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Determinants of Underpricing of Initial Public Offerings: Evidence from Pakistan

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Abstract

This study examines the determinants of underpricing of Initial Public Offerings (IPOs) using Extreme Bounds Analysis (EBA) in the Pakistani capital market. We measure the short-run performance of 75 IPOs from listing to the thirtieth-trading day issued on Karachi Stock Exchange from 2000 to 2011. The results confirm that IPOs have been underpriced from the first to thirtieth-trading day indicating that Pakistani IPOs outperformed over the sample period. Under EBA technique, eleven determining variables of IPO underpricing are investigated. With aftermarket risk of the IPO and oversubscription as the free variables, nine variables are selected as the variable of interest in combination with three other variables. We found that after market risk of an IPO, oversubscription, offer price and financial leverage are the true factors influencing IPO underpricing.

Key Words: Initial public offerings, Underpricing, Extreme bounds analysis

1. Introduction

Over the last four decades, extensive research has been done to investigate the determinants of underpricing of IPOs. The determinants may vary with the passage of time as it depends upon the degree of underpricing and influential factors. When the firms go public, these issues generally tend

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to be underpriced (Logue, 1973 and Ibboston, 1975). Underpricing is the percentage premium that the investor receives at the start of market trading (i.e. difference between the offering and listing price). Underpricing of IPOs has been a pervasive phenomenon for decades. Hence, IPOs on average exhibit significant abnormal returns on initial trading day.

Loughran et al. (2013) document that underpricing in developing markets is higher compared to developed markets as developing markets are highly volatile entailing high risk. Examples of the prevalence of underpricing in Asian countries are as follows: 39.86 percent in Pakistan (Kayani and Amjad, 2011), 46.55 percent in India (Sahoo and Rajib, 2010), 33.50 percent in Sri Lanka (Samarakoon, 2010), 108 percent in Bangladesh (Quayes and Hasan, 2008) and 35.66 percent in Pakistan (Sohail and Nasr, 2007).

A number of theoretical models have been developed for explaining the degree of IPO underpricing. Among others, the most prominent model is Information Asymmetry Hypothesis. Due to the information asymmetry problem, informed investors participate in the allocation process and receive shares of the underpriced IPOs and uninformed investors only bid for overpriced IPOs which leads to the Winner's curse Hypothesis. The Ex-Ante Uncertainty Hypothesis explains that the issue becomes riskier due to volatility of post issue stock prices, financial leverage, offer size, age of the firm, listing delay and return on assets, all of which results in inflation of the level of underpricing. The Underwriter's Hypothesis as determinant of underpricing suggest that generally, high prestige underwriters having access to superior information determine the final offer price, leading to lower level of underpricing. Whereas, due to paucity of resources, non-prestige underwriters are unable to find the exact offer price and a gap persists between the offer and market price resulting in higher IPO underpricing. The Signaling Mechanism Hypothesis of underpricing maintains that underpricing occurs when issuers intentionally float their IPOs at a lower price for leaving a good taste in investors' mouth while subsequent offerings will be less underpriced. Other theoretical aspects like Monitoring Hypothesis and Lawsuit Avoidance Hypothesis are additional factors that can cause underpricing in new issues.

The objective of this study is not to test a specific theory or a well-defined hypothesis. Rather, the purpose is to test the sensitivity of variables in a set of regressions that are truly influential and robust in terms of their effect on underpricing. This study measures the degree of underpricing from listing until the thirtieth-trading day period and also identifies the "true" determinants of IPO underpricing listed on Karachi Stock Exchange (KSE) from 2000 to 2011 using the EBA technique. We found that investors who participate on the offering day and hold on IPOs up to one or thirtieth trading day, reap abnormally high returns. The study also considers various explanatory variables documented by earlier studies. The main thrust of this research is to identify the true determinants of IPO underpricing by testing the sensitivity and robustness of the explanatory variables under EBA technique. We considered eleven explanatory variables and found only four robust variables that significantly influence underpricing. This study adds to the existing literature by employing EBA technique to find the determinants of IPO underpricing.

Rest of the paper is structured as follows: next section summarizes the related literature on IPO underpricing, Section 3 describes IPOs in Pakistani capital market, Section 4 discusses research methodology, Section 5 elaborates data and description of the variables, Section 6 examine empirical results and conclusions are drawn in Section 7.

2. Literature Review

The underpricing of IPOs has been observed over the decades and always considered as an important research area. Researchers are more interested in finding the magnitude of underpricing and its determinants which may change over the period of time. There are a number of reasons of IPO underpricing; explained by theoretical and empirical literature.

2.1 Theoretical Aspects of IPO Underpricing

A number of theoretical models have been developed to explain the IPO

underpricing. However, a simple theoretical model which explains all the factors affecting the underpricing is non-existent. The literature includes some main theories of underpricing i.e. Winner's Curse Hypothesis, Underwriter's Prestige Hypothesis, Ex Ante Uncertainty Hypothesis, Signaling Hypothesis, Monitoring Hypothesis and Lawsuit Avoidance Hypothesis.

One of the most prominent models is Winner's Curse Hypothesis, developed by Rock (1986). Rock divided the investors into two subsets: (a) informed and (b) uninformed investors. Informed investors seek more information by incurring certain evaluation costs to find the value of the firm while uninformed investors do not have sufficient resources to obtain information about the issues that is not readily available in the marketplace. Informed investors bid for only those issues which are to be underpriced, resultantly IPOs will be oversubscribed. Therefore, uninformed investors will be getting a limited number of shares. Due to information asymmetry, uninformed investors will purchase those shares which are to be overpriced and ultimately earn negative returns. As a result, uninformed investors will be successful in obtaining shares of the overpriced issues, but be unsuccessful at obtaining shares of the underpriced issues; this imposes a situation known as the winner's curse. To make these issues attractive for uninformed investors, IPOs are issued at a discount resulting in earning of positive returns. Hence, the winner's curse theory elaborates that information asymmetry can be reduced between informed and uninformed investors that will lead to a decrease in the underpricing of IPOs. Furthermore, underpricing can also be reduced with the assistance from a prestigious underwriter which provides assurance with regard to the quality of issue (Michaely and Shaw, 1994 and Carter et. al., 1998). As such, the number of informed investors decrease, which subsequently reduces the winner's curse problem in an IPO market.

