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1. Introduction

Initial Public Offering (IPO) is the issue of shares to the public from a company that was not publicly traded previously i.e. one that is going public for the first time. There are a lot of questions associated with the IPO of shares, for example why should firms go public, at what time during the life cycle of a company should they go public, to whom should they sell the shares etc. Various attempts have been made to explain these aspects and a range of theories and opinions have become more or less established in contemporary IPO literature.

Shares can also be sold to a single investor or to a few large investors, often called Angels or Venture capitalists. In that case we are not talking about IPO and although this is also interesting to elaborate, it is beyond the scope of my work and will not be considered here. The main feature is that pre-IPO investors, usually no more than a few, do not hold diversified portfolios and IPO allows more dispersion of ownership, with advantages and disadvantages.

A company may go public due to founder's willingness to raise equity capital, to diversify their portfolios, to finance a new project when the funds were not raised by the founders or received from the banks, to use some of the positive actual market conditions etc.

The main question that I will try to answer is how to evaluate and set the price of shares that the company intends to issue. The work will be based on the articles of famous economists and my personal opinions, queries and conversations with specialists. Deeper research is problematic due to the fact that investment bankers are not willing (and not allowed) to provide the data about bids and allocations, about long-term relationships between them and potential investors, and all other information that could shed some light on their pricing decisions.

By starting with the IPO, it must be stated that every share is difficult and costly to evaluate because there are lots of events that may influence the price of shares; like systematic and idiosyncratic risks, investor's sentiments, market movements etc., and all of these factors have to be put together in order to attempt to give a general opinion on what the price of this share could be. Even more effort has to be taken to evaluate and determine the price of shares that will

be issued, because there are no past analyst reports to read and no past market price to observe.

A lot of firms that go public for the first time (especially in the US) are young companies and it is very difficult to evaluate their strategic plan, compare them to their competitors, make a forecast of their possible future earnings and cash flows, find out their industry perspectives and other factors, evaluate their growth possibilities and management skills, and the actions which they will and can take.

Hence, it is a very difficult task, to determine the price of a newly issued share with no trading history, that the issuing company and its underwriter are faced with.

Some practitioners say that pricing an IPO is "part art and part science." The science is using comparable traded companies to assign a price to the IPO. The art is determining the market's interest in the offering.¹

Due to these obvious difficulties, that a company wishing to go public faces, it is common that the tasks of determining the price of the shares, and finding and attracting potential investors for the company are delegated to an underwriter. An underwriter is a specialized firm that determines the offer price of shares and conducts the marketing and selling, for which it earns a fee.

A company may wish to go public without using an investment banker in what has come to be called direct public offering (DPO). This process will not be considered here.

The task of an underwriter, who is normally an Investment banker, is to assist the issuing firm in designing and timing security offerings, formulating plans for raising funds through the capital markets and organizing the distribution. One fundamental economic function of the investment banker is to underwrite the risk of fluctuations in the market price of the securities being issued, during the time of the offering.²

¹ Corwin, Shane A. , and P. Schultz, 2005, The Role of IPO Underwriting Syndicates: Pricing, Information Production, and Underwriter Competition, *The Journal of Finance* 60, pp 448.

² see Mandelker, G. and A. Raviv, 1977, Investment Banking: An Economic Analysis of Optimal Underwriting Contracts, *The Journal of Finance* 32, pp 683.

The main advantages of employing an underwriter, is his reputation capital, his skills in evaluating the shares and determining the price, and his good contacts with potential investors. But a major advantage of using an Investment banker as underwriter is the fact that, while entrepreneurs approach the equity market only once, the investment banker interacts repeatedly with the equity market. Not only are they more skilled and experienced, they have also a reputation capital which they are afraid to lose, which forces them to evaluate honestly and make fair estimate of the firms value. Investment banks therefore face a trade-off between setting strict standards in evaluating firms, which is costly in the short run but beneficial in the long run, and setting low standards which would probably damage their reputation but be beneficial in the short run. Stricter evaluation standards lower the probability of incorrectly marketing a bad firm as a good one.

The objective of an investment bank is to maximize the expected value of its future profits. If the present value of future expected profits is bigger than the possible earnings from setting a low evaluation standard in the present and earning a profit by falsely advertising a bad firm as a good one, no rational investment banker will set low standards.

When a firm decides to go public, it has to consider and evaluate the potential benefits and associated costs of going public. There are lots of possible benefits that come from publicly traded shares, diversified ownership, venture capitalists etc., but there are also some costs of going public, in form of underwriter's fees and underpricing of the issue. More about that will be discussed in the forthcoming chapters.

There are also some anomalies related to the IPO of common shares, for example the underpricing phenomenon, long run underperformance of IPO shares and "Hot Issue" market. I will make a significant effort to explain these phenomena and give a broader view of existing theories related to these anomalies, which are inconsistent with the efficient markets theory that once an IPO stock is publicly traded, it is like any other stock, i.e. that the after-market stock price should appropriately reflect the stocks' intrinsic value.

A significant effort will also be given to explaining the diversification of ownership, i.e. at what time to sell the stock, to whom to sell and what are the benefits and disadvantages of dispersed and concentrated ownership.

For example, when stock is publicly traded the additional benefits for original stock holders is enhanced liquidity, which allows a company to raise capital on more favorable terms and sell shares easily in open-market transactions than if it had to compensate investors for the lack of liquidity associated with a privately-held company. There are of course the costs that come with these benefits, in the form of ongoing costs associated with the need to supply information on a regular basis to investors and regulators. Furthermore, there are substantial costs associated with IPOs that can be categorized as direct and indirect costs. Direct costs include legal, auditing, and underwriting fees. Indirect costs are the management time, effort devoted to conducting the offering, and underpricing. These direct and indirect costs affect the cost of capital for firms going public.³

Theory predicts that early in its life cycle, a firm will be private, but if it grows sufficiently large, it becomes optimal to go public. As long as the firm is private, any equity investment is illiquid. As stated before, there are costs that a potential investor faces with this lack of liquidity and lack of diversification, for which he will have to be compensated. There are also advantages of raising the capital from a few investors, as while they will be engaged in monitoring activities and the proprietary information will be disclosed to them. According to that, a firm faces a simple trade-off, between the benefits and costs of dispersed and concentrated ownership. When the cost of concentrated ownership outweighs the benefits, the firm will go public, and until then it will be privately owned.

All theories of going public and selling the shares to diversified owners assume that there are two type of investors, informed and uninformed. Neither the wealth of the informed nor that of the uninformed is assumed to be sufficient enough to absorb the whole issue⁴. Therefore, a part of the shares has to be sold to informed investors and a part of the shares to uninformed investors. The one

³ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2.

⁴ Some authors do have different assumptions, as shown in the Chapter 3.1.

price rule, which states that the same price charged to informed investors must also be charged to uninformed investors implies that the shares must be underpriced on average.

The existence of different types of investors is a very propitious thing, from the both underwriter's and issuer's view-point. Intuition suggests the following: Informed investors may have (or are able to produce) the information that may be valuable to pricing the issue. Consequently, a key design feature of the IPO process is to incentivize informed investors to acquire and reveal this favorable information to the underwriter in order to include this information in the process of pricing the shares. So the informed investors have to be incentivized to participate and to reveal information unknown to others.

The second important feature is that uninformed investors must also be incentivized to participate. They have to be allocated some minimum amount of shares due to the fact that the wealth of informed is assumed not to be large enough to absorb the whole issue and the fact that the listing requirements generally require a certain percentage of stock that must be widely held, in order to achieve a minimum average daily trading volume. It is important to mention here that secondary market liquidity increases with the level of ownership dispersion, which in turn increases the total information costs and underpricing.

Each investor has three alternatives when a firm makes an IPO: ignore the IPO, engage in uninformed bidding for shares in the IPO or conduct a costly evaluation of the firm, and depending on the outcome, bid (if he gets a good evaluation) or not bid (if he gets a bad evaluation) for a share. Among these alternatives, each investor chooses the one that maximizes the expected value of his time 1 cash flow.⁵

Because of the necessity to attract uninformed investors IPOs have to be underpriced on average. Underpricing is a cost known as 'the money left on the table'. It is commonly defined as the percentage price change from the offer price to the first day's closing price, unless there are some stock exchange restrictions in the allowed daily stock price movements (for example 10% of daily volatility

⁵ see Chemmanur, Thomas J. and P. Fuglieri, 1999, A Theory of the Going-Public Decision, The Review of Financial Studies 12, pp 258.

limit). In that case underpricing will be measured as the price change from the offering price to the one week closing price.

The focus of this work will be to explain the features of the going public decisions, implications and associated effects, with the main emphasis on explaining and providing some models for determining the share price and trade-offs that underwriters are faced to when trying to calculate and set the offer price.

2. Theoretical Implications of Initial Public Offerings

As mentioned already in the Introduction chapter, an IPO firm raises capital by selling shares. There are two possible 'sources' from where new shares come from; either by issuing new stakes of ownership and so nominally raising the ownership capital or by selling the original shareholders' stakes of the firm. The firms' objective is to raise desired amount of capital by retaining the largest possible amount of ownership in the firm.

The most important feature and question related with IPO is what are these new issued shares actually worth? The intuition should be straightforward; valuing IPO shares should not be different from valuing other stocks. The common approaches of discounted cash flow analysis and comparable firm analysis can be used. Why this is not so easy is that, as many IPOs are of young growth firms and high technology industries, historical accounting information is of limited use in projecting future profits or cash flows. A preliminary valuation may therefore rely on how the market is valuing comparable firms.⁶ This is also not so reliable, since there are lot of factors that can influence a young firm's market performance, especially their owner's skills and decisions, which are difficult to evaluate.

Due to the fact that IPOs are difficult to evaluate, Securities Exchange Commission, which has to register and approve United States IPO issues is 'explicitly concerned with full disclosure of material information, and does not attempt to determine whether a security is fairly priced or not'.⁷ The goal is to force a going-public company to supply audited financial statements. That is the reason why the most issuers employ underwriters when going public. Beside their marketing and selling effort and assistance in pricing, the investment banker provides auditing for financial statements. The investment banker will also conduct due diligence investigation of the firm, write the prospectus and file the necessary documents with the S.E.C.

The theory has recognized two possible sources of a buyer's valuation of a company which the incumbent should seek to capture: increase in cash flow and the increase in private benefit of control. When deciding whether to go public or

⁶ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 3.

⁷ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 1.

not and what fraction to sell, the initial owner must balance these two factors⁸. By selling to disperse shareholders, original owners maximize their proceeds from the sale of cash flow rights, and by directly bargaining with a potential buyer, a so called venture capitalist, they maximize the proceeds from the sale of control rights. Cash flow rights are of course enjoyed by all shareholders in proportion to the size of their equity stake in the company, and private benefits are captured only by the controlling shareholder. The theory behind this intuition is that there are two important factors that influence a company's value⁹; the observed and verifiable income produced by the company, and the private benefits of control, an observable but non-verifiable component, which only the party that has control over the use of corporate resources can enjoy. By issuing shares to outside shareholders, the initial owner claims only to give them a fraction of the verifiable income that the company will produce in the future.

This existence of different types of possible investors may give a trade-off answering the question at what stage of its life should a firm go public rather than undertake its project using private equity financing? If the intuition is that the venture capitalist has private information about his firm's value and that outsiders can reduce this informational disadvantage by evaluating the firm at a cost, the equilibrium timing of the going-public decision is determined by the tradeoff between minimizing the duplication in information production by outsiders and avoiding the risk-premium demanded by venture capitalists.¹⁰

A firm bears lots of costs when going public, but the most prominent are of course underwriting costs, underpricing costs, annual disclosure costs and the agency problem costs generated by a separation of ownership and control. The most prominent benefits are diversification, greater possibility of equity financing, publicity, outside monitoring etc.¹¹

The next chapter will try to shed light on, and give some theoretical remarks on, the underwriting process; a process that a firm going public and employing an underwriter will be faced with.

⁸ see Zinagles, L. ,1995, Insider Ownership and the Decision to Go Public, Review of Economic Studies 62, pp 425.

⁹ see Zinagles (1995) pp 428.

¹⁰ see Chemmanur, Thomas J. and P. Fuglieri (1999) pp 249 and pp 256.

¹¹ see Zinagles (1995) pp 425.

2.1. Underwriting process

Underwriting is an important point in explaining the IPO process. Firms that will go public in most of the cases employ an underwriter, which is, as stated before, a firm that helps the issuing firm in preparing the IPO process, soliciting the indications of interest from potential investors and factor those information into IPO process, marketing and selling the issue, setting the price of IPO and giving opinions (i.e. analyst coverage) about the stock's aftermarket performance to investors once the stock starts publicly trading etc. An underwriter can be viewed as a middle man who works between the potential investors and a going public company. Mainly the Investment banks play the role of IPO underwriters.

An underwriter is assumed to be a company which repeatedly appears in the IPO process and an IPO company uses its knowledge, skills, influence, business connections and reputation capital to ease its own going public process.

Wishing to set IPO share price, Investment banker use accounting information (earnings, sales, book value, operating cash flow, different ratios etc.) and comparable firms multiplies as benchmark for choosing a preliminary offer price range plus collecting the indications of interest, i.e. demand from potential investors to get much more accurate pricing.¹²

There is a wealth of literature¹³ that discusses various valuation methods, including: comparable firms' approach (which use market multiples as of a peer group), discounted cash-flow approach and asset-based approach, each with their advantages and disadvantages. The comparable firm approach works well when comparable firms are available, but has no protection against entire sector being over- or under-valued. These ratios essentially have only limited use if historical numbers rather than forecasts are used.

The discount cash flow method is, on the other hand, focused on the firm itself, but it is very difficult to make an honest estimate of firm's future cash flows and appropriate discount rate. The asset based approach, as the third valuation method is relevant when a significant portion of the asset can be liquidated quickly

¹² see Moonchul, K., and Jay R. Ritter, 1999, Valuing IPOs, Journal of Financial Economics 53, pp 2.

¹³ see Moonchul, K., and Jay R. Ritter (1999) pp 3.

at market prices. But for most IPOs, this approach has little evidence since most of stock value comes from growth opportunities rather than assets in place.

Within an industry, the variation in these ratios can be large, so they have only modest predictive value. Many idiosyncratic factors are not captured by industry multiples unless various adjustments for differences in growth and profitability are made. With the use of earnings forecasts, the valuation accuracy improves substantially. It is worth mentioning that the valuation accuracy is higher for older firms than for young firms. It is obvious that older firms have more data to use than young firms, which makes the estimate more accurate. The difficulty with using comparable firm multiples for valuing IPOs, without further adjustments, leaves a large role for investment bankers in valuing IPOs.¹⁴ Namely investment bankers are able to achieve additional valuation accuracy by canvassing market demand before setting a final offer price and to set the final offer price conditional on the market feedback they receive from potential investors.

Moonchul and Ritter [33] argue, that although 'much attention has been focused on the wide variation between the offer price and subsequent market prices that occur in practice, the pricing precision would be much worse if a mechanical algorithm was used instead.'¹⁵

The common way on which underwriters base their pricing decision is by first starting with an analysis of the market price ratios, adjusting for firm-specific differences, and then trying to determine a minimum and maximum offer price. After that, they gather more information about the IPO market by collecting the indications of interest from potential investors and depending on their expectations set a final offer price.¹⁶

Marketing and analyzing of IPO companies by reliable underwriters is also in the interest of potential investors, because the expected allocation an investor can expect may be too small to compensate him for the costs of analyzing the

¹⁴ see Moonchul, K., and Jay R. Ritter (1999) pp 19.

¹⁵ see Moonchul, K., and Jay R. Ritter (1999) pp 19.

¹⁶ see Moonchul, K., and Jay R. Ritter (1999) pp 7.

offering. Hence, potential investors will have to rely on the underwriter's information.¹⁷

Another reason to employ an Investment banker is his distribution and marketing effort. An investment banker, due to his business connections and skills, can generate demand for the issue. He can persuade customers to purchase, or he can certify the issue by putting his reputation behind it as well.¹⁸ A major advantage of the investment banker, beside already mentioned, is his reputation. An investment bank is namely an established institution with a lot of IPOs behind it and many to come as well. It is not willing to misrepresent the value of the issue to the potential investors because by doing so it would damage its own reputation, be pushed away from the market and lose its entire market place. The potential investors will be much more confident in the investment banker's value estimation than in the company's own estimation. The IPO Company itself cannot offer credible assurance that the offering price is not too high, i.e. below the expected market price. While entering the IPO market by definition only once, IPO firms therefore have much more incentive to misrepresent their own value and try to earn, cheating the investors by falsely representing themselves as a higher quality than they actually are.

