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IPO Underpricing

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Abstract

This study combines the leading theories and test them over a given sample of initial public offerings to see how influential non-fundamental factors are on the IPO price and how the characteristics of the IPO change the magnitude of signaling effects on the IPO price.

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I. INTRODUCTION

All firms need to raise capital at one time or another to finance new projects, expand operations, or in many cases, just to start up their business. One of the best ways that newer and less established companies have found to raise quick capital is to make a stock offering. Initial public offerings (IPOs) have historically had very large initial first day gains compared to the performance of the rest of the market. If we assume that the market price of the stock, dictated by supply and demand, is representative of the company's value, then the large gain reflects the fact that the IPO issuing price agreed upon by the underwriter and the firm making the offer is under the actual value of the firm. Historically, IPOs were underpriced by roughly 16% according to an industry expert at Stein, Roe & Fonham. However, in recent months, some IPOs have seen first day run-ups of as much as 200 to 400 percent, and the trend for the future is likely to increase. Loughran and Ritter studied IPO issues from 1990 through 1998. With more than three thousand initial public offerings during that period, the average gain in the first day of trading was 14.1%, though returns varied somewhat with the performance of the market. However, so far in 1999 more than 43% of all IPOs saw first day gains soar past 100%; only 3.7% of IPOs did so in 1998 (Barker, 1999). This study will break down the various demand components that have lead to the growing initial gains from IPOs.

Differences between the IPO offering price and the first day closing price occur too often and are, on average, too large to be explained away by error in auditing practices. If this were the case, then an auditing firm or investment bank would also error on the side of overpricing the stock. Various theories have come to the forefront of this IPO underpricing debate, most of them explaining the pricing of a company's stock in an IPO in terms of signaling effects as opposed to the fundamental characteristics of the firm and why a risk averse investment bank would be more likely to underprice a stock issue. The purpose of this study is to combine the leading theories and test them over a given sample of initial public offerings to see how influential non-fundamental factors are on the IPO price and how the characteristics of the IPO change the magnitude of signaling effects on the IPO price.

II. BACKGROUND

While skyrocketing first day prices seem to impress a large portion of the general public as well as the media, there are those in the investment community who view this price discrepancy as a major flaw in the auditing process of the investment bank (Stapelton). After all, the investment bank is working as an agent for the issuing firm. Any price movement upwards from the IPO price (minus floatation fees) is precious money left on the table by the issuing firm that will be needed someday. Ideally, stock prices should match the per share present value of the discounted future earnings of the company, theoretically paid out as dividends. This speculation of the future is based on the fundamentals of the company and its industry's anticipated growth. Also affecting investors' perceptions of the future earnings of a company are general market conditions and expectations of macroeconomic factors such as interest rates. The prevailing price decided by these combined factors does not spontaneously change the minute the stock begins trading. Various theories explain why IPO contracts are not decided on with prices equaling firm value per share minus floatation fees.

While some companies do become very successful before offering shares to the public, few are able to compete in the marketplace without the initial inflow of capital that a stock offering provides.

Consequently, many firms make IPOs before they have any basis on which investors can judge them. They have no past revenue records to look at and many have yet to turn a profit before their stock is trading on the exchanges. This is especially true in today's rapidly emerging sectors such as the Internet and technology sectors, where investors do not even have the luxury of looking to the past performance of the industry or finding information about the quality and real value of the firm. There exists huge informational asymmetries in the IPO markets, and various economic theories about such markets still argue over who does and does not have the correct information regarding the value of a firm (Weiss, 1988). I hypothesize that IPO pricing in newer industries will be more subject to non-fundamental factors and signaling effects than more seasoned industries with a longer, more informative history.

There are many entities involved when discussing an initial public offering. Each player in this IPO arena has its own agenda and acts rationally toward its own financial gain. The firm making the offering, the investment bank, the auditing firm (which will be regarded as part of the investment bank's services in this study), and the investors all interact in the process of bringing an initial public offering to the market. According to past research on this topic, the pricing of a company's stock in the IPO is greatly dependent on which of these entities possess perfect information about the issuing firm, and which entities must rely on the others to report the information to them. The latter must rely on signaling to infer the true value of a stock and must give the more informed entities incentive to provided accurate data about the firm's true value. Through these two mechanisms, the IPO price is agreed upon and it may or may not reflect the actual worth of the company.

