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Investigating the Underpricing Behavior of Initial Public Offerings: Tests of Underwriter Price Support and Signaling Theories

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Abstract

It is found that the IPOs are typically underpriced. Therefore, the return of the first trading day is always positive and abnormally higher. In this paper, we test the implications of three models of IPOs underpricing: (1) one for underwriter price support and (2) two for signaling models. The empirical results support the underwriter price support hypothesis and Grinblatt and Hwang (1989) model which states if the variance is constant, the fraction of shares held by insiders will positively influence the initial returns. On the other hand, we do not support the implication of Allen and Faulhaber (1989) model which predicts that a positive relationship between the degree of underpricing and subsequent earnings performance and dividend policy of a firm.

Keywords: Initial Public Offering, Signaling Model, Underwriter Price Support

Introduction

Most of the companies initiate their business by raising their equity capitals from the public, especially from diversified investors. If a company grows very well and needs extra equity capital to extend its operation, sometimes it is found that selling stocks to the public is a better way to acquire sufficient equity capitals. As the growth of economy and easy distribution of information develop, the number of firms going public to raise their capital is growing larger. For past decades, the

phenomena of initial public offerings (IPOs) have drawn much attention of financial researchers to understand the reasons behind these phenomena.

Abundant studies have explored three anomalies in the pricing of IPO of common stock (1) underpricing (or non-negative initial return), (2) "Hot Issue" market, and (3) underperformance in the long run. The systematic underpricing behavior of IPO of common stock has been broadly documented in financial literature. Ibbotson (1975) conducted a test to see whether unseasoned issues appear to be issued at a discount and found that there was 11.4% on average discount in the offer price that was gone within weeks following the offer date for a sample of IPOs offered from 1960 to 1969. Ibbotson and Jaff (1975) reported that there have been a number of periods over last two decades during which IPOs had very high initial returns. Smith (1986) documented that underpricing of IPOs exceeded 15%. Ritter (1984) reported that during the 15 months from January 1980, the average initial return of IPOs of common stock was over 48% and named this period as "hot issue" market.

Since there are so many studies having confirmed that the underpricing anomaly exists in IPOs, a number of reasons have been proposed for underpricing phenomenon of the unseasoned issues

1.Asymmetric Information Hypothesis

Barron (1982) advanced a model in which he assumed that investment bankers are better informed about the market demand condition than the issuers of securities. Therefore, the issuers would seek advising function that delegates the offer price decision to the investment bankers and distribution function that distributes the issues by using the channels of investment bankers. He showed that the value to the issuers of using advising function is an increasing function of the issuers' uncertainty about the market demand for the securities and the optimal offer price is a decreasing function of issuer's uncertainty. That is, the issuers of IPOs would be willing to accept a lower price once their uncertainty about the market demand conditions is greater.

However, the empirical test of Baron's model conducted by Muscarella and Vetsuypens (1989) showed the counter results in contrast to the prediction of Baron's

model that predicts the higher is the asymmetric information between the investment bankers and issuers, the larger is the average underpricing of IPOs. They used 38 self-underwritten initial public offerings securities firms as the sample in which there were no asymmetric information problem existing and found the average initial return of 17 issuing firms self-serving as lead managers was 13.23% larger than 2.17% of those firms not self-serving as lead managers. Meanwhile, the average initial return of the whole sample was not significantly different from that of not self-underwritten IPOs and even 0.58% larger than the latter.

Rock (1986) also used asymmetric information structure to analyze the underpricing of IPOs. Instead, this kind of asymmetric information exits among investors, not between investment bankers and issuers. He assumed that there are two groups of investors in the market (1) informed investors, who acquire superior information and bid for "mispriced" IPOs and (2) uniformed investors, who completely have no knowledge about the information hiding in the IPOs and bid IPOs indiscriminately. The informed investors always get the larger fraction of those IPOs with underpricing, but the uninformed investors often get only few fractions of most desirable IPOs while they are allocated with all of the least desirable IPOs. That is, the uninformed investors face a "winner's curse". Owing to the adverse selection problem, the uninformed investors will only buy unseasoned new issues with the underpriced amount large enough to compensate them for this kind of allocation bias. The more uncertainty is the IPO, the more is the degree of underpricing.

