Essay on the Optimal mechanism of the IPO market

by

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Abstract

This essay has introduced the IPO process and discussed the optimal IPO mechanism in order to protect the profit of the firm in an adverse selection environment. In the essay, the intermediary had the information about the demand of the market and the institutional investors have the private information about the value of the firm, and they may collude for maximizing their own profit with each other . The essay focuses mainly on finding the character of the IPO mechanism. In the end, I have extended the discussion into the aftermarket trading for the reason that the intermediary has the obligation to stabalize the IPO price, thus he may profit from underpricing the IPO in the primary market and repurchase back in the aftermarket trading with a low price, and this may results in great implicit impact on protecting the interest of the firm.

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Dedication

To my parents

Chapter 1

Introduction

1.1 What is an IPO

The Initial Public offering(IPO) is the most important event for the capital market. A company can raise the fund by issuing either the debt or equity. If he has never issued a stock before, this very first sale of stock by a company to the public is called the IPO, and after the issuing of IPO, the firm is called listed firm and he has to list the security on a public exchange.

There are two catogories of the companies: Private and Public, for the private company, the shareholders are fewer and the owners do not have to reveal too much information about the company. And the shares of the private firms are not for trading, so it is usually not possible to purchase the shares unless the owners would like to. But for the Public companies, they have to sold at least a fraction of their firms to be listed in the market which is through the IPO and be traded on a stock exchange, while they must have a board of directors and have to report their financial information quarterly .

Here are 6 major stages in the IPO process[5]:
1. Initial step:
The firm will select the potential investment banks, especially the book-running manager who will be in charge of the forming the syndicate(a group of investments

participating the IPO process) and being in charge of the entire issuing process. After the selection, the underwriters(investment banks) will sign an initial agreement with the issuer(the firm) which mainly includes the gross spread (the underwriting fee) and the commitment of granting the underwriter the 15% overallotment option.

2.Registration process:

The main perpose of this step is to ensure that public can acquire sufficient and reliable information. To achieve this, the underwriter has a "due diligence" requirement to investigate the firm and verify the information to the public market.

3. Marketing(Distribute prospectus and road show):

The importance of this process is obvious, and it is very important in the adverse selection which will be mentioned in the model. During the road show, the company officers would make numerous presentations to the institutional investors. And also some meetings will be held with both the retail and institutional investors. So the road show is great oppurtunity to promote the IPO. Meanwhile, if it is a good IPO, according to the institutional investors' own investigation of the firm value, they will hand in the indications of interest to the underwriters. And for the retail investors, they do not have any information about the firm but can also submit their interests of the IPO. However this is not a legally binding but indicaitons of interest. So no shares are sold at this stage. The underwriters will know who has sufficient fund to bid in the IPO market among the retail investors but not certain about the realization of the bidding in the allocation stage. And this is the beginning stage of the model in the paper "The Optimal IPO Mechanism" and will be discussed thoroughly mainly based on the information in the following chapters.

4. Pricing and allocation:

In this certain stage, the leading underwriter along with the firm will discuss the offer price and the exact number fo shares to be sold into the market, based on the information from the retail investors' indications of interest. And then decide the share allocation to each investors.

5. Aftermarket activities(Stabalization, Overallotment option):

The work of the underwriter does not end after the IPO was successfully issued and allocated, its obligation to work continues to the aftermarket activities. Like being a market maker to provide liquidity to the IPO and stabilize the price of the stock and if the stock price falls the underwriter will purchase the shares at the low price to stabilize the price, and if the price goes up, the underwriter would use the overallotment option to cover the short position.

There are two major reasons a firm would enter a new issue market. One reason is that the company can refinance itself and gain more fund through issuing while other founders like venture capitalists would like to add more liquidity to their investment. And for other stock holders like the employees, they would like to convert the shares into cash for consuming which in some respects add the liquidity of the shares. And the second reason is that going public for the firm is a better way for raising fund than debt when the projects for which the money is being raised may not generate predictable cash flows in the immediate future, the company may have a difficult time paying the consistent coupon payments required by the issuance of debt. The aim of the issuer is to trade the higher minimum fixed payment for a lower average take (Why New issues are underpriced)[7].

