IPO Underpricing and After-market Liquidity in the US Market

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1 INTRODUCTION

During the last decades companies have been listed on the stock exchange due to their business growth. In general, the listing has made easier to gain equity capital and created more stable for long-term financing opportunities. In addition, the listing has also created a continuous and visible valuation that will allow the share to be a new instrument for example rewarding the company's personnel as well as a payment for future acquisitions. So, the listing will allow more flexible capital structure that creates easier growth possibilities and visibility for the company.

It is important to understand the benefits and disadvantages of listing when a firm decides to go public. Therefore, we will tell you in our case, what kind of effects the Initial Public Offering has. Initial Public Offering that can be often used as an abbreviation IPO, means that a stock of a private company is offered to the public first time. The company tries to acquire more capital and expand its ownership base but unfortunately as often, we face with few problems. In our case, these problems are related to underpricing and can be seen as a capital loss from a company's point of view.
IPO is generally explained in the literature with asymmetric information about the security's value and with its fundamental risk. Related to that, the underpricing can be seen that the first day of trade due to that the offer price, is lower than the closing price after the first day of trade. This creates uncertainty and the issuer which is often the company, must leave enough ‘‘money on the table’’ to compensate investors for the uncertainty about the security's value.

The purpose of this study is to examine the relationship between underpricing and the aftermarket liquidity of IPO's in USA market area during the period 2010-2015. Frequently, the investors do not usually know how liquid the aftermarket will be and we have analysed how IPO underpricing may influence after-market liquidity.

2 THEORETICAL FRAMEWORK

This chapter will deal the theory of IPO as a process and what kind of benefits and disadvantages the companies usually faces. The chapter will also deal why IPO's are usually underpriced and shows what kind of effect the after-market liquidity has of underpricing.

2.1 What is an IPO?

IPO or initial public offering is when companies go from private which means that they have no general shareholders to public there they are a firm with general shareholders. In case of listing, potential investors are offered a certain subscription price.

Even if a company is private, they can have shareholders but they are only a few comparison with a public firm or regulated by the Securities and Exchange Commission does not regulate them. When they are public, they sell stocks shares in the firm. (CNBC 2013)

The IPO process does not happen overnight; it has many processes and takes a lot of time and effort to happen. An IPO takes three to four months before the first day´s trading on an exchange. When a company go public you can invest, before that, it is not possible. IPO:s results in lower cost of credit. (CNBC 2013)

2.2 Why firms go public?

The biggest cause why firms go public is because they get more liquidity or cash by selling shares and to raise funds. They can re-invest in the company´s infrastructure or expand their business. (CNBC 2013) One crucial cause why firms go public is that they want to expand their business, purchase assets where they simply want to secure capital through investments for future uses. The firm wants to rebalance their accounts after investment and growth. (Nasdaq 2013)

The company becomes more attractive and shows that they are doing well and also have capital. By going public stocks can be used in merger and acquisition deals as role in the payment. It´s more prestige to be a public firm than private because when they are more visible for example when they are listed on a big stock exchange like NYSE or Nasdaq. (CNBC 2013)

2.3 The IPO process

When a firm go public they hires an investment bank to handle the IPO, and that´s called underwriting. A company can sell shares themselves, but almost everybody hires investment banks or other banks. In the process of the IPO, the firm and the bank analyses how much money they will raise from the IPO in the future. When the firm and the bank have agreed an underwriting deal they have to do a registration statement, where they going through detailed information about the company and offering. The information about the company includes, financial statements, management background and legal problems, whereafter the SEC investigates the company that all the information is correct. When everything is as it should, the company get information about the date for the IPO. Finally, the underwriter have to compile all the information about the company before going public. (CNBC 2013)

2.4 Asymmetric Information

From investor's point of view, underpriced IPOs can provide a good deal at a first glance. We can assume that there are two types of investors and some of them have an information advantage compared to others. Usually the diversity of information can be seen between insiders and outsiders. According to Berk and DeMarzo (2014) they argue that the underwriters usually set the issue price high at the first day of trade to avoid their risk. Therefore, it can be seen that the insiders of the company may know the actual value of the company better than the outsiders. Often the listed company and the investment bank have different views of the company's value of shares compared to the investors from outside. (Berk & DeMarzo 2014: 820–822.)