Beatty and Ritter(1986)used Rock's(1986)model to derive their two propositions:

- **Proposition 1**: The greater is the ex ante uncertainty about the value f an issue, the greater is the expected underpricing. (Beatty and Ritter (1986), p.216)
- **Proposition 2**: Underwriters whose offerings have average initial returns that are not commensurate with their ex ante uncertainty lose subsequent market share. (Beatty and Ritter (1986), p.217)

Then, they used data from 1977 to 1982 and divided data into two subperiods to

test these two propositions. These two propositions are supported. Michaely and Shaw (1994) used two data sets to test Rock's Model in which there were (1) a sample of IPO master limited partnerships (MLPs) and (2) a sample of "regular" IPOs. They argued that the feature of MLP IPOs enabled them to test if asymmetric structure within investors is the reason of underpricing IPO because the institutional investors who were assumed with more information than the general public vastly avoid buying MLP IPOs owing to the tax problem. That is, there is less asymmetric information existing in MLP IPOs markets than in the regular IPOs markets. They concluded that regular IPOs experienced significantly greater underpricing than MLP IPOs, which is consistent with the prediction of Rock's model.

2.The Lawsuit Avoidance Hypothesis

Tinic (1988) cast doubt upon the approval of Rock's model advanced by Beatty and Ritter (1986). He thought that the support of Rock's model was very weak and the problem was that the proxy used as a measure of the deviation from the underpricing equilibrium explained only 7% of the cross-sectional variation in the market share changes. Because of that low explanation power of the proxy, he argued that he found no statistical relationship between market share changes and deviation of the discounts from the underpricing equilibrium from 1977 to first quarter of 1981. Therefore, the inferences drawn by Beatty and Ritter were not conclusive. However, since the theory of underpricing equilibrium is mostly based on considerations of rate of return on reputation capital, it seemed that the rank (reputation) of underwriters played a very important role in IPOs' underpricing. Tinic presented an explanation of the underpricing behavior of IPOs that the information produced by the investment banker would bring credibility to the investors because the investment banker would put the value of its reputation at risk by serving as an endorser of the IPOs, especially in a firm-commitment basis. Due to the Securities Act, the parties involving in the issues may be subject to civil liabilities for insufficiency or falsification of information presented in the registration statement. The issuers that are not very familiar with disclosure requirements will tend to seek an underwriter to assist them in preparation of required documents. If an underwriter agrees to underwrite the IPO for a firm, it also will have the legal responsibility and the possibility of the lawsuit as that firm does. The best way for them is to buy an insurance policy against

possible legal losses. Without this kind of insurance policy afforded in the market, underpricing of IPOs may provide issuers and underwriters with protection against potential lawsuit. Meanwhile, underpricing also can reduce the damage caused by the lawsuit because the Securities Act limits the maximum recoverable damage to the offer price.

Tinic tested his hypothesis by using the sample before and after the Securities Act of 1933 because the Securities Act of 1993 heavily increased the potential legal liabilities associated with new common stock issues. He found that results indicated that the Securities Act of 1993 did have a significant impact of the behavior of investment bankers and on the pricing of IPOs. Moreover, the most prestigious investment bankers began to avoid underwriting highly speculative small issues after 1993 (Tinic,1988 ,p.819). Drake and Vetsuypens (1993), however, found that the average initial returns of those IPOs with lawsuits were very similar to those of IPOs without lawsuits. Therefore, there is no agreement at the hypothesis that underpricing of IPOs is an insurance.

3.Underwriter Reputation Hypothesis

Carter and Manaster (1990) influenced by Rock (1986) and Beatty and Ritter (1986) proposed that the more prestigious is the underwriter, the lower is degree of underpricing of IPOs. In the meantime, the testing results were consistent with their projection. Michaely and Shaw (1994) also showed their results consistent with the prediction for Carter and Manaster's Model.

4.The Signaling Hypothesis

Some researchers address that new issues that are underpriced to "leave a good taste in investors' mouths" allow the firms to reveal some hidden information to outsiders and to sell future offerings at a higher price than otherwise be the case. Allen and Faulhaber (1989) proposed that because the best information is held in the firm itself, the firm signal this information by issuing underpriced IPO and investors update their Bayesian priors on the basis of the firm's performance. In their model, they implied that there exists a positive relationship between the degree of underprcing and the subsequent earning performance and dividend policy. Grinblatt and Hwang (1986) suggested another setup with assumption of risk-averse issuer and

