Ibbotson, R.G. (1975), "Price Performance of Common Stock New Issues," *Journal of Financial Economics*, 2, 235-272.
- Kaplan, S.N. and R.S. Ruback (1995), "The Valuation of Cash Flow Forecasts: an Empirical Analysis," *Journal of Finance*, 50, 1059-1093.
- Kim, M. and J.R. Ritter (1999), "Valuing IPOs," *Journal of Financial Economics* 53, 409-437.
- Liu, J., D. Nissim, and J. Thomas (1999), "Equity Valuation Using Multiples," working paper, UCLA and Columbia University.
- Liu, L. and W.D. Li (2000), "Research on First Day's Abnormal Returns of IPOs in China's securities market," *China Accounting and Finance Review*, 2(4), 26-53.
- Loughran, T. and J.R. Ritter (1995), "The New Issues Puzzle," *Journal of Fi-*



- nance, 50, 23-51.
- Loughran, T., J.R. Ritter and K. Rydqvist (1994), "Initial Public Offerings: International Insights," *Pacific-Basin Finance Journal*, 2, 165-199.
- Logue, D.E. (1973), "On the Pricing of Unseasoned Equity Issues: 1965-1969," *Journal of Financial and Quantitative Analysis*, 8, 91-103.
- Miurin, P. and A. Sommariva (1993), "The Financial Reforms in Central and Eastern European Countries and in China," *Journal of Banking and Finance*, 17, 883-911.
- Mok, H.M. and Y.V. Hui (1998), "Under-pricing and Aftermarket Performance of IPOs in Shanghai, China," *Pacific-Basin Finance Journal* 6, 453-474.
- Purnanandam, A.K. and B. Swaminathan (2004), "Are IPOs Really Under-priced?," *Review of Financial Studies*, 17, 811-848.
- Reilly, F.K. (1973), "Further Evidence on Short-run Results for New Issues Investors," *Journal of Financial and Quantitative Analysis*, 8, 83-90.
- Ritter J.R. (1991), "The Long-run Performance of Initial Public Offerings," *Journal of Finance*, 46, 3-27.
- Ritter, J.R. and I. Welch (2002), "A Review of IPO Activity, Pricing, and Allocations," *Journal of Finance*, 57, 1795-1828.
- Rock, K. (1986), "Why New Issues are Underpriced," *Journal of Financial Economics*, 15, 187-212.
- Stoll, H.R. and A.J. Curley (1970), "Small Business and the New Issues Market for Equities," *Journal of Financial and Quantitative Analysis*, 5, 309-322.
- Su, D.W. (1999), "Leverage, Inside Ownership, and the Underpricing of IPOs in China," working paper, University of Akron.
- Su, D.W. and B.M. Fleisher (1999), "An Empirical Investigation of Underpricing in Chinese IPOs," *Pacific-Basin Finance Journal*, 7, 173-202.
- Welch, I. (1989), "Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings," *Journal of Finance*, 44, 421-450.
- Wu, J. (2001), "Short-run Performance and Valuation of IPO in China," Unpublished Dissertation, the National University of Singapore.