Another model for explaining IPO underpricing is underwriter's prestige. Recent studies (Hoberg, 2007; Dimovski et. al., 2011) predict a positive relationship between underwriter's prestige and underpricing. Underwriters

intentionally underprice new issues so as to take advantage of the underpricing. Hoberg (2007) argued that high prestige underwriters have access to superior information and uses it to obtain more valuable issues. Empirical literature also claims that there is an inverse relationship between the underwriter's prestige and underpricing. During the 1970s and 1980s, a negative relationship between the prestige of underwriter and initial day returns was observed (Carter and Manster, 1990; Megginson and Weiss, 1991) while a positive relationship was found during the 1990s (Beatty and Welch, 1996). The change in relationship is based on the decision of some prestigious banks: who either want to promote IPOs or weaken the process of IPOs.

Beatty and Ritter (1986) further extended Rock's model of underpricing to envisage a positive relationship between underpricing and ex-ante uncertainty. They argued that greater the ex-ante uncertainty of an issue, higher the information asymmetry which leads to higher underpricing. Empirical studies have used various proxies to measure ex-ante uncertainty. For instance, Ljunsqvist (2006) divided these proxies into four groups, i.e., company characteristics, offering characteristics, prospectus disclosures and aftermarket variables.

Another theoretical model of underpricing is the Signaling Mechanism used by firms which was developed by Welch (1989). According to this theory, high quality firms intentionally underprice their IPOs to give a signal to the market. Though as a result, firms will be able to obtain lesser proceeds in the first instance, "leaving a good taste in investors' mouths" (Ibboston, 1975). By providing a good signal to the market, the firms will issue subsequent seasoned offerings at higher prices.

Under the Monitoring Hypothesis, firms have an incentive to underprice IPOs which reduces the monitoring by new shareholders and large institutional investors. This infers that conflict of interest may arise when the benefits of managers and shareholders are not aligned. According to Brennan and Franks (1997), managers diffuse ownership through underpricing so they

are not monitored by large outside shareholders. In effect, managers use underpricing as a means of control.

Lawsuit Avoidance Hypothesis indicates that firms underprice their IPOs to reduce lawsuits from investors, which may occur due to any errors or omissions of the probability of key facts in the prospectus. More recently, Banerjee et al. (2011) predicts a positive relationship between the accessibility of legal recourse and IPO underpricing. This hypothesis is treated as a second driver of underpricing.

2.2 Empirical Evidence of IPO Underpricing

Empirical evidence documents the underpricing of IPOs which persists in almost all the countries. However, the intensity of underpricing may vary from country to country and across different time periods. In an early study, Reilly and Hatfield (1969) found that US IPO market faced underpricing of 11 percent during the period from 1963–65. The degree of underpricing has changed over the period of time. In the US, underpricing was just 7 percent during the decade of 1980s but it was almost double (15 percent) during 1990–2000. According to Liu and Ritter (2010), IPO underpricing was 12 percent in US during 2001-2008.

Chambers and Dimson (2009) documented 19 percent underpricing in the UK IPO market during 1989 to 2007. More recently, Banerjee et al. (2011) reported the average underpricing is less than 10 percent in some European countries, while more than 20 percent in other markets of the world. By comparing the result of European, US and Latin American markets, the average underpricing is considerably higher in most of the Asian markets (Banerjee et al., 2011).

Wu, Ng and Moshirian (2010) analyzed underpricing across six major markets in Asia Pacific region during 1991 to 2004 and found underpricing of: China (202.63 percent), Korea (70.30 percent), Malaysia (61.81 percent), Singapore (33.10 percent), Japan (34.04 percent) and Hong Kong (21.43

percent). Alagidede and Heerden (2012) investigated the short-run performance of 138 South African IPOs and reported that underpricing ranges from 102 percent to 201 percent from listing to twentieth-trading day. Huang (1999) examined the underpricing of 311 Taiwanese IPOs during 1971-95 and confirmed abnormal initial returns of 42.60 percent primarily due to oversubscription. According to Zouari et al. (2009), Tunisian IPO market identified post issue promoters holding, oversubscription, listing delay and offer price as significant factors affecting underpricing.

Underpricing in Malaysian IPO market is examined by Abubakar and Uzaki (2012) using 476 IPOs during 2000 to 2011, they found the existence of underpricing of 35.87 percent and significant factors affecting IPO underpricing include: offer price, size of the issue and age of the firm. Adjasi et. al. (2011) investigated the underpricing of 77 Nigerian IPOs from 1990-2006 and reported initial abnormal return of 43.10 percent. They identified that the size of a firm and audit quality are important variables in determining IPO underpricing. Kiymaz (2000) found an average underpricing of 13.60 percent for a sample of Turkish IPOs from 1990-95.

In Mauritius, Brooks et al. (2012) proposed that aftermarket risk level, auditor reputation and ex-ante uncertainty are the significant factors affecting underpricing. Sahoo and Rajib (2010) documented the existence of IPO underpricing in India using 92 IPOs from 2002 to 2006. They identified that initial abnormal return is the result of over-expectation of the investors. Jain and Padmavathi (2012) analyzed 227 book-built Indian IPOs during 2004-2009 and concluded average IPOs are underpriced by 28 percent. They found that opening return at the start of first day market trading and oversubscription are the main determinants significantly influencing the level of IPO underpricing.

Quayes and Hasan (2008) used 90 Bangladeshi IPOs to measure underpricing on listing up to the twenty-first trading day from 1991-1997. They conclude that IPOs are underpriced on average by 108 percent and 119 percent in the first and twenty-first trading day, respectively. Further, they

found that volatility in ex-post prices and percentage of shares offered are significant factors. By comparing the underpricing in different Asian countries, underpricing in the Bangladeshi IPO market is considerably higher.

