UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

PRICE, VOLUME AND ADVERSE SELECTION COST EFFECTS ASSOCIATED WITH EXPIRATION OF IPO LOCK-UP AGREEMENT: EVIDENCE FROM CHINA'S GROWTH ENTERPRISE MARKET

LJUBLJANA, NOVEMBER 2012 YINGDONG XU

AUTHORSHIP STATEMENT

The undersigned YINGDONG XU, a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), declare that I am the author of the bachelor thesis / master's thesis / doctoral dissertation entitled PRICE, VOLUME AND ADVERSE SELECTION COST EFFECTS ASSOCIATED WITH EXPIRATION OF IPO LOCK-UP AGREEMENT: EVIDENCE FROM CHINA'S GROWTH ENTERPRISE MARKET, written under supervision of IGOR MASTEN and co-supervision of ALEŠ AHČAN.

In accordance with the Copyright and Related Rights Act (Official Gazette of the Republic of Slovenia, Nr. 21/1995 with changes and amendments) I allow the text of my bachelor thesis / master's thesis / doctoral dissertation to be published on the FELU website.

I further declare

- the text of my bachelor thesis / master's thesis / doctoral dissertation to be based on the results of my own research;
- the text of my bachelor thesis / master's thesis / doctoral dissertation to be language-edited and technically in adherence with the FELU's Technical Guidelines for Written Works which means that I
    - cited and / or quoted works and opinions of other authors in my bachelor thesis / master's thesis / doctoral dissertation in accordance with the FELU's Technical Guidelines for Written Works and
    - obtained (and referred to in my bachelor thesis / master's thesis / doctoral dissertation) all the necessary permits to use the works of other authors which are entirely (in written or graphical form) used in my text;
- to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Copyright and Related Rights Act (Official Gazette of the Republic of Slovenia, Nr. 21/1995 with changes and amendments);
- to be aware of the consequences a proven plagiarism charge based on the submitted bachelor thesis / master's thesis / doctoral dissertation could have for my status at the FELU in accordance with the relevant FELU Rules on Bachelor Thesis / Master's Thesis / Doctoral Dissertation.

Ljubljana, _____ Author's signature: _____

(Month in words / Day / Year,

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

In order to facilitate financing for small and medium-sized enterprises, China launched its own Nasdaq, Shenzhen growth enterprise market (China GEM), in 2009 October. It provides a listing channel for the exiting of venture capital; hence it stimulates the venture capital cycle and helps the innovative enterprise to develop. Meanwhile, it increases the liquidity of the shares of the companies. Therefore, it enables the companies to make better use of equity incentive mechanism to improve the economic efficiency and reduce the cost of management. Though the GEM promotes the use of equity incentive mechanism and provides exiting channel for venture capital, it is a two edged sword. It brings risk to the individual investors as it provides a platform where managers or venture capitalists can trade with the individual investors by exploiting the non-public information.

For protecting the individual investors' benefits, the GEM regulator (China Security Regulatory Commission) has enforced the rule that all IPO firms are obligated to sign a lock-up agreement, which prohibits the pre-market shareholders trading their shares for a specified period after IPO. The original rules allow managers to sell their shares earlier if they resigned their jobs. To get around the lock-up rules, many mangers of the listed firms surprisingly resigned their jobs shortly after their firms being listed. The disclosed reasons for those resignations are health issue, personal future, work pressure or even unknown. This abnormal phenomenon catches the regulator's attention. To counter it, the regulator revises the rules to postpone the unlock day. It also raises the investors' concern as the mangers' resignations could be a signal that they try to unlock and sell their shares as early as possible. In addition, the informational asymmetry between informed and uninformed traders maybe worsen around the unlock day when the mangers who hold superior information are allowed to trade their shares. These factors will cause the investors have similar behaviors around the unlock day, which are reflected in share price and trading volume.

As a newly launched market, there is only a limited amount of literature available on the China GEM lock-up agreement, which is now partially expired. In addition, the samples regarding the China GEM lock-up agreement have now become available. For these reasons I have chosen this topic which will discuss three main issues regarding lock-up agreement, namely:

Do investors face higher informational asymmetry risk due to the presence of more insiders in the market after unlock day?

Does the increased supply of shares lower the price after unlock day, and does pessimistic expectations bring forward the price drop before unlock day?

Does the trading volume increase after unlock day?

In China GEM, all issuers are obligated to sign IPO lock-up agreement, which prohibits insiders and other shareholders who held shares before IPO from selling any of their shares for a specified period. While the lock-up agreement is valid, the shares held by employees, executives and others before IPO are not allowed to be traded. On the unlock day the restriction is removed, these lock-up shares are suddenly allowed to be traded. This thesis aims to study the influence of the sudden change from the lock-up expiration, and consists of four purposes.

The first purpose is to study the asymmetric information problem between the inside and outside shareholders. I want to know if the insiders' entering into the market will intensify the asymmetric information problem after the lock-up expiration. I provide an extensive literature review of financial market microstructure theory. Based on those studies, I argue that the adverse selection component of bid-ask spread is a good measure of asymmetric information. Thus, one of the empirical issues of this study is to examine the change of adverse selection component. In addition, I will test if the IPO underpricing and PE ratio are the factors affecting the change of adverse selection cost.

The second purpose is to provide empirical evidence of market reaction to lock-up expiration from an emerging market China, other than US or EU markets. There are yet no studies on market reaction to lock-up expiration on China GEM market. It represents a valuable contribution as the characteristic of investors and regulations on lock-up agreements in China are significantly different from those in the US. In China, the pre-IPO shareholders are obligated to sign the lock-up agreements, while in US that agreement is optional. In addition, the ratio of individual investors to the institutional investors in China is higher than that in US. As the individual investors are not as rational as institutional investors, I argue that the higher ratio of individual investors will cause the market react less rationally to the lock-up expiration in China.

The third purpose is to present a detailed introduction of China GEM and discuss the market reaction based on this market background. It includes the evolution of market, the trading mechanism, the characteristic of investors, the regulation of the lock-up agreements and the explanation for the existence of them.

The fourth purpose is to provide statistical results of abnormal returns for the individual investors and for testing if the China market is efficient. In addition, I will test if the abnormal returns and amount of unlock shares are correlated. The Studies on US IPO show that there are significant abnormal negative returns around the lock-up expiration. This contradicts the semi-strong efficient market hypothesis, as the lock-up expiration information is publicly available. I want to test if there is abnormal return around the lock-up expiration date on China GEM as Ill. If the abnormal returns exist, it means the Chinese GEM is not an efficient market, which is valuable information for the investors.

This thesis provides a review on financial market microstructure and IPO lock-up expiration, and it presents the characteristics of China GEM. Through the literature review, I provide a collective document which shows what the market effects to the expiration is in the markets around the world. However, I discovered that only a limited amount of studies on the asymmetric information has been done, especially on the China GEM market. The empirical part of this thesis is to fill this gap.

With 268 sample IPOs from 2009 to 2011, I attain the following results. Firstly, the abnormal return around the unlock day is negative; and it is positively correlated with the size of unlock shares. Secondly, the abnormal volume is positive after the unlock day. Thirdly, the informational asymmetry problem measured by adverse selection cost is improved after the unlock day, which might be due to the decrease of private information caused by the competition among informed traders. For the firms with high underpricing or low IPO PE ratio, the adverse selection cost is not affected by the lock-up expiration.

The structure of this dissertation is presented in figure 1.

First part is the introduction of this dissertation, including background of the topic, purpose of the study, structure of this dissertation and the definitions of basic concepts.

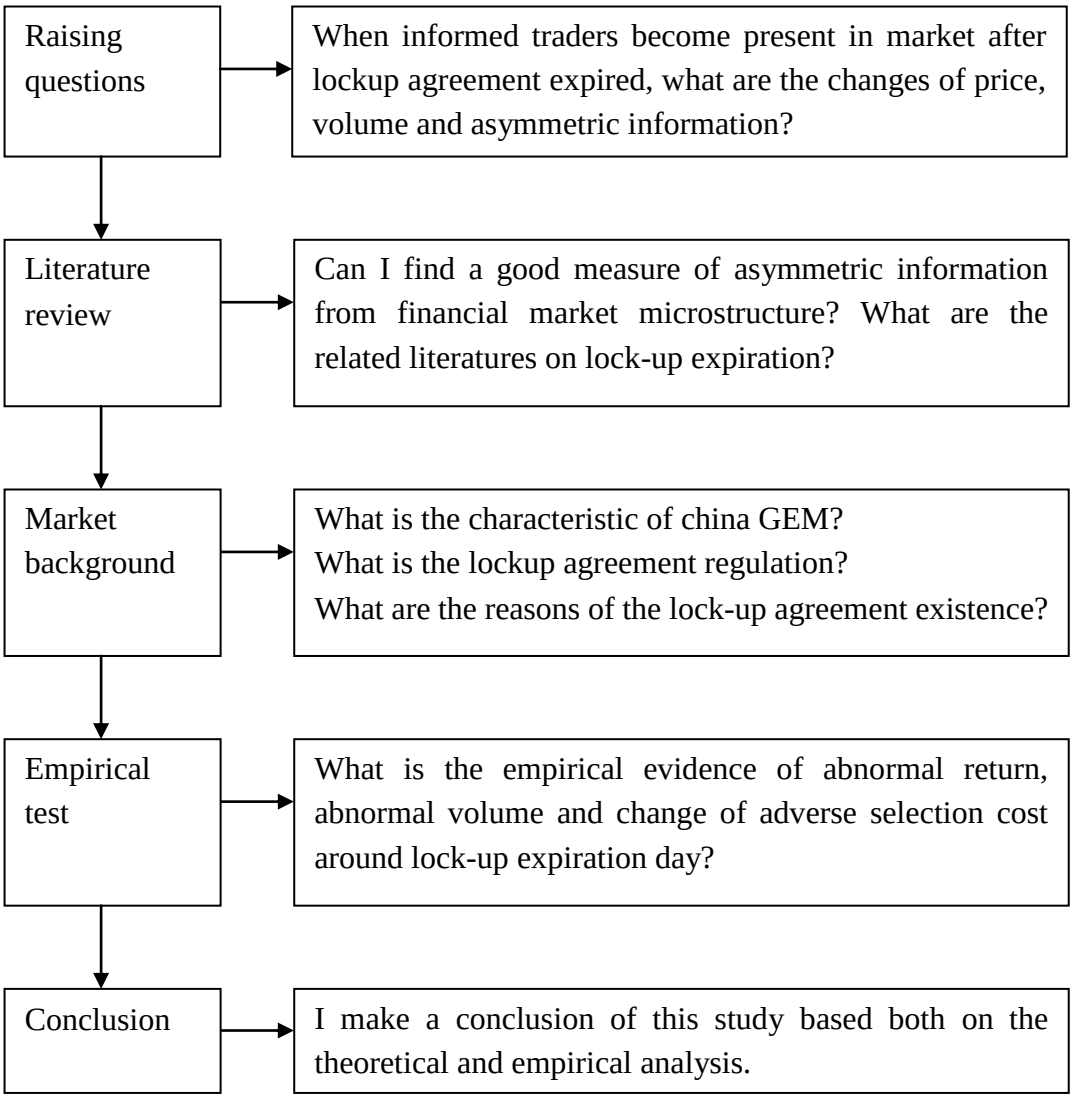
Chapter 1 provides an extensive literature review on financial market microstructure and lock-up expiration. The financial market microstructure theory supports that the adverse selection component of bid-ask spread is a suitable measure of asymmetric information. This chapter also provides brief review on downward slope demand curve theory and efficient market theory.

Chapter 2 provides firstly the introduction of the GEM market, including the overviews about market development, trading mechanism, lock-up agreement regulation. Secondly, it presents three explanations for the existence of lockup agreement namely, signaling hypothesis, commitment hypothesis and compensation hypothesis. Thirdly, it discusses the price effect, volume effect and adverse selection cost effect to the lock-up expiration.

Chapter 3 provides empirical test. I use bid-ask spread decomposing model to calculate the adverse selection cost. I test if the abnormal return and abnormal volume is significantly different from zero around the lock-up expiration date, and compare the difference of the adverse selection cost between before and after expiration. In addition, I repeat the testing in the sub-samples to find out the relationship between abnormal return and amount of unlock shares, between adverse selection cost and IPO underpricing, and between adverse selection cost and IPO PE ratio.

The last part offers conclusions.

Figure 1 The structure of this thesis



1 LITERATURE REVIEW

This chapter provides review on financial market microstructure. Based on market microstructure, I use the adverse selection cost of bid-ask spread as a measurement for market informational asymmetry in chapter 4. Secondly, I review the empirical research on lock-up expiration. Most of the previous research report a result that there is abnormal return around the unlock day. A limited amount of researches shed a light on the informational asymmetry change around the unlock day, particularly on China stock market, which is the main problem I will study in this thesis. Thirdly, I introduce the downward slope demand curve hypothesis, which can be used to explain why the abnormal return exists.

1.1 Market microstructure

Market microstructure is the study of the process and outcomes of exchanging assets under explicit trading rules. The bid-ask spread plays an important role in price formation. Consequently, literatures focus on the determinants of bid-ask spreads. Generally, the literature studies about how dealers actively change the price based on inventory condition and informational asymmetry. From the informational asymmetry model, I learn the method of decomposing the bid-ask spread to get the adverse selection cost as a measurement of informational asymmetry between informed traders and market makers.

1.1.1 Inventory model

Inventory model views the trading process as a matching problem between supply and demand. In this approach, the market maker always has some inventory position, which incurs some costs. The market maker adjusts the bid-ask spread for earning the profit to cover the inventory cost.

Garman (1976) studies how order flow determines the security price. In his model, the market orders' generation is a stochastic process following a poisson distribution, and there is a single market maker who adjusts the price, executes all the orders and clears trades. The dealer's goal is to maximize his own profit, while avoiding failure or bankruptcy. Failure means the dealers running out of inventory or cash. The dealer's capital is limited. She can increase her cash (or stock inventory) only through trading. The dealer protects herself from the imbalance between buy and sell orders by setting positive bid-ask spread. The limitation of this model is that the prices are fixed at the beginning of trading, but do not change according to the inventory change.

Amihud and Mendelson (1980) develop the inventory model. They study how the dealer's price changes with the change of inventory position. The basic framework is the same as the

Garman's model. The difference is that the dealer's inventory position can be viewed as semi-Markov process, but not Poisson process. The dealer's price depends on the level of the dealer's position. This model uses an assumption that the inventory is between some exogenous parameters. The assumption removes the possibility that the dealer becomes bankrupted. Three important results come out from that model. First, the optimal ask and bid price is negative related with the dealer's inventory position. Second, the dealer prefers a specified inventory position. Once the inventory is away from this preferred position, the dealer will adjust the price to move his position back. Third, the optimal bid-ask spread is positive.

1.1.2 Information-based models

The inventory model above provides insights into the formation of market prices. However, in those models, the bid-ask spread is determined only by the inventory costs. Beginning with an influential paper by Bagehot (1971), a new approach emerged to explain market price that rely on information but not only inventory cost. These models demonstrate that spreads will always exist if informational asymmetry exist, even in a competitive market without transaction and inventory cost.

Bagehot (1971) suggested that there are two different traders in the market, uninformed traders whose trades are motivated by liquidity and informed traders who possess superior information. The market maker, who is responsible for all trades, knows that there are these two different traders in the market, informed and uninformed traders. As the informed traders owns more information than the market make does, the informed traders will choose to buy at the price which is lower than its true value, and sell at the price which is higher than its true value. Moreover, these informed traders can chose not to trade. Consequently, the market makers will always lose while dealing with the informed traders. To avoid bankruptcy, the market maker has to earn some profit against this loss from the informed traders. These profits arise from the bid-ask spread, as the uninformed traders will sell the shares to the market maker at a lower price, and buy the shares at the higher prices.

Copeland and Galai (1983) develop a one-period model of information effects on the bid-ask spread. They assume that there is a market maker who optimizes his profit by setting a bid-ask spread for receiving profits from the uninformed traders and covering the loss from the informed traders. In this model, even though there are neutral competitive dealers on the market, the spread will always exists as long as there is a positive possibility that there are some informed traders. The authors report that the spread is a positive function of the level of price and return variance, and negative function of market depth and continuity. They find that the bid-ask spread will increase if price volatility is greater, price level is higher, or trade volume is lower..

Kyle (1985) develops a model, in which informed traders owning private information places

orders to get profits before the information become common knowledge. The market maker observes and studies from the order flow, and then adjusts the price of the share. The author shows that at the end the market price will incorporate all information on the market due to the learning process.

Holden and Subrahmanyam (1994) develop Kyle's model to include competition among several insiders with private information. They show that the competition among insiders will increase the trading volume and cause the private information become publicly available more quickly. Compare with that in Kyle's model, markets are more efficient and profits of insiders are lower as there is competition.

1.1.3 Bid-ask spread decomposing model

The information model suggests that the bid-ask spreads are determined by both the transaction cost and adverse selection cost. Scholars have developed models to decompose the spread into transaction cost and adverse selection cost.

