

Full Length Research Paper

Empirical study on initial public offering (IPO) underpricing and long-run performance: Evidence from China's A-share market

Niu Xia*, Song Junyan and Guo Pei

College of Economics and Management, China Agricultural University, Beijing100083, China.

Accepted 18 June, 2012

This paper studies the underpricing and long-term performance of A-share initial public offerings (IPOs) in China from June 19, 2006 to June 30, 2007. The average underpricing of A-share IPOs is 107%, and the average abnormal returns over one and three years after listing are both significantly negative at the 1% level. Considering both market risks and stock risks, abnormal returns over one year cover the interval [-1.71, -0.54], and abnormal returns over three years cover [-1.54,-0.27]. The underpricing of A-share IPOs is significantly affected by market volatility, ex-ante uncertainty, lucky number ratio, and first day trading ratio. In the long run, aftermarket abnormal returns over one year are significantly determined by market volatility, ex-ante uncertainty and, to a lesser extent, initial excess returns. Over three years, abnormal returns are driven by market volatility, offering price, ex-ante uncertainty and first day trading ratio. It is indicated that the initial excess returns does not show any influences on abnormal returns.

Key words: Initial public offering (IPO), underpricing, long-run performance, China's A-share market.

INTRODUCTION

Since stock exchanges established in December 1990, China's A-share market (A-share market: Trading market of shares listed in China for domestics with RMB transactions. B-share market: Trading market of shares listed in China for foreigners and residents from Hong Kong, Macau or Taiwan, denominated in RMB but with foreign currency transactions) has raised 49.4 trillion Yuan in total. The number of IPO stocks and the amount raised has grown rapidly after full circulation. Data released by China Securities Regulatory Commission (CSRC) shows that there were 70 IPOs raising 157.22 billion Yuan in 2006 and 349 IPOs with 488.99 billion Yuan, accompanied by 398.6 and 211% growth of the IPOs number of and the amount of raised money respectively. Public offering in China has become one of the most important ways of financing for large enterprises, also one of the basic alternatives for investors.

Most empirical studies on IPOs in developed and

emerging economies focus on financial and operating performance of listed firms, relying on specific accounting performance measures. However, the analysis of initial and long-run performance of IPOs in developed countries and certain emerging economies has attracted researchers in the past few years. Yet, little is known about the behavior of IPOs in China.

In this paper, we firstly examine the performance of the IPOs utilizing more recent sub-period data from 1993 to 1998 and B-share IPOs from June 19, 2006 to June 30, 2007. Another contribution might be that we examine what market factors determined by the characteristics of Chinese stock market can help explain IPOs underpricing in China. In line with previous studies, we find an average underpricing of A-share IPOs is 107%. The underpricing is mainly driven by market volatility (MV), ex-ante uncertainty (EX) and turnover rate (TR) on the first trading day, and first day trading ratio (TR). Furthermore, the underpricing can be also explained by the characteristics of Chinese stock market, especially the characteristics of investors.

We also investigate the long-term performance of IPOs after the listing. Despite the positive initial IPO returns, we

*Corresponding author. E-mail: niuxcau@126.com. Tel: +8618618268984.

find that the average abnormal returns over one and three years after listing are both significantly negative at the 1% level, considering both market and stock risks, abnormal returns over one year cover the interval [-1.71, -0.54], and abnormal returns over three years cover [-1.54, -0.27]. Aftermarket abnormal returns over one year are significantly determined by MV, EX and Initial excess returns. Over three years, abnormal returns are driven by market volatility (MV), offering price (OP), ex ante uncertainty (EX) and first day trading ratio (TR). Initial excess returns doesn't show any influences on abnormal returns.

The purpose of this study is not limited to adding another piece of evidence to the vast literature on IPO underpricing. Rather, we would like to investigate how the underpricing of IPOs is affected by some market factors determined by the characteristics of China's stock market. The rest of this paper is organized as follows: formulation of hypotheses that is to be examined and the methodology adopted; description of data and report of statistical results; empirical results; summary and conclusion.

LITERATURE REVIEW

Initial public offering (IPO) underpricing means IPOs offer the investors with positive initial returns on the first trading day. Chen et al. (2004) found an average initial return of 267% for the IPOs from 1991 to 2000 and 145% for IPOs from 1992 to 1997, respectively. Xu and Liang (2010) reported an underpricing of 91.6% for a sample of IPOs listed from 2006 to 2007. Some other literatures also show that the large underpricing magnitude in the Chinese IPOs market persists after full circulation (Yin and Wang, 2008; Xie, 2010).

Previous studies indicated that the mixed results are found in IPOs long-run performance. Chi and Padgett (2005) proved that positive long-term returns have been gained by IPOs between 1996 and 1997 in China. Wang (2009) found IPOs in China between 1999 and 2002 got an average of 37-month excess return of -23.4%.

There are many explanations behind underpricing IPOs such as asymmetric information, institutional explanations, and ownership and insider control.

According to the market volatility hypothesis (Jog and Wang, 2002), the magnitude of underpricing may depend on market volatility; in other words, issuers try to minimize the probability of unsuccessful issues by lowering prices as long as market volatility is high. Wang (1997) and Chen et al. (2008) evidenced its adaptability to China.