1.2 Issues addressed by "The Optimal IPO Mechanism"[3]

In this paper, the authors focus on the Initial Public Offering mechanism, by analysing the the information among the firms, intermediary,professional investors and retail investors in a adverse selection, which is professional investors and the intermediary hold more private information about the distribution of the demand while retail investors knows the realization of the quantity it receives. And the intermediary does not act in the best interest of their customer(the firm), instead they collude with the institutional investors. So it is a problem of adverse selection, by trying to measure risk and to adjust prices they charge for this risk. And the goal of this paper is to analyse the optimal design of the IPO mechanism. And in the model the optimal IPO has the following characters:

1.price is set as a function of the quantity allocated to each uninformed retail investor, this reveals the relationship between the private signal of the intermediary and the desire of purchasing.

2.In the optimal mechanism, the winner's curse is eliminated and every purchaser share the uniform price from intermediary to the retail investors.

3.The underpricing can be regarded as the informational rent earned by the informed agents.

And through the theorem, the IPO mechanism set in the model, the article has proved that the aunction-like IPO procedures used in U.K. and in France can demonstrate that the data has the same character as the theorem.

1.3 Issues supported by the"Why new issues are underpriced" [7] and the "Seven percent solution"[4]

"Seven percent solution"[4]

Many academic literatures have proved from a certain aspects about the behaviors of the financial institutions participating to IPOs. And the efficiency of the IPO process could be improved by allowing the IPO mechanism to define more precisely of the allocation rule. The article examines several possible explanations for the high average spreads on IPOs in the United States, the striking fact that so many issuers pay exactly 7.0 percent, and the increase in clustering during the past decade. And all the explanations of the article addressed for the high percentage of the spreads indicates the collusion between the investment banks and the collusion between the informed investors and the investment banks are called the Strategic Pricing, which in all proved from the empirical view that the investment banks and the sydicate members are on behalf of themselves instead of the seller.

"Why new issues are underpriced"[7]

In this paper, the authors approach the issue also based on the theory that the intermediary has some information that is superior than other uninformed investors and also the issuing firm. The uninformed investors can observe the movement of the informed investors and also the price corresponding to the demand level whereas this is the only channel the retail investors can observe and premium between the underpriced shares and the price corresponding to the demand can be regarded as the fee earned by the investors who has invested his money into the asset's value investigation that telling the market and other uninformed investors bettween the good deals and the bad deals.

Moreover the underpricing is the natral result of the IPO market since if the intermediary would like the uninformed investors to participate in the allocation, he has to offer a discount price to attract the uninformed meanwhile although reducing the offer price to get more demand is conceivable, the intermediary also has to pay attention to the sufficiency of the discount and this will lead to the problem of setting the optimal offer price which would be a great asset to support the theory of "Optimal IPO Mechanism"

Chapter 2

The model of ”The Optimal IPO mechanism” [3] and asymmetry of information

In this chapter we will discuss in detail about the models in asymmetry of information from the paper ”The Optimal IPO mechanism”.

2.1 Agents

There are four groups of people in the process of IPO

1) The Firm: selling its fixed amount of shares to public market and would like to seek the maximal sale from the process.

2) Intermediary: investment banks, a securities firm or a broker who are not acting in the best interest of the seller (firms) but themselves.

3) The institutional investors: have private information about their valuation of the asset