Lin, Sanger, and Booth (1995) develop a model to estimates the adverse selection cost component of the spread. In their model, market maker makes quote revision when adverse information is revealed at time t.

$$A_t = A_{t-1} + \lambda S_{t-1} + \varepsilon_t \quad (1)$$

$$B_t = B_{t-1} + \lambda S_{t-1} + \varepsilon_t \quad (2)$$

$$S_{t-1} = P_{t-1} - Q_{t-1} \quad (3)$$

$$Q_t = (A_t + B_t)/2 \quad (4)$$

Where A_{t-1} and B_{t-1} are the bid and ask price at time t, S_{t-1} is one half of the effective spread, P_{t-1} is the transaction price, Q_{t-1} is the quote midpoint at time t, λ is the proportion of the adverse selection component in the effective spread.
From equation (1) (2) (4), Q_t can then be expressed

$$Q_t = (A_{t-1} + B_{t-1})/2 + \lambda S_{t-1} = Q_{t-1} + \lambda S_{t-1} + \varepsilon_t \quad (5)$$

So that

$$\Delta Q_t = Q_t - Q_{t-1} = \lambda S_{t-1} + \varepsilon_t \quad (6)$$

The authors of the model suggest that adverse selection cost λ can be estimated by using ordinary least squares regression.

Madhavan, Richardson, and Roomans (1997) develop a model of price formation which incorporates different market microstructure frictions, which includes the adverse selection

cost, transaction cost, and autocorrelation of order flow.

In MRR model, P_J is the transaction price of the stock at time J, X_J is an indicator variable of trading initiation. $X_J = 1$ means buyer initiated, $X_J = -1$ means seller initiated, $X_J = 0$ means buyer and seller subjected the order at same price at same moment. The probability of buy and sell are equal, so that

$$Pr(X_J = 0) = \lambda \tag{7}$$

$$Pr(X_J = 1) = Pr(X_J = -1) = (1-\lambda)/2 \tag{8}$$

$$E(X_J) = 0 \tag{9}$$

$$Var(X_J) = 1-\lambda \tag{10}$$

The market maker changes the price depending on the observable public information and private information possessed by informed traders. The private information changes the bid and ask price by the following mechanism. The assumption is that the trading initiation contains the private information of the informed traders. The difference between the expectation and realization of trading initiation is $X_J - E[X_J \mid X_{J-1}]$. After the investors observe this difference, they will require compensation of adverse selection, which could be expressed as $\theta(X_J - E[X_J \mid X_{J-1}])$. θ captures the adverse selection cost. So the expected stock price from the market maker is:

$$\mu_J = \mu_{J-1} + \theta(X_J - E[X_J \mid X_{J-1}]) + \varepsilon_J \tag{11}$$

Where μ_J is the expected price at time J, ε_J is the effect of public information

The market maker needs to pay transaction cost if the orders are executed, so he requires transaction cost compensation. ϕ captures the transaction cost, so the ask price is with the transaction cost is:

$$P_J^a = \mu_{J-1} + \theta(X_J - E[X_J \mid X_{J-1}]) + \phi + \varepsilon_J + \xi_J \tag{12}$$

And bid price is

$$P_J^b = \mu_{J-1} + \theta(X_J - E[X_J \mid X_{J-1}]) - \phi + \varepsilon_J + \xi_J \tag{13}$$

So that the transaction price is

$$P_J = \mu_{J-1} + \theta(X_J - E[X_J \mid X_{J-1}]) + \phi X_J + \varepsilon_J + \xi_J \tag{14}$$

Where ξ_J is independent and identically distributed random variable with mean zero.

The authors assume a general Markov Process for the trade initiation variable. Let γ denote the probability that a ask (bid) transaction follow a ask (bid), that is $\gamma = \Pr[x_t = x_{t-1} \mid x_{t-1} \neq 0]$. From equation (7) (8) (9) (10), the first-order autocorrelation of the trade initiation variable can be expressed as

$$\rho = E[X_J X_{J-1}]/Var[X_{J-1}] = 2\gamma - (1-\lambda) \tag{15}$$

If $X_{J-1} = 0$, then $E[X_J \mid X_{J-1} = 0] = 0$ (16)

If $X_{J-1} = 1$, then

$$\begin{aligned} E[X_J \mid X_{J\text{-}1} = 1] &= 1 * \Pr[X_J = 1 \mid X_{J\text{-}1} = 1] + (\text{-}1) * \Pr[X_J = \text{-}1 \mid X_{J\text{-}1} = 1] \\ &= \gamma - (1 - \gamma - \lambda) = \rho \end{aligned} \tag{17}$$

If $X_{J-1} = -1$, then

$$\begin{aligned} E[X_J \mid X_{J\text{-}1} = -1] &= 1 * \Pr[X_J = 1 \mid X_{J\text{-}1} = -1] + (\text{-}1) * \Pr[X_J = \text{-}1 \mid X_{J\text{-}1} = -1] \\ &= (1 - \gamma - \lambda) - \gamma = -\rho \end{aligned} \tag{18}$$

From equation (16) (17) (18), $E[X_J \mid X_{J-1}]$ can be expressed as

$$E[X_J \mid X_{J-1}] = \rho X_{J-1} \tag{19}$$

From equation (13) (14) and (19), $P_J - P_{J-1}$ can be expressed as

$$\begin{aligned} P_J - P_{J-1} &= \mu_J + \phi X_J + \xi_J - (\mu_{J-1} + \phi X_{J-1} + \xi_{J-1}) \\ &= (\mu_J - \mu_{J-1}) + \phi X_J + \xi_J - \phi X_{J-1} - \xi_{J-1} \\ &= \theta(X_J - E[X_J \mid X_{J-1}]) + \varepsilon_J + \phi X_J + \xi_J - \phi X_{J-1} - \xi_{J-1} \\ &= \theta(X_J - \rho X_{J-1}) + \varepsilon_J + \phi X_J + \xi_J - \phi X_{J-1} - \xi_{J-1} \\ &= (\phi + \theta) X_J - (\phi + \theta\rho) X_{J\text{-}1} + \varepsilon_J + \xi_J - \xi_{J\text{-}1} \end{aligned} \tag{20}$$

The authors use the generalized method of moments (GMM) to estimate the parameters. The moment conditions are

$$E\begin{pmatrix} u_J - \alpha \\ (u_J - \alpha) X_J \\ (u_J - \alpha) X_{J-1} \\ X_J X_{J-1} - X_J X_J \rho \end{pmatrix} = 0 \tag{21}$$

Where $u_J = P_J - P_{J-1} - (\phi + \theta) X_J + (\phi + \theta\rho) X_{J-1}$, α is constant. The second and third equations are the OLS normal equations. The last one is the definition of autocorrelation in trading initiation.

I estimate firstly the ρ from the last equation. And then I use the estimated ρ to substitute the ρ of the first three equations. The first three equations then can be viewed as

$$P_J - P_{J-1} = \phi(X_J - X_{J-1}) + \theta(X_J - \rho X_{J-1}) \tag{22}$$

I use then OLS to estimate the parameters.

1.2 Review on IPO lock-up agreement expiration

Unlike in US markets, lock-up agreements, which prohibit insiders from selling shares before a certain date, are obligated but not optional on China GEM. On the unlock day, the pre-market shareholders are allowed to trade their shares. The empirical results from the literatures show that this sudden change causes abnormal returns, abnormal volume and informational asymmetry effect on the market around the unlock day.

1.2.1 Abnormal return and volume around unlock day

Field and Hanka (2001) examine the sample of 1948 share lockup agreements. They find a 3-day abnormal return of -1.5 %, and a permanent 40% increase in average trading volume. If the firm is financed by venture capital, the abnormal return and volume are larger. They also find that venture capitalists have stronger desire to sell than executives and other shareholders. They propose the downward sloping demand curve hypothesis to explain the abnormal return. Under that theory, the unlocked shares increase the supply, which moves the supply curve rightward. Then the price falls as the demand curve is downward slope. To support this hypothesis, they provide the evidence that the firms, which have higher percentages of lockup shares, have a larger negative abnormal return.

Espenlaub, Goergen, and Khurshed (2003) exam the sample of 188 firms from London stock exchange from 1992 to 1998, 83 firms of which are classified as high-tech firms. They find that the lock-in agreements of LSE-listed firms are with a standardized period of 180 days which are different from that of US. They find negative abnormal returns around the unlock date, but it is not statistically significant. They also find that the negative abnormal return around the unlock date of high-tech firms are larger than that of other firms, but the difference is not statistically significant either.

Bradley, Jordan, Roten and Yi (2001) examine the stock price change around the unlock day on the sample of 2529 firms from 1988 to 1997. They find that there are significant negative returns around the unlock day namely, average -0.74% on the unlock day and cumulative -1.61% over the 5-day window which has the center on the unlock day. Among firms, the negative return is largest in firms with venture capital backing, And in VC backing firms, the high-tech firms has the largest negative return. The absolute value of negative abnormal return is positively correlated with the increase of the share price between IPO and unlock day. It is also positively correlated with the trading volume around the unlock day, and the quality of the underwriters as well.

Ofek (2000) examine the price and volume reaction around the unlock day on a sample of 1053 IPOs from 1996 to 1998. He reports that the supply curve of shares has a permanent large shift at the end of the lock-up. He also finds that there is a statistically significant abnormal return of -1.15%, and an increase of 61% in trading volume on the unlock day. The

abnormal volume returns to its mean, but the abnormal return doesn't revert. He reports that this result is against market efficiency, but this inefficiency is not able to be exploited. He proposes also the explanation of downward sloping demand curve shifting for the permanent effect of abnormal returns.

Brav and Gompers (2000) examine the sample of 1948 US IPOs from 1988 to 1996. They find out that there are a statistically significant abnormal return of -1.2% and statistically significant increase of volume of 34.6% on the unlock day. Brav and Gompers(2003) examine the sample of 2794 US IPOs from 1988 to 1996. They find that there is a statistically significant abnormal return of -2% on the unlock day. They test the potential explanations for the existence of lock-up agreement that if the lock-up serve as a signal of firm quality, a commitment device to alleviate moral hazard, or a mechanism for underwriters to extract extra compensations. They find that the insiders who have greater potential for taking advantage of private information will lock up their shares for a longer period of time, which supports the commitment hypothesis.

1.2.2 Adverse selection cost effect around unlock day

Goergen, Renneboog, and Khurshed (2006) study on whether lock-up agreements in German and France cause informational asymmetry problem. They report that Lock-up agreements are different not only across different firms, but also across different shareholders in a single firm. For example, executive, non-executives, and venture capitalists have different lock-up period. They find that the diversity across firms can be explained by the uncertainty; the diversity across shareholders can be explained by the importance of the shareholders in the firm.

Mohan and Chen (2001) examine the sample of 729 IPOs from January 1990 to December 1992 in US. They report that large numbers of IPOs report lock-up agreements. The lock-up periods vary across different firms. They report that the different length of lock-up conveys information about the issuer's risk, and a 180-days lock-up period is seemingly the norm. There is deeper IPO underpricing if the lock-up period depart from the 180-day, which indicates that the firm's value is more uncertain. They also find that low volume trading activity after the unlock day is viewed as good news by the market, while high volume trading activity is regarded as bad news.

Aggarwal, Krigman, and Womack (2002) develop a model in which the executives intentionally underprice IPOs to optimize his personal profit by selling his shares after the unlock day. They report that the first-day underpricing will attract attention to the stock, and hence shift the demand curve of shares to the right. Therefore, the executives will be able to sell his shares at a higher price than the price in the situation without first-day underpricing. After examining the samples of IPOs in the 1990s, they find that the first-day underpricing and ownership by executives are positively correlated. Underpricing, research coverage, and

stock returns on the unlock day are all positively correlated. These results support their model.

Ofek and Richardson (2003) provide an explanation for the fall of internet stock prices in 2000. They develop a model, in which the investors with private information about the true value of the company are subject to lock-up agreements. Thus, it is possible that there are more optimistic investors than pessimistic ones in the market. It causes the share prices depart from the fundamental value. A large number of pessimistic investors enter suddenly into the market at the same time when the lock-up agreement expired in 2009. As a result, the Internet bubble then burst with the substantial drop of stock price.

Goergen, Mazouz, and Yin (2006) examine the price, volume and bid-ask spread reaction to the lock-up expiration on the sample in Hongkong Market. They find that there is increase in both trading volume and bid-ask spread around unlock day, but no significant change in share price. They explained that the reason of the absence of price change is that the shares are held by limited non-institutional shareholders who don't want to sell. They report that the wider bid-ask spread is caused by the higher adverse selection cost, which the market maker charge for covering the loss from dealing with informed traders.

Cao, Field, and Hanka (2004) test if the insider trading impairs market liquidity by examining the sample of 1497 IPOs lock-up expiration from 1995 to 1999. They find that the effective spread has no significant change around the unlock day, but quote depth and trading activity increase. In the 23% of firms who disclose shares sold by insiders, the spreads actually decline. They conclude that after the unlock day, the insider traders could enter the market without decreasing the market liquidity.

Krishnamurti and Thong (2008) examine a sample of 450 IPOs listed in NYSE and NASDAQ. They report that the market liquidity improves after unlock day and insider selling increases market liquidity, which are supported by the following result. In the firms which disclose insider sales within 10 days after unlock day, the bid-ask spread actually decrease more. They explain that this is because of the decreasing of adverse selection cost. They find that venture capital backing firms are also with decrease of quoted and effective spreads after unlock day.

1.3 Downward slope demand curve theory

Traditionally, scholars demonstrate that there are horizontal or nearly horizontal demand curves for shares. Under this condition, the moving of supply curve has no permanent, but temporary effect on price. However, more and more scholars prove that the demand curve should be downward slope, as there are differences between shares which remove the possibility of complete substitution among shares.

Shleifer (1986) does an event study on stock inclusions into the S&P 500 Index. He attains the following results which support the downward slope hypothesis. He finds that the shares which are included into the Index have a statistically significant positive abnormal return when the inclusion announcement is disclosed. The returns last at least 10 days after the announcement, and are positively correlated to the amount of shares bought by the Index funds.

Lynch and Mendenhall (1997) examine the market reaction to the change in the demand of a stock. They use the sample of shares which are included into index after October 1989. They find there is a statistically significant positive cumulative abnormal return from the day following the announcement, which is consistent with the downward sloping demand curve hypothesis.

After the unlock day, the supply of shares increase, which means the supply curve will move outward. Under this situation, if the demand curve is downward slope, then the price will fall down.

1.4 Efficient market hypothesis

Fama (1960) develops efficient market hypothesis. According to the hypothesis, nobody can exploit the information to make an abnormal profit, particularly when transaction cost exists. There are three common forms of efficient market. In weak-form efficiency, past price contains no information for future price, thus no abnormal return could be achieved by researching the price history. In semi-strong-form efficiency, the price adjusts immediately when the public information is disclosed. No abnormal returns could be achieved by using fundamental analysis. In strong-form efficiency, price incorporates both the public and private information. Even insiders who own private information could not get abnormal return. As the lock-up expiration is public information, there should not be abnormal return if the market is semi-strong-form efficient.

1.5 Basic concepts

1.5.1 China Growth Enterprise Market

China growth enterprise market is also named Chinext. In this thesis I call it China GEM. It was launched in Oct. 2009. It is the Chinese Nasdaq. Its purpose is to provide funding source to startups. The regulation and rules of it has been being revised, particularly about the IPO lock-up agreement.

1.5.2 IPO lock-up agreement

When the firms provide an initial public offering at the China GEM, the pre-IPO shareholders are obligated to sign a lock-up agreement, which prohibits the shareholders selling their shares during a specified period. The controlling shareholder, executive, manager and institutional investors are subject to different lock-up periods respectively. In this thesis, I call this agreement IPO lock-up agreement.

1.5.3 Unlock day, tradable shares and non-tradable shares

The lock-up agreement is expired at a specified day. In this thesis, I call this day unlock day. From the unlock day, the pre-market shareholders are allowed to sell their shares held before IPO.

On China GEM, the pre-IPO shares are not allowed to be traded until the lock-up agreement is expired. In this thesis, I call these shares non-tradable shares. From the unlock day, these shares become tradable shares.

1.5.4 Informed trader, uninformed trader and assumed market maker

In China GEM, two types of trader possess more information than individual investors. One of them is manager who is in charge of the firm, and the other one is institutional investor who has better channels of receiving information. In this thesis I call them informed trader. As the validity period of the private information held by the informed traders is short, they are more likely to subject market orders, which are executed immediately. .

The other traders trade for liquidity. They don't possess any private information. In this thesis I call them uninformed traders. They are not willing to wait for executing their orders, as liquidity means exchanging the shares and money in a short period. Thus these traders are more likely to subject market order as well.

Besides informed and uninformed traders who subject market order, there is another trader who subject limit order. These traders are liquidity providers, who quote the prices and volumes at which they are willing to trade. They as a whole could be seen as an assumed market maker, though the China GEM is an order driven market where no designated market maker exists. Thus, the informed and uninformed traders deal via the assumed market makers.

1.5.5 Adverse selection cost and transaction cost

When the market maker trade with the informed traders, they will always lose as the informed trader sell when the price is over fair value and buy when the price is below fair value. This loss is called adverse selection cost. Other costs including commission, inventory cost, risk bearing and transaction cost are generally called transaction cost.

In order to cover these two costs, the market makers set up the bid-ask spread to earn profit. The profit comes from the uninformed traders, who will always sell at a low bid price and buy at a high ask price. Thus the bid-ask spread reflects both the adverse selection cost and transaction cost.

1.5.6 Informational asymmetry

The market maker deals with both the informed and uninformed traders. The informational asymmetry exists between the informed traders and market makers. The two factors affecting it are the possibility that the market maker deals with an informed trader, and the quantity of private information on the market.

Under the assumption that the informed traders are not competitive, the informational asymmetry is worse when the number of informed traders increases. This is because that the presence of more informed traders increases the possibility that the market marker deals with informed traders.

Under the other assumption that the informed traders are competitive and the possibility that the market marker deals with informed traders is constant, the informational asymmetry is improved when the number of informed traders increases. This is because that the increasing of informed traders will intensify competition. The competitions cause the disclosing of private information become more quickly and then decrease the quantity of private information in the market.