Allen and Faulhaber (1989) argued that firms sometimes offer IPOs priced below their intrinsic value to signal their quality to investors, thus expecting to have a better chance at offering subsequent seasoned issues at higher prices. To the investors, lower offer price means lower risk and more opportunities to get speculative gains, and then they will trade actively on the market, further pushes price

up, which in return enlarge expand the magnitude of underpricing. In China, the IPOs are often priced according to Price/earnings (PE) ratios. Han and Chen (2001) favor this theory in their research.

According to asymmetric information theory, the uncertainty about the value of recent IPOs, is higher than that about long-history firms. Investors worry about the future performance of IPOs, which is referred to as ex ante uncertainty. Beatty and Ritter (1986) indicate that underpricing should increase with ex ante.

Previous studies Mok and Hui (1998), Chau et al. (1999), Chen et al. (2004) and Xie (2010) explored how the above mentioned theories explain the high IPO underpricing in China with varied methods.

Zou (2003) takes the opinion that the aftermarket performance could be explained by the previously mentioned determinants of initial performance, Levis (1993) and Paudyal et al. (1998) argued that initial excess returns might be due to initial over-optimism in the market. Accordingly, such issues should underperform the market in the long run. In contrast, if IPOs attain their equilibrium value at initial returns, their long-run performance should not be significantly different from that of the market.

This paper contributes to the literature by examining empirically IPO underpricing and long-run performance in China in light of the classical models. We consider three hypotheses that may explain the IPOs underpricing in China. They are the winner's curse hypothesis (Rock, 1986), the ex-ante uncertainty hypothesis (Ritter, 1984; Beatty and Ritter, 1986), and the signaling hypothesis (Allen and Faulhaber, 1989).

DATA AND RESEARCH DESIGN

Data

The data are selected from 116 A-share stocks that were offered between June 19, 2006 and June 30, 2007 (with full circulation) in China and have traded for three years. 6 stocks (merger, division or issued at a premium) were excluded, and the remaining 109 stocks become the study sample.

The data come from several sources, including the Tsinghua Financial Research Database, trading database from GTA (Guo Tai An Information Technology Company) and Dongxing Securities online trading software real-time quotes system. We processed the basic data with the EXCEL software, and then use SPSS 12.0 software for empirical analysis.

Calculation of IPO underpricing and long-term Performance

IPO underpricing is often in terms of initial return, namely the magnitude of price changes from the issue day to the first trading day. Considering the transaction costs, IPO initial return is calculated as follows:

$$r_i = \frac{P_{i,t} - P_{i,0}}{P_{i,0}} - \frac{TC_i}{P_{i,0}} \quad (1)$$

where r_i is the initial return of IPO i , $P_{i,t}$ is the closing price of IPO i at the first trading day, $P_{i,0}$ is the offer price of IPO i , and TC_i is the transaction cost per share.

Taking the effect on new shares prices into account, which market changes (or industry differences) may have during the period from issue day to the first trading day, the adjusted return should be calculated, namely the initial excess return. The adjusted return is then calculated as the initial return for IPO i minus the benchmark return on a corresponding reference portfolio. It is important to specify an appropriate benchmark. Either theoretically or practically, it is not obvious with what index or portfolio the IPO returns should be compared. We use more than one index: Shanghai and Shenzhen A-share index in China (CMI) and SFC industry index (IND), where the latter indexes serve as reference portfolios for IPOs according to their industry classification.

In contrast to initial excess returns, long-run performance seems to be more complicated. According to Barber and Lyon (1997), there is no consensus on the appropriate way of calculating long-run abnormal returns. In this paper, we consider different forms and models. We use the market adjusted model and CAPM to calculate the cumulative abnormal return (CAR) and buy hold abnormal return (BHAR), respectively.

First, we compute cumulative abnormal returns (CARs) and buy-and-hold abnormal returns (BHARs) using the market-adjusted model over one- and three- year intervals (12 and 36 trading months, respectively) after the IPO listing, exclusive of the initial returns.

$$CAR_{i,s,e} = \sum_{t=s}^e r_{i,t} - r_{crp,t} \quad (2)$$

$$BHAR_{i,T} = \left[\prod_{t=1}^T (1 + r_{i,t}) - 1 \right] - \left[\prod_{t=1}^T (1 + r_{crp,t}) - 1 \right] \\ T = \{12, 36\} \quad (3)$$

where $CAR_{i,s,e}$ is the cumulative abnormal return (CAR) for IPO i from the starting month s after trading to the anniversary month e (12 and 36 months); $r_{i,t}$ and $r_{crp,t}$ are the monthly returns for IPO i and on a corresponding reference portfolio in period t , respectively; $BHAR_{i,T}$ is the buy-and-hold abnormal return for IPO i in period T (12 and 36 months), and t is the aftermarket trading day.

Second, the returns using the market-adjusted model are not adjusted for risk other than that prevailing in the market as a whole, so we use the Sharp-Lintner capital asset pricing model (CAPM) to calculate the abnormal return to take into consideration the risk of individual IPOs.

$$CAPMAR_{i,t} = r_{i,t} - r_{f,t} - \beta_i [r_{crp,t} - r_{f,t}] \quad (4)$$

where $CAPMAR_{i,t}$ is the abnormal return using CAPM for firm i in month t ; $r_{i,t}$ is the risk-free rate proxied as a short-term one-month rate for bank deposits, and β_i is the risk of IPO i and is taken from the CAPM regression model (that is, the slope obtained from regressing $[r_{i,t} - r_{f,t}]$ on $[r_{crp,t} - r_{f,t}]$ for the estimation period). With $CAPMAR$ calculated, I apply the same two forms, CARs and

BHARs, mentioned earlier.