Sohail and Nasr (2007) investigated the short-run performance of 50 Pakistani IPOs during 2000 to 2006 and reported on average underpricing of 35.66 percent. They found that ex-ante uncertainty, oversubscription, offer size and market capitalization are the significant factors affecting the degree of underpricing. Sohail and Rehman (2010) studied the short-run performance of 73 Pakistani IPOs during 2000 to 2009 and measured underpricing on the first, fifth, tenth, fifteenth and twentieth trading day. They reported that on average underpricing ranged from 37 percent to 42 percent during first to twentieth-trading day. Kayani and Amjad (2011) analyzed 59 IPOs and concluded that offer size, aftermarket risk, firm size, oversubscription and float are the significant determinants influencing underpricing.

In short, empirical literature identifies a number of explanatory variables affecting the level of underpricing. It is important to note that regression results interpret a very few variables being statistically significant while most of the variables are insignificant. In order to test the sensitivity and robustness of the explanatory variables over IPO underpricing, EBA technique is used in this study. This method identifies variables which pass the sensitivity and robustness tests implying true determinants of the dependent variable. Recently, EBA is used to determine the emergence and survival of democracy (Vreeland et. al., 2012). They use 59 factors indicated by prior studies and run exhaustive regressions probably more than three million from 1976-2002 covering 165 countries. Their findings suggest that only five variables robustly determine the emergence of democracy, whereas just four factors determine the survival of democracy.

To find the determinants of R&D investment (Wang, 2010), twelve explanatory variables are considered and under EBA method just five

variables passed the sensitivity test and out of five, four variables are robust for determining R&D investment. Cardak and Moosa (2006) used EBA technique for determining factors of foreign direct investment. They tested the sensitivity and robustness of eight variables and found only three variables as robust. EBA is deployed by Al-Deehani (2005) to find determining factors for stock prices in Kuwait Stock Exchange wherein eleven explanatory variables are tested. Only three variables were able to clear the sensitivity and robustness test which actually influence the stock prices. Hence, EBA is more appropriate to identify only those variables truly affecting the dependent variable by running millions or thousands of regressions and from that one can infer whether they are robust or fragile.

3. IPOs in Pakistani Capital Market

With the advent of liberalization globally and locally in 1991, a number of reforms took place in the Pakistani capital market. As a result, IPOs picked up the pace and most of the companies floated their shares to diversify ownership, to raise funds for investment and as an exit strategy for mature firms. To administer reforms in the capital market, the Corporate Law Authority (CLA) was formulated in 1986. The role of CLA was to monitor the corporate sector by ensuring transparency and compliance with laws.

In order to further strengthen and make the IPO process more competitive, CLA was abolished and an independent commission was set up as Securities and Exchange Commission of Pakistan (SECP) in terms of Securities and Exchange Commission of Pakistan Act, 1997. SECP initiated its operational functions on January 01, 1999 with an objective to carry out the reform program of Pakistani capital market. After its establishment, the process of IPOs has become more rigorous and efficient as the companies having potential are allowed to float their shares and raise funds from the general public.

According to SECP, 407 IPOs are placed with total paid-up capital of Rs.265.699 billion during 21 years covering the period from 1991 to 2011.

During 1991 to 1998 period, that is, after the capital market reforms, major chunk of IPOs deals (334 IPOs, 82 percent of the total deal) took place with the paid up capital worth of Rs.84.242 billion. Hence, only 79 IPOs took place during the span of 12 years, i.e. 2000 to 2011 with paid-up capital of Rs.181.456 billion. In Pakistan, two methods are used to issue shares to the general public: (1) Fixed price method, and (2) Book building mechanism.

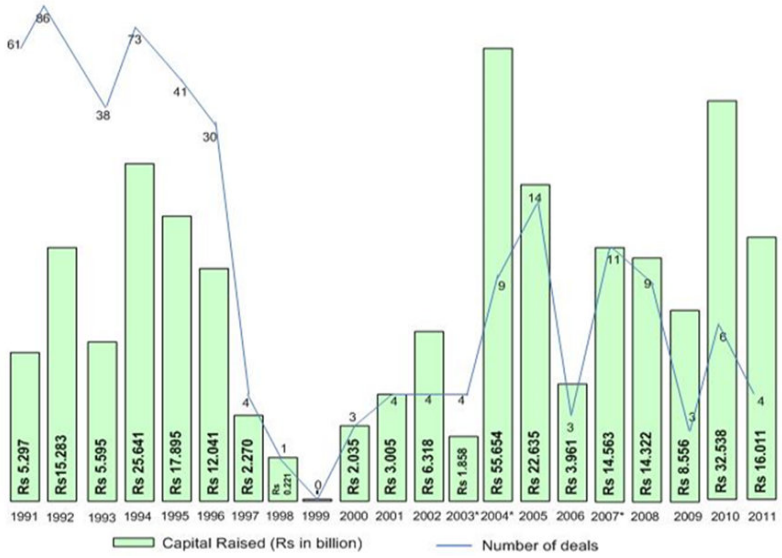

Fig. 1 Pakistani IPOs by Number of Deals and Capital Raised by Year[1]
Source: SECP

4. Research Methodology

4.1 Underpricing measurement

The IPO underpricing is measured through initial return for stock x at the close of d^{th} trading day and market adjusted abnormal returns are computed for stock x by using market return, i.e., return on benchmark index (KSE-

[1] excluding 3rd offer for sale of shares of National Bank of Pakistan in 2003. Offer for sales of shares of (i) M/S Sui Northern Gas Corporation Limited & ii) M/S Pakistan International Airline Corporation Limited in 2004 & 2nd offer for sale of shares of OGDCL shares in 2007 which were already listed.

100)[2]. Prior empirical studies have examined IPO underpricing on the initial trading day, whereas a few studies extended this to first week or first month to assess underpricing. Sohail and Rehman (2010) measured underpricing up to the twentieth-trading day in the Pakistani market. The present study extends the literature by investigating short-run IPO performance over the thirty-trading day to evaluate the magnitude of underpricing in Pakistan.