2 THE OVERVIEW OF CHINA GROWTH ENTERPRISE MARKET AND LOCK-UP AGREEMENT

This chapter provides the introduction of the GEM market, including the overviews about market development, trading mechanism, lock-up agreement regulation. And then, it presents three explanations for the existence of lockup agreement, which are signaling hypothesis, commitment hypothesis and compensation hypothesis. At the end it discusses the price effect, volume effect and adverse selection cost effect to the lock-up expiration.

2.1 The overview of China Growth Enterprise Market

2.1.1 Introduction

2.1.1.1 The launch of GEM

The firms postpone IPO issuing in the bear market and start it in bull market when most of stocks are overvalued. The increase of IPO initiates the falling of the market, when the increase of supplying of money doesn't follow up even in bull market. As presented in figure 2, the GEM was postponed in 2008 when the market was going down constantly. It was launched on October 2009, when the stock market was still going up. However, the market has been going down gradually since then. This is because the IPOs from the China GEM absorb the limited funds on the market. There is Petrochina IPO in 2007 as the other example. The market capitalization of it amounts half of the capitalization of the whole China stock market then. The timing of its launch is both the end of a bull market and the beginning of a bear market, during which the total capitalization of the market dropped by more than 70% as presented in figure 2.

Figure 2 The time when GEM is launched

Source: *Shenzhen Stock exchange, ChinNext Indices Performance, 2012.*

2.1.1.2 Listing standard in GEM

With the aim to protect the investor from the uncertainty of the firms, China GEM sets up stricter rules than other markets like Nasdaq as presented in Table 1. For example, the firms which are going to list in China GEM should meet requirement of the minimum profit. Traditionally the value of the firms is evaluated by the future income, profit and case flow, which are estimated based on the past and current performance of the firms. Hence, under the profit requirement, the investors could make a better evaluating on the firms to lower the risk than on Nasdaq, where firms are allowed to be listed with a good business model of even just an idea. However, the disadvantage of this profit requirement is that it makes some high-tech firms without the required profit unable to go listed even these firms are believed to earn profits by marketing their patented know-how with the help of new capital. For example, some good Chinese high-tech firms like the search engine company BAIDU, goes listed in USA Nasdaq but not Chinese GEM.

Table 1 The comparison of listing stand among different markets

	China Shanghai stock exchange	China GEM	NASDAQ GLOBAL MARKET
Operating history	3 years	3 years	2 years
Income revenue and profits	Aggregate profits of over RMB 30 million for the last three years. Aggregate net cash flow of over RMB 50 million for the last three years OR Aggregate revenue of over RMB 300 million for the last three years	Positive profits in the past two years. Aggregate profits of more than RMB 10 million, and the profit increase. OR positive profit in the last year. Net profit of more than RMB 5 million in the last year. Revenue of more than RMB 50 million in the last year. Growth rate of revenue of over 30% in the last 2 years.	Revenues (most recent year or two of last three years) USD 75 million
Market capitalization	Share capital no less than USD 7.5 million (RMB 50 million) before listing	Share capital no more than RMB 30 million after listing	--

(To be continued)

(continued)

Number of float shares	not lower than 25% not lower than 10% for issuers with expected market capitalization of over Rmb 400 million at the time of listing	1. not lower than 25% 2. Not lower than 10% for issuers with expected market capitalization of over Rmb 400 million at the time of listing.	1.1 million shares
Lock-up requirement	1. The stock issued by the issuer before the IPO shall not be traded within one year from the listing of its shares. 2. When the issuer applies to the Exchange for listing its IPO shares, its controlling shareholders and de facto controller shall make an lock-up agreement of 36 months period, they shall not transfer the issuer's shares issued before the IPO and held by them either directly or indirectly.	1. The stock issued by the issuer before the IPO shall not be traded within one year from the listing of its shares. 2. When the issuer applies to the Exchange for listing its IPO shares, its controlling shareholders and de facto controller shall make an lock-up agreement of 36 months period, they shall not transfer the issuer's shares issued before the IPO and held by them either directly or indirectly.	6 months as per underwriter's request

Source: *Shenzhen Stock exchange, Interim Measures on the Administration of Initial Public Offerings and Listings of Shares on the Chinext, 2009; THE NASDAQ OMX GROUP, Initial Listing Guide, 2012; Shanghai Stock Exchange, Listing requirements, 2012.*

2.1.1.3 The percentage of lock-up shares

There are 281 companies listed on Chinese GEM at the end of 2011. 66% of the total market value are prohibit to trade due to lock-up agreements, which is two times of the tradable value as presented in table 2. As it is a newly launched market, the expiration days of these lock-up agreements cluster at the end of 2012. In 2000, a large number of IPO lock-up shares went into the market during a short period in Nasdaq. It caused the internet bubble burst with substantial decrease of stock price. I raise the question if this will happen to China GEM too. The answer to this question will be discussed in chapter 3.

Table 2 Percentage of the value of lock-up shares

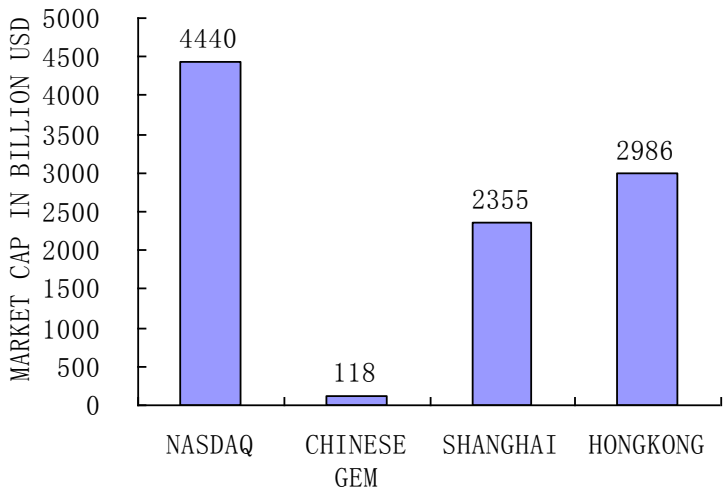
Date	30. Dec.2011
Number of listed companies	281
Total value of tradable shares (billion USD)	39.74
Total value of tradable and un-tradable shares (billion USD)	117.98
Percent of non-tradable value	0.66

Source: *Shenzhen Stock exchange, ChinNext Market Overview, 2012.*

2.1.1.4 The market capitalization of Chinese GEM

The market cap of Chinese GEM is $118 billion at the end of 2011, which is relatively small compare to other stock exchanges as presented in figure 3. However, the GEM has been growing rapidly since it is launched. The small-sized market is likely to be manipulated by the investors who hold large funds.

Figure 3 Market capitalization of main stock exchanges at the end of 2011

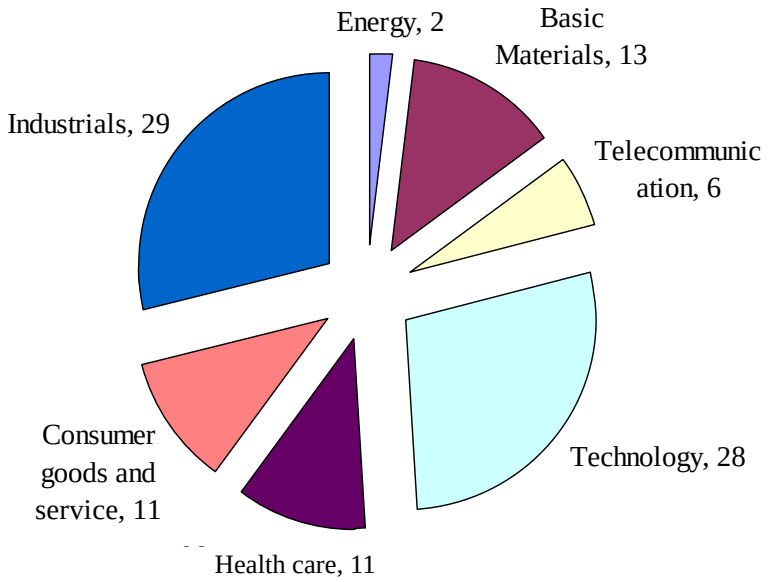


Source: *Shenzhen Stock exchange, ChinNext Market Overview, 2012; Shanghai Stock Exchange, Market at a glance, 2012; Hong Kong Exchanges and Clearing Limited, GEM Stock market highlight; World Federation of Exchange, Domestic market capitalization, 2012.*

2.1.1.5 Industry distribution of GEM listed firms

Figure 4 shows the industry distribution of listed firms on GEM. The technology firms amounts to 28%. In these firms, technique and patent play an important role in evaluating the company's value. The inside traders including executives and managers could know more about the true value of the technique than the outside traders. Hence, the informational asymmetry in these companies is likely to be worse than others.

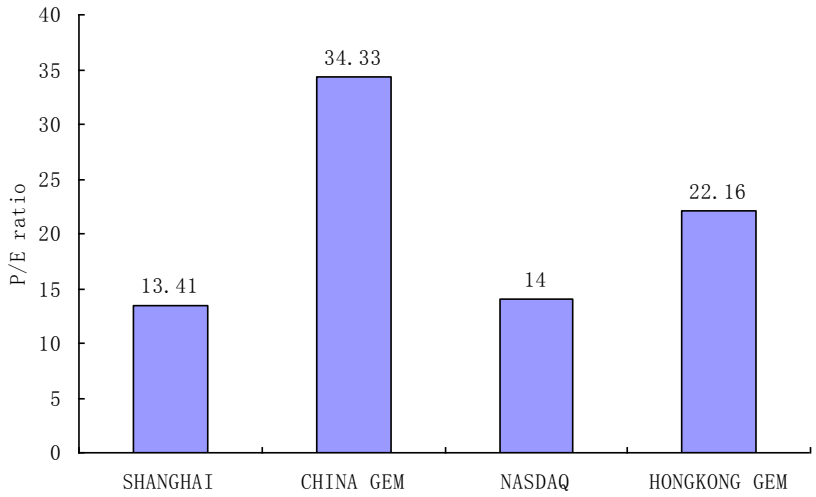
Figure 4 The industry distribution of listed firms on GEM in %



Source: *Shenzhen Stock exchange, ChinNext Market Statistics by sectors, 2012.*

2.1.1.6 Average price to earning ratio of GEM

Figure 5 The average PE of GEM at the end of 2011



Source: *Shenzhen Stock exchange, ChinNext Market Overview, 2012; Shanghai Stock Exchange, Market at a glance, 2012; Hong Kong Exchanges and Clearing Limited, GEM Stock market highlight, 2012; The Wall Street Journal, P/E & Yields on Major Indexes, 2012.*

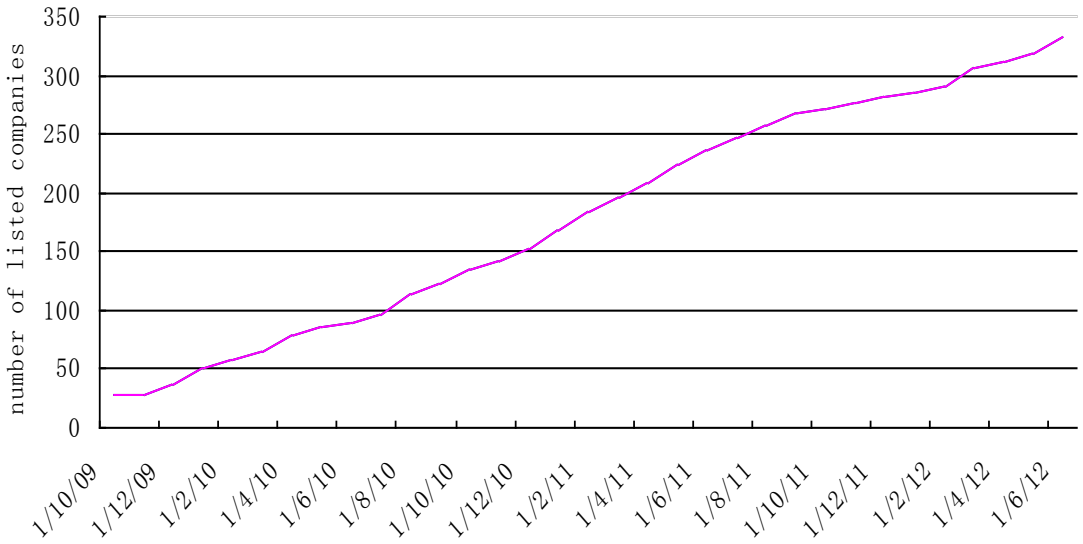
The average PE ratio of China GEM, which represent the expected growth of a firm, is much higher than that of main board Shanghai market, Hongkong GEM, and Nasdaq as presented in figure 5. It shows that the firms in China GEM are expected to grow up faster

than those in other markets. Though the China economy is going up strongly, the high expectation is maybe too optimistic as the Chinese economy relies on exporting to US and EU where the economic growth is slowing down. In other word, the high PE ratio shows that the firms are overvalued.

2.1.2 The evolution of the China GEM

2.1.2.1 The number of listed firms

Figure 6 The number of listed companies in GEM



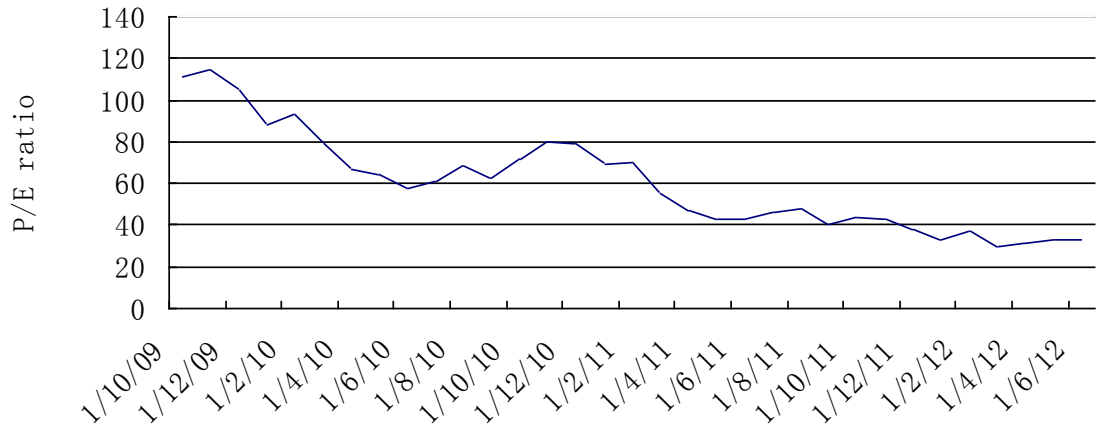
Source: *Shenzhen Stock exchange, ChinNext Market Overview Data, 2012.*

The number of the listed firms keeps growing up constantly as presented in figure 6, which means the market is developing with more and more listed firms. However, it is also the result from one imperfection of the China GEM that it is lack of an effective delisting mechanism. Until the end of Oct 2012, there have been no firms unlisted from China GEM. The absence of effective unlisted mechanism leads the listed firms to lose the incentive and motivation to avoid losing the qualification of listing. As a result, the firms whose principle activities have been actually incurring loss for a long period can still be on the market. It will cause the market as a whole become less attractive to the investors.

2.1.2.2 The average PE

The GEM was overheating within 2 months since it was launched. The average PE ratio of GEM was over 100 during that period as shown in the figure 7. It has been falling gradually to 30 since the beginning of 2010.

Figure 7 The average market PE in GEM

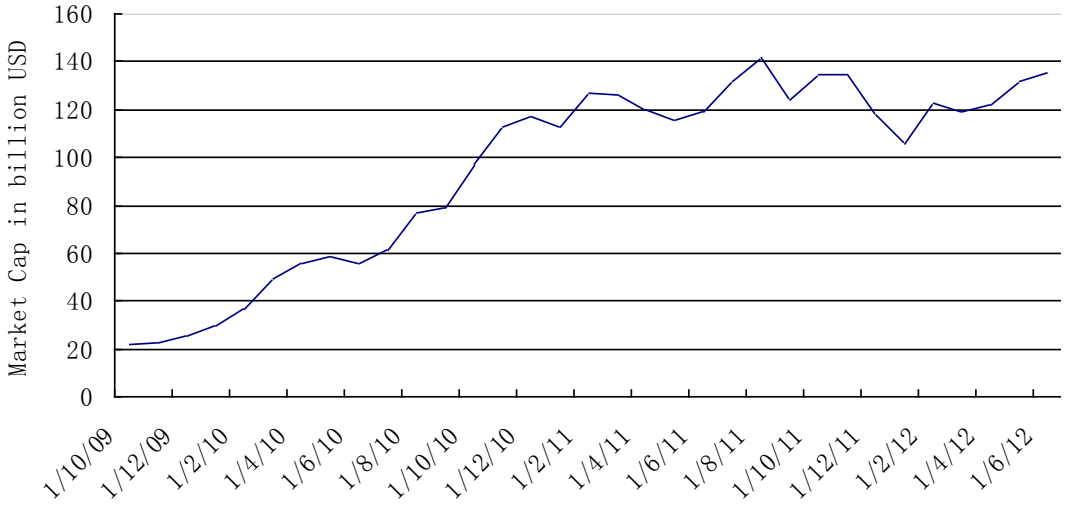


Source: Shenzhen Stock exchange, ChinNext Market Overview Data, 2012.

2.1.2.3 The market capitalization

The market capitalization goes up gradually until the end of 2010 as presented in figure 8. Though the number of the listed companies increases at 2011, the market capitalization does not go up simultaneously. Thus the average market capitalization of firms is actually decreasing. This is good for the incoming investors, but bad for the incoming listed firms as the evaluation of the firms is lower.