extended Leland and Pyle (1977) model with two unknown parameters, mean and variance of project's cash flow. The they got three unique implications: (1) Given the variance of the firm, the degree of underpricing is positively related to the issuer's fractional holdings, (2) Given the issuer's fractional holdings, firm value is positively related to the degree of underpricing, and (3) Given the variance of the firm, firm value and the degree of underpricing are positively related. (Grinblatt and Hwang (1986), p.415) Moreover, Welch (1986) focused on the reissues of firms going public and assumed that there is direct cost associated with low-quality firms going public imitating observable operations by high-quality firms. Three of important implications finalized in her paper are (1) There exist market conditions in which some firms choose to underprice, (2) The lower the probability that a firm is high quality, the higher the probability that it underprices, and (3) IPO firms issue a substantial amount of claims in seasoned offerings. (Welch ,1989, p.440) He also showed evidence that 288 of 1028 firms going public from 1977 to 1982 reissued 395 seasoned offerings and total proceeds of those seasoned offerings were three times their average IPO proceeds. However, Michaely and Shaw (1994) found that there was no relationship between initial returns and subsequent debt or equity issues and that only firms performing well reissued equity, which is contrary to the prediction of Welch's model. Meanwhile, Michael and Shaw also presented evidence in contrast to the predictions of Allen and Faulhauber's and Grinblatt and Hwang's models. There seemed to be doubts on the empirical results of signaling as a reason for underpricing.

5.Underwriter Price Support or Stabilization

Underwriter price support is to prevent subsequent market price of a security from declining and to make the distribution of shares of a security much easier. The Securities and Exchange Commission generally prohibits securities manipulation, but permits price support on the grounds that it mitigates underwriter losses stemming from temporary downward price pressure during the selling period (Securities Exchange Act Release NO. 2446). Rudd (1993) proposes that stabilization by underwriters will make the initial returns of IPOs substantially high. She conducted a test about distributions of initial returns and one-week to four week returns and concluded that there seemed to be very strong evidence that underwriter price

support plays a role in explaining average initial IPO returns and gradual withdrawal of price support would result in the minimum return of longer holding periods dropped very significantly from the first day to first week. Hanley, Kumar and Seguin (1993) also examined price stabilization in new equity issues. They argued that stabilization activities reduce dealers' potential losses. That is, the offering price is the floor price for dealers that make stabilization like a "protective put." They found that stabilization significantly and negatively affects quoted spreads. They also approved the stabilization hypothesis.

Data

The sample firms comprise of IPOs from January to March 1993 and satisfy the following criteria (1) firm commitment offerings without units,[1] (2) offer price is at least $1.00, (3) the return data are taped in CRSP. All these sample firms are identified from *Investment Dealers' Digest,* 1993 and *Going Public*: *IPO Reporter,* 1993. 149 firms went public from January to March 1993, but the number of the final qualified sample is 45 firms. We got earnings reports for 25 firms from COMPUSTAT and the dividend yield and the first cash dividend announcement date from CRSP and Moody's annual dividend report. Meanwhile, we also use the data provided by Professor Ritter to test the Grinblatt and Hwang's signaling model. The period of the data is from 1975 to 1984.

Empirical Methodologies and Results

1.Distribution analysis

Table 1 shows descriptive statistics for each of the distributions of one-day returns, one-week returns, two-week returns, three-week returns, and so on to eight-week returns. Figures 1 to 9 show graphic views. Figure 1 shows the highest peak at the return of 0% to 5% and asymmetry of one-day initial return distribution. In the meantime, the initial returns are never below zero return, which tells us that the

[1] Units include the common stocks and warrants or other rights.

distribution of initial returns may be a truncated distribution, i.e., only the positive returns can be seen for one-day initial returns. Meanwhile, in the next section we will show that the estimated results for this truncated phenomenon. Consistent with findings of Rudd (1993), the first two columns of table 1 show a large discrepancy between mean and median decreases as the time interval of return measurement increases. This is evidence of positive but decreasing skewness. The minimum return drops from 0 for one-day period to –0.0299 for one-week, which indicates the removal of price support happening in first week. This kind of suggestion can be upheld by the much smaller minimum return as time interval increases.

Observing the tendency of kurtosis, β_2, we find that it shows a significantly positive and decreasing pattern as the holding period increases, except for those of seven-week and eight-week periods, which means that the underwriters initially use stabilization policy to support the prices of those IPOs they underwrite, but gradually withdraw their price support intervention. That leads the spread of the return distributions to become larger over longer holding periods. Positive skewness will also decrease when price support action recedes.