The Underwriters' reputation is not only valuable for its credibility and trustworthiness, but also for the fact that the underwriter can reduce the costs of going public by allocating the IPO shares to regular investors and forcing them to participate in every issue even when they might not be willing, but are forced to do so because of the threat of reducing allocation priority in future if rejecting participation in every issue. The trade-off is that the expected value of future profits should exceed the possible losses incurred through participation in current issue. This way, investors' expected revenue can be reduced, in the favor of the issuer.

An underwriter faces a difficult task, namely, if on average it does not underprice its offerings enough, the average initial return will be too low and

¹⁷ see Tiniç, Seha M., 1988, Anatomy of Initial Public Offerings of Common Stock, The Journal of Finance 43, pp 798.

¹⁸ see Baron, David P., 1982, A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues, The Journal of Finance 37, pp 956.

investors will stop doing business with this underwriter. On the other hand, if it underprices its offerings too much, so that the average initial return is too high, potential issuers will cease using this underwriter.¹⁹

An important feature, to be further discussed in forthcoming chapters, is that not only the issuing company, but sometimes also potential investors are willing to misrepresent their valuation and findings, in order to benefit from falsely reporting their own estimates. The basic difficulty that an underwriter, wishing to collect information useful to pricing an issue, faces is therefore to force investors with information that can be useful in pricing the issue to report truthfully.²⁰

The focus of many IPO articles was to find out whether the issuer is more informed than the investor, or the opposite. If the issuer is better informed, rational investors would fear a lemon's problem. On the other hand if investors are more informed than the issuer then the issuer faces a placement problem, because he does not know the price the market is willing to bear and hence faces an unknown demand for its stock. In both cases, the observed (successful) IPOs necessarily have to be underpriced.²¹ Most theories imply that firms with greater uncertainty about their share value will be underpriced more and firms wishing to issue shares have incentives to reduce the amount of uncertainty that possible investors are faced with.²²

The common view on potential IPO investors accepts the fact that investors are not equally informed. Some are better informed, i.e. have preferential information and are informed even better than the underwriter (about the IPO firm, its competitors and market conditions for example), and others are less informed, the so called uninformed. If for example all investors were equally informed, then only underpriced shares could start trading because nobody would buy overpriced issues. There are, however, some overpriced firms that do go public, which would

¹⁹ see Beatty, Randolph P. and Jay R. Ritter, 1986, Investment banking, reputation and the underpricing of initial public offerings, *Journal of Financial Economics* 15, pp 217.

²⁰ see Benveniste, L. and P.A. Spindt, 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, *Journal of Financial Economics* 24, pp 344.

²¹ see Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, pp 1803.

²² This will be explained in more detail in the next Chapter.

not be predicted because all investors are assumed to know that these would be overpriced.²³

These informed investors are for sure not willing to reveal their positive information before the stock is on the market, because 'by keeping such information to themselves until after the offering investors can benefit; they would pay a low initial price for the stock and then could sell it at the full information price in the post offering market.'²⁴

The important part of Investment banker's work is to overcome these incentives, i.e. to induce informed investors to reveal their information. This can only be done if the investors with preferential information will be better-off revealing their information than retaining it for themselves.²⁵

After soliciting interest and making an estimate of offer price range, investment bankers promote the issue and induce an adequate number²⁶ of investors to investigate the issue and produce private estimates of value. After that, 'conditional on issuer's desired ownership dispersion and secondary market liquidity, investment bankers set a final offering price based on the estimates of total information costs and expected demand for shares.'²⁷

Nobody knows what the market performance of the stock will be when trading starts. If the demand is weak, investment bankers may try to stabilize the price by somehow reducing selling pressure. This type of market manipulation is the only one that Securities Exchange Commission allows. These price stabilization activities include pre-IPO allocation policy, post-IPO purchases of shares by the lead underwriter, and the discouragement of selling.²⁸

Hence, the underwriter services are very important for an IPO company wishing to make its going public process reliable and attractive to potential investors.

²³ see Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, pp 1804.

²⁴ see Benveniste, L. and P.A. Spindt (1989) pp 344.

²⁵ For more about this part of IPO process see Chapter 3.1.

²⁶ More about the adequate number of informed investors is going to be stated in the Chapter 3.4.

²⁷ see Booth, J. and L. Chua, 1996, Ownership dispersion, costly information and IPO underpricing *Journal of Financial Economics* 41, pp 292.

²⁸ see Ritter, Jay R. and I. Welch, (2002) pp 1804.

In the next chapter one of the most controversial facts related to IPO of shares will be described and tried to explain, namely the underpricing of IPOs.

2.2. Underpricing phenomenon

Underpricing is one of the costs that may²⁹ occur when a firm goes public. This is not literally a cost that the firm issuing shares has to pay; it is more the cost in the sense of foregone profits. For example, the shares are issued and at the end of the first trading day the price is 20% above the issuing price. Assuming that the shares actually could have been sold at this price, i.e. that the demand for shares is inelastic (whether or not this assumption holds is another important issue not considered here), the cost is then the multiple of number of shares issued times the change from offer price to first day closing price. Underpricing is therefore the cost and the amount of this cost is often referred as the 'money left on the table'.³⁰

This definition prevails, although some researchers argue with it. For example, Baron [3] shows that the underpricing is not simply the amount of money left on the table. He states that underpricing entails a wealth transfer from original shareholders to the new shareholders. The gains of these new purchasers must be equal to losses of original shareholders. From this wealth perspective, he states that the proper percentage measure of underpricing from the issuer's point of view depends on the extent to which "old" shareholders participate in the offering by selling their own shares. This is closely explained in the following sentence. If prior owners issue small IPOs in relation to their own shares, they will be less concerned with underpricing. They will be more concerned with underpricing as the size of the issue grows (relative to their own holdings) or as they participate further by offering more of their own shares. Thus, from the

²⁹ Some theories imply that underpricing has to occur in every single offering as it is actually a sort of repayment for the costs that informed investors have to bear when scrutinizing the firm. Nevertheless, there are some issues that turn out to be overpriced.

³⁰ see Ljungqvist, A., IPO Underpricing, 2004, Handbooks in Finance: Empirical Corporate Finance, Salomon Center, Stern School of Business, New York University and CEPR, pp. 6.

issuer's viewpoint, underpricing is especially costly in large issues in which a high fraction of the previously outstanding shares is offered.³¹

There are many explanations (attempts of explanations) as to why underpricing occurs and probably all of them contain some element of truth. The underpricing phenomenon has persisted for decades with no signs of imminent demise.³²

The most important theories about underpricing will be explained in this chapter. They are mainly based on uncertainty about the fair stock price, on the existence of different type of investors (uninformed and informed), on the necessity to underprice in order to encourage informed investors to reveal their positive information about the firm etc.

Benveniste and Spindt [6] argue that underpricing arises to provide incentives for regular investors to reveal good information and Rock [36] argues that underpricing is necessary to prevent the uninformed investors from leaving the IPO market. This explanation is controversial while some research³³ demonstrates the huge oversubscription of the issues; issues which could then easily be exhausted by informed demand. The question of what should, in that case, be the benefits of participation of uninformed investors remains unanswered. With oversubscription, rationing³⁴ has to occur. The IPOs may be so significantly oversubscribed because investors may be overstating their true interest in order to be allocated only their expected and desired amount of shares.

Booth and Chua [10] argue that the demand for ownership dispersion creates an incentive to underprice, because underpricing promotes oversubscription, which in turn increases secondary market liquidity and reduces the required return to the investor. I will now emphasize some of the most common accepted explanations of underpricing.

³¹ see Barry, Christopher B., 1989, Initial Public Offering Underpricing: The Issuer's View-A Comment, The Journal of Finance 44, pp 1101.

³² see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 10.

³³ see Koh, F., and T. Walter, 1989, A Direct Test of Rock's Model of the Pricing of Unseasoned Issues, Journal of Financial Economics 23

³⁴ More about rationing in the Chapter 4.3.

2.2.1. Winner's Curse

Winner's curse is one of the possible explanations of underpricing. It is the best known asymmetric information model, introduced in 1986 by Rock [36]. Rock observes some investors as being asymmetrically informed about the prospectus of an IPO, of the firm and its perspectives or about the market where the firm operates. Rock states that underpricing could arise from that fact. His work is an application of the famous lemon's problem. Rock thus assumes two different types of investors; informed and uninformed, with no group having enough funds to participate in the IPO alone, i.e. members of both groups have to participate in the offer. Uninformed investors bid in every offer, and informed investors bid only if their valuation or their expected market value of the share is bigger than the offer price. Assuming that the issuer would allocate the shares in the sense that every offer has an equal chance of being filled, uninformed investors would face so called winner's curse- they will receive their full allocation of the overpriced issues but only a small allocation of underpriced issues. If they get all of the shares which they ask for, it will be because the informed investors did not want the shares. That occurs due to the fact that relatively fixed number of shares are sold at IPO, and if demand is very strong, i.e. number of shares desired is bigger than number of shares offered, then rationing will occur. Rationing itself does not lead to underpricing, but if some investors are at an informational disadvantage relative to others, they will be worse off. If some investors are more likely to attempt to buy shares when an issue is underpriced, then the amount of excess demand will be higher when there is more underpricing.

The average return that uninformed investors earn conditional upon receiving shares is therefore lower than the average initial return conditional upon submitting a purchase order.³⁵ This is so called „winner's curse“ problem: if one is allocated the requested number of shares, one can expect that the initial return will

³⁵ The difference between these two conditional expected returns becomes larger as the dispersion of possible firm values increases. Thus, the uninformed investors will be willing to submit purchase orders for more speculative IPOs only if the expected underpricing is greater than for issues for which there is less ex ante uncertainty about the true firm value. See Ritter, Jay R., 1987, The costs of going public, Journal of Financial Economics 19, pp276.

be less than average.³⁶ Namely, if the IPOs were priced on average at their fair value, i.e. with no discount, retail investors would lose money while allocating a disproportionately small fraction of underpriced offers and a disproportionately large fraction of overpriced offers, and they would withdraw from the market.³⁷ Their demand would not be available any more. Thus, they must be somehow incentivized to participate, and one form of incentives could be to systematically underprice every IPO to offset this winner's curse problem. Thus, to eliminate the winner's curse problem, the expected profit of uninformed investors must be non-negative.

Even though IPOs are on average underpriced, no investor can be sure what an offering's value once it starts publicly trading will be. Beatty and Ritter [4] call this uncertainty *ex ante* uncertainty, and argue that the greater this *ex ante* uncertainty is, the greater will the winner's curse be, and hence the greater expected underpricing will be as well.

This is the main feature of underpricing theories based on asymmetric information³⁸. They predict that the underpricing is positively related to the degree of asymmetric information. When this asymmetric information uncertainty approaches zero in these models, underpricing disappears entirely. This statement makes an incentive for the issuers to voluntarily disclose the information that can be beneficial in reducing the information heterogeneity between informed and uninformed investors.³⁹

Therefore, winner's curse could be easily avoided. Above that, as Welch [48] concludes, winner's curse could also be avoided either by offering IPOs only in pools or by agreeing to withdraw an issue or to compensate in some other way the uninformed investors if demand from informed is not forthcoming.⁴⁰

³⁶ see Beatty, Randolph P. and Jay R. Ritter, 1986, Investment banking, reputation and the underpricing of initial public offerings, *Journal of Financial Economics* 15, pp 215.

³⁷ see Jenkinson, T., and H. Jones, 2007, The Economics of IPO Stabilisation, Syndicates and Naked Shorts, *European Financial Management* 13, pp 626.

³⁸ see Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, pp 1803.

³⁹ see Ritter, Jay R., 1984, The "Hot Issue" Market of 1980, *The Journal of Business* 57, pp 221.

⁴⁰ see Welch, I., 1989, Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings, *The Journal of Finance* 44, pp 421.

As winner's curse explanation of underpricing is based on information asymmetry between informed and uninformed investors, a logical conclusion would be that reducing this asymmetry reduces the underpricing.

2.2.2. Insurance hypothesis of underpricing

Another possible explanation of underpricing, outlined by Tiniç [47] is the Insurance hypothesis of underpricing. It is related to the insurance against legal liabilities and associated damages to investors.

This hypothesis is specially related to the US⁴¹, where the Securities Exchange Commission imposed a 'positive obligation for every professional involved in the offering to diligently examine, inquire, and ensure that every material fact relating to the operations and affairs of the issuer that may affect a potential investor is properly examined and disclosed'⁴². If they do not properly examine and disclose all related and important information, the Securities Act of 1933 makes them (all participants in the offer who sign the prospectus) liable for material omissions.⁴³

While 'due-diligence' investigations are 'fraught with difficulties and uncertainties'⁴⁴, the expected costs of legal liabilities are particularly high for IPOs.

Issuers and investment bankers are subject to legal liabilities and may try to protect themselves by underpricing the issue. Underpricing can be then viewed as implicit insurance against potential liabilities that may arise from the 'due-diligence' and disclosure requirements of the regulation authorities, while Securities Act limits the maximum recoverable damage to the offer price.⁴⁵ Large initial returns

⁴¹ Underpricing is a global phenomenon and liabilities are not.

⁴² see Tiniç, Seha M., 1988, Anatomy of Initial Public Offerings of Common Stock, The Journal of Finance 43, pp 798.

⁴³ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 9.

⁴⁴ see Tiniç, Seha M., 1988, Anatomy of Initial Public Offerings of Common Stock, The Journal of Finance 43, pp 799.

⁴⁵ see Tiniç, Seha M., 1988, Anatomy of Initial Public Offerings of Common Stock, The Journal of Finance 43, pp 800.

will namely 'reduce the probability of a lawsuit and the conditional probability of an adverse judgment'.⁴⁶

These large initial returns are induced by indicating many risk factors in the prospectus and thus shifting the risk to investors. This way, the probability of 'material omission' is curtailed, and underpricing is induced while more risk factors induce uncertainty about stock's performance, which results in increased underpricing.

2.2.3. Cascades

A cascade is another explanation of underpricing, outlined by Welch [50]. Cascades, in some cases also called 'bandwagon effects',⁴⁷ occur when underwriters market IPOs aggressively through the road shows.⁴⁸ If an investment banker markets the issue aggressively, the situation where investors pay no more attention only to their own evaluations and expectations but to the other investors' interest as well can occur. If it happens that some influential investors buy IPO shares and assess the issue as attractive, other investors could start buying shares irrespective of their own original valuation, which they will disregard. This could lead to excess demand for shares, which would be reflected in the high offer price.

Issuers could prefer to strategically underprice in order to encourage early demand and induce some informed and reputable investors to buy initially, and so to induce other investors to follow.

The flip side may occur as well; if an investor notices that other investors are not buying the shares, he can underestimate his own, maybe positive, information about the firms' value, and refuse to buy the shares irrespective of his own information.

⁴⁶ see Tiniç,SehaM., 1988, Anatomy of Initial Public Offerings of Common Stock, The Journal of Finance 43, pp 799.

⁴⁷ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 8.

⁴⁸ Underwriters job of marketing and selling to potential investors is called 'road show'. More about road show will be discussed in forthcoming chapters.

An interesting implication is that, in bandwagon cases, positively-sloped demand curve can occur.⁴⁹ If the offering price is adjusted upwards, investors know that it will be only partial adjusted⁵⁰ and will infer that these offerings are going to be underpriced. Accordingly, they'll try to purchase more shares, which will result in a positively sloped demand curve.

Early investors, knowing the benefits the issuer and investment banker will have if they purchase early, can demand greater underpricing in return for their early offer and thus start a positive cascade.⁵¹

2.2.4. Market feedback hypothesis

The market feedback hypothesis as the attempt to explain underpricing is based on the fact that, when pricing the IPO shares, an investment banker has to canvass the market demand and include a potential investor's indication of interest and their privileged information in the share pricing process. But the question of how to induce informed investors to reveal their preferred information to the investment banker arises. The investment banker can compensate them via underpricing the shares. This is what the market feedback hypothesis states. What would be the benefits of such behavior for the investment banker and the issuer? Well, including the positive information into the pricing process will lead to a higher offer price, but this offer price will only be partially adjusted- so the issuer will benefit and the informed investor will benefit as well. Those IPOs with the price adjusted upwards will therefore be more underpriced than those with a downward adjustment of price.

An informed investor will be promised to receive a bigger allocation⁵² in the shares than he would receive if not revealing the positive information. This way he will be also better-off when revealing positive information about share value.

⁴⁹ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 8.

⁵⁰ More about Partial adjustment phenomenon in the Chapter 4.2.

⁵¹ see Ljungqvist, A., IPO Underpricing, 2004, Handbooks in Finance: Empirical Corporate Finance, Salomon Center, Stern School of Business, New York University and CEPR, pp. 58.