4) Retail investors: some of whom has the fund to bid in the IPO

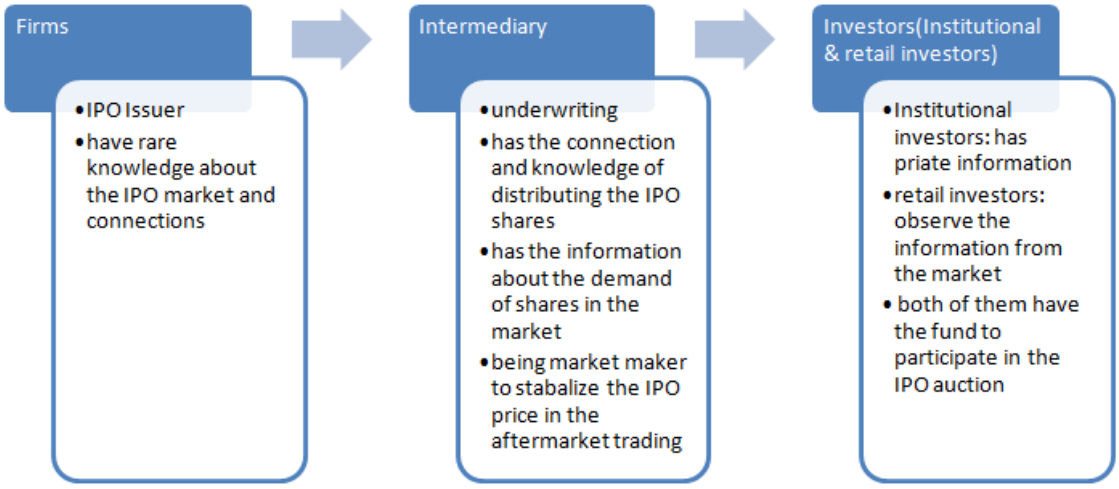

Figure 2.1: Agents Structure

2.2 The pricing mechanism and the adverse selection of the IPO

In the IPO market, when the firm would like to go public, the firm and the investment banks sets an offer price and the offer quantity of the shares. And the investors can bid the offers of the quantity they would like to buy. However, since it is not allowed for any further adjustment for either the quantity and the price, the issuing process may experience the demand is greater than the supply. In such condition, the issuer can only allocate to a fraction of demand which is called rationing. Sometimes, based on demand, the issuer can exercise the ”overrallotment option” or called the ”greenshoe option” which allows the underwriter sell 15% more of the shares issued. It can be regarded as the intermediary short selling of the stocks and buy back in the secondary market if it is a good IPO. Otherwise if

the supply of market shares excess the demand, the intermediary have to purchase themselves and then trade in the secondary market. Whereas each condition is not observable until the offering day and after that the group of investors, intermediary and firms will be devided into two groups: the informed and uninformed.

The informed investors include both the intermediary and the institutional investors. For the intermediary, the "Due diligence" has enforced the intermediary to investigate the firm thoroughly, therefore he knows better about the true value of the firm which will make him better evaluate whether the IPO is overpriced or underpriced. Moreover, due to the "Red Herring" (The process investors submit their indications of interest to the underwriter), the intermediary who is also the underwriter knows the total number of the investors who has the fund to bid, and after knowing so much information he may profit from the aftermarket trading. For the institutional investors, on the other hand, although they do not know the true value of the firm, based on their fund, they can investigate on their own, and get the private information. Thus these two groups of people can be regarded as the informed investors.

The uninformed investors merely include the retail investors who normally have less money than the institutional investors while have no information about the IPO. They will make a decision about the IPO position holding by observing the bahavior of the informed investors.

For the IPO pricing, the price is not simply determined by the bid and demand of the investors. Since not all the investors can get the desired amount of shares, even if the bid price has exceeded the issuer's reservation price. Furthermore, the issuing firm can also bid in the IPO auction which shows that he will also be regarded as the uninformed investors.

Normally, the price of the IPO is underpriced and it can be explained by the asymmetric information theory. It is an adverse selection, which means that investors have to find ways to measure the risk and to adjust the prices to the level they can charge for this risk. So in an adverse selection, the seller owns more infor-

mation and more advantage of the true value of the share than the buyer, in order to attract the uninformed buyer, they have to discount the price so as to attract the uninformed investors. And the greater the information, the higher percentage the price has to discount.

2.2.1 The meaning of being Optimal

In the "An Optimal IPO Mechanism"[3], the Investment banks holds the information about the numbers of retail investors who has the money to bid while the institutional investors have the private information about the true value of the assets being issued into the public market . So asymmetric information and agency problem prevail in the whole IPO process. And the design of the Optimal mechanism is in the best interest of the firms going public. Thus to set up a optimal mechanism, we have to find the following characters:

1. The optimal mechanism equals to a function of IPO price, mapping the quantity allocated to each uninformed retail investor, which can be expressed by the following equation

$$p = P(q) \tag{2.1}$$

2. The optimal mechanism has the uniform price which means that the intermediary, the firms and the investors purchase the share at the same price during the whole process.