First, the null hypothesis of normality for each of return distributions is rejected at 5% level of significance. However, the bar charts for longer time periods, for example 7-week and 8-week periods, show that the spread of observations is much wider than that of one-day. Although the long holding period distributions are not consistent with Fama's (1976) findings and Rudd's (1993) findings that indicated the monthly returns and four-week returns exhibited slightly positive skewness and are close to normality in terms of kurtosis, the large divergence of distributions between one-day and a long-holding time period suggests underwriter's price support and implied evidence of withdrawal of underwriter's price support.

Table 1 The descriptive statistics of each of distributions

	Mean	Median	Min	Max	Std dev.	Skew β_1	Kurto β_2
1-day	0.0564	0.0083	0	0.4855	0.0908	2.7239	10.3838
1 week	0.0599	0.0041	-0.0299	0.48550	0.1049	2.2036	5.5586
2 week	0.0536	0.0083	-0.0689	0.47	0.1001	2.3056	6.3461
3 week	0.0507	0.0083	-0.0339	0.4855	0.096	2.7256	9.1187
4 week	0.0518	0.0083	-0.1505	0.5108	0.1082	2.0913	6.5156
5 week	0.0559	0.0083	-0.1625	0.6107	0.1365	2.1588	5.932

6 week	0.0637	0.0083	-0.1942	0.597	0.1437	1.6945	3.8847
7 week	0.0573	0.0083	-0.2031	0.6506	0.1511	1.8534	5.0426
8 week	0.052	00165	-0.1924	0.6549	0.1544	1.8044	4.8594

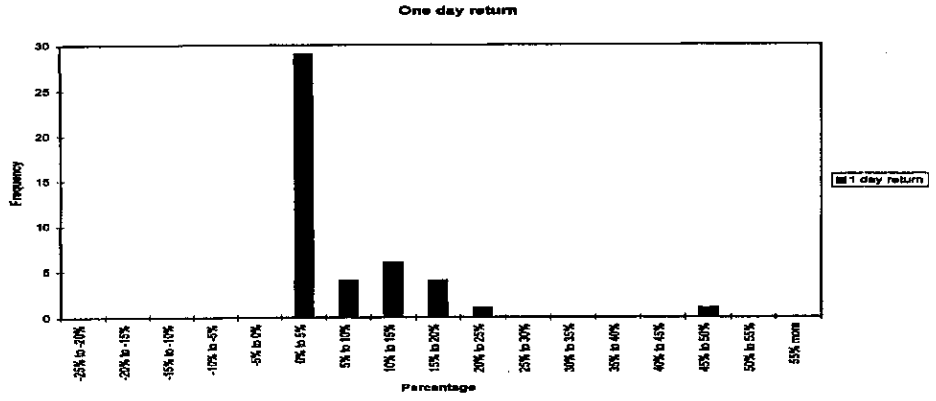
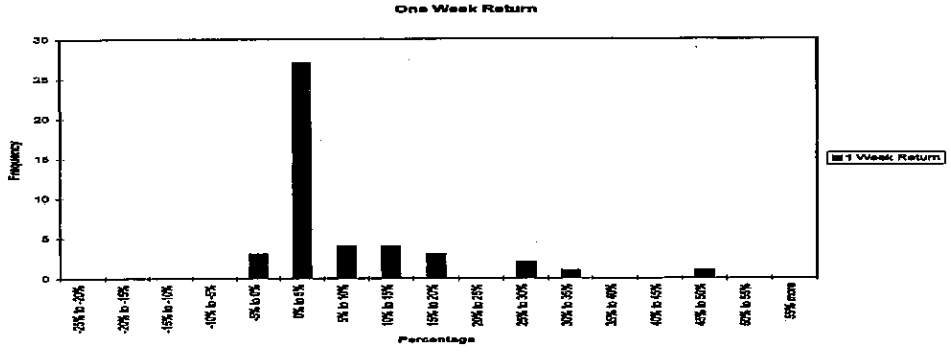