Unfortunately, in today's financial world, investment banks stand blocking the path to the capital markets. The reason for this is that the firm would incur crippling costs if it attempted to float a stock offer on its own. To sell the stock, the firm would have to discount the price on each share far below its actual value for liquidity and risk premiums that the investors would face. The investment bank is strategically positioned to take advantage of the economies of scale in their business and bring companies' stock to the markets with exposure that currently cannot be duplicated by individual firms without substantial expense. Although the Internet does offer some potential alternative methods of selling stock, these technologies are in their infancy and it will be years before they can make a serious impact on the investment banking business.

When a company uses an investment bank to float an issue of shares, they have two choices in terms of contracts with the investment bank. The company can choose to have the investment bank make a best effort offering, in which case the investment bank would simply sell as many shares as it could for the company and then take a percentage of the proceeds, or the issuing firm can opt for the investment bank to underwrite the issue. In an underwriting contract, the investment bank will buy all of the issued shares from the company for a set price and then make the offering to investors at the IPO price that is made public. It is easy to see how this second choice of contract brings a great deal more of risk to the investment bank. It is the underwriting contracts that this study will focus on as they present the investment bank and the issuing firm with a very unique set of considerations for setting the IPO price.

III. THEORY AND LITERATURE REVIEW

The first theory of IPO underpricing considered in this study is the Adverse Selection Theory. This model, developed in a study by Rock in 1986, divides the investors into two different groups, informed and uninformed (Eisenbeis, McEnally, 1995). According to Rock, the informed investors know the true value of the stock and uninformed investors invest randomly without any knowledge of the company. He also assumes that the investment bank has perfect knowledge of the issuing firm's real value and the issuing firm must rely on the investment bank's audit for this information. This overly simplistic model, while unrealistic, does give way to some interesting insights.

Since the supply of a company's common stock is held constant, the price fluctuates by changes in the demand for the stock. Here, demand is separated into two categories: informed investor demand

and uninformed investor demand. If companies had IPO prices that reflected their true value then, by the law of large numbers, the uninformed investors would either break even or lose money because the informed investors would only invest in the "good" IPOs, crowding out the uninformed investors, and be the only ones turning profits. If this were the case, uninformed investors would choose not to participate in the IPO market, thereby cutting the demand for stock in IPOs. This drop in demand for IPOs would leave less promising issuing firms with undersubscribed IPOs.

Complicating this problem is the fact that investment banks participate in share rationing of very promising IPOs to preferred customers. United States law, unlike most other countries, allows the investment banks to strategically allocate shares of oversubscribed issues, usually completely crowding out uninformed investors (Eisenbeis, McEnally, 1995). If these less informed investors had a better chance of obtaining shares of these high value IPOs, less underpricing would be necessary to keep their demand for IPOs in the market.

To compensate for this, Rock claims that companies intentionally underprice IPOs as a rational behavior in order to induce the uninformed investors to participate in the market and thereby raising the demand for the issues. For companies that are of very high value it is less necessary for them to underprice their issue because of the large demand for the stock by informed investors. This would explain the large first day run-ups in IPO prices for technology and Internet stocks. Typically, these stock offerings are too small to be of any interest to large, institutional investors, and this, together with the fact that there is little historical information to judge these companies, put them into the pool of companies that must underprice their issues in order to raise demand. Hence, Rock's basic pricing mechanism would dictate that the stock underpricing should vary directly with uncertainty about a company and vary indirectly with the true value of the issuing firm. To test for this effect, variables measuring the size of the company will be entered into the empirical model to test for uncertainty. These variables will also serve to represent fundamental valuations of the issuing firm.

The second theory of underpricing examines the relationship between the investment bank and the issuing firm. The Principal-Agent Theory used by Baron in a 1982 study yielded the Hazard Model of Underpricing (Eisenbeis, McEnally, 1995). In this model, it is assumed that the issuing firm does not know its own true value and must rely on the auditing of outside companies and the investment bank to report accurate information. The issuing firm and investment bank agree to an IPO contract based on the report that the investment bank gives the issuing firm concerning its value.