3. In the optimal mechanism, the intermediary will underprice the IPO, and the premium between the true value and the price of IPO can be regarded as the compensation for the uninformed investors.

The Model

According to Rock(1986)[7], the professional investors who are informed during the IPO, can demand of I shares at most while retail investors can demand d shares at most and the probability of doing so is $1/u$ and the the random variables determining whether the retail investors has the money to bid and how much they would purchase are i.i.d. Moreover, the total mass of the investors are normalized to 1 while the number of stocks are also normalized to 1 and by the large number law, the mass of retail investors who can bid is $1/u$, so u can be interpreted as: if the uninformed investors buy out all the shares in the IPO, the quantity each retail investor would receive is u.

In the model, the objective of the firm is to maximize the profits from the process of IPO. And the intermediary is the only pass that the firms can distribute and underwrite the IPO, who is the link between the firm and the investors(both institutional and retail investors).

For the IPO, a good deal means that the market valuation of the share v is greater than the price of the IPO p, which is $v > p$, and the professional investors demand I shares. Where on the contrary, if the $v < p$ means the IPO is a bad deal, and the institutional investors would not invest in the auction, so all the shares must be allocated to the retail investors, by which the intermediary would suffer from unable to allocate all the shares. And since the intermediary is the only link between the firms and the investors, while in the aftermarket trading, the intermediary is also in the group of the informed side and do the stabalization of the IPO, being the market maker, it would be reasonable that they will be trying to favour the institutional investors in the IPO market which we usually call the coalition of the informed investors and the intermediary, in order to maximize the profits of their owns.

So for the uninformed investors their expected profit can be expressed in the following equation

$$E(q(v-p)) = \begin{cases} d/(I+d/u) & v > p \\ \text{u} & v < p \end{cases}$$

where the covariance of the v and q is negative. This means if the price goes up, the demand will drop or vice versa.

The IPO process is a process of asymmetric information, the intermediary collects all the intentions of interest before the IPO, so he knows the number of the retail investors who have the fund to bid, but only the distribution, and the retail investors will be more informed of the u ,since they can update their prior on u, conditionally on whether they have the funds to bid.

So for a specific retail investor if he has the funds to bid , we will denote the value of Y as an indicator that equals to 1, and 0 otherwise. Denote $f(u,v,Y)$ be the joint density of these 3 random variables.so

$$f(u,v|Y=1) = \frac{f(u,v,Y=1)}{P(Y=1)} = \frac{P(Y=1|u,v)}{E(1/u)} f(u,v) = \frac{(1/u)f(u,v)}{E(1/u)} \tag{2.2}$$

replace the (u,v) in the function to be Z, we can get a conclusion that

$$E^*(Z) \stackrel{d}{=} E(Z|Y=1) = \frac{E(Z/u)}{E(1/u)} \tag{2.3}$$

2.2.2 the mechanism

The problem is: the intermediary wants to use his information, the number of retail investors who would bid in the auction $(1/u)$ and market valuation of the share v, to determine the price $p(u,v)$ and the quantity $q(u,v)$ while he also receives the commision fee $t(u,v)$, in sum the intermediary would pay $p(u,v) - t(u,v)$ to get the whole shares from the firm if we normalize the shares in total to be 1. And if $t(u,v) = 0$ then he will pay as much as the retail investors.

The incentives for the retail investors and the interediary are listed below:

• **The incentive of the intermediary:**

If we denote B(u,v) to be the profit of the intermediary, the profit of the intermediary is consisted of two parts: the unit margin $(v-p(u,v))$ multiply the quantity of trading $(1-q(u,v)/u)$ plus the commision $t(u,v)$

$$B(u,v) = (v-p(u,v))(1-q(u,v)/u)+t(u,v) \tag{2.4}$$

thus the incentive has become the problem of finding the certain $(\hat{u},\hat{v})$ that satisfies the following condition

$$\forall(u,v),(u,v) \in Arg\max_{(\hat{u},\hat{v})}[(v-p(\hat{u},\hat{v}))(1-q(\hat{u},\hat{v})/u)+t(\hat{u},\hat{v})] \tag{2.5}$$

