IPO Underpricing in China Growth Enterprise Market

By

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Abstract

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The phenomenon of IPOs' underpricing has been investigated of stock markets around the world. In this paper, I focus on 203 IPOs from 2009 to 2011 extracted from Shenzhen growth enterprise market. Underpricing is directly related to turnover ratio, initial P/E ratio, prior year's ROE, subscribe multiple and free float. The study shows that the initial abnormal return on the secondary market is significantly positive. This study also finds that the initial return in the primary market is negatively related to the free float and IPO P/E ratio. And it is positively related to the prior year's ROE, subscribe multiple and the turnover rate.

Chapter 1

Introduction

1.1 Initial Public Offerings (IPOs)

IPO refers to a private company offering its shares to the public for purchase for the first time. The purpose of IPO is to raise capital to expand a business.

1.2 Background of IPO

The formation of the two stock markets in Shanghai and Shenzhen in 1990 was unprecedented in socialist China. The government allowed enterprises to raise funds by issuing corporate bonds and stocks to the public. IPO underpricing is a comprehensive phenomenon in many markets, and has been noted as one of the 10 puzzles in financial research (Brealey and Myers, 1991). A common perception is that the underpricing of IPO is a challenge to market efficiency, and that is may hurt emerging firms trying to raise capital for expansion (Loughran et al., 1994).

The growth enterprise market started in October 2009, with the aim of supporting small and medium size enterprises, high and new technology enterprises and growth enterprise. Companies in growth enterprise market (GEM) usually have high growth, high proportion of intangible assets, business uncertainty characteristics and small scale. The Chinese IPO market is very special when compared to other countries' IPO markets.

According to finance theory, the risks and benefits are positively related. The larger degree of risk, the higher risk yields. GEM companies' high growth can quickly reduce P/E ratio in the short term, the mature market usually give higher valuations of listed companies. In NASDAQ market, the listed company average P/E ratio is more than 100 times. In China, GEM companies' P/E ratio is 50 times. After the research, I found the average underpricing rate is higher than 50%, with the highest being 209.7%.

The first empirical evidence on IPO underpricing comes from the US Securities and Exchange Commission in 1963. Since then a number of subsequent empirical researches have confirmed the results that IPOs tend to be substantially underpriced in the US, as well as internationally. Ibbotson (1975) found that 120 companys' IPOs have 11.4% of the excess profits in the United States for the first time. And then he also found that there is the existence of "hot issue" markets, which he defines as periods during which the initial performance of IPOs is especially high. Moreover, he found evidence of a strong concentration of IPO activity in certain periods. In the past, some scholars have proposed a series hypothesis to explain the IPO price phenomenon name by asymmetry hypothesis, the signal hypothesis, underwriter's reputation hypothesis and investor's behavior hypothesis.

1.3 The pricing of IPO

If a company wants to issue stock it must receive a permit from China Securities Regulatory Commission (CSRC), and then work with an investment bank or a financial institution, who underwrites the offering. The company together with underwriters determine what type of security to issue, issue date, the best offering price, and the amount of distribution. The most important is how to decide the exact price of IPO.

Jonathan (2008) argues that “Within the region, there are two approaches of pricing shares in an IPO. The first one is to sell shares at a fixed price. This is the approach used by most of the region, including companies on the Dubai Financial Market. The second is the book building method, used widely and also the DIFX's method of choice.”

1.4 Rational of the study

In China, the equity market is very young compared to the developed countries. So, it means there is a large space for Chinese equity market to develop. In addition, in November 2001, China joined the WTO (World Trade Organization). And then the government open up its securities market gradually in the following years. So understanding of the performance and the characteristics of Chinese markets is important for both domestic and foreign investors who want to enter the Chinese markets. This is the reason why China was chosen as the subject in this study.

GEM board is a financing platform for those companies which are small and high-growth but need money to expand its business. Most firms in GEM are high-tech innovation enterprises. The analysis of underpricing of firms' IPOs in GEM is instructive and can offer investors a good prediction of growth firms' IPOs which can make them gain the abnormal return.

1.5 Objective of study

In this paper, I used the regression analysis to test the relationship among degree of underpricing(DUP), ROE in prior year, win a label rate, turnover ratio on the first trading day , starting P/E ratio and Institutions subscribe multiples. The research seeks to find the correlation between independent variables and dependent variable, and find the coefficients of each independent variable. After using the regression model, use growth firm's information to predict the degree of underpricing when IPO.

1.6 limitation of this paper

GEM board in China has only been in existence for two and half years. Therefore, there isn't sufficient data in this regard to substantiate my conclusions. As we know, there are a lot of factors that can influence the pricing of IPO. This paper just focus on company's internal factors, and ignore the external factors such as underwriter's reputation、agency cost、duration time、economic environment and so on.

1.7 Organization of the study

This paper is organized into four chapters. Chapter 1 discusses the background and objective of the paper. Chapter 2 is a review of relevant sources regarding the IPOs underpricing and influence factors. Then, it is followed by the methodology for analysis and model specification in chapter 3. The results of the data analysis are presented and discussed in chapter 4. Finally, in chapter 5 conclusions and recommendations for future research are presented.

Chapter 2

Literature Review

2.1 Underpricing of IPOs

IPOs are usually underpriced because uncertainty surrounding the issue. The less liquid and less predictable the shares are, the more underpriced they will have to be in order to compensate investors for the risk they are taking. Ibbotson (1975) first finds that IPOs have positive initial returns and names it the mystery of IPOs. Ritter (1991) has researched 1526 IPOs between 1975 and 1984 and finds that the average IPO initial return is 14.3%. In table 2.1, it shows 33 countries IPO initial abnormal return in the past. As we can see, China has the highest initial return of 135%, while France has the lowest return of 4.2%. The total average abnormal return is 30.8%, China's IPO initial return has 3 times more than the average level.

2.1.1 Information asymmetry hypotheses

A large number of researchers believe that the underpricing IPO can be explained by information asymmetry hypotheses. Because of the issue company knows more about the value of the shares than the investors. Therefore, this hypothesis states that the company must underprice its stock to attract investors to participate in the IPO. Baron and Holmstrom (1980) argue that information asymmetry exist between underwriters and issuers, with underwriters having superior information to the issuers. In order to solve this moral hazard, underpricing is necessary. According Rock (1986) there is information asymmetry between informed and uninformed investors. In order to keep the uninformed investors leave in the market, underwriters need to underprice IPOs.

Table 2.1 Average degree of underpricing of IPOs in 33 countries

Country/ Market	Time Period	Sample Size	Initial Return	Country/ Market	Time Period	Sample Size	Initial Return
Emerging Markets (13)				Developed Markets (20)			
Israel	1993-1994	28	4.5%	France	1983-1992	187	4.2%
Turkey	1990-1995	138	13.6%	Canada	1971-1992	258	5.4%
Hong Kong China	1980-1996	334	15.9%	United States	1980-2000	6,169	6.3%
Chile	1982-1990	19	16.3%	Austria	1964-1996	67	6.5%
Singapore	1973-1992	128	31.4%	Netherlands	1982-1991	72	7.2%
Mexico	1987-1990	37	33.0%	Denmark	1989-1997	32	7.7%
India	1992-1993	98	35.3%	Finland	1984-1992	85	9.6%
Taiwan China	1971-1990	168	45.0%	Belgium	1984-1990	28	10.1%
Thailand	1988-1989	32	58.1%	Germany	1978-1992	170	10.9%
Korea	1980-1990	347	78.1%	Australia	1976-1989	266	11.9%
Brazil	1979-1990	62	78.5%	United Kingdom	1959-1990	2,133	12.0%
Malaysia	1980-1991	132	80.3%	Norway	1984-1996	68	12.5%
China	1999-2002	354	135.0%	Japan	1970-1996	975	24.0%
China	1990-1996	226	388.0%	Italy	1985-1991	75	27.1%
				New Zealand	1979-1991	149	28.8%
				Sweden	1980-1994	251	34.1%
				Spain	1985-1990	71	35.0%
				Switzerland	1983-1989	42	35.8%
				Greece	1987-1991	79	48.5%
				Portugal	1986-1987	62	54.4%
Average (excluding China)			40.8%	Average			19.6%
Average (including China 1999-2002)			48.1%				
Total Average (excluding China)							27.6%
Total Average (including China 1999-2002)							30.8%

Source: Ritter (1998), Loughran & Ritter (2002).