This contract must satisfy several conditions imposed by each entity. First, the contract price must meet certain minimal levels of expected returns to the investment bank. Secondly, the price of the IPO must be low enough to induce the investment bank, the agent in this scenario, to act in the issuing firm's best interest. In other words, the issuing firm leaves some money on the table for the investment bank in order to insure that they (the agent) disclose all information about the firm and act in the firm's best interest. The level of uncertainty the issuer faces with respect to the investment bank's reported information is positively related to underpricing. Underpricing therefore can reduce the costs of assuring truthful advice from the banker. This reveals the same correlation that Rock found with small, unestablished firms and underpricing. If a firm is in a situation of uncertainty, chances are it does not have the same resources to conduct proper internal audits as a larger, higher value firm.

Just as in the former model given by Rock, Baron's model can also be criticized as being overly simplistic. It does not take into account competition in the investment banking business which would automatically ensure a certain amount of agent loyalty. This model also does not take into consideration the fact that the investment bank would be worried about supporting its own reputation and therefore have additional incentive to produce truthful information about the firm's value. However, it does clearly define an inverse relationship between the real value of a firm and the degree of underpricing.

The testable hypothesis in this model is that the uncertainty that the issuer faces with respect to

the bank's information will be reflected in the initial first day returns of the IPO. This study will attempt to measure this effect by using investment bank reputation as a proxy for uncertainty from the issuing firm's point of view in addition to the issuing firm size variable measuring real value. This assumes that as the size and reputation of the investment bank increases, their incentive for keeping their reputation also increases so they will be more motivated to produce truthful information. Therefore, as reputation increases, the uncertainty of the information provided by the investment bank and IPO underpricing should go down.

The next theories all focus on the effects of signaling on an IPO's price. This compilation of theories and mechanisms is probably the most realistic and comprehensive theory of IPO underpricing. These theories start from the assumption that the firm issuing stock has perfect information about its own value and that the investors are the uninformed entities. The investors then value the company as a function of several different signaling mechanisms.

In a study by Leland and Pyle in 1977, the conclusion was that the firm could signal its value to outsiders by retaining its own shares (Eisenbeis, McEnally, 1995). The percentage of shares retained by the original owners and insiders would logically signal high value. The only reason that these people would choose to hold onto shares would be to sell them later in more seasoned offerings by the company at a higher price. Conversely, if the firm's value was low then presumably in this model the insiders in the firm would know this and choose to sell as many shares as possible to acquire the start up capital before the firm's real, lower value becomes evident in the lower market price.

When the retention of shares is high, another effect, also contributing to underpricing, is evident. The theory here stems from general opinion in the finance industry rather than from an empirical study. The hypothesis asserts that firms will intentionally underprice their issues specifically for the attention gained by the large first day run-up in the stock price. This gives the firm added publicity and media exposure while simultaneously proving the firm's value to investors. This technique is referred to as

grandstanding an IPO and would also be more frequently employed by smaller, less established firms who need to draw investor attention and whose value is considered very uncertain by potential investors (IPO Maven). Hence, the degree of underpricing would again be inversely related to the size of the issuing firm.

In a 1999 published study, Michael Willenborg presented a theory that explained demand for IPO shares as a function of several signaling mechanisms which relate to the size and status of the auditing firm, which in many cases also involves the investment bank (Weiss, 1988). Specifically, he used compensation payed to the auditing firm as proxy for auditing firm reputation. The two most prominent effects found in Willenborg's work are the informational signaling and insurance signaling effects. He found that although all companies benefit from a more reputable (and therefore more expensive) auditing firm, different sized companies have very different reasons for seeking a prestigious underwriter and auditor.

Willenborg separates issuing firms into two categories depending on how established a company is. If a company hires a more reputable firm, the signal to the investor is that the company will stand to benefit from having its financial statements more accurately analyzed. Logically, the management of a firm would only desire this if, in fact, its financial statements were positive. Therefore, the better the auditing firm, the better the perceived health of a firm's finances. This is the *informational signaling* effect which raises the demand for the IPO.