• **The incentive of the retail investors:**

$$E^*((v-p(u,v))q(u,v) \geq 0 \tag{2.6}$$

The objective of the mechanism is to find

$$(u,v) \rightarrow (p(u,v),q(u,v),t(u,v)) \tag{2.7}$$

which will maximize the revenue of the firm

$$E(p(u,v)-t(u,v))$$

2.2.3 The Theorem and The Implementing Rules

1.The Theorem

Denote

$$(p*(.),q*(.),t*(.))$$

to be the optimal mechanism. $\hat{p} = p^*(u,v)$ is the resulting price and $\hat{q} = q^*(u,v)$ the rationing rate. P has a unique solution. And they will have the following properties:

•The IPO price is uniform that all the investors purchase at the same price which means that the intermediary would not have any commision fees $t^*(u,v) \equiv 0$

•The IPO price is equal to the expectation of the market valuation of the asset,conditional on the quantity allocated to retail investors, which is

$$E^*(v|\hat{q}) = \hat{p} \tag{2.8}$$

Thus

$$E^*(\hat{q}(v-\hat{p})|\hat{q}) = 0 \tag{2.9}$$

So in an adverse selection of the IPO mechanism, the most striking stylized fact is the underpricing. And it equals:

$$E(v-\hat{p}) = E[(1-\hat{q}/u)(v-\hat{p}) + \hat{q}(v-\hat{p})/u] \tag{2.10}$$

and due to $Theorem1 : the\ E^*(v|\hat{q}) = \hat{p}$, we can rewrite it as

$$E(v-\hat{p}) = E[(1-\hat{q}/u)(v-\hat{p})] \tag{2.11}$$

This indicates that the underpricing is because of the informational rent of the informed agent, as in Benveniste and Spindt (1989)[1] and Benveniste and Wilhelm (1990)[2]. And in order to maximize the optimal IPO mechanism we have to minimize the underpricing, in other word we have to minimize the informational rent of the intermediary.
In the paper by Mirrlees(1971)[6], analysing the design of the optimal IPO mechanism, we have to use the dual problem, first let us define

$$U(u,v) \overset{d}{=} uB(1/u,v) \tag{2.12}$$

B is the profit of the intermediary under the condition that he trufully announce the information and u is the quantity of shares each retail investors receive, so U can be

regarded as the profit for the intermediary from each of the retail investors. So if we want to continue minimizing the profit of the intermediary B we have to minimize the U/u instead, so the P_1 has sucessfully converted the problem of minimizing the profit of the intermediary to the minimize the expectation of the $E(U/u)$

$$P_1 : \min E(U/u) = \min E^*(U) \tag{2.13}$$

s.t.
1.the incentives condition of the professional investors is satisfied
2.$U \geq 0$

So we will start with the first condition that makes U work. The condition is to find the (u,v) that makes the profit of the intermediary largest, and by the defination of the $B(u,v)$ while we know that $B = U/u$, so we get

$$U(u,v) = \{\max_{u,\hat{v}}[(v - p(\hat{u},\hat{v}))(u - q(\hat{u},\hat{v})/\hat{u}) + t(\hat{u},\hat{v})]\}u \tag{2.14}$$

$$= \{\max_{u,\hat{v}}[(v - p(\hat{u},\hat{v}))(u - q(\hat{u},\hat{v})) + ut(\hat{u},\hat{v})]\} \tag{2.15}$$

Subtracting uv on both sides and we get

$$U(u,v) - uv = \{\max_{\hat{u},\hat{v}}[p(\hat{u},\hat{v})q(\hat{u},\hat{v}) + \hat{u}(\hat{v} - p(\hat{u},\hat{v}))(1 - q(\hat{u},\hat{v})) + \hat{u}t(\hat{u},\hat{v})]\} \tag{2.16}$$

Since it is a maximum of affine function, so it is convex and by the Fenchel's duality theorem(Rockafellar(1970))[8] any convex function can be obtained for an adequate choice of the mechanism.

Therefore the P_1 has become the following problem

$$P_1 \begin{cases} \min\limits_{U} E^*(U) \\ s.t. \\ U - uv\text{convex} \\ U \geq 0 \end{cases}$$

And we will introduce the P_2. So if in a model where the firm set the price based on the quantity allocated by the intermediary who would also regard maximizing his own profit as his priority.