The total return, i.e. raw return $R_{x,d}$ for stock x at the end of the *dth* trading day is calculated as:

$$R_{x,d} = \left(\frac{P_{x,d}}{P_{x,0}}\right) - 1 \qquad (1)$$

where $R_{x,d}$ = return on stock x at the end of the *dth* trading day, $P_{x,d}$ = price of stock x at the end of *dth* trading day and $P_{x,0}$ = offer price of stock x. The market return is obtained from benchmark index (i.e. KSE-100) and it is computed as follow:

$$R_{m,d} = \left(\frac{I_{m,d}}{I_{m,0}}\right) - 1 \qquad (2)$$

where $R_{m,d}$ = market return at the end of *dth* trading day, $I_{m,d}$ = value of market index at the end of *dth* trading day and $I_{m,0}$ = value of market index on the offering date of stock x.

Market Adjusted Abnormal Return (MAAR) for stock x at the close of *dth* trading day is, therefore, calculated as under:

$$MAAR_{x,d} = 100 \times \left\{\left[\frac{(1+R_{x,d})}{(1+R_{m,d})} - 1\right]\right\} \qquad (3)$$

Equation (3) is also known as the short-run IPO underpricing. According to Ljungqvist et al. (2006), it is appropriate to investigate underpricing over a long horizon in emerging markets where post-IPO prices may take more time

[2] See for instance, Aggarwal et. al. (1993), Chi and Padget (2005) and Sohail and Nasr (2007).

to correct and reach equilibrium. The sample mean MAAR for the *dth* trading day is measured as:

$$MAAR_{x,d} = \frac{1}{n}\sum_{i=1}^{n} MAAR_{x,d} \quad (4)$$

We test the null hypothesis that the mean $MAAR_{x,d}$ is equal to zero. To test the hypothesis that $MAAR_{x,d}$ equals zero, the following *t*-statistic is computed as:

$$t = \frac{(MAAR_{x,d})}{s/\sqrt{n}} \quad (5)$$

where s = standard deviation of $MAAR_{x,d}$ for a n number of firms.

4.2 Extreme Bounds Analysis (EBA)

This study employs the EBA method to examine the sensitivity and robustness of the explanatory variables of IPO underpricing. The purpose of using this technique is to reduce the ambiguity of selected variables that affect the degree of underpricing. Theoretically, it was developed by Leamer (1983, 1985) and applied by Levine and Renelt (1992) to examine the determinants of cross country economic growth. Originally, the idea of EBA was conceived from the understanding given by Cooley and LeRoy (1981) explaining that economic theory does not "indicate a complete specification of which variables are to be kept constant when performing statistical tests so as to identify variables of primary interest amongst the dependent and the independent variables".

The determinants of MAAR are typically based on the following regression:

$$MAAR_x = \alpha_0 + \sum_{j=1}^{n} \alpha_j X_{jx} + \varepsilon_i \quad (6)$$

where $MAAR_x$ is the market adjusted abnormal return of firm x and X_{ji} the *jth* explanatory variable of firm x. Earlier research reported a number of regressions having a set of explanatory variables. The problem is to select the variables which are not adequately explained by the theory of underpricing that can reflect a "true" model. For instance, x_1 may be significant when x_2 and x_3 are included in the regression but not when x_4 is included.

The core purpose of applying this approach is to test the robustness and sensitivity of the determinants of the dependent variable. Prior studies of IPO underpricing explained a number of preferred models as per diagnostic tests; however, it is difficult to find the degree of reliability of the determinants. Under this technique, all combinations of explanatory variables are considered which enable us to find upper and lower bounds from the parameters of interest. It is an appropriate technique for evaluating and reporting the sensitivity of estimated results to specification changes. Importantly, the extreme values of the coefficient on the variable of interest reduce the ambiguity to select the choice of model, i.e. to reduce the model uncertainty (Leamer and Leonard, 1983). EBA is applied to a linear regression which is used to explain underpricing. The model describes as follows:

$$MAAR_x = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{jx} + \beta Q_x + \sum_{j=1}^{m} \gamma_i Z_{jx} + \varepsilon_i \qquad (7)$$

where X is a vital explanatory variable(s) as identified by prior studies, therefore, it is included in every regression. Q, the variable of interest of which robustness is tested and Z is a potentially important variable. The Xs are called free or fixed variable whereas Q is called the variable of interest.

This technique is used to estimate the value of the coefficient on the variable of interest, Q of which robustness is tested. A large number of regressions are required to be run so as to find out the value of this coefficient. Whereas free variable(s) X is included in every regression, the variable of interest and the set of Z variables are selected from a

predetermined pool. The combination of Z variables changes in the regression and we are able to obtain the widest range of coefficient on the variable of interest β, which standard hypothesis tests do not reject. The exercise of exhaustive regressions for each variable of interest gives the highest and lowest values of β that cannot be rejected at a particular significance level. In a set of regressions, the value of coefficient having the same sign being statistically significant, is called a "robust" variable otherwise the variable is treated as "fragile".

While implementing EBA, a major drawback is that it may generate multicollinearity inflating standard errors. This problem arises due to weak data problems (Leamer, 1978). According to Levine and Renelt (1992), multicollinearity exists due to insensitivity of the conditioning set of information though it is not a procedural problem. To make the results more valid, Levine and Renelt (1992) impose three conditions under this technique: (a) only three explanatory variables are used in each regression, (b) small group of variables are selected which comprise three Z variables, and (c) for selecting every variable of interest, confine the group of variables from which Z variables are selected that, a priori, might measure the same phenomenon. On the basis of these conditions, they argued that it is more difficult to implicate past findings as fragile.

EBA has also been criticized as being too stringent a test of robustness. Under this method, if a coefficient changes its sign in even one regression out of many thousand regressions, a variable is said to be"fragile". It is the case of "one rotten apple" for which McAleer et al. (1985) refers to when they speak of "families of models". Sala-i-Martin (1997) indicates by regressing different set of control variables drawn from the sample with some errors from the true population. It is possible to get a model where the coefficient of interest changes its sign or is statistically insignificant. Consequently, one may conclude either no variables are robust or they fail to clear the test of robustness. For instance, McAleer et al. (1985) contend that without full information about model characteristics generating extreme bounds, it becomes difficult to emphasize on EBA for testing the robustness

of any variable.