Figure 8 The Market Cap in GEM



Source: Shenzhen Stock exchange, ChinNext Market Overview Data, 2012.

2.1.2.4 The price index

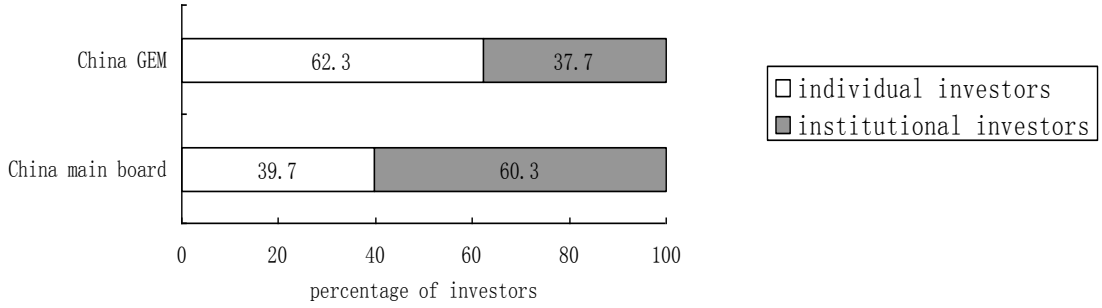
The price index falls down from the top 1200 to 700 as presented in figure 9. This is probably caused by the increasing number of IPO and the additional shares which are unlocked as lock-up agreements were getting expired given the demand of the market didn't follow up.

Figure 9 The price index of GEM

Source: *Shenzhen Stock exchange, ChinNext Indices performance, 2012.*

2.1.3 The characteristics of investors in the GEM

Figure 10 The distribution of individual and institutional investors in GEM

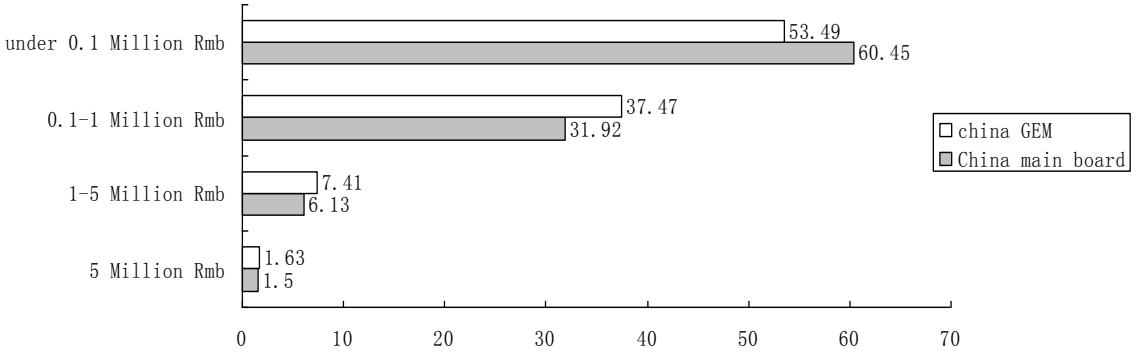


Source: *Shenzhen Stock exchange, ChinNext Summary, 2012.*

In GEM, the active experienced individual investors amounts a higher portion of the whole investors. The percentage of individual investors is 62.3% in GEM, while it is 39.7 in Main board (Figure 10). The percentage of individual investors whose annual transaction above 0.1 million, and who has more than 8 years investing experience in GEM are both higher than those in Main board market respectively (figure 11,12) . The GEM is supposed to be a buyer-beware market for professional investors. The listed firms on it are with both higher

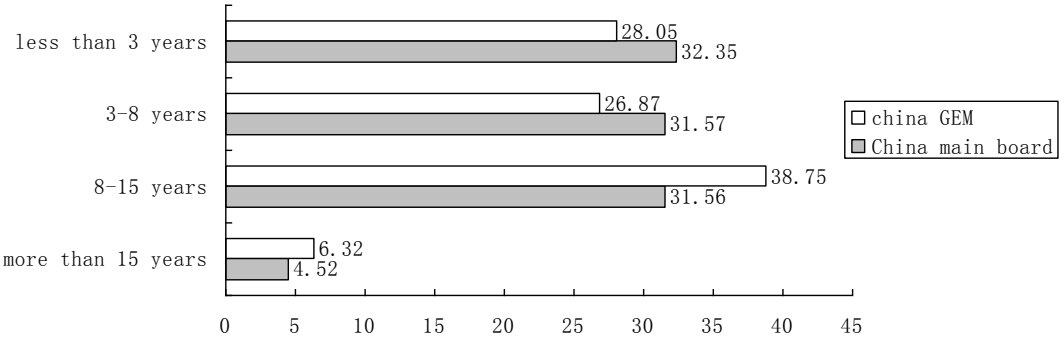
expected growth and higher risk than those on Main board. Though the individual investors are more experienced in GEM than in Main board, it is commonly believed that they are not as experienced as the institutional investors in terms of the ability of achieving new information. Then the institutional investors can earn the profits from the individual investors by exploiting the private information which is not available to the individual investors. In the other word, the informational asymmetry problem among the investors is supposed to be worse due to the higher portion of individual investors in GEM.

Figure 11 The distribution of transaction amount from individual investors in 2010



Source: *Shenzhen Stock exchange, ChinNext Summary, 2012.*

Figure 12 The distribution of investing experience of investor in GEM



Source: *Shenzhen Stock exchange, ChinNext Summary, 2012.*

2.1.4 Trading mechanism of China GEM

2.1.4.1 Call auction and continuous market

The GEM is a limit order market. The opening procedure of GEM is call auction market, which lasts from 9:15 to 9:25 at morning of trading day. During this period, the trading system collects and stores all submitted orders according to the price-time prior rule without matching them. At 9:25, the trading system sets a trading price at which the orders could be

matched as much as possible. The closing procedure lasts from 14:57 to 15:00, which takes the same call auction market as opening procedure. During 9:25-9:30, the trading system only accepts orders, but not executes the orders. It is continuous market from 9:30 to 15:00 with a break from 11:30 to 13:00

As all orders are executed at once, call markets lowers the transaction cost, reduce the volatility and improve the functioning of the market. Furthermore, informed traders are unable to exploit the private information as they need to wait for certain period during which the private information may be disclosed and become public.

In the continuous market, the transaction can be done at any time when the market is open. Informed traders can earn profit immediately by dealing with the limit order submitter when they see the stock price is under (or over) the true value.

2.1.4.2 Raising limit of 10% per day

China stock market imposes raising limit rule of 10% up or down on one trading day based on the immaturity of the market. This mechanism can prevent the price rising or falling substantially from speculation. However, it impairs the liquidity of the market. Investors are unable to exchange the shares, even though they are willing to pay at a better price when the price arrives at the limit. Consequently, the price is more likely to continue going up (or down) on the second day than to reverse as the unexecuted orders from the first day are probably submitted again by the same investors. Informed traders can try to manipulate the stock price to the limit on first day, to induce other investors to place the orders with the expectation that the price will continue going at the same direction on the second day. And then they can earn profit by exchanging their shares to other investors at a better price.

2.1.4.3 Settlement of one day, tick size and block trade

The settlement period in China GEM is T+1 to all shares. Under the rule, the buyer must transfer the cash to the seller, and the seller must transfer the ownership of the stock to the buyer within one day after the order is executed. In other word, the stocks purchased on the first day can only be sold from the second day. The tick size of the quotation price of an order is RMB 0.01. Buying and selling of shares shall be in a round lot of 100 shares or the multiple thereof. The traders can chose the block trade if the trading volume is more than 500,000 shares or the trading value is more than RMB 3 million. Block trades are excluded in a stock’s real-time quotation with the aims to reduce the price violability.

2.2 The overview of lock-up agreement

2.2.1 Lock-up agreement regulation in China GEM

The China stock market imposes obligated lock-up agreement rule. The lock-up period last 12 months for the common shareholders who held the shares before IPO. It lasts 3 years for the controlling shareholders. The related regulation from the Rules Governing the Listing of Shares on the Chinext of Shenzhen Stock Exchange is as following.

"The directors, supervisors and senior management of the company shall not, within one year since the listing of the company's shares and within half year after leaving office, transfer the shares they hold in the company. Upon the expiration of the one-year lock-up period, any one of them wishing to purchase or sell the shares of the company during his term of office shall file with the Exchange in advance pursuant to relevant regulations."

"When an issuer applies to the Exchange for listing its IPO shares, its controlling shareholder and de facto controller shall make an undertaking that, within thirty-six months of listing of the issuer's shares, they shall not transfer the issuer's shares issued before the IPO and held by them either directly or indirectly, or appoint others for the management of such shares, and such shares shall not be repurchased by the issuer. "

However, some of the shareholders try to move around the restrictions by leaving office after IPO. This behavior causes the government's attention. In order to protect the other investors' from undertaking risk from the resigned shareholder, the government revise the regulation by extending the lock-up period for resigned shareholders. The revised regulation article is as below.

"The directors, supervisors and senior management of the company shall not, within six months since the listing of the company's shares and within eighteen months after leaving office, transfer the shares they hold in the company. The directors, supervisors and senior management of the company shall not, within seven to twelve months since the listing of the company's shares and within twelve months after leaving office, transfer the shares they hold in the company. Upon the expiration of the one-year lock-up period, any one of them wishing to purchase or sell the shares of the company during his term of office shall file with the Exchange in advance pursuant to relevant regulations."

Under the new rule, the resigned officers can't sell theirs shares within two years, while they can sell after only one year since IPO under the old rule. Contrary to the shareholders who leave office for selling shares more early, some shareholders are willing to undertake a longer lock-up period. By extending the lock-up period, they convey the information to the investors that they will hold their shares as they believe the firm's value will grow up and that they are willing to work for the firm for a longer time.

2.2.2 Disclosure rules for selling of lock-up shares

The selling of lock-up shares affects the price, volume, and informational asymmetry around the unlock day. In order to give us a better understanding of it, it is important to discuss the disclosure rules of selling unlock shares.

According to the new disclosure rules, the controlling shareholders, who want to use block trade to sell their unlock shares, have to disclose their selling plan two trading days in advance. If they didn't obey the rules, they are not allowed to sell more than 5% of the total shares of the firms within the subsequent six months.

Under this rule, the outside investors are able to sell the shares before the controlling shareholders sell. The controlling shareholders are informed traders who possess superior information which reflect the true value of the firms. Before the new rule is imposed, they were able to earn profit as they can buy the shares when they are undervalued, and sell them when they are overvalued. However, they are unable to do that now as they are required to disclose the selling plan in advance. Upon knowing that the controlling shareholder is going to sell her shares, investors expect that the price will fall down and start selling their shares. It moves the stock price down to the fair value of the firms prior to the planed date when the controlling shareholders sell their shares. As a result, it eliminates the possibility that the controlling shareholders sell their shares immediately when they know their firms are overvalued. They must wait for at least two days.

2.2.3 The purpose of lock-up agreement

There are three explanations to the existence of lock-up agreement from different standpoints. From the issuers' perspective, they use lock-up agreement as a signal of the company's quality. From the regulator's perspective, they require the issuers to sign lock-up agreement, which is viewed as a commitment device to avoid moral hazard problems. From the underwriter's perspective, they extract extra compensation from the issuers as the issuers can sell their share prior to lock-up expiration only if the underwriter consents.

2.2.3.1 Signaling hypothesis

Leland and Pyle (1977) develop a model in which the fraction of IPO retained shares from the insiders is viewed as a signal of the quality of the firms. Courteau (1995) incorporates voluntary lock-up agreement as a signal tool into Leland and Pyle's model. In the IPO market, the quality of the issuer is unable to be observed easily due to the short period of presence in the market. In other word, all the firms are similar in the investors' eyes. Hence, the good quality firms can not ensure that the investors are willing to pay high price for their shares. In order to be distinguished from the low quality firms, the good ones are willing to

accept IPO underpricing and longer time lock-up agreement as well. The reason for that is the insiders of good quality firms believe that they don't need to sell their shares in the near future since the price of them will go up with the developing of the firms. By contrast, the growth of the bad quality firms can not support the price in the long run. Thus they are not willing to undertake long lock-up agreement, because it will impose a high cost on them as the price is likely to go down prior to the lock-up expiration.

2.2.3.2 Commitment hypothesis

The lock-up agreement can be used as a commitment device to avoid moral hazard problems. In this hypothesis, the firm's quality is observable before IPO. However, the insiders may act for their own interest but not for the whole shareholders' after IPO, particularly in the firms with great price volatility. This problem can be solved when they are required to sign the lock-up agreements. When the agreements are valid, their interests are connected with all other shareholders as they must hold their shares for a specified period. If they take advantage of other shareholders, they will bear loss from their shares as the price will not go up. In order to avoid the loss, they work harder to maximize the benefits of all shareholders by promoting the firm's developing at least as long as the agreement is valid. Therefore, the outside investors and regulators both prefer that the controlling shareholders are subject to lock-up agreement. On the other hand, the controlling shareholders take that agreement as a commitment device to satisfy the investors' preference.

2.2.3.3 Compensation hypothesis

In the compensation hypothesis, the underwriters can extract extra compensation from the insiders as it needs their agreement if the insiders want to sell their shares prior to the unlock day. In this case, insiders can choose to take a block trade with underwriter, which will incur an extra fee charged. Or insiders can choose to take a seasoned equity offering, which will incur an extra fee charged as well. Because of that, the high quality underwriter expects to get more extra compensation by requiring longer lock-up period due to their great reputation. And firms are willing to accept longer lock-up period from greater underwriters due to the greater service. Thus the quality of underwriter is positively correlated with lock-up period, given the quality of firms.

2.2.4 The market reaction to lock-up expiration

2.2.4.1 Price effect

The prices decrease before the unlock day. Under the assumption of downward slope demanding curve, the price will fall down when the supply curve move outward. After the unlock day, the IPO lock-up shares become tradable in the market, which increase the supply

of shares and then move the supply curve outward. If the investors could not predict this, then the price will fall down after unlock day as supply excess demand of shares. However, the investors can actually predict the expiration event as the amount of unlocked shares and unlock day are both public available information. According to rational expectations theory, the investors will sell the shares prior to the unlock day as they expect the decrease of price. Hence, the pre selling from the pessimistic expectation will bring forward the falling of price before the unlock day.

2.2.4.2 Volume effect

The trading volume will be higher after the unlock day. The direct reason is that the quantity of tradable shares is larger. The indirect reason is that after the unlock day, more informed traders are present in the market. The increase of the number of informed traders will intensify the competition among themselves, which makes the private information become public more fast. Thus the adverse selection risk is lower in the market. Under this better market situation, more investors are willing to provide liquidity. As a result, the trading volume increases.

2.2.4.3 Adverse selection cost effect

The adverse selection cost will be lower after unlock day. More informed traders will be present in the market, which means that the possibility of trading with informed trades will be higher after unlock day. Without considering the competition among informed traders, the adverse selection cost will be higher as the market makers require more compensation due to the higher possibility of dealing with informed traders. However, I should not assume that there is no competition among informed traders, because they all have incentive to maximize their profit by exploiting the private information on their own. If they cooperate with each other, then they should maximize the total profit of them instead of the individual profit. Therefore, I assume the informed traders are competitive. Then the competition will cause the private information become public more quickly. Consequently, the informational asymmetry between informed and uninformed traders is improved, so that the required adverse selection cost compensation is lower.

3 EMPIRICAL TEST ON THE PRICE, VOLUME AND ADVERSE SELECTION COST EFFECT

This chapter investigates the abnormal return, the abnormal volume and the change of adverse selection cost around the unlock day on the sample of stocks on GEM.

3.1 Hypothesis development

The efficient market theory predicts that the price at the time of IPO should reflect all the disclosed information on the lock-up agreement. Thus, there should not be any abnormal return around the unlock day. Espenlaub et al. (2001) reports that the abnormal return around unlock date is not significant different from 0 in UK market. And Goergen et al (2006) report the similar result from French and German market. Thus I raise the following hypothesis:

Hypothesis 1 (a). The abnormal return after the unlock day is not statistically significantly different from zero.

China stock market is not considered to be an efficient market. After the lockup day, the price is expected to fall down as the supply of stock will increase greatly in a short time. The rational investors will sell their shares prior to the unlock day. Their selling will cause the stock price fall before unlock day. Thus I raise the following hypothesis:

Hypothesis 1 (b). The abnormal return after the unlock day is statistically significantly negative.
Hypothesis 1 (c). The abnormal return before the unlock day is statistically significantly negative.

After the unlock day, there are more tradable shares in the market. And under the assumption that the informational asymmetry is lower, there will be more investors providing liquidity. Both of these two factors will increase the trading volume. Thus I raise the following hypothesis:

Hypothesis 2. The abnormal volume after the unlock day is statistically significantly positive.

After the unlock day, more informed traders will be present in the market, which will increase the possibility that the market maker trade with informed traders. Therefore the market marker will require more adverse selection compensation.

Hypothesis 3 (a). The adverse selection cost is higher after unlock day.

After unlock day, the number of informed trades increase in the market, which will intensify the competition among themselves. The competition will make the disclosure of private information faster. Thus the market informational asymmetry problem is improved. Then the market maker will require lower compensation.

Hypothesis 3 (b). The adverse selection cost is lower after unlock day.