So the U defined above has become the following:

$$U(u,v) = \max_{q,p\in P(q)} [v - P(q)](u-q) \tag{2.17}$$

then define the expected profit of the intermediary when the firm sets the price shedule:

$$\mathscr{B}(P) = E[\max_{q,p\in P(q)} [v - P(q)](u-q)/u] = E[U(u,v)/u] = E^*(U)E(1/u) \tag{2.18}$$

Thus the P_2 has become the maximization of $\mathscr{B}(P)$. Since P_2 has at least one solution and the optimal price is a differentiable function, and from the appendix of the (Optimal IPO Mechanism)[7] we know that the optimum for the informed agent that for every (u,v) obtained there is a unique q, denoted $q^*(u,v)$, So the first order condition of the profit of the intermediary must equal 0,

$$\lim_{t\to 0^+} \frac{B(P^*(u,v)+tK) - B(P^*(u,v))}{t} = \int K(q^*(u,v)(u - q^*(u,v))f^*(u,v)dudv = 0 \tag{2.19}$$

therefore

$$u - q^*(u,v) = 0 \tag{2.20}$$

And this indicates the incentive the firm will utilize. When the firm would like the intermediary to long more position in the IPO, it will raise the price which will lead to loss in intermediary's profit and if the firm would like the intermediary to sell, he will lower the price. Therefore the optimum of the stage is that the intermediary

would like neither to sell or to buy.

Define $U^*(u,v) = \max(v - P^*(q))(u-q)$ as proved in the proposition 7 of the (Optimal IPO mechanism)[3] $E^*(u|q)q = q$ and $E^*(v|q)q = P^*(q)$, therefore the expectation of the problemP_1 can be converted to

$$E^*(U^*(u,v) - uv|q) = -qP^*(q) \tag{2.21}$$

And by Jensen's inequality due to $U - uv$ is a convex function

$$U(q,P^*(q)) - qP^*(q) \leq E^*(U(u,v) - uv|q) \tag{2.22}$$

And so

$$E^*(U^*(u,v)|q) \leq E^*(U(u,v)|q) \tag{2.23}$$

By the proof above we can conclude that

$$U = uv - (v-p)q - u(p-t) \tag{2.24}$$

and

$$E(p-t) = E(1/u)E^*(u(p-t)) = E(1/u)E^* \tag{2.25}$$

and

$$E(p^* - t^*) = E(1/u)E^*(uv - U^* - (v-p^*)q^*) \tag{2.26}$$

so

$$E(p^* - t^*) - E(p-t) \geq E(1/u)[E^*(U) - E^*(U^*)] \geq 0 \tag{2.27}$$

This is the desired result of the mechanism

2. The Implementing Rules

The optimal mechanism can be implemented by the following rules:

• The firm sets the price as a function of the rationing rate
• the intermediary observes the (u, v) in the adverse selection and sets the rationing rate q to maximize the profit.
•According to the Theorem and the first rule, the price schedule can be written in the following equation:

$$P^*(q) = P^*(q^*(u,v)) = p^*(u,v) \tag{2.28}$$

So the optimal price is a funtion with repect to the number of allocation to the retail investors and the market valuation of each share. When the intermediary investigate that the price of the stock is underpriced, he would also like to profit from it. This means that he has to buy the stocks from the uninformed investors: the retail investors in the after market trading. To achieve this, the intermediary has to ration more to the retail investors. Which by the information of the rationing conveyed, the price of the stock must shift upward.

To consider it more precisely, we can consider this price adjustment in another way: from the view of the informed investors. From the rules above we can see that the mechanism has simplified the price function to be only with repect to the quantity of allocation $p = P(q)$, and used the iso-profit curve. Meanwhile it has set the informed profit to a positive constant K, so we can get the following equation:

$$p = v - \frac{K}{1 - q/u} \tag{2.29}$$

It is very clear that it is a graph of the typical hyperbola, with the point (u,v) in

the center, and by the incentive of the agents, the informed investors has assure that their profit to be positive in order to trade. And we can see from the graph that

• when $u > p$ that means the the market value has to be greater than the price when he purchase, therefore $v > p$.