There are informed investors who may know the true value of shares, and uninformed who may invest in the IPOs in any case. Informed investors will only buy shares when the shares are attractively priced. Instead, the uninformed investors do not have any information if the offering is attractively priced or not, and they might buy shares regardless of that. The average return for uninformed investor is often negative if the investor faces competition with the informed investor. We can see that the less informed investors will receive less of the more wanted shares, if they place a purchase order on IPO shares and are able to obtain all the shares that they desire. On the other hand, well-information investors would not buy the shares, so this can be seen as a winner's curse where the less informed investors would only be compensated if the shares are

underpriced enough. (Grinblatt & Titman 2002: 85–87.) It can be reflected to the theory of supply and demand where the smarter party will win the game.

Usually in every IPO there is a certain number of shares that are to be sold off to the public. Sometimes we will also come across that the company and investment bank have a different opinion of the issue price. Sellers, who are the current shareholders have a different view of the value of shares than the investment bank is willing to pay. When distributing the shares to the investors it can be seen as an oversubscribed offering, which means that investors are not willing to pay the price that the underwriter plans to sell. Usually the underwriter knows the real market price even though the owners would disagree. When setting an offering price, the underwriter tries to price their issues as high as possible which is however, according to the owners' interest. There is at least asymmetric information because underwriters have to underprice the issue by ensuring that they can sell all the shares. So, they have to act by their own interest and try to tempt uninformed investors by underpricing to ensure that if sometimes the demand of shares would be insufficient they will minimize their risk in any case. (Grinblatt & Titman 2002: 81–84.)

2.5 Relationship between IPO Underpricing and Aftermarket Liquidity

When going public, usually wealth maximization and aftermarket liquidity are closely related even though they are different objectives. It is assumed that pre-IPO owner has a negotiation advantage because their decisions related to underpricing, share retention and lockup are important issues that can maximize the aftermarket liquidity of their stock. Share retention leads to a decrease in trading volume. When pre-IPO owners retain more shares, there are fewer shares available for trading and thus lower liquidity. Because of share retention, it is more probable that outside investors trade with pre-IPO owners and this relationship may affect to underpricing and lockup decisions. (Zheng, Odgen & Jen 2005: 293–296.)

Underpricing and share retention are both beneficial for pre-IPO owners that has a signal of the value. It can be assumed that underpricing improves liquidity and share retention reduces liquidity. As more shares the pre-IPO owners have retained, the less they will lose and potentially gain more later due to underpricing. Investors will demand a lower liquidity premium on the stock if the stock is liquid and in that way the market price will be higher. Higher liquidity means lower trading cost which further improves the amount

that pre-IPO owners will receive when they will later sell their retained shares. This improves the liquidity of the stock when they retain more shares by underpricing. So, underpricing is required to improve the liquidity. (Zheng, Odgen & Jen 2005: 296.)

Often, the IPO has also a lockup restriction that forbids pre-IPO owners from selling retained shares for a certain period. Usually the period of lockup is 180 days. Lockup cuts down number of floating shares by restricting the trading of retained shares, and this decreases liquidity. The impact of lockup is significant for pre-IPO owners, because it allows them to sell shares at a higher price than would otherwise be possible. (Zheng, Odgen & Jen 2005: 297.)

It can be stated that pre-IPO owners' main target is to establish a liquid market for their shares by trying to maximize the value of their wealth. So, they try to underprice the issues to get more investors to follow the stock and trade it. In that way there is a positive relation between aftermarket trading volume and underpricing. In addition, lockup improves the positive effect. The IPO process is complex and pre-IPO owners' object to improve liquidity is just a one part of that process. (Zheng, Odgen & Jen 2005: 310.)

3 METHODOLOGY

3.1 IPO Underpricing

This study follows the method in Booth and Chua (1996) to calculate IPO underpricing, formulated as:

$$Underpricing\ (UNDER) = \frac{P_{close} - P_{offer}}{P_{offer}} \quad (1)$$

Where:

P_{close} is the closing price on the first trading day

P_{offer} is the offer price

According to equation (1), IPOs with a value equal to zero are considered correctly priced, while a positive value indicates that underpricing exists.