3.2 Methodologies

3.2.1 Price effect

The abnormal returns are measured by the difference between daily returns and market returns.

$$AR_{it} = (r_{it} - r_{mt}) \tag{23}$$

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{24}$$

$$CAR_i[d1, d2] = \sum_{t=d1}^{d2} AR_{it} \tag{25}$$

$$CAAR[d1, d2] = \frac{1}{N}\sum_{i=1}^{N} CAR_i[d1, d2] = \sum_{t=d1}^{d2} AR_{it} \tag{26}$$

$$r = (p_c - p_o)/p_o \tag{27}$$

r_{it} is the daily returns of i stock on day t, t=0 is the unlock day.

r_{mt} is the daily market returns on day t

p_c is the closing price, p_o is the opening price

AR_{it} is the daily abnormal return

CAR_i is the cumulative abnormal returns

$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$ is the average abnormal returns

$CAAR[d1, d2]$ is the cumulative average abnormal return over the interval of day d1 and d2

3.2.2 Abnormal volume

I use the market-adjusted ratio method of Harris and Gurel (1986) to measure the abnormal volume on day t.

$$AV_{it} = \frac{V_{it}/V_{mt}}{\frac{1}{50}\sum_{k=-150}^{-101} V_{ik}/V_{mk}} - 1 \tag{28}$$

$$AAV_t = \frac{1}{N}\sum_{i=1}^{N} AV_{it} \tag{29}$$

V_{it} is the daily trading volume in RMB of i firm on day t

V_{mt} is the daily trading volume in RMB of the market on day t

AV_{it} is the abnormal volume of i firm on day t

AAV_t is the average abnormal volume on day t.

3.2.3 Adverse selection cost effect

I use the MRR (Madhavan, Richrdoson and Roomans, 1997) model to decompose the bid-ask spread into transaction cost and adverse selection cost. As shown in the model, the final equation is as following (details are presented on literature review):

$$P_J - P_{J-1} = (\phi + \theta)X_J - (\phi + \theta\rho)X_{J-1} + \varepsilon_J + \xi_J - \xi_{J-1} \tag{30}$$

Where θ is the adverse selection cost，ϕ is the transaction cost, ρ is the autocorrelation of the order flow, P_J is the transaction price at time J (the second when the order is executed), X_J is the indicator of buy or sell, ε_J , ξ_J , and ξ_{J-1} are error terms。

I use the generalized method of moments (GMM) to estimate the parameters.

$$E\begin{pmatrix} u_J - \alpha \\ (u_J - \alpha)X_J \\ (u_J - \alpha)X_{J-1} \\ X_J X_{J-1} - X_J X_J \rho \end{pmatrix} = 0 \tag{31}$$

Where $u_J = P_J - P_{J-1} - (\phi + \theta)X_J + (\phi + \theta\rho)X_{J-1}$, α is constant. The second and third equations are the OLS normal equations. The last one is the definition of autocorrelation in trading initiation.

I estimate firstly the ρ from the last equation. And then I use the estimated ρ to substitute the ρ of the first three equations. The first three equations then can be viewed as

$$P_J - P_{J-1} = \phi(X_J - X_{J-1}) + \theta(X_J - \rho X_{J-1}) \tag{32}$$

I use then OLS to estimate the parameters.

3.3 Sample and descriptive statistics

The sample includes 268 firms that went listing on from October 2009 to December 2011. I exclude the firms which has ex-right date during the time window [-20,20] center on unlock day. The valid sample for adverse selection cost test includes over 10 million observations of 3-seconds frequency transaction data from 315 lock-up expiration events of 255 firms. The valid sample for price and volume test includes 436 lock-up expiration events from 268 firms. All data are from Shenzhen Stock Exchange market data via Zhaoshang Security Software. The data are editted and calculated by using Stata 12.

The Table 3 shows that the average fund raised is 676 million RMB (100 million USD). The average opening price is 43.14 RMB (7 USD). The average underpricing ratio is 38%. The average IPO PE ratio is 62.89.

Table 3 Descriptive statistics of sample

	Max	Min	Median	Mean	Std. dev
Float shares (10 thousand)	9000.00	900.00	2000.00	2308.43	1109.94
Funds raised (100 million RMB)	25.53	0.80	5.67	6.76	4.53
Offering price (RMB)	110.00	9.00	28.00	32.24	16.70
Opening price (RMB)	157.31	14.29	37.17	43.14	23.18
IPO underpricing ratio	210%	-17%	28%	38%	39%
IPO PE ratio	150.82	18.12	60.63	62.89	22.33

Note: The IPO undpricing ratio is caculated as (Opening price – Offering price)/offering price. The IPO PE ratio is calculated as offering price / earning per share of year before the IPO.

3.3.1 The distribution of the IPO underpricing

Figure 13 The distribution of IPO underpricing

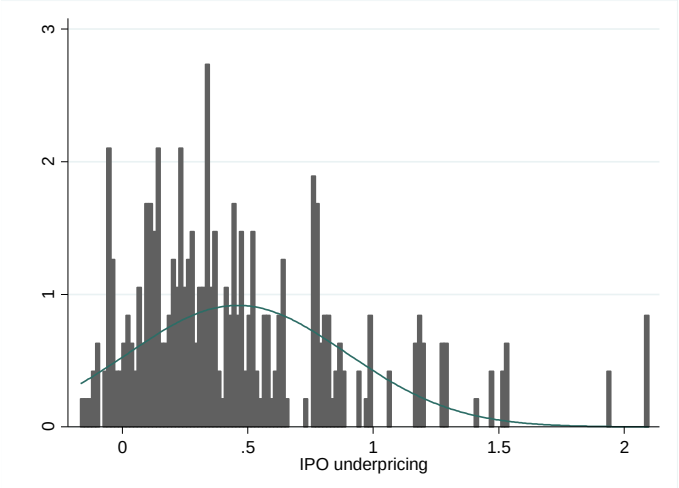


Figure 13 shows that the majority of the IPO underpricing is lower than 50%. There is

distribution on the left side where is lower than 0, which shows that negative IPO underpricing exists on the China GEM market. It is the result of that the underwriter overvalues the firms, or the market undervalues the firms. It happens particularly to the firms with high growth. Though the underwriter sets up a higher price for those firms, it is hard for the investors to believe that they are really good ones. In china stock market, the investors have observed that the firms prefer over reporting their profits before IPO issuing. In the short run their profits fall gradually and in the long run it even becomes negative. Thus the investors are now more conservative than they were. As a result, they are not willing to pay a price higher than the IPO offering price on secondary market for those good firms. This phenomenon exists in US market too, where the IPO of Facebook is an example. Its price repeated testing the offering price as a floor on the first trading day, and is 10% lower than the offering price on second trading day. I conclude that the informational asymmetry from the unbalanced knowledge of the firm quality causes the overvaluation from underwriter or undervaluation from investors, which are reflected as negative underpricing.

3.3.2 The distribution of offering price

Figure 14 The distribution of IPO offering price

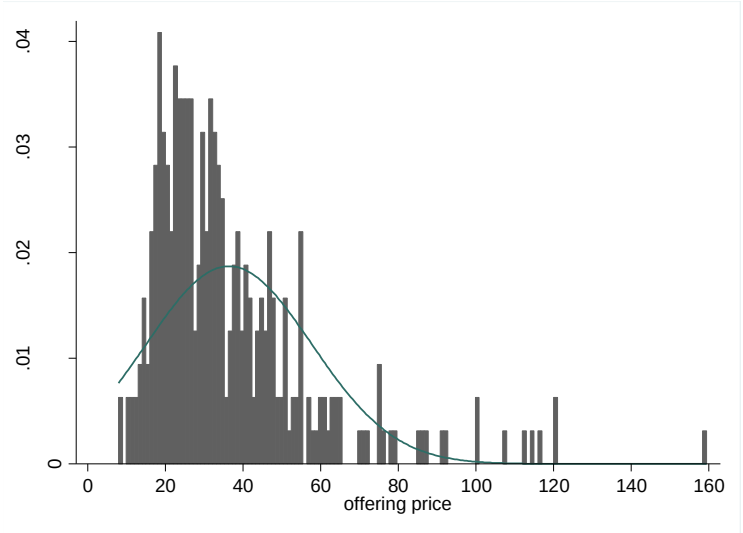


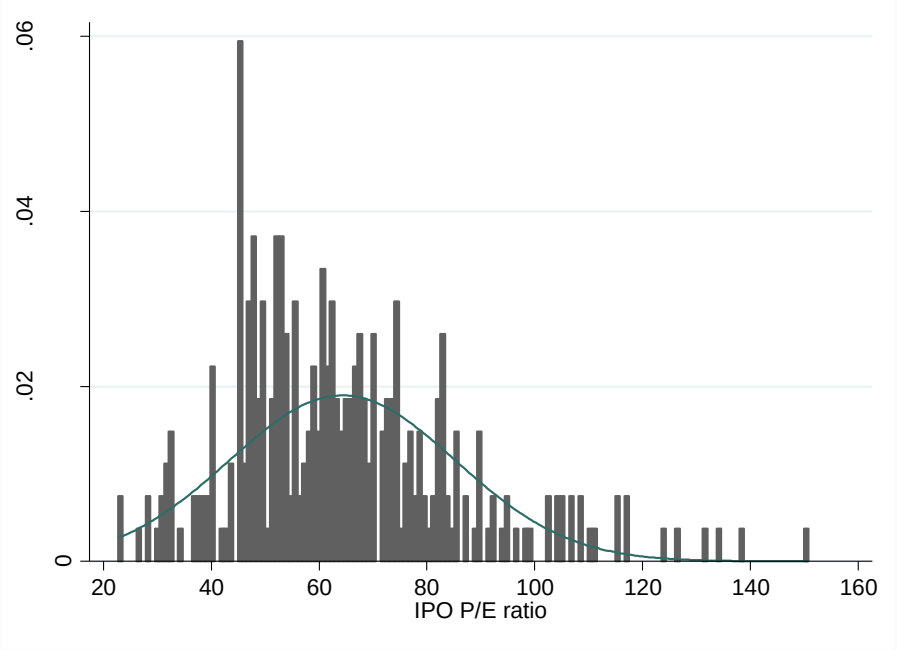
Figure 14 shows that 70% of the offering price distributed between 20 and 40 RMB (middle priced), 10% is under 20 RMB (low priced) and 20% is over 40 RMB (high priced). The low priced stock has a higher percentage bid-ask spread of the share price, as the tick rule determines that the minimum bid-ask spread of 0.01 RMB at which an order can be executed at different price level. In other word, the tick size 0.01 is proportionately higher of the smaller RMB value of low priced stocks. Demsetz (1968) provides also empirical evidence that the percentage spread increase as the price decrease. Therefore, I conclude that the low priced stocks have relatively higher transaction cost and lower liquidity.

The threshold for investing the high priced stock is high for the individual investors with limited capitals as the trading of shares should be in one or multiple round lot of 100 shares. Given the same market capitalization, firms prefer to have lower share price with larger number of shares. In that case they can lower the investing threshold to attract more individual investors to provide liquidity.

3.3.3 The distribution of IPO PE ratio

Figure 15 shows that on the right side of the distribution there are IPO PE ratio of over 100, which shows that both the issuers and underwriters are more confident of the future of those firms. In that case, the shareholders who held the shares before IPO can earn a larger profit. After unlock day, they may have stronger desire to sell out the shares. Thus the decrease of those share price is likely to be larger around the unlock day.

Figure 15 The distribution of IPO PE ratio

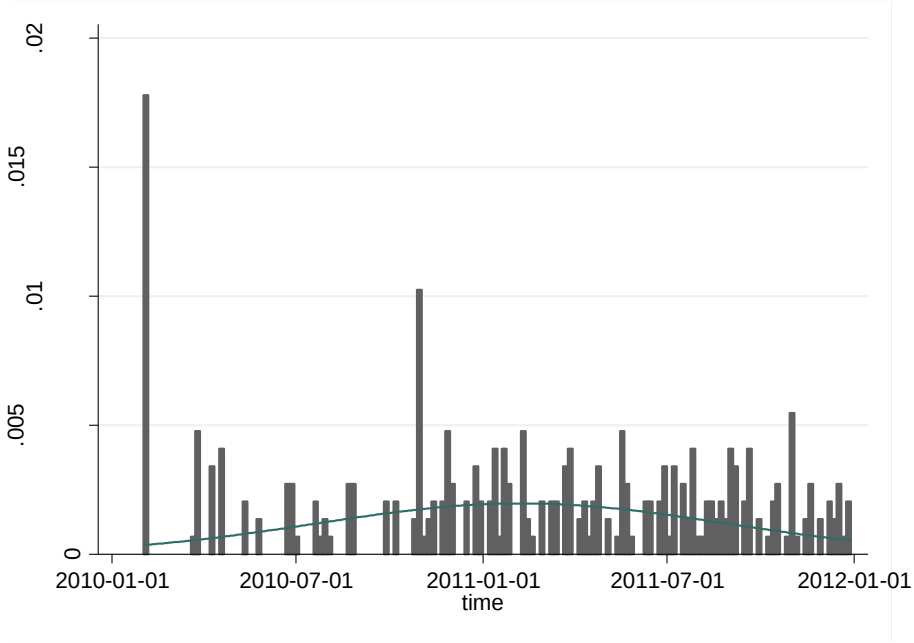


3.3.4 The distribution of time

Figure 16 shows that the IPOs are distributed over time evenly. Normally, firms go listing on the bull market, and avoid it on the bear market when the stocks are undervalued. However, there are always firms in queue for going listing even in bear market in China. The application of IPO issuing is subjected to the government and then to the stock exchange. It is completely different from most of other markets like Hongkong GEM where issuers just need to only apply and register in stock exchange. In China the issuer doesn't know when exactly they will receive the approval from the government and market is unpredictable, so it happens that the issuer receives the approval in a bear market. In that case the firms will still continue their plan of listing, because the cost of one more waiting in a line of

hundreds IPO application is large. Only in some extreme situation when the market is really lack of liquidity, the government will impose a pause of IPO while the issuers are still eager to apply for IPO issuing.

Figure 16 The distribution of IPO over time



3.4 Empirical result of price, volume and adverse selection effect

3.4.1 Price effect

Figure 17 Cumulative average abnormal returns and cumulative average daily returns around the unlock day [-30,30]

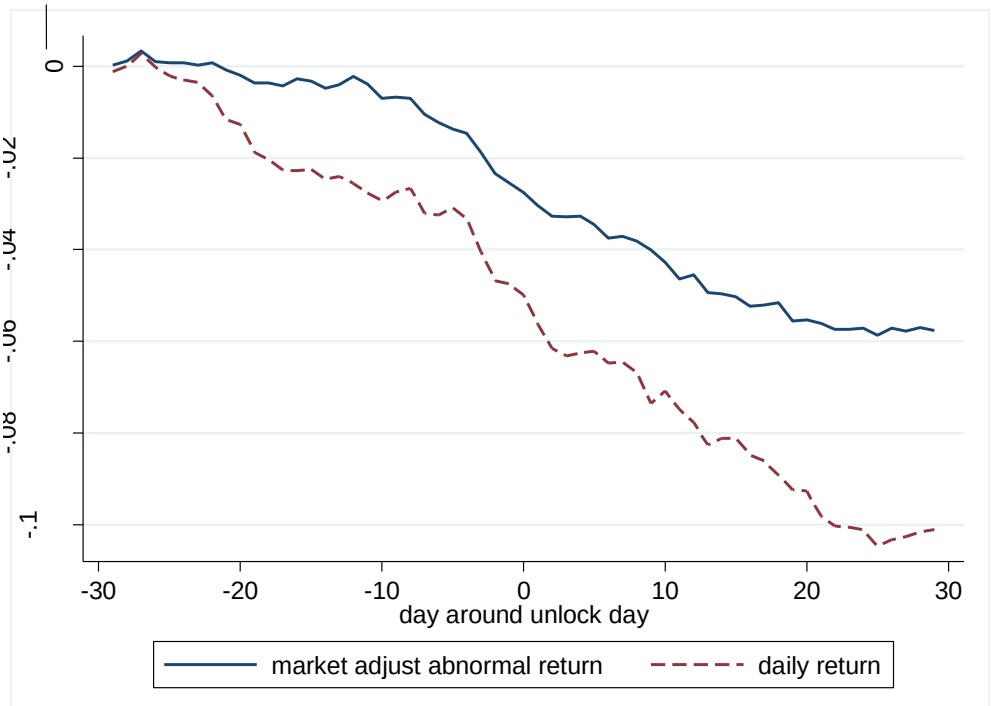


Figure 17 presents the time series figure of cumulative average abnormal returns and cumulative average daily returns around the unlock day. The cumulative abnormal return is close to zero in the time window [-30,-10] and [20,30].This is maybe because the date is still not close to the unlock day. It goes down constantly in the time window [-10,20]. This supports that the price fall around the unlock day as the supply of share increase and the investors are rational and pessimistic. When the day comes closer to the unlock day, the investors starts selling their shares as they worry that the incoming unlock shares will cause the price go down. The cumulative daily return goes down in the time window [-30,-20] and [-10,20]. It stays almost constant in [-20,-10] and [20,30]. In [-30,30], the cumulative abnormal returns is -10%, which is 4% larger than the cumulative daily returns.