• When he sells, $u < q$, which indicates that $v < p$.

This means that when the informed investors decrease the price of stock, he can make his purchases more profitable otherwise he can make a more quantitative purchase while reducing the volume of purchases.

Let us take the first derivative of the price equation and get

$$-P'(q) = \frac{v - P(q)}{u - q} \tag{2.30}$$

Since the

$$\frac{v - P(q)}{u - q} > 0 \tag{2.31}$$

Therefore the optimal price is decreasing in the quantity allocated to each uninformed investors.

And by the equation above, we can see that

$$v = -P'(q)(u - q) + P(q) \tag{2.32}$$

This means that after receiving the information about the number of retail investors who have the fund to bid, the intermediary will determine the quantity and the price of the stock, which means the indifference curve of the intermediary is tangent to the price function at this point .

2.3 Asymmetric information in the IPO mechanism

In the process of building up the optimal IPO mechanism, the asymmetric information is the major consideration. The intermediary who is also the seller holds more information than the retail investors and this has resulted in the underpricing of the IPOs which from the retail investors' point of view is "the money left on the table"and the underpricing can be regarded as kind of compensation to the retail investors for the informational rent.

But for the asymmetric information in the IPO mechanism, it is the adverse selection rather than the moral hazard, since the retail investors lack the information about their own risk. And by observing the informed investors and intermediary's behavior, the retail investors can predict the information about the asset. If an investor finds that he receives none of the underpriced issues due to rationing, then he will turn down the valuation of his new shares while refuse to purchase more new shares until the price falls enough to compensate him for his informational disadvantage.

Thus in an adverse selection problem, the uninformed investors can be regarded as the driver who help to let informed ones extract information in the machanism. Obviously the informed investors's profits must be greater than the uninformed investors otherwise they would be as the uninformed investors or keep the information. Therefore the uninformed investors play a significant role as the minimum profit benchmark for the informed investors. And this also on the other hand propel the informed investors to reveal their information and in the end attract more uninformed investors to participate in the IPO process.

Chapter 3

Conclusion

In the IPO market where the intermediary is the underwriter who underwrites the IPO and allocates the shares to the informed investors and the uninformed retail investors, and he gets the commision from the firm. While in an optimal mechanism, our goal is to protect the benefit of the firms issuing the IPO. Whereas the battle between the Firm and Underwriter does not end in the issuing process but continues on to the after market trading. Since mentioned in the previous chapter the underpricing is a good way to attract the uninformed investors which is also regarded as a compensation to the uninformed investors

In the paper "When the Underwriter is the market maker"[5], the author has focused on the aftermarket trading especially focusing on the collusion between the intermediary and the institutional investors. This is not the adverse selection any more but the moral hazard, since for his own benefit, the intermediary would underprice the IPO not only intentional to attract the uninformed retail investors, but also would like to do so for his own sake . And the paper has examined the trading activity in the 90-day period after the IPO. This has not only demonstrated the positive effect of the intermediary while also reveals the negtive affects which can be combined with the previous chapter of how to form an optimal IPO mechanism.

3.1 Being a market maker

After the allocation of the IPO, the intermediary becomes the market maker of the IPO who will be in charge of the stabalization of the IPO price and also provide liquidity to the market. Here comes the problem, since the intermediary's concern is to maximize the profit of his own instead of the interest of the firm proved in the IPO session, he would do the same in the aftermarket trading process.

Aftermarket activities: stabilization and overallotment option

For the stabalization activities, the underwriter will support the price of the stock by purchasing more shares if the order falls. And the stabilization can only be done when the price is under or below the offering price. If the price goes up, the intermediary will use the overallotment to cover its short position and if the price goes down, he will buy the stocks in the open market.

Risk of holding the inventory

Shown in the paper "when the underwriter is the market maker"[5], although holding the large inventory has a substantial risk, the intermediary may suffer from the falling of the IPO price when providing liquidity as a market maker, whereas the paper has examined the trading and found that the risk of the large inventory position is much lower since most of his purchases are used to offset his initial position, since on the offering day the underwriter can be regarded as holding a short position and if the issue is good, he will use the overallotment option to cover his short position or if the issue is bad, he will purchase the shares from the market to cover.