2.1.2 Underwriter’s reputation hypothesis

Some researchers use reputation of underwriters to explain IPO underpricing phenomenon and document that the better underwriters will price IPOs closer to its intrinsic value. Therefore, the reputation of underwriters is negatively related to the degree of underpricing(DUP). Tian and Zhan (2000) examine the relationship between the reputation of underwriters and IPO underpricing in China, and find that underwriters’ reputation have no explanatory power on Chinese IPO underpricing, due to the important role played by the regulator in IPO pricing.

As a result of investment bank underwriting a lot of stock and have a large number of potential customers, therefore, it can set up its reputation by using appropriate IPO underpricing and by extension making a lot of money by relying on its reputation. Again due to the change of the environment, investment bank also change its method to make money by using its reputation. Carter and Man-aster (1990) make a empirical study by using IPO data in US market in 1980s. Their results show that the reputation of investment bank gives a risk information to the market. Due to the less amount financing of high risky small company, those investment bank with higher reputation will reject young and high risky small company to the IPO market. Thus, the company that has lower underpricing rate could underwrite by higher reputation investment bank.

2.1.3 Investor's behavior hypothesis.

Ljungqvist (2004) argue that the behavior theories assume that those irrational investors will raise the price of the IPO shares higher than the true value, or that issuers are subject to behavior biases and therefore fail to put pressure on the underwriting banks to have underpricing reduced. Those investors who came into the market later will learn experience from the former investors and ignore themselves private information to imitate former investor's behavior. If less early investors think issue price is high, but they can affect the decision of following investors, which will make the IPO fail. Conversely, if less early investors think issue price is low and worth to purchase, it will increase the demand of the stock. This phenomena is called "cascade effect", also it can be defined as IPO market herd behavior.

Ritter (1998) suggest that the IPO market may be subject to the bandwagon effects. A positive cascade or bandwagon means that the IPO is under-priced. Amihud, Hauser, and Kirsh (2001) support this hypothesis by showing that IPOs tend to be either undersubscribed or hugely oversubscribed with very few moderately oversubscribed in Israel.

2.1.4 Investors opinion divergence hypothesis

Miller (1997) uses investor’s opinion divergence hypothesis to explain the phenomena of IPO underpricing and long-term under-performance. He assumes that IPO pricing is similar to a bidding process. The number of new investors and the value estimation of stock look like a normal distribution. When all investors purchase one share, those investors should be the maximum number shareholder of the company. At this time, the price is the market average price. In fact, due to the optimistic predict the value of new stock; investors want to buy more than one share. So that only less investor can purchase the stock at clearing price, even if there exist enough stock in the market. Therefore, the valuation of optimistic margin investors are on the right of average price, it means margin investor want pay more than normal investors. The stock price was determined by optimistic investors.

The level of investor’s opinion divergence will decrease as time goes on. In the short term, the future is full of uncertainties, but the optimistic investors have full of confidence about the future of company. Those investors are willing to pay more than the intrinsic value of the stock. As time goes on, more and more real information about IPO appear in the market, the divergence between investors and the number of optimistic investors will decrease. The market clearing price is close to the intrinsic value. Compared with the price of first trading day, the long-term market value has decreased, so long-run underpricing underperform can be well explained.

2.1.5 The Investment Banker's Monophony Power Hypothesis

Baron (1982) offers a different, agency-based explanation for under-pricing. In this theory, he argues that the issuing firm can't assess its own true value and must depends on the auditing of outside companies and the investment bank to report accurate information. The issuing firm and investment bank agree to an IPO contract based on the report that the investment bank gives the issuing firm concerning its value.

To induce the underwriter to put good effort to market shares, it is optimal for the issuer to permit some under-pricing, which is some kind of monitoring costs for the issuer to the underwriter. Another interpretation of underwriters' superior knowledge of market conditions is that using under-pricing to expend less market effort and to get in with themselves with buy-side clients. There is undoubtedly some truth to this, especially with less experienced issuers (Ritter 1998).

However, Muscarella and Vetsuypens (1989) find that when underwriters themselves go public, their shares are underpriced at the similar rate even though there is no agency problem. This evidence does not favor the Baron hypothesis, although it does not refute it either. One explanation could be underwriters may want to under-price their own offerings in order to convince that under-pricing is normal and necessary for IPOs.

Loughran and Ritter(2002) study the relationship between the issuer and underwriter and they think if underwriter have the right to decide the share placement, this decision will not automatically service issued company’s maximum interest. When necessary, the underwriters deliberately set a low issue price and left more money aside, and then take these shares placement to customers.

2.1.6The changing issuer objective function hypothesis

This hypothesis means keep the managerial stockholding and other characteristics under the constant condition. The goal of issue firm has changed from financing income maximization to accept IPO underpricing. TimLoughran and JayRit—ter(2004) study US IPO market, and found that the IPO average underpricing rate is 7% in 1980s, and then this rate increased to 15% between 1990-1998. However, during the internet bubble times it increased to 65% in 1999-2000. They believe that the change of underpricing is derived from the change of issuers' objective function during the internet bubble times. The issuer’s objective function changes may come from two factors: one is the securities analysts recommend report has received more and more attention from the issuer, at the same time which underwriter should be choose depend on if it has excellent analysts.

Hoberg (2003) argue that each industry usually has only five star analysts, this led to the enterprise face a demand exceeds supply market. And the underwriter as a lead role is more and more obvious, IPOs underpricing rate is also higher than before.

The other problem is publishers are increasingly willing to accept high price; in fact, it is a way to get the gray income for decision maker. Since the 1990s, some underwriters for venture capitalists and issuing companies establish personal sell stock management account so that placement hot sell IPO stock for them, actually at the end of last century this phenomenon are common, the goal is to influence the issuer to chose the underwriter. The management's grey income will stimulate enterprises to choose those underwriters who have a higher underpricing reputation brokers to underwriting their stocks, such as this image is called spinning.

2.2 Initial turnover of IPOs

The initial turnover rate on the first trading day in China IPO market is very high. Zhu and Tian (2002) study the daily turnover rate from days 1 to 40 for over-priced and underpriced Chinese IPOs respectively. They find that the average initial daily turnover rate is 57.91%, which is much higher than that in developed stock markets. The higher the initial turnover rate, the higher the initial returns. It indicates that there exist high speculations on Chinese IPOs market. The daily turnover starts to drop from the second day of trading, and reaches equilibrium around the tenth trading day in

China. The volatility of daily turnover for the overpriced IPOs is higher than that for underpriced IPOs.

2.3 Theories focusing on shares allocation

Shares allocation model was created by Benveniste and Spindt(1989). In this model, underwriters collect information from investors by themselves, for the issuers, it can reduce the level of IPO underpricing. Sherman(2000) If in the future underwriters sell stock to investors during the process of IPO, it will decrease the IPO underpricing level. A lot of researchs about IPO placement problem are very focus on the difference between institution investor and personal investor. Because institutional client is different from retail customers, their scale determine its advantage in information area, so underwriters are treated differently when making the placement policy.

Chapter 3
Data and methodology

3.1 Data sources

In this paper, I collected the data from the Shenzhen stock exchange website. Some of company's data is hard to find. Therefore, I used 203 company's data for my research. These data contain turnover ratio、IPO P/E ratio、prior year's ROE、subscribe multiple and free float from 2009 to 2011. The data of prior year's ROE come from the financial report of each company. The data of turnover ratio come from the Fang zheng security software. And the data of win a label rate come from the website of Eastern wealth.