⁵² For more about partial adjustment phenomenon and allocation see Chapter 4.

When there are many informed investors, underpricing arises when they reveal their information, but that in turn increases the ownership dispersion, which increases liquidity and consequently the share price.

The market feedback theory implies that informed investors are rewarded for their preferential information. In a competitive market, investors will choose to become informed as long as the costs of becoming informed are lower than the benefits of becoming informed and to reveal the results of their information gathering process to the investment banker. In equilibrium, as more and more investors enter the market, the costs of becoming informed have to be equal to the benefits of receiving underpriced shares and the costs of becoming informed are actually borne by the firm due to necessity of underpricing. An outsider's expected payoff from producing information, net of information acquisition costs, is zero.⁵³ In that sense, a fact that the firm obtains a significant part of its financing from uninformed investors means that the cost of capital will be reduced.⁵⁴ Beatty and Ritter⁵⁵ [4] model an optimal IPO offer price based on these costs of becoming informed.

One could argue, that if the issuer has to bear all incurred costs of all investors who desire to become informed, then why not to sell shares to a single investor, venture capitalists. This logic holds, but we have to consider the flip side as well; if all shares are bought by a single investor, he will be less diversified and hence desire a risk premium, plus he will have 'considerably more bargaining power relative to the entrepreneur compared to the numerous small investors whose financing the firm can tap in the public equity market'.⁵⁶

In equilibrium, a firm should be indifferent to selling to venture capitalists or to numerous outside investors. The theory predicts that a young firm, where evaluation costs would be large, is better-off when selling to venture capitalists. And as the firm ages, establishes a business and becomes publicly 'known', it's

⁵³ see Chemmanur, Thomas J. and P. Fuglieri, 1999, A Theory of the Going-Public Decision, *The Review of Financial Studies* 12, pp 267.

⁵⁴ see Chemmanur, Thomas J. and P. Fuglieri, 1999, A Theory of the Going-Public Decision, *The Review of Financial Studies* 12, pp 270.

⁵⁵ A closer look to their work will be given in the Chapter 3.3.

⁵⁶ see Chemmanur, Thomas J. and P. Fuglieri, 1999, A Theory of the Going-Public Decision, *The Review of Financial Studies* 12, pp 269.

evaluation costs sink and the firm will be better-off selling to numerous outside investors. The logic is straightforward; these smaller magnitudes of the evaluation cost and the ability to tap numerous small investors by going public will outweigh the disadvantage of the duplication in evaluation costs which occurs in the public equity market.⁵⁷

2.3. Type of underwriting contracts

After explaining the possible sources of underpricing and actions the underwriter can take in order to closely determine IPO share price, I will start to explain the actions which the issuer and investment banker can undertake and different contracts they can sign, in order to put their goals in line.

There are two main ways- or contracts- how an issuer and underwriter can regulate their business. One is firm commitment contract and the other is best effort contract.

The investment bank, having signed a firm-commitment contract with the issuer, usually conducts the marketing campaign and solicits interest from potential investors. At the end of this period, the investment banker and issuer construct a demand curve and, depending on the position of it, set the final offer price. In the best-effort offering, the investment bank is not soliciting the indications of interest. Firm commitment offerings are hence typically sold using bookbuilding⁵⁸ and best effort offerings are conducted via fixed price offerings.⁵⁹

The main difference, despite above mentioned dissimilarities, is that under the firm commitment contract, the underwriter commits to purchasing new issued stock from the firm and then trying to sell them to the public, while with best effort contract arranged, the underwriter commits only to making his best effort in selling the some prespecified minimum and maximum number of shares. So, in the best effort offer the issuing firm bears the proceeds risk, whereas in a firm commitment

⁵⁷ see Chemmanur, Thomas J. and P. Fuglieri, 1999, A Theory of the Going-Public Decision, *The Review of Financial Studies* 12, pp 269.

⁵⁸ see Benveniste, L. and W. Busaba, 1997, Bookbuilding vs. Fixed Price: An Analysis of Competing Strategies for Marketing IPOs, *The Journal of Financial and Quantitative Analysis* 32, pp. 394.

⁵⁹ More about bookbuliding and fixed price offerings will be discussed in forthcoming chapters.

offer this risk is borne by the investment banker. More about firm-commitment and best-effort offerings will be told in the next chapters.

2.3.1. Firm commitment contract

As mentioned already, under a firm commitment contract an investment banker manages and markets the issue, sets together with the issuer a tentative number of shares to be sold and tentative offer price⁶⁰, tries to solicit the investors' interest and depending on received indications together with the issuer sets the offer price. After the completion of these steps, the investment banker is obliged to buy the whole issue from the issuer. But the investment banker will certainly not hold the whole issue for himself; he will rather try to sell the shares on the market. Regardless of over- and under-subscription and of the proceeds of the issue, the issuing firm will receive all the fixed proceeds that the investment banker has guaranteed.

Clearly, in firm commitment offering, the investment banker puts his own capital at risk by committing to buy the securities from the issuer. Investment banker consequently needs reliable information to avoid overpricing this shares and losing money on the offering.⁶¹

While the Investment banker has to purchase all shares not presold at the offer price, he has the incentive to sell the entire issue in the premarket. But, if the investors demand is not forthcoming, he has to induce them to buy shares, and he will be doing this by underpricing the shares.⁶²

If the other extreme occurs, i.e. if the demand exceeds supply, the rationing will occur, and/or the so called 'overallotment option', i.e. Green shoe option, if settled, will be exercised. This option permits the investment banker to sell as many as 15%⁶³ more shares.⁶⁴

⁶⁰ see Ritter, Jay R., 1987, The costs of going public, *Journal of Financial Economics* 19, pp 274.

⁶¹ see Tiniç, Seha M., 1988, Anatomy of Initial Public Offerings of Common Stock, *The Journal of Finance* 43, pp 790.

⁶² see Benveniste, L. and P.A. Spindt, 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, *Journal of Financial Economics* 24, pp 357.

⁶³ Prior to August 1983 it was 10%, see Welch, I., 1991, An empirical Examination of Models of Contract Choice in Initial Public Offerings, *Journal of Financial and Quantitative Analysis* 26, pp 498

This underwriters ability to exercise the option for oversubscribed (i.e. underpriced) offers helps to ameliorate the adverse selection facing uninformed investors,⁶⁵ if there are more shares, uninformed investors will be less rationed and consequently be less frightened of winner's curse problem. Hence, their desired underpricing will be smaller. Similarly, the informed Investors' desired underpricing will also be smaller, while when there are more shares to be allocated to them, then they can receive the same profit with less underpricing per share. Thus, the Over Allotment option reduces the underpricing.

If the investment bankers expect the aftermarket demand to be high, they will exercise the Over Allotment option. And how would they act if they expect the aftermarket demand being weak? In this situation, they may 'presell'⁶⁶ 135% of the offering with the shares above the Over Allotment option representing a naked short position in the stock. If they expect shares to be 'flipped', i.e. sold immediately in the aftermarket, they can buy them back and retire the shares just as if they had never been issued'.⁶⁷ This way they can manipulate the share's price, alleviate the price drop, and earn on a price difference.

An underwriter's incentive is to presell the whole issue, and that promotes underpricing. The stronger ex ante price uncertainty about the offering, the stronger is the underwriters' incentive to presell the issue.⁶⁸ To remove this underwriter's incentive to presell, and consequently reduce the underpricing, a firm facing high price uncertainty may select a best-effort underwriting contract, under which the proceeds are more uncertain⁶⁹, as will be shown in the next chapter.

This situation leads to a trade-off; firms facing more price uncertainty, whose IPOs will consequently have to be most severely underpriced are 'more

⁶⁴ see Rock [36], pp 188.

⁶⁵ see Ritter, Jay R., 1987, The costs of going public, Journal of Financial Economics 19, pp 280.

⁶⁶ I.e. sell on the premarket to the regular (informed) investors.

⁶⁷ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 21.

⁶⁸ see Benveniste, L. and P.A. Spindt, 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, Journal of Financial Economics 24, pp 345.

⁶⁹ This uncertainty can be reduced by stipulating a minimum-sales constraint, but this revives the underwriter's incentive to presell the issue.

likely to choose best-effort contracts, whereas those whose owners are most risk-averse are more likely to choose firm-commitment contracts.⁷⁰

Firm commitment offer is an offer without any selling requirements, but they are not simply best effort offerings with zero sales requirements;⁷¹ here the underwriter commits to accept any unsold shares, what is not the case in the best-effort offerings.

If the underwriter will not guarantee a sufficiently high price that the issuer is happy with, the firm-commitment offering will be thus converted to best-effort offering if the firm desires to take its chance on the market rather than accept lower investment's banker price proposal.

The total net proceeds the issuer gets are lower than the multiple of shares issued and the offering price- since the investment banker may not sell the shares for a bigger price than the offering price, and since he must also earn something, the actual amount that the issuing firm receives is issuing proceeds minus the investment banker fees.⁷²

2.3.2. Best effort contract

The Best effort contract is the second possible contract that IPO firm can underwrite with its investment banker. The main difference from the firm-commitment offering is that, under the best effort contract, the investment banker is only employed for distribution and does not underwrite the issue. The investment banker is simply employed to provide its best efforts to obtain purchasers for the newly issued securities. It does not commit to buy the whole issue from the issuer and therefore, the whole risk is born by the issuing firm.⁷³

As argued in the previous chapter, firms with higher ex ante uncertainty about its share value will most likely prefer to use a best effort contract than the

⁷⁰ see Benveniste, L. and P.A. Spindt, 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, *Journal of Financial Economics* 24, pp 345.

⁷¹ see Welch, I., 1991, An empirical Examination of Models of Contract Choice in Initial Public Offerings, *Journal of Financial and Quantitative Analysis* 26, pp 500.

⁷² see Ritter, Jay R., 1998, Initial Public Offerings, *Contemporary Finance Digest* 2, pp 19.

⁷³ see Mandelker, G. and A. Raviv, 1977, Investment Banking: An Economic Analysis of Optimal Underwriting Contracts, *The Journal of Finance* 32, pp 684.

firms with low ex ante uncertainty about their share value.⁷⁴ The logic is straightforward; with firm-commitment offering, as ex ante uncertainty increases, more and more money has to be left on the table to compensate uninformed investors for the winner's curse problem they face and consequently increasing the dilution of the original owner's stakes. At some point, as this dilution increases, the issuing firm finds it will be better-off switching to a best efforts offering. In this offering the adverse selection problem is avoided and less underpricing is required. The firm trades-off this dilution facing the original shareholders with the probability of subscription. Namely, with best-effort offerings some projects will be foregone if the best-effort offering (due to its minimum sales constraint) are withdrawn. Only if dilution from using a firm commitment contract would be sufficiently great, then it is optimal to forego this positive net present value projects.⁷⁵

With a best effort contract, issuing firm and its investment banker agree on the offer price⁷⁶ and on the minimum and maximum number of shares for selling.⁷⁷ Then a selling period commences, during which the investment banker makes its best effort to sell the shares. If the minimum number of shares is not sold at the offer price within a specified period, the offer is withdrawn, investor's monies are refunded and issuing firm receives no money.

This feature of imposing a minimum number of shares that have to be sold, so called "Minimum Sales Constraint," is often settled in the best-effort contract. It reduces the underpricing by alleviating the winner's curse on uninformed investors, but increases the probability of withdrawing the offer if the informed demand is not forthcoming.

⁷⁴ see Ritter, Jay R., 1987, A Theory of Investment Banking Contract Choice, Working Paper #488A, Division of Research, School of Business Administration, The University of Michigan, pp 2.

⁷⁵ see Ritter, Jay R., 1987, A Theory of Investment Banking Contract Choice, Working Paper #488A, Division of Research, School of Business Administration, The University of Michigan, pp 17.

⁷⁶ In a best-effort offering, unlike firm-commitment, there is no canvassing of market demand and constructing a demand curve for the shares to get a more detailed view on the possible offer price, i.e. offer price can not be adjusted after obtaining indications of interest. See Booth, J. and L. Chua, 1996, Ownership dispersion, costly information and IPO underpricing, Journal of Financial Economics 41, pp 298.

⁷⁷ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 19.

High minimum sales constraint and high over allotment option protect uninformed investors against the winner's curse, by hence eliminating offerings with poor demand or by adding shares when demand is high.⁷⁸ This commitment to reduce the underpricing due to minimum sales constraint is more valuable when the required underpricing without minimum sales constraint would be too high.⁷⁹

In that sense, a best-effort contract with minimum sales constraint can be viewed as a firm commitment contract, in which the investment banker gives the uninformed investors the right to sell the shares back to the firm at the offering price if the informed demand is not forthcoming. Informed demand is only forthcoming when the offering is underpriced, which actually means that the uninformed investors have this put option always when the market price of share is smaller than the offer price.⁸⁰ If there are no costs of submitting a purchase order and exercising this put option, uninformed investors will submit purchase orders as long as there is some positive probability that market value of share will exceed the offer price. Since the offering is withdrawn if informed demand is not forthcoming, issuing firm faces a trade-off between the offering price and the probability that the offering will be subscribed.⁸¹

2.4. Hot Issue Market

One of interesting features of Initial public offerings is so called 'Hot issue Market' phenomenon. Hot issue Market is 'a short interval of time, characterized by high IPO volume, when disproportionately large number of firms from a particular industry goes public'⁸² and high levels of initial returns.⁸³

⁷⁸ see Ritter, Jay R., 1987, The costs of going public, *Journal of Financial Economics* 19.

⁷⁹ see Welch, I., 1991, An empirical Examination of Models of Contract Choice in Initial Public Offerings, *Journal of Financial and Quantitative Analysis* 26, pp 500.

⁸⁰ see Ritter, Jay R., 1987, A Theory of Investment Banking Contract Choice, Working Paper #488A, Division of Research, School of Business Administration, The University of Michigan, pp 9.

⁸¹ see Ritter, Jay R., 1987, A Theory of Investment Banking Contract Choice, Working Paper #488A, Division of Research, School of Business Administration, The University of Michigan, pp 11.

⁸² see Ritter, Jay R., 1984, The "Hot Issue" Market of 1980, *The Journal of Business* 57.

⁸³ see Derrien, F., 2005, IPO Pricing in 'Hot' Market Conditions: Who Leaves Money on the Table?, *The Journal of Finance* 60, pp 487.

Rational explanations for the existence of hot issue markets are difficult⁸⁴ to find (some authors⁸⁵ also state that corporate finance theory does not have at all any good explanations for these patterns) but there are some explanation attempts. One possible explanation of the hot issue markets could be that when the level of stock prices is high, the private benefits consequently are less important and more companies will want to go public. This implies that the 'IPO activity should rise following an increase in stock prices. The flip side may occur as well; when the stock prices are low then the average value of cash flow rights is low and the private benefits of control are then relatively more important.'⁸⁶

This explanation is based on the conjecture that the level of demand is extremely variable and related to the market conditions that prevail at the time of the offering.⁸⁷ Derrien [19] states that 'in bullish situations the huge uninformed demand for the shares, submitted mostly at market prices is very likely to influence the outcome of the offering and the aftermarket IPO share performance'.⁸⁸

Another possible explanation of the 'hot issue market' phenomenon is that, when one firm goes public, investors inquire not only its particularities, but also market conditions, industry perspectives etc. When another firm from the same industry chooses to go public, the evaluation costs that the investors, wishing to scrutinize this firm, will have to borne are therefore smaller and consequently the underpricing will be smaller as well. Hence, when one firm from a specific industry desires to go public, others will go public as well, i.e. underwriters bundle the IPOs across industries.⁸⁹

With this conjecture, the underpricing should therefore be smaller when the IPO volume raises; the first firm from a specific industry going public will offer higher initial return, which will be followed by rising IPO volume (other firms from

⁸⁴ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp.12

⁸⁵ see Ritter, Jay R., 1984, The "Hot Issue" Market of 1980, The Journal of Business 57, pp 219.

⁸⁶ see Zinagles, L., 1995, Insider Ownership and the Decision to Go Public, Review of Economic Studies 62, pp 444.

⁸⁷ see Derrien, F., 2005, IPO Pricing in 'Hot' Market Conditions: Who Leaves Money on the Table?, The Journal of Finance 60, pp 506.

⁸⁸ see Derrien, F., 2005, IPO Pricing in 'Hot' Market Conditions: Who Leaves Money on the Table?, The Journal of Finance 60, pp 487.

⁸⁹ see Benveniste, L. and W. Busaba, 1997, Bookbuilding vs. Fixed Price: An Analysis of Competing Strategies for Marketing IPOs, The Journal of Financial and Quantitative Analysis 32.

the same industry will go public) and consequently decreasing initial returns will be observed. The question how to induce one firm from a specific industry to be the first one to go public, when it could benefit if waiting for one of its competitors go public first, remains.