Following Ritter (1991), we calculate the wealth relative (WR) to compare the average buy-and-hold return (BHR) on a portfolio of IPOs relative to the average BHR on a corresponding reference portfolio to interpret the performance of IPOs. A WR greater than 1.00 means that IPOs outperform their corresponding reference portfolio, and vice versa:

$$WR_T = \frac{1 + AvgBHR_{T,IPOs}}{1 + AvgBHR_{T,CRP}} \quad T=\{12, 36\} \quad (5)$$

where WR_T is the wealth relative over T periods, and $AvgBHR_{T,IPOs}$ and $AvgBHR_{T,CRP}$ are the average BHR on a portfolio of IPOs and on a corresponding reference portfolio over T periods, respectively.

Determinants of IPO underpricing and long-term performance

To better understand the magnitude of observed initial and long-run performance of IPOs, we conduct several cross-sectional regressions of initial excess returns and long-term abnormal returns to identify the significance of selected exogenous variables mentioned in the hypothesis. As far as initial excess returns are concerned, we estimate the following model:

$$Ar_i = \alpha + \beta_1 EX_i + \beta_2 OP_i + \beta_3 MV_i + \beta_4 PER_i + \beta_5 MR_i + \beta_6 TR_i + \varepsilon_i \quad (6)$$

where Ar_i is the initial excess return of IPO i that refers to the level of underpricing; EX_i refers to the ex ante uncertainty measured by the standard deviation of daily returns of IPO i one year after official listing; OP_i is the offer price of IPO i ; MV_i is market volatility, which is calculated, following Paudyal et al. (1998), as the standard deviation of daily market returns over the two months before the closing date of subscription to buy shares of firm i ; PER_i is the price/earnings ratio of IPO i ; MR_i is the lucky number ratio calculated as total investment amount divided by issuable portion.

With regard to the determinants of aftermarket performance, we rely on the same independent variables that explain initial excess returns, according to Zou (2003). And based on the Levis's (1993) argument, we add initial abnormal returns into the model. We estimate the following model to explore the explanatory power of the model:

$$AFTMARKAR_{i,T} = \alpha + \beta_1 Ar_i + \beta_2 EX_i + \beta_3 OP_i + \beta_4 MV_i + \beta_5 PER_i + \beta_6 MR_i + \beta_7 TR_i + \varepsilon_i \quad (7)$$

Where, $AFTMARKAR_{i,T}$ is the aftermarket abnormal return for IPO i over T periods.

DESCRIPTIVE STATISTICS

Descriptive statistics analysis of initial excess returns

In this area, we test whether IPOs are underpriced, in other words,

Table 1. Descriptive statistics of IPO initial returns.

Variable	IPO	CMI	IND
Mean	1.0768	0.0036	0.0037
Median	0.8667	0.0060	0.0061
Maximum	4.6936	0.0458	0.0654
Minimum	0.0459	-0.0884	-0.0909
Standard deviation	0.7134	0.0218	0.0248

Note: The table shows basic descriptive statistics for IPO initial returns of China A-share market of sample period. CMI = the capital market index; IND = the industry index. The table includes the mean, median, maximum, minimum, and standard deviation values for IPO initial returns and their corresponding reference portfolios.

Table 2. Descriptive statistics of IPO initial excess returns.

	Firms with >0 abnormal returns	Firms with <0 abnormal returns	Mean	t-statistic	Median	z-statistic	Mean wealth relative	Median wealth relative
CMI	70	39	1.0745	15.608***	0.8561	1.635***	2.10	1.86
IND	69	40	1.0744	15.620***	0.8602	1.621***	2.07	1.86

Note: The table shows initial excess returns for 119 Initial public offering (IPOs), which is calculated as $ar_i = r_i - r_{crp}$, where ar_i is the initial excess return of firm i from subscription time to the closing of the first trading day, r_i is the initial raw return of firm i from subscription time to the closing of the first trading day, and r_{crp} is the raw return on a corresponding reference portfolio, that is general market index or industry index over the same period. The t -statistic for the average excess returns is computed as $t(ar) = \frac{\overline{ar}_i}{(\sigma(ar_i)/\sqrt{n})}$, where \overline{ar}_i is the sample average of initial excess returns, and $\sigma(ar_i)$ is the cross-sectional sample standard deviation of initial excess returns. The z-statistic is based on the Wilcoxon signed-rank test. We provided the number of firms that experience positive or negative initial excess returns, the mean and median values of initial excess returns, and the t - and z-statistic values with their significance levels. Mean (median) wealth relative is calculated as the ratio of 1 plus the mean (median) initial raw returns of IPOs divided by 1 plus the mean (median) initial raw return on a corresponding reference portfolio. ***Significant at the 1% level.

whether investors, on average, outperform the market through buying IPOs at subscription prices and selling them on the first trading day.

As shown in Tables 1 and 2, on average, IPOs yielded 107.7% on the first trading day, which are far above the average return on corresponding reference portfolios. Some investors obtained superior initial returns as high as 496%, and others achieved initial returns as low as 4.5%. The mean (median) initial excess return is around 107.4% (85.6%), it would be obtained by an investor who bought IPOs at the offer price and sold them at the end of the first trading day. Also, the results showed that 64.2% of IPOs (70 of 109) provide investors with positive initial excess returns. Using two benchmarks, CMI and IND, the results from the parametric t -statistic (the nonparametric z -statistic) reveal that the mean (median) initial excess return is significantly positive at the 1% level. These findings indicated that IPOs in China are grossly underpriced, in line with the findings reported in the relevant literature (Chi and Padgett, 2005; Xu and Liang, 2010). What is more, the level of underpricing is higher than that observed in most countries (Loughran et al., 2003).