Table 3.1: Industry distribution of GEM Company

Industry	numbers	Industry	numbers
oil	4	**Biopharmaceutical**	23
Auto	4	**Electron device**	44
Transportation	3	**Non-ferrous metal**	3
Medical equipment	14	**Papermaking**	1
Hospitality	2	**Environmental protection**	10
Commerce	1	**Ceramics**	2
Food	4	**Cloths**	1
Agriculture & Farming	9	**Generating equipment**	13
Media and Entertainment	6	**Printing-packaging**	2

Chemicals	27	**plastic product**	8
Architecture	4	**Glass**	3
Electronic information	77	**Instrument**	14
Machinery	41	**Electrical equipment**	9

3.2 Methodology

3.2.1 Assumed condition

For convenience of research, I made some assumptions as follows; 1) Don't consider subscription costs, including opportunity cost and subscription fees. 2) Don't consider transaction cost, including brokerage and stamp duty.

3.2.2 Underpricing estimate

1) Degree of underpricing

$$\mathrm{DUP} = (\mathrm{P}_{1i} - \mathrm{P}_{0i})/\mathrm{P}_{0i}$$

Where P_{1i} is the closing price of stock i in the first trading day

P_{0i} is the offering price of stock i

If DUP>0, it means the security is underpricing

If DUP<0, it means the security is overpricing

If DUP=0, it means the security is correct priced

3.2.3 Adjusted degree of underpricing

Eliminates the effect of market overall revenue level from initial rate of return.

$$\mathrm{ADUP} = (\mathrm{P_{1i}} - \mathrm{P_{0i}})/\mathrm{P_{0i}} - (\mathrm{L_{1i}} - \mathrm{L_0})/\mathrm{L_0}$$

Where $\mathrm{P_{1i}}$ is the closing price of stock i in the first trading day

$\mathrm{P_{0i}}$is the IPO price of stock i

$\mathrm{L_{1i}}$is the closing Shenzhen indexin the first trading dayof stock i

$\mathrm{L_0}$is the last trading day's closing index of GEM before IPO of stock i

3.2.4. Model and variables

I choose the DUP as a dependent variable, and use those factors, which have effects on DUP, as independent variables to build multiple linear regression models.

DUP=β_{0i} +β_{1i}*PE+β_{2i}*TURNOVER+β_{3i}*RATIO1+β_{4i}*RATIO2+β_{5i}*WINRATIO+

β_{6i}RATIO3+e_i

Where DUP=degree of Underpricing

$\beta_{0i=}$Interception of the regression

$\beta_{1i=}$coefficient for P/E ratio

PE=initial P/E ratio

β_{2i}= coefficient for turnover ratio

TURNOVER=turnover ratio on first exchange day

β_{3i}= coefficient for ROE of prior financial year

RATIO1= prior year's ROE

β_{4i}= coefficient for free float

RATIO2= free float in IPO

β_{5i}= Coefficient for win a label rate

WINRATIO=win a label rate

β_{6i}= Coefficient for subscribe multiple

RATIO3= subscribe multiple for each stock

Predict the signs of the coefficients 1) the initial return of the primary market is negatively related to the free float; 2) the initial return is positively related to the prior year's ROE: 3) the initial return is positively related to the subscribe multiple 4) the initial return is positively related to the turnover rate; 5) the initial return is negatively related to the IPO P/E ratio.

For convenience, I use the X_i to instead the independent variables.

X1= initial P/E ratio

X2=win a label rate

X3=turnover rate on the first trading day

X4= subscribe multiple

X5= prior year's ROE

X6=free float

3.2.5 White's General Heteroscedasticity Test

In statistics, when the standard deviations of a variable, monitored over a specific amount of time, are non-constant.

The possible existence of heteroscedasticity is a major concern in the application of regression analysis, including the analysis of variance, because the presence of heteroscedasticity can invalidate statistical tests of significance that assume that the modeling errors are uncorrelated and normally distributed and that their variances do not vary with the effects being modeled. White's General Heteroscedasticity Test, which requires reordering the observations with respect to the *X* variable that supposedly caused heteroscedasticity, or the BPG test, which is sensitive to the normality assumption, the general test of heteroscedasticity proposed by White does no t rely on the normality assumption and is easy to implement. The White test proceeds as follows:

Step 1. Given the data, we estimate the following equation and obtain the residuals ui .

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+ ui$$

Step 2. We then run the following regression: u^2=Y+Y^2 That is, the squared residuals from the original regression are regressed on the original *X* variables or regressors, their squared values, and the cross product(s) of the regressors. Obtain the *R*2 from this regression.

Step 3. Under the null hypothesis that there is no heteroscedasticity, it can be shown that sample size (*n*) times the *R*2 obtained from the auxiliary regression asymptotically follows the chi-square distribution with df equal to the number of regressors (excluding the constant term) in the auxiliary regression. That is,

$$n \cdot R^2 \sim \chi^2 \, \text{d.f.}$$

where df is degree of freedom. In our example, there are 27 df since there are 27 regressors in the auxiliary regression.

Step 4. If the chi-square value obtained from the above equation exceeds the critical chi-square value at the chosen level of significance, the conclusion is that there is heteroscedasticity. If it does not exceed the critical chi-square value, there is no heteroscedasticity.

3.2.6. Detecting Autocorrelation

The most celebrated test for detecting serial correlation is that developed by statisticians Durbin and Watson. It is popularly known as the **Durbin–Watson *d* statistic,** which is defined as

$$d = \frac{\sum_{t=2}^{t=n} (\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{t=n} \hat{u}_t^2}$$

The mechanics of the Durbin–Watson test are as follows, assuming that the assumptions underlying the test are fulfilled:

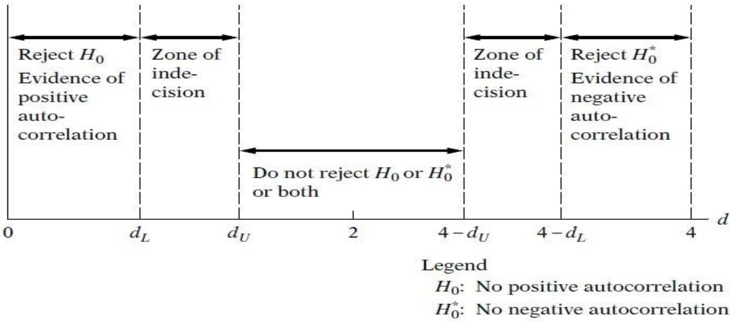
1. Run the OLS regression and obtain the residuals.

2. Compute *d* from above formula.

3. For the given sample size and given number of explanatory variables, find out the critical *dL* and *dU* values.

4. Now follow the decision rules given in Table 3.2. For ease of reference, these decision rules are also depicted in Figure 3.1.

Figure 3.1 Durbin–Watson *d* statistics



Source: R.Carter, William E. and Guay C.(2010)

Given the level of significance α,

$$\mathbf{ut = \rho ut{-}1 + \varepsilon t.}$$

1. H0: ρ = 0 versus H1:ρ > 0. Reject H0 at α level if d < dU. That is, there is statistically significant positive autocorrelation

2. H0: ρ = 0 versus H1:ρ < 0. Reject H0 at α level if the estimated (4 − d) < dU, that is, there is statistically significant evidence of negative autocorrelation.

3. H0: ρ = 0 versus H1: ρ ≠0. Reject H0 at 2*α* level if d < dU or (4 − d) <dU, that is, there is statistically significant evidence of autocorrelation, positive or negative.

Table 3.2 Durbin-Watson d test: decision rules

Null hypothesis	Decision	If
No positive autocorrelation	Reject	$0 < d < d_L$
No positive autocorrelation	No decision	$d_L \leq d \leq d_U$
No negative correlation	Reject	$4 - d_L < d < 4$
No negative correlation	No decision	$4 - d_U \leq d \leq 4 - d_L$
No autocorrelation, positive or negative	Do not reject	$d_U < d < 4 - d_U$

Source: R.Carter, William E. and Guay C.(2010)

Chapter 4

Analysis and Test

This paper uses Stata/SE 12.0 edition to run a regression using a sample size of 203 IPOs companies in China growth enterprise market (GEM).