3. Different efforts on determining IPO share price

After explaining theoretical implications of IPO's and laying stress on different IPO phenomena and irregularities, in the forthcoming chapters significant effort will be given in pointing out different efforts that have tried to explain, establish and calculate the optimal IPO share price. As already mentioned, IPO process is very stressed and difficult while lot of factors and possible outcomes have to be viewed and incorporated in the pricing process. IPO pricing process is not a simple mechanical algorithm⁹⁰, it is rather a sum of different methods, efforts, market conditions, goals and skills that the investment banker has to put together and, based on his broad knowledge and experience aligned with issuer goals, determine the offer price.

Although the IPO process is not a simple algorithm, there is however regularities and models that an underwriter has to observe and implement in the IPO pricing process in order to set the offer price range more precisely.

3.1. Information Extraction Model

Information Extraction Model was introduced by Benveniste and Spindt [6] in 1989. A part of their work, related to this model, was already mentioned.⁹¹ In this Chapter their work will be presented in more detail.

The Work of Benveniste and Spindt is based on asymmetrically informed investors, i.e. informed investors and uninformed investors. As stated already, informed investors are assumed to have some preferential information about the issuing company. This preferential information the investment banker has to solicit and factor these findings as much as possible into the IPO pricing process.

A firm may have informational advantage relative to the outsiders about firm specific, i.e. idiosyncratic, risks and opportunities and the outsiders may be more informed about systematic factors. But neither these informed investors nor the issuing firm itself can know precisely what the aftermarket's stock performance will be. Incorporating outsider's information in the pricing process may help to determine the fair price more precisely. The basic difficulty that an underwriter

⁹⁰ see Moonchul, K., and Jay R. Ritter (1999) pp 19.

⁹¹ see Chapter 2.

faces in this process of collecting useful outsider's information is that outsiders have no incentive to reveal this positive information. They are more willing to keep such information for themselves until the firm goes public and consequently buy the underpriced shares which they will sell after the positive information has been revealed.

Benveniste and Spindt argue that this incentive has to be overcome. They model a rule relating to the offer price and share allocation to investor's indications of interest that will induce informed investors to reveal the preferential information. This process has a consequence that some money is left on the table by the issuer. Important feature of the model is the discretionary allocation rule, which underwriters have to have. Only with this threat that an informed investor, if not reporting truthfully, will be excluded from the allocation process, underwriter can induce informed investors to reveal their information. Truth-telling investor will consequently be rewarded with some proportion of money that has been left on the table. The ability to sell to uninformed investors as well is valuable for underwriter in the sense that informed investors do not need to be over-compensated.⁹² With this threat of giving some allocation to uninformed investors, informed investors will be forced to give more honest and accurate feedback consequently receiving the higher allocation and in the same time increasing the offer price. Benveniste and Spindt are especially interested in this part of inducing information revelation, establishing the offer price and allocation rules.⁹³

Before collecting the information from informed investors, underwriter first conducts its own analysis of the issuer⁹⁴ and then creates so called 'road show'; a process of informing and educating potential investors and in the same time soliciting their indications of interest and preferential information about the issue. This term, 'indication of interest', authors define as nonbinding orders at the different prices that underwriter solicits from informed investors during the premarket process. These nonbinding orders are then used in setting the final offer price and in the process of determining the allocation of shares.

⁹² see Maksimović, V., and P. Pichler, 2006, Structuring the Initial Offering: Who to Sell To and How To Do It, *Review of Finance* 10, pp 30.

⁹³ More about allocation in Chapter 4.

⁹⁴ Different approaches already mentioned in chapter 2.1.

Benveniste and Spindt express a simple model. In this model regular investors in the premarket choose simple indications of interest, in form of either g (good) or b (bad) which consequently determines their allocation and the offer price that the issuer will set. Price and allocation hence depend jointly on investor's indication and declarations of other investors.

Only the flexibility of the book-building allocation mechanism⁹⁵ allows the preferred information to be extracted. As stated before, the cost that the issuers have to pay in order to be able to extract this information is underpricing.

Underwriters are willing to voluntarily underprice the issues because by doing that, they can get more precise view about stock's value and set a price more accurately. The offer price would be much smaller if no information was raised and the uncertainty about stock market performance remained high.

Consequently, informed investors are more willing to reveal their preferential information and thus receive a bigger allocation of higher-priced shares, then to cheat and indicate a low quality trying to earn on misrepresenting their information. This behavior could jeopardize their expected allocation if the underwriter finds out that the investor has cheated.

The more favorable information are revealed the higher will the offer price be. On the other hand, underpricing will be higher as well. The reason for this higher underpricing is the fact that the offer price will be only partially adjusted⁹⁶ because the informed investors who revealed their information have to be rewarded.

Basic Benveniste and Spindt model consists of a private firm offering a fixed fraction of its future cash flows (Shares) for sale, and a population of investors. The future cash flow for sale is summarized as a random variable V , about which mean value both, the firm making an offer and investors in the model, have some information. The firm consequently decides to sell off V in Q shares. The price of the offering should be the expected present value of V / Q .

⁹⁵ described in the Chapter 4.1.

⁹⁶ Hanley [20] provides empirical support for the model by demonstrating that initial returns are higher for stocks with offering prices above the filing price range.

To capture in the model some real world facts, Benveniste and Spindt, as mentioned before, distinguish between regular and occasional investors. There are H regular and many occasional investors and both have some information relevant to the expected value of the issuing firm's shares.

Benveniste and Spindt consequently assume that each regular investor has one piece of information, that is either 'good' or 'bad', and that each piece of information has an equal (absolute) marginal impact on the stock's value. To reflect this, they write the expected price conditioned on the information of all H regular investors in the form

$$P_h = A - (H - h) \alpha \quad (3.1.1)$$

where A is the price when all information is good, and h is the number of regulars with good information.

The price function is structured in this way to isolate a measure - α - of the marginal impact of each regular's information on the expected price of the issue.

After considering regular investors, Benveniste and Spindt start their work on the occasional investors' impact on pricing decision. They stress that occasional investors have information which are independent of the regular investors' information. Conditioned on all the information possesses by both type of investors, Benveniste and Spindt state that the value of stock is

$$P_{h,\lambda} = A - (H - h)\alpha + \lambda \quad (3.1.2)$$

where λ represents the effect of occasional investors' information on price.

Benveniste and Spindt state that the market proceeds in two stages. In the first, the issue is premarket to regular investors, and in the second, the market is opened up to occasional investors, i.e. only regular investors are targeted in the premarket (which is considered as the first stage).

Benveniste and Spindt assume that the aftermarket price reflects all the private information of all regular and occasional investors, i.e. that the aftermarket price is a full-information-revealing equilibrium price. Regular investors that decide to buy the shares in the premarket will factor their expectations about what the aftermarket price of the stock will be in their offer to buy.

Benveniste and Spindt stress some assumptions about regular investors. Namely, they assume that:

1. Regular investors' investment preferences are identical and that each regular investor is willing to purchase up to \bar{q} shares at a cost not exceeding his or her expectation of the aftermarket value of the stock,
2. Regular investors' demand just exhaust the issue; that is, $H\bar{q} = Q$,
3. Regular investor's information is independent. Each regular investor's responses will be based on their subjective valuation of the stock and their expected profits.

One major difference between Rock's⁹⁷ and Benveniste and Spindt model can be noticed here. Namely, Rock bases his work on the assumption that informed demand is not high enough to exhaust the issue and Benveniste and Spindt, in the 2nd assumption, state that the informed investor's demand will exactly exhaust the issue.

Nevertheless, Benveniste and Spindt continue their work by pointing out that regulars use their private information to compute subjective estimates of the aftermarket price that are superior to those of the underwriter and the issue firm.⁹⁸

To represent this, Benveniste and Spindt index the state of the premarket by the total number h of pieces of good information possessed by regular investors. Unconditionally, the probability of state h is π_h , where

$$\pi_h = \binom{H}{h} p^h (1-p)^{H-h} \quad (3.1.3)$$

But, from the vantage point of any regular investor who has a piece of good information, state h , $h = 1, \dots, H$, occurs with the conditional probability π'_{h-1} and from the vantage point of any regular investor who has a piece of bad information, the probability of state h , $h = 0, \dots, H-1$, is π'_h , where

$$\pi'_h = \binom{H-1}{h} p^h (1-p)^{H-1-h} \quad (3.1.4)$$

⁹⁷ Rock's model was already mentioned in the Chapter 2.2.1 and will be described more in detail in the Chapter 3.2.

⁹⁸ In that sense, regular investors can be viewed as informed investors (the notion that has been used in the previous Chapters).

Consequently, Benveniste and Spindt state that regular's premarket reservation price is his or her conditional estimate of the aftermarket price. The reservation price of a regular investor with a piece of good information is

$$P_g = \sum_{h=0}^{H-1} \pi'_h P_{h+1} \quad (3.1.5)$$

and the reservation price of a regular investor with a piece of bad information is

$$P_b = \sum_{h=0}^{H-1} \pi'_h P_h \quad (3.1.6)$$

The empirical significance of the model parameter α is apparent from these empirical expressions for regular's premarket expectations. As $P_g - P_b = \alpha$, α represents the marginal ex ante value of a regular's information. The more valuable private information relevant to the aftermarket stock price is, the greater α will be.

Accordingly, Benveniste and Spindt try to explain how are these positive and negative information used to determine the offer price and allocation of the IPO. Assuming that regulars are truthful in declaring their information, Benveniste and Spindt argue that the underwriter can, based on these indications, compute the true conditional estimate for the aftermarket equilibrium price.

The following notation is used in discussing the offer price and allocation conditioned on the premarket indications of interest.

P_h^o = Offer price when h regular investors indicate their information is good (state h)

$q_{g,h}$ = Shares allocated to an investor who indicates good in the premarket when $h - 1$ others indicate good (state h)

$q_{b,h}$ = Shares allocated to an investor who indicates bad in the premarket when h others indicate good (state h)

Regular investors declare their indication of interest, i.e. in this model declares either g (good) or b (bad), and conditional on their indications and other investors' declarations, offer price and their own allocation will be determined.

Investors have to be induced to disclose their information truthfully. First, an investor who has a good information about the firm must expect to profit more by declaring g than by declaring b . Assuming that the other investors also indicate their information truthfully, the expected profit accruing to an investor truthfully announcing his piece of good information is the expected return between the aftermarket and premarket, i.e.

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_{h+1}^o) q_{g,h+1} \quad (3.1.7)$$

On the other hand, investor with a piece of good information who falsely declares bad information will be allocated a b portion and the offer price will reflect one less piece of good information. Such investor expects profit of

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_h^o) q_{b,h} \quad (3.1.8)$$

To induce the investors to be truthful, (3.1.7) must exceed (3.1.8). Using a fact that $P_{h+1} = \alpha + P_h$, (when additional good information is received, the new offer price will be higher for the margin impact, α , of this new information) Benveniste and Spindt conclude that an investor with a piece of good information will declare it truthfully if

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_{h+1}^o) q_{g,h+1} \geq \sum_{h=0}^{H-1} \pi'_h ((p_{h+1} - p_h^o) + \alpha) q_{b,h} \quad (3.1.9)$$

Second, investors must be assured of nonnegative expected profits from any premarket order they make because they cannot be forced to participate. Thus,

$$p_h^o < p_h \quad (3.1.10)$$

Outcomes that would result in state h from a particular choice of offer price and allocation (OP&A) schedule based on the premarket indications of interest are:

$$\text{Allocation to each } g = q_{g,h},$$

$$\text{Allocation to each } b = q_{b,h},$$

$$\text{Total shares presold} = hq_{g,h} + (H - h)q_{b,h},$$

$$\text{Aftermarket sales} = Q - hq_{g,h} + (H - h)q_{b,h},$$

$$\text{Expected proceeds} = P_h Q - (P_h - P_h^o)(hq_{g,h} + (H - h)q_{b,h}).$$

In calculating the state h expected proceeds, Benveniste and Spindt assume that the expected value of λ is zero. If the objective in choosing an offer price and allocation schedule based on the premarket indications of interest is to maximize the expected proceeds of the issue, the underwriter needs only, as Benveniste and Spindt argue, to settle on how much of the issue to presell. For example, Benveniste and Spindt suppose that the issuer decided to sell at least \tilde{Q} shares. Conditioned on \tilde{Q} , the proceeds-maximizing offer price and allocation schedule can be found among the solutions to:

$$\underset{\{p_h^o, q_{g,h}, q_{b,h}\}}{\text{maximize}} \sum_{h=0}^H \pi_h \left(P_h Q - (p_h - p_h^o)(hq_{g,h} + (H - h)q_{b,h}) \right) \quad (3.1.11)$$

subject to

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_{h+1}^o) q_{b,h+1} \geq \sum_{h=0}^{H-1} \pi'_h ((p_{h+1} - p_h^o) + \alpha) q_{b,h},$$

$$hq_{g,h-1} + (H - h)q_{b,h} \geq \tilde{Q} \quad h = 0, \dots, H,$$

$$p_h^o \leq p_h \quad h = 0, \dots, H,$$

$$0 \leq q_{g,h} \leq \bar{q} \quad h = 1, \dots, H,$$

$$0 \leq q_{b,h} \leq \bar{q} \quad h = 0, \dots, H - 1.$$

Furthermore, for a specified level of presales, \tilde{Q} , Benveniste and Spindt state that the proceeds-maximizing offer price and allocation schedule relating

indications of interest to the offer price and share allocation will have the following characteristics:

- $q_{g,h} = \bar{q}$ for every outcome h ,
- $P_h^o = P_h$ for every h such that $h\bar{q} < \tilde{Q}$,
- underpricing occurs in states where $h\bar{q} \geq \tilde{Q}$

and the expected proceeds from the issue are

$$\sum_{h=0}^H \pi_h \left[P_h Q - \alpha \left[\frac{p}{1-p} \right] \max(\tilde{Q} - h\bar{q}, 0) \right] \quad (3.1.12)$$

This finding also implies, as Benveniste and Spindt state, that regular investors who indicate bad information should be allocated the remaining $\tilde{Q} - h\bar{q}$ shares in state h . Benveniste and Spindt thence derive the expected underpricing:

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_{h+1}^o) = \frac{\alpha}{\bar{q}} \sum_{h=0}^{H-1} \pi'_h \max \left[\frac{\tilde{Q} - h\bar{q}}{H - h}, 0 \right] \quad (3.1.13)$$

Furthermore, Benveniste and Spindt elaborate the statement that expected underpricing arises to provide incentives for regular investors to reveal good information. They find out that, as the level of profit is determined by the allocation to regulars who declare b , underpricing will be minimized by giving priority to regulars who declare g . Benveniste and Spindt also state that the surplus will be targeted at regulars with good information most effectively by underpricing when all regulars who declare g receive allocation—that is when h is high. Benveniste and Spindt also state correctly that, in the model with more types of information (usual model that occurs in real life),⁹⁹ underpricing would be directly related to the quality of information. Empirical implications that Benveniste and Spindt derive from this findings are:

- Underpricing is directly related to the ex ante marginal value of private information.
- Underpricing is directly related to the level of presales.

⁹⁹ see Chapter 4.1.

- Underpricing is minimized if priority is given to orders from investors who indicate good information.
- Underpricing is directly related to the level of interest in the premarket.

Benveniste and Spindt argue that, as the level of underpricing depends on quantities allocated to investors who indicate low interest, underpricing can be minimized by including as many investors in the premarket as is practical and by doing this it will be possible to allocate small quantities to investors who indicate low interest. This statement holds, but is a bit in conflict with the work of Beatty and Ritter¹⁰⁰, who state that the underpricing is equal to costs that investors have borne in the process of scrutinizing the firm and hence, as more investors are engaged in the premarket investigations, the aggregate costs will be higher causing the increasement of underpricing.¹⁰¹ Obviously, a tradeoff between this two factors will occur.¹⁰²

Relating to the underpricing phenomenon, Benveniste and Spindt continue their work by introducing a new variable L , which is the present value of all expected future profits accruing to a regular investor who participates in the IPO.

By introducing this variable into the analysis, effect of permitting the underwriter to expect investors to purchase shares of the current issue even if they will take a loss by doing so is created. The only condition is that this loss does not exceed the present value of the future expected profits. At this point, Benveniste and Spindt state an altered pricing constraint required to induce investors indicating low interest to purchase their allotted shares.

This new condition is

$$(p_h^o - P_h)q_{b,h} \leq L \quad (3.1.14)$$

This is a strong incentive tool, while by introducing the possibility of being excluded from the future IPOs, the underwriter reduces the incentive for investors with good information to lie. The already stated condition,

¹⁰⁰ for detailed view in Beatty and Ritter's work see Chapter 3.3.