3.2 Liquidity

There are various different measures that can be considered a proxy to liquidity. The volume-based approach will be used in this study to measure after-market liquidity. Specifically, the average trade volume is collected for all stocks during three diffrent time frames: 30 days, 120 days and 240 days after the listing date. This approach was also used in previous studies such as Zheng and Li (2008), Khodavandloo and Zakaria (2016). However, it has been well observed that trade volume is abnormally high during the first week of trading (Reese, 1998; Li et al., 2005). Therefore the first six business days will be excluded to reflect true market intention. The formula can be expressed as:

$$Liquidity\ (LIQ) = \frac{1}{N}\sum_{t=6}^{t+N} VOL_t \quad (2)$$

Where:

VOL_t is the trade volume at time t

N is the study period (30, 120 and 240 days)

3.3 Data and Regression Model

The sample for this study is drawn from IPOs in the US market during the period 2010-2015. The intitial dataset is collected from IPOScoop.com database, which contains records of all US IPOs since 2000. The sample is filtered by excluding all Real Estate Investment Trusts (REIT) and closed end funds IPOs. Special purpose acquisition

company (SPAC) IPOs are also exlcuded since their objective is different from an ordinary company. Due to technical difficulty in obtaining historical data, stocks that went on to be listed in the OTC market are also removed from our sample. Finally, stocks that got delisted before 240 days are also not considered to avoid comparability issue.

To monitor after-market liquidity, we obtain historical market data for all stocks in the sample from Google Finance. A linear regression model is constructed to test the causal relationship between underpricing and liquidity. The dependent variable is the natural log of LIQ from equation (2). The log transformation is neccessary to ensure an approximate normal distribution for the variable, which enhances estimation reliability (Wooldridge, 2012, p.216). The independent variable is UNDER from equation (1). Previous studies have shown that other factors such as offer price, offer size, risk and market capitalization of IPO also have significant explanatory power on liquidity, which we will include in the model as control variables (Pham et al., 2003; Karpoff, 1987; Sapian et al., 2013). The model is expressed as:

$$Ln(LIQ) = \alpha + \beta_1 UNDER + \beta_2 PRICE + \beta_3 Ln(SIZE) + \beta_4 Ln(MCAP) + \beta_5 RISK + \varepsilon \quad (3)$$

Where:

LIQ =	*Average volume of IPO during the study period*
UNDER =	*Underpricing level of IPO*
PRICE =	*Offer price of IPO*
SIZE =	*Number of shares offered at IPO*
MCAP =	*Market Capitalization of IPO*
RISK =	*Standard deviation of stock price during the study period*

A summary of descriptive statistics of the studied variables is given in Table 1. The average initial return on the first trading day, which is used to measure underpricing, is found to be 14,6% for the period 2010-2015. This value is lower than the underpricing level reported in Boulton et al. (2006) for the US market, which is 28,9% during 2000-2004. According to Loughran et al. (2004) who also study the US market, underpricing level can fluctuate significantly through different periods, for instance, the average for 1990-1998 is 14,8% while it is 65,0% during the 1999-2000 tech bubble. The data for our sample show that the distribution of initial return is heavily skewed to the right, which suggests that IPO underpricing might exist in the US market.

Variable	Unit	Mean	Median	Max	Min	Std. Dev.
UNDER	%	14,6	6,6	206,7	-35,2	26,8
LIQ (30 Days)	Share	453 633	163 757	32 553 803	395	1 822 489
LIQ (120 Days)	Share	426 285	140 037	42 175 070	204	1 875 140
LIQ (240 Days)	Share	490 957	166 179	48 037 973	312	2 087 931
PRICE	$	15,48	15	91	4	6,65
SIZE	Share	14 364 154	8 000 000	478 000 000	625 000	28 816 867
MCAP	Mil. $	1 100	377	49 500	25	2 840
RISK (30 Days)	%	1,91	0,95	208,49	0,04	7,75
RISK (120 Days)	%	4,52	1,93	682,59	0,04	26,07
RISK (240 Days)	%	6,94	2,73	1752,78	0,04	60,82
Total Observations: 908						

Table 1 Descriptive Statistics

The variables are checked for multicollinearity using correlation matrix, which suggests that multicollinearity is not a serious problem for the regression model. Serial correlation is also not a concern since the model is not dependent on time series. The large sample size allows us to ignore the normal error distribution assumption. However, heteroskedasticity in the residuals is expected to exist, given the huge degree of difference in some of the variables' data values, even after applying log transformation. Therefore, we will use the White-Huber consistent standard errors when constructing our OLS regression model to acknowledge for heteroskedasticity. Finally, functional form misspecification is tested using the RESET test to evaluate the adequacy of model selection. The Eviews program is used for these tests and model estimation.