4.1 The results of adjusted degree of underpricing (ADUP)

In table 4.1, it shows the results of sample's DUP of each stock. We can see, most of the IPOs abnormal return always positive, and a few of them are negative. The average ADUP is 28.0136%, with the minimum benefit -16.67% and maximum is 199.01%. It means under the present issue system, the underpricing phenomenon exists in China's IPO market.

Table 4.1 Part of sample stock's ADUP

stock	ADUP	stock	ADUP	stock	ADUP	stock	ADUP
300240	0.6292	**300221**	-0.0019333	**300202**	0.163752	**300173**	0.0708672
300239	1.99009	**300220**	0.531092	**300201**	0.0753429	**300172**	0.137025
300238	1.46878	**300219**	0.135975	**300200**	-0.059789	**300171**	0.00460233
300237	0.229522	**300218**	0.0288222	**300199**	-0.04128	**300170**	-0.03564
300236	0.438381	**300217**	0.162775	**300198**	-0.0576065	**300169**	0.2662
300235	0.457018	**300216**	0.154784	**300197**	0.164409	**300168**	-0.117729
300234	0.2696	**300215**	0.0669895	**300196**	0.184399	**300167**	-0.138266
300233	0.0922613	**300214**	-0.0488	**300195**	-0.0591	**300166**	-0.130151
300232	-0.0766749	**300213**	-0.0999364	**300194**	-0.0441636	**300165**	-0.163069
300231	0.292775	**300212**	-0.0919106	**300193**	-0.0392585	**300164**	0.145475
300230	0.118427	**300211**	0.142001	**300192**	0.220712	**300163**	0.102746

300229	0.133233	**300210**	0.232073	**300191**	0.0440811	**300162**	0.109689
300228	0.202864	**300209**	-0.113053	**300190**	0.115605	**300161**	0.0727462
300227	0.264094	**300208**	-0.0652	**300189**	0.10615	**300160**	-0.0416714
300226	0.191778	**300207**	0.119222	**300188**	0.2399	**300159**	0.525578
300225	-0.0670143	**300206**	-0.0535	**300187**	0.2147	**300158**	0.00792784
300224	0.130689	**300205**	-0.0775	**300186**	0.0183364	**300157**	0.230947
300223	-0.0754324	**300204**	-0.0498095	**300185**	-0.0247	**300156**	0.15269
300222	-0.0240938	**300203**	0.074	**300184**	0.265	**300155**	-0.0245306

4.2 Regression results

In table 4.2, we can see the regression results. The R-squared of this model is 0.5293 means the independent variables can explain 52.93% of dependent variable. The test of the regression function: F = 35.28, Prob(F-statistic) = 0.000, which means the parameters of each variables are not equal to zero and all independent variables have affects on the degree of underpricing. Therefore, this model has pass the significance test.

Explanations of regression results:

1) The relationship between PE ratio and DUP: The parameter of starting P/E ratio is β_1=0.0017035 which has positive relationship with the DUP, it means the high P/E ratio indicates the company has a good development potential and it can attract more investors. From the investor's view point, the higher P/E ratio means

a good development potential, which is known by informed player. But for those uninformed player, they worry the stock price is overpriced, so it increase the information asymmetry level. As compensation, they need a high underpricing rate.

2) The relationship between win a label rate and DUP: The parameter of win a label rate is β_2= -.0128134 which has negative relationship with the DUP. This rate reflect the demand and supply of new stock, if the rate is low, it means the stock demand more than supply and the IPO price will higher than its true value. The t value is equal to -4.33 which means it is significant.

3) The relationship between turnover rate and DUP: The parameter of turnover rate is β_3=0.839176 and t=10.32 which has positive relationship with the DUP and it is very significant. The higher turnover rate, the higher attraction of the stock. It also increases the liquidity of the stock and it is benefit to find the true value of the stock.

4) The relationship between subscribe multiple and DUP: The parameter of subscribe multiple is β_4=0.0039414 and t=6.65which has positive relationship with the DUP and it is very significant. This ratio reflect the fondness degree of institution investors, the higher this ratio, the higher attention from institution investors. If the stock attack a lot of institution investors to subscribe, it means this stock is underpricing and it price has more space to increase.

5) The relationship between prior years ROE and DUP: The parameter of firm's ROE of prior year is β_5=0.2207151 which has positive relationship with the DUP.

The t value is equal to 3.17 which means it is significant. As we know, ROE reflect the income level of shareholder and it is a tool to measure the effectively of capital use. The higher the ratio, the more return from the investment.

6) The relationship between float rate and DUP: The parameter of free float rate is β_6=-0.0684037 which has negative relationship with the DUP. But the t=-0.09, means the relationships is not significant.

Table 4.2 Regression results

<table>
<tr><td>Source</td><td>SS</td><td>df</td><td colspan="2">MS</td><td colspan="2" rowspan="7">Number of obs = 203
F(6, 196) = 35.28
Prob > F = 0.0000
R-squared = 0.5293
Adj R-squared = 0.5145
Root MSE = .22363</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Model</td><td>10.5873309</td><td>6</td><td colspan="2">1.76455516</td></tr>
<tr><td>Residual</td><td>9.8022356</td><td>196</td><td colspan="2">.050011406</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Total</td><td>20.3895665</td><td>202</td><td colspan="2">.100938448</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>dup</td><td>Coef.</td><td>Std. Err.</td><td>t</td><td>P>|t|</td><td colspan="2">[95% Conf. Interval]</td></tr>
<tr><td>X6</td><td>-.0684037</td><td>.7982091</td><td>-0.09</td><td>0.932</td><td>-1.642585</td><td>1.505777</td></tr>
<tr><td>X4</td><td>.0039414</td><td>.0005926</td><td>6.65</td><td>0.000</td><td>.0027727</td><td>.0051101</td></tr>
<tr><td>X2</td><td>-.0128134</td><td>.0009644</td><td>-4.33</td><td>0.006</td><td>-.0318328</td><td>.006206</td></tr>
<tr><td>X5</td><td>.2207151</td><td>.001559</td><td>3.17</td><td>0.016</td><td>.5915879</td><td>1.1501577</td></tr>
<tr><td>X3</td><td>.839176</td><td>.0003241</td><td>10.32</td><td>0.000</td><td>.6787933</td><td>.9995586</td></tr>
<tr><td>X1</td><td>.0017035</td><td>.0007315</td><td>2.33</td><td>0.021</td><td>.0031461</td><td>.0052608</td></tr>
<tr><td>_cons</td><td>-.2607703</td><td>.1620482</td><td>-1.61</td><td>0.109</td><td>-.5803523</td><td>.0588117</td></tr>
</table>

4.3 The result of White's General Heteroscedasticity Test

The table 4.3 shows the result of the heteroscedasticity test. I can get the R^2 value from the result and after calculation, I also can get the χ^2 value equal to $n*R^2 = 203*0.1171=23.7713$.

Null hypothesis H$_0$: there is no heteroscedasticity

Alternative hypothesis H$_1$: there is heteroscedasticity

According to the rule, if the chi-square value obtained from the equation not exceeds the critical chi-square value at the chosen level of significance, the conclusion is that there is no heteroscedasticity. In white test regression model, the degree of freedom is 27, so the critical chi-square value is 40.113, which is larger than 23.7713. Therefore, we do not reject the null hypothesis, there is no heteroscedasticity.

Table 4.3 White test result

Number of obs = 203
F(2, 200) = 6.58
Prob > F = 0.0002
R-squared = 0.1171
Adj R-squared = 0.0947
Root MSE = 1.6495

usq	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
y	-.3958885	.0298356	-0.69	0.492	-.4547212	-.3370558
ysq	.6424541	.0226524	0.03	0.972	.5977859	.6871222
_cons	.0441336	.0068644	6.430.000		.0305977	.0576695

4.4 The result of Autocorrelation test

After the OLS regression analysis, we get the parameter of each independent variable. And then use the data to calculate all the residual value as showed in Appendix B.