Descriptive statistics analysis of long-term abnormal returns

In this area, we consider whether IPOs sustain their initial excess returns and provide investors with positive abnormal returns over a

long period.

Tables 3 and 4 showed summarized statistics for the long-term abnormal returns of IPOs using two benchmarks, CMI and IND, respectively, over one- and three-year periods. After full circulation, IPOs in China A-share market both yielded negative returns, over one- and three-year periods. Long-run abnormal returns over one-year period cover the interval [-1.71, -0.54], and over three-year period cover the interval [-1.54, -0.27]. In general, the buy-and-hold strategy produces, on average, lower returns for investors than does the cumulative abnormal return (CAR) strategy. The parametric test statistics are significant negative at the 1% level for all models, which means investors achieve abnormal negative returns, and their IPOs investments underperform market over one- and three-year periods. The null hypothesis that the median abnormal returns of IPOs are not different from zero cannot be rejected, because the nonparametric Wilcoxon signed-rank test statistics are not significant. The mean and median wealth relatives for all models are all less than 1, which means if an investor bought each IPO for an equal amount of money at the closing price of its first trading day and held it until the first or third anniversary, he or she would have achieved a return less than that achieved by investing in the whole market. The mean wealth relative of 0.59 for IPOs, in a best-case scenario, implies that an investor would have to invest 69% more to get the same performance as the market. Moreover, in a worst-case scenario, an investor would need to invest 300% more to catch up to

Table 3. Abnormal returns for IPOs VS. Alternative indexes based on CAR.

IPO VS. CMI	MAM		CAPM	
	1 year	3 year	1 year	3 year
Number	109	109	109	109
Firms with > 0 abnormal return	11	28	11	18
Firms with ≤ 0 abnormal return	98	81	98	91
Mean abnormal returns	-12.04***	-3.49***	-12.21***	-8.99***
t-statistic	-0.61	-0.43	-0.61	-0.54
Median abnormal returns	1.31	1.35	1.31	1.11
IPO VS. IND				
Number	109	109	109	109
Firms with > 0 abnormal return	9	11	2	1
Firms with ≤ 0 abnormal return	100	98	107	108
Mean abnormal returns	-12.69***	-13.48***	-19.87***	-22.00***
t-statistic	-0.61	-0.57	-1.39	-1.39
Median abnormal returns	0.74	0.50	0.97	0.55

Note: The table provides abnormal returns of initial public offering (IPOs) over one and three years. The aftermarket abnormal returns are calculated based on cumulative return using the market-adjusted model and the capital asset pricing model (CAPM). The market-adjusted return (MAM) = $r_{i,t} - r_{crp,t}$ where $r_{i,t}$ and $r_{crp,t}$ are the monthly returns for IPO i and on a corresponding reference portfolio in month t , respectively. $CAPM_{i,t} = r_{i,t} - r_{i,t} - \beta_i[r_{crp,t} - r_{f,t}]$, where $CAPM_{i,t}$ is the abnormal return using CAPM, $r_{f,t}$ is the risk-free rate proxied as short-term one-month rate for bank deposits, and β_i is the risk of IPO i , and is given from the CAPM regression, which is the slope obtained from regressing $[r_{i,t} - r_{f,t}]$ on $[r_{crp,t} - r_{f,t}]$ for the estimation period. $CAR_{i,s,e} = \sum_{t=s}^e r_{i,t} - r_{crp,t}$ where $CAR_{i,s,e}$ is the cumulative abnormal return (CAR) for IPO i from the starting month s after trading to the anniversary month e (12 and 36 months); $r_{i,t}$ and $r_{crp,t}$ are the monthly returns for IPO i and on a corresponding reference portfolio in period t , respectively. We provide the number of firms that experience positive or negative aftermarket abnormal returns, the mean and median values of aftermarket abnormal returns, and the t - and z -statistic values with their significance level. CMI= the capital market index; IND=the industry index. ***Significant at the 1% level.

the market performance (the mean wealth relative is only 0.25 over a three-year period using the IND as a benchmark). These results support the idea that, in the long run, IPOs cannot sustain their initial excess returns, and provide investors with negative abnormal returns, in line with the findings reported in the literature for IPOs in some economics (Ritter, 1991; Gregory et al., 2010; Chang et al., 2010).

EMPIRICAL RESULTS AND ANALYSIS

Initial excess returns

In this area of the analysis, we examine the determinants of initial excess returns or the level of underpricing. Regression results for Equation 6 are shown in Table 5.

As Jog and Wang (2002) suggested, we found a significantly (1%) positive relationship between market volatility and initial excess return. It proved that behaviors of investors in China A-share market are easily influenced by the stock market volatility. They tend to invest prudently when stock market is in severe volatility, and invest actively when stock market is smooth. Such characteristics of investors' behavior lead listed companies to issue IPOs with a price below its intrinsic value when stock market is in severe volatility.

The estimation results showed that the coefficient on ex-ante uncertainty is significantly positive at the 5% level, supporting Beatty and Ritter's (1986) argument that investors seek higher returns to compensate for their angst about future performance of IPOs. To invest in a

Table 4. Abnormal returns for IPOs VS. Alternative indexes based on BHAR.