EBA method has been widely used in many areas. Empirical literature spells out that EBA has been used to identify the determinants of: emergence and survival of democracy (Vreeland et. al., 2012), R&D investment (Wang, 2010), foreign direct investment (Cardak and Moosa, 2006), corruption (Haan and Seldadyo, 2006), stock prices in Kuwait Stock Exchange (Al-Deehani, 2005) and regional trading arrangements (Ghosh and Yamarik, 2004).

5. Data and Description of Variables

This empirical study uses 75 IPOs listed on KSE from 2000 to 2011. The sample comprises 95 percent of the total number of IPOs issued during this period. Data about IPOs is obtained from the prospectus for issuance of new shares to the general public and information is extracted about offer price, size of issue, underwriters and characteristics of firms. Information regarding opening and closing prices of shares and benchmark indices are gathered from the KSE data base.

Prior empirical studies used various explanatory variables that affect the degree of underpricing; however, it is imperative to select only those variables that influence underpricing. EBA technique is used in this study to examine the robustness and sensitivity of eleven explanatory variables. The possible explanatory variables that cause IPO underpricing can be expressed in the form of following equation:

$$MAAR_x = \alpha_0 + \alpha_1 Risk_x + \alpha_2 Sub_x + \alpha_3 ROA_x + \alpha_4 FinLev_x + \alpha_5 Age_x + \alpha_6 OPrice + \alpha_7 UW + \alpha_8 OSize_x + \alpha_9 EPS_x + \alpha_{10} PIPH_x, + \alpha_{11} LDel_x + \varepsilon_x \quad (8)$$

where *MAAR* is market adjusted abnormal return, *Risk* is after market risk level of the IPO, *Sub* is oversubscription ratio, *ROA* is return on assets, *FinLev* is financial leverage, *Age* is firm age, *OPrice* is offer price, *UW* is underwriter's prestige, *OSize* is offer size of issue, *EPS* is earnings per share,

PIPH is post-issue promoters holding and *LDel* is listing delay.

The important aspect is selection of *X*, *Q,* and *Z* variables mentioned in the equation (8). The *X*-variable(s) are important determinants from the perspective of theoretical and empirical evidences mentioned in prior studies used in every equation. Out of the eleven variables, two variables are considered as *X*-variables, i.e., the aftermarket risk of the IPO (Risk) and oversubscription ratio (Sub). Both these variables are vital for determining the underpricing indicated by several studies[3]. Now, we have to select *Q* and *Z* variables from the rest of nine variables. Out of the nine variables, the variable of interest *Q* is selected whose robustness is tested. For a given *Q* variable, three Z variables are selected from the remaining eight, giving 504 regressions (56 regressions for each variable of interest) and in total 1,008 regressions for determining the explanatory variables of underpricing on the first and thirtieth-trading day. The variables used in the study are summarized as below.

Aftermarket risk of the IPO is used as a proxy for measuring risk attached with the IPOs. The risk is estimated as the standard deviation of first 30 day return after the issuance of IPO (Brooks et. al, 2012). Oversubscription ratio indicates that the numbers of shares demanded are more than the number of shares offered. Prior studies argued that oversubscription is an important determinant that influences aftermarket performance of IPOs (Rock, 1986; Chang et al., 2005 and Ljungqvist et al., 2006). The return on assets (ROA) is calculated by net income to total assets prior to going public. High ROA indicates high profitability of a firm showing the efficient utilization of assets which reduces the uncertainty and concerns of the investors. Financial leverage is used as a proxy for measuring riskiness on the part of a firm. Higher the financial leverage, higher the degree of underpricing, documented by Ritter (1984) and Lougrhan and Ritter (1995). Age of the firm is used as a proxy for determining the degree

[3] For example, Rock (1986), Ljungqvist et al. (2006), Sahoo and Rajib (2010) and Sohail and Nasr (2007).

of underpricing following the IPO. Matured firms have substantial published information which reduces information asymmetry, therefore, underpricing would be lower (Ritter, 1984; Ritter et. al., 1991; Hensler et. al., 1997 and Sahoo et al., 2012).

The offer price of an IPO is another important determinant to identify the magnitude of underpricing. Higher offer prices indicate lesser uncertainty about the firm's future performance (Daily et al., 2003). As such, empirical studies provide evidence of an inverse relationship between the offer price and underpricing (Adjasi, et al., 2011 and Zouari et al., 2009). Previous studies reported a negative relationship between the underwriter reputation and the degree of underpricing (Logue, 1973; Beatty and Ritter, 1986; Johnson and Miller, 1988). To test the hypothesis, underwriter's reputation is taken as a dummy variable where a value of 1 indicates the prestige of underwriter and 0 denotes non-prestigious underwriter. Brooks et al (2012) document an inverse relationship between the size of an issue and the degree of underpricing. Small offerings are more speculative than large offerings that exhibit greater underpricing. EPS is measured by net income over total outstanding shares prior to the listing of the IPO. Firms having higher EPS represent more demand, indicating positive signal to market on the firm profitability.

In the post IPO scenario, takes the percentage of shares held by the promoter and the promoter group. This indicates that more retention of shares by the promoters lead to increase in the value of the firm (Jensen and Meckling, 1976). When firm owners are more confident about the future prospects, they retain a high proportion of capital. As a result, existing owners predict the true value of the firm for setting the higher offer price to the prospective investors (Mroczkowski and Tanewski, 2004). Listing delay is associated with the number of days between offering and listing price. Delay in listing cause uncertainty on the part of investors, which results in an increase in the degree of underpricing. Beatty and Ritter (1986) argued that the degree of underpricing reflects the intensity of ex-ante uncertainty at the time of IPO issuance. Among others, Knopf and Teall (1999), Ljungvist and

Wilhelm (2002) and Loughran and Ritter (2004) found that underpricing is the risk faced by IPOs due to delay in the number of days.