Using the below formula, I get the “d” value is equal to 1.821856

$$d = \frac{\sum_{t=2}^{t=n}(\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{t=n}\hat{u}_t^2} = 12.21344018/6.703844969=1.821856$$

Null hypothesis: H0: ρ = 0

Alternative hypothesis: H1: ρ ≠ 0.

Reject H0 at 2α level if d < dU or (4 − d) <dU, that is, there is statistically significant evidence of autocorrelation, positive or negative.

In this sample, it has 200 sets of data and 6 independent variables. It means n=200, k=6, use the table "Durbin-Watson Statistic: 5 Per Cent Significance Points of dL and dU", we can find the d_u=1.735 and d_L=1.613.

Because du=1.735<d=1.821856<4-du=2.256, so we can't reject the null. It means ρ = 0 and there is no autocorrelation.

Chapter 5

Conclusions

5.1 Conclusion

The purpose of this paper was to examine the factors which affect GEM IPOs underpricing. My models incorporate variables reflect China’s unique economic and institutional framework. Underpricing of GEM IPO is extremely high and far exceeds that observed in other emerging economies. In contrast to NASDAQ, the degree of underpricing of China’s GEM is much higher.

In my regression model, the factors considered are indicate that inverse relationship with win a label rate and free float, while the others are positive. China’s IPO market has many unique features that make it an interesting environment to investigate. The results clearly show very high levels of underpricing of GEM shares and we establish reasons for this. China’s equity markets are expected to expand rapidly in the coming years as the state and individual entrepreneurs tap investors to help finance the economic restructuring of SOEs and fund the expansion of privatized firms. China will, therefore, provide a major investment destination for both domestic and global investors. One concern investors have, however, is their lack of knowledge about China’s markets. Hopefully my study provides some insights and some understanding of the pricing of IPOs in China

5.2 Recommendation

Since IPO underpricing phenomenon exists in GEM (growth enterprise market). I have some following suggestions to firm's that decide to go further.

First, the research of IPO had better separate the sample to different industries which can provide a deep analysis for the mispricing in GEM board. Second, with the purpose of make this paper more accurate, we also need take more variables into consider, such as the reputation of underwriter and firm's age.

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Appendix A: Data of the paper

stock	starting P/E ratio	turnover ratio on first exchange day	firm's ROE of prior financial year	the Free float in IPO	Win a label rate(%)	DUP(degree of underpricing)%	Institutions subscribe multiples
300240	32.36	0.92	0.28461	0.215849	3.636	62.8	11.5
300239	33.48	0.95	0.16681	0.200053	0.402	198.889	16.26
300238	38.16	0.96	0.20121	0.201309	0.683	146.758	27.5
300237	18.12	0.88	0.44271	0.201754	2.514	21.8422	10.14
300236	28.38	0.91	0.28206	0.201925	0.777	42.7281	21.2
300235	26.13	0.91	0.40605	0.2	1.269	44.5918	6.25
300234	30.77	0.93	0.26329	0.2	0.817	27.25	12
300233	22.68	0.86	0.26494	0.206612	2.037	9.51613	15.1
300232	28.14	0.55	0.30516	0.205996	2.509	-7.3775	17.57
300231	30.99	0.89	0.29862	0.2	0.985	28.2875	15
300230	34.48	0.88	0.21240	0.200602	0.858	10.8527	16.4
300229	31.91	0.84	0.22384	0.2	0.996	12.3333	8.33
300228	40.55	0.90	0.21504	0.202985	8.187	20.4564	18.8
300227	45.54	0.88	0.20755	0.204478	0.883	26.5794	17.33

300226	38.33	0.86	0.24759	0.2	1.447	19.3478	16.5
300225	23.41	0.36	0.37897	0.203582	1.559	-5.0714	11.14
300224	32.45	0.88	0.36609	0.2	2.242	14.6989	12.9
300223	42.86	0.38	0.42085	0.2	10.142	-5.9132	19.12
300222	42	0.50	0.47619	0.2	2.714	-3.5494	20.33
300221	43.61	0.60	0.20288	0.2003	2.218	-1.3333	12.71
300220	33.86	0.90	0.33053	0.205714	0.741	51.9692	24.67
300219	32.04	0.78	0.32581	0.203252	0.963	14.4375	19.25
300218	32.73	0.68	0.23033	0.199245	2.8	3.72222	2.87
300217	31.19	0.83	0.27662	0.204717	5.946	17.1175	2
300216	45.78	0.86	0.24994	0.202985	4.028	15.3584	15
300215	56.43	0.74	0.23267	0.204444	18.691	6.57895	8.1
300214	37.29	0.27	0.29631	0.207407	2.348	-5	8.9
300213	53.66	0.33	0.20687	0.2	1.102	-9.8636	18.33
300212	68.76	0.28	0.23060	0.202985	2.792	-9.0611	18.4
300211	55.98	0.85	0.23278	0.205076	1.481	14.3301	14.25
300210	46.81	0.91	0.22137	0.203073	0.717	22.7273	23.25
300209	61.21	0.21	0.28463	0.2	2.634	-11.785	20

300208	46.64	0.29	0.21511	0.200286	0.802	-7	21.5
300207	58.94	0.78	0.22881	0.2	0.705	12.2722	18.9
300206	60.32	0.25	0.29378	0.2	3.082	-5	3.9
300205	66.89	0.21	0.20692	0.200276	2.941	-7.4	26
300204	63.25	0.23	0.33436	0.2009	1.426	-5.181	23
300203	60.89	0.72	0.24084	0.080899	0.56	7.2	38.22
300202	60.32	0.80	0.19092	0.2	0.633	16.1752	25
300201	51.22	0.79	0.14371	0.2	0.448	8.71429	27.78
300200	62.51	0.28	0.26667	0.200935	0.709	-4.7989	11.6
300199	67.09	0.29	0.24860	0.2004	1.279	-2.948	25.38
300198	63.63	0.27	0.27777	0.201087	1.324	-4.5806	6
300197	110.07	0.84	0.27294	0.201429	0.94	14.9009	37.5
300196	46.45	0.79	0.21373	0.2	0.303	16.8999	38.33
300195	53.33	0.21	0.33964	0.2	1.01	-7.45	15.1
300194	46.02	0.18	0.44149	0.201278	1.144	-4.2264	23.12
300193	63.1	0.22	0.25133	0.20045	1.005	-3.7358	26.91
300192	49.02	0.82	0.22075	0.201361	0.421	22.2612	27
300191	56.03	0.73	0.27660	0.2	1.051	5.66811	6.63

300190	69.64	0.76	0.37613	0.201887	0.846	12.8205	38.2
300189	88.89	0.75	0.15402	0.2	0.646	11.875	7.2
300188	80	0.87	0.35320	0.201869	0.899	25.25	39.8
300187	81.63	0.85	0.31602	0.200659	0.728	21.5	8.64
300186	51.16	0.60	0.27541	0.201498	1.017	1.86364	14.27
300185	53.42	0.34	0.17655	0.2	2.252	-2.44	8.6
300184	68.97	0.70	0.20371	0.2009	1.449	23.4	16
300183	59.23	0.65	0.56532	0.2	2.401	6.731	16.8
300182	74.32	0.84	0.34389	0.2	3.923	22.1818	17
300181	60.72	0.73	0.18679	0.2	1.653	19.9149	6.4
300180	51.92	0.63	0.21980	0.202532	4.164	2.33147	4.1
300179	68.75	0.87	0.24370	0.2	2.872	32.3232	22.8
300178	49.77	0.84	0.21295	0.201681	2.351	46.7123	9.1
300177	73.13	0.75	0.31742	0.2	3.024	23.9957	23.6
300176	45.47	0.78	0.28952	0.201342	1.189	26.5356	7.5
300175	51.82	0.78	0.22401	0.201869	1.905	25.2632	11.5
300174	88.89	0.71	0.26183	0.201471	1.891	5.54167	25.67
300173	49.6	0.68	0.20140	0.202985	1.575	7.05672	9.6