¹⁰¹ for more information about the optimal amount of information gathering before setting the issue price see Maksimović and Pichler[29].

¹⁰² More about this in Chapter 3.4.

$$\sum_{h=0}^{H-1} \pi'_h (p_{h+1} - p_{h+1}^o) q_{g,h+1} \geq \sum_{h=0}^{H-1} \pi'_h ((p_{h+1} - p_h^o) + \alpha) q_{b,h} \quad (3.1.15)$$

describes the profit required to induce regulars with good information to truthfully reveal it.

Benveniste and Spindt conclude this part of their work with the statement that the profit needed to induce regulars who have good information to reveal it is lower when the future profits are included in the model. Anyhow, the amount of overpricing is constrained by L and the underwriter has to provide regulars with some profit on average so that L is positive.

Benveniste and Spindt conclude their work in this article assuming that the issuing firm can be described by a one-dimensional random variable f with a distribution function $\xi(f)$. Hence, Benveniste and Spindt state that the offer price and allocation schedule for each firm f , satisfying the previous two equations, will be denoted as

$$\{P_h^{0,f}, q_{g,h}^f, q_{b,h}^f\}$$

Benveniste and Spindt argue that regular investors don't know in advance what their information about a firm will be. They rather face an ex ante probability p of having a good information about f and hence expect a profit from f 's issue in a form of weighted average

$$p \sum_{h=0}^{H-1} \pi'_h (\alpha + (P_h^f - P_h^{0,f})) q_{b,h}^f + (1-p) \sum_{h=0}^{H-1} \pi'_h (P_h^f - P_h^{0,f}) q_{b,h}^f, \quad (3.1.16)$$

which equals

$$u_f \equiv \sum_{h=0}^{H-1} \pi'_h (p\alpha + (P_h^f - P_h^{0,f})) q_{b,h}^f \quad (3.1.17)$$

Benveniste and Spindt conclude their work in this article with a statement that underpricing is induced by the underwriter's willingness to extract the information from regular investors. This information will be then useful in setting IPO offer price. They argue that, as the amount of information production increases, the expected secondary market price of firm is closer to its true

value.¹⁰³ Underpricing compensates investors for revealing preferential information. Consequently, the more preferential information are revealed, the greater will the underpricing be. Price is namely adjusted for the positive impact of information, but it is adjusted only partially due to necessity of leaving some money on the table for information providers. In Benveniste and Spindt's model underpricing is hence a cost that the issuer has to bear in order to adequately compensate private information suppliers.

3.2. Winner's Curse Model

Winner's Curse Model is also based on asymmetric information among investors. It was introduced by Rock [36] in 1986. Rock's work was already partially described in the Chapter 2.2.1. In this Chapter I will present Rock's article in more detail, and focus on the use of Rock's model in setting the IPO share price.

Rock recognizes two different groups of investors, namely informed investors, which are simply endowed with their preferential information (no information production costs in this model), and uninformed investors. Rock states that underpricing is necessary to hold the uninformed investors in the market. The model is based on the assumption that informed demand is not big enough to buy the whole issue and consequently the uninformed demand is also needed to raise funds. As explained in the Chapter 2.2.1., uninformed demand is only forthcoming if the issues are underpriced on average, i.e. if the issues are offered at a discount from their expected aftermarket share price.¹⁰⁴

Rock's builds his model on the simple consideration that there are two assets available for investment. One is safe, with return normalized to 1 and the other is one whose value (per share) \tilde{v} is uncertain. The latter asset is the one that is being issued. The model afterwards assumes that the issuer pre-selects an offer price, p , and an offer quantity, Z , of shares. Rock also assumes that no re-adjustment of price or quantity is allowed and consequently the issuer can

¹⁰³ see Chemmanur, Thomas J., 1993, The Pricing of Initial Public Offerings: A Dynamic Model with Information Production, *Journal of Finance* 48, pp. 295

¹⁰⁴ see Levis, M., 1990, The Winner's Curse Problem, Interest Costs and the Underpricing of Initial Public Offerings, *The Economic Journal* 100, pp 79.

experience demand lower or bigger than supply. If demand exceeds supply, the investment banker can fill only a fraction of the order and hence rationing occurs.

When oversubscription occurs, Rock assumes that it occurs exclusively due to the large orders placed by investors who have favorable information about the prospects of the offering. This privileged sector of the market is what Rock calls 'the informed'. All other investors, including the issuer, are called 'the uninformed'.

Informed demand, I , is no greater than mean value of the shares offered, $\bar{v}Z$, and the informed investors submit orders for the new shares whenever the realized value per share¹⁰⁵, \tilde{v} , exceeds the offer price, p . Hence, when $p < \tilde{v}$, informed investors order I and when $p > \tilde{v}$ there are no orders from the informed investors.

Unlike the informed investors, the uninformed investors, who are N in number, cannot predicate the size of their order upon the realization of \tilde{v} . Each uninformed investor wants to submit a fraction, T , of his wealth for the new issue (assumption is that they have homogeneous expectations about the distribution of \tilde{v} , same wealth and the same utility). The combined dollar demand of the informed and uninformed is

$$\begin{aligned} NT + I & \text{ if } p < \tilde{v} \\ NT & \text{ if } p > \tilde{v} \end{aligned}$$

Since the demand fluctuates according to whether \tilde{v} is above or below p , the issuer must experience either excess supply or excess demand in one of the two states, and a particular mechanism for allocating rationed shares must be devised.

In the state $\tilde{v} > p$, the probability of receiving an allocation will be denoted as b , and if $\tilde{v} < p$ holds, the receiving-allocation probability is denoted by b'

The intuition based on two equations stated above says that the probability of receiving an allocation of an underpriced issue is less than or equal to the probability of receiving an allocation of an overpriced issue. Rationing is

¹⁰⁵ In this Model, Rock assumes that informed investors have perfect information about the realized value of the new issue.

consequently 'bigger' for underpriced than for overpriced issues, i.e. $b < b'$. This bias in allocation causes the uninformed investors to revise downward their valuation of the new shares.

Therefore, as Rock states, to attract uninformed investors the offering, the issuer must price the shares at a discount. This discount can be interpreted as compensation for receiving a disproportionate number of overpriced stocks, when the informed demand is not forthcoming.

Investor's terminal wealth is therefore a function of the aftermarket value of the new issue and the probability of receiving an allocation. Rock also states that investor's beliefs about the chances of being dealt a good or bad offer must equal the actual probabilities which arise from the allocation mechanism.

Rock argues that the fact that uninformed investors earn approximately the risk-free rate in a large market is what actually determines their chances of receiving an allocation of good shares. Intuition behind this is straightforward; as the issue becomes more and more attractive, uninformed investors will receive allocation that is so rationed (his probability of receiving allocation will be so small) that the actual profits, no matter how big the underpricing is, will be at the level of risk-free rate conditional on the whole amount that was originally intended to be invested.

This low probability is the smallest probability of obtaining rationed shares that an investor will tolerate before withdrawing from the market, given the offering price p . This low probability function, $b_0(p)$, of receiving shares given offering price Rock names 'zero demand probability'. Accordingly, Rock states the full subscription price, which must be close to the solution of

$$b_0(p) = pZ / (pZ + I) \quad (3.2.1)$$

Furthermore, Rock describes the opportunity set an investor is facing and argues that, as the offer price is reduced, the offering becomes more and more subscribed, i.e. elicit larger uninformed orders.

As the result of the uninformed investors, demand is, therefore, also growing in the state where the informed do not find the shares worth purchasing. At some point, the price is so low that the uninformed could by themselves fully

account for the issue. Rock calls this the 'full subscription price' – the price at which the issuer can rely on selling all the shares in the bad issue as well as in the good issue, and shows how to compute it

$$p_f Z = NT(b(p_f, N), p_f) \quad (3.2.2)$$

Moreover, Rock, given that the motive of going public is risk aversion on the part of the founders, employees and financial backers of the firm, states that the offer price cannot exceed the unconditional mean value of the shares, \bar{v} . If the price is greater than \bar{v} , Rock states that the uninformed would never submit an order.

Next Rock's supposition is about the collective preferences of the owners, which according to Rock can be expressed by a utility function:

$$U(w) = -w^{-1} \quad (3.2.3)$$

Rock states that the owner's terminal wealth is a function of the true price (revealed in the aftermarket) and that the expected utility of the owners, accordingly, is:

$$EU(w) = p(\tilde{v} > p)U(pZ) + p(\tilde{v} < p) * E(U(NT(b, p) + \tilde{v}(Z - NT(b, p)/p)) | \tilde{v} < p) \quad (3.2.4)$$

Under the assumption that \tilde{v} is uniform on $(0, 2\tilde{v})$, Rock states a new equation:

$$EU(w) = \frac{-1}{pZ} + \frac{1}{2\tilde{v}Z} \left\{ 1 + \frac{\log(NT(b, p) - pZ)}{1 - (NT(b, p)/pZ)} \right\} \quad (3.2.5)$$

Rock's interpretation of this expression is straightforward; the first term, $(-1/pZ)^{-1}$ is the utility of the owners given the issue is completely subscribed at the price p . The second term is a correction that depends upon the fraction of the issue subscribed by the uninformed:

$$NT(b, p) - pZ \quad (3.2.6)$$

Using the definition of the probability of receiving an allocation $b(p, N)$, Rock writes the maximization problem:

$$\max_{p > p_f} \frac{-1}{pZ} + \frac{1}{2\bar{v}Z} \left\{ 1 + \frac{\log\left(\frac{1}{b(p, N)} - \frac{\bar{v}}{p}\right)}{1 + \frac{\bar{v}}{p} - \frac{1}{b(p, N)}} \right\} \quad (3.2.7)$$

For big markets, where the number of investors is large, probability of receiving allocation for uninformed investors is approximately equal to the zero demand probability, $b_o(p)$ and in this instance the maximization problem, as Rock states, becomes:

$$\max_{p > 0.8\bar{v}} \frac{-1}{pZ} + \frac{1}{2\bar{v}Z} \left\{ 1 + \frac{p^2 \log((4\bar{v} - p)(\bar{v} - p)p^{-2})}{5\bar{v}(p - 0.8\bar{v})} \right\} \quad (3.2.8)$$

Solution to the constrained distribution occurs at the boundary $0.8\bar{v}$, and the owners choose the smallest discount which guarantees full subscription in every state.

3.3. Cost of Information Acquisition Model

Cost of information acquisition Model, developed by Beatty and Ritter [4] in 1986 is an extension of Rock's Winner's Curse Model. This Chapter will give a closer look to their work.

The most important statements and empirical findings of this Model are, as Beatty and Ritter argued, that the equilibrium for informed investors occurs when their expected gains from receiving allocations in underpriced issues equal the costs of search for the information.¹⁰⁶ The underpricing is directly related to the ex ante uncertainty about the stock's price in a way that when the uncertainty of share's value rises, more effort has to be given in order to evaluate the share properly and hence more money has to be 'left on the table' to compensate investors for the evaluation costs incurred. Other way around, when ex ante uncertainty is high, the value of private information is also high and the underwriter must promise deeper underpricing to induce honest indications of interest.¹⁰⁷

Consequently, as the number of informed bidders increase, the

¹⁰⁶ see Koh, F., and T. Walter, 1989, A Direct Test of Rock's Model of the Pricing of Unseasoned Issues, *Journal of Financial Economics* 23, pp 252.

¹⁰⁷ Benveniste, L. and W. Busaba, 1997, Bookbuilding vs. Fixed Price: An Analysis of Competing Strategies for Marketing IPOs, *The Journal of Financial and Quantitative Analysis* 32, pp 393.

underpricing will increase as well, due to necessity of compensating more investors for their incurred costs.¹⁰⁸ Related to the work of Rock, who considers the adverse selection risk as a source of underpricing, it can be argued that, as the amount of information gathering (pool size) increases, the underpricing that is necessary to eliminate the adverse selection risk decreases, but on the other hand the underpricing that is necessary to cover information gathering costs increases, as will be shown in this Chapter. Therefore, the underpricing in a public offering with information gathering will be the maximum of these two and the optimal amount of information gathering can be viewed as the one that equates this different levels of underpricing.¹⁰⁹

In that sense, Beatty and Ritter provide an intuition¹¹⁰ on why underpricing should increase with the ex ante uncertainty about the shares value. An investor who decides to scrutinize the firm actually invests in a call option on the IPO shares, the option which will be exercised if the share value exceeds the strike (i.e. offer) price. As the value uncertainty increases, the value of the option increases as well. Consequently, the greater valuation uncertainty is, the more investors will become informed. This will aggravate the winner's curse problem that uninformed investors are faced with and enlarge the sum of money that has to be left on the table to compensate investors for their information acquisition costs.

In Beatty and Ritter's equilibrium, investors incurring evaluation costs will earn sufficient profits to cover them. And that is what creates winner's curse for the so called uniformed, i.e. 'representative', investors who intend to free ride. Faced with this winner's curse problem, as mentioned already, representative (uninformed) investor will place purchase order only if IPOs are on average underpriced.

When information production is costly, underwriters need to focus on another important implication, i.e. how much information production to induce. This will be more discusses in the Chapter 3.4.

¹⁰⁸ see Chemmanur, Thomas J., 1993, The Pricing of Initial Public Offerings: A Dynamic Model with Information Production, *Journal of Finance* 48, pp 299.

¹⁰⁹ see Maksimović, V., and P. Pichler, 2006, Structuring the Initial Offering: Who to Sell To and How To Do It, *Review of Finance* 10, pp 22.

¹¹⁰ see Ljungqvist, A., IPO Underpricing, 2004, *Handbooks in Finance: Empirical Corporate Finance*, Salomon Center, Stern School of Business, New York University and CEPR, pp. 15.

In their Model, Beatty and Ritter assume that an issuing firm is uncertain about its value per share. It must first set an offering price, OP , and then solicit purchase orders from the public at this price. If the shares are oversubscribed, rationing in proportion to the excess demand occurs. Potential investors are also uncertain about the value of a share. But for a cost c , as Beatty and Ritter assume, they can become informed about the price per share, v , that will prevail once the stock starts trading. Investors who do not incur this costs are termed uninformed investors, and their knowledge about v is limited to knowing its probability density function, denoted by $f(v)$. Issuing firms and their investment bankers are assumed by Beatty and Ritter to be among the uninformed, i.e. to be uncertain about the true value per share. Otherwise there would be no need to underprice, as Beatty and Ritter state correctly.

Informed investors, each of whom has investable wealth of $W - c$, (original wealth minus the information acquisition costs) will submit purchase orders only if the offering is underpriced, i.e. if $(v > OP)$. As mentioned already, this behavior by informed investors creates an adverse selection problem for uninformed investors. For underpriced issues ($v > OP$), both informed and uninformed investors will submit purchase orders, and uninformed investors will be allocated only some of the shares that trade at a premium in the aftermarket. Instead of that, for overpriced issues where $v < OP$, only uninformed investors submit purchase orders. Consequently, they are allocated with 100 % of all the issue that trade at a discount in the aftermarket.

Beatty and Ritter state that, if an uninformed investor is allocated shares in an IPO, there is a greater than usual chance that the issue will start trading at a discount in the aftermarket. Therefore, for an uninformed investor the expected return conditional upon being allocated shares is less than the expected return conditional upon submitting a purchase order. But an uninformed investor will participate in the market only if the expected return conditional upon being allocated shares is non-negative. This can only happen if, on average, issuers underprice their shares.

Beatty and Ritter argue that the number of investors who choose to become informed is endogenous. In the equilibrium, this condition converges into two

equations. These two conditions are (i) zero expected profits for informed investors, and (ii) zero expected profits for uninformed investors.

The first condition can be expressed as

$$N * c = \alpha \int_{OP}^{\infty} n (v - OP) f(v) dv, \quad (3.3.1)$$

where Beatty and Ritter term N as the number of informed investors, c as the cost per investor of becoming informed, α as the fraction of shares allocated to informed investors when an offering is underpriced¹¹¹, OP as the offering price, n as the number of shares and v as the after-market price.

This equation simply states that the sum of all information costs (of all investors that have choose to become informed) equal the profits that this informed investors gain via receiving the allocation in the underpriced issues. The left-hand side is the aggregate cost of becoming informed. The right-hand side is the proportion of each underpriced issue that will be allocated to informed investors multiplied by the gross profits on underpriced issues.