Figure 1



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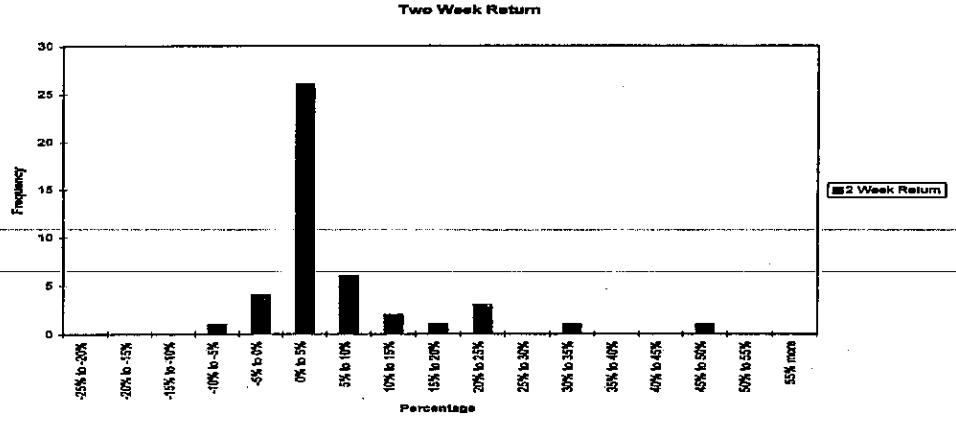

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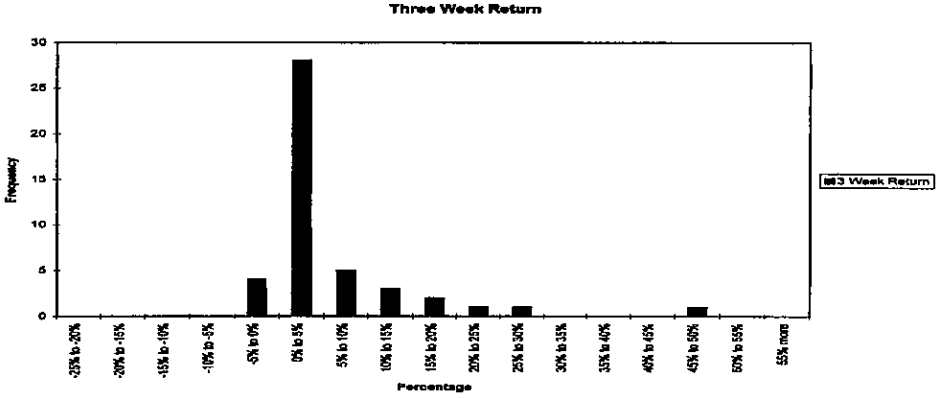

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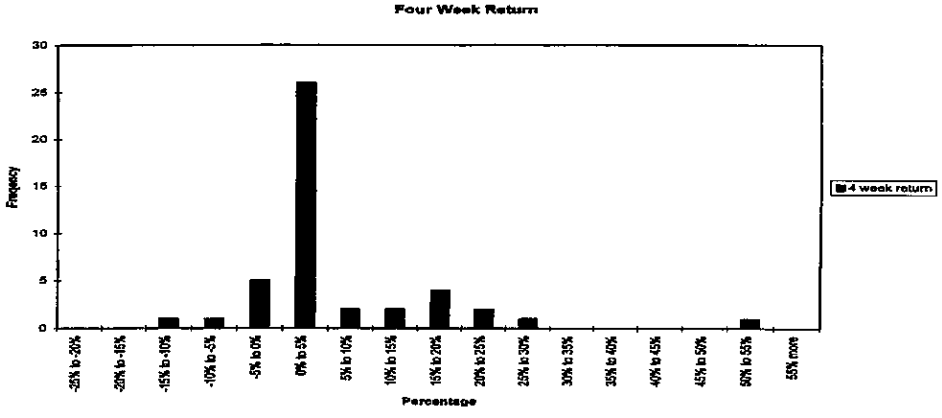

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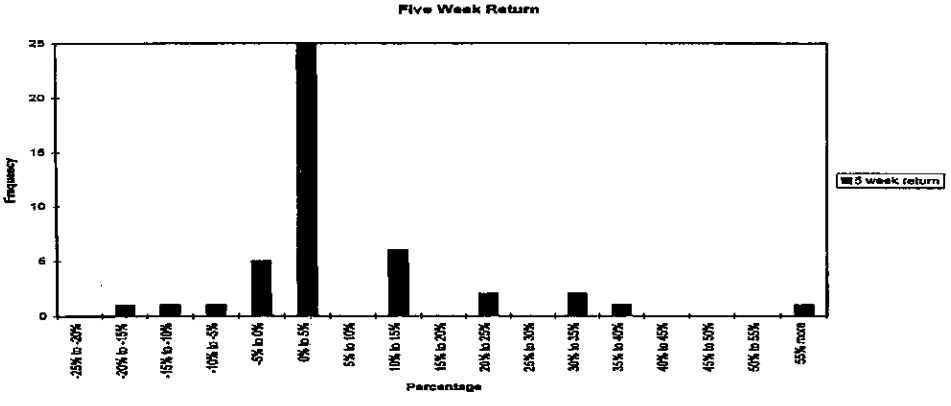