IPO VS. CMI	MAM		CAPM	
	1 year	3 year	1 year	3 year
Number	109	109	109	109
Firms with > 0 abnormal return	10	4	10	4
Firms with ≤ 0 abnormal return	99	105	99	105
Mean abnormal returns	-1.00	-0.99	-1.01	-1.00
t-statistic	-11.55***	-14.88***	-11.70***	-15.27***
Median abnormal returns	-1.04	-1.07	-1.05	-1.09
z-statistic	0.73	1.10	0.71	1.10
Mean wealth relative	0.59	0.49	0.58	0.48
Median wealth relative	0.51	0.37	0.50	0.37
IPO VS. IND				
Number	109	109	109	109
Firms with > 0 abnormal return	7	2	3	3
Firms with ≤ 0 abnormal return	102	107	106	106
Mean abnormal returns	-0.97	-1.11	-1.71	-1.54
t-statistic	-11.78***	-18.21***	-16.33***	-18.71***
Median abnormal returns	-1.01	-1.05	-1.69	-1.57
z-statistic	0.90	0.63	0.96	0.83
Mean wealth relative	0.59	0.46	0.28	0.25
Median wealth relative	0.53	0.38	0.25	0.22

Note: The table provides abnormal returns of initial public offering (IPOs) over one and three years. The aftermarket abnormal returns are calculated based on buy-and-hold return using the market-adjusted model (MAM) and the capital asset pricing model (CAPM). The market-adjusted return (MAM) = $r_{i,t} - r_{crp,t}$ where $r_{i,t}$ and $r_{crp,t}$ are the monthly returns for IPO i and on a corresponding reference portfolio in month t , respectively.

$CAPM_{i,t} = r_{i,t} - r_{i,t} - \beta_i[r_{crp,t} - r_{f,t}]$, where $CAPM_{i,t}$ is the abnormal return using CAPM, $r_{f,t}$ is the risk-free rate proxied as short-term one-month rate for bank deposits, and β_i is the risk of IPO i , and is given from the CAPM regression, which is the slope obtained from regressing $[r_{i,t} - r_{f,t}]$ on $[r_{crp,t} - r_{f,t}]$ for the estimation

period. $BHAR_{i,T} = \left[\prod_{t=1}^T (1 + r_{i,t}) - 1 \right] - \left[\prod_{t=1}^T (1 + r_{crp,t}) - 1 \right]$, $T = \{12, 36\}$, $BHAR_{i,T}$ is the buy-and-hold

abnormal return for IPO i in period T (12 and 36 months), and t is the aftermarket trading day. We provide the number of firms that experience positive or negative aftermarket abnormal returns, the mean and median values of aftermarket abnormal returns, and the t - and z -statistic values with their significance level. Mean (median) wealth relative is calculated as the ratio of 1 plus the buy-and-hold aftermarket raw returns of IPOs divided by 1 plus the mean (median) buy-and-hold aftermarket raw return on a corresponding reference portfolio. CMI= the capital market index; IND=the industry index.

***Significant at the 1% level.

listed company, an investor must take more energy to collect relevant information; otherwise, he or she will face a “winner curse”. Most investors in China’s stock market are individual investors, who are eager to get rich quickly. They invest in stocks to get speculative returns, and their investment decisions mainly rely on back alley news, stock comments and newspapers articles, etc. Therefore, in the subscription, they would rather be uninformed investors than collect information, so that their adverse selection seems more serious. Such characteristics determine that investors in China face higher risk when they subscribe. Furthermore, investors require higher

returns to compensate for the risk. So IPOs cannot but be underpriced.

The coefficient of lucky number ratio is positive and significant (5%), which suggests that IPO underpricing is related to the absorption capacity of the market, in line with Paudyal et al. (1998). When the demand for IPOs is high, investors receive fewer shares than they ordered. In turn, they try to buy from the market at a higher price on the first day and a period after to get quick fortunes. Investors overreaction pushes prices up, further, enlarge the magnitude of IPO underpricing. This phenomena, too, is determined by China stock market characteristics,

Table 5. Determinants of initial excess returns of IPOs.

Independent variable	Dependent variable: Initial excess returns (AR)	
	CMI	IND
Intercept	-1.533**	-1.521**
EX	29.584**	29.366**
OP	0.007	0.007
MV	44.898***	44.797***
PER	0.004	0.004
MR	-0.348**	-0.342**
TR	0.012*	0.012*
R ²	0.303	0.299
Adj. R ²	0.262	0.257
F-value	7.319***	7.165***
DW-stat.	1.469	1.473

Note: The table shows the results from multivariate cross-sectional regression analysis based on the following model:

$$AR_i = \alpha + \beta_1 EX_i + \beta_2 OP_i + \beta_3 MV_i + \beta_4 PER_i + \beta_5 MR_i + \beta_6 TR_i + \varepsilon_i, \text{ where}$$

AR_i is the initial excess return of IPO i that refers to the level of underpricing; EX_i refers to the ex ante uncertainty measured by the standard deviation of daily returns of IPO i one year after official listing; OP_i is the offer price of IPO i ; MV_i is market volatility, which is calculated, following Paudyal et al. (1998), as the standard deviation of daily market returns over the two months before the closing date of subscription to buy shares of firm i ; PER_i is the price/earnings ratio of IPO i ; MR_i is the lucky number ratio calculated as total investment amount divided by issuable portion.