3.4 Hypotheses

Our first hypothesis tests the existence of underpricing in the US market:

H1: US IPOs are fairly priced during 2010-2015

Our second hypothesis examines whether liquidity is one of the benefits of IPO underpricing:

H2: Underpricing level does not influence after-market liquidity

4 EMPIRICAL RESULTS

4.1 IPO Underpricing in the US Market

In order to test the existence of underpricing (Hypothesis 1), we perform a simple t-test on the mean value of the variable UNDER. The result in Table 2 indicates that the initial return of US IPOs is significantly different from zero at 1% level. Therefore, we can reject the null hypothesis that IPOs are correctly priced and confirm that underpricing exists in our sample.

Hypothesis Testing for UNDER
Included observations: 908
Test of Hypothesis: Mean = 0.0000

Sample Mean = 0.145951
Sample Std. Dev. = 0.267871

Method	Value	Probability
t-statistic	16.41819	0.0000

Table 2 T-test on the mean value of sample's initial return

To strengthen the claim above, we perform an additional test on the median value of the initial return. As depicted in Table 3, all testing methods confirm that the median value is also significantly different from zero at 1% level. It can be concluded that IPO underpricing is an existing phenomenon in the US market during the study period.

Hypothesis Testing for UNDER
Included observations: 908
Test of Hypothesis: Median = 0.000000

Sample Median = 0.065650

Method	Value	Probability
Sign (exact binomial)	627	0.0000
Sign (normal approximation)	13.69574	0.0000
Wilcoxon signed rank	16.25505	0.0000
van der Waerden (normal scores)	16.36972	0.0000

Table 3 Median test of sample's initial return

4.2 Result of Cross-sectional Regression on After-market Liquidity

The regression result of our model in equation (3) is shown in Table 4. Overall it can be observed that all independent variables show significant influence on volume of trade after public listing. This is within our expectation, since these variables have been consistently showing strong relationship with market liquidity in previous studies. To test the robustness of our model, three separate regressions were run on short-term period (30 days) as well as longer periods (120 and 240 days). The results show

consistency in all different time frames, indicating that the model is relevant in both short-term and long-term. The R-squared value ranges from 0.55 to 0.60, indicating that the independent variables can explain more than half of the movement in the dependent variable.

Independent Variables	Dependent Variable: Ln(LIQ)		
	30+6 Days After IPO	120+6 Days After IPO	240+6 Days After IPO
α (Constant)	-6,205**	-6,247**	-6,076**
	(-7,617)	(-8,009)	(-7,776)
UNDER	1,16**	1,227**	1,333**
	(7,859)	(9,703)	(9,807)
PRICE	-0,017*	-0,019*	-0,022**
	(-2,067)	(-2,544)	(-3,017)
Ln(SIZE)	0,796**	0,767**	0,682**
	(11,1)	(10,89)	(9,47)
Ln(MCAP)	0,173**	0,199**	0,276**
	(3,887)	(4,239)	(5,303)
RISK	-0,036**	-0,011**	-0,004**
	(-5,099)	(-4,728)	(-5,351)
Adj. R^2	0,584	0,595	0,55
F-stat	256,16	267,85	223,05

(Note: figure in parenthesis indicates t-statistic. ** and * indicate significance at 1% and 5%, respectively.)

Table 4 OLS Regression on After-market Liquidity

Our first interest from the regression result is to test Hypothesis 2. Since the level of underpricing shows significant influence on liquidity in all three regressions, the null hypothesis is rejected and it can be stated that the decision to underprice IPO has a direct relationship with after-market liquidity. Furthermore, the coefficient for UNDER is positive and increasing as the liquidity period increases, suggesting that the more an IPO is underpriced, the higher trade volume will accumulate in the secondary market, and this effect will also become stronger overtime. The β coefficient can be understood as, for instance, if underpricing level increases by 1%, the daily trade volume will be expected to increase by β%.