The second equilibrium condition that Beatty and Ritter state, is the zero expected profits for the uninformed, which occurs when the aggregate losses on overpriced issues (the uninformed get all of the losing issue) equal the uninformed Investors' share of the gross profits on underpriced issues:

$$\int_0^{OP} n (OP - v) f(v) dv = (1 - \alpha) \int_{OP}^{\infty} n (v - OP) f(v) dv \quad (3.3.2)$$

Beatty and Ritter argue that equations (3.3.1) and (3.3.2) hold for any probability density function for the aftermarket price. These equations imply that, due to the winner's curse problem facing uninformed investors, all of the profits accruing to investors due to underpricing will be received by informed investors. Investors seeking these profits, however, will incur sufficient costs so that the aggregate costs of becoming informed equal the amount of money 'left on the table:

$$N * c = \int_0^{\infty} n (v - OP) f(v) dv = n[E(v) - OP]. \quad (3.3.3)$$

¹¹¹ Do not mix this α with the α in Chapter 3.1.

In this equation, the number of investors who choose to become informed, N , determines the required amount of underpricing, $E(v) - OP$. The decision to become informed is analogous to the decision to buy call option giving the right to buy shares if $v > OP$. Just as with standard option pricing analysis, this option is worth more the greater is the dispersion of v , which for few issues corresponds to greater ex ante uncertainty. Beatty and Ritter argue that, since the price of the option is the fixed cost c , the greater is the ex ante uncertainty, the greater will the number of investors who choose to become informed be. This way they have found a positive relation between ex ante uncertainty and the degree of underpricing of IPOs.

One can argue that the costs of becoming informed are not fixed, i.e. they rise with the rising ex ante uncertainty and thus the number of investors who choose to become informed is not rising in exactly the same proportion with the ex ante uncertainty. But Beatty and Ritter did not quest this hypothesis.

In addition, Beatty and Ritter formally demonstrate their underpricing result. In this demonstration, they denote the fraction of underpriced issues allocated by informed investors, α , be given by

$$\alpha = \frac{N(W - c)}{N(W - c) + OP * n} \quad (3.3.4)$$

where $(W - c)$ is the investment per informed investor. With this expression, Beatty and Ritter assume that aggregate uninformed demand is sufficient to fully subscribe an issue. Consequently, for underpriced issue, aggregate informed demand is given by $N(W - c)$ and aggregate uninformed demand is equal to $OP * n$.

Now, Beatty and Ritter denote the after-market price, $f(v)$, as $f(v) = 1 / (b - a)$, on $[a, b]$, $b > a \geq 0$, where a replaces 0 and b replaces ∞ in the limits of integration in eq. (3.3.1) and (3.3.2).

Performing the integration in eq. (3.3.1) using a uniform distribution and solving for N / n , Beatty and Ritter conclude that the number of informed investors per share results in

$$\frac{N}{n} = \left(\frac{1}{b - a}\right) \left(\frac{1}{2c}\right) (OP - b)^2 - \frac{OP}{W - c}. \quad (3.3.1)'$$

Performing the integrations in equation (3.3.2) results in

$$\frac{N}{n} = \frac{OP}{W-c} \left(\frac{OP-b}{OP-a} \right)^2 - \frac{OP}{W-c}. \quad (3.3.2)'$$

Beatty and Ritter conclude that the equations (3.3.1)' and (3.3.2)' hold for parameter values of W, a, b, c and n such that the number of informed investors, N is strictly positive. If this is not the case, there is no adverse selection against the uninformed. If there is no adverse selection, Beatty and Ritter argue that a pooling equilibrium would exist in which there is no underpricing.

In the two-equation system given by (3.3.1)' and (3.3.2)', Beatty and Ritter find that the endogenous variables are N , the number of informed investors, and OP , the optimal offering price.

Beatty and Ritter now start equating equations (3.3.1)' and (3.3.2)' what results in a quadratic equation for the issuing firm's optimal offering price:

$$OP^2 - 2[a + (b-a)C]OP + a^2 = 0 \quad (3.3.5)$$

where $C \equiv c / (W - c)$. C is the cost of becoming informed as a fraction of the investable wealth of the informed. This quadratic equation (3.3.5) has roots of

$$OP_{1,2} = a + (b-a)C \pm \sqrt{2aC(b-a) + C^2(b-a)^2}. \quad (3.3.6)$$

Of two roots, Beatty and Ritter correctly conclude that the $-\sqrt{\cdot}$ root is not economically meaningful, while in that the offering price would be less than a , the lower limit of probability density function for the aftermarket price.

Beatty and Ritter conclude that this would mean that there is no possibility of a loss for any investor submitting a purchase order. Thus, the unique offering price is given by the $+\sqrt{\cdot}$ root.

Before analyzing the effect of a decrease in the dispersion of possible aftermarket prices on the optimal OP , Beatty and Ritter find that it will be useful to rewrite expression (3.3.6), noting that

$$a = \frac{b+a}{2} - \frac{b-a}{2} \quad \text{where} \quad \frac{b+a}{2} = E(v).$$

Beatty and Ritter consequently find that the equilibrium offering price is therefore

$$OP = E(v) + \left(C - \frac{1}{2}\right)(b - a) + \sqrt{2E(v)C(b - a) - C(b - a)^2 + C^2(b - a)^2} \quad (3.3.7)$$

3.4. Ownership Dispersion Model

Ownership Dispersion Model is a model made by Booth and Chua [10] in the year 1996 and its main finding is that the demand for ownership dispersion affects IPO (under)pricing. Booth and Chua argue that owners' value more dispersed ownership structure, as that may result in more liquid secondary market, which in turn increases the share price. In this Chapter the work of Booth and Chua will be explained.

Booth and Chua start their work with the assumption that, for an issue, j , an investor, i , can further improve his estimate of the market price per share, $E(v)$, for a cost Ci .

After incurring this costs, investor compares his improved estimates of value with the final offer price, OP , to determine whether or not to bid for the shares.

Compared to uninformed investors, who choose not to incur information costs, Booth and Chua assume that informed investors are more likely to participate in secondary-market trading and future offerings. They argue that the size of the potential-investor base is important in promoting secondary-market liquidity.

One of the main assumptions of Booth and Chua's work in this framework is that the number of investors encouraged to incur information costs, n , is set by the issuer in conjunction with the investment banker. Investment banker can namely promote the issue and encourage the information production that will be sufficient to induce oversubscription.

Booth and Chua assume that investment bankers first solicit potential investors with lower information costs to investigate the issue. Subsequent investors who investigate the issue incur a cost that increases at an increasing

rate, i.e. the total information costs, $C(n)$, represents a function with positive first and second derivatives;

$$\partial C(n) / \partial n > 0 \text{ and } \partial^2 C(n) / \partial n^2 > 0$$

To achieve a preferred level of oversubscription, Booth and Chua argue that the investment banker must first encourage an adequate number of investors to purchase information. In this framework, issue proceeds, R (here equal to final offer price, OP) are maximized, with investors recovering their information costs, when

$$R = Ev(n^*) - C(n^*), \quad (3.4.1)$$

where

R = issue proceeds

$Ev(n^*)$ = investment banker's estimate of value at the optimal level of oversubscription; this function Booth and Chua assume to be increasing at a decreasing rate

$C(n^*)$ = total information costs for all potential investors at the optimal level of oversubscription; this function Booth and Chua assume to be increasing at an increasing rate;

n^* = optimum number of potential investors purchasing information.

Consequently, in an equilibrium, maximizing proceeds involves calculating the estimated value and setting the final offer price (OP), taking into account the number of potential investors purchasing information, such that

$$[Ev(n^*) - OP] - C(n^*) = 0 \quad (3.4.2)$$

This equation states that initial returns to the winning bidders equal the total information costs for all potential investors.

Booth and Chua conclude that the expected value of the winning bid is lower than the expected value of the asset. In models of this type, potential investors enter the auction process until the winner's expected profit equals the sum of all bidders' information costs.

Booth and Chua now try to estimate the optimum number of potential investors purchasing information, n^* , that will maximize the issue proceeds while investors recover their pre-bid information costs.

In this framework, Booth and Chua argue that $Ev(n)$ increases with the level of oversubscription, n . They give two grounds for this assumption: First, value increases when the issue is widely promoted since the most optimistic investors are more likely to be bidding for shares. Secondly, by observing that the issue is being widely marketed, investors estimate a certain level of liquidity for the share in the secondary market and set their estimate of value accordingly.

Booth and Chua assume that total information costs, $C(n)$, also increase with n , since more investors purchasing the information are expected to be compensated in equilibrium. Since an increase in n leads to an increase in both $Ev(n)$ and $C(n)$, offer price (OP) can either increase or decrease. In equilibrium, following conditions have to be satisfied:

$$OP = Ev(n) - C(n) \quad (3.4.3)$$

$$\partial OP / \partial n = dEV(n) / \partial n - \partial C(n) / \partial n \quad (3.4.4)$$

The intuition is straightforward; Booth and Chua state that when $\partial EV(n) / \partial n > \partial C(n) / \partial n$, then $\partial OP / \partial n > 0$. Therefore, OP increases with oversubscription because the rate of increase in $EV(n)$ is greater than the rate of increase in $C(n)$, i.e. greater than the cost associated with informing the marginal investor.

On the other hand, when $\partial EV(n) / \partial n < \partial C(n) / \partial n$, then $\partial OP / \partial n < 0$, which actually means that OP will decrease with oversubscription. Booth and Chua argue that OP is hence maximized at n^* , when $\partial OP / \partial n = 0$, i.e. when $\partial EV(n^*) / \partial n = \partial C(n) / \partial n$.

At n^* , investment bankers have promoted oversubscription to the point where the benefit in terms of the increase in expected value is equal to the information cost of a marginal investor. At n^* , the issuer maximizes total proceeds (here, equal to OP), subject to investors recovering information costs through initial underpricing.

Moreover, Booth and Chua model the optimal number of shares issued (ownership dispersion), S^* , consistent with issuers maximizing proceeds and potential investors recouping pre-bid information costs across multiple issues. At S^* , $Ev(n^*)|S - C(n^*)|S$ is maximized.

This occurs when

$$\partial[Ev(n^*)|S - C(n^*)|S] / \partial S = 0 \quad (3.4.5)$$

or

$$[\partial Ev(n^*)|S] / \partial S = \partial[C(n^*)|S] / \partial S \quad (3.4.6)$$

Booth and Chua hence incorporate secondary liquidity in their model. When this secondary-market liquidity is incorporated into potential investors' estimate of market value, issuers' proceeds are maximized when the rate of increase in total market value equals the rate of increase in total information costs (assuming the optimal level of oversubscription per allocation).

At distributions greater than S^* , the increase in total information costs would exceed the benefits of increased secondary-market liquidity, resulting in lower total proceeds. At distribution less than S^* , the savings in information costs are offset by the decrease in value due to lower secondary-market liquidity. Therefore, at S^* the difference between $Ev(n^*, S)$ and $C(n^*, S)$ is the biggest.

Booth and Chua argue that, since information are costly to produce, underpricing is used to compensate investors for incurring pre-bid information costs in IPOs. Their model illustrates that an optimal level of underpricing is reached when the issuer maximizes proceeds. Optimal ownership dispersion, S^* , is partly determined by the value of the secondary market liquidity. Booth and Chua argue that maximizing proceeds involves promoting secondary-market liquidity through initial ownership dispersion and oversubscription to the point where the rate of increase in total market value equals the rate of increase in total information costs. Related to the work of Booth and Chua, Maksimović and Pichler [30] on the other hand argue¹¹² that for any given amount of information gathering, wealth loss due to that information gathering is a fixed cost. Contrarily, the wealth loss that is caused by adverse selection risk is variable cost which increases with

¹¹² see Maksimović, V., and P. Pichler, 2006, Structuring the Initial Offering: Who to Sell To and How To Do It, Review of Finance 10, pp 22.

the issue size. The optimal amount of information gathering will therefore, as Maksimović and Pichler state, increase in the issue size.

3.5. When-Issue Market

When-issue market is actually a market for shares that have not been issued yet, but whose issue is already announced. My effort on describing When-issue market will be based on the work of Aussenegg, Pichler and Stomper [1], as they argue that when-issue market is a good way of pricing the IPO shares. When-issue market, as stated by Aussenegg, Pichler and Stomper, can not completely eliminate bookbuilding but can reduce underpricing.

Aussenegg, Pichler and Stomper state that in auctions, same as in bookbuilding, the pricing relevant information is obtained directly from potential buyers in the primary market. This information revelation consequently incurs some costs for the issuer. Aussenegg, Pichler and Stomper argue that the information relevant for pricing IPO shares may be revealed through trading in related securities in a pre-auction, "when-issued", market before these securities are offered in the primary market. The intuition is that this "when-issued" market can release the information that may affect investor's bidding strategies in the auction and thus the price(s) at which the securities are sold. When-issued trading therefore provides pricing-relevant information for free because when-issued prices are publicly observable.

An underwriter by observing when-issue trading can gauge the market's interest for an IPO and thus the bookbuilding mechanism can be used only as a means for distributing IPO shares and not any more for obtaining costly information. Authors differentiate between bookbuilding that occurs prior to the opening of when-issued market and bookbuilding that occurs concurrently with when-issued market trading.

Anyhow, issuer has to have a notion of IPO share price, while when-issue trading begins only after the posting of an indicative range for the IPO offering price and lasts till the day before the start of secondary market trading of IPO shares. That gives the traders an indication of how IPO shares will be priced in the primary market.

When-issued market can represent a potentially valuable source of free information for IPO pricing, but it does not unconditionally imply that this trading can supplant bookbuilding as an indicator of how IPOs should be priced. Namely, when-issued market may not be able to open on its own. As Aussenegg, Pichler and Stomper argue, prospective sellers may stay out of the market because of the possibility of a "squeeze", which can occur if short sellers in the when-issued market are not awarded securities in the auction.

Nevertheless, it appears as Aussenegg, Pichler and Stomper state that when-issued market provides an indication of how IPO should be priced in the primary market. It revises this information relevant for IPO pricing, but the offer price is not fully adjusted relative to this information. This under revision can be viewed as an evidence of rents that investors receive for providing underwriters with information. However, Aussenegg, Pichler and Stomper argue that these rents are not paid for information that underwriters obtain after the opening of when-issued trading. Aussenegg, Pichler and Stomper argue that lack of such phenomenon suggests that, once when-issued trading commences, bookbuilding is not a source of costly information for IPO pricing. Any such informational role of bookbuilding is therefore confined to the period before the opening of the when-issued market, as the authors differentiate between bookbuilding that occurs prior to the opening of the when-issued market and bookbuilding that occurs concurrently with when-issued market trading. Indeed, Aussenegg, Pichler and Stomper's finding suggest that underwriters do gather information through bookbuilding in order to set price ranges *before* when-issued trading begins.

Consequently, there is a value to gathering information before setting the offer price range. The range is hence a signal of information held by the underwriter.

The main finding of this article would be that, if when-issue trading of IPO shares reveals investors' private information for free, then there is no need to pay them informational rents once when-issued trading commences and therefore the underpricing should be smaller.

4. Indications of Interest and Theoretical Implications

In this Chapter the process of collecting potential investor's interest will be described. A significant effort will be given on explaining the Bookbuilding process, on the Partial Adjustment Phenomenon and on the process of allocation of (rationed) shares.

4.1. Bookbuilding

Bookbuilding procedure is a process of soliciting bids for shares from potential investors prior to pricing an equity issue.¹¹³ After the bids have been solicited, the investment banker uses his discretionary right aligned with the issuers' goals to price the issue. Subsequent to this process the investment banker allocates the shares at his discretion to the investors. Bookbuilding can be viewed as an information gathering process because the offer price and allocation of shares depend on information exchanged, as it involves information 'flow from investor to the issuer and vice versa'¹¹⁴.

The bookbuilding process is often used for pricing the IPOs. The informed bidders, who provide information about the share's value in their bids, are expected to receive favorable allocations, especially when the issue is heavily oversubscribed.¹¹⁵ Therefore in exchange for truthful revelation, investors receive some rents. The intuition is that if the investment bank can allocate more shares to the bidders who provide valuable information, less underpricing will be required.

Indications of interest¹¹⁶ consist of bids for quantity of shares desired and may include a maximum price (limit price) that an investor is willing to pay, or

¹¹³ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2337.

¹¹⁴ see *Sherman, Ann E., 2003, Global trends in IPO Methods: Book Building vs. Auctions, www.nd.edu/~finance/020601/news/Sherman%20Paper.doc*, pp.3.

¹¹⁵ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2337.

¹¹⁶ Collecting indications of interest and the way how this indications can influence the IPO price and allocation was already described in Chapter 3.1., using the model introduced by Benveniste and Spindt [6]. This model is based on the assumption that only two possible indications, good or bad, can be given. This Chapter will show that in the real word, this is not the case. Nevertheless, merits of Benveniste and Spindt's model are still undoubtfull.

some other information that is relevant for underwriter to price the issue. With all the information collected investment banker constructs a demand curve for the shares offered. It is important to say the issue price is then not set according to any explicit rule, but rather based on 'the investment banker's interpretation of investor's indications of interest'.¹¹⁷ As the information contained in the bids is used in pricing the issue, investors that submitted the bids consequently lose their informational advantage.