Figure 18 Average abnormal returns around unlock day [-30,30]

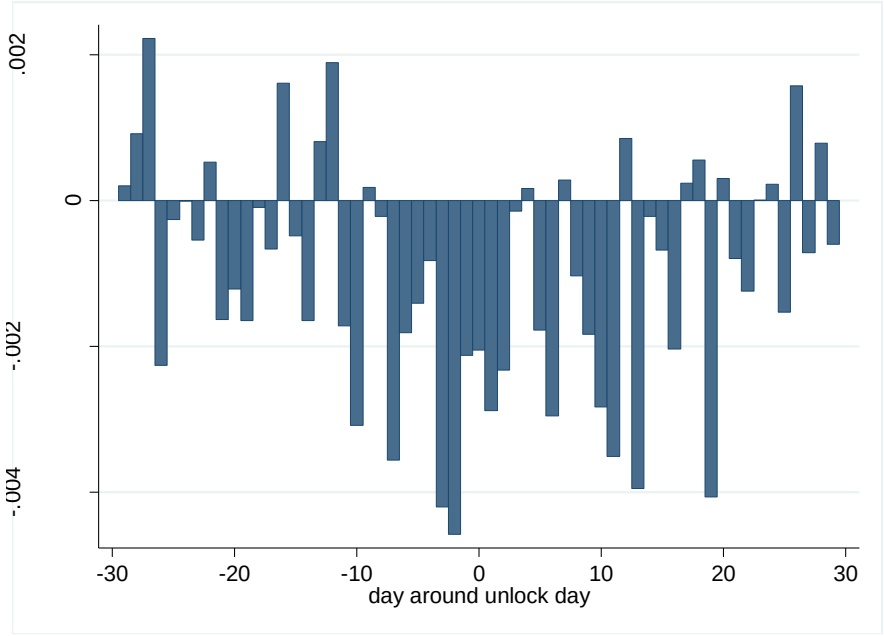
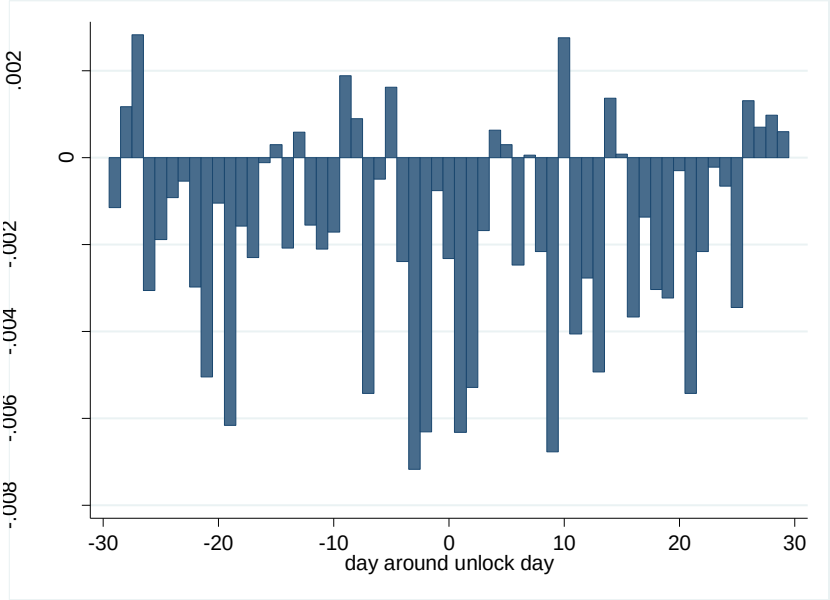


Figure 19 Average daily returns around the unlock day [-30,30]



The figure 18 and 19 show that both the daily abnormal returns and daily returns are mostly negative in both 30 days before and after unlock day in the whole sample. None of the positive abnormal daily returns and daily returns is statistically significant. This market efficiency can not be exploited given that the investors are not allowed to short the shares.

Table 4 reports the abnormal returns around the unlock day. The results suggest there is significant price reaction to lock-up expiration. The accumulative average abnormal return is significantly -2.05% in [-10,0] and -1.59% in [0,10], and negative on [-3], [-2], [-1], [1] and [2] day. The cumulative average daily abnormal return is not significantly different from zero In [-30,-10] and [20,30] and on [0] and [3] day. It is consistent with the results from US market. Field and Hanka (2001) report a statistically significant negative abnormal return for the [-1,1] window .

The accumulative daily return is -1.16% in [-30,-20], -2.05% in [-10,0] and -2.65% in [0,20]. It is not significantly different from zero in [-20,-10] and [20,30]. The daily return is significantly negative on [-3], [-2], [1] and [2] day. It is not significantly different from zero on [-1], [0] and [3] day.

Table 4 Average abnormal returns around unlock day

Market adjusted abnormal return (N=378)			**Daily return (N=436)**		
Time window	**t-value**	**Mean %**	**Time window**	**t-value**	**Mean %**
-30,-10	-1.23	-0.70	-30,-20	-2.28**	-1.16
-10,0	-4.73***	-2.36	-20,-10	-1.55	-0.53
0,10	-3.64***	-1.74	-10,0	-4.71***	-2.05
10,20	-2.14**	-1.53	0,20	-3.80***	-2.65
20,30	-0.70	-0.32	20,30	-0.28	-0.10
-30,30	-5.29***	-5.76	-30,30	-7.20***	-10.10
-3	-3.23***	-0.42	-3	-4.57***	-0.72
-2	-2.57***	-0.05	-2	-3.10***	-0.63
-1	-2.31**	-0.02	-1	-0.54	-0.08
0	-1.55	-0.02	0	-1.27	-0.23
1	-2.65***	-0.03	1	-4.11***	-0.63
2	-1.81*	-0.02	2	-3.05***	-0.53
3	-0.10	-0.01	3	-1.02	-0.17

Note: *** ,**,* indicates significance at the 1%, 5%, 10% level respectively for two-tailed t test. Day 0 is lock-up agreement expiration day. Market adjusted abnormal return has fewer samples than daily returns is because that the price index which used to calculate abnormal return is not available until several months after GEM is launched.

3.4.2 Price effect in sub-sample

Most firms of the sample have two unlock events. The first unlock event comes from the

institutional investors who attend the book building of IPO. The lock-up period of this agreement is 3 month. The amount of lock-up shares is below 5% of the total shares of a firm. The second unlock event comes from the executives, other institutional and individual investors who held the shares before IPO. The lock-up period is 1 year. The amount of lock-up shares is averagely about 20% of the total shares of a firm. To examine whether the abnormal return effect to lock-up expiration depends on the amount of lock-up shares, I divide the whole sample into two subsamples namely, first unlock event and second unlock event.

3.4.2.1 Price effect of the first unlock event

Figure 20 presents the time series figure of cumulative average abnormal return and average daily return around the unlock day of the first unlock event. The result is similar to that from the whole sample, which supports the hypothesis 1(b) and 1(c) that the abnormal return before and after unlock day are both significant negative. The cumulative abnormal return goes up in the time window [-30,-20]. It goes down constantly in the time window [-10,10]. It stays almost constant in the time window [-20,-10] and [10,30], when the timing is not close the unlock day. The cumulative daily return has similar result. It goes up in the time window [-30,-20]. It goes down constantly in [-20,20]. It stays almost constant in the time window [20,-30].

Figure 20 Cumulative average abnormal returns and cumulative average daily return around the unlock day [-30,30]of the first unlock subsample

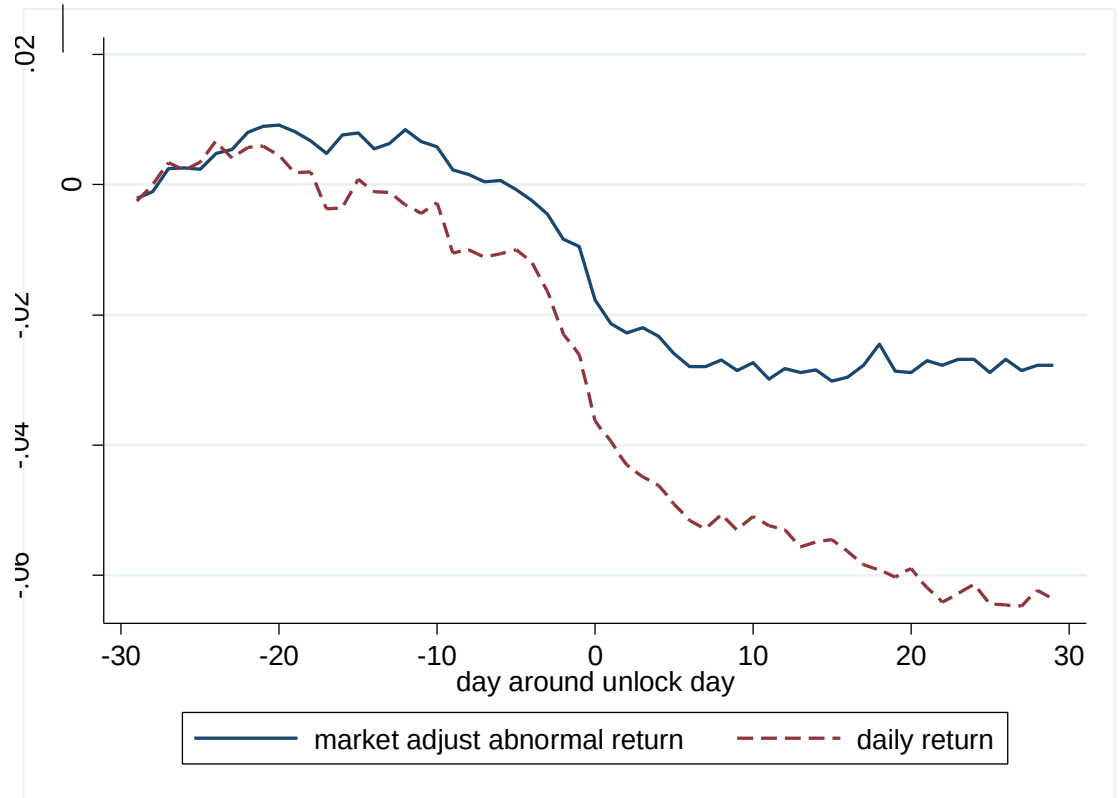


Figure 21 Average abnormal return around unlock day [-30,30] of the first unlock subsample

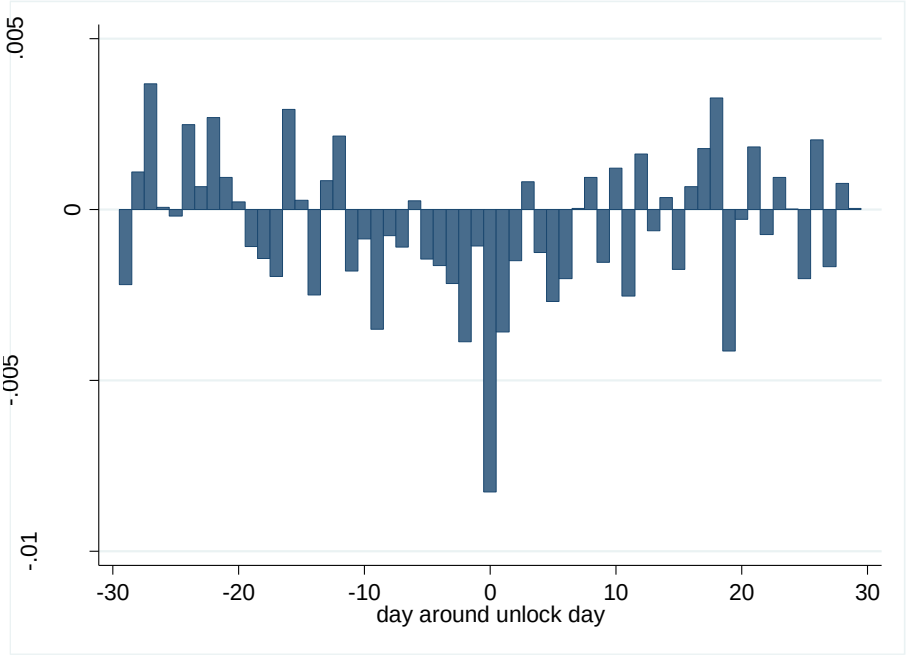
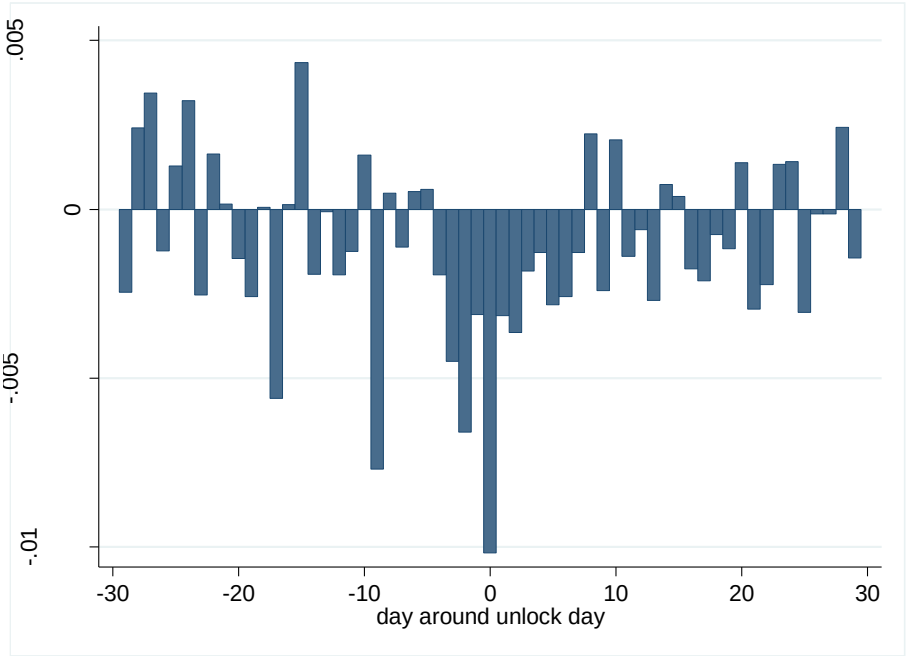


Figure 22 Average daily return around unlock day [-30,30]of the first unlock subsample



The figure 21 and 22 show that both the daily abnormal returns and daily returns are mostly negative in both 30 days before and after unlock day in the first unlock event sample. None of the positive abnormal daily returns and daily returns is statistically significant. This result is similar to the result from the whole sample.

Table 5 reports the abnormal returns around the unlock day. The results suggest there is

significant price reaction to lock-up expiration. The significant accumulative abnormal return is 0.89% in [-30,-20], -2.44% in [-10,0] and -1.78% in [0,10]. The reason to the positive abnormal return in [-30,-20] could be the price manipulating from the financial institution who took part in book building of IPO pricing. They have the intention to spread the good news of the firms, and buying the shares to support the price of the shares before unlock day by taking the advantage of the large scale of their fund. In that case they can sell their unlock shares at a better price. The abnormal return is significantly negative on [-3], [-1], [0] and [1] day. It is not significantly different from zero in [-2], [2], [3], [-20,-10] and [10,30].

The accumulative daily return is -2.67% in [-20,-10], -3.19% in [-10,0] and -3.28% in [0,20]. It supports that the abnormal return is significantly different from 0 both before and after unlock day. It is not significantly different from zero in [1], [2], [3], [-30,-20] and [20,30]. It is significantly negative on [-3], [-2], [-1] and [0] day.

Table 5 Average abnormal returns of the first unlock subsample around unlock day

Market adjust abnormal returns (N=208)			**Daily return (N=208)**		
Time window	**t-value**	**Mean %**	**Time window**	**t-value**	**Mean %**
-30,-20	2.00**	0.89	-30,-20	-0.7	0.45
-20,-10	-0.62	-0.31	-20,-10	-4.19***	-2.67
-10,0	-4.51***	-2.44	-10,0	-4.14***	-3.19
0,10	-3.36***	-1.78	0,20	-2.56***	-3.28
10,30	0.08	0.08	20,30	-0.47	-0.34
-30,30	-2.20**	-2.77	-30,30	-3.68***	-6.38
-3	-1.73*	-0.22	-3	-2.78***	-0.45
-2	-1.34	-0.39	-2	-2.06**	-0.66
-1	-0.87*	-0.11	-1	-1.66*	-0.31
0	-4.80***	-0.83	0	-4.28***	-1.02
1	-2.45**	-0.36	1	-1.52	-0.31
2	-0.78	-0.15	2	-1.53	-0.36
3	0.63	0.08	3	-1.05	-0.18

Note: *** ,**,* indicates significance at the 1%, 5%, 10% level respectively for two-tailed t test. Day 0 is lock-up agreement expiration day. Market adjusted abnormal return has fewer samples than daily returns is because that the price index which used to calculate abnormal return is not available until several months after GEM is launched. I chose the time interval from 30 days before unlock day because the first unlock event is just 3 months after IPO.

3.4.2.2 Price effect of the second unlock event

Figure 23 presents the time series figure of cumulative average abnormal return and cumulative average daily return around the unlock day of the second unlock event. The cumulative average abnormal return goes down in the time window [-100,-20] and [-10,20].

It stays almost constant in the time window [-20,-10] and [20,30]. The cumulative average daily return has similar result. It goes down constantly in [-100,-10] and [0,30], and stays constant in the time window [-10,0]. The result shows that the abnormal negative returns around unlock day is positively correlated with the amount of unlock shares. The cumulative abnormal return is -4.3% in [0,20] and -3.3% in [-20,0] of second lock-up expiration (average unlock shares amount 20%), while it is only -1.7% in [0,20] and -2.7% in [-20,0] of first lock up expiration (average unlock shares amount 5%).