300172	66.21	0.66	0.23785	0.2	1.018	13.6725	18.8
300171	96.63	0.52	0.34311	0.2	7.164	0.43023	15.69
300170	72.4	0.23	0.25518	0.20819	2.236	-3.594	9.89
300169	88.89	0.88	0.16485	0.20107	0.648	26.25	13.2
300168	87.5	0.25	0.17462	0.2	0.438	-12.143	25.51
300167	77.7	0.23	0.23071	0.20054	0.617	-14.197	23.6
300166	92.65	0.24	0.37784	0.201728	0.739	-13.385	6.4
300165	72.63	0.25	0.39345	0.2	1.089	-16.677	24.3
300164	73	0.80	0.19153	0.206061	0.928	14.6575	11.75
300163	123.81	0.67	0.14637	0.202532	0.691	10.3846	32.8
300162	131.49	0.69	0.29887	0.202239	0.636	11.0789	45
300161	89.66	0.68	0.13963	0.2	0.603	7.38462	25.5
300160	87.5	0.33	0.21136	0.200428	1.259	-4.0571	17.33
300159	150.82	0.89	0.23317	0.207317	1.284	52.3578	60.6
300158	82.58	0.51	0.18911	0.2	1.094	0.59278	14.42
300157	99.92	0.88	0.19535	0.200495	1.71	22.8947	30.8
300156	63.04	0.77	0.34426	0.200125	1.013	15.069	29
300155	69.01	0.33	0.37674	0.2	1.377	-2.6531	18.62

300154	98.72	0.63	0.26823	0.2	0.821	3.11688	8.75
300153	72.73	0.53	0.31318	0.2	0.469	1.95	7.38
300152	79.59	0.86	0.26145	0.207407	0.462	30.8974	67.62
300151	85	0.77	0.21039	0.202985	0.568	30.8529	48.4
300150	105.4	0.86	0.19107	0.207926	0.5	80.0546	92.11
300149	64.39	0.73	0.28774	0.202985	0.314	51.4643	13.8
300148	84.15	0.88	0.20315	0.205333	0.45	57.2212	23
300147	82.9	0.65	0.15733	0.201951	0.52	15.0338	37.25
300146	115.29	0.81	0.48769	0.200805	0.846	33.4364	10.6
300145	74.12	0.65	0.27225	0.200125	0.645	10.8995	45
300144	103.92	0.83	0.32087	0.2	0.936	21.6792	41.85
300143	138.46	0.77	0.15047	0.202985	0.401	31.1111	59.88
300142	133.8	0.76	0.40503	0.2	1.481	43.5263	46.26
300141	72	0.86	0.32140	0.202899	0.636	93.8131	59.07
300140	54.47	0.68	0.28854	0.203279	0.798	26.4882	34.03
300139	55.56	0.74	0.32593	0.2	1.211	30.992	20.84
300138	63.83	0.65	0.22397	0.204945	0.567	24.2333	36.17
300137	85.6	0.83	0.19832	0.2	0.439	51.3636	65.28

300136	85.35	0.87	0.30504	0.19994	0.644	63.3701	48.23
300135	50.01	0.71	0.26432	0.2	1.471	11.3823	6.73
300134	58.24	0.65	0.42966	0.2	2.506	6.80808	21.4
300133	85.43	0.84	0.24782	0.199894	1.356	58.5294	57.61
300132	67.85	0.81	0.18805	0.202985	1.017	35.6087	42.44
300131	65.45	0.76	0.28289	0.206957	0.577	22.9722	49.41
300130	69.7	0.70	0.23529	0.201575	0.774	10.4316	41.09
300129	47.99	0.82	0.25729	0.2	0.592	40.8387	30.5
300128	67.44	0.65	0.24767	0.2	0.64	6.62857	64.46
300127	72.87	0.75	0.19841	0.202469	0.365	44.2778	97.09
300126	68	0.68	0.24732	0.2	0.763	8.08824	46.72
300125	89.72	0.85	0.20263	0.20339	0.704	33.6182	79.63
300124	78.13	0.87	0.46077	0.2	1.448	27.9772	60.33
300123	96.27	0.72	0.15591	0.202438	0.522	17.3823	123.18
300122	66.63	0.56	0.50589	0.08	0.563	1.50079	61.66
300121	51.36	0.72	0.24719	0.2	0.29	46.1058	90.1
300120	56.76	0.66	0.29464	0.202299	0.329	27.1905	46
300119	74.07	0.81	0.29167	0.200701	0.483	32.0167	72.18

300118	67.52	0.75	0.29366	0.205714	0.821	37.1905	32.46
300117	45.61	0.75	0.17109	0.205505	0.657	40.7692	26.71
300116	76.85	0.84	0.23689	0.2	0.343	127.878	107.72
300115	70.49	0.69	0.19392	0.2	0.64	34.6047	78.98
300114	58.14	0.74	0.19677	0.2	0.347	57.16	99.87
300113	82.65	0.88	0.57845	0.2	0.673	63.2852	90.77
300112	48.42	0.79	0.24450	0.201033	0.399	44.0046	39.58
300111	74.67	0.75	0.14684	0.080157	0.5	43.2143	36.02
300110	50.38	0.75	0.18903	0.200374	0.527	55.3252	107.46
300109	61.22	0.88	0.28710	0.2	0.56	120	78.78
300108	53.14	0.77	0.24420	0.2	0.501	52.9297	49.85
300107	61.29	0.84	0.29692	0.202093	0.724	44.7368	47.96
300106	51.74	0.84	0.16853	0.205128	0.29	151.933	89.53
300105	53.46	0.84	0.30510	0.2	0.581	57.6981	69.48
300104	66.36	0.77	0.23647	0.2	0.545	47.1233	41.96
300103	43.43	0.84	0.32217	0.200153	0.524	58.7629	26.06
300102	70.31	0.81	0.33371	0.2	0.821	77.0667	73.97
300101	59.26	0.88	0.24736	0.212443	0.381	118.469	117.63

300100	40.21	0.82	0.21140	0.20107	0.537	77.6662	20.57
300099	49.44	0.83	0.31008	0.201742	0.578	60.1233	68.5
300098	44.72	0.71	0.29170	0.2	0.697	12.3611	37.16
300097	45.07	0.85	0.23907	0.2	0.421	52.4768	34.2
300096	63.87	0.87	0.26779	0.195556	0.563	47.6263	58.5
300095	36.98	0.90	0.22290	0.202597	0.531	64.0071	17.74
300094	57.52	0.39	0.17490	0.2	0.81	-0.6259	36.37
300093	46.29	0.87	0.14598	0.2	0.517	36.5432	50.25
300092	48.48	0.79	0.21449	0.204444	0.429	20.5625	38.09
300091	48.62	0.70	0.28326	0.197647	0.414	16.1348	34.24
300090	49.56	0.75	0.14690	0.2048	0.385	32.9412	53.03
300089	47.67	0.67	0.19257	0.2	0.366	12.5854	35.2
300088	52.17	0.88	0.17671	0.2016	0.994	50.5	96.94
300087	58.22	0.76	0.36904	0.203846	0.989	8.98876	64.19
300086	62.5	0.33	0.39752	0.2	1.471	-5.6167	77.3
300085	60.87	0.76	0.25634	0.2	1.107	10.4286	78.67
300084	78.57	0.75	0.22562	0.196923	0.866	12.6667	80.78
300083	53.73	0.25	0.27765	0.2	1.255	-5.6667	44.96