To guarantee that investors accurately report their preferential information to the investment banker, the investment bank has to set the prices and allocations so that it is optimal for them to do so. Consequently, investment banker faces a set of "truth-telling" constraints¹¹⁸ to induce informed investors to tell the truth. They must be offered some combination of more IPO allocations and underpricing when they indicate a willingness to purchase shares at a high price.¹¹⁹ Therefore some money has to be 'left on the table' to induce truth-telling.

Related to the work of Booth and Chua [10] and Beatty and Ritter [4] another big advantage of the bookbuilding process is the underwriter's discretionary right to choose the number of investors that enters the bookbuilding procedure¹²⁰. This discretionary right will guarantee the sufficient number, but not too many, of investors who are involved¹²¹. Therefore the investment banker will be able to assume and control the amount of cost investors incurring in scrutinizing the firm. Moreover, the issuer will select the accuracy of each investor's information by setting the prices and allocations that will induce investors to purchase the optimal amount of information.¹²² Underwriter has to trade-off the increase in information accuracy against a corresponding increase in

¹¹⁷ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2337.

¹¹⁸ see Sherman, Ann E., 2000, IPOs and Long-Term Relationships: An Advantage of Book Building, *The Review of Financial Studies* 3, pp 702.

¹¹⁹ Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, pp 1804.

¹²⁰ see Sherman, Ann E., 2000, IPOs and Long-Term Relationships: An Advantage of Book Building, *The Review of Financial Studies* 3, pp 710.

¹²¹ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, www.nd.edu/~finance/020601/news/Sherman%20Paper.doc, pp 3.

¹²² see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, www.nd.edu/~finance/020601/news/Sherman%20Paper.doc, pp 8.

required underpricing which will be necessary to compensate investors for their evaluation costs.

The bookbuilding procedure is similar to an auction, although some important differences that are worth mentioning arise. The most important difference is that the pricing and allocation rules are not announced in the bookbuilding procedure.¹²³ During the auctions (sometimes called the open offer systems) securities are priced and allocated according to explicit rules,¹²⁴ i.e. are based only on current bids. In the auctions there is no possibility, contrary to the bookbuilding, to coordinate the number of investors involved in the process. Therefore it may occur that too few investors enter the process causing the offer to fall, or it may occur that too many investors enter and bid all of the potential profits away and consequently prevent investors from recovering their information costs.¹²⁵ Investors have namely no guarantee that if they scrutinize the firm they will have a reasonable chance to obtain shares.¹²⁶

Contrary to the bookbuilding procedure, in the auctions there is no possibility to refuse any order for any arbitrary reason while allocations are determined solely by bids¹²⁷. Thus two investors that submit the same bid have the same ex ante expected allocation, whatever their identity is.¹²⁸ Obviously the bookbuilding process gives the underwriter control over the process, which is not the case in the auctions.

For both methods, the expected proceeds will be equal to the offer price minus expected aggregate information costs of investors. The difference is that in bookbuilding there is a greater ability to control information expenditures and thus

¹²³ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2337.

¹²⁴ see Aussenegg, W., Pichler, P. and A. Stomper, 2006, IPO Pricing with Bookbuilding and a When-Issued Market, *Journal of Financial and Quantitative Analysis* 41, pp 829., and DeGeorge, F., Derrien, F. and Kent L. Womack, 2008, Auctioned IPOs: The U.S. Evidence, Swiss Finance [Institute Research Paper, 08-38](#), pp 5.

¹²⁵ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, [www.nd.edu/~finance/020601/news/Sherman%20Paper.doc](#), pp 4.

¹²⁶ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, [www.nd.edu/~finance/020601/news/Sherman%20Paper.doc](#), pp 31.

¹²⁷ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, [www.nd.edu/~finance/020601/news/Sherman%20Paper.doc](#), pp 8.

¹²⁸ see DeGeorge, F., Derrien, F. and Kent L. Womack, 2008, Auctioned IPOs: The U.S. Evidence, Swiss Finance [Institute Research Paper, 08-38](#), pp 5.

the expected proceeds as well. In the bookbuilding procedure there is no undersubscription possibility since the underwriter will recruit a sufficient number of investors that will have incentive to attend the road show and consider the offering.¹²⁹ In the bookbuilding, unlike the auctions, underwriter has the control over information expenditures and the underpricing is expected to be lowered.¹³⁰

Without the ability to make allocations dependent on the information reported, there is no way for underwriters to give investors the incentive to report their information accurately.¹³¹ Consequently this will also lead to more underpricing.

Another popular method of selling shares is Hybrid offering. This is where bookbuilding is used to gather information from institutional investors and the public offer tranche is used for local retail investors which do not participate in the price-setting process.¹³²

As mentioned already in the bookbuilding procedure there is no pricing¹³³ and allocation rules. Investment banker uses his knowledge and experience in line with the issuers' interest to price and allocate the shares to the desired investors. The desired investors are mainly the ones who gave some valuable information regarding to the IPO share price and did not free-ride on other investor's information, who have long term relationship¹³⁴ with the investment banker, or by some other conjecture viewed as desirable for receiving an allocation (for example preferred ownership structure, nationality of the bidders, favorable treatment of domestic investors etc.). Investment bank may also follow its own interest by favoring its "friends," who in return can help the bank in other circumstances.

¹²⁹ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, www.nd.edu/~finance/020601/news/Sherman%20Paper.doc, pp 19.

¹³⁰ see Sherman, Ann E., 2003, *Global trends in IPO Methods: Book Building vs. Auctions*, www.nd.edu/~finance/020601/news/Sherman%20Paper.doc, pp 31.

¹³¹ see Sherman, Ann E., 2000, *IPOs and Long-Term Relationships: An Advantage of Book Building*, *The Review of Financial Studies* 3, pp 697.

¹³² see Sherman, Ann E., 2000, *IPOs and Long-Term Relationships: An Advantage of Book Building*, *The Review of Financial Studies* 3, pp 697.

¹³³ Only pricing related rule is so called one-price rule, that states that all shares must be sold at the same price, see DeGeorge, F., Derrien, F. and Kent L. Womack, 2008, *Auctioned IPOs: The U.S. Evidence*, [Swiss Finance Institute Research Paper, 08-38](#), pp 2.

¹³⁴ What may help reducing the underpricing, as was already discussed.

In a bookbuilding procedure, unlike the auctions, investor's bids are not presenting a commitment to purchase; they present merely an indication of interest. It is however very rare for any investor to abandon its own bid.¹³⁵

The bookbuilding procedure begins with the investment bank announcing a price range (after conducting due-diligence of the firm and observing other factors that may influence the share's performance), which is only indicative and then the investment banker starts the 'road show' in order to market the issue and solicit the indications of interest from potential investors who bid for the shares.

The book contains each bid submitted, identification of the bidder, the number of shares requested, date when the bid was submitted, possible revisions of the bid and a limit price (i.e. how much the investor is willing to pay) if specified.¹³⁶

Normally the book does not include the retail demand, which is handed separately for a prespecified number of shares.¹³⁷

There are three types of bids an investor can submit:¹³⁸

1) 'Strike bid', which is actually a request for shares regardless of the issue price (bidder submitting a strike bid is willing to pay the issue price). It can be submitted either in the number of shares desired (regardless the price per share), or in the currency amount desired to invest (regardless the amount of shares that enters in that sum).

2) 'Limit bid', which specifies the maximum price that the bidder is willing to pay for the shares.

3) 'Step bid'; if the bidder submits a demand schedule as a step function (step bid is like a sequence of limit bids, i.e. it states multiple limit prices).

¹³⁵ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2337.

¹³⁶ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2340.

¹³⁷ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2340.

¹³⁸ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2340.

Actually, any of these bids can be submitted for a specified quantity of shares or for a given amount of money regardless the issue price. Limit and step bids are categorized¹³⁹ as price sensitive bids.

'Currency bids' define those bids that specify an amount of money. The number of shares requested by currency bids changes with the issue price.¹⁴⁰

Most interesting from a rational investor's viewpoint are the strike bids, and the question why do investors submit strike bids. Strike bid could be submitted when the investor is uncertain about valuation and is simply prepared to accept consensus price. It is also possible that investors place a value on the shares that is at least at the top¹⁴¹ of the indicative price range, in which case a strike bid can be read as a limit bid at the top of the range.¹⁴²

Underwriter prefers limit bids, while with submitting limit bid, 'an informed investor reveals his information. If all bids were for example strike bids for fixed quantity of shares, the aggregate demand would be perfectly inelastic and the book would provide no indication of how to price the issue, other than through the overall level of demand. On the other hand, limit bids provide specific information about the elasticity of the demand and give the underwriter a better idea of the true value of the share and where to price the issue within the price range'.¹⁴³ According to this conjecture, if the purpose of bookbuilding is to extract information, limit and specially step bids should be treated more favorably in the allocation of shares while they provide more information.¹⁴⁴

It is assumed that only informed investors submit limit bids. If an uninformed investor submits a limit bid, two types of costs will occur:¹⁴⁵ If the limit price is too

¹³⁹ Jenkinson, T. and H. Jones, 2004, Bids and Allocations in European IPO Bookbuilding, *The Journal of Finance* 59, pp 2323.

¹⁴⁰ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2350.

¹⁴¹ When the range cannot be revised, as will be discussed at the end of this chapter.

¹⁴² Jenkinson, T. and H. Jones, 2009, IPO Pricing and Allocation: A Survey of the Views of Institutional Investors, *The Review of Financial Studies* 22, pp 1490.

¹⁴³ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2346.

¹⁴⁴ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2350.

¹⁴⁵ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2346.

low, the investment bank might set the issue price higher than the limit price and the investor would obtain no shares. But if the investor's limit price is too high, he might¹⁴⁶ influence the price upwards and receive overpriced shares. The underwriter may also reject this order finding it to be as "disguised market orders", i.e. quasi-market orders, placed high only to disguise the underwriter and not actually be based on share's evaluation.¹⁴⁷ There are some evidences that retail investors much more likely than institutional investors place these high and uninformative bids.¹⁴⁸

When the submitting period is over, the investment banker 'aggregates all of the bid information, constructs a demand curve and determines the issue price, which is usually set so that the total demand is larger than the number of shares'¹⁴⁹, i.e. offer price is below the market clearing price.

After the issue price is set, the investment banker asks the investors to confirm their indications of interest¹⁵⁰, and decides how to allocate the total shares among investors without following any explicit rule.¹⁵¹ The main result of such behavior is that bidders are not rationed equally, i.e. pro rata; instead of that some are rationed in favor and some are rationed against.¹⁵²

The share distribution is assumed not to influence the pricing decision; for example the possibility that the investment banker would set a low price to ensure that a particular limit order is hit, is excluded.¹⁵³ Logically as the oversubscription increases, investment banker gets more and more discretion in allocating the

¹⁴⁶ Although this occurs very rarely, since retail investor's bids are assumed to be small and thus without any significant impact on pricing decisions.

¹⁴⁷ see McDonald, J., and B. Jacquillat, 1974, The French Sealed-Bid Auction, The Journal of Business 47, pp 41.

¹⁴⁸ see Degeorge, F., Derrien, F. and Kent L. Womack, 2008, Auctioned IPOs: The U.S. Evidence, [Swiss Finance Institute Research Paper, 08-38](#), pp 3.

¹⁴⁹ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2343.

¹⁵⁰ Ljungqvist, A., IPO Underpricing, 2004, Handbooks in Finance: Empirical Corporate Finance, Salomon Center, Stern School of Business, New York University and CEPR, pp 3.

¹⁵¹ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2343.

¹⁵² see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2345.

¹⁵³ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, The Journal of Finance, 56 (6), pp. 2348.

shares, whereas in the other extreme, if the demand is exactly equal to supply, he has no discretion while all orders are filled by 100 %.¹⁵⁴

Investment banker allocates some shares to the individual investors, who are typically small and uninformed occasional players on the stock market, but as they behave like the noise traders, their sentiment is likely to affect the aftermarket share's performance. IPO price is set to partially reflect their bullishness or bearishness,¹⁵⁵ because they are assumed to participate in the aftermarket only if they are bullish about the share's performance. If retail investors are bullish about the shares' aftermarket performance, they will buy the shares that are flipped by institutional investors. Otherwise, the aftermarket is assumed to be restricted to institutional investors.¹⁵⁶

McDonald and Jacquillat [32] in their article give an example of IPO pricing and allocation, which I'll elaborate at this place in order to closely explain pricing and allocation process.

In McDonald and Jacquillat's [32] article there is an example given of IPO pricing and allocation, which I will elaborate at this place in order to closely explain pricing and allocation process.

The authors elaborate a French company, that wanted to issue 100,000 shares and the minimum acceptable price (after conducting due-diligence and other valuation methods) was set at 850 francs per share. Subsequent to soliciting investor's interest and setting the demand curve, the apparent market clearing price was about 1,180 francs per share. The committee regarded this price to be 'too high' in terms of their expectation of market price in the aftermarket and has decided upon 1,025 francs per share as the offering price. The bids at 1,500 francs or more, totaling 4,000 shares, were rejected¹⁵⁷ as 'disguised market

¹⁵⁴ see Cornelli, F. and D. Goldreich, 2001, Bookbuilding and Strategic Allocation, *The Journal of Finance*, 56 (6), pp. 2359.

¹⁵⁵ see Derrien, F., 2005, IPO Pricing in 'Hot' Market Conditions: Who Leaves Money on the Table?, *The Journal of Finance* 60, pp 498.

¹⁵⁶ see Derrien, F., 2005, IPO Pricing in 'Hot' Market Conditions: Who Leaves Money on the Table?, *The Journal of Finance* 60, pp 499.

¹⁵⁷ This certainly does not mean that the same procedure is conducted in every IPO and that there are always some bids rejected. For example, Maksimović and Pichler (see [29], pp. 3) state that 'any regular investor who participates actively in the pricing process by providing information is offered an

orders', i.e. they were conceived as too high to be credible, and thus treated equivalent to a strike bid with defrauding intention. Bids between 1,350 and 1,500 francs per share were accepted in full and allocated 32,000 shares of the issue, bids between 1,120 and 1,350 francs were accepted at 50% of the quantity requested and allocated 43,000 shares, and bids between 1,025 and 1,350 francs were 30% filled with 25,000 shares, therefore a total issue of 100,000 shares were allocated at the common offering price of 1.025 francs per share.

A question that arises is why the issuer and the underwriter decided to allocate the shares at 1,025 francs when they could have been actually sold at the market clearing price, 1,180 francs, i.e. for 15% more. Maybe the reason for that was the insurance hypothesis of the underpricing, as discussed in the Chapter 2.2.2., but that hypothesis was stated as more US centric and this IPO was located in France. Why the offer price was set at 1,025 francs may be, as McDonald and Jacquillat argue, that the partial allocation ensured wider distribution of the shares, as maybe desired by the issuing company. On the other hand a circular process of reinforcement in previous auctions may have led bidders to expect partial allocation and a downward adjustment of the apparent market clearing price in determining the offering price, so that the apparent market clearing price represents a consistently upward-biased estimate of true market clearing price. Following passage will show that the investment bank would lose its reputation if the shares were priced beyond the initial offer range; the reason why the price was not set at the 1,180 francs could be that the top of the initial price range was beneath the market clearing price. It is namely important to stay within the range to be able to extract private information from investors.¹⁵⁸

The huge difference of US and Europe bookbuilding procedures is that in the US the interactions with potential investors prior to registration, which is routine in Europe, are strictly prohibited. The information gathered during the pre-marketing phase can be taken into account when setting the initial indicative price range. This European-centric ability to canvass the opinion of investors prior the setting the initial indicative price range adds complexity to the information

allocation, regardless of the nature of the information'- another proof that IPO procedures and rules vary a lot.

¹⁵⁸ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 185.

revelation problem.¹⁵⁹ The intuition is straightforward; knowing that positive feedback will drive up the offer price, investors have an incentive to understate their beliefs.¹⁶⁰

This incentive distortion can be resolved by the bank's commitment not to exceed the indicative price range regardless of the feedback during the bookbuilding effort it will receive and to favor all other ("uninformed") investors in the event of oversubscription.¹⁶¹

By committing to favor uninformed investors, investment bank frightens the informed investors with the possibility of withholding allocation if the private information exogenously reveals to uninformed investors prior to the completion of the offering. With this threat, and a firm commitment to the upper bound of the indicative price range, informed investors run the risk of being crowded out at the offering if they understate their beliefs in communications, on which the investment bank conditions the indicative price range.¹⁶²

The threat that uninformed investors will become exogenously informed and crowd out the informed investors' disciplines informed investors.¹⁶³ Although the banks optimal ex post response to overbidding would be to raise the price range, uninformed investors would never oversubscribe a new issue if they anticipated a price increase. The disciplining role of uninformed investors would then be lost.¹⁶⁴

That is the reason why the final price is set within and very often at the boundaries of the price range in Europe, while in the US the final price is frequently set outside the initial price range.¹⁶⁵

¹⁵⁹ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 187.