This result is consistent with previous research, despite the differences in liquidity measures in some studies. In one of the first notable papers on the topic, Booth and Chua (1996) investigate 2151 US IPO issues during 1977-1988 to determine the cause of underpricing. The empirical result suggests that underpricing is positively related to oversubscription and ownership dispersion, which implies a highly liquid secondary

market. This finding contributes another explanation to underpricing, in addition to other theories such as adverse selection, signalling and information asymetry.

Numerous following researches were conducted to examine the liquidity theory. Pham et al. (2003) study 113 Australia IPOs from 1996-1999 and the relationship between underpricing, ownership structure and post-listing liquidity. The study found that underpricing level is affected by increasing the number of shareholders and reducing the concentration of share ownership. In addition, the authors also measure liquidity directly by two proxies: trading turnover and bid-ask spread, and confirms the strong and positive relationship between underpricing and liquidity, regardless of firm's characteristics. Zheng et al. (2005) use a similar measure of liquidity to our study, average trade volume, and also study the US market during an extended period from 1976 to 1998. The study came to the same conclusion, while offering the argument that a liquid market will maximize the wealth of IPO owners and therefore, they will try to manipulate factors such as underpricing to achieve this objective. In a more recent study on the US market, Hahn et al. (2013) examine a variety of liquidity measures (spread, price and volume based) and found significance impact of underpricing on most measures. Moreover, the effect is found to be extended beyond the lock-up period, implying that underpricing is also a strategy employed by IPO owners concerning about long-term liquidity.

Studies about underpricing and liquidity are found in many different markets. Chang et al. (2008) study 819 Chinese IPOs for the period 1996-2004 and found that high initial return will lead to high initial turnover, but not vice versa. Ellul and Pagano (2006) study 337 British IPOs between 1998 and 2000 and relate the asymetric information theory to illiquidity risk. According to the authors, IPOs are underpriced to compensate investors for bearing the risk from lack of information, including the risk of expected after-market liquidity. Bouzouita et al. (2015) study a sample of IPOs on the Euronext exchange from 1995 to 2008 and found that underpricing affect liquidity through information production, rather than ownership dispersion, which contradicts with previous researchers. The authors suggest that the more an IPO is underpriced, the more analyst coverage it will attract, which in turn cause higher liquidity. In general, all studies agree on one common conclusion, that underpricing is positively related to liquidity in the secondary market, and this relationship can be universally observed in both short and long term.

Aside from the discussion about underpricing, it is also interesting to look at the impact of other aforementioned control variables on liquidity. First of all, the negative sign of PRICE coefficient suggests that cheaper IPOs will attract more trading activity than higher priced IPOs. However this effect is less prominent in shorter periods, since the beta is only significant at 5% level. Next, the size of the offer (SIZE) and the firm's market value (MCAP) are also major factors that decides liquidity, and it can be inferred that larger firms tend to have higher liquidity after the launch of IPO. Finally, it is observed that firm's risk measured by standard deviation of share price (RISK) is negatively related to liquidity, or that investors are less willing to trade stocks with high volatility.

5 CONCLUSION

The objective of this paper is to study the underpricing phenomenon that is prevalent in IPO issues. The paper focuses on finding the causal relationship between underpricing and after-market liquidity, thereby offering an explanation to why firms are willing to underprice their stock at IPO. The study follows closely the methodology of previous researches in measuring underpricing and liquidity and model construction. The results are supported by empirical evidence from 908 US IPOs between 2010 and 2015.

The results support previous researches and offer no contradiction. The initial result confirms that underpricing exists in the US market, as a significant portion of IPOs experience increase in price at the end of the first trading day. Furthermore, we also found that this initial return is positively related to stock liquidity, measured by volume of trade, up to 240 days after the first week of trading.

The results suggest implications for both investors and companies. For investors concerning about liquidity risk, there is a great incentive to look for underpriced IPOs. High liquidity often result in lower transaction cost, and as our study suggests, market risk is also lower in stocks that are more liquid. The same principle applies to firms looking for a liquid market and greater exposure after going public. The decision to offer the IPO at a lower price than its intrinsic value may help firms achieve these objectives. Mantecon and Poon (2009) suggest that a more liquid secondary market can benefit firms by increasing the value of stock held by shareholders, as well as the value of stock used as currency in acquisitions. It is therefore, up to the firm's decision to weight these benefits against the initial trade-off from underpricing their IPO.

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