CMI= the capital market index; IND= the industry index; DW-stat. = Durbin-Watson statistic.
***Significant at the 1% level. **Significant at the 5% level.*Significant at the 10% level.

namely, the majority of investors individuals lack in investment knowledge and skills with a immature investment mentality.

The positive and less significant (10%) coefficient for first day trading ratio showed that IPOs are more underpriced in a hot market. Believing the existence of "IPO myth", investors' expectation for higher return from IPOs leads to grumous speculative atmosphere, which make the price too high in the secondary market. Then a high IPO underpricing emerged.

However, other factors such as firm-specific characteristics (price/earnings ratio) and pricing mechanism (offer price) are insignificant in explaining IPO underpricing, indicating that investors in China's A-share market paid little attention to the actual value of the listed companies.

The initial IPO excess returns are significantly affected by market factors (market volatility, ex-ante uncertainty, lucky number ratio and first day trading ratio) and insignificantly influenced by stock factors. This finding showed that investors are more concerned about short-term returns that IPOs can bring about when making the decision. Further, this reflects, in Chinese A-share market, investors buy IPOs for speculation rather than investment.

The model only explains 26.2 and 25.7% (using CMI

and IND respectively) of the variability in initial excess returns of the sample of Chinese A-share IPOs, initial returns, which showed the general explanatory power of the three hypotheses earlier mentioned. F-value is significant at the 1% level, indicating that the equation has some linear relationship, and moreover, the model is set up correctly. DW-statistic is close to 2, indicating that the regression does not include serial autocorrelation.

The lower adjusted R²s mean the model explained only a part of the high IPO underpricing in China's A-share market, and they are lower than that of similar studies about some other economies (Guo et al., 2006; Ljungqvist et al., 2006). These results show there is still gap between China marketization level and that of mature market economy. What is more, China has its unique pricing mechanism and trading system, so the reasons for IPO underpricing in China are more complicated, and existing theories cannot fully explain it.

Long-term abnormal returns

In this area of the analysis, we examine the determinants of long-run performance or long-run abnormal returns.

Regression results for Equation 7 are shown in Tables 6 and 7.

Table 6. Multivariate cross-sectional regression analysis of the determinants of long-term abnormal returns of IPOs (CMI).

Independent variable	Dependent variable: Long-term abnormal returns							
	1 Year				3 Year			
	Market-adjusted model		CAPM		Market-adjusted model		CAPM	
	CR	BHR	CR	BHR	CR	BHR	CR	BHR
Intercept	-3.181***	-4.416***	-3.189***	-4.405***	-2.597***	-1.667**	-1.960***	-1.687**
Ar	-0.258***	-0.224*	-0.258***	-0.221*	-0.373***	-0.027	-0.192**	-0.022
EX	58.139***	78.584***	58.134***	78.155***	68.579***	30.086**	49.557***	29.931**
OP	-0.004	-0.012	-0.004	-0.012	-0.017	-0.029**	-0.021**	-0.028**
MV	42.417***	94.488***	42.420***	94.471***	43.364***	56.535***	36.176***	56.530***
PER	0.001	-0.002	0.001	-0.002	-0.006	-0.005	-0.004	-0.005
MR	0.275***	0.385**	0.275***	0.382**	0.365*	0.489***	0.333***	0.484 (3.203)**
TR	0.002	-0.009	0.002	-0.00	-0.002	-0.016**	-0.007	-0.016**
R ²	0.501	0.404	0.501	0.406	0.265	0.353	0.347	0.357
Adj. R ²	0.466	0.363	0.466	0.365	0.214	0.308	0.301	0.312
F-value	14.337***	9.698***	14.337***	9.769***	5.159***	7.801***	7.575***	7.937***
DW-stat.	1.847	1.784	1.847	1.783	2.384	1.902	2.298	1.887

Note: The table shows the results from multivariate cross-sectional regression analyses of the determinants of aftermarket abnormal returns over one and three years with the whole A-share market as the corresponding reference portfolios. The following model is employed: $AFTMARKAR_{i,T} = \alpha + \beta_1 Ar_i + \beta_2 EX_i + \beta_3 OP_i + \beta_4 MV_i + \beta_5 PER_i + \beta_6 MR_i + \beta_7 TR_i + \varepsilon_i$, where $AFTMARKAR_{i,T}$ is the aftermarket abnormal return for IPO i over T periods, which takes the form of cumulative returns (CR) or buy-and-hold returns (BHR) using market-adjusted model or the capital asset pricing model (CAPM); Ar_i is the initial excess return of IPO i that refers to the level of underpricing; EX_i refers to the ex ante uncertainty measured by the standard deviation of daily returns of IPO i one year after official listing; OP_i is the offer price of IPO i ; MV_i is market volatility, which is calculated, following Paudyal et al. (1998), as the standard deviation of daily market returns over the two months before the closing date of subscription to buy shares of firm i ; PER_i is the price/earnings ratio of IPO i ; MR_i is the lucky number ratio calculated as total investment amount divided by issuable portion. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

As seen in Tables 6 and 7, the long-term performance of IPOs in China's A-share market over a one-year period is significantly (1%) affected by market volatility, ex-ante uncertainty, and, to a lesser extent, initial excess returns. The negative coefficient estimate of initial excess returns is consistent with Levis (1993) and Paudyal et al. (1998). This finding suggested that investors are overoptimistic about the performance of IPOs in the short run, but grow more pessimistic over time, which is determined by Chinese unique market characteristics: heavy speculative atmosphere and high turnover of new shares. There is no price limiting limits on the first trading day in China, and in addition, there is frequent issue of new shares. Therefore, most of the primary market investors sell their shares to recoup funds to subscribe for another IPO stock on the first trading day and sell in a short period after. This pushes the price down, and leads to negative long-term abnormal returns.