Figure 23 Cumulative average abnormal returns and cumulative average daily return around the unlock day [-100,30]of the second unlock subsample

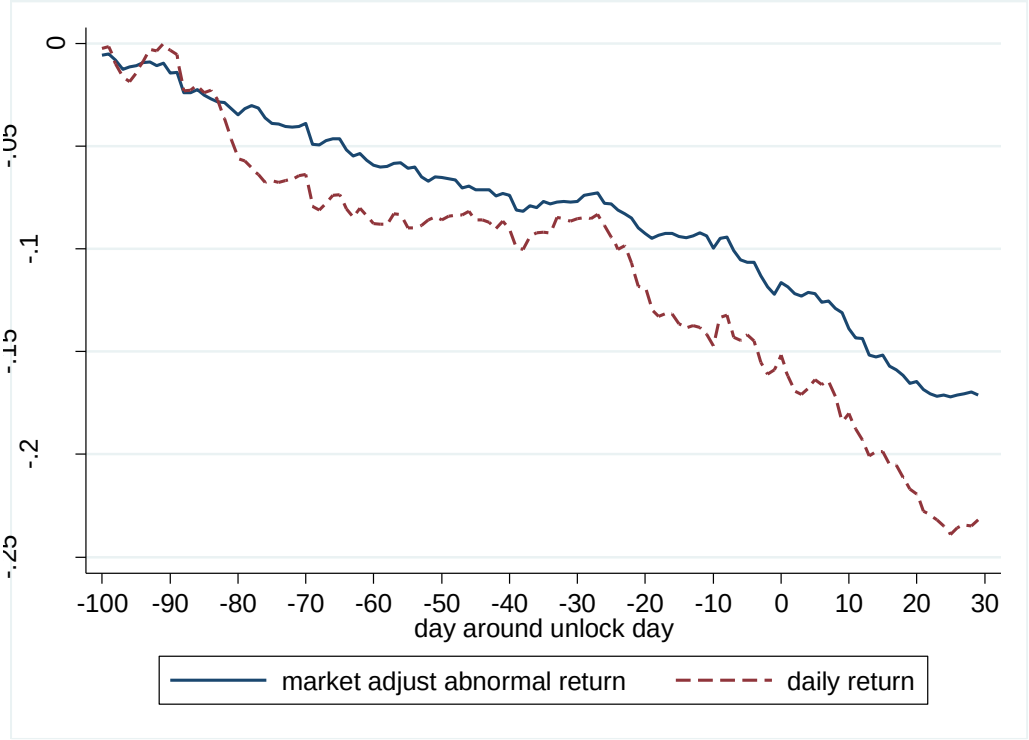


Figure 24 Average abnormal return around unlock day [-100,30]of the second unlock subsample

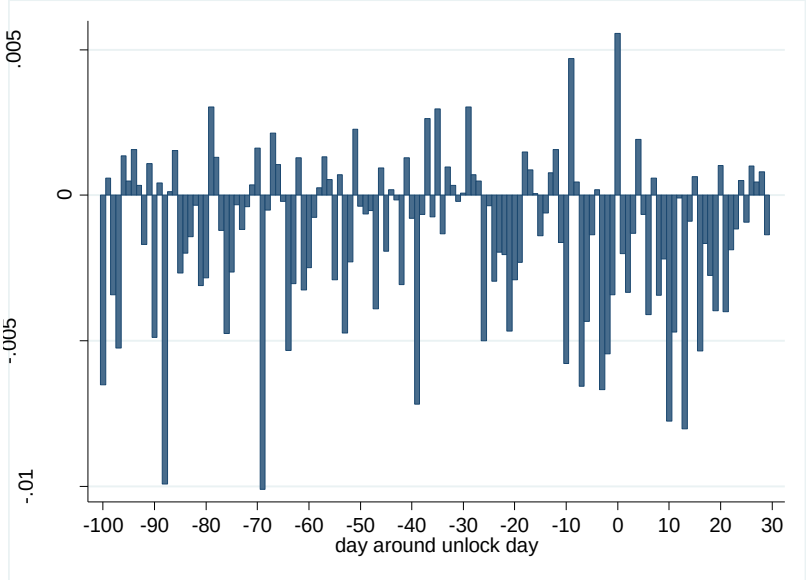
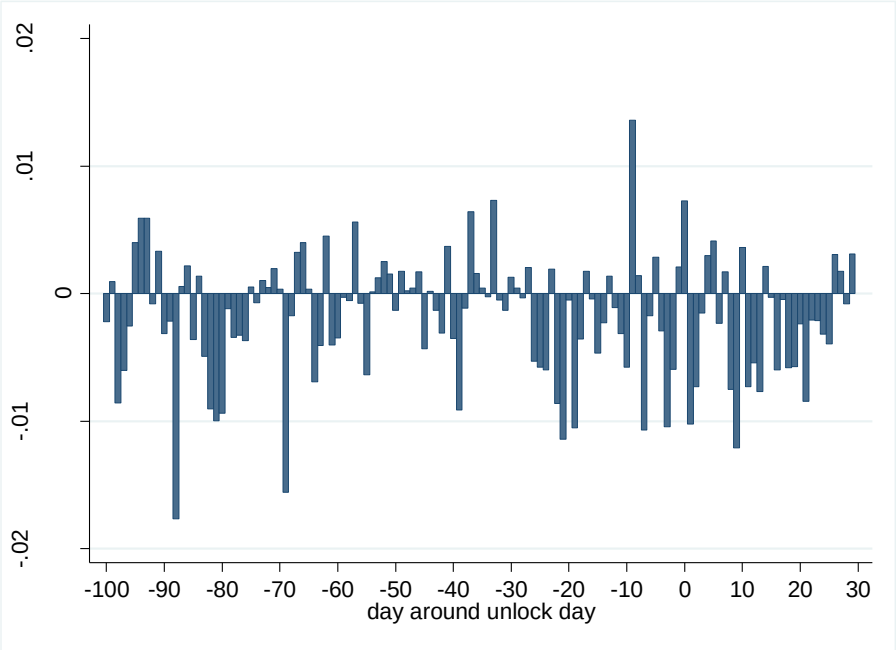


Figure 25 Average daily return around unlock day [-100,30] of the second unlock subsample



The figure 24 and 25 shows that both the abnormal return and daily return are mostly negative from 100 days before to 20 days after unlock day, though abnormal return on the unlock day is significant positive.

Table 6 Average abnormal returns of the second unlock subsample around unlock day

Market adjust abnormal returns (N=170)			**Daily return (N=170)**		
Time window	**t-value**	**Mean %**	**Time window**	**t-value**	**Mean %**
-100,-20	-4.47***	-9.25	-100,-20	-4.79***	-11.88
-20,-10	-1.57	-0.99	-20,-10	-4.03***	-2.89
-10,0	-2.54**	-2.27	-10,0	-0.83	-1.03
0,20	-3.30***	-4.26	0,20	-3.85***	-6.02
20,30	-1.30	-0.65	20,30	-1.99**	-1.27
-30,30	-5.11***	-9.41	-30,30	-6.46***	-14.53
-3	-2.74***	-0.67	-3	-3.65***	-1.04
-2	-3.03***	-0.54	-2	-2.61***	-0.60
-1	-2.44**	-0.34	-1	0.99	0.21
0	2.93***	0.56	0	2.76***	0.73
1	-1.24	-0.20	1	4.47***	-1.02
2	-2.05**	-0.33	2	-2.89***	-0.73
3	-0.47	-0.13	3	-0.50	-0.15

Note: *** ,**,* indicates significance at the 1%, 5%, 10% level respectively for two-tailed t test. Market adjusted abnormal return has fewer samples than daily returns is because that the price index which used to calculate abnormal return is not available until several months after GEM is launched.

Table 6 reports the abnormal returns around the unlock day. The results suggest there is significant price reaction to lock-up expiration. The abnormal return is -9.25% in [-100,-20], -2.27% in [-10,0] and -4.26% in [0,20], and is significantly negative on [-3], [-2], [-1] and [2] day. It is not significantly different from zero in [-20,-10], [20,30], and on [1] and [3] day. The abnormal return and daily return are 0.56% and 0.73% respectively on the unlock day, which is a surprise to us. This is an interesting phenomenon. The unlock day is the first trading day of the unlock shares, which should be viewed as the beginning of bad days by investors, but it causes the price increase. I propose an explanation that the there are some investors choose buying on the unlock day according to the strategy buy on bad news and sell on good news.

The accumulative daily return is -11.88% in [-100,-20], -2.89% in [-20,-10], -6.02% in [0,20] and -1.27% in [20,30], and significantly negative on [-3], [-2], [1] and [2] day. It is not significantly different from zero in [-10,0] and on [-1] and [3] day. It is significant positive on unlock day.

3.4.3 Volume effect

Figure 26 Average abnormal volume around the unlock day [-100,30]

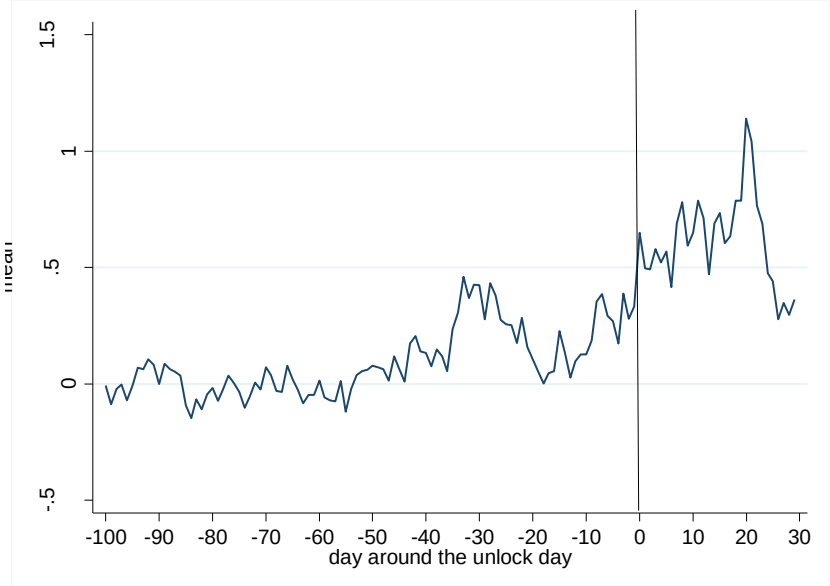


Figure 26 reports the time series of abnormal trading volume around unlock day. The trading volume increase significantly by more than 50% after unlock day. Field and Hanka (2001) also report a volume increase subsequent to the unlock day. This result is consistent with the prediction of hypothesis 2. I propose that the direct reason is that the quantity of tradable shares is larger. The indirect reason is that after the unlock day, more informed traders are present in the market. The increase of the number of informed traders will intensify the competition among themselves, which makes the private information become public more fast. Thus the adverse selection risk is lower in the market. Under this better market situation, more investors are willing to provide liquidity. As a result, the trading volume increases.

3.4.4 Adverse selection cost effect

I test the change of the adverse selection cost between before and after unlock day. The first step is to calculate the adverse selection cost of each stock, during the period [-10,-1] and [1,10] respectively. Then I calculate the mean of all stocks. At the end I use a pair t-value test to see if they is significantly different.

The table 7 shows that the means of adverse selection cost are 0.0116 before and 0.0123 after unlock day respectively. The means of transaction cost is 0.0119 before and 0.0113 after unlock day respectively. The adverse selection cost decrease after unlock day. The transaction cost increase after unlock day. It supports the hypothesis 3(b).

Table 7 Change of adverse selection cost around unlock day

Variable	Obs	Mean	t-value
Adverse selection cost			
θ [+1, +10]	315	0.0117***	27.33
θ [-1, -10]	315	0.0123***	25.50
Diff	315	-0.0006***	-2.98
Transaction cost			
ϕ [+1, +10]	315	0.0120***	23.95
ϕ [-1, -10]	315	0.0114***	23.59
Diff	315	0.0006***	2.58

Note: *** indicates significance at the 1% level for two-tailed t test. Obs is the number of the stocks of the sample. Day 0 is the unlock day. θ [+1,+10] means the mean of the adverse selection cost of the 10 days subsequent to the unlock day, while [-10,-1] means 10 days prior to the unlock day. Diff of θ is calculated as $\theta[+1,+10]-\theta[-1,-10]$. The transaction cost ϕ is calculated similarly.

Figure 27 Adverse selection cost around the unlock day [-20,20]

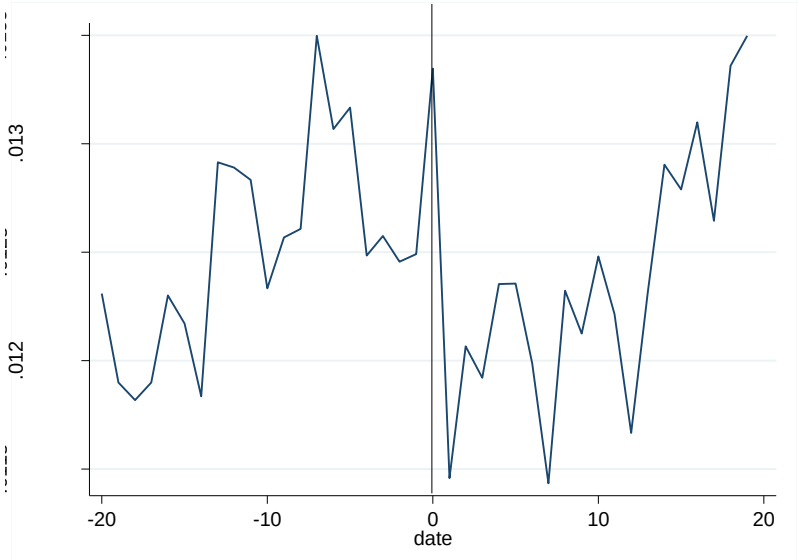


Figure 28 Transaction cost around the unlock day [-20,20]

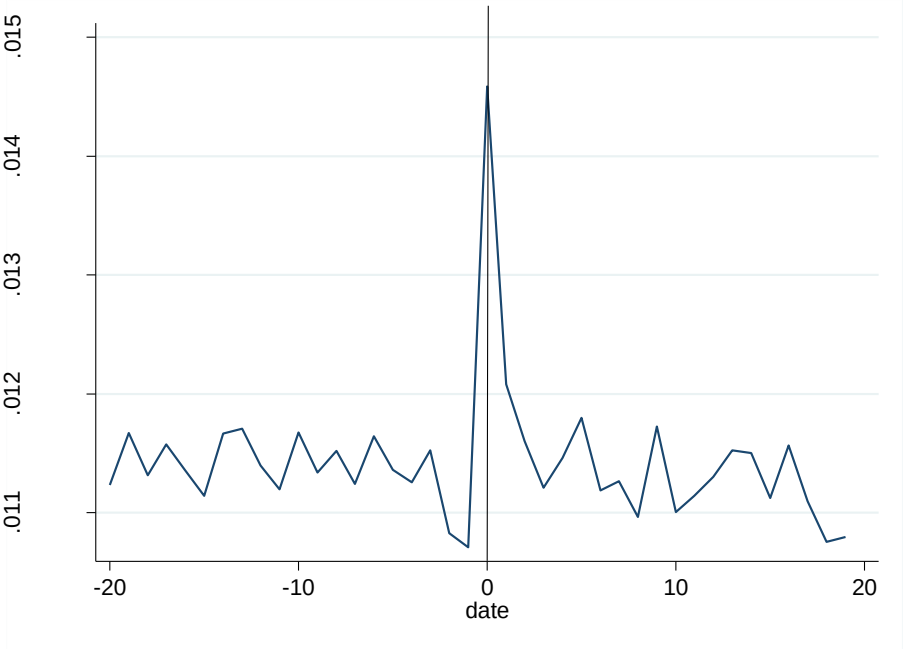


Figure 27 and 28 show that at the unlock day, the adverse selection cost decrease and the transaction cost increase. It is consistent with the hypothesis 3. Also it is consistent with Knishnamurti and Thong (2007), Cao, Field and Hanka (2003). I propose the following explanation to it. On the unlock day, the new insiders enter into the market and compete with other informed trades. This competition lowers the informational asymmetry between informed traders and market markers. Thus the adverse selection cost required by market makers is lower. In addition, the reason can also be the usage of limit order by new insiders. The new insiders can place limit order to lower the bid-ask spread to attract more investors to buy their shares. After 10 days, the adverse selection grows up again. This is caused by the decreasing of competition as some informed traders leave the market due to competition during those 10 days. And the transaction cost increase, probably because the number of small orders and order continuation increase. The new insiders always hold a larger percent of the shares than others. As a larger trader, they typically break their order into small components for easier execution, which makes order continuation more likely than reversal to happen. Thus the market maker espouse to a higher transaction risk.

3.4.5 Adverse selection cost effect in sub-sample

To test whether the adverse selection reaction to the lock-up expiration depends on the IPO PE ratio, IPO underpricing, and market condition, I repeat the analysis using the sub-samples divided accordingly.

3.4.5.1 IPO underpricing and adverse selection cost effect

The table 8 reports that the adverse selection cost significantly decrease in the sub-sample of which the underpricing is lower than 0.36. And it does not change significantly in the sub-sample of which the underpricing is over 0.36. I propose an explanation to that. Higher underpricing can be viewed as a signal of the good quality of the firms. These firms are more likely to disclose the inside information to the all investors, to avoid that some insiders take advantage of it. Thus the private information of them is less on the market. In addition, the managers of them is not supposed to viewed as insiders who intend to earn profits by exploiting superior information, because they lower the IPO offering price to leave the money on the table on the primary market. Because no new insiders enter into market after unlock day and only limit amount of private information is on market, the expiration of lock-up agreement don't change the adverse selection cost.

Table 8 IPO underpricing and adverse selection cost effect

Variable	**Obs**	**Mean**	**t-value**
Underpricing <0.36			
θ [+1, +10]	161	0.0117***	20.97
θ [-1, -10]	161	0.0124***	20.44
Diff	161	-0.0007***	-2.72
Underpricing >0.36			
θ [+1, +10]	154	0.0117***	17.85
θ [-1, -10]	154	0.0122***	16.10
Diff	154	-0.0005	-1.64

Note: *** indicates significance at the 1% level for two-tailed t test. Obs is the number of the stocks of the sample. Day 0 is the unlock day. θ [+1,+10] means the mean of the adverse selection cost of the 10 days subsequent to the unlock day, while [-10,-1] means 10 days prior to the unlock day. Diff of θ is calculated as $\theta[+1,+10]-\theta[-1,-10]$. Underpricing <0.36 means the IPO underpricing of the stocks in the sample is lower than 0.36, which is calculated as (IPO opening price – offering price)/ offering price.