Figure 6

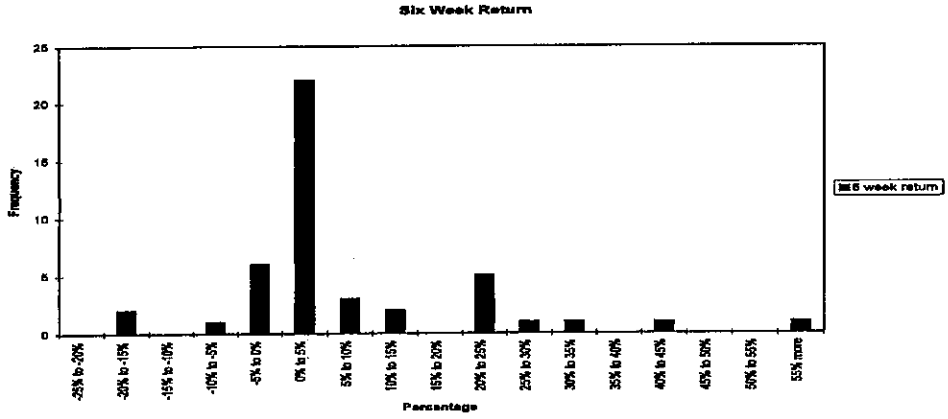

Figure 7

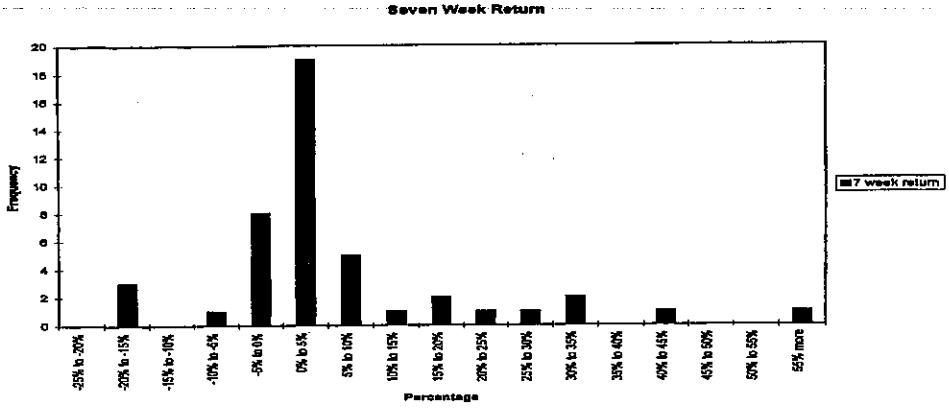

Figure 8

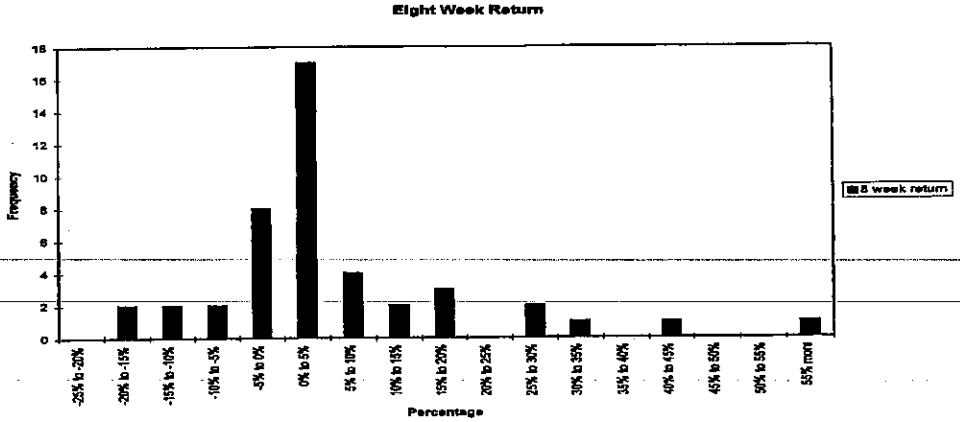

Figure 9

2.Tobit Analysis of one-day returns

The positive one-day returns show that underwriters don't want the prices of IPOs to fall below the offering prices for the first few trading days after IPOs's going public. This kind of censoring effect won't make us really understand what the one-day returns should be like if without underwriters' price support. Therefore, adopting Tobit model dealing with censoring data problem can provide us with more insights about the true distribution of one-day returns and make us check whether underwriters' price support produce this kind of almost non-negative or slightly negative initial returns. The model is defined as follows:

$$\gamma_i^* = u + \varepsilon_i \quad \text{where} \quad \varepsilon_i \sim N(0,\sigma^2) \tag{1}$$

$$\gamma_i = \begin{cases} \gamma_i^* & if\ \gamma_i^* > 0 \\ 0 & if\ \gamma_i^* \le 0 \end{cases}$$