Also, when a company employs a reputable auditor, it also benefits from the fact that if the IPO is overpriced and/or is involved in securities litigation, it is more likely that the investor seeking to get his investment back will be successful if the defendant auditing firm is large and well established. This is the *insurance signaling* effect which also serves to increase the demand for the IPO. Willenborg used previous research to secure the validity of his assumptions that "one might expect that investors would be willing to pay more for the stock because of the availability of a potential recovery under the securities laws" (Alexander, 1994 p.1441).

This theory then assumes that the investment

bank knows about these signaling effects and takes them into account when agreeing to an IPO contract. To reduce downside risk, the underwriter will lower the share price of the IPO. By doing so, they decrease the risk of either damaging their reputation by having an undersubscribed and overpriced offering or by drawing securities litigation from investors in a high-risk company. The uncertainty about the firm making the issue and their motive to maintain and improve firm credibility is the catalyst behind the investment bank's incentive to reduce the price of the offering. The most important determinants of the uncertainty are the deal size and the size of this issuing firm. Therefore, this theory predicts that as the deal size decreases, the degree of underpricing will increase. Since, in most cases, the deal size is directly related to the size and value of the issuing firm, this theory fits the trend of the previously mentioned studies and theories. It also implies that as the size and reputation of the investment bank grows larger, the more likely the investment bank is to underprice the issue.

IV. EMPIRICAL MODEL

The vast majority of the theoretical models discussed in past research have linked the performance of an IPO on its first day of trading to signaling factors. The most prominent factor in the degree of underpricing has been the uncertainty that exists about the firm making the issue. The information about the firm available to the firm itself, the investors, and the investment bank is key in deciding the degree of underpricing that the IPO will receive. As uncertainty about the firm increases, so does the amount of underpricing and consequently the initial first day gains. To test for this effect, variables will be entered into the empirical model to represent the uncertainty about the firm. Most of the past literature has proclaimed both deal size and issuing firm size as a valid proxy for this. However, actually determining the issuing firm size before an initial public offering can be a problem because of the question of how a firm should be evaluated. Most Internet companies have yet to turn a profit when they make an IPO. In a market with even minimal efficiency, deal size should be a valid proxy for issuing firm size and so only the known deal size variable will be used. As the deal size goes up, the uncertainty involved should go down along with the degree of underpricing.

To supplement this variable, additional consideration needs to be given to the industry in which the firm does business. Because it is hard to decide on common starting points of most industries,

Table 1: Regression Model Variables

Variables	Symbol	Explanation	Expected Sign
1st Day Gain	%Gain	The % change from the IPO offering price and the price at the end of the first day of trading.	Dependent Var.
Insider Retention	Retention	The percent of the issued stock retained by the original owners and insiders in the company.	positive
Investment Bank Size	IB	The size of the Investment Bank given by market capitalization.	positive
IPO Deal Size	DEALS	The dollar value of the number of shares issued multiplied by the IPO price.	negative
Middle Industries	MIDDLE	Companies in industries that are new but established: Telecom., Biotech, Computers & Software, etc.	positive
Internet Sector Industries	INTERNET	Companies with primary business in the Internet.	positive

dummy variables will be used to segregate the companies by which industry they are in. The hypothesis here is that industries with a longer, more informative history will be underpriced less because there is less uncertainty about the issuing firm. Two dummy variables will be used in this equation. The first dummy variable, **INTERNET**, will take a value of one if a company's primary business is in the Internet sector and zero otherwise. The second dummy variable, **MIDDLE**, will take a value of one if a company is in a newer industry that has some informative history and zero otherwise. Examples of such companies are telecommunications companies, biotechnology companies, computer and software manufacturers, and certain pharmaceutical companies. A value of zero for both **INTERNET** and **MIDDLE** will represent a company that is in an industry that has been around for an extended period of time and should therefore have the least amount of uncertainty attached to it. These companies come from the energy, food and agriculture, manufacturing, and some pharmaceutical sectors.