Table 1 summarizes firm characteristics for 75 IPOs issued from January 2000 to December 2011. Variables such as market adjusted abnormal return (MAAR), return on assets (ROA), financial leverage (FinLev), post-issue promoters holding (PIPH) are denoted in terms of percentages. Offer size (OSize) is estimated in PAK rupees in million and offer price (OPrice) in PAK rupees. Listing delay (LDel) is scaled in days and age is in years. Earnings per share (EPS) is measured in rupees per share and oversubscription ratio (SUB) is represented in times. Risk is measured through the standard deviation of post listing price behavior which is calculated in percentages.

Table 1
Descriptive Statistics of Variables

Variables	Mean	Median	Max. Value	Min. Value	Std. Dev.	Skewness	Kurtosis
MAAR	30.30	8.71	315.88	-31.59	58.27	2.35	10.19
Risk	2.34	1.12	28.06	0.00	3.86	4.71	29.45
Sub	2.76	1.21	18.69	0.01	3.64	2.63	10.73
ROA	4.04	1.41	26.73	-7.41	6.98	1.91	3.52
FinLev	21.73	16.32	77.08	0.00	21.55	0.77	-0.43
Age	11.53	7.00	67.00	1.00	13.35	2.30	8.25
OPrice	23.97	12.50	235.00	10.00	32.85	4.30	25.20
OSize	672.62	250.00	8,107.50	40.00	1,150.48	4.35	24.03
EPS	3.27	1.04	28.10	-4.93	5.41	2.40	7.00
PIPH	64.60	67.00	97.50	16.70	19.69	-0.45	-0.62
LDel	43.13	39.00	91.00	9.00	13.31	1.15	5.59

Underwriter prestige (UW) is used as a dummy variable.

On listing day, average underpricing is 30.30 percent with a median return of 8.71 percent. Highest underpricing is 315.88 percent and lowest underpricing (overpricing) is -31.59 percent showing a large variability among returns as standard deviation is 58.27 percent. These returns are rightly skewed and kurtosis shows the thickness in the tail of a probability density function. Average underpricing is 24.17 percent on the thirtieth-trading day. Maximum and minimum underpricing are 315.50 percent and -

38.66 percent respectively. It is important to note that the standard deviation of these returns increase during thirty trading days. One can infer from these results that investors are making abnormal excess returns if on hold those shares up to thirtieth trading days.

The data relating to aftermarket risk of IPO reports a mean value of 2.34. Highest value is 28.06 and a low median value of 1.12 indicates lesser variability in the post-listing prices. The mean value of aftermarket risk of IPOs is 1.79, with the highest value of 8.91 and the median value of 0.99. IPO are subscribed by 2.76 times on average and median value suggests that the oversubscription rate is more than one time with a standard deviation of 3.64 showing negligible oversubscription in Pakistani IPOs. The maximum value of oversubscription rate is 18.69 times; whereas minimum value is under subscribed by 0.01 times indicating that the demanded shares are less than offered shares. The average ROA is 4.04 percent indicating before going public IPO firms earn a very low return on their assets. The maximum and minimum ROA are 26.73 percent and -7.41 percent along with a standard deviation of 6.98.

Financial leverage is an important determinant to measure the underpricing level. Table 1 depicts that the mean value of financial leverage is 21.73 percent. The median value of financial leverage is 16.32 percent, reflecting that average IPO firms do not have a high debt burden before going public. On an average, the age of IPO firms is 11.53 years. Six firms having more than 30 years of age and by excluding those firms, the average age would be 8.25 years that is close to the median age of 7 years. Average offer price is Rs.23.97 whereas median is Rs.12.50. Maximum and minimum offer prices are Rs.235 and Rs.10 respectively. This implies that experienced firms have high offer price due to their financial soundness whereas new firms issue shares at a lower offer price due to uncertainty in achieving the desired results. The mean value of offer size is Rs.672.62 million. The lowest and the highest offer size was Rs.40 million and Rs.8, 107 million respectively. Large variation in offer size indicates diversified IPOs having small and large issues are part of the sample IPOs.

The average EPS ratio is Rs. 3.27 showing every share of IPO firms earn Rs. 3.27. This EPS ratio is too low, indicating that IPO firms do not have sufficient capability to earn profit. Maximum EPS is Rs. 28.10 and minimum EPS is Rs. -4.93. Average PIPH is 64.60 percent and a median value is 67 percent. High retention of equity in the post-IPO scenario indicates the promoter's confidence in IPO firms. Skewness and kurtosis of PIPH indicate the near normal distribution for the variable. The mean listing delay is 43.13 days and median delay is 39 days. It is observed that IPO firms take much time to float their share from the offering day which creates uncertainty and consequently increase the level of underpricing.

6. Empirical Results

6.1 Average Underpricing

This section examines the average underpricing wherein investors participate in IPOs by offering price and sell them on the first trading day or subsequent to any other day up to thirtieth-trading day. It is observed that investors earn significant abnormal returns over thirty trading days from the date of listing.

Table 2 reports, average returns from first to thirtieth trading day for 75 IPOs during the period from 2000 to 2011. It is observed that average initial raw returns are 34.01 percent and the average market return is 3.19 percent, whereas market adjusted abnormal return is 30.30 percent on the first day of trading. By comparing average raw return over the thirty-trading day, it is the highest at 34.74 percent on the fourth trading day from listing. However, average raw returns decrease and drop to 30.46 percent on the thirtieth-trading day. Market return increases and reaches to 6.38 percent on thirtieth-trading day from listing. Thus, MAAR on the thirtieth-trading day is 24.17 percent, reflecting that raw return decreases with the passage of time while market return increases showing that MAAR decreases if investors hold on IPOs over the thirty-trading day. Standard deviation of IPOs increase with increase in trading days showing the inclusion of diversified IPOs on the

portfolio.