300082	55.92	0.32	0.35644	0.2	1.55	-9.9059	70.93
300081	62.55	0.27	0.27086	0.209231	1.068	1.28932	51
300080	68.89	0.36	0.33484	0.202899	1.668	-3.2488	54.24
300079	78.82	0.51	0.21455	0.203636	0.914	4.04007	51.13
300078	72.5	0.56	0.38397	0.194286	0.763	10.431	83.41
300077	98.33	0.82	0.43639	0.197818	1.049	79.7829	117.37
300076	73.86	0.51	0.26966	0.198364	0.803	5.01538	80.46
300075	73.97	0.61	0.36094	0.2	1.013	25.9259	100
300074	68.57	0.67	0.36159	0.190476	1.027	42.5139	80.15
300073	78.26	0.74	0.24498	0.2	0.746	73.8333	117.8
300072	66.67	0.84	0.20290	0.2	0.581	73.4688	101.26
300071	50.58	0.78	0.27825	0.196226	0.481	71.8	132.19
300070	94.52	0.88	0.33355	0.197333	1.606	120	118.07
300069	64.59	0.68	0.23715	0.2	0.572	47.113	88.8
300068	54.1	0.74	0.30026	0.1984	0.981	36.6667	58.81
300067	55.79	0.63	0.24033	0.2	0.653	36.0849	68.24
300066	46.67	0.81	0.31549	0.2	0.412	76.5306	65.81
300065	74.55	0.78	0.19163	0.197857	0.375	76.0976	91.48

300064	64.61	0.63	0.16137	0.2	0.441	36.3977	73.09
300063	55.38	0.70	0.24002	0.194286	0.422	36.7361	61.88
300062	45.62	0.78	0.27070	0.2	0.657	45.5749	46.4
300061	52.17	0.82	0.20596	0.2	0.49	61.2778	48.03
300060	0	**0.00**	**0.00000**	**0**	**0**	**0**	0
300059	116.93	0.70	0.25057	0.2	0.839	43.79	59.37
300058	67.72	0.66	0.23270	0.197531	0.713	18.0744	57.05
300057	65.64	0.61	0.21558	0.197209	0.808	14.2002	23.16
300056	102.81	0.86	0.19679	0.196226	0.681	75.8221	47.58
300055	71.4	0.74	0.48461	0.2	1.245	23.7631	46.66
300054	89.85	0.70	0.18230	0.2	0.831	8.11784	72.57
300053	73.87	0.77	0.19381	0.2	0.541	25.2353	65.76
300052	93.75	0.69	0.23105	0.2	1.237	15	64.02
300051	65.38	0.71	0.31678	0.2	0.603	10.0294	36.96
300050	123.94	0.73	0.33144	0.2	1.354	30.9432	53.29
300049	82.8	0.54	0.20967	0.194872	0.624	18.323	91.18
300048	106.95	0.69	0.46696	0.2	0.732	23.7705	61.9
300047	78.95	0.56	0.23014	0.196364	0.575	17.5667	49.41

300046	66.61	0.69	0.25183	0.2	0.715	23.3656	48
300045	76.75	0.59	0.32837	0.2	0.665	27.0033	87.68
300044	81.48	0.59	0.24069	0.195122	0.373	29.0909	70.4
300043	91.49	0.60	0.37988	0.199245	0.918	13.7335	63.75
300042	76.47	0.65	0.20307	0.197647	0.647	34.4872	70.65
300041	67.41	0.67	0.20059	0.209231	0.864	27.4451	62.24
300040	68.75	0.61	0.14267	0.2	0.62	26.9091	57.53
300039	82.61	0.61	0.39620	0.199636	0.797	19.6842	48.45

Appendix B: Data of the error term

stock	e	stock	e	stock	e	stock	e	stock	e
300240	0.2507	300200	0.120265	300160	0.100515	300120	-0.02271	300080	-0.06109
300239	1.501042	300199	0.087151	300159	0.137652	300119	-0.17281	300079	-0.12107
300238	0.94629	300198	0.16516	300158	-0.008	300118	0.079782	300078	-0.20229
300237	-0.12465	300197	-0.16936	300157	-0.1212	300117	0.07174	300077	0.198669
300236	-0.02479	300196	-0.24039	300156	-0.13896	300116	0.61135	300076	-0.22498
300235	0.082479	300195	0.142962	300155	0.115958	300115	-0.09874	300075	-0.15367
300234	-0.15978	300194	0.180595	300154	-0.01966	300114	-0.02165	300074	0.030564
300233	-0.28793	300193	0.122282	300153	0.019129	300113	0.088158	300073	0.124442
300232	-0.18227	300192	-0.15976	300152	-0.20507	300112	0.037179	300072	0.070925
300231	-0.11734	300191	-0.13763	300151	-0.05523	300111	0.093062	300071	-0.02964
300230	-0.30348	300190	-0.17306	300150	0.218933	300110	-0.0909	300070	0.525645
300229	-0.22343	300189	-0.07086	300149	0.299529	300109	0.600304	300069	-0.00535

300228	-0.12869	300188	-0.13412	300148	0.211855	300108	0.111946	300068	-0.04077
300227	-0.13153	300187	-0.03972	300147	-0.08475	300107	0.007244	300067	0.085276
300226	-0.18031	300186	-0.10559	300146	0.202236	300106	0.865403	300066	0.255056
300225	0.021471	300185	0.089659	300145	-0.14476	300105	0.03853	300065	0.19426
300224	-0.20307	300184	0.039046	300144	-0.11038	300104	0.106357	300064	-0.027
300223	0.116926	300183	-0.01348	300143	-0.02219	300103	0.206275	300063	-0.03717
300222	-0.04933	300182	-0.02287	300142	0.225912	300102	0.277788	300062	0.038641
300221	-0.14497	300181	0.001621	300141	0.46001	300101	0.418318	300061	0.150408
300220	0.082169	300180	-0.05659	300140	0.001492	300100	0.404025	300060	0.26077
300219	-0.17255	300179	-0.01456	300139	0.063343	300099	0.069368	300059	0.156172
300218	-0.12786	300178	0.162823	300138	-0.00547	300098	-0.19472	300058	-0.14783
300217	-0.06808	300177	0.025393	300137	0.029493	300097	0.086061	300057	-0.01717
300216	-0.16781	300176	0.012376	300136	0.208944	300096	-0.03512	300056	0.350488
300215	0.074607	300175	-0.01055	300135	-0.07169	300095	0.208518	300055	-0.04827

300214	0.122311	300174	-0.13358	300134	-0.06112	300094	-0.05547	300054	-0.31388
300213	-0.02217	300173	-0.11413	300133	0.145368	300093	-0.17056	300053	-0.203
300212	0.080358	300172	-0.03845	300132	-0.04614	300092	-0.19727	300052	-0.18036
300211	-0.18565	300171	0.112675	300131	-0.14654	300091	-0.13609	300051	-0.17772
300210	-0.21557	300170	0.215387	300130	-0.18992	300090	-0.11242	300050	0.062882
300209	0.102387	300169	-0.05737	300129	0.020625	300089	-0.17228	300049	-0.15988
300208	0.013575	300168	0.035893	300128	-0.28104	300088	-0.20038	300048	-0.01621
300207	-0.17194	300167	0.037683	300127	-0.12205	300087	-0.33287	300047	-0.02216
300206	0.206373	300166	0.164784	300126	-0.21925	300086	-0.15026	300046	-0.0819
300205	0.119068	300165	0.026631	300125	-0.20971	300085	-0.39465	300045	-0.08447
300204	0.138857	300164	-0.11769	300124	-0.1603	300084	-0.35212	300044	-0.01086
300203	-0.25248	300163	-0.06099	300123	-0.43617	300083	-0.00032	300043	-0.09157
300202	-0.18067	300162	-0.07289	300122	-0.19934	300082	-0.17892	300042	-0.02138
300201	-0.28613	300161	-0.13157	300121	-0.07805	300081	0.040408	300041	-0.08785

Appendix C: The sample stock's DUP

stock	DUP(degree of underpricing)%	stock	DUP(degree of underpricing)%	stock	DUP(degree of underpricing)%
300240	62.8	300194	-4.226361032	300128	6.628571429
300239	198.8888889	300193	-3.735849057	300127	44.27777778
300238	146.7582418	300192	22.26117441	300126	8.088235294
300237	21.84220754	300191	5.668113845	300125	33.61818182
300236	42.72809395	300190	12.82051282	300124	27.9771842
300235	44.59183673	300189	11.875	300123	17.38227147
300234	27.25	300188	25.25	300122	1.500789889
300233	9.516129032	300187	21.5	300121	46.10576923
300232	-7.377490576	300186	1.863636364	300120	27.19047619
300231	28.28746177	300185	-2.44	300119	32.01666667
300230	10.85271318	300184	23.4	300118	37.19047619
300229	12.33333333	300183	6.731001206	300117	40.76923077
300228	20.45636509	300182	22.18181818	300116	127.8778779
300227	26.57935285	300181	19.91489362	300115	34.60465116
300226	19.34782609	300180	2.331474911	300114	57.16
300225	-5.071428571	300179	32.32323232	300113	63.28524895