¹⁶⁰ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 187.

¹⁶¹ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 187.

¹⁶² see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 187.

¹⁶³ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 199.

¹⁶⁴ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 199.

¹⁶⁵ see Jenkinson, T., Morrison, A., and W.J. Wilhelm Jr., 2006, Why are European IPOs so rarely priced outside the indicative price range?, *Journal of Financial Economics* 80, pp 188.

4.2. Partial Adjustment phenomenon

Partial adjustment phenomenon was already mentioned in previous Chapters, but will be discussed here in more detail. This phenomenon was introduced by Benveniste and Spindt [6] and explained by Hanley [20]. The phenomenon is actually the common observed fact that those issues that have positive revisions in the offer price, due to the positive information revealed during the pre-issue period, will show more underpricing than other IPOs.¹⁶⁶ It can be also deducted, in that sense, that the relation of the final offer price to the range of anticipated offer prices disclosed in the preliminary prospectus is a good predictor of the amount of underpricing on the first trading day.¹⁶⁷

The conclusion is that instead of raising the final offer price to the expected market value of equity on the initial trading day, underwriters only partially adjust the price upwards.¹⁶⁸

A most common accepted explanation of partial adjustment phenomenon is that investors must have an incentive to reveal positive information. When good information is revealed, the offer price will be adjusted to these new findings, but not completely while some of the profits have to be left for the information supplier. The more valuable the information is, the more wealth has to be paid for receiving it while there is greater incentive to withhold it. This payment is made via (under)pricing and allocation schedule that maximizes the investors' total expected profit.¹⁶⁹

If the issue is oversubscribed, then underwriters may not be able to fully compensate investors for their truthful revelations by simply increasing the number of shares to be issued. Consequently, if the shares are rationed, the offer price will only partially adjust to good information and underpricing will be used together with increased share allocation to reward truth-telling investors.

¹⁶⁶ see Hanley, Kathleen W., 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, pp 231.

¹⁶⁷ see Hanley, Kathleen W., 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, pp 232.

¹⁶⁸ see Hanley, Kathleen W., 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, pp 232.

¹⁶⁹ see Hanley, Kathleen W., 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, pp 232.

The issuer faces thus a perplexing situation¹⁷⁰: the bad news that a lot of money was left on the table arrived at the same time with the good news of high proceeds and a high market price. Because a lot of money is left on the table almost exclusively when it is packaged with good news, issuers rarely complain. The possible complaint could though be in the sense that initial price range could have been wider, or shifted towards bigger prices.

Nevertheless, issuers with the greatest underpricing are happy because they ended up with greater proceeds (and wealth) than they originally anticipated.¹⁷¹

4.3. Allocation and Rationing phenomenon

Allocation and Rationing phenomenon have been mentioned already,¹⁷² while it cannot be given a detailed overview about the bookbuilding without mentioning allocation and rationing. Allocation and rationing are the two sides of the same coin, and come along with the bookbuilding, where the underwriter has the discretion right regarding allocation and rationing.

The basement of this phenomenon is the underpricing, while the underpricing creates excess demand and consequently the underwriter has to decide whom to allocate rationed shares and how much to allocate per single investor. This is one of the most salient features of the IPO market, while once the offer price is set, any excess demand for the issue creates a situation of quantity rationing, rather than further adjustment of the offering price.¹⁷³

Assuming the investment bankers act in the interest of the issuer, they will allocate shares to those investors who provide positive information about the issue's value, conditional on desired ownership structure and other goals that the issuer has. For example, shares could be also allocated to those investors who

¹⁷⁰ see Ritter, Jay R., 1998, Initial Public Offerings, Contemporary Finance Digest 2, pp 10.

¹⁷¹ see Cliff, Michael T. and David J. Denis, 2004, Do Initial Public Offering Firms Purchase Analyst Coverage with Underpricing?, The Journal of Finance 59, pp 2885.

¹⁷² see Chapter 4.1.

¹⁷³ see Beatty, Randolph P. and Jay R. Ritter, 1986, Investment banking, reputation and the underpricing of initial public offerings, Journal of Financial Economics 15, pp 215.

buy hot and cold IPO's, thus reducing the average underpricing.¹⁷⁴ Stoughton and Zechner [45], in line with Jensen and Meckling [25], argue that the desired ownership structure can depend on the possibility that the block holder will have an incentive to monitor the firm's management (which is an important feature when ownership and control are not in the same hand any more) and thus discipline them. Ownership structure affects namely the efficiency of corporate governance and thus the intrinsic value of the firm.

Underwriters have to grade the amount of flippers (i.e. those who sell the shares immediately after receiving them) and to gauge the effect of their shares on the market once when the trading commences. On the one hand, flippers are good for liquid aftermarket trading and helping the price to jump to the unsustainable levels, but on the other hand, if the demand is weak, the flipped shares can reduce the price substantially.¹⁷⁵

Jenkinson and Jones [21] state that investment bankers, when asked about allocation 'claim that they are influenced by the "quality" of the bidder.' But in none of the books Jenkinson and Jones analyzed did the bookrunner attempt to make a systematic and objective ranking of bidders by their quality. When pressed to define a high-quality investor, Jenkinson and Jones state that many investment banks will relate quality to the probability of the investor being a longer-term holder of the stock.¹⁷⁶

Jenkinson and Jones also state that larger bids receive larger pro rata allocations, and that price sensitive bids are rationed less. It is also important to mention that the bid submitted early in the bookbuilding process will be considered as more valuable, as well as the revised bids.

If the purpose of the bookbuilding is to elicit information from the investors, then the most informative bids should face the smallest rationing. The allocation process is mainly determined by rewarding the information providers, but the other issues, as like business relationship with the underwriter, desired shareholders

¹⁷⁴ see Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, pp 1808

¹⁷⁵ see Ritter, Jay R. and I. Welch, 2002, A Review of IPO Activity, Pricing, and Allocations, *Journal of Finance* 57, 1815.

¹⁷⁶ Jenkinson, T., and H. Jones, 2004, Bids and Allocations in European IPO Bookbuilding, *The Journal of Finance* 59, 2316.

structure, nationality of the bidders etc. are also relevant for the allocation. What factors do prevail and what are the relative strengths of them remains in the underwriter's discretion and can vary through different IPOs.

5. Conclusion

The IPO process is not easy, as it requires skills, experience, established business connections, special knowledge about firm valuation, about identification of market conditions, investors' sentiment and their aftermarket conduct etc. The most prominent issues of IPO process is how the price of IPO shares is determined and how the shares are allocated to the investors that wanted to buy them.

IPO shares should be valued as any other share. Pricing process is therefore based on valuation methods. But all evaluation methods are based on forecasting and forecast is based on personal convictions that can differ a lot between investors, as they may have different expectations of future earnings, future discount rates, future systematic and idiosyncratic risks, about present conditions, about markets, about managers, about competitors etc.

As there is an ample of uncertainty regarding the IPO firms, valuation of its shares is not so easy. So, underwriter - the investment banker who helps the IPO firm to price, market and sell the issue - often works with other investors, trying to elicit their preferential information that can help in pricing the IPO shares. That's why the pricing decision is not a simple mechanical algorithm, while there are many factors, personal interests, market feedback and investors sentiment that have to be put together to establish the offer price. The investment banker has skills and experience in observing these factors and will, depending on his own opinion about them, set the fair offer price.

Fair offer price cannot be viewed alone. Instead the allocation process has to be observed in the same time. It is due to the fact that offer price was established conditional on investors' feedback and since they helped the investment banker to set the price more fairly, they have to be rewarded by receiving the underpriced shares. And the level of underpricing is determined by the costs that investors incurred in evaluating the company.

Therefore, as the IPO share price is not a simple algorithm, there are some incentive constraints that the investment banker has to follow in establishing the price and allocation rules. Since the IPO process is not exact, there is a huge possibility that the future researchers will find and identify something new that has

an impact on IPO process and that actual IPO process (which differs a lot from country to country) will be out of date in the future.

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Appendix

Abstract – English version

As many things in economics, the IPO problematic is also not exact, and there is an ample of literature and different opinions about influences, relations between the parties involved, conditions, timing, expectations and others related to the IPO process.

One of the most interesting and enigmatic features of the IPO process is how the price of new-issued shares is determined. The IPO shares should be priced and valued as any other shares, but there are some interesting features that IPO shares demonstrate and explanations of these features, as for example IPO underpricing, Hot-issue market or Long-term underperformance of IPO shares, are miscellaneous.

Pricing process is not a simple mathematical algorithm. Nevertheless, different valuation methods are used in the pricing process, but the difficulty of estimating the future revenues, choosing the appropriate discount rate, valuing the assets in place, estimating the growth probabilities, and lack of comparable firms in most of the cases makes the IPO pricing process more complex. Due to this complexity, the pricing and distribution process is commonly conducted by an investment banker, a specialized institution that has more experience in pricing and distributing activities, and which is employed by the issuing firm to help in the IPO process. This investment banker is called the underwriter of the issue.

As the value of a company is not determined only by idiosyncratic factors, but with the external ones like market conditions, political risks, competitors, expectations and plenty of others as well, the company has to learn these factors and somehow incorporate all of them in the share pricing process.

The intuition is that the issuing company and its underwriter do have some knowledge about these outside factors, but they are in disadvantage comparing with the aggregate knowledge of all the other market participants. This point of IPO process is the most interesting one – Issuing firm, willing to price its share precisely, has to cooperate with the outside investors, who will on the other hand benefit if the price is not set at an appropriate level.

The main problem an issuer faces is how to induce these informed investors to reveal their preferential information knowing that they might benefit when reporting falsely. It is the bookbuilding process that enables the information extraction and rewarding the truth-telling investors. The process of building a book is nothing else but the collecting of indications of interest from potential investors, and setting the price and allocation.

The main characteristic of the bookbuilding process is that there is no rule about setting the price and determining the allocation that each investor will receive. This is the big advantage of the process because the investment banker can punish the falsely-reporting investors by excluding them from allocation, induce the potential investors to scrutinize the firm and set the price at the level which will enable the investors to recoup their research costs.

Possibility of being excluded from the allocation if reporting falsely induces the informed investors to reveal their preferential information. In return, the investment banker promises these investors to receive more shares as a reward for telling the truth. These shares have to be underpriced as well, but not so much as they would have been without information collecting process. The informed investor hence faces the trade-off between falsely reporting and hoping to receive allocation in more underpriced shares and reporting truly and receiving the bigger allocation of less underpriced shares. Therefore, the conditions that an investment banker has to observe is that informed investors have to be better-off when reporting truly than when reporting falsely, and that the issuing company itself has to benefit from the information gathering process as well. It is possible that both benefit, while this interaction between them reduces the free riding of uninformed investors which will get less amount of highly priced shares.

Abstract – German version

Da es keine allgemein gültige Formel oder mathematischen Algorithmus für einen Börsengang (engl. – IPO, Initial Public Offering) gibt, bietet die Literatur eine Fülle an Informationen über Einflüsse, Beziehungen zwischen den eingebundenen Parteien, Rahmenbedingungen, Zeitpunktwahl und Erwartungen beim Börsegang.

Eine der interessantesten und rätselhaften Eigenschaften des IPO-Prozesses ist die Preisbestimmung von neuen Aktien. IPO-Aktien sollten wie Aktien, die bereits gehandelt werden, bewertet werden. IPO-Aktien weisen aber einige interessante Eigenschaften, dessen Erklärungsversuche unterschiedlich begründet sind, auf. Einige dieser Eigenschaften sind zum Beispiel die IPO-Unterbewertung, Hot-Issue Markt, und schwache langfristige Leistung.

Obwohl sich der Bewertungsprozess von IPO-Aktien als komplexer mathematischer Algorithmus gestaltet, werden dennoch verschiedene Bewertungsmethoden verwendet. Diese Methoden haben einige Schwächen, wie z.B. die Unsicherheit künftiger Einnahmen und Erträge, Wahl eines adäquaten Abzinsungsfaktors, Bewertung der vorhandenen Assets, Wachstumsraten, unzureichender Peer-Group Vergleich bei einer zu kleinen Unternehmensgruppe usw.

Wegen dieser Komplexität bei der Bewertung von IPO-Aktien, wird der Preiskalkulations- und Vertriebsprozess durch eine Investmentbank durchgeführt. Diese haben sowohl in der Preiskalkulation als auch in der Distribution mehr Erfahrung. Aufgrund ihrer einschlägigen Bewertungs- und Vertriebserfahrung werden sie von der emittierenden Gesellschaft in den IPO Prozess eingebunden. Investmentbanken sind auch unter dem Schlagwort Konsortialbanken bekannt.

Der Wert einer Gesellschaft ist nicht nur durch idiosynkratische Faktoren bestimmt, sondern auch durch äußerliche (systematische) Faktoren (Marktbedingungen, politische Gefahren, Mitbewerber, Erwartungen, usw.) Im Rahmen des Börseganges müssen alle diese Faktoren erwogen und in die Berechnung des Emissionspreises einfließen.

Emissionsgesellschaft kann mithilfe der Investmentbank einen Teil der Außenfaktoren bewerten, jedoch ist sie im Vergleich zu der Information der anderen Marktteilnehmer immer noch im Nachteil. Dieser Punkt des IPO-

Prozesses ist der interessanteste - die Unternehmer die ihre Anteile genau bewerten möchten, müssen mit den Außenkapitalanlegern zusammenarbeiten, die andererseits wieder einen Vorteil haben, wenn der Preis nicht am passenden Niveau gesetzt wird.

Demzufolge besteht für den Emittenten das Hauptproblem darin einen Zustand zu generieren wo informierte Kapitalanleger wissen, dass sie einen Vorteil haben könnten, wenn ihre Information unentdeckt bleibt. Mit dem Bookbuilding-Prozess ist es dem Emittenten möglich informierte Kapitalanleger zum Aufdecken ihrer wahren Präferenz zu bewegen.

Der Bookbuilding-Prozess ermöglicht die Informationssammlung und die Belohnung der beteiligten und „Wahrheit-Sagenden“ Investoren. Er unterteilt sich in die Sammlung von Interessenindikationen der potenziellen Kapitalanleger und deren Einstellung bezüglich des Preises und der Allokation.

Es liegen keine standardisierten Regeln über die Erstellung des Preises und den Ablauf der Zuteilung der Aktien an die potentiellen Kapitalanleger vor. Ein großer Vorteil des Prozesses liegt darin, dass die Investmentbank falschberichtenden Kapitalanleger vom Zuteilungsprozess bestrafen und somit ausschließen kann. Weiters haben die potenziellen Kapitalanleger das Recht das betreffende Unternehmen zu prüfen und den Preis so anzusetzen, dass die Möglichkeit der Deckung der Forschungskosten besteht.

Die Gefahr bei einer falschen Berichtigung vom Zuteilungsprozess ausgeschlossen zu werden, veranlasst die Investoren zur Offenlegung ihrer Informationen. Als Gegenleistung für diese Offenlegung garantiert die Investmentbank den Kapitalanlegern einen höheren Anteil. Diese Anteile werden mit einem Abschlag ausgegeben, der jedoch niedriger als bei einem Fehlen eines solchen Informationssammelungsprozess ist. Der informierte Kapitalanleger steht folglich vor der Entscheidung einerseits durch falsches Berichten mehr unterbewertete Anteile erhalten zu können oder andererseits durch richtiges Berichten sicherlich eine höhere Anzahl von weniger unterbewerteten Anteilen zu bekommen.

Unter den gegebenen Bedingungen beobachten die Investmentbanken, dass ein wahrheitsgetreues Berichten mehr Vorteile für den informierten

Kapitalanleger bietet als ein falsches Berichten. Zusätzlich muss die Emissionsgesellschaft selbst aus dem Prozess der Informationssammlung einen Nutzen ziehen. Es ist möglich, dass beide von so einem Austausch profitieren. Des Weiteren wird die Gefahr des „Free-riding“ von uninformierten Kapitalanlegern reduziert, da diese eine geringe Anzahl an höher bewerteten Anteilen bekommen.

Curriculum Vitae

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Education

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Sept. 1997– June 2001	High School in Opatija, Croatia.
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