The Tobit estimation result of $\mu = -0.002144$ different from sample mean 0.0564 and t value=-0.0756 is not significantly different from zero. However, this value is slightly negative and not equal to median of one-day returns. Therefore, the distribution of one-day returns is not symmetric that is not consistent with symmetry of one-day tobit returns in Ruud's (1993) paper. The possible reason may be that the number of observations is not large enough to get a precise result or that investors of IPOs goes with "animal spirits"- Keynes's (1936) famous declaration, i,e., fad, to invest IPOs and thought they will get abnormal profits from investment even if the profitability of abnormal profits does not exit.

3.Migration Analysis

There is 48.9% of the one-day initial returns whose closing price is equal to the offering price at the first trading day. If underwriters gradually withdraw price support from the market, we may find the subsequent returns do not keep positive and possibly yield negative returns when the investment period gets longer. Table 2 represents the descriptive statistics of subsequent returns of IPOs with initial returns equal to zero. The skewness shows decreasing pattern as the time interval of return measurement increases expect for 7-week distribution. The minimum observation in

the left tail decreases from 0 for one-week returns to –0.0601 for eight-week returns. The maximum from two-week to eight-week returns is not greater than that of one-week returns. This phenomenon points that strong influence of underwriters' price support for IPOs. Since underwriters can not and do not want to maintain the subsequent prices of IPOs above the offering prices, the subsequent returns of IPOs would return to the normal price evaluation. Moreover, figures 10 to 17 show that the spread of observations increases over longer holding periods. Therefore, most stabilization behavior taken by underwriters ends within one week or two weeks.

Table 2 The descriptive statistics for each of distributions given initial returns=0

	Mean	Median	Min	Max	Std dev.	Skew β_1	Kurto β_2
1 week	0.0063	0	0	0.1009	0.2155	4.4255	20.153
2 week	0.0079	0.0062	0	0.07232	0.0155	3.7082	15.264
3 week	0.0056	0.0083	-0.0084	0.0247	0.0074	0.6885	0.9427
4 week	0.0057	0.0083	-0.0168	0.0308	0.0109	0.0238	0.3838
5 week	0.0044	0	-0.0253	0.0308	0.0122	-0.0962	1.4904
6 week	0.0024	0	-0.0339	0.0547	0.0174	0.9275	3.4364
7 week	0.0024	0.0021	-0.0339	0.0953	0.0247	2.4389	9.7751
8 week	0.0031	0.0083	-0.0601	0.0953	0.0311	0.7563	2.9969

* the return is calculated as logarithm of the ratio of the market price at the end of the indicated period to the offering price.

4.Test of the signaling hypothesis

Underpriced unseasoned issues "leave money on the table" in a certain amount with investors may allow firms going public to transmit some unknown good private information to the investors and make subsequent seasoned issues sold easily. This argument inspired some researchers to formalize signaling models, such as Allen and Faulhaber (1989), Welch (1989), and Grinblatt and Hwang (1989). In this section, we will test two testable implications, one in Allen and Faulaber model and one in Grinblatt and Hwang model. All these models consider the degree of success in a seasoned offering after firms going public. In Allen and Faulhaber model, they

assumed investors cannot directly observe either the quality of the firm's innovation or the success of failure of its implementation, investors can observe only (1) the price and proportion of the firms sold in the IPO, and (2) the dividends at the end of each period. Meanwhile, investors are risk-neutral. Consequently, the following implication can be derived:

Implication: *There is positive relationship between the degree of underpricing and the subsequent earnings performance and dividend policy of the firm*

Based on the implication above, two linear models are set up as follows

$$\gamma_i^0 = \alpha + \beta\ Earnings_i + \varepsilon_i \tag{2}$$

$$\gamma_i^0 = \delta + \omega_1 DIY_i + \omega_2 Time_i + \mu_i \tag{3}$$

where γ_i^0 represents initial return for firm i. $Earnings_i$ represents firm i earnings at the year when IPO is issued. DIY_i represents firm i dividend yield which is yearly rate at the year when IPO is issued, and $Time_i$ is the reciprocal of time interval between initial offering date and first dividend announcement date if there is no dividend paid, Time will be assigned 0.