Table 2
Aggregate Underpricing of IPOs

Trading Day	Raw Return (%)	Market Return (%)	MAAR	Std. Dev.	*t*-Statistics	*p*-Value
1	34.01	3.19	30.30	58.27	4.50	0.00
2	34.16	3.28	30.26	58.57	4.48	0.00
3	33.97	3.43	29.76	57.69	4.47	0.00
4	34.74	3.82	29.91	59.67	4.34	0.00
5	34.50	3.96	29.47	59.49	4.29	0.00
6	34.14	4.20	28.97	59.46	4.22	0.00
7	33.96	4.42	28.40	59.75	4.12	0.00
8	34.21	4.58	28.42	60.10	4.10	0.00
9	33.90	4.74	27.93	59.08	4.09	0.00
10	33.19	4.91	27.17	59.23	3.97	0.00
11	32.51	5.10	26.25	58.66	3.88	0.00
12	32.82	5.00	26.64	58.22	3.96	0.00
13	32.75	5.00	26.56	59.00	3.90	0.00
14	32.31	5.01	26.29	58.78	3.87	0.00
15	32.38	5.22	26.03	59.06	3.82	0.00
16	32.49	5.17	26.30	59.82	3.81	0.00
17	32.56	5.48	25.95	59.79	3.76	0.00
18	32.20	5.34	25.82	58.97	3.79	0.00
19	32.32	5.47	25.84	60.60	3.69	0.00
20	32.78	5.68	26.11	61.65	3.67	0.00
21	32.41	5.86	25.79	62.07	3.60	0.00
22	32.10	5.94	25.66	62.23	3.57	0.00
23	32.38	5.89	26.13	62.83	3.60	0.00
24	31.21	5.95	25.37	62.41	3.52	0.00
25	30.65	5.85	25.09	62.12	3.50	0.00
26	30.06	5.98	24.18	61.91	3.38	0.00
27	31.12	6.29	24.68	62.83	3.40	0.00
28	30.78	6.41	24.16	62.54	3.34	0.00
29	30.67	6.41	24.23	64.42	3.26	0.00
30	30.46	6.38	24.17	66.33	3.16	0.00

Short-run performance of 75 IPOs listed on KSE is measured from the first to thirtieth trading day from 2000–2011. MAAR for stock *x* at the end of *d*th trading day is computed as $MAAR_{x,d} = 100 \times \left\{\left[\frac{(1+R_{x,d})}{(1+R_{m,d})} - 1\right]\right\}$ where $R_{x,d}$ denotes raw return and $R_{m,d}$ shows market return. $R_{x,d}$ is calculated as $R_{x,d} = \left(\frac{P_{x,d}}{P_{x,0}}\right) - 1$ and return on market index (KSE) is measured as $R_{m,d} = \left(\frac{I_{m,d}}{I_{m,0}}\right) - 1$.

These results confirm that investors yielded significant abnormal excess

returns over the thirtieth-trading day indicating on average Pakistani IPOs are underpriced. This evidence is consistent with most of the earlier studies (e.g., Abubakar and Uzaki, 2012 and Samarakoon, 2010). Hence, we reject the null hypothesis that mean MAAR is different from zero.

From the sample of 75 IPOs, 24 IPOs (32 percent) are overpriced indicating that the listing price is less than the offer price. By excluding those overvalued IPOs, average underpricing reaches 50.28 percent on the listing day, which is comparatively higher than international evidences. The performance of undervalued IPOs over thirtieth-trading day, reflects that underpricing ranges from 50 to 47 percent. By comparing higher magnitude of undervalued Pakistani IPOs with international markets, it appears that Pakistani issuers are leaving too much money on the table.

6.2 Results of Sensitivity Tests

The EBA technique is used to examine the robustness and sensitivity of the explanatory variables in determining the IPO underpricing. Sensitivity results are summarized as follows:-

6.2.1 Some Preliminary Results

The preliminary regressions include the aftermarket risk level of the IPO (Risk) and the oversubscription (Sub) as *X*-variables. These regressions indicate the importance of *X*-variables affecting IPO underpricing on the first and thirtieth trading day. On the first trading day, the regression can be specified as

$$MAAR = \underset{(-0.11)}{-0.7295} + \underset{(1.80)^{*}}{2.8176}\, Risk + \underset{(5.30)^{***}}{8.8380}\, Sub \qquad (9)$$

Equation (9) is estimated by using the OLS method, Adj. R^2 = 0.4358, number of IPOs = 75 and *t*-value are given in brackets. From the above, oversubscription ratio and the aftermarket risk level of the IPOs are

significant at 1 and 10 percent respectively. It appears that oversubscription is the foremost determinant followed by aftermarket risk of the IPO in term of the first day of underpricing. The regression on thirtieth-trading day can be presented as:

$$MAAR = \underset{(-1.62)}{-14.3721} + \underset{(3.21)^{***}}{10.3278\ Risk} + \underset{(3.95)^{***}}{7.2641\ Sub} \qquad (10)$$

Adj. R^2 = 0.3314, number of IPOs = 75 and *t*-value are in brackets. Equation (10) explains the significance of both *X*-variables at the level of 1 percent showing their importance to investigate the underpricing on thirtieth-trading day.

6.2.2 Results of Basic Model without Z-Variables

Two regressions, excluding Z-variables, were tested to examine underpricing on the first and thirtieth-trading day. In both the regressions, *X*-variables comprised aftermarket risk of the IPO and oversubscription ratio. Offer price and financial leverage are used as *Q*-variables in regression I and II while post issue promoters holding is included as *Q*-variable in regression I.

Table 3 present estimation results of the basic model of regression I and II. First, adjusted R^2 of regression I and II are 0.4871 and 0.4058 respectively showing the regressions fitted in the sample data. Second, both the *X*-variables – aftermarket risk and oversubscription ratio are significantly positive at 1 percent level on the first and thirtieth-trading day. This elaborates that aftermarket risk and oversubscription are prime factors in determining IPO underpricing in both the regressions. Higher the aftermarket risk, indicate more uncertainty, therefore, underpricing would be higher. The positive relation of oversubscription indicates that IPOs are offered at lesser prices, which result in high demand for shares. Third, among the *Q*-variables, offer price is significant at the 10 percent level in regression I and 5 percent

level in regression II having a negative impact on IPO underpricing. The higher the offer prices, higher the chance of underpricing. Fourth, the effect of financial leverage is positive on IPO underpricing. Both the regressions are significant at 10 percent level. High leverage depicts that high debt burden ratio causing higher uncertainty and eventually underpricing would be higher. Finally, holding of post issue promoters is not significant in regression I. Thus, offer price and financial leverage are two important factors determining the IPO underpricing on the first and thirtieth-trading day from the *Q*-variables.