300224	14.69890944	300178	46.71232877	300112	44.00458979
300223	-5.913242009	300177	23.9957265	300111	43.21428571
300222	-3.549382716	300176	26.53562654	300110	55.32523231
300221	-1.333333333	300175	25.26315789	300109	120
300220	51.96917808	300174	5.541666667	300108	52.9296875
300219	14.4375	300173	7.056721751	300107	44.73684211
300218	3.722222222	300172	13.67249603	300106	151.9327731
300217	17.11746522	300171	0.430232558	300105	57.69811321
300216	15.35836177	300170	-3.59399684	300104	47.12328767
300215	6.578947368	300169	26.25	300103	58.7628866
300214	-5	300168	-12.14285714	300102	77.06666667
300213	-9.863636364	300167	-14.19656786	300101	118.46875
300212	-9.06106369	300166	-13.38511561	300100	77.66618843
300211	14.33009709	300165	-16.67692308	300099	60.12332991
300210	22.72727273	300164	14.65753425	300098	12.36111111
300209	-11.78529755	300163	10.38461538	300097	52.47678019
300208	-7	300162	11.07894737	300096	47.62626263
300207	12.27224009	300161	7.384615385	300095	64.0070922

300206	-5	300160	-4.057142857	300094	-0.625869263
300205	-7.4	300159	52.35781652	300093	36.54320988
300204	-5.180952381	300158	0.592783505	300092	20.5625
300203	7.2	300157	22.89473684	300091	16.13475177
300202	16.17515639	300156	15.06896552	300090	32.94117647
300201	8.714285714	300155	-2.653061224	300089	12.58536585
300200	-4.798903108	300154	3.116883117	300088	50.5
300199	-2.947996025	300153	1.95	300087	8.988764045
300198	-4.580645161	300152	30.8974359	300086	-5.616666667
300197	14.90085824	300151	30.85294118	300085	10.42857143
300196	16.89989236	300150	80.05456199	300084	12.66666667
300195	-7.45	300149	51.46428571	300083	-5.666666667
300194	-4.226361032	300148	57.22120658	300082	-9.905882353
300193	-3.735849057	300147	15.03383348	300081	1.289324394
300192	22.26117441	300146	33.43636364	300080	-3.248847926
300191	5.668113845	300145	10.8994709	300079	4.040066778
300190	12.82051282	300144	21.67924528	300078	10.43103448
300189	11.875	300143	31.11111111	300077	79.78285714

300188	25.25	300142	43.52631579	300076	5.015384615
300187	21.5	300141	93.81313131	300075	25.92592593
300186	1.863636364	300140	26.48824412	300074	42.51388889
300185	-2.44	300139	30.992	300073	73.83333333
300184	23.4	300138	24.23333333	300072	73.46875
300183	6.731001206	300137	51.36363636	300071	71.8
300182	22.18181818	300136	63.37007874	300070	120
300181	19.91489362	300135	11.38233681	300069	47.11297071
300180	2.331474911	300134	6.808080808	300068	36.66666667
300179	32.32323232	300133	58.52941176	300067	36.08490566
300178	46.71232877	300132	35.60869565	300066	76.53061224
300177	23.9957265	300131	22.97222222	300065	76.09756098
300176	26.53562654	300130	10.43157166	300064	36.39774859

Appendix D: The sample stock's ADUP

stock	ADUP	stock	ADUP	stock	ADUP
300240	0.6292	300173	0.0708672	300106	1.53973
300239	1.99009	300172	0.137025	300105	0.597381
300238	1.46878	300171	0.00460233	300104	0.482933
300237	0.229522	300170	-0.03564	300103	0.599329
300236	0.438381	300169	0.2662	300102	0.782367
300235	0.457018	300168	-0.117729	300101	1.16849
300234	0.2696	300167	-0.138266	300100	0.760462
300233	0.0922613	300166	-0.130151	300099	0.585033
300232	-0.0766749	300165	-0.163069	300098	0.099111
300231	0.292775	300164	0.145475	300097	0.500268
300230	0.118427	300163	0.102746	300096	0.451763
300229	0.133233	300162	0.109689	300095	0.615571
300228	0.202864	300161	0.0727462	300094	-0.00415869
300227	0.264094	300160	-0.0416714	300093	0.367532
300226	0.191778	300159	0.525578	300092	0.207725
300225	-0.0670143	300158	0.00792784	300091	0.175548
300224	0.130689	300157	0.230947	300090	0.343612
300223	-0.0754324	300156	0.15269	300089	0.140054
300222	-0.0240938	300155	-0.0245306	300088	0.5053
300221	-0.0019333	300154	0.0269688	300087	0.0901876
300220	0.531092	300153	0.0153	300086	-0.0558667
300219	0.135975	300152	0.304774	300085	0.104586
300218	0.0288222	300151	0.316729	300084	0.131267
300217	0.162775	300150	0.808746	300083	-0.0520667

300216	0.154784	300149	0.522843	300082	-0.0944588
300215	0.0669895	300148	0.580412	300081	0.0174932
300214	-0.0488	300147	0.158538	300080	-0.0182885
300213	-0.0999364	300146	0.342564	300079	0.0434007
300212	-0.0919106	300145	0.129795	300078	0.10731
300211	0.142001	300144	0.237592	300077	0.800829
300210	0.232073	300143	0.331911	300076	0.0531538
300209	-0.113053	300142	0.505263	300075	0.280559
300208	-0.0652	300141	1.008131	300074	0.446439
300207	0.119222	300140	0.334882	300073	0.759633
300206	-0.0535	300139	0.37992	300072	0.755988
300205	-0.0775	300138	0.232233	300071	0.6983
300204	-0.0498095	300137	0.503536	300070	1.1803
300203	0.074	300136	0.623601	300069	0.45143
300202	0.163752	300135	0.114123	300068	0.346967
300201	0.0753429	300134	0.0683808	300067	0.341149
300200	-0.059789	300133	0.585594	300066	0.752606
300199	-0.04128	300132	0.356387	300065	0.748276
300198	-0.0576065	300131	0.204322	300064	0.351277
300197	0.164409	300130	0.078916	300063	0.354661
300196	0.184399	300129	0.382987	300062	0.446249
300195	-0.0591	300128	0.0476857	300061	0.603278
300194	-0.0441636	300127	0.424178	300060	0
300193	-0.0392585	300126	0.0622823	300059	0.4284
300192	0.220712	300125	0.317582	300058	0.185344
300191	0.0440811	300124	0.291672	300057	0.146602
300190	0.115605	300123	0.185723	300056	0.762821

300189	0.10615	300122	0.0269079	300055	0.242231
300188	0.2399	300121	0.457058	300054	0.0779784
300187	0.2147	300120	0.267905	300053	0.249153
300186	0.0183364	300119	0.316167	300052	0.1468
300185	-0.0247	300118	0.359005	300051	0.097094
300184	0.265	300117	0.394792	300050	0.341932
300183	0.09831	300116	1.26588	300049	0.21573
300182	0.252818	300115	0.333147	300048	0.270205
300181	0.230149	300114	0.5693	300047	0.208167
300180	0.0543148	300113	0.630552	300046	0.266156
300179	0.325332	300112	0.437746	300045	0.302533
300178	0.469223	300111	0.429843	300044	0.323409
300177	0.242057	300110	0.575552	300043	0.169835
300176	0.267456	300109	1.2223	300042	0.342472
300175	0.254732	300108	0.551597	300041	0.272051
300174	0.0557167	300107	0.467768	300040	0.266691