Owing to the availability of earnings data and dividend yields in COMPUSTAT, there are 20 observations entering equation (2) and 44 observations in equation (3). The estimation results are in table 3.

Table 3 The estimation results for equations (2) and (3)

	Intercept	earnings	Dividend yield	time	R^2
Initial returns	0.1202 (4.449)	-0.0001 (0.4158)			0.0013
Initial returns	-0.09744 (6.628)*		-0.01202 (-4.123)*	-1.3816 (-0.3548)	0.1508

* means that the coefficient is significant from 0 under 5% significance level

a.Using white's (1980) heteroskedastic-consistent covariance matrix of regression coefficient corrects the heteroskedasticity problem in covariance matrix of error terms.

b.We also use Lagarangian Multiplier to test if there is ARCH structure with 2 lag periods problem in error terms and find there is no ARCH problem in error terms.

Because the number of observations used in estimation of equation (2) is too small, there is not any informative result in equation (2) we can use to infer any conclusion. On the other hand, the estimating result of equation (3) tells us that both coefficients of dividend yield and time are negative, implying higher initial returns with lower dividend payment. The coefficient of the time interval is negative, which means firms that underprice less tend to pay high dividends and pay them earlier rather than later. Accordingly, there is no positive relationship between initial returns with dividend policy. This is consistent with the findings of Michaely and Shaw (1994).

Another test is to understand if the initial return on the IPO is positively related to the fraction held by insiders for a given variance level which is a implication of Grinblatt and Hwang(1986). The model can be set as follows.

$$r_i^0 = \alpha + \beta_1 Variance_i + \beta_2 Insiders_i + \varepsilon_i \qquad (4)$$

where $Variance_i$ represents variance of 21daily returns following the initial offering date for firm i.. $Insider_i$ represents the fraction held by insiders for firm i.

The estimation results are shown in table 4

Table 4 The estimation results for equation (4)

	Intercept	Variance	Insiders	R^2
Initial returns	-0.0628	-0.0174	0.14282	0.0044
	(-2.882)	(-0.5772)	(1.9133)*	

* means that coefficient is significant from 0 under 5% significance level

a.using white's (1980) heteroskedastic-consisent covariance matrix of regression coefficient corrects the heteroskedasticity problem in covariance matrix of error terms.

From table 4, we can find that the coefficient of insiders is positive and significantly different from 0, but the coefficient of variance is negative and insignificantly different from 0. Hence, the implication that the initial return on the IPO is positively related to the fraction held by insiders for a given variance level is upheld. This is in contrast to discovery of Michaely and Shaw (1994) that the fraction held by insiders has no explanation power to explain the initial returns.

This means that insiders underprice IPO more enough to make subsequent seasoned equity issuing more easily and hold a large fraction of shares in the meantime.

Summary and Conclusion

The fundamental question addressed in the IPOs is why the underpriced IPOs are so prevailing in the market. Some financial researchers cast doubt on the market efficiency and think there may be some market inefficiency function causing this kind of anomaly. However, another group of researchers think that this kind of phenomenon is an equilibrium situation and propose theories to explain it, such as signaling theory, and Rock's model.

Even though there are so many theories explaining the underpricing behavior of IPOs, there is still no consensus in this area. In this paper, we test the underwriter price support hypothesis and signaling hypothesis. The results support underwriter price support hypothesis since the subsequent returns of IPOs are not all positive at all and the distributions of long holding periods have more two-tail observations than the distribution of initial returns. The finding of this paper also provides us with an indication that underwriters will gradually withdraw the stabilization within one or two weeks following the offering date. However, the distributions of long holding periods are not normal. The mean of Tobit analysis is not significantly different from zero, which tells us that underwriters tend to prevent the price of the first trading of IPO from dropping far away from the offering price.

Regarding the tests of signaling theory, the findings of this paper do not support the predictions of Allen and Faulhaber model, but support the prediction of Grinblatt and Hwang (1989) model. That is, if the variance is given constant, the fraction of shares held by insiders will positively influence the initial returns of IPOs. This is contrary to the conclusion drawn by Michaely and Shaw's (1994) paper which stated the insiders' holding has no significant effects on the degree of underprice of IPOs.

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