Tables 6 and 7 showed, over three-year period, abnormal returns are significantly affected by market volatility, offer price, and to a lesser extent, ex-ante uncertainty and first day trading ratio, consistent with the hypothesis. Initial

excess return is insignificant in explaining it.

The positive and significant coefficient for the market volatility showed that the larger the market volatility is, the higher the long-term abnormal returns bears. The negative and significant coefficient for the offer price suggests IPOs with higher offer price provide investors with negative abnormal returns in long run. The positive coefficient for the ex-ante uncertainty indicated the uncertainty of IPO companies' actual value diminish over the time while investment risk decreasing, so the IPOs become hot, which provide investors with positive abnormal returns in long run, in line with Omran (2005) finding. The negative coefficient for the first day trading ratio reflected that investors grow more pessimistic over time, gradually pushing the price down.

The initial IPO excess returns significantly affect abnormal returns over one-year, but have insignificant influence on abnormal returns over three-year, indicates that the information asymmetry resulting in the IPO underpricing was made up in three years or less but over one year. This is determined by the A-share market's characteristics in China that information asymmetry can

Table 7. Multivariate cross-sectional regression analysis of the determinants of long-term abnormal returns of IPOs (IND).

Dependent variable: Long-term abnormal returns								
Independent variable	1 Year				3 Year			
	Market-adjusted model		CAPM		Market-adjusted model		CAPM	
	CR	BHR	CR	BHR	CR	BHR	CR	BHR
Intercept	-2.583***	-3.020***	-2.162***	-0.984	-1.362***	-0.915	-1.304*	-0.930
Ar	-0.264***	-.254**	-0.113	0.109	-0.190***	-0.037	-0.066	0.111
EX	44.345***	42.404**	19.325	-12.475	31.146***	-5.234	3.870	-19.795
OP	0.000	-0.003	-0.012	-0.017	-0.023***	-0.035***	-0.036***	-0.032**
MV	37.290***	85.733***	68.91***	100.952***	32.673***	55.334***	60.094***	63.329***
PER	0.003	0.005	0.012***	0.022***	0.000	0.007	0.011**	0.019***
MR	0.059	-0.136	-0.201	-0.679***	0.013	0.044	-0.182	-0.229
TR	0.001	-0.009	-0.014**	-0.034***	-0.006	-0.012*	-0.016**	-0.019**
R ² %	0.373	0.302	0.422	0.497	0.279	0.278	0.334	0.332
Adj. R ² %	0.329	0.253	0.382	0.461	0.228	0.228	0.287	0.286
F-value	8.503***	6.170***	10.436***	14.098***	5.524***	5.513***	7.154***	7.110***
DW-stat.	1.841	1.864	1.667	1.894	2.206	2.080	1.924	2.064

Note: The table shows the results from multivariate cross-sectional regression analyses of the determinants of aftermarket abnormal returns over one and three years with industry as the corresponding reference portfolios. The following model is employed:

$$AFTMARKAR_{i,T} = \alpha + \beta_1 Ar_i + \beta_2 EX_i + \beta_3 OP_i + \beta_4 MV_i + \beta_5 PER_i + \beta_6 MR_i + \beta_7 TR_i + \varepsilon_i, \quad \text{where}$$

$AFTMARKAR_{i,T}$ is the aftermarket abnormal return for IPO i over T periods, which takes the form of cumulative returns (CR) or buy-and-hold returns (BHR) using market-adjusted model or the capital asset pricing model (CAPM); Ar_i is the initial excess return of IPO i that refers to the level of underpricing; EX_i refers to the ex ante uncertainty measured by the standard deviation of daily returns of IPO i one year after official listing; OP_i is the offer price of IPO i ; MV_i is market volatility, which is calculated, following Paudyal et al. (1998), as the standard deviation of daily market returns over the two months before the closing date of subscription to buy shares of firm i ; PER_i is the price/earnings ratio of IPO i ; MR_i is the lucky number ratio calculated as total investment amount divided by issuable portion. ***Significant at the 1% level. **Significant at the 5% level. * Significant at the 10% level.

be made up in a short time. As the spotlight of the stock market, IPOs are well studied by underwriters, research institutes, and etc. There is lots of public evaluation information about them, which greatly shorten the time that prices use to come to a reasonable level. It is worth noting that factors such as the global financial crisis had its effects on the overall trend in the market. Recalling that most IPOs were traded in the market over one year but less than three years before the economic slump, and that they were among the big stock winners in the bull market, they experienced a huge sell-off in the subsequent period of bear market. Therefore, investors seem to descend a "worriment", and grow more pessimistic, which speed up the disappearance of IPO underpricing.

The R² of the fitted models provides a better explanation for the behavior of IPOs over a one-year period compared with a three-year period. The highest adjusted R² over a one-year period is 46.6% compared with 31.2% over a three-year period, whereas the lowest R² is 25.3% over a three-year period compared with just 21.4% over a three-year period. F-value is significant at the 1% level, indicating that the model is set up correctly. DW-statistic is

close to 2, indicating that the regression does not include serial autocorrelation. The R²s over one- and three-year periods are lower than similar study of other economies (Omran, 2005), again proving that existing theories cannot fully explain IPOs aftermarket performance in China.