The next variable will be one to take into account the dual effect of the motivation of the investment bank to preserve their reputation. Since a more prestigious investment bank raises the demand for an IPO through informational and insurance signaling, the price will rise, exhibiting a higher degree of underpricing. Also, because a more reputable firm will be more rigorously protecting its reputation and liability, it will tend to underprice issues as much as possible. This is because an investment bank's reputation can be seriously compromised if their auditing efforts overprice the offering. A variable measuring the size of the lead underwriting investment bank will be added to the equation. The size variable will be measured by the market capitalization of each bank. This study will limit the number of investment banks used in order to give significant representation to each. Although the number of investment banks will be small, the range of market capitalization values should be sufficient to investigate its effects on the underpricing of IPOs. The investment banks included in this study are Goldman Sachs & Company, J.P. Morgan & Company, Merrill Lynch, Lehman Brothers, Donaldson,

Luftkin & Jenret (DLJ), Bear Stearns & Company, and Hambrecht & Quist. It is hypothesized that, as market capitalization increases, initial gains should also increase.

To account for the effect of original owner and insider retention of shares found by Leland and Pyle, the variable **Retention** will measure the percentage of shares owned by insiders. This fraction is simply the total shares retained by insiders divided by the total shares outstanding. As the percentage retained goes up, by way of a quality signal to the investors, the demand for the stock should increase, raising the initial first day gains and therefore the degree of underpricing.

The data for this study will come from IPOs in the 1990s from an array of industries and investment banks previously mentioned. Data collection comes from a variety of web sites where IPO information is available (IPO Maven), (Nazdaq.com). Although there may be some problems with the consistency of the data because it will come from different sources, SEC filings and other measurements to be looked at are mostly standardized. Also, because the required information is not available for every company, adverse selection may occur, yielding only information about those companies for which information has been more readily available, and subsequently have less uncertainty. The preceding theories have lead to the variables chosen which make up the following equation:

$$\% \text{ 1st Day Change} = B_1(\text{Retention}) + B_2(\text{IB}) + B_3(\text{Deals}) + B_4(\text{Middle}) + B_5(\text{Internet})$$

Also, the predicted signs on the chosen coefficients are displayed in the Table 1.

V. RESULTS

The results of an OLS regression found three variables to be significant. These variables were the dummy variable INTERNET, the size of the investment bank (IB), and the retention of stock by insiders. All had the predicted signs and seem to duplicate the results found in earlier research. As predicted, Internet companies were underpriced much more than other sectors. The middle sector, comprised of fairly new industries like biotech and

telecommunications companies, did not differ enough from the older industries (indicated by a zero value for both MIDDLE and INTERNET variables) to become significant. This would lead us to believe that the brief history that these industries have had is sufficient to reduce the uncertainty involve in investing in them. The coefficient on MIDDLE was extremely small and it was not significant. The only other variable that did not prove to be significant was deal size, which displayed an extremely small coefficient. The regression was run without a constant, drawing on the premiss that without any of the factors being measured here, the degree of underpricing would be zero. With 142 observations, the overall model returned an adjusted R squared value of .414. The regression results and coefficients are displayed in Table 3.

Table 4 provides descriptive statistics for the three sectors included in this study. For example, the 19 Internet companies were underpriced on average by 109.67%. Meanwhile, the 55 companies included in the Middle sector were underpriced by 25.85% on average. Finally, those companies in the "Old Sector" were underpriced by 21.64% on average.

VI. CONCLUSIONS

Because of the complexity of company valuations, this study was subject to numerous sources of error. The most concerning was distinction of industries. Because technology has advanced so rapidly in recent years, the Internet has been brought into most industries in some form or another. Most companies have a web page and many of them sell products through those pages. The problem comes in drawing the line between companies that merely use the Internet to conduct business, and companies whose primary business is the Internet. Although deciding this can be easy for companies like America Online or EBay, there are a host of other companies who may be associated with the Internet enough to make their stocks perform more like Iinternet stocks although their main line of business is manufacturing or retail.

In the future we can only expect the lines between these companies to blur even more. However, as of now, the Internet is still in its infancy and this study concluded, as others have, that Internet related companies pose a higher risk factor due to the youth of the Internet sector. While many of the companies in older sectors are valued by a combination of present earnings and future discounted cash

Table 2: Regression Results

R Squared	Adjusted R Squared	Significance	Degrees of Freedom
0.435	0.414	0.000	5

Table 3: Regression Coefficients Results

	Unstandardized		Standardized	t	Sig.
	B	Std. Error	Beta		
Retention	0.249	0.141	0.158	1.765	0.080
MIDDLE	0.05782	0.089	0.050	0.647	0.518
INTERNET	0.881	0.140	0.448	6.291	0.000
IB	0.008946	0.003	0.256	2.604	0.010
DEALS	-5.589E-11	0.000	-0.065	-0.793	0.429

flows, many Internet company valuations are based solely on discounted future earnings, some as far as twenty or thirty years in the future. This study showed that Internet stocks were underpriced much more than established industries, mainly because investment banks are more uncertain of the value of Internet companies and subsequently underprice them to minimize the downside risk if the stock is overvalued and the issue is under subscribed.