3.4.5.2 IPO PE rate and adverse selection cost effect

The table 9 reports that the adverse selection cost significantly decrease in the sub-sample of which the IPO PE is over 62. And it does not significantly change in the sub-sample of which the IPO PE is under 62. As IPO PE is negatively correlated with IPO underpricing, this result is consistent with the result of the relation between IPO underpricing and adverse selection change. Low PE ratio can be also used as a signal to convey the quality of the firm to the outside investors.

Table 9 IPO PE rate and adverse selection cost effect

Variable	Obs	Mean	t-value
IPO PE ratio >62			
θ [+1, +10]	153	0.0132***	20.76
θ [-1, -10]	153	0.0142***	19.95
Diff	153	-0.0010***	2.94
IPO PE ratio <62			
θ [+1, +10]	162	0.0103***	18.50
θ [-1, -10]	162	0.0106***	16.79
Diff	162	-0.0003	-1.15

Note: *** indicates significance at the 1% level for two-tailed t test. Obs is the number of the stocks of the sample. Day 0 is the unlock day. θ [+1,+10] means the mean of the adverse selection cost of the 10 days subsequent to the unlock day, while [-10,-1] means 10 days prior to the unlock day. Diff of θ is calculated as $\theta[+1,+10]-\theta[-1,-10]$. IPO PE ratio >62 means the IPO PE ratio of the stocks in the sample over 62, which is calculated as IPO offering price / earning per share of the immediate year before IPO.

3.4.5.3 Market condition and adverse selection cost effect

Table 10 shows that the adverse selection cost does not change after unlock day in the bull market, but change in bear market. I propose the following explanation to it. The private information on the market is limited in bull market as it is more easily accessible due to more coverage from media. Thus the presence of new insiders will have only limited influence on the informational asymmetry reflected by adverse selection cost.

Table 10 Market condition and adverse selection cost effect

Variable	Obs	Mean	t-value
Bull market [Jan. 2010.01- Dec. 2010]			
θ [+1, +10]	157	0.0130***	18.73
θ [-1, -10]	157	0.0135***	17.17
Difference	157	-0.0005	-1.55
Bear market [Jan. 2011.01- Dec. 2011]			
θ [+1, +10]	158	0.0104***	21.49
θ [-1, -10]	158	0.0111***	20.29
Difference	158	- 0.0007***	-2.97

Note: *** indicates significance at the 1% level for two-tailed t test. Obs is the number of the stocks of the sample. Day 0 is the unlock day. θ [+1,+10] means the mean of the adverse selection cost of the 10 days subsequent to the unlock day, while [-10,-1] means 10 days prior to the unlock day. Diff of θ is calculated as $\theta[+1,+10]-\theta[-1,-10]$. The market generally goes up in 2010 and goes down in 2011.

CONCLUSION

This study explores and investigates the IPO lock-up agreement issues in the China growth enterprise market, with the empirical study being focus on the price, volume and adverse selection cost reaction to the lock-up expiration.

Through the reviews on lock-up expiration, I find that most of the previous research investigates only the abnormal return and volume around the unlock day, while relatively little is known about the informational asymmetry change. The empirical part of this thesis is to fill this gap. The literature review section entails also reviews on the financial market microstructure, which suggests that the adverse selection cost of bid-ask spread can be used as a measurement for market informational asymmetry.

In order to gain a better understanding of the lock-up agreement issues, I provide the introduction of the GEM market, which includes an overview on the market development. This also includes information regarding the trading mechanism, the lock-up agreement regulation, and three explanations, namely the signaling hypothesis, the commitment hypothesis and the compensation hypothesis for the existence of lockup agreements. Subsequently I test empirically the following issues.

First, I investigate the abnormal return around the unlock day. Consistent with other studies in literature, I find a statistically significant abnormal negative return in the time window [-10,10]. I conclude that the abnormal return is caused by both the rational expectation and supply increase of stock after unlock day. The supply increase will move the price down after unlock day, but rational expectation from investors will bring the price decrease backward before the unlock day. In the robustness check, I test the above issue on the sub-samples of first unlock event and second event. The same results are attained. In addition, I find the degree of the abnormal return is larger in the large sized unlock share subsample than that in the small sized one, which indicates the abnormal return is positively correlated with the size of unlock shares.

And then I investigate the abnormal volume. The empirical results support the hypothesis that the abnormal volume after unlock day is significantly positive. I conclude that it is partly because of the number of tradable shares which increase significantly, and partly because the increased liquidity caused by the lower adverse selection.

At the end I investigate the adverse selection cost effect. The empirical result shows that the adverse selection cost become lower after the unlock day, which indicates that the informational asymmetry problem is improved. I conclude that it occurs as a result of the increasing of number of informed traders and the competition between them. The competition will spread out more private information, thereby lowering the required adverse selection compensation. In the robustness check, I test the above issue on the sub-samples.

The same results are attained in the sub-samples of firms with low IPO underpricing, firms with high IPO PE ratio and firms in bear market respectively. The adverse selection cost dost not change significantly in the sub-sample of firms with high IPO underpricing, firms with low IPO ratio and firms in bull market. I conclude that the IPO underpricing, IPO PE ratio and market condition are the factors affecting informational asymmetry on the market which is measured by the adverse selection cost.

As a concluding remark, my study provides several implications to the participants in the market of IPOs.

For issuing firms and underwriters, I suggest that the lockup agreement could be used as a signaling tool of the quality of firms, or a commitment device to avoid moral hazard problems.

For investors, I suggest that the firms with lower IPO PE ratio or higher IPO underpricing, are associated with lower informational asymmetry. The cumulative return is negative around the unlock day and the volume is larger after unlock day.

For the regulators, I suggest that more informed traders in the market could increase the competition among them and then improve the informational asymmetry problem. The institutional investors can be viewed as informed traders as they have better information than individual investors. Thus the regulator shall encourage more institutional investors to participate in the market.

REFERENCE LIST

(1) Affleck-Graves, J., S. P. Hedge, & R. E. Miller (1994). Trading mechanisms & the components of the bid-ask spread. *Journal of Finance*, 1471-1488.

(2) Aggarwal, R. K., L. Krigman, & K. L. Womack (2002). Strategic IPO underpricing, information momentum, and lockup expiration selling. *Journal of Financial Economics 66*(1), 105-137.

(3) Ahn, H. J., J. Cai, Y. Hamao, & R. Y. K. Ho (2002). The components of the bid–ask spread in a limit-order market, evidence from the Tokyo Stock Exchange. *Journal of Empirical Finance*, *9*(4), 399-430.

(4) Amihud, Y., & H. Mendelson (1980). Dealership market, Market-making with inventory. *Journal of Financial Economics, 8*(1), 31-53.

(5) Amihud, Y., & H. Mendelson (1986). Asset pricing and the bid-ask spread. *Journal of financial Economics, 17*(2), 223-249.

(6) Amihud, Y., & H. Mendelson (1989). The effects of beta, bid-ask spread, residual risk, and size on stock returns. *Journal of Finance*, 479-486.

(7) Bagehot, W. (1971). The only game in town. *Financial Analysts Journal, 27*(2), 12-14.

(8) Bradley, D. J., B. D. Jordan, H. C. Yi, & I. C. Roten (2001). Venture capital and IPO lockup expiration, An empirical analysis. *Journal of Financial Research, 24*(4), 465-494.

(9) Brau, J. C., D. A. Carter, S. E. Christophe, & K. G. Key (2004). Market reaction to the expiration of IPO lockup provisions. *Managerial Finance, 30*(1), 75-91.

(10) Brav, A., & P. A. Gompers (2000). *Insider trading subsequent to initial public offerings, Evidence from expirations of lock-up provisions. Unpublished working paper*. Massachussetts: Duke Unweversity, North Carolina, and Harvard Unweversity.

(11) Brav, A., & P. A. Gompers (2003). The role of lockups in initial public offerings. *Review of Financial Studies, 16*(1), 1-29.

(12) Brockman, P., & D. Y. Chung (1999). Bid-ask spread components in an order-driven environment. *Journal of Financial Research, 22*(2), 227-246.

(13) Cao, C., L. C. Field, & G. Hanka (2004). Does insider trading impair market liquidity? Evidence from IPO lockup expirations. *Journal of Financial and Quantitative Analysis, 39*(1), 25-46.

(14) Chen, D., C. Chen, L. P. Blenman, & F. Bin (2005). The Effect of IPO Lockup Agreements on Stock Prices, An Empirical Analysis on the Taiwan Stock Exchange. *GLOBAL BUSINESS AND FINANCE REVIEW, 10*(1), 39.

(15) Chung, K. H., & C. Charoenwong (1998). Insider Trading and the Bid‐Ask Spread. *Financial Review, 33*(3), 1-20.

(16) Chung, K. H., T. H. McInish, R. A. Wood, & D. J. Wyhowski (1995). Production of information, information asymmetry, and the bid-ask spread, Empirical evidence from analysts' forecasts. *Journal of Banking & Finance, 19*(6), 1025-1046.
(17) Chung, K. H., B. F. Van Ness, & R. A. Van Ness (1999). Limit orders and the bid–ask spread. *Journal of Financial Economics, 53*(2), 255-287.
(18) Cohen, K. J., S. F. Maier, R. A. Schwartz, & D. K. Whitcomb (1981). Transaction costs, order placement strategy, and existence of the bid-ask spread. *The Journal of Political Economy*, 287-305.
(19) Copeland, T. E., & D. Galai (1983). Information effects on the bid-ask spread. *Journal of finance*, 1457-1469.
(20) De Jong, F., T. Nijman, & A. Röell (1996). Price effects of trading and components of the bid-ask spread on the Paris Bourse. *Journal of Empirical Finance, 3*(2), 193-213.
(21) Ertimur, Y., E. Sletten, & J. Sunder (2007). Voluntary disclosure strategy around IPO lockup expirations. *AAA 2006 Financial Accounting and Reporting Section (FARS) Meeting Paper*. Washington, D.C.: Omni Shoreham Hotel.
(22) Espenlaub, S., M. Goergen, & A. Khurshed (2003). PO Lock‐in Agreements in the UK. *Journal of Business Finance & Accounting, 28*(9-10), 1235-1278.
(23) Field, L. C., & G. Hanka (2001). The expiration of IPO share lockups. *The Journal of Finance, 56*(2), 471-500.
(24) Garfinkle, N., B. G. Malkiel, & C. Bontas (2002). Effect of underpricing and lock-up provisions in IPOs. *The Journal of Portfolio Management, 28*(3), 50-58.
(25) Garman, M. B. (1976). Market microstructure. *Journal of financial Economics, 3*(3), 257-275.
(26) George, T. J., G. Kaul, & M. Nimalendran (1991). Estimation of the bid-ask spread and its components, A new approach. *Review of Financial Studies, 4*(4), 623-656.
(27) Glosten, L. R. (1987). Components of the bid-ask spread & the statistical properties of transaction prices. *Journal of Finance*, 1293-1307.
(28) Glosten, L. R., & L. E. Harris (1988). Estimating the components of the bid/ask spread. *Journal of financial Economics, 21*(1), 123-142.
(29) Goergen, M., L. Renneboog, & A. Khurshed (2006). Explaining the dweversity in shareholder lockup agreements. *Journal of Financial Intermediation, 15*(2), 254-280.
(30) Holden, C. W., & A. Subrahmanyam (1994). Risk aversion, imperfect competition, and long-lived information. *Economics Letters, 44*(1), 181-190.
(31) Hong Kong Exchanges and Clearing Limited (2012). *GEM Stock market highlight*. Retrieved May 8, 2012, from http://www.hkgem.com/statistics/ms1/e_MktHighlights201112.html
(32) Huang, C. J., & C. G. Lin (2007). Earnings management in IPO lockup and insider trading, evidence from Taiwan. *Emerging Markets Finance and Trade, 43*(5), 78-91.
(33) Huang, R. D., & H. R. Stoll (1997). The components of the bid-ask spread, A general approach. *Review of Financial Studies, 10*(4), 995-1034.

(34) Jordan, B., D. Bradley, I. Roten, & H. C. Yi (2001). Venture capital and IPO lockup expiration, an empirical analysis. *Journal of Financial Research, 24*(4), 465-493.
(35) Keasler, T. R. (2001). Underwriter Lock‐up Releases, Initial Public Offerings and After‐market Performance. *Financial Review, 36*(2), 1-20.
(36) Kini, O., & S. Mian (1995). Bid-ask spread and ownership structure. *Journal of Financial Research, 18*(4), 401-414.
(37) Krishnamurti, C., & T. Y. Thong (2008). Lockup expiration, insider selling and bid–ask spreads. *International Review of Economics & Finance, 17*(2), 230-244.
(38) Kyle, A. S. (1985). Continuous auctions & insider trading. *Econometrica, Journal of the Econometric Society*, 1315-1335.
(39) Li, M., T. H. McInish, & U. Wongchoti (2005). Asymmetric information in the IPO aftermarket. *Financial Review, 40*(2), 131-153.
(40) Lin, J. C., G. C. Sanger, & G. G. Booth (1995). Trade size and components of the bid-ask spread. *Review of Financial Studies, 8*(4), 1153-1183.
(41) Lynch, A., & R. Mendenhall (1997). *Journal of Business, 70*, 351-383.
(42) Madhavan, A., M. Richardson, & M. Roomans (1997). Why do security prices change? A transaction-level analysis of NYSE stocks. *Review of Financial Studies, 10*(4), 1035-1064.
(43) McInish, T. H., & R. A. Wood (1992). An analysis of intraday patterns in bid/ask spreads for NYSE stocks. *Journal of Finance*, 753-764.
(44) Mohan, N. J., & C. R. Chen (2001). Information content of lock-up provisions in initial public offerings. *International Review of Economics & Finance, 10*(1), 41-59.
(45) Ofek, E., & M. Richardson (2000). *The IPO lock-up period, Implications for market efficiency and downward sloping demand curves.* Unpublished working paper, New York Unweversity.
(46) Ofek E & M. Richardson (2003). DotCom Mania: The Rise and Fall of Internet Stock Prices. *Journal of Finance, American Finance Association, 58*(3), 1113-1138.
(47) Roll, R. (1984). A simple implicit measure of the effective bid-ask spread in an efficient market. *Journal of Finance*, 1127-1139.
(48) Shanghai Stock Exchange (2012). *Listing requirements.* Retrieved May 8, 2012, from https://listingcenter.nasdaqomx.com/assets/initialguide.pdf
(49) Shanghai Stock Exchange (2012). *Market at a glance.* Retrieved May 8, 2012, from http://www.sse.com.cn/sseportal/en_us/ps/md/sh_b_qc9.jsp
(50) Shenzhen Stock exchange (2012). ChinNext Market Statistics by sectors. Retrieved May 8, 2012, from http://www.szse.cn/main/en/MarketStatistics/BySectors/
(51) Shenzhen Stock exchange (2012). *ChinNext Market Overview*. Retrieved May 8, 2012, from http://www.szse.cn/main/en/MarketStatistics/MarketOverview/
(52) Shenzhen Stock exchange (2012). *ChinNext Summary*. Retrieved May 8, 2012, from http://www.szse.cn/main/files/2011/06/27/672798306314.pdf
(53) Shenzhen Stock exchange (2012). *ChinNext Indices performance*. Retrieved May 8, 2012, from http://www.szse.cn/main/en/marketdata/indicesPerformance/

(54) Shenzhen Stock exchange (2009). *Rules Governing the Listing of Shares on the Chinext of Shenzhen Stock Exchange*. Retrieved May 8, 2012, from http://www.szse.cn/main/files/2009/11/05/860391378693.pdf
(55) Shenzhen Stock exchange (2009). *Interim Measures on the Administration of Initial Public Offerings and Listings of Shares on the Chinext.* Retrieved May 8, 2012, from http://www.szse.cn/main/files/2009/09/20/422878574611.pdf
(56) Shleifer, A. (1986). Do demand curves for stocks slope down?. *Journal of Finance, 41*, 309-317.
(57) Stoll, H. R. (1989). Inferring the components of the bid-ask spread, Theory and empirical tests. *Journal of finance, 44*(1), 115-134.
(58) THE NASDAQ OMX GROUP (2012). *Initial Listing Guide.* Retrieved May 8, 2012, from https://listingcenter.nasdaqomx.com/assets/initialguide.pdf
(59) The Wall Street Journal (2012). *P/E & Yields on Major Indexes.* Retrieved May 8, 2012, from http://online.wsj.com/mdc/public/page/2_3021-peyield.html
(60) Venkatesh, P., & R. Chiang (1986). Information asymmetry and the dealer's bid-ask spread, A case study of earnings and dividend announcements. *Journal of Finance,* 1089-1102.
(61) World Federation of Exchange (2012). *Domestic market capitalization.* Retrieved May 8, 2012, from http://www.world-exchanges.org/statistics/monthly-reports
(62) Wyart, M., J. P. Bouchaud, J. Kockelkoren, M. Potters, & M. Vettorazzo (2008). Relation between bid–ask spread, impact and volatility in order-driven markets. *Quantitative Finance, 8*(1), 41-57.
(63) Yung, C., & J. F. Zender (2010). Moral hazard, asymmetric information and IPO lockups. *Journal of Corporate Finance, 16*(3), 320-332.