Conclusion

This paper studies the underpricing and the long-term performance of 109 A-share IPOs issued in China between June 19, 2006 and June 30, 2007, and explore their reasons.

Consistent with results from previous studies, we found there is a huge underpricing of A-share IPOs, as the average return on the first trading day is 107%. Taking both market risk and stock risk into consideration, abnormal returns over one year cover the interval [-1.71, -0.54], and abnormal returns over a three-year period cover the interval [-1.54, -0.27].

The initial IPO excess returns are significantly affected

by market volatility, ex-ante uncertainty, lucky number ratio and first day trading ratio, are insignificantly influenced by stock factors such as price/earnings ratio and offer price. This finding suggests investors' behavior plays a major role in IPO underpricing and investors buy IPOs aimed at speculation rather than investment.

In the long run, aftermarket abnormal returns over a one-year period are significantly affected by market volatility, ex-ante uncertainty, and, to a lesser extent, initial excess returns. Over three years, abnormal returns are driven by market volatility, offering price, ex-ante uncertainty and first day trading ratio. Initial excess returns' significant influence on abnormal returns over one year indicates China A-share market is inefficient with one year after IPO. However, initial excess returns do not show any influences on abnormal returns over three years, which is determined by the Chinese A-share market's characteristic that information asymmetry can be made up in a short time.

This study on the IPO underpricing, long-run performance and their determinants with full circulation in China contribute to literature for providing new evidence. Since it is not long after full circulation, the sample demanding for IPOs trading for full three years is limited. Further study can track panel data of China A-share market to examine the aforementioned results.

REFERENCES

- Allen F, Faulhaber G (1989). Signalling by Underpricing in the IPO Market. *J. Fin. Econ.* 23: 303-323.
- Barber B, Lyon J (1997). Detecting long-run abnormal stock returns: the empirical power and specification of test statistics, *J. Financ. Econ.* 43:341-372.
- Beatty RP, Ritter JR (1986). Investment banking reputation, and the underpricing of initial public offerings, *J. Financ. Econ.* 15:213-232.
- Chau CT, Ciccotello CS, Grant CT (1999). Role of ownership in Chinese privatization: Empirical evidence from returns in IPOs of Chinese A-Shares, 1990-1993. *Adv. Financ. Econ.* 4:51-78.
- Chen YL, Xiong H, Luo QL (2008). Empirical Study of IPO underpricing in Chinese security market under full circulation, reform and strategy, p. 9.
- Chen G, Firth M, Kim JB (2004). IPO underpricing in China's new stock market, *J. Multinational Financial Manag.* 14:283-302.
- Gregory A, Guermat C, Al-Shawawreh F (2010). UKIPO: Long Run Returns, Behavioural Timing and Pseudo Timing, *J. Bus. Financ. Account.* 37:612-647.
- Guo RJ, Lev B, Shi C, (2006). Explaining the short- and long-term IPO anomalies in the US by Rand D, *J. Bus. Financ. Account.* 33:550-579.
- Han DZ, Chen J (2001). Empirical Study of IPO underpricing in China, *Statist. Res.* p.4.
- Chi J, Padgett C (2005). The Performance and Long-run characteristics of the Chinese IPO Market. *Pac. Econ. Rev.* 10:451-469.
- Levis M (1993). The long-run performance of initial public offerings: The UK experience 1980-1988. *Financ. Manag.* 22:28-41.
- Ljungqvist A, Nanda V, Singh R (2006). Hot markets, investor sentiment, and IPO pricing, *J. Bus.* 4:1667-1702.
- Loughran T, Ritter JR, Rydqvist K (2003). Initial public offerings: International insights. http://bear.cba.ufl.edu/ritter/publ_papers/int.pdf
- Mok MK, Hui YV (1998). Underpricing and after-market performance of IPOs in Shanghai, China, *Pacific-Basin Financ. J.* 6:453-474.
- Omran M (2005). Underpricing and Long-run performance of Share Issue Privatizations in the Egyptian Market. *J. Financ. Res.* 2:215-234.
- Paudyal K, Saadouni B, Briston RJ (1998). Privatization initial public offerings in Malaysia: Initial premium and long-term performance, *Pacific-Basin Financ. J.* 6:427-451.
- Ritter JR (1991). The long-run performance of initial public offerings. *J. Financ.* 46:3-27.
- Ritter JR (1984). The hot issue market of 1980, *J. Bus.* 57:215-240.
- Rock K (1986). Why new issues are underpriced?, *J. Financ. Econ.* 15:187-212.
- Wang JB (1997). Measure of new shares expected excess returns and the possible explanation. *Econ. Res.* p.12.
- Wang Z (2009). Empirical Study of IPO long-term returns based on time series, *Business Times.*
- Chang X, Lin S, Lewis HKT, George W (2010). Cross-sectional determinants of post-IPO stock performance: evidence from China, *Account. Financ.* 50:581-603.
- Xie JL (2010). Study of A-share IPO underpricing under full circulation, *Financ. Econ.* p.2.
- Xu SX, Liang SX (2010). Study of China A-share IPO underpricing under full circulation. *Stock Mark.* 10:94-97.
- Yin XB, Wang R (2008). Study of IPO underpricing under full circulation, *Econ. Issues* p.2.
- Zou J (2003). Study of determinants of IPO underpricing and long-term abnormal returns Under Verification Mechanism, Report of Shenzhen Stock Exchange Research Institute, Shenzhen Res. Inst. p. 0077.