Although many of the companies included in the middle sector variable were makers of computers and software, there was still a large difference between the degree of underpricing they received compared with the Internet stocks. Surprisingly, there was an extremely small difference between these companies and the old sector companies including manufacturers of steel and oil companies. The short history of these companies must be sufficient for auditors to confidently evaluate the earnings potential of these firms.

The percentage of the shares retained by the company insiders also affected the initial first day gains. This leads us to believe that investors take insider retention as a signal of company value, agreeing with the previous research and theories by Leland and Pyle. Although this study took their research once step further and included majority stockholders as "insiders," the results held true and the positive coefficient on the retention variable was very significant. This result seems very logical and

was completely in line with expectations. If a company's IPO is undervalued, the most likely people to know this are the company insiders, who would then hold onto as much of the stock as possible.

The variable for deal size was not significant in this regression model. It had an extremely small coefficient and actually had an unexpected sign. The results indicate that the deal size had no effect on the amount of an IPO underpricing. Perhaps a study with more investment banks would yield a different result. In addition, the investment banks used may cater to a specific deal size range and not alter their policy on underpricing with different size firms.

While the number of investment banks in this study was limited, the differences in underpricing used by each bank proved to be significant. The degree of underpricing rose with the bank's size. This finding is explained by two theories mentioned earlier. The insurance and informational signaling effects of a larger bank theorized by Willenborg could be driving up the demand for the issuing firms beyond what would be warranted on the firm's credentials alone. This effect may be happening alone or in conjunction with the fact that the investment banks with large market capitalizations and better reputations may be underpricing IPOs more because they have more to lose if they mistakenly overprice a stock issue. These two effects were obviously stronger than the informational signal from the in-

Table 4: Sector Statistics

Internet Sector		Middle Sector		Old Sector	
Mean	109.67%	Mean	25.85%	Mean	21.64%
Standard Error	21.64%	Standard Error	7.69%	Standard Error	4.75%
Median	83.33%	Median	8.33%	Median	14.89%
Standard Deviation	94.32%	Standard Deviation	57.02%	Standard Deviation	39.18%
Range	359.52%	Range	296.77%	Range	247.16%
Minimum	-18.70%	Minimum	-63.43%	Minimum	-41.61%
Maximum	340.82%	Maximum	233.33%	Maximum	205.56%
Count	19	Count	55	Count	68

vestment bank to the issuing firm. This would dictates that the underpricing would have gone down as the investment bank size increased due to the fact that a larger, more prestigious investment bank would be more likely to conduct a higher quality audit.

VII. POLICY IMPLICATIONS

With investment banks as the "gatekeepers" of the publicly traded markets, it will not be easy for the system to change without regulatory changes. Although many think that investment banks carry too much power, they give investors and issuing firms the security and liquidity that they need. For most firms, making a stock offering as a private placement without the use of an investment bank is counterproductive. The floatation costs involved in issuing the stock, finding investors, and keeping up investor relations would make offering stock one of the most expensive sources of capital. An investment bank has the economies of scale to streamline an initial public offering process in order to lower the costs enough to make it worth the time and effort for the issuing firm.

However, with the advent of the Internet, there is talk of using online auction style bidding in order to create an equilibrium market price before a single share is sold. If this process becomes more popular, it could eventually alleviate the need for the floatation services of an investment bank, providing the liquidity and low costs the firm needs without leaving any money on the table. Since the market price will already be determined by bids coming in before the stock is released, there cannot be any underpricing and the signaling effects are greatly reduced (Barker, 1999). If a process such as this could be put to use, the IPO run-up frenzy will likely disappear from the stock market. But, as long as investment banks hold the key to this market, issuing firms will continue to miss out on IPO proceeds.

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