Table 3
Estimation Results of Benchmark without *Z*-Variables

Regression	I	II
Constant	36.7747	31.7447
	(1.57)	(1.22)
X-variables		
Risk	4.9876	13.4931
	(2.92)***	(4.20)***
Sub	8.0050	7.2227
	(4.96)***	(4.16)***
Q-variables		
OPrice	-16.6999	-22.3163
	(-1.91)*	(-2.51)**
FinLev	46.1633	50.1738
	(1.97)*	(1.79)*
PIPH	-5.4034	-
	(-1.19)	
Adj. R^2	0.4871	0.4058
F-value	15.06***	13.64***

Notes: 1. Estimated using Stata.
2. *t*-Values are in parentheses.
3. ***, ** and * represent significance level at the 1, 5 and 10% respectively

Offer size and age of the firm are seen to have no effect on underpricing. As the offer size increases, underpricing would be higher (Adjasi et. al., 2011). Whereas the empirical evidence reflects the contrary, i.e. the offer size and underpricing have an inverse relationship. Age of the firm depicts a positive association with underpricing (Tian, 2011). As the older firms intentionally underprice IPOs so they attract a large number of investors with

an assurance to sell off all the stocks. However, listing delay show no effect on the degree of IPO underpricing. By comparing the results of regressions without and with all Z-variables, it clearly emphasizes that economic theory does not produce a complete specification of which variables are to be held constant when performing statistical tests. In a nutshell, it seems that EBA is a more useful technique for explaining sensitivity analysis and providing more authentic results.

Table 4
Estimation Results of Benchmark with all *Z*-variables

Regression	I	II
Constant	-8.0169	85.1304
	(-0.07)	(0.69)
X-variables		
Risk	3.0897	10.4346
	(1.49)	(3.23)***
Sub	8.1925	5.5088
	(4.94)***	(3.30)***
Q-variables		
OPrice	-27.6237	-44.1276
	(-2.47)**	(-3.54)***
FinLev	41.8115	33.3162
	(1.65)	(1.18)
PIPH	-21.4760	-3.3330
	(-0.65)	(-0.09)
Z-variables		
EPS	0.4823	-0.5017
	(0.37)	(-0.34)
ROA	102.7751	287.1917
	(1.47)	(4.27)*
UW	6.6899	17.3082
	(0.64)	(1.47)
OSize	3.7362	0.9687
	(0.65)	(0.15)
Age	3.3432	0.0857
	(0.52)	(0.01)
LDel	-0.9591	-7.7988
	(-0.06)	(-0.43)
Adj. R^2	0.4730	0.4939
F-value	7.04***	7.56***

*, ** indicate significance level at the 1% and 5% respectively.

6.2.3 Results of Sensitivity Analysis

An important aspect of our analysis is to test the sensitivity of *X*- and *Q*-variables, i.e. whether these variable are robust or fragile. In every regression, three of the nine *Z*-variables are selected as regressors, i.e. a total of 56 forms are tested. Our objective is to determine those variables that are significant at 10 percent. Table 5 present the results of sensitivity test which reflects that aftermarket risk of the IPO, oversubscription ratio, offer price and financial leverage are the robust variables in determining the IPO underpricing whereas post issue promoter holding is a fragile variable in our analysis.

Table 5
Summary of EBA tests

	Sign	Robust/fragile
X-variable		
Aftermarket risk of the IPO	+	Robust
Oversubscription	+	Robust
Q-variable		
Offer price	–	Robust
Financial leverage	+	Robust
Post issue promoters holding	–	Fragile

7. Conclusions

This study empirically investigates the short-run underpricing of 75 IPOs listed on Karachi Stock Exchange from 2000 to 2001. Since IPO underpricing is measured from the first day of listing to thirtieth trading day, EBA technique is used to investigate the determinants of IPO underpricing on the first and thirtieth trading day. The results confirm that Pakistani IPOs outperformed over the sample period. On the first day of trading, underpricing was the highest i.e., 30.30 percent. If investors hold those shares till the end of the thirtieth-trading day, they earned abnormal return of 24.17 percent.

We use eleven explanatory variables for testing robustness and

sensitivity on the first and thirtieth-trading day. EBA technique determines that the coefficient of aftermarket risk of the IPOs and oversubscription positively affects the degree of underpricing. Aftermarket risk of the IPOs denotes the risk of a particular IPO as a result of fluctuations in stock prices. Thus, higher uncertainty would lead to higher underpricing. Oversubscription is another important factor which explains that when the shares are oversubscribed due to low offer thereby resulting in higher underpricing. Practically speaking, IPOs in Pakistani capital market face risk of floating shares and oversubscription surging to inflate underpricing level. To this effect, models of underpricing that is winner's curse and ex-ante uncertainty are applied in explaining Pakistani IPOs. Low offer price aims to ensure that the entire stock be sold out through oversubscription for which underpricing will be higher. With high financial leverage, the commitment towards debt obligation would be higher resulting in underpricing on the higher side.

This study guides the policy makers in the sense that they need to focus on those IPOs having more uncertainty in post issue pricing of shares, low offer price and high financial leverage prior to IPOs which cause a higher level of underpricing, giving a chance to the issuers to achieve oversubscription. By decreasing the impact of these determinants, underpricing may be minimized in Pakistani capital market.

In the EBA method, only four variables are identified as robust affecting the magnitude of the underpricing of IPOs. We understand that EBA is a better process to find the determinants of IPO underpricing as compared to other alternatives for reporting variables. EBA facilitates to enlarge the horizon of search so as to identify the most favorable and the least favorable outcomes (Cardak and Moosa, 2006). On the basis of these results, it is suggested that future research may focus on adding more explanatory variables for testing their robustness towards underpricing level. Moreover, the time frame of the study may be enhanced probably prior to 2000 for generalization of the results as well as identification of more robust variables from a large data sample.

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