Profits of the market making

The market making profits of the underwriter includes both the profits of his inventory position and the trading profits which are:

1.Holding the inventory which helps the intermediary to perform as a market maker in IPO process.

2.The stabalization of the market to buy or sell.

Most of the intermediary will be the market maker after the IPO, although having the obligation to be the liquidity provider, he also benifits from trading in the aftermarket. The profits of the market making according to the paper is profitable, since the risk of inventory positions shown above can be lowered by the over-allotment option positively and the inventory profit is positive[5](examined in the paper), and the trading is a profitable activity for the market maker. Thus the whole market making actitivity is profitable.

3.2 Connection to the Optimal IPO mechanism

From the paper, since the market making is profitable which will attract the intermediary to participate, while the underwriters make greater trading profits for good issues and it was the underwriter who sets the price of the IPO, thus the underwriter has a great incentive to underprice the IPO which can be an asset for the informational rent of the Optimal IPO mechanism's character.

3.3 Conclusion

The essay provides a complete description about the Optimal IPO mechanism from introducing the asymmetric information of the agents, the relation among agents, the characters of the optimal IPO mechanism, and the theorem built in the model.

The Theorem, described in the optimal mechanism, characterize the relation between the price and allocations and in the optimal IPO mechanism the winner's curse is eliminated while the IPO price is uniform that all investors purchase the shares at the same price. The implementing rules reveal the relation between the optimal price schedule and the rationing rate. And the construction of the proof of the theorems are based on the dual problem by Mirrlees(1971)[6].

In all, the optimal IPO mechanism have the following three characters:
• The optimal mechanism is a price function which mapping the quantity into the IPO price.

• The optimal mechanism requires the uniform price.
• The price of the IPO is decreasing while the quantity allocated to the retail investors is increasing.

The whole problem is an adverse selection and for the aftermarket trading, it becomes the moral hazard and can be proved from the view of assymetric information, there are more things can be done, since the paper has concentrated on the IPO mechanism in the primary market and the coalition with the institutional investors has been analyzed in the model, and as described in the paper, the underpricing seems a kind of way to attract the uninformed investors. However, how to prevent the intermediary from underpricing in the primary market and then purchase the shares on the secondary market which has enormously encroached the profit of the issuer is a problem that can be extended in the future.

Bibliography

[1] L. M. Benveniste and P. A. Spindt. How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics*, 24 (2):343–361, 1989. → pages 13

[2] L. M. Benveniste and W. J. Wilhelm. A comparative analysis of ipo proceeds under alternative regulatory environments. *Journal of Financial Economics*, 28(1-2):173–207, 1990. → pages 13

[3] B. Biais, P. Bossaerts, and J.-C. Rochet. An optimal ipo mechanism. *The Review of Economic Studies*, 69(1):117–146, 2002. URL http://restud.oxfordjournals.org/content/69/1/117.abstract. → pages 3, 6, 9, 16

[4] H.-C. Chen and J. R. Ritter. The seven percent solution. *The Journal of Finance*, 55(3):pp. 1105–1131, Jun., 2000. ISSN 00221082. URL http://www.jstor.org/stable/222447. → pages 4

[5] K. Ellis, R. Michaely, and M. O'Hara. When the underwriter is the market maker: An examination of trading in the ipo aftermarket. *The Journal of Finance*, 55(3):pp. 1039–1074, Jun., 2000. ISSN 00221082. URL http://www.jstor.org/stable/222445. → pages 1, 20, 21, 22

[6] J. A. Mirrlees. An exploration in the theory of optimum income taxation. *The Review of Economic Studies*, 38(2):pp. 175–208, 1971. ISSN 00346527. → pages 13, 22

[7] K. Rock. Why new issues are underpriced. *Journal of Financial Economics*, 15(1-2):187–212, 1986. URL http://ideas.repec.org/a/eee/jfinec/v15y1986i1-2p187-212.html. → pages 3, 4, 5, 10, 15

[8] T. ROCKAFELLAR. Convex analysis. 1972. → pages 14